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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.

OUTLINE

EXECUTIVE SUMMARY

"It's not the age… it's the mileage"…
It is logical that a car driven 25% 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% fewer hours per year, it could last up to 30% longer. A 15 year replacement policy could be changed to 20 years.*[3]

[1] Download the spreadsheet (under the "Resources" tab) here: www.ProfitableGreenSolutions.com

[2] *For Example: an energy conservation program that saves $100,000 in operating costs is equivalent to generating $1,000,000 in new revenue (assuming the organization has a 10% profit margin). It is more difficult to generate $1,000,000 in new revenue, and would require more marketing, infrastructure, etc.. Thus, the energy conservation/efficiency program is an investment with less risk and quickly improves cash flow.*

[3] Further savings could result from considering that if equipment lasts longer, then staff/engineering/project management time is reduced for reviewing new equipment proposals, evaluating competing bids, overseeing installation efforts, coordinating invoices and payables with accounting.

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 less "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% 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]

[4] Predictive maintenance technologies can also assist in this strategy and reduce the cost per horsepower by 50%. (Ameritech)

[5] When energy is saved, power plants do not have to produce as much electricity, thereby reducing "smoke stack" emissions. *Emissions benefits from energy conservation can be expressed in terms of "equivalent trees planted", or "equivalent barrels of oil not consumed".*

[6] New York Times, December 6th 2007- "Senate Passes Cap & Trade Legislation"

[7] Wall Street Journal, November 13th, 2007- "How Going Green Draws Talent, Cuts Costs".

[8] Wingender, J. and Woodroof, E., (1997) "When Firms Publicize Energy Management Projects: Their Stock Prices Go Up"- How much- 21.33% on Average! *Strategic Planning for Energy and the Environment*, Summer Issue 1997.

[9] McCain-Lieberman Senate Proposal, 110th Congress, 8/2/2007

[10] "Mayor Bloomberg calls for Carbon Tax", New York Times Article November 7th, 2007

As will be shown in the example on the next page, 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.[11] The data is compelling and creating change in consumer choices.[12] 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 are 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% 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

[11] Climate change is a result of changes in the Earth's atmosphere. The growth of "greenhouse gases" between 10,000 years ago and the 1800s was approximately 1% for that period. Since the 1800s, greenhouse gases have increased 33%. Thus, it is logical that this growth is due to human-caused activities with the dawn of the industrial age. - Time Magazine- Special Report, December 2007. *Also quoted by the UN Intergovernmental Panel on Climate Change- February, 2007 as well as the US EPA website: www.epa.gov*

[12] "If the entire world lived like North Americans, it would take three planet Earths to support the present world population (in 2006)"- Source: Harvard Business Review on Business and the Environment.

[13] Carbon offset trading growth is greater than 200%: "in June of 2007, the Chicago Climate Exchange reported that in the past six months, it had already traded 11.8 MtCO2e – more than had been traded in the entire year of 2006." – Source: State of the Voluntary Carbon Market 2007, 18th July 2007

[14] "69% of consumers shop for brands aligned with a social cause." – Survey data from United States Green Building Council.

[15] Numerous legislative bills in progress: Bingaman-Specter, Kerry-Snowe, Sanders-Boxer Senate Proposals, 110th Congress, 8/2/2007.

[16] In September 2006, Governor Schwarzenegger signed the California Global Warming Solutions Act, which mandates a 25% cut in emissions by 2020 and an 80% cut by 2050.

[17] Hewlett-Packard says that in 2004, $6 Billion of new business depended on answers to customer questions about the company's environmental record- a 660% growth from 2002. – Daniel Esty, (2006) Green to Gold.

[18] "Sustainability efforts protect our license to grow" – Wal-Mart CEO Lee Scott, (2005)

[19] Harvard Green Campus Initiative, UCSB Sustainability Program

[20] Based on findings of survey in Getting Ahead of the Curve: Corporate Strategies That Address Climate Change, Pew Center on Global Climate Change, 2006

[21] Sources- Pew Center on Global Climate Change, *The U.S. Electric Power Sector and Climate Change Mitigation* and *Towards a Climate Friendly Built Environment*

[22] Wall Street Journal, November 13th, 2007- "How Going Green Draws Talent, Cuts Costs".

[23] For example: With motor systems, if maintenance is performed according to "run hours" and operating hours are less, the schedule could be extended.

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%.[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% 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% less, the lighting system (ballasts) should last about 25% 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 12th 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 12th year would be:

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

[24] Association of Energy Engineers (2008)- Certified Energy Manager Program Workbook.

[25] Although it is noted that "plug loads" (computers, printers and other digital equipment) have increased significantly during the past 20 years.

[26] Some people will not turn "off" computers due to fear of reduced computer life. This may have been true years ago, however today most computers will last longer if turned off during the night (Source: Dell, HP). *Although extending computer life may be irrelevant because they are typically obsolete after 7 years.* In addition, computer security is better when the computer's power is "off". Computer "hackers" can not manipulate your system if it is turned "off".

