Auditing for Energy Savings: Do We Really Need Star Wars Technology And the Third Decimal Place?

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ACCURACY AND TECHNOLOGY

Over the past twenty years I have had the opportunity to review a number of commercial and industrial audits. Generally, they have been technically sound, but I have been perplexed at the extremes that appear in these reports. Many seem to fall into one of two categories; sufficiently vague or too detailed. Also, the very detailed reports have a tendency to rely on *Star Wars* technology for a major portion of their savings.

On one hand a report may be so vague that the variation in the projected savings may be plus or minus 100%. "If this recommended measure is implemented the annual savings should be between $1,000,000 to $2,000,000." Or, at the other extreme, the report may try to be too precise and quote energy savings with decimals; "You will save 129,227.5 kWh annually with the application of enthalpy controls." In both situations it appears that something is missing, the application of good solid technology sprinkled with common sense.

In dealing directly with customers I have found that most simply want accurate reproducible results. For a report to be meaningful to a customer and stand any chance of having its recommendations implemented, it must:

- Reflect results based on the customer's goals and objectives. If a customer's reason for having the audit is to minimize energy expenditures, the report must focus on rate-related options, as well as energy improvements. For example, certain load factor or demand based rates with low charges may actually provide a disincentive to

saving. Customers have purposely used additional energy or increased their peak demand in order to qualify for a lower rate. While this is not sound energy or environmental reasoning, it does meet the customer's goal and should be addressed.

- Reflect results based on the customer's economic criteria. If a customer has a specific *firm* payback or ROI limitation, it is fruitless to include high-tech strategies or recommendations that do not conform. However, it is always best to test the firmness of their criteria. Do they really mean two years, or will they consider a three year payback?

- Provide sufficiently accurate information (but not too detailed) for the customer to make an informed decision and assure them that the projected savings will result. Customers with a sound technical understanding of their facility, or even those with a limited technical background, are often skeptical of reports that predict results too precisely.

While this may appear to be a reasonably straightforward simple task, for many it is not. Let's take a brief look at the two types of reports (the vague and the detailed) and see how they stack up in overall effectiveness.

SUFFICIENTLY VAGUE

The sufficiently vague type of report can also be referred to as the *"sufficiently vague so that I can't be held accountable and won't get into trouble report."* As with all reports these start out with the best of intentions, but wind up recommending measures based upon generalized assumptions of saving potential. Such as, "Based on 200 motors with an average size of 25 HP and an assumed efficiency of 88%, the projected annual savings associated with upgrading to premium efficiency motors should be between...." Frequently hard (metered) data is not used in determining the projected savings.

We have all encountered this type before. There is a lot of gloss, color, and graphics. They look very professional and are visually impres-

sive. Usually about one-third to one-half of the report is dedicated to self-serving biographical sketches, statements reflecting their expertise, and lists of satisfied customers. However, as far as meaningful content, meeting the customer's needs, and overall effectiveness are concerned these reports fall short. They are usually relegated to a back shelf on some plant engineer's office to collect dust and ultimately become part of a high school recycling program.

TECHNOLOGY AND DETAILS

The reports that intrigue me the most are those that recommend *Star Wars* or cutting edge technologies and strategies, without first thoroughly examining the benefits of proven technology. While it is not a prerequisite, many are steeped in detail and quantify savings to the second or third decimal place. Don't let me give the wrong impression, being hung up on theoretical accuracy is not totally the domain of the *Luke Skywalkers* of energy auditing. There are many who try and apply proven technologies with too fine a pencil point.

For admittedly understandable reasons, there are those that are fascinated with technology and a high degree of accuracy. However, we cannot lose sight of the fact that when we perform an energy survey we are agents of the customer. It is our responsibility to provide technical expertise that will result in a report that gives the customer recommended measures and strategies for meeting their goals and objectives. In addition, we want to do everything feasible to save energy and improve the environment. Ultimately, however, if we are to have any impact at all, the product must be a report that provides accurate meaningful information.

The first step in doing this is assessing the customer's needs. Questions that need to be addressed include: What are their goals and objective? In other words, what do they want to get out of the audit? Also, do they have a long term energy strategy? What are their constraints (technical, financial, political)? Who are the decision makers?

Once these and other pertinent questions have been answered, the next step would be to gather information relating to the facility's operation. Here is where accuracy becomes a two edge sword. We must be sufficiently accurate, but temper our calculated accuracy with reality.

ACCURACY IS ONLY AS GOOD AS THE INFORMATION

Performing a comprehensive energy survey on a commercial or industrial facility requires a thorough understanding of energy sources, end use applications and processes, utility rate structures, and how all of these interrelate. While it does involve a high degree of technical skill, it is by no means an exact science.

While audit reports will vary in level of detail and appearance, nearly all will include some language that denotes the results should be considered engineering *estimates*, based upon the information provided by the customer during the survey. To some this may seem to be a way of explaining results that may not match projections. But there is very valid reason for including such wording in a report. A report can only be as accurate as the information provided.

Unless a customer is willing to pay for audit personnel to be on-site for an extensive period of time (which most are not), an audit is a "snapshot" or brief look at the operation of a facility. He or she only gets a glimpse of how a plant is operated. When plant personnel are asked if this brief look is representative of typical operation, the answer is usually yes.

