Investment Analysis:
Proper Risk Evaluation makes Conservation Projects the *RIGHT CHOICE*

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ABSTRACT

Investment opportunities in renewable and low environmental impact generation capacity are abundant, and green energy has become the media darling. In the shadows of this limelight are probably better opportunities for investment-conservation projects. Proper risk analysis is the essential tool used to divine between stereotypically mundane conservation projects and the more glamorous green power ones.

Business analysts measure investment opportunities based on the predicted risk of future cash flow and its expected magnitude. As energy engineers and managers, our task is to generate projects with sufficient credibility to warrant investment. These analysts are accustomed to evaluating projects using metrics, including IRR, NPV, ROI, and other more sophisticated decision tools such as the Capital Asset Pricing Model. We as energy engineers are accustomed to conversing in Btus, kWh, therms, quads, and tons of cooling. Our role is to be the translator of expected energy impact in Btus, kWh, and other units into credible expected dollars. Failure to do this consistently, while delivering cost avoidance as predicted, is the daily challenge we face as we compete with other investment opportunities for project funds.

The ongoing challenge faced by facility managers and energy engineers is how to get conservation projects funded when competing against emerging generation technology and price hedging. In most cases, particularly in periods of rapid energy unit cost escalation, the magnitude of the predicted return is not the impediment. It is the perceived relative risk of the conservation projects compared against either internal investment or generation technology. When a financial manager can refer to a measurement and verification plan which has been properly prepared

and executed on an existing project and substantiates project performance (or lack of performance, along with the necessary and appropriate adjustments or causes of non performance), the likelihood of consideration of future projects increases dramatically. In contrast, if a financial manager has no substantiation of past project performance of previously funded projects, the prospects of continued funding decreases simply because there is no credible data for evaluating risk.

Therefore, if we want to get more projects funded, we need to document our successes (or failures) and explain why they happened. This is no different than building a credit history. The only indicator of future performance is past performance. That is what financial analysts look at. We audit, identify, engineer, and propose projects to our managers—only to have them turned down. At the same time, careful consideration is given to alternative energy sources, or even to buying more costly "green power." Why?

Often, it's not that the customer (think "investor") does not understand, does not care, or dislikes saving money. Where we see opportunity, financial managers (read investors) see risk! Based on the past performance of some contractors and projects (read investments), this perception of risk is justifiable.

The first rule is that you need to learn the common language, the cash flow tools: net present value, internal rate of return, savings-to-investment ratio, etc. It is imperative that we speak the language of the people holding the investment purse strings. Once you know the language, everything gets easier. Ever been in a non-English speaking country and not know the language? Try to order breakfast. Better yet, try and convince your hosts to invest in a nebulous series of cash flows based upon some indecipherable calculation constructed in a foreign language. Again, *learn the language*: savings-to-investment ratio, net present value, internal rate of return, discount rate, etc. Remember, in most cases selling Btus, megawatts, negawatts, therms, Mlbs, and tons of cooling to individuals who speak in dollars and cents will not work very well.

RISK MEASUREMENT TOOLS

Sensitivity Analysis

The use of sensitivity analysis with financial tools applied to energy projects will normally require the assumption of one or more variables while manipulating the dependent variables. Sensitivity analysis will illustrate whether a project will or should be considered based upon potential scenarios and their probability of occurrence. Varying the time frame for discounted cash flow analysis or manipulating the energy price (or price escalation factor), as well as the specific risk of the project will illuminate the probability of successful or unsuccessful outcomes based on alternative scenarios.

Regression (Correlation) Analysis

Proper correlation analysis using single or multivariable regression analysis may be used to help predict project risk. Variables analyzed may include project types, contractor, energy source, etc., and the correlation to predicted performance.

INVESTMENT EVALUATION

To financial analysts every investment, every transaction, or even businesses may be distilled down to a predicted or expected series of cash flows. Investment (negative) cash is readily measurable. Our expertise is needed to provide credible prediction and measurement and verification of actual cost avoidance or predicted cost avoidance. The certainty and magnitude of these cash flows is discounted based upon the specific risk of the cash flows and the risk-free rate of return based on historical data. The specific risk of the cash flows from energy projects is what we, the energy engineers, project developers, measurement and verification specialists, or whatever we choose to call ourselves, impact based on the quality of our predication and veracity of our M&V work.

