Discerning the Multiple Business Benefits of Energy Efficiency

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ABSTRACT

Business decision-makers are more likely to implement energy efficiency improvements if proposals demonstrate a wider range of benefits than those initially apparent. Proponents of energy savings improvements must be prepared to demonstrate more than simply energy savings. Improvements to a company's energy performance can positively impact operational procedures, technology mixes, maintenance requirements and other agendas. Business managers who fail to recognize energy efficiency's multiple benefits will forfeit business earnings and diminish stakeholder value. Such forfeiture retards economic development and efforts to reduce environmental pollutants.

This article describes a study that sought several outcomes: 1) to make the wider consequences of energy-efficiency more transparent to business investment decision makers; 2) to stimulate the market for energy efficiency solutions by improving business sector understanding of—and thus demand for—energy efficiency and its coincident benefits; and 3) to expand the body of knowledge that can be used to promote energy efficiency to business facilities.

INTRODUCTION

"Multiple benefits" refers to value created beyond the energy expense savings or productivity attributed to an energy efficiency improvement. Energy efficiency—and its coincident benefits—accrue to a variety of stakeholders.

For energy consumers, energy expense savings may be accompanied by concurrent savings in maintenance, labor, and safety or

emissions compliance; creation of new value such as enhanced business productivity, product quality, or occupant safety and comfort; or instances where efforts to save a particular form of energy create simultaneous savings of dissimilar forms of energy in the same facility. This last dimension ensures that the term "multiple benefits" captures a broader range of impacts than what is implied by "non-energy benefits."

Facility and energy managers can seize career-sustaining opportunities by harvesting the multiple benefits of energy efficiency. In the past, managers have accepted a business culture that reduces facility management to reactionary activities. After surviving periodic organizational retrenchments and budget cuts, many facility managers may not feel empowered to do more than reactively "repair what is broken." The pursuit of multiple benefits suggests a new paradigm where facility management is not simply a cost center (to be minimized), but a resource for creating value. This paradigm, however, requires facility managers to take a proactive stance on training, human resource development and performance optimization. It requires unprecedented collaboration with other professionals outside the facilities department.

Electric and gas distribution utilities may defer or reduce future capital expenditures needed to grow energy supply infrastructure. Effective utility investment in supply infrastructure is achieved when customers are provided least-cost supply resources. When comparing the unit costs of supply capacity, energy-efficient end-use applications will often cost less than utilities' traditional investment in generation, transmission, and distribution assets [1].

Society benefits when energy efficiency forestalls the market turmoil that accompanies energy resource depletion. Energy efficiency reduces the volume of pollutants caused by power generation, and allows investment capital to serve purposes more productive than building unnecessary energy capacity.

The concept of multiple benefits is interesting to stakeholders of energy efficiency programs conducted by electric and gas utilities in the U.S. The focus is on screening the costs and benefits of such programs. While this article is market-oriented, it parallels discussions concerning policies and programs. Herein, I consider the multiple benefits of energy efficiency as they accrue to business enterprises, and the roles of facility or energy managers who create such value.

Program Evaluation: To What End?

Classic economic theory offers the concept of *Pareto optimality* as a guide for resource allocation. A Pareto optimum describes a state of resource allocation in which no one individual can become better off without making at least one other individual worse off. When evaluating regional economic performance, an absolute finding of "better or worse off" requires consideration of value beyond what is strictly ascribed to energy supply. With the Pareto optimum in mind, we might argue that cost-benefit screening of energy efficiency investments fails to describe resource allocations if the scope of evaluation excludes coincident non-energy impacts. A one-dimensional, energy-only approach would be akin to evaluating a house solely for its capacity, while ignoring value of its location, quality of construction and maintenance requirements.

Program evaluators' recognition of multiple benefits reduces the tendency to undercount the full value created by an energy efficiency improvement. The result—a fuller and more accurate accounting of benefits—facilitates Pareto optimums reducing the potential for misallocating investment in energy supply resources.

