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The Energy Audit: A Sacred Cow of Energy Management

By **Bill Holmes, P.E.** December 1, 2011 05:24:10 pm

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Don't be frightened. Energy audits aren't all that scary.

Have you ever read the story, "The Emperor's New Clothes," by Hans Christian Anderson; the one where the Emperor is walking down the street naked all puffed up showing off his beautiful new invisible suit, the one that he can't see but believes all of the commoners can, according to the story, the incompetent and stupid people? Of course, no one wanted to be the first to admit that they didn't see any clothes, that they were stupid; they thought that there must be something wrong with them. Then a child in the crowd called out, "But he isn't wearing anything at all!" and gradually everyone realized there wasn't anything wrong with them after all. But by keeping silent they had been unwittingly helping to perpetuate the hoax.

Every time I read an article about the value of an energy audit, how essential it is, how it must be the first step in any energy savings effort, or look at the many job openings wanting people to do energy audits and energy models, I am reminded of that story. I have heard that when people get to a certain age, they start to become rather childlike again, they tell things the way they see them without worrying too much about what others think. Apparently I have reached that age, so I am going to give you my opinion on energy audits.

What is an Audit, Anyway?

Let's go back and start with the basics. I Googled "audit" and came up with several interesting definitions, including: "An examination of records to check their accuracy, an adjustment or correction of accounts, an examination and verification of a company's financial and accounting records and supporting documents by a professional such as a certified public accountant." Or, "an IRS examination of an individual or corporation's tax return, to verify its accuracy. Since there is always the chance of an audit, experts recommend keeping good records to support all the information in a return."

I then Googled "energy audit" and found that it is defined as an assessment of the energy needs and efficiency of a building or buildings. There is no mention of the examination of data, of records, to check their accuracy and make adjustments or corrections as required. According to its definition, an "audit" requires detailed and accurate bookkeeping. But other than utility bills, sometimes from only one meter for an entire industrial plant, military base or university campus, most facilities or organizations have no detailed energy records.

So an energy audit really isn't an "audit" after all, is it? An audit requires data, records, facts. Because the energy conservation profession has, for reasons that have mystified me for more than 30 years, never required detailed records showing where and when every KWH, therm or gallon of water is used, there can be no audit of actual data. And an audit needs to be performed by an unbiased professional, someone with no conflict of interest, someone whose company does not coincidentally just happen to sell the product or service that the audit will recommend. So with their own definition of "audit," in the absence of actual data, this profession goes to great lengths and expends tremendous resources trying to estimate what that data would be if they actually had some.

Maybe the IRS could learn something from the energy conservation profession. Think how much money they could save if they did away with all of those irritating forms and recordkeeping and detailed audits. When you go into your accountant's office every year on April 14th, you wouldn't need to lug along that

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Author Bio



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Bill Holmes, P.E. founded Holmes Energy LLC www.holmesenergy.com and developed the AutoPilot Monitoring-Based Commissioning (MBCx) System in 1979. He has a B.S. and M.S. in mechanical engineering and has done additional coursework and research for his PhD. He is a former Purdue professor and taught for several years in the Continuing Education in Energy Management Program at the University of Wisconsin.

Bill has produced savings from 20% to, in a few projects, more than 50% from low-cost, no-cost changes in management, operation, maintenance and control alone in all types of facilities including Industrial Plants owned by Fortune 500 Companies.

He is the recipient of a DOE Award for Energy Innovation and was the Indiana Energy Manager of the Year in 1990. He has published

cardboard box full of all of your cancelled checks and credit card receipts. All you would need are your monthly pay stubs; you could just estimate where all of that money went each month.

Energy Auditing Courses Haven't Evolved

When I was first getting started in this field, in the mid-'70s, there were few resources or training courses to help me. I was mostly self-taught, relying on my day-to-day experiences as I was starting an energy conservation department for a consulting engineering firm, my engineering education, my old textbooks and handbooks from American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) and other professional organizations.

I did find and attend a four-day energy auditing course offered by the Continuing Education in Engineering Program at the University of Wisconsin in Madison. (I later taught my monitoring approach for several years in another course in that program.) For someone new to the field, it helped me learn about building energy systems, how to estimate their energy usage and how to identify potential savings opportunities. That program was for many years known as one of the premier programs for continuing education in energy management, and may still be. I also went to Atlanta for a week and took a similar course taught by Al Thuman, the founder of the Association of Energy Engineers. I joined AEE as a charter member, later became a certified energy manager and in 1990, I was the AEE Indiana Energy Manager of the Year.

I still remember the basic structure of those early courses so I thought I should look up the current offerings to see what has changed. To my surprise, all of the courses that I looked at in August, 2011, look very much the same as the ones I took 35 years ago with topics including energy estimating techniques, audit instruments and measurements, energy conservation opportunities, utility bill and rate analysis, and energy reporting.

