Increasing Commercial Real Estate Returns With Energy Risk Management

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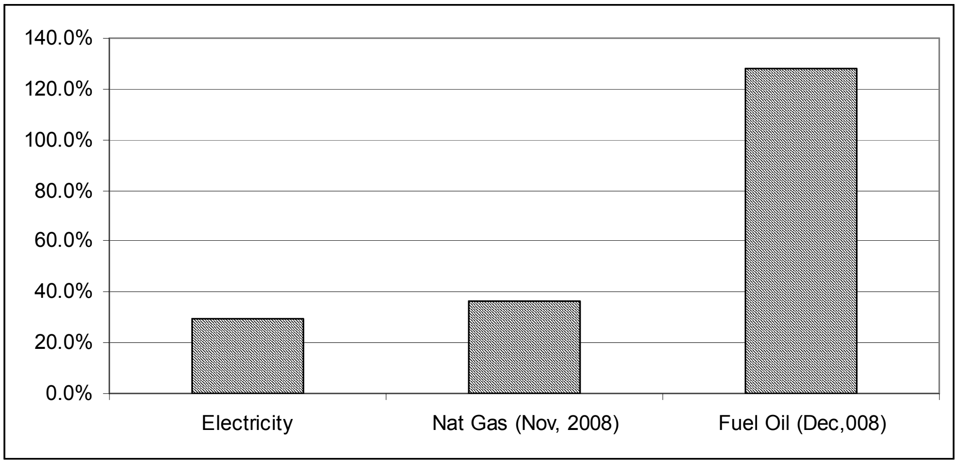
Introduction

While oil prices have fallen dramatically, natural gas and electricity prices have only moderated slightly in the last year. Figure 1, below shows commercial sector energy price increases of 30, 36 and 128 percent from 2003 to the end of 2008 for electricity natural gas and fuel oil respectively. These price are unlikely to moderate much further because the price of coal, the primary electric generating fuel, remains high and natural gas prices tend to be regional markets impacted less by swings in oil prices.

Figure 1. Energy Price Increases, 2003-2008alue at Risk (VaR)



Many large retail and office-building owners are paying $300,000 or more in increased electric and natural gas costs compared to for common areas compared to five years ago. In addition to reducing net operating income, these increased costs reduce the market value of real estate. With a market capitalization factor of 8, a building owner paying an extra $300,000 in energy costs is also losing $2.4 million in capital value of the real estate. These calculations become even more important as the recession increases vacancy rates and puts downward pressure on rents.

Energy cost histories of commercial space are also increasingly a consideration in lease negotiations. Energy costs of leased space, regardless of whether directly billed to the tenant through submetering, included in the rent or included as an add-on energy charge, will become more important as more energy-efficient new construction is added to the market.

Increasing emphasis on sustainability and carbon emissions will undoubtedly increase the focus on building energy use, especially as an Obama administration carbon policy is articulated.

Real estate owners have traditionally been reluctant to invest in energy efficiency. Alternative investment priorities and uncertainties concerning returns to efficiency investments generally require investments to provide paybacks of a year or less to qualify for serious consideration.

However, building owners can apply energy risk management to identify efficiency investments that reduce energy costs by more than the cost of financing the investments, providing increased cash flows and market value. Appropriate energy efficiency investments have the same bottom-line impact as increased rent revenues.

Estimates of cost-effective energy savings potentials are 30 to 40 percent or more of current energy costs in most commercial real estate. A risk management analysis provides the tools to identify which investments are most profitable and the associated risk. Rather than screening efficiency investments with a "one-size-fits-all" payback requirement designed to filter out all but "sure thing" investments, risk management analysis permits owners to consider efficiency investments with a strategy more consistent with risk considerations applied to other investments.

This paper describes Energy Budgets at Risk (EBaR)® , a facility energy-efficiency investment risk management analysis system developed by the author that provides internal rate of return and net savings (savings after subtracting amortized costs of the investment) of individual efficiency investments at alternative confidence levels that can be matched to each organization's risk tolerance. Impacts on energy budgets and expected budget variances are also provided.

EBaR analysis is demonstrated with a case study application to an Austin, Texas office building described in more detail in Energy Budgets at Risk (EbaR)®: A Risk Management Approach to Energy Purchase and Efficiency Choice (Jackson, 2008).