Hurdles to energy efficiency implementation include disconnects among society's needs versus the needs of individual business and household decision-makers. Emerging policy and program strategies increasingly promote energy efficiency not for its own sake but for its ancillary benefits. The popular realization of ancillary benefits is far from complete. Full realization requires marketing outreach by solution providers with commensurate education of business decision-makers. Evolution of markets, technologies, and business cultures are already moving energy management from the traditional focus on "projects" (discrete episodes of equipment installation) to the practice of continuous energy improvement. Awareness communications, training, education, financing, and other efforts that indirectly boost consumers' appetites for energy improvements drive this evolution. These indirect investment stimuli are the precedent for promoting energy efficiency's multiple benefits. Assistance programs conducted by electric and gas utilities are important to this process.

To develop this article, I convened a group of energy experts who opined on the apparent challenges to evaluating multiple benefits in commercial, institutional, and industrial facilities. They are: Gary Ambach, Michaels Energy; Whitney Brougher, National Grid; Clint Christenson, Consulting energy engineer; Vicki Folmar, Weir-TSUS; Tom

Giffin, Leidos Engineering; Katherine Johnson, Energy consultant; Greg Lehoux, B.C. Hydro; Robert Lung, U.S. Department of Energy; and William Steigelmann, Lockheed Martin Energy Services.

Their collective expertise provided information to draft a categorized ranking of multiple benefits for their ease of definition, documentation and reporting.

Attempts to promote energy efficiency by leveraging its multiple benefits require thoughtful market segmentation strategies. The next section considers the concept of implementing multiple benefits.

MULTIPLE BENEFITS: CONCEPTS AND APPLICATIONS

Energy's multiple benefits arise from facility-level energy improvements—referred to collectively as "projects." Projects are discrete episodes of capital investment that involve the replacement, upgrading, or incremental addition of facility equipment that contributes to business operations.

Large businesses tend to lose awareness of their energy use among their many other daily priorities. When their employees have little or no accountability for energy performance, potential energy-derived value is often squandered. Top business managers vary widely in their perception of benefits as well as their motivations to measure and attain them [2]. Not all enterprises employ professional energy managers. Business leaders often underestimate the value of energy; hence such responsibilities are delegated to unempowered subordinates. Most energy managers may only influence and suggest rather than compel their organization's energy choices. Low-level staff may also have a limited perception of energy efficiency, expecting nothing more than reduced utility costs. By depending on lower level staff to administer energy-related concerns, managers remain unaware of the broader variety of benefits resulting from energy efficiency. Limited management awareness further complicates researchers' efforts to document multiple benefits.

Business information and accounting systems can both help and hinder the revelation of energy-related value. Business leaders increasingly rely on software that presents a "dashboard" of up-to-the-minute business performance indicators. Similarly, management priorities may focus only on line items in charted accounts. Herein lies the challenge:

management tools often hide or dilute energy expenses as well as the value coincident with energy usage. While this suggests a need to upgrade information systems, managers are often reluctant to endure the expense and hassle that such modifications require. Information barriers of this nature are hurdles to be surmounted if business leaders are to become aware of—and motivated to pursue—the multiple benefits of energy efficiency. If properly designed, business information systems will demonstrate not only energy efficiency's cost savings, but also improvements in productivity, product quality, mitigation of operational risks and employee skills [3]. Few energy solution providers are positioned to advocate the overhaul of their customers' business information systems.

Energy savings may motivate some to make improvements at their facilities, while for others they support similar investments primarily for productivity, safety, or reliability reasons. Additionally, most utility assistance programs promote energy savings as an isolated benefit, ignoring the larger business contexts in which investment choices are made. For business leaders, energy efficiency investment choices are usually discretionary rather than obligatory. The concept of multiple benefits, broadens the scope of perceived opportunities. Certain business investments are more likely, not due to their energy savings, but because of the greater visibility of the sum of their benefits. Transparency of multiple benefits is the key to compelling business initiatives that provide energy efficiency.

