City Building Energy Efficiency Programs: Hindering Real Energy Efficiency?..One Practitioner's Real World Marketplace Observations

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ABSTRACT

Although created with best intentions, several city-run energy efficiency programs actually hinder energy efficiency. The two programs we are familiar with (San Francisco's Energy Performance Ordinance and New York City's Local Law 87) require energy audits on larger commercial buildings. The intent of the programs is to save energy, but the result is instead that energy audits are performed, reports filed, but energy efficiency does not necessarily result. Instead many building owners have told us that they view the ordinance as a tax, and are motivated to pay as little as possible for the audit while fulfilling the ordinance requirements. This has led to a "race to the bottom" on pricing and quality of the resulting energy audits. Audit prices have dropped by over 50% in both markets. Lower costs generally mean less time is devoted to the audit, and the work is done by less experienced and lower cost personnel. This paper presents a side-by-side comparison of the differences between a traditional energy audit conducted by experienced auditors and a compliance audit provided by a firm focused on taking advantage of the market created by these local ordinances—both audits on the same building. Results of these city ordinances are that comprehensive energy efficiency services become crowded out of the market, there is less need for accomplished energy professionals, and significantly less energy efficiency is achieved overall.

The Law of Unintended Consequences

Things often do not happen as we expect. We make great plans with a desired result in mind, and then something else happens, sometimes contrary to our initial goal. This is called the Law of Unintended Consequences. For example, in Colonial India, the British government wanted to reduce the number of poisonous cobras in Delhi. The government offered a bounty for every dead cobra. This strategy worked initially, as a large number of snakes were killed for the reward. Eventually, some people began breeding cobras for the income. When the government learned of this the bounty program was stopped, with the result that the cobra breeders set their now-worthless cobras free. In the end the wild cobra population increased as a result of the well-intentioned reward program.

It is my contention that the city run energy efficiency programs have also suffered from the Law of Unintended Consequences. While the initial goal was to have energy savings measures implemented in buildings and thereby reduce CO_2 emissions, the opposite may have happened,

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while at the same time compromising the energy efficiency consulting industry. As a colleague of mine said: “It almost seems as if the utilities created these ordinances to wipe out the energy consulting industry.”

The Ordinances

The two city run energy efficiency programs we are familiar with are summarized in the paragraphs below.

In 2011, the City of San Francisco implemented an ordinance requiring benchmarking and energy audits for larger commercial buildings. The ordinance requires ASHRAE Level 1 audits for buildings that are between 10,000 and 49,999 square feet, and ASHRAE Level 2 audits for buildings that are larger than 50,000 square feet. The audits are required every 5 years.

Starting in 2013, Local Law 87 requires all buildings in New York City over 50,000 square feet to undergo an ASHRAE Level 2 energy audit and retro-commissioning every 10 years. The audit and retro-commissioning must be performed by or under the supervision of a qualified individual.

Implementing Energy Efficiency Measures

While New York City requires that basic maintenance type repairs be made during the retro-commissioning process, neither city program requires that capital energy efficiency improvements be made. The desired result was that building owners would voluntarily implement energy efficiency measures once they understood the energy savings potential.

The Rise of the Energy Efficiency Compliance Industry

Upon learning that the ordinances were coming out, some entrepreneurs established businesses to provide the required services, but with a different focus from traditional energy efficiency consulting companies. Meanwhile, in both San Francisco and New York City, the existing energy efficiency consultants expected to find more work from the new laws, but observed the opposite, since the market was now inundated with new energy consulting companies offering low cost compliance audits.

The Traditional Energy Consulting Approach

The traditional approach, which has been practiced for decades, has been to provide the building owner with the best energy efficiency advice possible; that is, to find the most cost-effective ways to reduce energy costs for the client. The intent was to identify, describe, quantify and scope out all energy efficiency opportunities at the client’s buildings. To deliver the best value, and the best audits, this approach typically required the use of experienced energy professionals, who command a high rate of pay.

A good energy audit can be a valuable guide to making the best building energy efficiency investment decisions. When the best energy efficiency measures (EEMs) are identified and implemented, the facility owner will have made the smartest choices, and will receive the

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greatest return on investment. When the best EEMs have not been identified and implemented, then the opportunity for reducing utility costs will have been squandered, and the facility owner will suffer financially as a result. Generally, the more seasoned and skilled the energy auditor, the better the energy audit, and the better the result for the client.

