Enhancing Shareholder Value: Making a More Compelling Energy Efficiency Case to Industry by Quantifying Non-Energy Benefits

Miriam Pye, American Council for an Energy-Efficient Economy
Aimee McKane, Lawrence Berkeley National Laboratory

ABSTRACT

This paper describes a more compelling case for industry to promote the non-energy benefits of energy efficiency investments. We do this in two ways to actively appeal to chief executive officers' (CEOs') and chief financial officers' (CFOs') primary responsibility: *to enhance shareholder value*. First, we describe the use of a project-by-project corporate financial analysis approach to quantify a broader range of productivity benefits that stem from investments in energy-efficient technologies, including waste reduction and pollution prevention. Second, and perhaps just as important, we present such information in corporate financial terms. These standard, widely accepted analysis procedures are more credible to industry than the economic modeling done in the past because they are structured in the same way corporate financial analysts perform discounted cashflow investment analyses on individual projects. Case studies including such financial analyses, which quantify both energy and non-energy benefits from investments in energy-efficient technologies, are presented.

Experience shows that energy efficiency projects' non-energy benefits often exceed the value of energy savings, so energy savings should be viewed more correctly as part of the total benefits, rather than the focus of the results. Quantifying the total benefits of energy efficiency projects helps companies understand the financial opportunities of investments in energy-efficient technologies.

Making a case for investing in energy-efficient technologies based on energy savings alone has not always proven successful. Evidence suggests, however, that industrial decision makers will understand energy efficiency investments as part of a broader set of parameters that affect company productivity and profitability.

Introduction

"Far from being a soft issue grounded in emotion or ethics, sustainable development involves cold, rational business logic."
— Robert Shapiro, CEO, Monsanto (HBR 1997)

The interest of U.S. industry in linkages between energy efficiency and efficiency of production, greater reliability, and reduced waste and pollution is all related to a larger global movement described as sustainable development. Energy is a major source of environmental pollutants. U.S. industry, in its drive toward overall efficiency of production, has begun to make important connections among reducing waste (including wasteful use of energy), profitability, public relations, and other benefits of being identified with sustainable development (McKane

1998). Companies not only prevent pollution but can also enhance profits by reducing energy and material use. Companies save the direct costs of these resources, as well as reducing disposal costs, avoiding fines, and minimizing bad publicity. In addition, resource efficiency enhances productivity, streamlines production, and improves workplace conditions. Experience shows that energy efficiency projects' non-energy benefits often exceed the value of energy savings (Pye 1998). Companies come out ahead by helping the environment, their employees, and their bottom line.

This paper presents examples of energy efficiency projects that have yielded significant benefits beyond energy efficiency. The box at right lists types of environmental and business achievements realized in the case studies summarized in this paper. This paper also discusses how to make a compelling case to business management by understanding the financial benefits of energy efficiency, pollution prevention, and enhanced productivity.

> ***Project Achievements***
>
> - ***reduce energy required***
> - ***increase production***
> - ***reduce operating time, which saves direct labor and reduces ancillary operations***
> - ***save raw material***
> - ***improve product quality***
> - ***extend the life of equipment and supplies***
> - ***reduce cleaning and maintenance requirements***
> - ***increased system capacity***
> - ***decreased noise***
> - ***reduce emissions***

Some believe that protecting the environment will hurt the U.S. economy and put us at a disadvantage with foreign competitors who have less rigorous environmental standards. This may have been true years ago when "tailpipe" technologies were the primary solution to minimizing pollution. Today, however, we know how to protect the environment by using resources more efficiently: energy efficiency and pollution prevention are just two ways of increasing productivity. As the positive correlation between energy efficiency and productivity becomes more widely understood, businesses will be more motivated to invest in (1) energy-efficient technologies that have productivity benefits and (2) productivity technologies that have energy efficiency benefits.

Enhancing Shareholder Value

While the U.S. government struggles with establishing policy on climate change, many corporations, particularly multinational corporations, are developing new approaches for improving environmental conditions, including CO_2 reduction, an essential element of climate change mitigation. This may seem to be an argument in support of a position that government involvement is not needed to achieve sustainable development; however, we believe that it illustrates that participation by corporations can occur voluntarily if public good can be effectively linked to private profit potential. The companies currently involved in sustainable development are corporate leaders; they are not the majority of participants in the private sector for whom the linkages to profit potential (or the down side of inaction) must be made much more explicit. National governments must work with the private sector because corporations are absolutely essential to achieving any lasting improvements (McKane 1998).