Payback Pitfalls

Payback (PB) analysis (investment cost divided by annual savings) is a traditional investment criteria used to evaluate energy-related real estate investments. If a property is likely to be sold in two years, the owners presumably would like to have the investment pay for itself before the sale. Furthermore, uncertainties surrounding energy prices, weather, actual performance of energy-efficient equipment and other factors are addressed by applying short paybacks to energy-efficiency investments.

PB analysis makes intuitive sense with regard to ownership expectations and avoiding investment risk; however, it is an exceedingly poor financial approach to deal with high and volatile energy costs. For instance, if a 500,000 square foot office building with annual electricity costs of $1 million per year (a reasonable estimate in many states), is approached by XYZ energy service company offering an energy conservation project with an estimated reduction of $400,000 in electric bills based on an initial investment cost of $850,000 the 2.1 year payback would most likely disqualify the investment.

However, with an amortized cost of $150,000 per year that XYZ will finance, the owner could increase net operating income by $250,000 per year ($400,000 savings minus $150,000 amortized efficiency costs). In addition, if a capitalization factor of 8 is appropriate for the market, the capital value of the building will increase at the outset by $2 million.

Thus, the owner enjoys an increase in income of $250,000 per year for each year of ownership and sells the building for $2 million more than would have been the case if the efficiency investment had not been made.

Of course, if this example included no uncertainty, the decision would be easy. The investment would be made; the owner's profits and the value of the property would increase. However, uncertainty with respect to actual energy bill savings is a more difficult issue to address. The projected energy savings might, in reality, not cover the amortized payments.

Decision-makers prefer PB analysis to address these concerns because PB provides a simple decision metric and because textbook approaches such as net present value (NPV) and internal rate of return (IRR) require questionable adjustments to future savings to account for risk. If "expected" energy cost savings pay for investment costs in a year, any likely divergence from the expected is not likely to be great enough to extend the payback beyond two or three years which still translate into attractive IRRs of approximately 50 or 30 percent.

As a financial decision rule, payback has serious and widely recognized deficiencies. To provide an effective screening of risky projects, the payback threshold must be defined with a worst-case scenario; otherwise, risky investments will slip through. On the other hand, efficiency investments with less uncertainty over performance, operating hours, or other variables that determine cost savings and those with longer lifetimes will be summarily rejected even though they may actually reflect little or no risk.

The costs of neglected efficiency investments with conservative payback requirements are substantial. A variety of US Department of Energy studies indicate that unrealized cost-effective energy savings potentials are 30 percent or more.

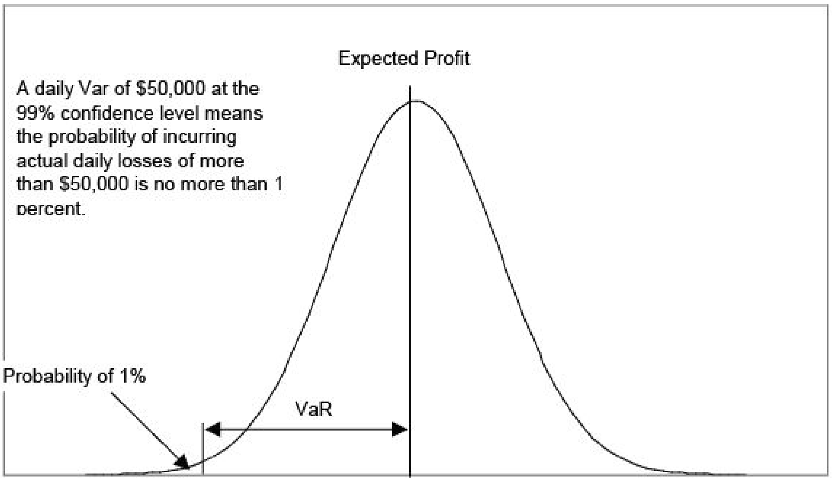
Every building requires lighting, heating, air conditioning, ventilation and other energy-using equipment. Investing in more efficient energy equipment provides the same services (heating, lighting, and so on) at a smaller cost. As long as the facility is occupied, benefits of the investment will continue. Investment risk arises because of uncertainty over future energy prices, operating performance, weather and other factors. All of these factors can be quantified and incorporated in a financial energy-efficiency risk management analysis.

Rather than applying payback analysis to avoid risk associated with energy-efficiency investments, a more profitable approach manages risk by applying modern financial risk management tools.

