The Energy Savings Analysis Protocol: A New Standard for Energy Auditing

Coriolana W. Simon
Project Principal
Concurrent Technologies Corporation

NOTE: This document is adapted from a paper presented at the World Energy Engineering Congress in October, 1999. The project described herein was initiated within the ENERGY STAR program at the US Environmental Protection Agency (EPA) and has since been privatized and transferred to Concurrent Technologies Corporation (CTC). Through a special arrangement with EPA, CTC invited Coriolana Simon, the original project principal, to direct the completion of the project and its deployment. Lindsay Audin, president of Energywiz, Inc., remains the technical director of the project.

ABSTRACT

To present opportunities for whole-building upgrades, Concurrent Technologies Corporation (*CTC*)[1] is developing a standard for energy auditing: the Energy Savings Analysis Protocol, or ESAP. By following the performance specification, or auditing guidelines, reports resulting from such enhanced audits will be approved as "ESAP Solutions."

The Energy Savings Analysis Protocol follows an approach of "approving, adapting, or enhancing" existing auditing tools and formats, and then combining them to form a coordinated and complete

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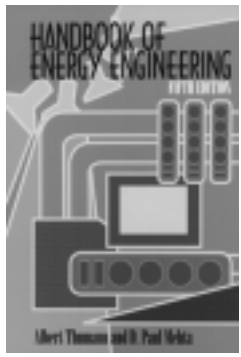

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package. It then adds features not found in conventional energy audits. In creating this set of standards, market research was conducted on the concept, on current auditing procedures, and on integration with related federal programs. To ensure a market-based perspective, a peer review panel of industry experts was also convened. In phase one preliminary design, protocols were developed for approving existing auditing tools. Phase two called for the ESAP guidelines to be developed in draft form and presented to a wide array of stakeholders in the energy marketplace for two purposes:

1) to solicit input and secure commitments of support and

2) to establish an organizational framework for the subsequent stages of project development.

One principal feature of the Energy Savings Analysis Protocol is the integrated analysis of energy use, wherein interactions among building systems are examined, rather than looking only at single systems or components. This permits more realistic portrayal of potential savings of both cost and energy. By more clearly demonstrating how energy savings can improve an energy customer's bottom line, the Energy Savings Analysis Protocol will encourage implementation of profitable energy efficiency measures (EEMs).

Such results will increase the perceived value of the audit process, while reducing the perceived risk in energy efficiency investment. This will be accomplished by highlighting energy efficiency opportunities as a business plan, according to the customer's own financial parameters.

As a new tool for today's energy industry, the Energy Savings Analysis Protocol is designed to yield:

- **greater value and less risk for energy customers**
- **greater energy savings**
- **reduced strain on the electric grid**
- **a higher level of energy audits**
- **a broader product offering for energy service providers**
- **increased efficiency of energy use**
- **lower greenhouse gas emissions**
- **help in sustaining our nation's growing economy.**

The Energy Savings Analysis Protocol seeks to augment the value of energy auditing through market transformation.

MAKING A STRONGER CASE FOR ENERGY EFFICIENCY

Energy efficiency technologies for buildings are well known, and the benefits of a well planned facility energy strategy have been promoted for years. So why haven't more buildings been made energy efficient? Some feel that the case for energy efficiency has often not been made in a sufficiently compelling way to building owners and managers.

To help correct this situation, Concurrent Technologies Corporation (*CTC*) is developing a standardized energy upgrade analysis process that offers a convincing presentation of energy savings. This initiative builds on work begun within the ENERGY STAR program of the US Environmental Protection Agency.

Why An Energy Auditing Standard?

In the past, the essential instrument leading to savings has been, in one form or another, an analysis of the ways energy is used—and could be saved—in an existing building. Such analyses have been called "energy audits," "technical assistance studies," "feasibility studies," "energy assessments," or "energy upgrade proposals." All recommend specific changes to equipment and/or operating procedures and indicate the economic value of such changes.