A poor quality energy audit will often miss the most cost-effective EEMs—the retro-commissioning measures that are not obvious to novice auditors. The result is that the building owner, following the advice of the energy audit, invests his capital in second and third-rate EEMs, and sometimes EEMs that will not even save energy. The best savings opportunities are missed, and the building owners do not even know that they are continuing to waste money.

Having spoken to hundreds of building owners, I can say that when building owners want an energy audit because they want to reduce their energy costs, they often are aware that "you get what you pay for." These clients are sophisticated enough to avoid audits by manufacturer representatives and free audits from utilities and non-profits. Many of these building owners do not select the free or low-cost audit, but choose an auditor based on referrals, recommendations, samples of work and experience, while taking into account the going market price of an audit. They spend money to get the best possible energy efficiency advice, so that they can make the best possible energy efficiency investments.

The New Energy Compliance Approach

Reducing energy costs does not make it to the top of the building owner's list very often. There are typically many more pressing concerns that compete for the building owner's attention, such as avoiding fines for noncompliance with city regulations. It was precisely in response to this customer need that the new energy efficiency compliance companies came into being.

These new entrants into the auditing business focus their efforts on offering an easy and inexpensive method for building owners to comply with the ordinances. They offer turnkey services which include providing the benchmarking, auditing and retro-commissioning services, as well as preparing and submitting the required reports to city agencies with as little hassle to the client as possible.

These companies offering compliance audits are often new companies that came into being only in response to the new city mandates. Other new entrants into the auditing businesses are companies that have little to no previous auditing experience, but have opened a new business line, again, in response to the city mandates.

When faced with an ordinance, success to the building owner is often reduced to achieving compliance with the lowest possible investment of time and money. Any business that offers compliance will suffice. When compelled to perform energy efficiency studies, actual quality of the energy auditing no longer becomes a factor, all that matters is compliance at the lowest possible cost. So the typical building owner's response is to secure proposals from a number of energy consulting companies and select the lowest cost proposal.

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There is no nuance in the compliance business. Either a building complies or it does not. If two companies guarantee compliance, why would a building owner select the more expensive company? In this environment, companies compete to win jobs based on lowest price, not on quality of work.

Because there is no room for differentiation, energy audits have become a commodity.

In order to complete the work at these lower prices, these compliance companies must perform the work in fewer hours, and with less expensive, and therefore, less experienced staff. There is no incentive for a compliance business to perform high quality analyses when a bare bones budget is all that is required to satisfy the customer, and there is no reason to send experienced, well-paid professionals on site to inspect the building when any novice can do the job. The compliance business promises compliance, not thorough, best in class analysis.

It is not necessary to find all cost-effective energy efficiency measures to achieve compliance. All that is necessary is to perform an "energy audit", or "retro-commissioning" as described by the ordinance. Due to the complex nature of building energy systems, any number of pre-packaged or inaccurate recommendations could be included in the report without being noticed and rejected by the ordinance administration. While some building owners are familiar with energy efficiency, they are not experts and cannot be reasonably expected to tell the difference between high and low quality recommendations. Many owners may not read the reports at all if they do not intend to apply the information and are only seeking compliance. In this environment, superior reports do not offer any additional value to most building owners. So instead the bare minimum required, with the minimum cost outlay, is the route taken.

Another colleague summed it up well:

> *"For mandated work such as energy audits, clients seem to be going through the motions just to get the boxes checked without really valuing the end result. The mandates have good intent behind them, but without an appropriate understanding of value by the client our services will be subject to lowest cost mentality."*

It can be said then, that two different paradigms are concurrently existing at this point. There is the traditional energy efficiency approach, which strives to provide the best energy efficiency investment opportunities for the client who intends to invest in reducing energy usage. And there is the energy efficiency compliance approach, which exists to help clients avoid fines at the lowest possible cost. The unfortunate thing is that the deliverable for both approaches has the same name, "energy audit", while they provide vastly different services.