In the investment world concerned with long-term (historical) performance of an investment such as a mutual fund or debt funds, or even corporate performance for stock price valuation, the single most important factor is not what the future growth potential of the company is, or even what the expected return is. The single most important factor is the historical performance of the investment. What is the track record of the company or fund in terms of meeting or beating an earnings projection? Do they consistently deliver or exceed expectations? Or are they intermittent performers? Nothing drives a stock price down faster than an unexplained missed earnings projection. Nothing will hinder a company's ability to borrow faster than late payments. In the energy arena, when contrasting the investment opportunities of production versus conservation, history plays an even larger role. Emerging generation technologies, which have no track record, have a larger risk component than proven technologies, as well as generally lower returns than conservation strategies. This larger risk and lower reward return on investment number, when evaluated over economic life, is the primary driver behind incentive programs implemented to generate investment in new technology. Conservation strategies also provide an effective hedge against energy price escalation, arguably more effectively than rate hedging or strip pricing.

Our objective should be to build credibility with complete energy engineering, proper installation, commissioning and *measurement and verification*. Measurement and verification is the mechanism that identifies the causes of gaps between the *pro forma* and real world cash flow performance of projects or retrofits.

Unfortunately, when performing cash flow analysis for potential projects there are a number of common errors which contribute to unrealistic expectations, selection of a bad project or mix of projects, and a perception of poor project performance:

1. *Inappropriate discounting rate*. Application of a single discount rate (known as the MIRR in texts) to all projects, or even all energy conservation measures (ECMs) within a single project portfolio, does not accurately reflect the actual or relative risk of the projects. What does this mean? Does a lighting retrofit project comprised of replacing screw-in incandescent light bulbs with compact fluorescent lamps have the same risk as a photovoltaic array to generate power, or even as a combined cycle natural gas-fired turbine? Obviously not. It is common to take these disparate projects and discount each individually, or as a group, at the same MIRR when constructing pro forma cash flow analysis. This typically leads to overstated pro forma cash flow.

2. *Using identical discounting rates to compare dissimilar projects*. On the surface, this appears as though an unbiased approach to evaluation of cash flows is used. In fact, by evaluating risk laden cash flow at an unadjusted rate, the risk of underperformance that should be incorporated into the cash flow analysis is shifted to the owner or intended recipient of the benefits.

3. *Failure to incorporate all costs or opportunities in the cash flow streams.* This oversight is common, particularly in new generation or distributed generation projects, as the cost or opportunity of distribution and distribution maintenance is ignored.

Financial analysts look at the valuation of large projects based upon the risk and timing of multiple cash flows, applying appropriate risk discounts, and the present valuation of the cash flows. In most cases, large projects are comprised of a subset of smaller projects, each with its own risks. The value of aggregating projects into a single large cash flow model is that normally (unless we are aggregating a bundle of similar projects, i.e. all lighting) the risk of the total project will decrease due to the diversification of the project. The expected return on an investment may be calculated using the CAPM, capital asset pricing model.

The capital asset pricing model was developed by William F. Sharpe in 1964 while at the Rand Corporation.[1] The CAPM was developed to explain and predict how performance of investments (cash flow streams) may be measured and predicted based on the non-specific risk of a specific investment sector and the specific risk of the investment instrument. Subsequent revisions of the CAPM incorporated predictors for use in explaining returns above or below expectations, as well as diversification, into modern portfolio theory.[3]

The basic formula for the CAPM is: $ER_n = R_f + \beta \times (K_m - R_f)$ [4]

Where:

ER_n is the expected return on the investment.

R_f is the rate of return on a "risk-free" investment such as treasury bills.

K_m is the return on the asset class.

β is the correlation factor to of the asset class to the market return.

The challenge of estimating β has been addressed by academia at length, and numerous methods have been documented and proven using regression analysis, with some adjustments. There are also numerous estimates available for β for energy projects, which can be obtained from websites nationally and internationally.

The interaction of energy conservation projects and associated covariance can be calculated using the CAPM as well. There are numerous case studies of the application of the CAPM to multiple projects.

The CAPM incorporates the non-specific risk of the industry (that risk which cannot be diversified away) as well as the specific risk of the project(s) which can be calculated, or at a minimum, estimated, to properly identify the MARR. The MARR for a project is not the same as the company internal rate of return when using internal funds unless the specific risk of the other investment opportunities calculated as a portfolio for the company are identical to the specific risk of the energy conservation investment opportunities. Energy projects are not risk free. Even mundane projects such as fuel switching, time clocks, and lighting retrofits are subject to risks not included in a diversified portfolio of high quality securities. Consequently, the risk must be accounted for and included in what we expect for a return.

