The "Secret Benefits" From Energy Conservation

Contribute Value Worth An 18% Improvement to Energy Savings

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ABSTRACT

In addition to saving energy and reducing utility expenses, there are additional (often unreported) benefits from conserving energy. These financial and strategic benefits extend beyond the utility budget. These non-utility benefits contribute value worth an additional 18 to 50 percent of the energy savings—as demonstrated via a simple example. Calculations are shown on a spreadsheet, which can be downloaded for applications in your own facility.[1] Beyond illustrating these additional benefits, the goal of this article is to motivate change towards saving more energy and money, while preserving more of our natural environment.

SUMMARY

"It's Not the Age… It's the Mileage…"

It is logical that a car driven 25 percent less each year will last longer. The same is true for most energy-consuming equipment, such as lights, motors, and even digital equipment. By turning "off" energy-consuming equipment when it is not needed, an organization can find a financial jackpot which extends beyond the utility budget. *It doesn't matter how energy-efficient an organization is, there are savings from turning equipment "off" when it is not needed.* Listed below are some "secret" benefits of energy conservation, and these are benefits that can be attained without a negative impact on productivity.

Budgetary Improvements

1. Efficient Net Income: When energy is conserved, utility budgets are reduced. This is no secret, but what is noteworthy is that conservation savings impact a bottom line far more efficiently than many other investment initiatives.[2]
2. Extended Equipment Lives: If assets are lasting longer (due to reduced operation per year), replacements are less frequent, thereby reducing capital budget requirements. *For example—if a lighting system is operating 30 percent fewer hours per year, it could last up to 30 percent longer. A 15-year replacement policy could be changed to 20 years.*[3]
3. Reduced Maintenance Costs: When equipment runs fewer hours per year, maintenance material/labor requirements are reduced. For example, if maintenance on a motor is done on a "run hour" basis and there are fewer "run hours" per year, there should be fewer maintenance visits. Further, if the motor is part of a ventilation system, air filter replacements would occur less often, reducing material and labor costs.[4]
4. Reduced Risk to Energy Supply Price Spikes: For example—if less energy is consumed, the operational budget is less vulnerable when electric/gas/heating oil prices hit their seasonal spikes. The avoided costs can be worth millions to a large organization.

Beyond the large financial benefits mentioned above, there are many strategic benefits of energy conservation, which can significantly add to your organization's "jackpot."

Long-term Strategic Benefits

5. Ability to Sell "Carbon Credits": Organizations can claim emissions reductions from energy conservation.[5] There are environmental markets where "emissions credits" (from energy conservation) can be sold, generating revenue for an organization. These markets are already liquid in Europe (and are motivated by carbon-related legislation). California and other states already require emissions reporting and reductions, and federal regulations are in process that will open the door to a similar trading environment in the United States.[6]
6. Enhanced Public Image: Organizations that conserve/manage energy (thereby reducing emissions) can differentiate themselves as "environmentally friendly" and "good" members of a community. This can have tremendous political, strategic, competitive, and

morale-building value for organizational leaders. Many benefits (such as attracting and retaining better employees, faculty, students, clients, suppliers, etc.) result from being the "leader" in your field. A recent study showed that 92 percent of young professionals want to work for an organization that is environmentally friendly.[7] Even stock prices of corporations have been proven to improve dramatically when energy management programs are announced.[8]

7. Reduced Risk to Environmental/Legal Costs: If assets are replaced less frequently, an organization will generate less waste and be less vulnerable to environmental regulations governing disposal. (Disposal of batteries and fluorescent lamps is already regulated in most states). Greater environmental regulations are inevitable and unforeseen legal costs can pose a significant expense and political risk.[9,10]

As will be shown in the following text, benefits #2 through #7 represent a significant improvement (18 to 50 percent) to the original savings estimates.

CLIMATE CHANGE AND ITS EFFECT ON ENERGY CONSERVATION APPROACHES

"The Writing is on the Wall"…

The glaciers are melting and climate change is here.[1] The data are compelling and creating change in consumer choices.[1] Consumers are becoming more "green-minded" in their purchases—especially young people and college students. Studies show that more consumers are choosing to reduce their "carbon footprint," and thereby choosing products, companies, and colleges that are more environmentally friendly.[13,14] Federal and state governments are introducing legislation that will mandate carbon emissions reporting and management.[15,16] In summary, the need for a "carbon diet" is driving activity in the energy-conservation industry.