Energy Budgets at Risk (EBaR) Investment Analysis

Risk associated with financial investments has increased significantly since the early 1970s because of volatility in international exchange rates, commodity prices, interest rates, and geopolitical events (Bernstein, 1996). Investment portfolio management now depends heavily on an array of quantitative tools to assess risks and returns associated with financial investments (Crouhy, Galai, and Mark, 2006). The most widely used quantitative tool is "value at risk" or VaR which measures the probability that portfolio losses over some period will exceed a set amount at a predetermined confidence level (Holton, G.A, 2002). A daily VaR of $50,000 at a 99 percent confidence level means the probability that the portfolio will lose more than $50,000 in a day is less than 1 percent. That is, losses of more than $50,000 can be expected to occur no more than 4 days in a year. VaR statistics are calculated using historical data on returns of the individual stocks or other financial investments in the portfolio and are reflected in Figure 2

Figure 2 Value at Risk (VaR)



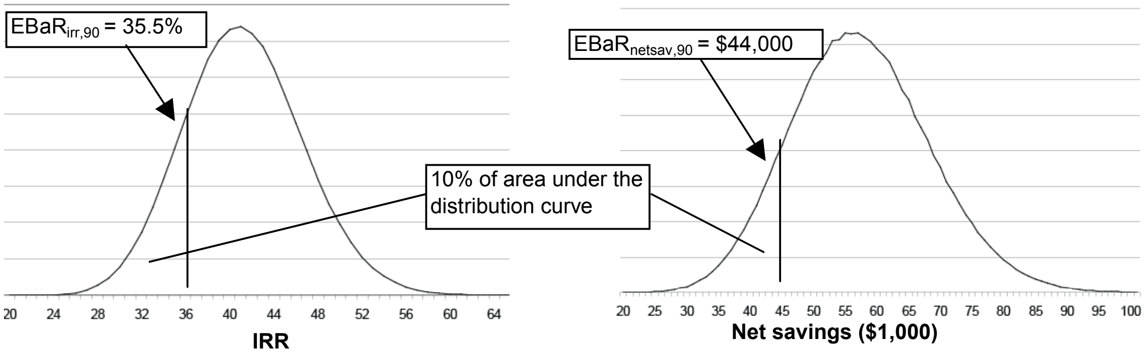
Virtually all investment firms, banks and financial institutions manage their investment risk using some variant of VaR analysis. VaR is also used by US and international regulators to insure financial institutions' capital adequacy.

Energy Budgets at Risk or EBaR is a new energy efficiency investment analysis process developed by Jackson (2008) to extend and apply the VaR methodology to assess investment risk associated with energy efficiency investments. Not only has the basic analytical application applied in EBaR been vetted in the financial industry, it provides the kind of easy to evaluate decision variables favored by financial decision-makers.

EBaR efficiency investment analysis applies quantitative characterizations of uncertainty associated with each of the variables that determine energy cost savings using Monte Carlo analysis, the same analysis technique used in scheduling and budgeting risk management software. EBaR analysis results are generated as probability distribution of outcomes. Distributions for the two primary investment variables, internal rate of return (IRR, or annualized return over the life of the equipment) and net savings (energy cost savings minus annualized cost of the investment) are shown in figure 3

These distributions reflect case study results described in the next section. $\text{EbaR}_{irr,90}$ indicates that the probability of receiving an internal rate of return smaller than 35.5 percent is less than 10 percent; $\text{EbaR}_{netsav,90}$ indicates the probability of achieving an annual net savings (increase in cash flow) less than $44,000 is less than 10 percent.

Figure 3 EBaR IRR and Net Savings Definitions



An EBaR Case Study

EBaR investment analysis is described in this section with an illustrative case study analysis of an energy efficiency option for a five story, 120,000 square foot Austin, Texas, office building. The least-cost baseline design results in modeled annual electricity use of 16.42 kWh/square foot and natural gas use is 35.1 kBtu/square foot. Energy bills at current prices will be approximately $210,000 per year for electricity and $50,000 for natural gas.

Two efficiency options are considered. The first is a package of lighting technology upgrades, and the second is an HVAC redesign including an energy management and control system. A summary of the efficiency investments is shown in Table 1.

Table 1. Investment Analysis Summary

Item	Value	Item	Value
Total investment cost	$225,000	Internal rate of return	42.30%
Estimated energy cost savings	$98,000	Net cash flow	$58,300
Payback	2.3 years		

The payback of 2.3 years is longer than the building owner's 1-year requirement. Consequently, even though this investment would reduce the building's annual energy costs by 38 percent, the investment would not be made because it falls short of the payback criteria. From the owner's perspective, investments with expected paybacks greater than 1 year carry too much risk of unacceptable investment returns.