NUANCES OF BUSINESS MARKET SEGMENTATION

Electric and gas utilities typically segment their customers according to class of service. These classes reflect the practical logistics of energy services, customers' load profiles, facility configurations, and equipment selection that identify ways energy is used. Consequently, commercial customers are distinguished from industrial users by load and technology profiles.[1] Customers' eligibility for supply interruptions, curtailments, or transportation-only options imply functional segments for utility services. These distinctions may determine tariff structures, and often the organizational chart of the utility. It is common for energy efficiency program stakeholders to use this long-standing approach to customer segmentation. Many energy solution providers are

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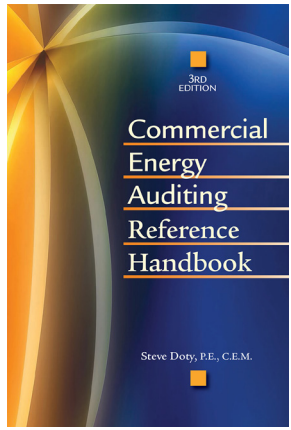

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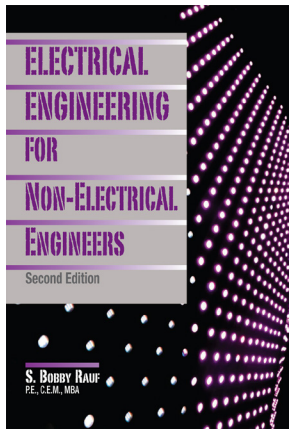

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veterans of the utility culture, so they tend to apply similar approaches to their marketing and outreach.

For energy efficiency proponents, the opportunity is to engage customers for whom utility logistics lack meaning. Business decision-makers place many other criteria above energy efficiency. By recognizing these other priorities, energy solution providers may discern customers' affinities between energy and non-energy choices. In addition to energy savings, segmentation strategies recognize customers' other coincident priorities.

Energy is an absolute necessity for most facilities. Consumers' use and perception of energy reveals distinctions between commercial and industrial segments. Designs for commercial (office, retail, or institutional) properties emphasize human comfort over mechanical activity. In the commercial sector, energy is an enabler of core business functions. Except for occupant comfort considerations, commercial facilities' energy-related equipment can be selected, operated, and maintained almost independently from core business decisions. The commercial sector's uptake of energy efficiency is both helped and hindered by this division of interest. The positive features of commercial facility management are: 1) its isolation from the core commercial business, which often provides facility management departments with greater freedom in deciding how and when to optimize their energy-related equipment; and 2) the relative homogeneity of commercial building types and eligible energy solutions. This allows energy solution providers to enjoy economies of program design and outreach. Alternatively, facility management is of comparatively marginal importance to commercial enterprises, limiting the facility management department's access to capital and diminishing its relative importance among investment priorities. Accordingly, articulation of multiple benefits may increase commercial sector interest in energy efficiency improvements. In this context, leading benefits might include occupant comfort, increased ease of facility management tasks, or creating value (energy savings or productivity) that enhances the worth and influence of the facilities department. Examples of coincident savings in commercial facilities of dissimilar energy types are evident in the interaction of simultaneous heating, cooling and lighting activities. For commercial enterprises, multiple benefits are often more compelling than energy savings alone.

In the industrial sector, energy resources are a factor of production and integral to the core business. Industrial energy-related choices

usually impact the volume, pace, and quality of production. Energy efficiency decision-making likely impinges more upon industry's core business staff and their activities than it does for their commercial counterparts. Accordingly, industrial facility managers are typically more sensitive than their commercial equivalents to changes that might interfere with process continuity and production targets. Compared to those in the commercial sector, industrial managers are less likely (or able) to respond to energy efficiency proposals with alacrity. Because of the large volumes of energy consumed, industrials present very attractive energy savings potential per measure installed. The magnitude of savings, as well as lower cost per unit of energy saved, underscores the value of industrial energy improvements as a least-cost energy supply resource.

The multiple benefits from industrial energy efficiency are mostly distinct from those accruing to commercial facilities. There are occupant comfort improvements available, but positive impacts on process productivity, product quality, workplace safety, and simultaneous resource optimization are also evident. Due to the unique features of industrial facilities and their equipment configurations, the detection of multiple benefit potential requires greater facility scrutiny than in the commercial sector. For energy solution providers, this implies a customized approach to defining efficiency measures. Indeed, the close and ongoing consultation between solution provider and customer may be a precursor to realizing multiple benefits.

Understanding the nature of energy efficiency's multiple benefits—and how they manifest differently within economic sectors—is a prerequisite to quantifying the true costs and benefits of energy efficiency program activities.