By focusing on single systems or components instead of whole buildings, energy audits have often overlooked how energy efficiency measures (EEMs) work together or with other energy-related building systems. Taking account of these interactions between and among EEMs is critical for an accurate analysis of energy use—and therefore, an accurate depiction of potential cost savings. Ignoring them can result in overestimation of savings, and/or operational problems.

Traditionally, the results of energy efficiency audits have been presented as a list of individual measures, each showing installation cost and payback period, ordered from the shortest to the longest. This practice encourages customers to pick and choose among what may be unrelated EEMs, often "cherry picking" the easiest measures with the

quickest paybacks.

A truer picture of potential savings is derived by integrating the measures—that is, by analyzing the cost and savings from carrying out a defined set of measures simultaneously.

"Integration" of EEMs is slightly different from "cascading," an earlier approach that was required under the Department of Energy's (DOE) Institutional Conservation Program (ICP). "Cascading" means examining, in a suggested order based on payback and practicality, the cost of doing one measure, then a second measure assuming the first had already been done, then a third measure, assuming the first two had been done, and so on. Ideally, an *integrated* package would include the full list of cascaded measures instead of looking at each one individually.

Over the 25 or more years that energy audits have been performed, their range of quality and completeness has widened. In the 1980s and early 1990s, efforts to reduce imported oil fostered federal grants to states for energy upgrades in institutional buildings, accompanied by the first standards defining an acceptable level of analysis. When utilities became involved in energy efficiency by offering rebates and free energy audits, the number of audits—and auditors—increased dramatically. Vendors trying to sell energy efficient products also got into the audit business—though the results were often little more than refined sales promotions.

Missing The Mark On Savings

Many energy customers upgraded their facilities with new equipment but were often disappointed with the results. Too many conflicting and exaggerated claims were made, and too little guidance was available to help discern the best approach. Unsophisticated analyses failed to account for interactions between systems, yielding inflated savings assumptions and occasionally resulting in lost productivity and/or comfort.

Some new installations were too complicated for untrained building maintenance personnel and were disconnected or ripped out. A few such "horror stories" were sufficient to convince many facility personnel that there was too little value in energy savings to risk their careers. Very little effort was devoted to measuring and verifying (M&V) the savings from EEMs.

The end result has been a skeptical attitude toward energy effi-

ciency, with many building managers waiting for a new product to develop a longer track record, or simply avoiding involvement with energy efficiency altogether. When energy prices leveled off and began to drop, sales got even tougher. Early experience with deregulation misled some into thinking that prices would drop so far that there was little need to even consider investing in energy upgrades.

While few vendors are willing to provide numbers, many would agree that most energy audits end up gracing a bookshelf or recycling bin, instead of serving as the basis for an upgrade.

The Need For A New Approach

Experience has shown that investing in energy upgrades can, if done properly, provide an excellent rate of return. If such proposals became more persuasive to energy customers, more energy savings would result. Some form of independent, objective standard is needed to attain a level of acceptability for energy upgrades.

To upgrade the nearly 80 billion square feet of commercial space in this country, an approach is needed that provides standardized, integrated, whole-building energy analyses that improve on today's often minimal audits. Such an improved procedure, backed up with independent oversight, would convince energy customers to invest in energy efficiency and help maximize delivered energy savings.

The Energy Savings Analysis Protocol (ESAP) is that new approach.

WHAT'S THE ESAP ALL ABOUT?

The ESAP Process Defined

In pursuit of such higher quality, whole-building upgrades, Concurrent Technologies Corporation recently assumed development of this innovative approach for enhanced energy upgrade analyses. This offering is not another piece of software, nor is it a service that performs energy audits. Rather, the Energy Savings Analysis Protocol project is creating ***a set of standards and supporting documents for energy upgrade analysis whose goal is to make convincingly clear the magnitude and likelihood of savings expected from such installations***. Any energy upgrade analysis that follows the ESAP standard and bears the identifying quality label will be known as an "ESAP Solution."