> The roots of the problem -- explosive population growth and rapid economic development in the emerging economies -- are political and social issues that exceed the mandate and the capabilities of any corporation. At the same time, corporations are the only organizations with the resources, the technology, the global reach, and, ultimately, the motivation to achieve sustainability (Hart 1997).

The primary responsibility of business management is to *increase shareholder value.* Shareholder value can be increased by cutting costs or increasing revenues. Increasing productivity, improving product quality, reducing risk, and enhancing reputation are several ways a company can cut costs or increase revenues. Energy efficiency and pollution prevention have been shown to do all of these things. Several studies document a positive correlation between a company's environmental performance and its shareholder value:

> Two management professors studied 243 firms over a two-year period (1991/92), comparing environmental ratings (including compliance records, expenditures, waste reduction, support for environmental groups, etc.). Using return on assets (ROA) as a dependent variable, they found a positive correlation between ROA and environmental ratings (Russo and Fouts 1997).

> Innovest Group International, an environmental and investment advisory firm in Toronto, developed an analytical tool that predicts how a company's environmental performance translates into financial terms. Innovest found that environmental ratings correlate closely with financial performance and that the companies with the highest environmental ratings outperformed their competitors by as much as five percent. Besides being an indicator of strong financial performance, environmental performance also correlates with more sustainable earnings quality (Green Business Letter 1998).

> A study conducted by two economics professors at Dickenson College in Pennsylvania found a positive correlation between a group of 84 companies' financial performance and several aspects of social performance, including environmental record.[1] Companies with top-rated environmental records, compared to those with the worst records, faired significantly better financially, including a 3.9 percent higher return on investment, a 4.4 percent higher earnings-to-assets ratio, and a 16.7 percent higher operating income growth (Makower 1994).

Since these studies show a correlation and not causation between environmental and financial performance, further evidence is required to show whether: (1) financial performance

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[1] Ratings by Council on Economic Priorities based on ten key social issues, including environmental performance.

is enhanced by good environmental performance; (2) companies that are stronger financially are better able to be more proactive environmentally; (3) each kind of improvement supports the other; or (4) environmental integrity is just part of an overall pattern of good management and operations. Although cause and effect cannot be proved by these studies, they do indicate that being an environmentally conscientious company does not *hurt* financial performance.

Case studies presented in this paper support the hypothesis that environmental performance — if done by enhancing productivity gains through appropriate investments in energy efficiency and pollution prevention — can enhance shareholder value. For example, a 1992 study of 75 case studies of pollution prevention across a variety of industries found an average payback of 1.6 years (Fischer and Zachritz 1992) — these investments certainly would enhance shareholder value.

Critics may claim that there are a limited number of energy efficiency projects that have a favorable financial return. This is what Dow Chemical thought when its Louisiana Division, in response to rising energy prices, created an Energy Contest to reduce energy use with projects that provided a minimum of 100 percent return on investment (ROI). In the first year (1981), the 27 (out of 39) projects that survived the review process cost $1.7 million to implement, but paid off with a 173 percent ROI. These impressive results left employees feeling like all opportunities had been tapped. However, the following year's contest had 32 winners, at a cost of $2.2 million and an ROI of 340 percent. In the third year, the contest was expanded to include waste reduction, and 38 winning projects had an ROI of 208 percent on a capital investment of $4 million. Dow's contest was eventually formalized as "WRAP" — Waste Reduction Always Pays. Over a 12-year period, Dow implemented 936 projects with ROIs averaging between 97 percent and 470 percent. Of these projects, 575 projects were audited, verifying savings of more than $110 million per year and an average ROI of 204 percent. Dow attributes its success with energy and waste reduction to creating an environment of teamwork and cooperation among plants that continually builds momentum towards bigger and better projects with higher ROIs (Nelson 1993).

Companies do not undertake sweeping changes without careful consideration. For example, the desirability of participating in ISO 14001, an international voluntary standard for environmental management systems, has been debated due to a perceived lack of a clear, compelling 'business case' to do so. For many companies in the U.S. and Canada, this case has not been made, especially where there is no significant pressure from external stakeholders (Willson and McLean 1996).

Data on pollution control and abatement expenditures by U.S. manufacturers indicate a shift in expenditures from control technology to production process improvements. These advanced manufacturing systems are distinguished by a blend of technological and organizational changes inside the factory (e.g., self-directed work teams, worker rotation, and continuous process improvement) and by close and interdependent relationships across the production chain, particularly between end-users and suppliers (Florida 1996).