The "Good" News…

Companies, colleges, and governments are responding to this growing "green" consumer market and competitors are innovating to be the "environmental leaders" of their fields.[17,18,19] Energy efficiency/conservation is ranked by corporate executives as the #1 way to reduce

emissions in a cost-effective manner.[20] Because buildings contribute approximately 43 percent of the carbon emissions in the US, an opportunity exists to reduce a large part of these emissions and become "environmental heros."[21] In addition, organizations perceived as more "environmentally friendly" can recruit better faculty, students, suppliers, and employees.[22] Finally, the "secret benefits" (discussed in the Executive Summary) are increasing in value and importance. *An energy conservation program is more valuable today because the material, waste, labor, emissions, and risk savings are more valuable in today's economy.*

A SIMPLE EXAMPLE TO DEMONSTRATE THE "SECRET BENEFITS"

A lighting conservation measure will serve as the example, although similar calculations could be applied towards motor systems.[23] Motors and lights consume the majority of electricity in a typical building.[24,25] Computers and other digital equipment are also worth mentioning, because they can consume considerable amounts of energy.[26] *See footnote for additional commentary on security benefits related to computers.*

For this example, consider a large school with 10,000 light fixtures. Through a variety of energy conservation measures, it is common to reduce consumption by 25 percent.[27,28] First, we will calculate the dollar savings from electricity conservation. Then, we will show the "secret benefits," which have impacts beyond the utility budgets. A spreadsheet will illustrate the total savings/benefits, and you can download this sample spreadsheet to estimate "rough" benefits in your facility.[29]

Benefit #1: Reduced Utility Budget from Lighting Conservation:

Assume the fluorescent lights are relatively new and consume 60 watts per 2-lamp fixture and operate 5,000 hours per year[30]. Our baseline energy consumption is:

= (5,000 hrs/year)(.060 kW/fix)(10,000 fix.)

= 3,000,000 kWh/year

If the school pays approximately $.08/kwh, then the dollars spent on electricity for this lighting system:

= $240,000/year.

Thus, a 25 percent reduction from the baseline usage would equal: 750,000 kWh/year, or $60,000/year in savings, *which goes immediately to the bottom line* and improves cash flow.[31,32]

Benefit #2: The Value of Extended Equipment Lives (reducing capital budgets):

If lights are used 25 percent less, the lighting system (ballasts) should last about 25 percent longer.[33] A lighting ballast is rated for 60,000 hours of operation. If the school operates the lights 5,000 hours per year, they would need to replace the ballasts at the twelfth year and dispose of the old ballasts. If there are 5,000 ballasts, each costing $25 to $55 (material, installation and disposal costs vary by geographic location), the replacement cost (minimum) at the twelfth year would be:

= ($25/ballast)(5,000 ballasts)
= $125,000

Annualized replacement cost would be:
= $125,000)(1/12 years)
= $10,417/year

With a use rate of only 3,750 hours/year (a 25 percent reduction), the ballasts should last 16 years.[34] This would reduce the annualized replacement cost to:

= ($125,000)(1/16 years)
= $7,813/year

Thus, the annualized savings, (calculated as the difference between the original replacement cost minus the reduced replacement cost) are:

= $10,417/year - $7,813/year
= $2,604/year (at $25 per ballast)

Using the same equations, at $55/ballast, the annualized savings, (from replacing at 16 years instead of 12 years) would be:

= $5,729 per year.

Thus, due to extended equipment life, we have reduced the annualized replacement cost by a minimum of $2,604/year to a maximum of $5,729/year.

Benefit #3: The Value of Reduced Maintenance Costs (operating expenses, not capital replacements):

If the lights are used 25 percent less, the lamps should last about 25 percent longer[35]. A typical fluorescent lamp life is 20,000 hours.[36] With a use rate of 5,000 hours per year, the school would need to replace lamps at the fourth year. If there are 10,000 lamps, each costing $3 to $5 (material, installation and disposal costs vary by location), the replacement cost[37] (minimum) at the fourth year would be:

= ($3/lamp)(10,000 lamps)
= $30,000

Annualized replacement cost would be $30,000/4 = $7,500.