Essential components of the Energy Savings Analysis Protocol process include:

- an energy auditing performance specification, with a report template
- vendors' guides for using the spec to perform an energy study and produce an ESAP Solution
- a consumers' manual to simplify handling the energy upgrade process

Designing The Spec

Development of the ESAP process was begun at EPA in September, 1998. The first phase of the work, completed in April, 1999, included market and product research as well as preliminary design for the actual performance specification. The draft spec grew out of two research efforts: one to examine analytical software tools on the market and the other to look at a host of procedural tools for auditing, both manual and electronic.

A listing of these tools and procedures, or others with equivalent characteristics, will be incorporated as examples that may be followed in the ESAP spec. The goal of this effort is to offer guidance and examples for users of the spec so that they may economically pursue higher quality energy upgrade analyses.

What's New/Different

Market research by the ESAP project principals revealed many well developed tools and practices for energy analysis, yet a distinct lack of integration in their use. Rather than reinvent current practices, the ESAP project is drawing on the best existing individual tools and procedures and shaping them into a performance specification, approving, adapting, or enhancing them as appropriate to yield one consistent, comprehensive approach.

Much of the value of the ESAP process lies in the following enhancements, many of which are missing from most of today's energy upgrade analyses:

- The ESAP Solution (i.e. report) presents upgrades as an energy business plan in the language and terms to which a CFO is accustomed, rather than as a mainly technical document.

- A detailed interview with the building owner or operator at the beginning clarifies goals and expectations while forging a strong customer/vendor working relationship.
- The "preliminary analysis" roughs out the potential for savings and engages the customer further in the auditing decision process.
- Analysis of building system interactions (such as lighting and cooling) that impact savings is a central feature.
- An integrated package of measures that fits the customer's own financial criteria is proposed, shown as both a single proposal and as a cascaded list of EEMs, not just simple paybacks for individual measures.
- Application of formal savings measurement and verification processes in upgrade design and costing are built in at the beginning. For each suggested measure, M&V is described and priced as a way to ensure and quantify real savings.
- Independent quality control is exercised through random sampling of completed reports by a third-party contractor.
- Reductions in greenhouse gas emissions (at power plants and building sites) that could result from an upgrade are properly quantified so options can be laid out to employ greenhouse emissions credits in upgrade funding.[2]
- ENERGY STAR Buildings benchmark scores, both pre- and post-upgrade, are provided to show if a building qualifies for the ENERGY STAR Label for Buildings, which rewards buildings reaching a high level of efficiency in energy use.
- An energy master plan is presented that focuses on options beyond the immediate upgrade, guiding customers in long-term planning of energy efficiency as part of their facility maintenance, management, and design.

Emphasis On A Business Plan Approach

Central to the ESAP's approach is the emphasis on dollars first, Btus second. In its opening pages, an ESAP Solution will highlight en-

ergy efficiency opportunities as a business plan—not an engineering task—based on financial parameters chosen by the customer, not the vendor. While offering the familiar context of simple payback, an ESAP Solution takes customers a step further in their economic understanding of energy efficiency as an internal "profit center" by also offering a variety of other financial criteria and a probability curve for savings.

As part of an ESAP pre-audit interview, for example, a customer's financial parameters will be reviewed to ensure that his goals and desires are explored. **Would life-cycle costing or a cash flow analysis over a 10-year period help him understand and sell the upgrade to his senior management? Is there a funding limit that cannot be exceeded, regardless of payback? Are there measures that must be taken (e.g., chiller replacement) for non-energy reasons?**

Another part of an ESAP Solution financial presentation shows the probability and range of payback for a specified group of measures, taking into account such variables as weather. Most business decisions today involve some analysis of risk so that it may be appropriately managed. An ESAP Solution will offer a simple curve (using existing PC-based software) that shows how calculated savings could change due to conditions such as a warmer winter or uncertainty over burn hours for lighting. The result will be a more credible portrayal of likely savings or rate-of-return in the sophisticated manner to which CEOs or CFOs are accustomed.[3]

Such financial presentation reduces customers' perceived risk of investing in energy efficiency while increasing their perceived value of the audit process. At the same time, this approach benefits vendors by turning more of their audits into actual projects and providing a unique edge over their competitors.