Making a Compelling Case to Business

Making a compelling case to business begins with the profit motive. Energy efficiency is generally not a primary driver in industrial decision making. Industry is much more interested in approaches whose impact on profit is more apparent, such as productivity enhancements. Whether one's perspective is that energy efficiency is a byproduct of productivity gains, or that productivity gains are a byproduct of energy efficiency, it is generally the productivity gains that will motivate industry to take action.

Regardless of whether energy efficiency is the driver or the byproduct of a project, management must understand *all* of the costs and benefits associated with an investment in efficiency in order to make decisions that enhance shareholder value. Potential benefits beyond energy savings may include:

- increased productivity,
- reduced costs of environmental compliance,
- reduced production costs (including labor, operations and maintenance, raw materials),
- reduced waste disposal costs,
- improved product quality (reduced scrap/rework costs, improved customer satisfaction)
- improved capacity utilization,
- improved reliability, and
- improved worker safety (resulting in reduced lost work and insurance costs).

While estimating energy and non-energy benefits, it is also critical to estimate all incremental costs, including indirect costs. For example, many projects will require process line shutdown during implementation, causing production losses. To gain credibility with the industrial sector, it is critical to be able to quantify both the upside and downside potential of proposed projects.

An important element in a successful comprehensive evaluation of industrial efficiency projects is to ensure that top and middle management understand the need for data that will support a full assessment of non-energy benefits. If the data doesn't exist over a suitable time frame, or if management is unwilling to release proprietary information, these efforts will be difficult or could fail. If proprietary information is involved, the conditions of confidentiality and release of sensitive information should be worked out in advance (Pearson 1999).

The financial analysis of an efficiency project is the basis for making the investment decision. The financial analysis may range in sophistication from a simple payback (investment/annual net savings) or rate of return (average annual net savings/total investment) to more accurate calculations, such as net present value (NPV) or internal rate of return (IRR), which take into account the time value of money. Regardless of which calculation is used, *the most important part of a financial analysis is the estimation of total incremental project costs and benefits*.

ACEEE, Lawrence Berkeley National Laboratory (LBNL), Oak Ridge National Laboratory (ORNL), and U.S. Department of Energy's Office of Industrial Technology (OIT) are working together to develop the business case by pursuing several of the following action items:

- Compile financial analyses of pertinent case studies that cover different industries and regions.

- Attract national financial media (e.g., Wall Street Journal, Time, Business Week, Forbes, Harvard Business Review) coverage, presenting financial analyses for case studies that highlight non-energy benefits.

- Use case studies, along with a financial analysis primer, to educate the energy efficiency and pollution prevention communities on how to make a more compelling case to industry by using examples of completed projects and better understanding the decision-making process of business management.

- Educate plant engineers on how to sell projects to management more effectively.

- Facilitate a dialog between industry and the energy efficiency community, working with such programs as The Compressed Air Challenge, Steam Challenge, and Combined Heat and Power.

The business, energy efficiency, and pollution prevention communities need to understand the interrelatedness of energy efficiency, pollution prevention, and profitability in order to maximize their effectiveness. The energy efficiency and pollution prevention communities must be able to understand the motivation and terminology of the business community and present their proposals to business in an integrated manner that begins with the profit motive.

Case Studies

ACEEE, LBNL, ORNL, and OIT worked together to develop business case studies with financial analyses for several US DOE Motor Challenge Showcase Projects. The case studies show how several industries have implemented projects that profit from significant benefits beyond energy savings. These business case studies are written for a non-engineering audience, with the intention of being used as a summary of a project that may be presented to a CEO or CFO to explain the project's financial ramifications. Additional engineering detail for these cases can be found in the *Motor Challenge Showcase Demonstration Case Stud(ies)*, prepared by US DOE (DOE 1997a; 1997b; 1997c).

Alcoa/Alumax Mt. Holly, South Carolina Aluminum Smelter
Improved Dust Collection Systems *Motor Challenge Showcase*

Net Present Value[2]: $412,000
Payback: 6 days

Background: In 1995, Alumax (subsequently acquired by Alcoa), an aluminum refiner, decided to improve the energy efficiency of its four pot-line dust collection systems. One consultant recommended installation of variable frequency drive (VFD) controls on the four-fan system.

[2] 12% discount rate applied to after-tax cash flows, assuming 35% tax rate and 2.5-year project life.

A second consultant recommended a three-fan, variable inlet valve (VIV) controlled system. Motor Challenge was then called upon to determine which proposal was the most efficient and cost effective.

Decision: Motor Challenge determined that the three-fan VIV system, which, in contrast to the VFD proposal, required no capital investment, was the most efficient, reducing system energy costs by $103,700 per year. This was accomplished by opening the VIVs wider, resulting in less pressure loss through the VIVs, which increased fan efficiency and allowed for one fan in each of the four systems to be shut down. The system operated in this configuration for two and a half years, until the fourth fan was required to accommodate a 7-8% increase in production.