The Effect on Energy Efficiency

In cities with energy efficiency ordinances, "energy audits" have become a commodity and the price of "energy audits" has dropped by over 50%. For a traditional energy efficiency company to drop auditing costs by 50% requires devoting fewer hours to the job, using less experienced auditors, and producing a lower quality audit report. Most building owners, not knowing the

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difference between a quality and cut-rate audit, will choose the less expensive option. Again, my colleague:

> *"We were asked a few months ago to perform Level 2 audits on a couple of buildings in San Francisco for less than $2k each. The gentleman I spoke with described his buildings, that he needed to comply with a mandate, and asked what we would charge. Realizing he was price shopping and did not understand what he was asking for, I gave him a ballpark of cost. He was shocked at how much we would charge; I was shocked at how little he said others were charging. Fortunately, we did not waste each other's time.*
>
> *We have stopped going after this sort of work when it is procured in this manner. It's just not worth it."*

Comparison of a Traditional Audit against a Compliance Audit

We happened upon an example of a cooperative housing complex that underwent energy studies twice, once under a NYSERDA program, and 3 years later in order to comply with New York City's LL-87, both an ASHRAE Level 2 Energy Audit and retro-commissioning (RCx). Facility management never saw the first study, due to changes in management and bureaucratic delay in presenting the report to the new management. The low-cost/no-cost measures found in the first study were never remedied, and almost assuredly remained for the second RCx team to discover.

The original audit was somewhere between an ASHRAE Level 1 (AL1) and an ASHRAE Level 2 (AL2) energy audit. According to ASHRAE, an AL1 does not, by definition, require any numerical estimates of energy or cost savings, implementation costs or measures of economic viability. This original audit was like an AL2 audit, in that it did include these items. But it was also akin to an AL1 audit in that less time was spent on the audit, loggers were not placed, many estimates were made, and the report was not as thorough or detailed as an AL2 audit. In this paper, then, we will refer to the original NYSERDA audit as an AL1.5 audit and the latter two studies as the AL2 audit and the RCx study.

The primary defined purpose of an AL1 audit and RCx is to find low-cost/no-cost energy efficiency measures (EEMs) and RCx measures (RCMs). Both studies then, are looking for the same measures, except RCx usually finds many more measures because RCx is detailed testing, whereas an AL1 is merely a "walk-though" audit. The RCx study did present a long list of tests that were performed to evaluate the building's HVAC equipment and controls.

The sadly interesting (but expected) conclusion from this comparison of energy studies is the extent to which the compliance-based studies, the RCx and the AL2 audit, offered comparatively little energy efficiency value to the building owner. Whereas the original AL1.5 energy audit performed by a traditional energy efficiency firm found 10 RCMs that were estimated to save $19,219 each year, the RCx study performed by the compliance company found only 1 RCM which was estimated to save $1,253 annually. A comparison of the two approaches is shown in the Table 1.

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Table 1. Comparison of traditional vs. compliance approach for RCMs only

Item	First Study	Second Study
Year completed	2012	2015
Type of study	ASHRAE Level 1.5 Audit	Retro-commissioning
Done under	NYSERDA FlexTech Benchmarking Program	New York City's Local Law 87
Cost to perform study on 1 building	$18,500 for AL1.5 Audit	$6,000 for both RCx and AL2 Audit
# RCMs found	10	1
RCMs found	● Enhance boiler maintenance operations to maintain efficiency & reduce wear ● Adjust burner/boiler controls ● Install motorized vent damper ● Install heat-timer multi-mod sequencing control ● Install make-up water meter ● Balance heating distribution system ● Recalibrate heat-timer ● Install steam pipe insulation ● Adjust DHW temperature controls ● Restore and weatherize exterior doors	● Install steam pipe insulation
Estimated RCM annual $ savings	$19,219	$1,253
Estimated RCM implementation cost	$20,879	$1,725

Source: **The original AL1.5 audit and the later compliance-based RCx study**

Assuming that the building owner implemented all of the RCMs in both studies a year after the studies were conducted, the net cost benefit to the building owner of the traditional energy consulting approach dwarfs the net cost benefit from the compliance approach. Whereas the compliance approach cost the owner much less, and the investment in RCMs was much less, the project breaks even in year eight, and after ten years, the building owner is ahead by almost $5,000. (Interest expense was not considered in this analysis.) On the other hand, with the traditional approach, the building owner pays out almost $40,000 in the first two years for the study and the RCM implementation, breaks even after 3 years, and ends up ahead by about