How does this investment fare when evaluated with the EBaR risk management framework? Uncertainty surrounding electricity prices, natural gas prices, weather and operating performance are based on historical data (see Jackson, 2008). Uncertainty surrounding model-estimated efficiency savings estimates is specified as +-15 percent for lighting impacts and +-20 percent for HVAC impacts based on consultations with equipment representatives and internal analysis.

Representing investment returns (IRR) and net savings (cash flow increase) with the distributions in Figure 3is not a "user-friendly" presentation for most financial and other executives. Selecting several levels of risk that match potential decision-maker risk-tolerance provides more transparent decision statistics. Table 2 and Figures 4 and 5 show IRR and net savings (savings after deducting financing costs) in presentation format for the lighting and HVAC investment.

Table 2. Efficiency Program Returns

Confidence Level	Minimum IRR (%)	Minimum Net Savings
Expected	42.3	$58,300
90%	35.5	$44,000
95%	33.5	$40,000
97.50%	32.4	$37,800

Figure 4 Investment Internal Rates of Return (IRR)

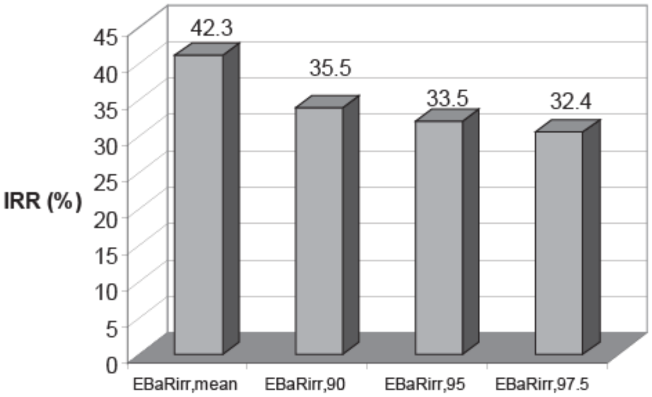
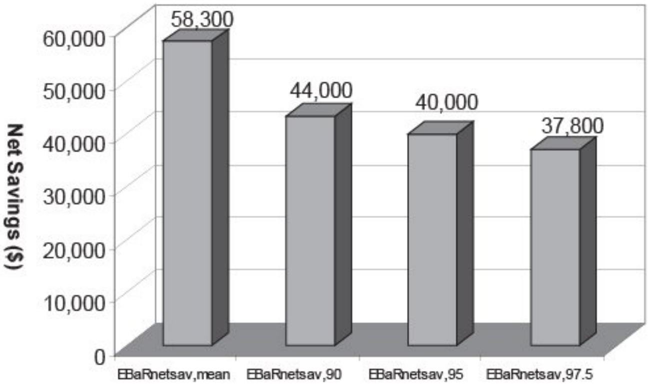


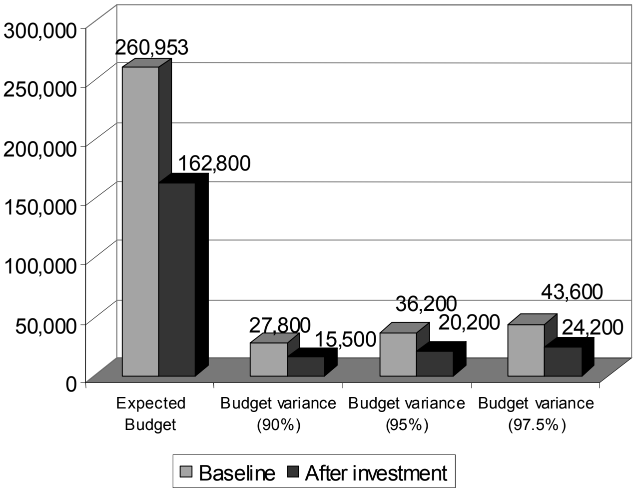
Figure 5 Investment Net Savings



As indicated in the table and figures, this investment has an expected payback of 2.3 years and 42.3% IRR with virtually no chance (2.5 %) of providing an IRR less than 32.4% and an annual net savings of less than $37,800. Expected returns are great enough and the risk of unacceptable results is small enough to override the payback outcome and recommend the investment.