But is it really? Without accurate first hand information, it is very difficult for an auditor to say, with a high level of confidence, that a specific plant or process operates exactly in the observed manner over an extensive period.

Part of the problem lies in the fact that there is a great difference between perception and reality. To illustrate this point, we performed a survey (lighting only) on a large multistory state government office building. According to the building operations manager and the maintenance supervisor, all systems were essentially shut down in this one shift building on weekends and after 7:00 PM during the work week (except during the heating season). Systems were turned on about 5:00 AM, so that everything would be ready for occupants beginning at 7:00 AM.

According to their description of the building's operation, the load factor should have been in the 35% to 45% range. In reviewing the electric utility billing records the load factor was shown to be 71%. In fact, nothing was being turned off. The operations and maintenance supervisor personnel knew how the building was *supposed to* operate, but had no idea how it was actually being controlled.

This is just one of several examples that could be used to illustrate

the need for audit personnel to research and validate information that is used in the report. However, one can never be sure, without physically observing or reviewing accurate detailed consumption information, that data is correct.

THE INFORMATION IS ACCURATE

Let us assume that for the sake of argument the information we have obtained is very accurate. What assurances do we have that the facility will operate in exactly the same manner for the next year? How many potential variables are there in the operation of a building or plant? If we were lucky enough to have very good information, how many other factors (weather, market influences, etc.) would have to fall into place for our results to be within 5% of our projected values? It can be said with a reasonable degree of confidence that the information obtained during most audits, unless metered for extended periods, is not sufficient to yield results within 10% of our best calculated efforts.

This is not to say that we should not strive for accuracy. Every effort should be made to obtain the most accurate and reliable information available. We should, however, recognize that our best efforts might be quickly rendered woefully inaccurate by factors beyond our control.

PROVEN TECHNOLOGY AND *STAR WARS*

Technology has always fascinated many of us. There is an allure to be the first one on the block with a new innovative technology that may reduce energy or help the environment. Therefore, it is only natural that we try and apply all that is new in the energy technology arena to help our customers. In doing so, however, we may not be representing their best interests, if we do not first apply the off-the-shelf proven technology.

All too often vendors, and even some engineers, look to technology for the resolution to a problem without first fully understanding it. Only after the customer's concerns and current operating procedures are understood can the auditor determine how best technology can serve them.

Again looking at a lighting example, a small industrial facility was provided a report that recommended that a new lighting technology be

installed to minimize overall energy expenditures. The analysis focused on the existing operation (annual operating hours), without first determining if the current operating strategy was necessary. As it turned out, through more effective use of existing lighting controls, the system operating cost was significantly reduced, without a substantial capital investment. Re-examining the recommended technology, the revised payback was then well beyond what the customer deemed acceptable.

While statistically valid numbers are not available, it is arguable that it is the application of *older proven* technologies and strategies that holds the greatest potential for energy savings. While not the least bit attractive, proper system maintenance can be the most effective way of reducing energy consumption and dollars. In many facilities appropriate and regular maintenance on steam, compressed air, and HVAC systems can do more for improving efficiency and minimizing energy expenditures than new technologies.

This should not be construed as an effort to discourage the application of new technologies. On the contrary. I firmly believe that any time we can automate the control of an energy consuming system and remove the *human element,* we have a greater likelihood for savings. Therefore, we should strive to recommend new technologies, but only after we have assessed the situation, made sure that the systems are properly maintained, and examined the available proven options.

SUMMARY

The ultimate measure of an effective audit report is the customer's confidence in the report and the level of recommendations that get implemented. It is only through an understanding of the customer's operation and their limitations that we can provide a meaningful report.

Realizing the number of variables that can influence energy consumption in any facility, it would appear to be counterproductive to spend time deriving precise energy and dollar savings, especially when the accuracy of the data itself may be questionable. In addition, proper system maintenance and off-the-shelf technologies hold the greatest potential for saving energy and improving the environment. New technologies can be very effective and they certainly have their applications, but they should be considered after other viable options have been thoroughly examined.

ABOUT THE AUTHOR

Thomas D. "Dan" Mull, P.E., CEM, has more than 20 years' experience in energy management, focusing on commercial and industrial energy utilization. As a field engineer, he has performed numerous energy audits and conservation assessments for commercial and industrial clients.

As manager of commercial conservation and load management for Carolina Power & Light Company (1982-1989), Mr. Mull directed the development and implementation of CP&L's commercial DSM strategy.

Mr. Mull formed the Carolina Consulting Group, Inc. (CCG) in 1988. CCG provides technical training seminars, comprehensive site surveys and energy analyses, and DSM program development/implementation services to assist clients in fully utilizing their energy resources in the most cost effective manner possible.

Mr. Mull has served as chairman, Commercial Section, Southeastern Electric Exchange (1986); instructor, North Carolina State University Industrial Extension Service; guest speaker, Virginia Polytechnic Institute and State University, Mechanical Engineering Department; regional vice-chairman, American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) (1986-90); president, Tarheel Chapter AEE (1997).

Mr. Mull has published several articles on energy management and spoken frequently on DSM and marketing nationally. In 1994 he was named Energy Engineer of the Year for Region II, by the Association of Energy Engineers.