Interesting. I would have expected that this profession would have advanced beyond those first courses that had been put together on the heels of the Energy Crisis of 1973-74, nearly 40 years ago, before the Internet even existed. Particularly with all of the advances in the gathering and dissemination of information.

Energy Auditing Didn't Work for Me

I started out with the consulting firm doing a lot of the things I was taught in those classes, what others just getting into this new field were doing: energy audits, then detailed energy studies. Of course, all of those things were headed toward capital projects, buying new equipment. Everyone knew that was the only way to save energy. After I started my own business, I at first would go to each prospective project and spend a day, similar to a walk-through audit, looking at everything in the building, all of the energy systems, to see if it looked like a good candidate for my services. Would I be able to save them anything? But you know what? You can't tell. There is absolutely no way to know without accurate information, and it can't be determined just from a spot check or from installing temporary monitoring equipment. Energy usage patterns in any type of industrial plant or large building are extremely complex. They change every hour of every day. Even if temporary instrumentation is installed for a few weeks or months, energy audits are just a snapshot of individual energy systems taken during a limited time period. And audits have no way to account for the interaction of all of the energy systems on an ongoing basis, really essential information. If some potential savings are found, more are missed.

It didn't take long before I stopped doing any type of audit, survey or study to see if I could determine if a facility had potential opportunities to save energy. I realized that every single one had potential. I decided that there were only two criteria for determining whether a facility would be a good candidate for my services. Number one was, did top management strongly support the efforts to save energy? Number two was, did the facility spend enough on utilities to justify my efforts? If so, we spent every hour and every dollar on installing instrumentation, a monitoring system. From then on, the facility had a permanent, unbiased ongoing energy audit that showed where every dollar was spent every hour of every day. Then utility dollars could be managed like every other dollar. The monitoring system allowed us to start generating energy savings the first day, literally. And in every case it completely paid for itself in a few weeks or months. I was always surprised by what the data exposed; often huge problems that had gone undetected for many years, in some cases since the building was built. Problems that made the obvious ones exposed by an energy audit pale by comparison.

Auditing for a Local Electric Utility Company

After I had been in business for a few years, I agreed to do an energy audit of the local Golden Foundry for the electric company so the plant could qualify for a grant from the utility. I wanted to learn about the utility's program for myself, to see how effective it was. But when I finished, even with my experience teaching energy conservation courses, designing and operating building energy systems, installing instrumentation and producing huge savings, when I read the energy audit report I had written, I knew it had little value. I had identified some possibilities and provided some estimates of potential savings, but basically the audit and report had little connection to the real world. The plant was too complex for an audit to reveal much of any value.

numerous papers and been making presentations on his projects and methods for more than 25 years. Bill is a sculptor, a writer and a regular contributor to Sustainable Plant.

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But the utility was happy. They had what they needed to check off a box on a form, to give the foundry some money, something they were required to do by the State Public Service (utilities) Commission. The fact that the energy audit had little value, hadn't and probably wouldn't result in any significant energy savings, didn't seem to matter to anyone but me. I resented wasting my time in a paperwork exercise when I could have been actually working with building systems, saving energy.

Just a side note, during one of the meetings with the utility company's sales engineer, the president of Golden asked the engineer why, when the utility's profits were regulated by the public service commission as a percentage of electricity sold, he should believe that they actually wanted to reduce the amount of electricity the foundry was using and therefore, their profits. The wide-eyed rep had no answer. I was glad Larry had asked the question; I had always wondered about that myself.

I've seen a number of audit reports that include checklists or menus: turn off equipment when not in use, replace the lights, etc. Try telling those things to Scott, the energy manager at Golden. Why not just tell him his mother wears combat boots? You couldn't insult him any more than that. A high school graduate, he knew more about that foundry and all of the energy systems than anyone doing an energy audit could ever know, unless they had worked in that specific foundry for a few years themselves. Scott was the third generation of his family to have worked at Golden. I have always marveled at the ego or cluelessness of some engineers or energy auditors, I'm not sure which, who think that they can spend a few hours or days in a facility and know more about it than the people who work there. I have worked in a building for months or even years without recognizing an opportunity and then one day, or in the middle of the night, it will hit me.

Admittedly, a very experienced professional can sometimes walk into a facility and see it with fresh eyes; see possibilities that those who work there have just taken for granted and never really questioned. I have done it a few times. But an auditor with little field experience who is often in an entry-level position can only mirror what they have been taught; they don't actually know. It's really not that simple. And no matter who comes up with a savings possibility or opportunity, actual monitored data should always be required to confirm and quantify their suspicions before an investment is made. Years ago I copied the following Walt Disney World policy for energy projects:

"Prior to a commitment of major capital expenditures, there must be documented proof that the investment will produce cost-effective savings. Adequate documentation can only be accomplished by end-use metered evaluation and analysis techniques."