Figure 6 shows the expected budget with and without efficiency investments and expected budget variances at three confidence levels. Not only have the investments reduced the expected annual energy budget from $261,000 to $163,000, the size of likely budget variances (the amount by which actual costs exceeds the budgeted amount for any year) is reduced by about 45 percent. Both the annual budget and budget risk have been significantly reduced.

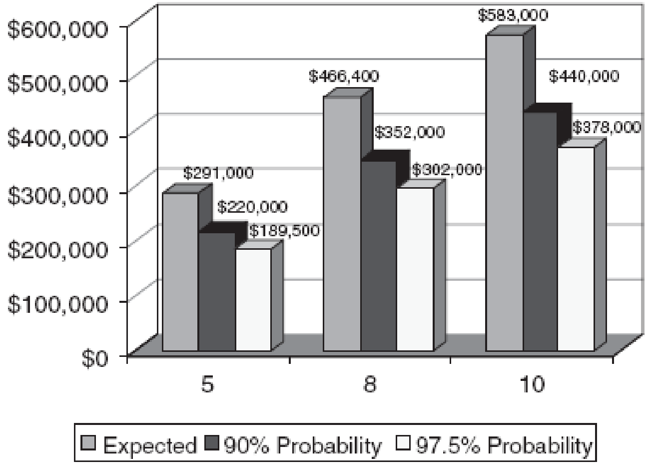
Figure 6. Expected Annual Energy Budgets Before and After the Investment



In addition to reducing annual energy costs and budget volatility, energy-efficiency investments also increase the capital value of the building by reducing its operating costs.

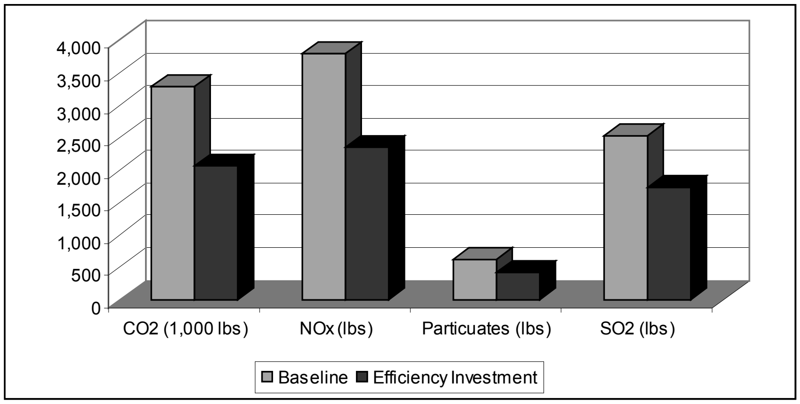
With a capitalization factor of 8, and expected net savings of $58,300, the expected capital value of the building is increased by more than $450,000. As indicated in Figure 7, EBaR risk analysis provides a range of increased values associated with specific confidence levels. In the worst case outcome, which is likely to occur with a probability of 2.5 percent or less, the capital value still increases by $300,000.

Figure 7. Expected Annual Energy Budgets Before and After the Investment



The impacts of efficiency investments can also be assessed with EBaR analysis as shown for this case study building in Figure 8. Annual baseline of CO2, NOx, particulates and SO2 emissions are shown with and without the efficiency investments. This buildings carbon footprint has been reduced by 37.4 percent and reductions in other emissions range from 31 to 38 percent.

Figure 8. Reductions in CO2 Emissions



Conclusion

Payback analysis traditionally used to evaluate incremental energy-efficiency investments is designed to avoid investment risk. However, payback analysis does not consider energy cost savings beyond the required payback period, rejecting many profitable building design options - options that reduce annual energy costs by even more than the annualized investment cost.

Energy Budgets at Risk (EBaR) provides a new quantitative energy risk management process based on Value at Risk (VaR), a financial risk management process vetted in financial industry.

EBaR provides information on the least attractive returns likely to occur at various confidence levels. EBaR provides this information in a simple decision-variable framework like payback analysis; however, EBaR avoids all of the limitations of payback analysis. Investments with varying lifetimes, savings throughout the life of the equipment and a comprehensive and explicit accounting of the uncertainty associated with every aspect of the analysis is included in EBaR analysis.

This quantitative approach to evaluating energy-efficiency investments provides a more accurate assessment of investment risks and rewards permitting building owners to reduce operating costs and increase building values in a manner consistent with their risk tolerance.

References

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