Rationale: This decision produced the following benefits:

- ***Energy savings*** resulted from shutting down one fan in each of four systems.
- Reducing energy to operate the dust collection system gave Alumax the potential to redirect that energy to ***increase aluminum production*** more than 500,000 pounds/year[3].
- Lower flow rates improved efficiency of dust collection bags, ***reducing emissions 1-2%.***
- Lower flow rates ***extended the life of the dust collection bags by at least 10%.***
- The project had greater potential benefits in that the ***fourth fan became a spare*** which, in case of another fan breakdown, could be used as a spare and prevent unknown hours of downtime. Such a situation, however, did not occur during the project time frame.

These modifications can be ***easily replicated*** at other Alcoa sites.

Total Value Added:

Initial Costs (consulting fees):	$5,000	
Potential Incremental Annual Revenue[4]	$375,000	
Annual Profit Potential:		
Estimated profit on incremental revenue	75,000	(assumes 20% marginal profit)
Energy savings	103,700	(3,346 MWh saved * $0.031/kWh)
Reduction in Dust Collection Bags	123,500	(10%*16,896 bags* $73.08/bag)
Labor (reduced bag changeout)	10,000	(est'd 10% time savings * $48/hr(fully loaded)*2080 hrs/yr)
Total incremental pretax profits	$312,200	

[3] Alumax was contractually obligated to purchase a certain amount of energy. Therefore, although Alumax saved energy in the maintenance area, it was still obligated to purchase that energy. The opportunity is that this energy saved could potentially be redirected to produce more aluminum.

[4] Incremental revenue assumes that 3,346,320 kWh in saved energy is redirected to produce an additional 500,000 lbs. of aluminum, which is sold at $0.75/lb market price.

Greenville Tube Clarksville Plant Drawbench Upgrade

Net Present Value[5]: **$201,000**
Internal Rate of Return: **149%**
Payback: **5 months**

Background: Greenville Tube (GT) manufactures high-precision, small-diameter stainless steel tubing. A system performance optimization assessment of the Clarksville plant by GT engineering staff, with technical assistance from Evans Electric Motors, Baldor Electric Company, and DOE's Motor Challenge program, identified several problems with the No. 6 drawbench that result from an antiquated power distribution system and an inefficient eddy current clutch drive.

Proposal: To increase system efficiency and control, the team recommends replacing the magnetic starter and eddy current clutch with a Baldor vector controller and line reactor, and replacing the 150-hp, 1,770 rpm motor with a high-efficiency 200-hp, 1,180 rpm Baldor motor.

Rationale: This investment produces the following benefits:

- The more efficient vector drive ***reduces the energy consumed*** per foot of draw.
- Greater available horsepower enables many tubes to be reduced to the desired size with fewer breaking draws (average 1 less draw on half the orders processed), which ***reduces operating time*** per foot drawn and allows No. 6 drawbench to take over work previously done on other, less efficient benches. Fewer draws ***saves direct labor*** and ***reduces ancillary operations*** (e.g., degreasing, cut-off, swaging, and annealing).
- The reduced number of draws reduces the number of swaged (flared) ends that get cut off, which ***saves stainless steel***.
- The vector drive and improved process control system allows the operator to control drawbench speed more precisely, resulting in ***improved product quality***.
- Reduced electricity ***reduces emissions*** (CO_2, SO_x, NO_x, particulate matter, VOCs, CO).

These drawbench modifications can be ***easily applied to improve other benches***.

Costs:	vector motor	$11,200
	enclosure and air conditioner	19,000
	installation	7,000
	Total Costs	$37,200
Annual Savings:	electricity (34% reduction)	$7,100
	labor (2,760 hours)	23,500
	stainless steel	41,300
	other direct	5,400
	Total Savings	$77,300

[5] A 7-year equipment life is assumed for the NPV and IRR and the NPV assumes a 12% discount rate.