Just give Scott some tools to help him, and some training. Instead of paying for a one-time energy audit, the utility could have better spent their money to install permanent instrumentation. I believe utility companies do actually know a little about energy monitoring. Golden would have had a continuous energy audit, 24 hours a day, 365 days a year, from then on. Along with a strong incentive from top management, in the hands of anyone who understands their facility, good, accurate, continuous information, clearly presented, is the way to find, achieve and maintain real savings. Plus the data from the system can be used to avoid costs, manage utility consumption to match rates, properly size new equipment, verify savings from operational changes and capital projects, plan for growth and much, much more.

At an energy conference a few years back I heard one of the presenters describe how he did very detailed energy audits for industrial plants, sometimes spending weeks in a plant. His audits could cost up to \$150,000; more than twice what GE paid us to install a turnkey energy monitoring system in their 1,100 acre plant in Louisville, Kentucky, a system that within a few weeks, exposed opportunities that led to documented savings exceeding \$250,000 during the first 12 months; savings created through changes in operating procedures alone, savings requiring no capital projects.

As I listened to the presentation I just couldn't help thinking what a waste of time and money. I had been in enough plant engineer's and plant manager's offices over the years and had them show me four-inch-thick Energy Audits laying on shelves gathering dust to know what kind of savings often resulted from energy audits: none. But it made somebody happy. It was the accepted first step; everyone knew that. And the next time the CEO or CFO asked plant engineering what they were doing to cut utility costs, they could say, "We just spent \$150,000 on a very detailed audit and implemented some of the recommendations."

"How much did it save? Let me see the bills."

"Well, I'm sure it saved a bundle but our utility costs actually increased. Remember, we only have one electric meter for the entire plant. Don't forget about that new press line we just started up and the third shift we added over in finishing. And, oh yes, our electric utility company has added some type of charge that nobody can understand, which has increased our bill by 12%. But without that energy audit, think how much more we would have spent."

The DOE Energy Grant Program

After I opened an office in Colorado in 2009, I was meeting with the building manager and the energy manager for one of the most progressive cities in the state. Knowledgeable guys, they were in charge of actual building energy systems on a 24/7 basis. They knew what worked in the field and what didn't.



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They were going to get some energy grant money to hire one of the 14 performance contracting firms on the state's list of approved vendors. They told me that they had serious doubts about replacing existing systems that were working well with new equipment. They weren't sure if it would really save them anything or at least enough to justify the added workload and pain that would go with it. They had less than satisfactory experiences in the past with similar projects and understood that they would be the ones responsible for operating and maintaining the equipment for the duration of its life or theirs, whichever came first, during the next 20 to 30 years.

Energy projects are kind of like having a baby, everyone is really excited at the beginning and all of the neighbors and relatives come by for the first week or two to see if they can help out. But when you are 65 and get a call from jail in the middle of the night to come bail out that baby, your 37-year-old daughter for the third time this year, you are all alone. Where did everybody go?

These managers had been through similar projects before and said while everyone was really pumped up at first, after a few months, they were basically on their own, even in one project when the guaranteed savings from improvements made by a performance contracting company disappeared after three months. When they reported it to the company they were told it was their fault, they must have changed something, the guarantee was void. But as city employees they couldn't turn down that "free money" and new equipment; they had no choice.

For the 2009 energy grant program they had selected one of the 14 approved contractors, one from Seattle, for their projects. Their selection was based on the fact that this one company had all of the capabilities to provide everything required by the DOE and the Colorado Governor's Energy Office (GEO). Don't you just love the fact that because this company from the State of Washington had put together a team specifically to comply with the requirements of the government energy grants, they were now being sought out by buildings in Colorado wanting or being forced to jump on the "free money" bandwagon.

The First Step: an Energy Audit

The first step that the company from Seattle was going to take was to do what they called "an Investment Grade Energy Audit." Apparently that meant a very detailed, probably very expensive audit; one that would ensure that all of the capital projects, the costs and paybacks, the ROIs from the recommended improvements were accurate. No sense spending money on an audit where the findings are inaccurate, one of those less expensive audits. This time we are going to get a good audit; not one of those cheap ones. And how convenient that the Seattle company had assembled a team that could sell the products that the audit would recommend. No need for the building owners in Colorado to have to deal with three completely separate and independent companies; one to recommend improvements, another to provide them and a third to evaluate the savings. How considerate of the GEO.