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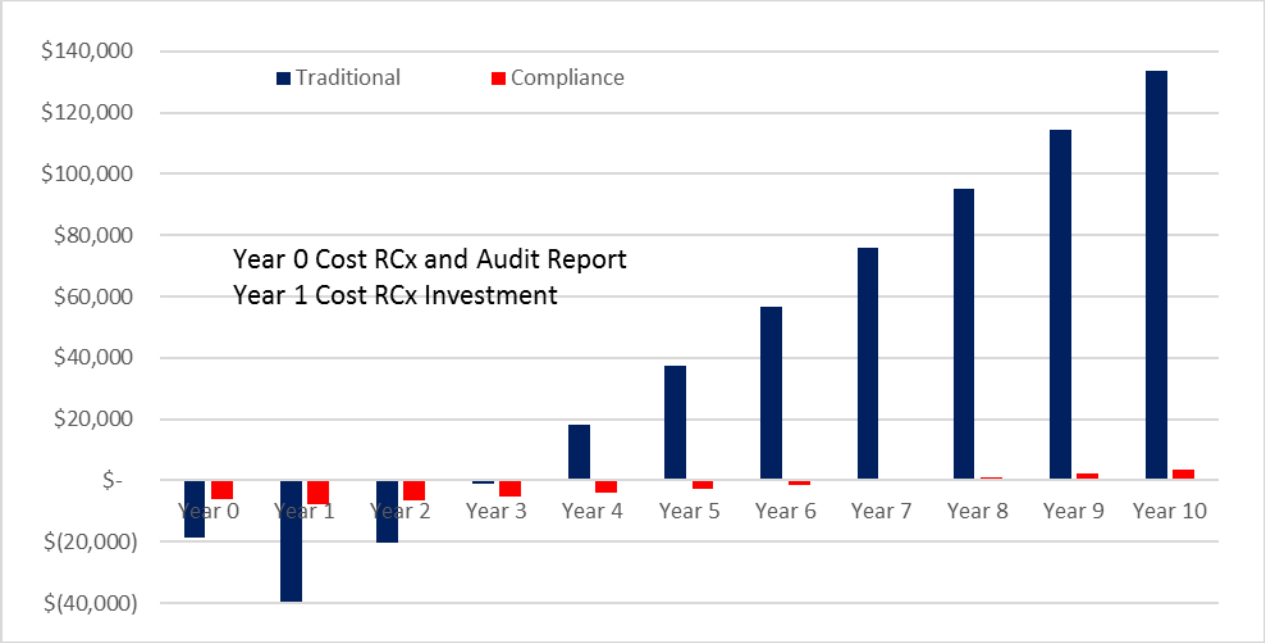
$130,000 (that is, assuming the RCx measures continue to work). Figure 1 presents a comparison of the two approaches.[1]

Figure 1. Cumulative financial benefit of traditional vs. compliance approach (RCMs only).



***Source*: The original AL1.5 audit and the later compliance-based RCx study.**

The compliance contractor also performed an AL2 audit on the building. The audit identified five energy efficiency measures (EEMs), as did the traditional-approach AL1.5 audit. Results from the two paths, compliance and traditional are shown below.

Table 2. Comparison of traditional vs. compliance approach for RCMs & EEMs

Item	First Study	Second Study
Year completed	2012	2015
Type of study	AL1.5 energy audit	AL2 energy audit
Done under	NYSERDA FlexTech Benchmarking Program	New York City's Local Law 87
# Capital measures found	5	5
Capital measures found	• Install DHW pipe insulation • Install DHW recirculation	• Install DHW pipe insulation • Upgrade public area lamps and

[1] Dollars were applied to electricity and gas energy savings using the applicable utility rates. No discount rate was involved in this simple comparison, nor in the comparison to follow.