PRIORITIZING MULTIPLE BENEFITS FOR THE BUSINESS SECTOR

It is clear that business facilities offer energy saving opportunities. What is less obvious is how energy efficiency and its multiple benefits are perceived within these sectors. Further differentiation within sectors is warranted. The business sector requires distinction both *between* and *within* industrial and commercial segments.

Energy efficiency's multiple benefits found in industrial settings are situational and often unique to the configuration of each facility. The variety of impacts defies easy categorization and measurement.

Regardless, we might reasonably assume that subsets of the benefits are comparatively easier to detect and measure. This suggests the need categorize tangible, readily identifiable benefits from those that are less scrutable.

In 2015, the American Council for an Energy-Efficient Economy (ACEEE) organized a small, informal group of advisory experts to discuss the multiple benefits that may be concurrent with business sector energy efficiency improvements. Businesses included industrial, commercial, and institutional structures. Advisors were provided a list of suggested benefits, asked to add any additional benefits not listed, and to rank each on a scale of 1-5 for its ease of measurement (5 being the easiest to 1 being most difficult). A summary of the advisors' responses is presented next to support the development of future energy efficiency programs.

EVALUATING MULTIPLE BENEFITS FOR PROGRAM USEFULNESS

Energy efficiency program administrators usually reach out to potential participants through a series of program initiatives, each of which promote energy-efficient technologies and the incentives available for investing in them. Program initiatives are added and deleted over time, crafted to match the program's energy resource goals with consumer needs and interests. Program initiatives may include product initiatives such as lighting, motors, and compressed air, or analytical support initiatives such as energy audits and retro-commissioning.

Consequently, we might anticipate a variety of multiple benefit initiatives promoting one or more of energy efficiency's multiple benefits for participant satisfaction. The program administrator's goal is to advance energy efficiency but results are achieved by promoting the multiple benefits that lead to energy savings. For policy and program professionals who want to advance energy efficiency, a multiple benefits initiative is useful for engaging industrial managers who are often ambivalent about the promise of energy savings. Considering multiple benefits encourages businesses to choose those that advance their energy efficiency goals.

The understanding, motivation, interest, and ability to participate in a multiple benefits program initiative vary widely among business sector decision-makers. Accordingly, we would expect certain sets of multiple

benefits to be more relevant than others. This implies a segmented market for energy efficiency's multiple benefits. Market segmentation is the key to program design, outreach and implementation. Business sector segmentation may begin broadly with a distinction between commercial, institutional, and office facilities versus industrial or manufacturing facilities. Business energy use may be categorically distinguished by the mechanical demands of each industry, such as washing machines for laundries, ovens for bakeries, compressed air for vacuum-formed plastics fabrication, etc. When industries have consistent requirements across all facilities, the companies in the industry may have very different business cultures, investment priorities and asset management philosophies. It is likely that two sample companies in the same industry, with identical facilities, products, or service offerings, will respond very differently to an appeal for energy efficiency and its available multiple benefits. Energy efficiency proponents can expect to gather participants over time as each management team sorts through its unique priorities and circumstances. The following is a discussion of the factors that determine the pace of business participation in multiple benefit initiatives.

Prospective participants' capital budget cycles—When businesses express verifiable interest and ability to invest in multiple-benefit improvements, their actions are almost always paced by their capital budget planning calendar. Incentives may help offset investment delays. Businesses may take 3-5 years to make a commitment.

Management stability—During the time required for capital budget processes, many business management teams experience personnel turnover. Similarly, financial decision makers may change. Either case could have negative consequences for implementing a proposed multiple benefits project.

Economic conditions—Decision-makers' receptiveness to multiple benefits concepts may be tempered by prevailing economic conditions. Good economic conditions may bode well for investment. While managers may have funds they might lack the time required to analyze proposals and implement projects. A poor economy often means limited availability of investment capital. Conversely, a slower pace of output means that resources may be idle and therefore available to pursue facility improvements.

Product market evolution—Over time, companies add, eliminate, and refine the products and services they offer. They do so in response to perceived market opportunities and changes to their business attributes and strategies. These changes may impact facility operations in general and energy use in particular. The task for energy efficiency proponents is to work with business leaders to detect opportunities to match multiple benefit investment proposals with the changing needs of business leaders. For example, a hotel converts a number of units to long-term rental suites, requiring kitchen appliance installations and heating, ventilating and air conditioning (HVAC) controls different from what is installed in short-term rentals.