Investors attach risk to projects by adding basis points to financing rates. 100 basis points are equal to 1 percent in interest rate. The two factors which affect the risk energy conservation (or generation) projects are the timing variability and the cash flow volatility. If a project has potential time delays, lack of an M&V plan, and potential third party claims against generated cash flow or equipment, risk escalates. According to FEMP, "A payment structure that minimizes risk to the finance company is the central element of reducing perceived risk and obtaining a lower interest rate. To keep rates low, include clear terms for how and when payments will be made, demonstrated ability to comply with those terms, and standard clauses to protect the finance company from offsets and future claims related to performance (assignment of claims)."[2]

The quandary is that there typically is no track record or documentation of historical performance of a specific project or family of projects. There is generally no mechanism to evaluate the specific risk of the individual project on a pro forma basis. When we talk about the track record, it does not necessarily mean the track record of the individual project but in general the composite of the project risks—something we euphemistically refer to as "the experience factor."

Broken into composites, the experience factor can be quantified based on a few elements. These would differ from project to project; however, in general they would be:

Savings Calculation Methodology

Do the calculation methods make sense and are they appropriate based on the size and complexity of the project? Is the methodology

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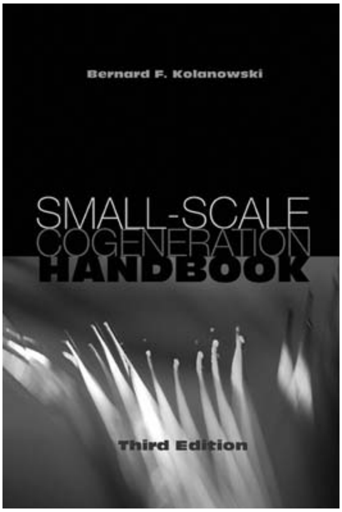

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congruous with the IPMVP, or ASHRAE 14? Is there a documented M&V plan? Were the calculations and plan prepared properly by a firm or individuals having verifiable experience? According to FEMP, one of the methods to reduce the cost of external financing is to implement M&V: ["Cost-effective measurement and verification of energy efficiency improvement and savings, coupled with a performance guarantee, is strongly recommended and can be achieved through alternatives to a contractual cost-savings guarantee. Finance companies reportedly establish the interest rate primarily on the basis of the experience and expertise of the utility and its subcontractors, relying on their credibility to evaluate the risk of specific technologies. While the margin for specific technologies set by the utility can be reduced by negotiating reasonable measurement and verification criteria, interest rates should not be affected by the complexity of the energy conservation measures."][2]

Design/ Application Experience

Does the designer or the design firm have the appropriate skill set and experience to properly fit the product/ system to the current application, without systemic disruptions or irreversible negative impact? Can the designer or design team provide references with documentation or substantiation of performance on similar projects roughly equivalent in size and complexity?

Technology Risk

Is this a leading edge or bleeding edge technology? Will this be an application of well proven technology, or a beta test of emergent products or systems? In general, conservation projects have lower risk than emerging generation technologies. This is primarily because, with the current level of investment in new technology, not only is emerging generation technology expensive (although green), there is a likelihood that a technology breakthrough will occur with associated paradigm shift and resulting generation cost reduction. No matter what technology is implemented in generation, conservation will continue to produce verifiable results. This means that conservation will always have more predictable results and produce cost-avoidance at the highest marginal rate of energy consumption.

Installation Risk

Is the estimated time frame for installation attainable? Are there installation risks associated with the contractor or installation team? Cash flow timing is of greater risk than most engineers and project managers would like to believe. Whether an investor waits one year versus two years for a return is of considerable importance when calculating the MARR. This goes directly to the timing of the cash flows, one of the two primary concerns for investors, whether corporate, public, or private.

Contractor Risk

If this is a performance contract, what is the record of the installing company? Is there a history of shortfall? Was it successfully resolved? Was litigation required? This contractor risk, even if the project is not a performance contract, is significant. If the contractor defaults, is in any way unable to execute, or is undertaking the project as a learning experience, cash flow timing is jeopardized.