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	controls ● Upgrade public area lamps and ballasts ● Install lighting controls ● Upgrade roof insulation	ballasts ● Upgrade roof insulation ● Install low flow aerators ● Install EMS/BAS
EEM with largest savings impact	Install DHW recirculation controls	Install EMS/BAS
% Savings associated with largest EEM	53%	59%
Estimated EEM annual $ savings	$4,818	$8,984
Estimated EEM implementation cost	$15,884	$47,907
Totals: RCMs & EEMs		
Total estimated annual RCM & EEM $ savings	$24,037	$10,237
Total estimated RCM & EEM implementation cost	$36,763	$49,632

Source: **The original AL1.5 audit and the later compliance-based AL2 audit.**

Three of the EEMs were in common in both reports, but the compliance report identified two EEMs that were questionable: aerators on water faucets and showers, and a building automation system (BAS), also known as an energy management system (EMS). The building is a cooperative housing complex. With the exception of those who live in drought-stricken areas, many people are not likely to accept reduced flow in their bathroom sinks and showers. In addition, many occupants have unique fixtures that may not fit the aerators. This measure, though it would indeed reduce energy used to heat sink and shower water, is unlikely to be implemented in a housing complex where the occupants own their apartments. The other questionable measure was a BAS/EMS. The EEM description in the compliance audit did not explain how the BAS/EMS was to save energy. There is no description of any controls strategies to be employed. However there is a savings number assigned to the system. How it might save energy is unknown, and should bring cautious analysts to question if this was more than a blanket number applied to a generic recommendation, rather than one that could realistically be expected to produce savings in this particular building. Still, assuming that the aerator and BAS/EMS measures were acceptable, we put together a cash flow comparing the two

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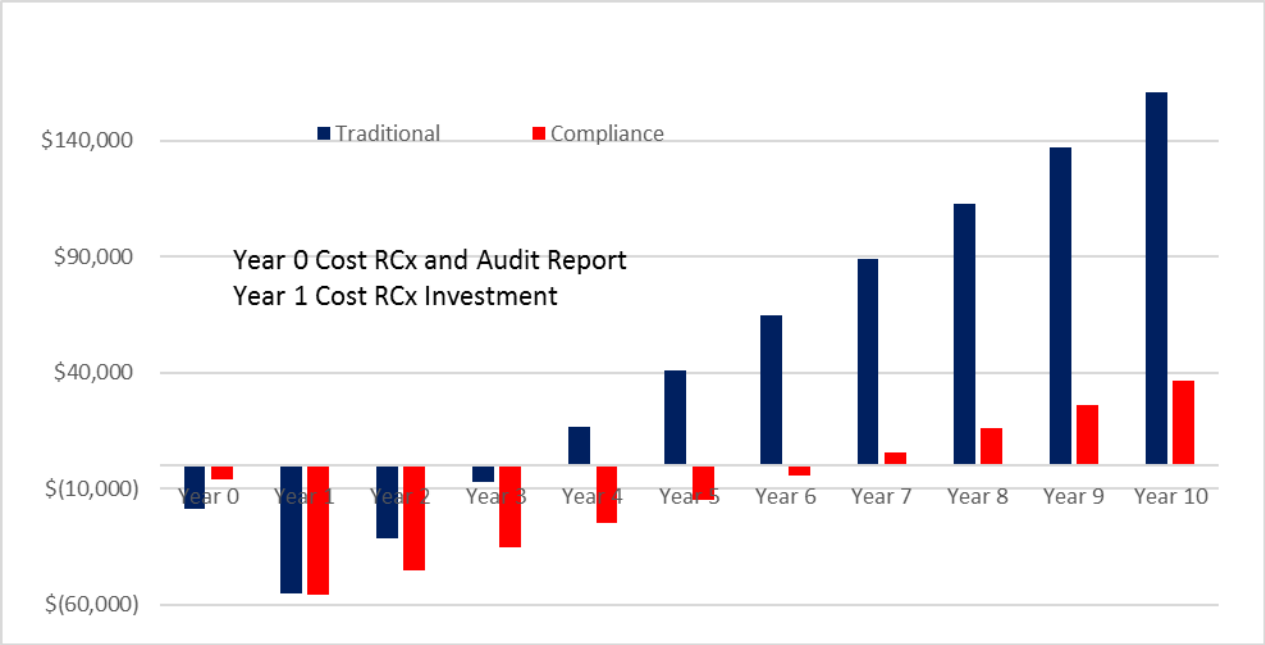
approaches. We assumed that all EEMs and RCMs were implemented in Year 1, a year after the reports were delivered. After 10 years, the compliance studies would net the building owner $36,500, while the traditional approach would have brought the building owner $161,000 in energy cost savings. Figure 2 presents a cash flow of the two approaches, this time including both RCMs and EEMs.