[27] There are many ways to accomplish energy savings (via conservation, technologies, commissioning, process changes, etc.). The authors recommend that readers consult with energy experts to determine the exact "how" to achieve the savings potential. *This article's purpose is to describe additional benefits (usually unreported) that have impact beyond the utility budget.*

[28] Gregerson, J., (1997) "Cost Effectiveness of Commissioning 44 Existing Buildings", 5th National Conference on Building Commissioning.

[29] Download the spreadsheet under the "Resources" tab here: www.ProfitableGreenSolutions.com

[30] This example uses a standard T-8 lighting system, although the energy conservation savings would be even greater with a less efficient lighting system, such as a T-12.

[31] Note we will not count demand (kW) savings as the electrical load reduction would likely occur during non-occupied hours (off-peak electrical rates). *However, it is not unusual for conservation programs to reduce both kWh and kW.*

[32] In addition to "direct dollar savings", there are tax rebates and credits available that can further improve the financial results from energy conservation/efficiency programs/projects. See these websites for more information about tax rebates:
www.dsireusa.org , www.energytaxincentives.org
http://www.efficientbuildings.org

[33] Fluorescent fixture and wiring replacement costs are not included, as these components typically last longer than the ballast. We will address lamp life as a part of "maintenance costs" in Benefit #3

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% 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% less, the lamps should last about 25% 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 4th 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 4th 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]:

[34] If replacement occurs at failure or based on run time, these savings automatically occur. If replacements are planned in advance, planners should adjust their schedules to insure savings are captured from extended equipment lives (not replacing assets pre-maturely).

[35] Note that if lamps are turned "on" and "off" frequently at less than 3 hour intervals, the lamp's expected life will be reduced by approximately 25%, which would erode the savings in this category.

[36] Lamp life is rated at the factory by turning lamps on and off every three hours until they burn out. If the frequency of on/off cycling is less than 3 hours, lamp lives will decline by 25% on average. Therefore, turning a lamp off for longer periods is better than shorter periods. *For example, it is better to find locations where you can turn off lamps for 5 hours out of 15 hours, instead of 1 minute out of every 3 minutes, although the % time off is the same.*

[37] Average lamp material, labor and disposal/recycling pricing from several vendors including Muska , Lektron, Sylvania, Philips, www.budgetlampreclaimers.cnchost.com and www.AirCycle.com,

[38] Although not counted in this article, there are additional utility-related savings from implementing an energy management program. For example, a focused effort on utility bill analyses often reveals utility billing errors (including sales tax overcharges), which can be considerable. *For example, one ESCO reported that 70% of the time, they find errors that are worth approximately 5% of an energy user's bill.*

Assume that on average, for 1 quarter of the year, energy prices are 25% to 50% 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% 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 CO2 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 CO2/kWh)
= 1,027,500 lbs of CO2 saved per year

Translating lbs to Metric Tons:
=(1,027,500 lbs CO2)(.000454 Metric Tons/lb)
= 466.5 Metric Tons of CO2 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 CO2/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 CO2/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 green-shaded area of Table 1 below 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,

[39] Similar calculations could be used for systems that use natural gas, due to its seasonal volatility.
[40] The Environmental Protection Agency's avoided power plant emissions calculations (updated October 2006) are included in a simple spreadsheet, which can be downloaded under the "Resources" tab at www.ProfitableGreenSolutions.com
[41] An "aggregator" may be required to trade carbon credits in small quantities.
[42] Note as of this printing, European prices for carbon credits are well over 5 times the price of carbon credits in the US. The US carbon market is expected to follow Europe's lead as US regulations begin to take effect. Therefore, it is logical that the US prices will approach the European prices, which are currently at $34/metric ton.
[43] Several examples include: Patagonia, Google, GE, Home Depot, etc.. Other examples can be downloaded from the "Resource Vault" at www.ProfitableGreenSolutions.com
[44] You can use this emissions calculator to estimate the environmental benefits from your energy saving projects. Download the spreadsheet (under the "Resources" tab) at www.ProfitableGreenSolutions.com

suppliers, distributors, shareholders and other groups relevant to the success of an organization.

Thus, due to 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 out-weigh all the benefit estimates in this article. *See Table 1 for additional expressions of environmental benefits.*

INSERT 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.

INSERT TABLE 2

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.

CONCLUSION

This article has presented additional benefits from energy conservation. The example described an energy conservation project that was achieving a 25% 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% of a utility budget, the "secret benefits" are worth an additional 4.6% to 12.6%.*

Looking at this a different way, **the "secret benefits" contribute additional value worth a minimum 18% 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% 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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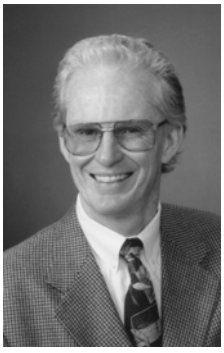

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Table 1

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 2

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.