Performance Guarantee

In the case of a performance contract, there may be an attached performance guarantee. Does a performance guarantee reduce risk? It may. Do not assume that simply because a guarantee exists that it is enforceable or valuable. Performance guarantees contain caveats which require specific performance from the host site as well as the performance contractor. Guarantees are nearly always tied to the project-specific M&V plan. A fully stipulated guarantee, where no measurements are required pre- or post-retrofit, is fully worthless in economic value. Failure of the host to perform in accordance with the constructs of the guarantee may nullify the guarantee at worst and at best increase the cost of litigation. A guarantee by a performance contactor who does not have the financial means to fulfill the obligation and has not bonded or otherwise insured the guarantee, is basically worthless. The current rise in energy costs has produced an influx of new entrants into the PC market similar to the 1980s. With the rise in competition and downward economic pressure, the propensity to overpromise rises. Careful scrutiny of providers and guarantees is necessary. The fiscal and legal boundaries of a performance guarantee may change the project specific risk.

Risk That is General to the Industry

This risk which affects all energy and conservation projects, can be incorporated into the beta value for use in the capital asset pricing model; it is systematic and cannot be diversified away. This type of risk is defined as beta in the CAPM. Beta measures an individual investment or cash flow's return relative to the movements of the overall market, such as an energy price index, or other highly correlated variable. Any investment with a beta value larger than 1 moves more quickly and in positive fashion with the independent variable. A cash flow with a value less than one moves more slowly and is considered less risky. An astute observer will identify quickly that if energy conservation projects are correlated to an energy price index, the beta will be positive (as energy prices rise, so will the value of the cash flows) and the correlation should be good.

KEY FACTORS IN THE β VALUE ARE

Legislative/ Regulatory Risk

Is there a potential impact of legislation or regulation which may adversely impact the financial performance of a project? If so, how can it be avoided, and what contingent costs must be allocated?

Rate/ Energy Cost Risk

In times of volatile energy costs, this risk plays a measure role in the evaluation of energy conservation projects. It should be noted that in most cases we are looking at escalation rate, rather than rate of cost decline.

Risk of Obsolescence

What is the probability that emerging technology will make existing investment obsolete before the cash flows have been exhausted? This specific risk with conservation projects is minimal, as it would be very unlikely any source of energy would have significantly lower total cost of production than current generation technology. (Marginal cost may be lower for wind/ solar, but when capital recovery is added the total cost of alternative generation is higher.) When evaluated inclusive of environmental costs, it is very possible that current fossil fuel-based and nuclear generation technology will incur higher generation costs as environmental regulations continue to constrict, raising costs for existing generation and future permitting.

EVALUATION OF CONSERVATION VERSUS GENERATION:

When evaluating the return on investment of conservation, either natural gas or electric, vs. the return on investment of new generation (or in the case of natural gas, exploration, drilling and development), consideration must be given to environmental impact, ancillary cost (distribution), and time horizon of the investment in either case.

Traditionally, consideration has only been given to avoided energy cost when evaluating conservation projects. To evaluate properly in contrast to generation projects, credit must be given for capacity competition in transmission and distribution, as well as environmental impact (positive for conservation, negative for generation).

More important are the unit price considerations. The cost of generation is always calculated using the capital costs, maintenance costs, and primary energy source, if purchased. These costs are aggregated, required rate of return after taxes is calculated, and the price to the ratepayers is set. As additional generation is required at peak utility demand, generation with higher marginal cost and marginal price is brought on line. The cost of construction to build and operate high marginal-cost energy capacity versus low marginal-cost energy capacity is high. This means it is cheaper to construct high production cost megawatts than low production cost megawatts.

The overwhelming benefit of conservation projects is that the cost avoidance is always calculated at the highest marginal cost, that is the cost of last purchased high-cost kWh, or spot price decatherm. These marginal units have the highest cost of all energy consumed, especially when the costs of grid or transportation capacity are considered.

Investment in conservation projects on a continuous basis in an ideal world will transform a customer into the ideal consumer, with a flat load profile, predictable consumption, and reduced weather sensitivity. As this transformation occurs, the customer has better leverage in the marketplace when buying energy. Of course this state of being the "ideal consumer" is never attained in actuality, but as a customer moves toward the ideal state, high marginal cost of purchased energy is reduced, and purchases are made at commodity rates.