Coordination with other energy solution initiatives—The energy efficiency proponent may be constrained by the mix of resources and priorities of their own energy solution business. Will a multiple benefits initiative complement or conflict with other marketing initiatives? The marketing budget may be the deciding factor.

Coordination with allied industry initiatives—A variety of diverse business issues (e.g., labor turnover, training, regulatory compliance, etc.) may weigh heavily on customer organizations. Many of these issues are the focus of economic developers, trade associations, or professional societies that have outreach agendas. These could be opportunities for energy efficiency proponents to co-promote multiple benefits with these allied organizations.

Advisors' responses were organized into classes of individual benefit types in rank order by their practicality for energy efficiency promotion.[2] For the following typology, each class of benefits is successively more difficult to measure. Accordingly, Class 1 represents the easiest benefits to measure while Class 7 benefits are the most difficult.

Class 1, Concurrent expense reduction: Any specific energy efficiency initiative may cause other expenses to be reduced concurrently. Our advisors felt that the most likely (and most easily measured) concurrent expense reductions include those within the traditional purview of facilities management, such as water use; dissimilar energy consumption (e.g., when the optimization of electric fans that supply induction air for combustion improves overall boiler fuel utilization); electricity demand and power factor charges coincident with electric

energy consumption; maintenance and/or labor required for facilities operation; and costs to comply with emissions or workplace safety regulations. These Class 1 benefits should be easiest for a facility's energy manager to identify, measure and document. This is especially true for activities grouped under a single budget and administrative authority for facilities management. As such, the facility manager escapes the hassle of crossing departmental lines to find or generate information—a chore that is often complicated by departmental rivalries and the need to explain the task to skeptical colleagues.

Class 2, Business efficiency: "Business efficiency" refers to any enhancement in productivity, such as reduced cycle times for certain industrial production runs, improved productivity of material inputs, and avoidance of unscheduled work stoppages (with resulting revenue loss). Business efficiencies are beneficial but not always as easy to quantify as the expenses traditionally within the facility management's purview (see Class 1). Demonstration of business efficiency value requires access to cost accounting data external to the facilities department. The detection, measurement, and tracking of multiple benefits concurrent with energy savings will often require a business to either modify its existing performance metrics or develop new metrics.

Class 3, Quality improvements: The very actions that improve an industrial process' energy efficiency can also improve the quality of the product being produced. One example is the optimization of heat and humidity levels that also improves the consistency of food processing or pharmaceutical products. A commercial sector example is when office or client spaces are made more comfortable due to energy-saving initiatives, thus reducing complaints from occupants.

Class 4, Capital value enhancement: Advisors suggested that energy efficiency will in some circumstances enhance or sustain real property (buildings) value or will extend the economic life of certain energy-using assets. The latter point recognizes new technologies that provide energy efficiency simultaneously with reduced wear on energy-consuming mechanical assets, thus reducing or delaying future capital expenditures to replace equipment. Together, these benefits become evident in capital asset valuation and management. Energy efficiency may also reduce a facility's future investment in renewable power capacity.

For example, the solar photovoltaic capacity required to serve a building using T12 lighting fixtures is greater than the solar capacity required if that building's lighting system is first converted to more efficient T8 or LED fixtures.

Class 5, Risk abatement: Energy efficiency will often counteract a variety of energy-related business risks. These risks can be direct consequences of energy use, or indirect business liabilities that are a consequence of energy choices. Energy market supply disruptions and price volatility pose a direct risk to a business' operational viability, operating budget performance and profitability. Indirect business risks are manifest in emissions abatement, workplace safety and asset management. Energy efficiency helps to alleviate fines or penalties resulting from lapses in emissions or safety compliance. Improved compliance means direct reductions in penalties and costs resulting from non-compliance, such as workman's compensation claims or workers' health care costs. Asset management risks are evident in the pace and volume of capital spending needed to offset equipment degradation. The risks associated with real property value variance may vary directly with the performance of their energy-related mechanical assets. Such values are readily perceived. It is difficult to measure the worth of avoided penalties, claims and asset value adjustments. However, the risk abatement value attributable to energy efficiency varies directly with the magnitude of potential damages that these measures guard against.