With a use rate of only 3,750 hours, the lamps should last 5.3 years, thereby reducing the annualized replacement cost to:

= $30,000/5.3 years
= $5,660/year

Thus, annualized savings are:
= $7,500 - $5,660/year
= $1,840 per year (at $3/lamp)

Using the same equations, at $5/lamp, the re-lamping cost would be $50,000 and the annualized savings from replacing at 5.3 years instead of at 4 years would be = $3,066 per year.

Thus, due to extended lamp life, we have reduced the annualized maintenance cost by a minimum of $1,840/year to a maximum of $3,066/year.

Benefit #4: The Value of Reduced Risk to Energy Supply Price Spikes[38]:

Assume that on average, for 1 quarter of the year, energy prices are 25 percent to 50 percent higher ($.02 to $.04 more per kWh) due to seasonal/supply spikes.[39]

If we are using less energy, we will pay less of a premium for the price spike. The avoided price spike premium is equal to:

=(price premium)(kWh saved)(premium period)
=($.02/kWh)(750,000 kWh/yr)(1/4)

= $3,750/year

Using the same equations, a 50 percent price spike would represent an avoided premium worth:

=(price premium)(kWh saved)(premium period)
=($.04/kWh)(750,000 kWh/yr)(1/4)
= $7,500/year

Thus, due to reduced risk from price spikes, the avoided premiums are $3,750 to $7,500 per year.

Benefit #5: The Value of Carbon Credits:

According to the EPA, 1.37 lbs of CO_2 are created for every kWh burned. So if we are saving 750,000 kWh/year, the avoided power plant emissions would be equivalent to[40]:

=(750,000 kWh saved)(1.37 lbs of CO_2/kWh)
= 1,027,500 lbs of CO_2 saved per year

Translating lbs to metric tons:

=(1,027,500 lbs CO_2)(.000454 Metric Tons/lb)
= 466.5 Metric Tons of CO_2 saved per year

These avoided power plant emissions could be claimed as "carbon credits" and sold to another party who wants to buy "carbon credits."[41]

Assuming a market price of $6 per metric ton[42], the additional revenue generated by selling the carbon credits would be:

=(466 Metric Tons of CO_2/year)($6/M-Ton)
= $2,799 per year

Using the same equations, at $30 per metric ton, the additional revenue generated by selling the carbon credits would be:

=(466 Metric Tons of CO_2/year)($30/M-Ton)
= $13,980 per year

Thus, due to the new carbon market, there is a possible additional revenue stream worth a minimum of $2,799 to a maximum of $13,980 per year from selling carbon credits. In addition as carbon prices go higher…so does the value of this new revenue stream.

Benefit #6: The Value of Enhanced Public Image

Although calculation of this value is difficult and is not generalized here, it can be far greater than any of the benefits mentioned above. In today's "green-minded" economy, many organizations have used "green" programs as a very effective marketing tool to differentiate themselves from the competition, achieve business objectives, secure and retain talent, improve productivity, and capture a greater market share.[43]

The shaded area of Table 1 shows the "equivalent environmental benefits" from avoided power plant emissions.[44] These reductions/benefits can be published in various places to improve the organization's green image with employees, clients, students, suppliers, distributors, shareholders, and other groups relevant to the success of an organization.

Thus, due to an energy conservation program, the school can claim environmental benefits equivalent to removing 1,008 cars off the road, thereby improving the school's public image. Although not calculated here, the benefits of attracting better faculty, students, employees, etc., could far outweigh all the benefit estimates in this article. See Table 1 for additional expressions of environmental benefits.

PROFITABLEGREENSOLUTIONS

Complete Emissions Calculator

INSTRUCTIONS: Type in the kWh savings and see the emissions-environmental benefits in green-shaded areas . Insert your own $$ values for the Strategic Benefits in blue text .