Example

This project cash flow pro forma appears straightforward from the perspective of rudimentary analysis for purposes of budgeting and comparison to other similar project cash flows. What is not shown is that the project is a composite of seven different buildings, five with a common utility rate structure, and two additional buildings with individual rates. A total of 39 energy conservation measures are included in the aggregate number, stated as "electric, gas, and water/ sewer savings." The same energy escalation rate is applied to all utility costs, including water, electricity, and natural gas. The same discounting rate is applied to all cash flows, including thermally sensitive measures, lighting, and maintenance savings. Should this be considered correct? Not entirely. If contract values for maintenance are predetermined and fixed for the life of the performance contract, it would be reasonable to assume a lower discount rate (and one could be calculated readily at a near risk free rate with a beta value close to one).

The questions to ask are, first, are we willing to accept partial stipulation as less risky? Although there is a performance guarantee, depending on the accuracy of the stipulation, the true budget impact may be significantly different than the partially stipulated savings. Second, what level of M&V is involved in the option C bill comparison? Are the buildings being considered as a whole (as a diversified portfolio) or as individual projects? Either method is acceptable and neither is necessarily better. The M&V plan must address the baseline measurements and assumptions clearly to calculate risk-adjusted discount rates. Third, technology based projects and retrofits with resulting maintenance reductions such as telephones, BAS maintenance, etc., are at risk as technology continues to change rapidly. Is it reasonable to assume that telephone and BAS technology will be static, along with labor, for the next ten years? Should we expect to maintain existing technology for ten years? Probably not. A better option may be to shorten the useful life or use a more reasonable discount rate. Assignment of independent discount rates to cash flows which have different certainties is more realistic than applying a flat discount rate (which has not been calculated correctly) to the project. The discount rate used in this project was 4.5%, basically the risk-free rate for municipal entities at the time of the project development. Note that for the example, year 0 is the initial year and assumes that 50% of the annual savings occur in the installation period, with ten subsequent years of savings. This discount rate at 4.3% financing, with escalation applied to energy and maintenance costs, returns a value of $845,465 for the NPV.

As identified in Figure 2, the risks associated with the cash flows are :

Projected Energy and Operational Savings from Vendor Pro Forma Cash Flow	**YEAR**	**YEAR**	**YEAR**	**YEAR**	**YEAR**	**YEAR**	**YEAR**	**YEAR**	**YEAR**	**YEAR**	**YEAR**	**TOTALS**
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
electric, gas water/sewer	$197,481	$394,961	$402,860	$410,917	$419,136	$427,518	$436,069	$444,790	$453,686	$462,760	$472,015	$4,522,194
Total Utility Savings	$197,481	$394,961	$402,860	$410,917	$419,136	$427,518	$436,069	$444,790	$453,686	$462,760	$472,015	$4,522,194
lamp and ballast savings	$8,719	$17,438	$17,787	$18,142	$18,505	$18,875	$11,325	$11,552	$11,783	$12,018	$12,259	$158,403
Existing Vendor Automation Maintenance Contract	$0	$10,000	$10,200	$10,404	$10,612	$10,824	$11,041	$11,262	$11,487	$11,717	$11,951	$109,497
chiller repairs	$0	$20,000	$20,400	$20,808	$21,224	$21,649	$22,082	$22,523	$22,974	$23,433	$23,902	$218,994
mechanical system repairs	$6,000	$12,000	$12,240	$12,485	$12,734	$12,989	$13,249	$13,514	$13,784	$14,060	$14,341	$137,397
pool chemicals	$750	$1,500	$1,530	$1,561	$1,592	$1,624	$1,656	$1,689	$1,723	$1,757	$1,793	$17,175
telephone system maintenance savings	$0	$6,000	$6,120	$6,242	$6,367	$6,495	$6,624	$6,757	$6,892	$7,030	$7,171	$65,698
in warranty maintenance services	$0	$4,000										$4,000
modem line savings	$0	$8,600	$8,772	$8,947	$9,126	$9,309	$9,495	$9,685	$9,879	$10,076	$10,278	$94,168
total operational cost	$15,469	$79,538	$77,049	$78,590	$80,162	$81,765	$75,472	$76,982	$78,521	$80,092	$81,693	$805,332
Total Maintenance and Operational Savings	***$0***	***$474,499***	***$479,909***	***$489,507***	***$499,297***	***$509,283***	***$511,541***	***$521,772***	***$532,207***	***$542,851***	***$553,708***	***$5,114,575***