Class 6, Revenue enhancement: Energy efficiency improvements may be an indirect cause of new revenue receipts. Demand response programs (DRP) are a practical example, allowing businesses to be paid by demand response providers for curtailing electrical power consumption during periods of peak demand. Businesses can also be paid for simply enlisting as a DRP participant. Another revenue enhancement is the marketability of new products and services that somehow leverage the business' improved energy performance. One example is Frito-Lay's "Sun Chips" products which are produced in a Modesto, CA facility that uses renewable energy sources and energy-efficient production systems. Another example is the revenue earned by material or service suppliers who must meet their business customers' criteria for green or sustainable provisions.

Class 7, Ancillary benefits: This is a broad "catch-all" class of positive business consequences. These benefits are difficult to identify and quantify. They result from a variety of causal forces which may be unrelated to energy efficiency. A corporation may enjoy an enhanced corporate image as a result of publicity for its energy efficiency efforts. However, the value and duration of the benefit is likely unquantifiable. How can energy efficiency benefits be disaggregated from others? When a business invests in energy measurement and verification training for its staff, the learned methodologies readily transfer to non-energy resource management activities, thereby creating additional value that is difficult to quantify.

CONCLUSIONS

Challenges abound in defining and measuring benefits. Stakeholders almost always concede that multiple benefits exist, but problems remain with their detection, measurement and documentation. This explains why many decision-makers tend to evade or at best generalize the value of assessing multiple benefits.

Proponents face trade-offs when attempting to recognize multiple benefits. Two scenarios frame the possibilities. The first is to promote a wide variety of benefits to be achieved from a given energy improvement. This implies interaction with a variety of decision-makers in the business organization, many of whom are located outside the facilities management department. The second is to concentrate on a limited variety of benefits, emphasizing those that are easiest to detect and measure.

The most attractive multiple benefits are those defined as "Class 1," which are 1) related to expenses already subject to monitoring and billing, 2) managed by the same departmental authority that is also responsible for energy, and 3) easily tracked for benchmarking, trending, and performance analysis purposes. Dissimilar energy commodities, water, labor, and other direct costs of facility management are examples. Reliance on these most tangible values should appeal to more skeptical business managers.

The ideal set of multiple benefits are those that are easily quantified by facility managers. These benefits typically include quantifiable savings from water, dissimilar energy consumption, and related main-

tenance costs when these are improved by a facility's singular energy improvement initiative. When quantification is elusive, a second-best alternative is to demonstrate customers' realization of benefits in qualitative terms. Case studies will help in this capacity, especially those compiled without commercial bias by electric and gas utilities.

If some types of benefits are easier to quantify than others, stakeholders would appreciate a categorization that stratifies multiple benefits accordingly. Such categorization may also help business owners to better prioritize their own pursuit of such value. Without categorization of this knowledge, many business facility managers will find it more difficult to recognize multiple benefits, much less ascribe value to them in a consistent fashion. Insight from a team of energy experts organized for this report yielded a typology that classifies energy efficiency's multiple benefits according to their ease of definition, measurement and documentation.

Another opportunity is to refine the customer segmentation framework through which benefits are ascribed. This is especially true for commercial and industrial facilities, where business management styles, more so than technical features, can be stronger determinants of an owner's readiness to consider energy efficiency's multiple benefits. Opportunities for business sector energy efficiency increase directly with perceptions of their value. Multiple benefits are integral to demonstrating that value, if they are properly presented to the appropriate decision-makers. Alternative approaches to customer segmentation will facilitate energy efficiency program outreach.

Endnotes

1. For a comprehensive listing and discussion of various approaches to assigning value to energy efficiency's multiple benefits in commercial and industrial sectors, see ACEEE's report [2].
2. While average scores per type of benefit were calculated, the resulting averages are not shown here. Given the small number of responses (and a lack of representative sampling), such averages compared on an interval scale are not statistically meaningful. Instead, the averages are used to create a rank order of magnitude. Data from the nine responses, when used this way, allow us to state that Class 1 may be easier to measure than Class 2, etc.

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