Type the amount of electricity your program will save	750,000 kWh/year

Emissions Reductions:	Annual Reductions	Reductions over 10 years
Conversion Factor: 1 kWh is worth 1.37 lbs of CO2 (Source: EPA 2006)		
GreenHouse Gas Reduction (in pounds of CO2)	1,027,500 lbs	10,275,000 lbs
or when converted to Metric Tons of CO2 >>>	466.5 Metric Tons	4,665 Metric Tons

Equivalent Environmental Benefits (mutually-exclusive):	Annual Reductions	Reductions over 10 years
Acid Rain Emission Reduction	5,625.0 lbs of SOx	56,250 lbs of SOx
Smog Emission Reductions	2,700.0 lbs of NOx	27,000 lbs of NOx
Barrels of Oil Not Consumed	1,085.0 Barrels	10,850 Barrels
Cars off the Road	100.8 Cars	1,008 Cars
Gallons of Gas not Consumed	53,130.3 Gallons	531,303 Gallons
Acres of pine trees reducing carbon	388.6 Acres	3,886 Acres

Strategic Benefits (quantifiable at site-specific level)	Annual Benefits	Benefits over 10 years
Annual Report to Shareholders,	?	?
Community Morale & "Green Image",	?	?
Productivity Improvements, Cost-Competitiveness	?	?
Avoided Future Capital Outlay	?	?
LEED Points, White Certificates, RECs	?	?
FREE Public Press (GREAT), Political/Strategic	?	?
Legal Risk Reduction, Avoided Penalties	?	?

Table 1

Benefit #7: The Value of Reduced Risk of Environmental/Legal Costs

Although calculation of this value is also difficult and is not generalized here, it can be very significant. The risk is real, but unknown. This is demonstrated by the following environmental disasters that significantly crippled or destroyed the organizations deemed responsible:

- The Union Carbide accident in Bhopal,
- Love Canal's hazardous waste,
- Mercury poisoning at Alamogordo, NM

It is also interesting to note that Exxon's penalties and fees were 4 times the actual clean-up costs for the Valdez oil spill.

More relevant to this article is that emissions regulations are likely to become a standard in the United States. Organizations that are implementing energy conservation programs will have a regulatory advantage over those that do not. Inaction could pose legal risks.

Thus, due to its energy conservation program, the school in this example can reduce its risk from unknown environmental and legal risks that may arise in the future.

Table 2 summarizes the dollar value from the benefits mentioned in this article. The approach and calculations for these benefits could be used as a guide to identify the "secret benefits" of other energy consuming systems, such as HVAC and motors, etc.

Example: The "Secret Benefits" of Energy Conservation

	Additional Benefits Estimates	
	Min	Max
Assumptions: Baseline Electricity Expenses from the Lighting System = $240,000 per year. A 25% savings via basic energy conservation measures would yield $60,000 in savings/year	$/Year	$/Year
Value of "Secret Benefits" (most exist outside the utility budget)		
Benefit #2: Extended Equipment Lives (Avoided Annual Capital Costs)	$2,604	$5,729
Benefit #3: Reduced Maintenance Costs (Avoided Operational Expenses)	$1,840	$3,066
Benefit #4: Reduced Risk to Energy Price Spikes (Avoided Premium Costs)	$3,750	$7,500
Benefit #5: Selling Carbon Credits (emissions reductions via energy conservation)	$2,799	$13,980
Total Additional Value from Quantifiable "Secret Benefits">>>	**$10,993**	**$30,275**
% Savings of Baseline Electricity Expenses ($240,000/year) of the Lighting System	***4.6%***	***12.6%***
% Savings Improvement from Original Estimate of $60,000/year in Savings	***18.3%***	***50.5%***

Note: Estimates are Conservative because Dollar Values for Benefits #6 and #7 were not included here.

Table 2

CONCLUSION

This article has presented additional benefits from energy conservation. The example described an energy conservation project that was achieving a 25 percent reduction in electrical consumption from the lighting system. Beyond obvious energy savings, the "secret benefits" #2 through #5 yield additional value worth $10,993 to $30,275 per year. *In other words, if energy conservation saves 25 percent of a utility budget, the "secret benefits" are worth an additional 4.6 to 12.6 percent.*

Looking at this a different way, the "secret benefits" contribute additional value worth a minimum 18 percent improvement from the original estimated savings of $60,000 per year. *In other words, if we value the secret benefits as worth only an additional $10,993, this represents a minimum improvement of 18 percent to our energy savings of $60,000. In addition, there is a $4,660 value improvement for each $10 rise in US carbon prices.*

Finally, all estimates in this article only included the quantifiable "secret benefits" (benefits #2 though #5). Actual values could be much higher when accounting for enhanced public image and a reduction in legal and environmental risks (benefits #6 and #7).

We hope that this article motivates additional action for energy conservation, dollar savings, and environmental benefits.

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