I have no idea how much the audit cost or what part of the grant money was used for it, but I did know that whatever it cost, it wasn't a good use of the money. Audits are not worth whatever money is spent on them. That is with the exception of the free ones; then their value is equal to the cost. Spend that money on something that will actually save energy; spend it to install instrumentation. There will then be a very detailed ongoing energy audit – facts, not models, estimates or projections.

Changes can be made and savings realized from the first day, the very first day. No kidding. That is what I had to do to pay for all of the instrumentation I installed at my own expense when I was managing buildings for a share of the savings. It works. You start seeing opportunities on Day 1, you make changes. Your next utility bill is lower and you reinvest those savings in your building. (Unless you happen to be the university campus in Indiana where I cut energy costs by 35% with no capital projects. Instead of allowing the chancellor, Dr. Paul Bippen, who had been a big supporter of my efforts, to use those savings for other things, they lowered his budget by that amount – took the money away from him. Talk about a negative incentive to save energy!)

I guess my main point, what really frustrates me, is that it seems that so much of the effort and resources devoted to saving energy don't actually save any energy. They are just the preliminary steps: "raise awareness," do audits, estimate costs and savings, construct computer models of buildings and energy systems. Paperwork exercises. What about the implementation; what about savings? Without instrumentation, if there are any savings from these "exercises," how can they be verified?

Replace "Energy Audit" with "Energy Inventory"

How about this approach? Slaughter that "Sacred Cow" after more than 35 years of providing tainted milk in the form of calculated or estimated savings based on little hard data, often biased toward the solution that the auditing company may be selling. That cow is old; it's past its time, it's had a long life; put it out of its misery.

Replace the "energy audit" with the "energy inventory." The energy inventory will be the first step leading to the installation an unbiased, permanent, continuous energy auditing system. Instead of trying to estimate usage and potential savings without accurate, validated data, back up a step. First just identify

the significant energy-using equipment and systems, and select the points to be monitored. Do away with the idea that an energy audit should be the first step in every energy conservation project, a step that leads to capital improvements. Capital improvements really should be the last step in any energy savings effort, not the primary objective from the beginning. They may not even be necessary.

After all of the no-cost, low-cost changes in operation, maintenance and control have been made, then use the data from the monitoring system to see if and what capital projects might still be a good investment. Use it to establish a baseline before any changes are made, get a written guarantee of promised savings and use the monitoring system to confirm the results and verify that they are maintained on an ongoing basis.

Valid scientific methods need to be employed to actually measure and verify the savings. The monitoring system will serve as a completely unbiased, independent auditor. It will provide more than the subjective findings of those involved in the project. In the words of Mary Walton in "The Deming Management Method," (Putnam Publishing Group, 1986):

"Views not backed by data are more likely to include personal opinions, exaggerations and mistaken impressions."

Just a thought, along with the IRS, maybe the airlines could follow the lead of the energy conservation profession: save some money and lower the ticket prices a little by taking out all of the heavy and costly fuel gauges and monitors. Just calculate how much fuel will be required for each flight and load exactly that amount. Make sense, doesn't it? So what if they exaggerate a little? It won't hurt anything.

Where Are the Energy Savings?

Have people forgotten about the primary goal, the primary reason the profession even exists? Are they satisfied with paperwork? When they have done an audit or a model do they somehow think they have accomplished something that will magically save energy? Or have they forgotten about that minor detail? How many people in the energy efficiency profession does it take to do audits, studies, reports, designs, etc. for every KWH or Btu saved? Have we become like the medical profession, where a neurologist friend of mine in an office with four other neurologists, has an administrative staff of 22 just to fill out insurance and government forms? Or like the IRS, where the tax code has become so unimaginably complex that for every dollar collected, a dollar is spent on tax lawyers and accountants just to fill out the forms?

My final thought is to propose a really radical new (not) approach; something that was pursued vigorously but unsuccessfully for years by Walter Johnston, president of AEE in the 1980s. Instead of training those in our profession to do audits and studies and models, paperwork exercises that save no energy, train them to be energy managers; to work in actual buildings with actual energy systems every day. Provide a structure and environment where they can be successful. Train them to install energy information systems; include both the theory and "hands on." And teach them how to analyze and use the resulting data to actually save energy; create standards and certifications and quality control. Make them responsible and accountable for the actual savings and reward them based on the results. Create true "green jobs" that will actually save enough to pay their salaries many times over.

You wouldn't fly on a plane where the engine mechanic's attitude was, "Try that for awhile and see if it fixes the problem." You shouldn't have to put up with any other profession that operates that way, either.

For more information about energy monitoring, be sure to watch Bill Holmes' "Sustainability Matters" webinar, "The Case for Permanent Energy Monitoring."

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