IPMVP Option A

IPMVP Option B

IPMVP Option C

Figure 1

Projected Energy and Operational Savings from Vendor Pro Forma Cash Flow	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTALS
electric, gas water/sewer	$197,481	$394,961	$402,860	$410,917	$419,136	$427,518	$436,069	$444,790	$453,686	$462,760	$472,015	$4,522,194
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modem line savings	$0	$8,600	$8,772	$8,947	$9,126	$9,309	$9,495	$9,685	$9,879	$10,076	$10,278	$94,168
total operational cost	$15,469	$79,538	$77,049	$78,590	$80,162	$81,765	$75,472	$76,982	$78,521	$80,092	$81,693	$805,332
Total Maintenance and Operational Savings	***$0***	***$474,499***	***$479,909***	***$489,507***	***$499,297***	***$509,283***	***$511,541***	***$521,772***	***$532,207***	***$542,851***	***$553,708***	***$5,114,575***

Technology Risk

Cash flow timing risk

Performance Risk

Figure 2

1. The technology risk. Will the phones and BAS be obsolete and require upgrade or replacement? There may be no cost avoidance in later years, or even a negative cash flow when upgrades or replacements are required.
2. The timing risk. Unless cash flows are contractually fixed (versus partially stipulated in the M&V plan), there is cash flow risk associated with major repair or breakdown. A large repair in year 2 would have a high negative effect on the individual cash flow. It must be risk adjusted.
3. Performance Risk. In this bundle of retrofits a component of the risk is diversified away because of the number of projects. Nonetheless, the cash flow is at risk due to performance and should be adjusted upwards from the general MARR used by the facility.

Each of these cash flows must be discounted independently with risk adjustments to accurately evaluate the investment. The discount rates of each cash flow must be adjusted upward to reflect the risks identified above.

When the cash flow discount rates are adjusted to realistic risk, adjusted rates are as follows:

total utility savings	10%
lamp and ballast savings	8%
existing automation maintenance contract	8%
chiller repairs	8%
mechanical system repairs	8%
pool chemicals	8%
telephone system maintenance savings	8%
in warranty maintenance services	8%
modem line savings	8%

The project NPV becomes ($144,312). Ultimately this failed performance contract was remediated with a financial settlement for the host site. A large portion of the overstatement of savings was due to improper cash flow analysis and the incorrect overstatement of future savings.

Conservation projects remain the best investment compared to new traditional and emerging generation technologies. It is imperative that as energy engineers we provide valid cash flow models, valid risk adjustment, and *pro formas* that will withstand critical scrutiny. Understanding of risk adjustment, sensitivity analysis, and potential results are an often overlooked component of our responsibility that warrants better understanding and application.

Expected Return (ER)

$$ER = R_f + beta \times (K_m - R_f)$$

When we apply risk adjustments to each cash flow prior to discounting, the NPV or IRR is correctly predicted, versus applying a uniform MARR or opportunity cost of capital to the project. Whether using the CAPM or estimates, careful risk adjustment of individual cash flows is imperative and gives more accurate prediction, guiding better investment decisions. Risk adjustments properly applied to generation and conservation comparisons will assist in the correct evaluation of projects and alternatives.

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ABOUT THE AUTHOR

Mark Sankey, MBA, CEM, CDSM, CMVP, CSDP, CBCP, has been actively engaged in industrial, institutional, and commercial energy conservation and control projects for over ten years. His work experience includes over ten years of sales and management experience at Johnson Controls, as well as the formation, growth and sale of a profitable independent controls and performance contracting company. Mark has performed over 350 industrial and commercial energy audits and forensically reviewed over 75 performance contracts to accurately assess performance and/ or construct damages models. He has person-

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Mr. Sankey has been professionally published extensively and presents annually at the World Energy Engineering Congress. He holds an undergraduate degree in engineering and a Masters Degree in finance. Mark attained multiple certifications from the Association of Energy Engineers, including Certified Energy Manager (CEM), Certified Demand Side Management Professional (CDSM), Certified Measurement and Verification Professional (CMVP), Certified Building Commissioning Professional (CBCP), and Certified Sustainable Development Professional (CSDP). Mr. Sankey was the 2008 AEE International Award recipient for energy professional development.

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