Incremental Cashflow Analysis
Greenville Tube Clarksville Plant Tube Drawing Bench Upgrade

	Time (years)							
	0	1	2	3	4	5	6	7
Operating Savings:								
Energy		$7,100	$7,100	$7,100	$7,100	$7,100	$7,100	$7,100
Labor		23,500	23,500	23,500	23,500	23,500	23,500	23,500
Reduced scrap/rework		41,300	41,300	41,300	41,300	41,300	41,300	41,300
Other direct expenses		5,400	5,400	5,400	5,400	5,400	5,400	5,400
Operating Expenses:								
Installation	$7,000							
New equipment depreciation*		4,314	4,314	4,314	4,314	4,314	4,314	4,314
Incremental Pre-tax Profits	(7,000)	72,986	72,986	72,986	72,986	72,986	72,986	72,986
Tax (@35%[6])	(2,450)	25,545	25,545	25,545	25,545	25,545	25,545	25,545
After-tax Profits	(4,550)	47,441	47,441	47,441	47,441	47,441	47,441	47,441
New equipment depreciation*		4,314	4,314	4,314	4,314	4,314	4,314	4,314
Capital Expenditures	30,200							
After-tax Cashflow	($34,750)	$51,755	$51,755	$51,755	$51,755	$51,755	$51,755	$51,755
Net Present Value (NPV)	$201,447							
Internal Rate of Return (IRR)	149%							

* New equipment depreciation is a tax shield, so it reduces taxable income, but it is a non-cash item, so is added back to arrive at after-tax cash flow.

Town of Trumbull Sewage Pump System Improvement

Net Present Value[7]: **$60,000**
Internal Rate of Return: **52%**
Payback: **1.9 years**

Background: The Town of Trumbull wanted to increase the operating performance of one of its 10 sewage pumping stations. Built in 1971, the station had twin pumps (40-hp direct drive, wound rotor motor) handling 340,000 gallons of raw sewage per day. One pump handled the entire peak flow under normal operation, while the second pump kicked-in only in extreme conditions. Each pump rarely operated more than five minutes at a time. The system experienced frequent breakdowns, occasional flooding, and sewage spills.

Decision: With help from ITT Flygt Corp., engineers investigated total system performance and decided to add a smaller, 10-hp pump with direct online motor starters and a level control system with float switches. The new pump handles the same volume as the original pumps during non-peak periods, but runs for longer periods of time. The old pumps handle infrequent peak flows. The 2 compressors for the bubbler level control system and the 2 circulating pumps for the old motor control system were also eliminated, and lighting efficiencies were implemented.

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[6] ACEEE estimate.

[7] 7% discount rate applied to cash flows (no taxes apply) over a 25-year measure life.

Rationale: This decision produced the following results:

- ***Reduced energy consumption by almost 44%*** due to:
  - lower outflow rate reduced losses in the piping system
  - lighting system upgrades
  - elimination of the bubbler level control and cooling water pumps
- ***Reduced cleaning and maintenance*** requirements (supplies and labor) and downtime
  - eliminated the need to replace 2 mechanical seals per year
  - new, submersible pump is much easier to swap out if repair/replacement is needed
- ***Extended equipment's expected life*** due to longer operating times (fewer starts and stops) and reduced power input
- ***Increased pumping capacity 25%***, potentially deferring need for additional pump stations
- ***Decreased noise*** from new pump, improving relations with local residents

These modifications can be ***easily replicated*** at other sites (new sites or retrofit).

Value Added:

Equipment Cost, fully installed:		$12,000	
Annual Savings:			
Energy savings		$2,600	(31,900 kWh/yr.)
Maintenance savings:			
Mechanical seals		$1,800	(2 seals/yr. * $900 each)
Labor		$1,800	
	Total	$6,200	

Conclusion

When efficiency advocates understand the business decision-making perspective and can communicate with management using financial and strategic arguments for energy efficiency, the case for energy efficiency is greatly strengthened. Making business sense of energy efficiency reduces its perceived risk to management, which may, in turn, reduce the hurdle rate (or payback period) that a company requires of an energy efficiency investment. There are no guarantees that management will implement energy efficiency projects even if they make sense from a financial perspective. Other investments or projects may have greater financial returns than energy efficiency projects, capital may be unavailable, or certain projects may not fit with a company's strategic plan. However, if advocates do not make business sense of energy efficiency, it may continue to be perceived by many business people as a warm and fuzzy but costly and unnecessary extravagance.

Since businesses make most decisions based on bottom-line impact, it makes sense to look at energy efficiency as part of overall 'efficiency' (e.g., process efficiency, enhanced productivity) to account for *all* the savings that a business will realize from energy efficiency projects. In order to make a more compelling case for energy efficiency and pollution prevention, it is critical to understand the decision-making process of business management. This means understanding the interrelationships of various forms of efficiency, and measuring costs and benefits so that the financial ramifications of our proposals are fully understood and can be communicated to management in terms with which they can identify. Probably the most effective way to get management's attention is to not even mention energy efficiency or pollution prevention, but to call it simply "efficiency" or "productivity," which have always had a positive connotation in the business community.

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