Figure 2. Cumulative financial benefit of traditional vs. compliance approach (RCMs & ECMs).



Source: **The original AL1.5 audit and the later compliance-based AL2 audit.**

As described above, there were other issues with the compliance audit and RCx report including:

- Inexperience: The RCx study performed a combustion efficiency test on the steam boilers, and found the net stack temperature to be 795°F on one of the boilers, which should have raised a red flag. No further investigation was made regarding the high stack temperature, nor, even more critically, was a recommendation made addressing it. High stack temperatures are often sign of poor combustion.
- Perfunctory Testing:
    - The boiler combustion efficiency testing should have been taken at minimum at the boilers' high medium and low firing rates, but was only taken at the high firing rate.
- No Real Commitment to Efficiency: A boiler combustion test determined boiler efficiency was at 73%, and was considered acceptable in the compliance audit. Most

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traditional auditors would consider any combustion efficiency below 80% problematic and would recommend a clean and tune to increase the combustion efficiency.

- Cutting Corners:
    - Much of the compliance audit was boiler plate. Much of the verbiage was general and did not apply to the building, and in fact, more directed to meet New York City regulations than to actually reduce energy usage or otherwise benefit the facility.
    - The compliance audit boiler plate language said that 10% of the units were visited, but the report only listed results of visiting one of the units.
- Less Time Onsite: To complete the RCx and AL2 studies of all 6 buildings of the complex, the compliance crew was onsite for 1 day. To complete the AL1.5 audit for all 6 buildings, the traditional auditors were onsite for 2 days.
- Short EEM descriptions:
    - The compliance audit EEM descriptions were 2 to 6 lines long and include little if any detail specific to the building, whereas some recommendations in the traditional audit were much more detailed, were focused on the building being audited, and were anywhere between a paragraph to over 3 pages long.
    - The traditional audit was written to give the owner actionable information that would benefit the facility systems, the residents and improve the bottom line, rather than to just meet the ordinance guidelines.

The Law of Unintended Consequences Revisited

The cities in which these ordinances are in effect are full of low cost vendors offering low cost audits. Traditional energy auditors are faced with the choice of competing in the ordinance compliance business and lowering the quality of their offering, or not—and having a difficult time finding work in these cities.

As quality energy auditing is less-often being provided in cities with energy efficiency ordinances, building owners are not being presented with the best energy savings opportunities, and much of the energy savings that would have occurred from implementing these best opportunities is not happening.

And there you have the law of unintended consequences. Require energy audits, audits become a commodity, building owners expect to pay low prices for audits, the serious energy auditors cannot win jobs as they charge “too much” for an audit, serious energy auditors get crowded out of the market, the quality of audits drops, and the best energy efficiency recommendations do not get implemented.

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As this occurs, the whole process risks becoming what many building owners already suspect it is: a waste of their time and money. Only high quality audits can provide substantial value to building owners and the city by identifying the best energy saving opportunities. The low cost alternative results in reduced identification of the best measures, and works contrary to the intention of the ordinances and to the best interests of the building owners.

They say it is not right to pick at things and not offer a solution, and although I do have an alternative in mind, it too would be subject also to the Law of Unintended Consequences, and I cannot predict how it would turn out. But at the very least, rolling back the city ordinances might likely result in the compliance businesses leaving the market, with only the serious energy consulting companies remaining to perform valued services, like was done before.

About the Author

John Avina, CEM, CEA, CMVP, CxA, has worked in energy analysis and utility bill tracking for over 19 years. During his tenure at Thermal Energy Applications Research Center, Johnson Controls, SRC Systems, Silicon Energy and Abraxas Energy Consulting, Mr. Avina has managed the M&V for a large performance contractor, managed software development for energy analysis and M&V applications, created M&V software that is used by hundreds of energy professionals, taught over 250 energy management classes, created hundreds of building models and utility bill tracking databases, modeled hundreds of utility rates, and has personally performed energy audits and RCx on over 25 million square feet. Mr. Avina currently sits on the Certified Energy Auditor Test Committee for the Association of Energy Engineers. Mr. Avina has a MS in Mechanical Engineering from the Univ. of Wisconsin-Madison.

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