Market Focus and Market Support

From the beginning, the ESAP process has been aimed at the marketplace. It is intended for use by ESCOs, consultants, and other energy professionals providing services to energy customers responsible for commercial, institutional, and multi-family buildings.

Energy managers wishing to pursue high quality energy upgrade analyses are, of course, also welcome to apply the ESAP process in their own facilities. While it could also be applied to individual residences and industrial facilities, the simplicity of the former and the complexity of the latter often make other tools more appropriate.

Since the ESAP process is meant as a mechanism for general market transformation, the project principals sought broad market support at an early stage. Such support helps ensure acceptance and adoption when the ESAP is completed and offered for use in the marketplace. To that end, an independent Peer Review Board of energy experts was assembled and has participated in the initial development process.

To become the standard for enhanced energy upgrade analysis, the ESAP needs champions from many quarters of the energy marketplace. Assistance is therefore being sought from a broad spectrum of stakeholders who may benefit from application of such a standard.

The types of support being sought include endorsements and promotion, funding for specific tasks, in-kind services (such as originating content through in-house staff), and eventual adoption as a standard for energy analyses sponsored by those groups.

As the ESAP concept reinforces its market-based foundation, the following tasks will be pursued:

- refinement of the auditing specification, or guidelines
- design of technical, financial, and management enhancements to traditional energy auditing
- field testing on existing buildings
- marketing
- training design and delivery
- development of quality control methods
- program maintenance
- feedback, evaluation, and revision.

A Solution For The Future

Turning a diverging set of trends and a history of uncodified practice in energy auditing into a credible standard the market will trust is not an easy task. With the commitment and participation of the energy community as partners in its development, the Energy Savings Analysis

Protocol will guide the energy efficiency industry toward a true market transformation. It is thus poised to become the new standard for energy upgrade analysis in the market of tomorrow.

References

1. Concurrent Technologies Corporation (CTC) is an independent, non-profit, professional services company offering management and technology-based solutions to a wide array of public and private sector clients. For example, for DOE's National Energy Technology Laboratory (NETL), CTC serves as prime contractor, providing management, engineering, and technology analysis services. For the private sector, CTC's work involves environmental management, systems integration for complex business solutions, e-commerce training and consulting, and quality-management consulting and training.
2. Prior carbon mitigation efforts used average power plant emissions, defined by the ten EPA federal regions or state boundaries. Greater precision is obtained, according to EPA's Acid Rain Division, by utilizing the marginal emission rates based on the dispatching of peaking generation units as defined by the boundaries of reliability councils established by the North American Electricity Reliability Council (NERC).
3. An article in the January, 1999, issue of Engineered Systems magazine demonstrated how Crystal Ball, an Excel add-on by Decisioneering Corp., may be used to develop such a curve. Such tools are commonly used by energy marketing firms to assess and manage risk in pricing.

ABOUT THE AUTHOR

Coriolana Simon is project principal for the Energy Savings Analysis Protocol, a new standard for energy auditing. She initiated the project within the ENERGY STAR program at the US Environmental Protection Agency and has now privatized the project and transferred it to an independent non-profit professional services organization, Concurrent Technologies Corporation (*CTC*). Ms. Simon is on a special assignment to *CTC* to complete the development of the auditing standard and launch it into the marketplace.

While involved primarily in energy efficiency innovations and

analysis of energy market trends, Ms. Simon has also led projects in risk management planning, at both the national and international levels. She brings to her 14 years with EPA a long career in architecture and engineering in the private sector. Trained as an architect, Simon has been vice-president at a prominent international A&E firm. She has also taught at the School of Architecture and Urban Planning and in the engineering curriculum at City College of New York. She has published, lectured, and designed traveling exhibits for the Smithsonian on subjects in this field. Simon completed her bachelor's and master's degrees at New York University, where she was named a Woodrow Wilson Fellow, and her professional degree in architecture at City College.

International Trade Center-North Tower (Suite 200), 1300 Pennsylvania Avenue, NW, Washington, DC 20004-3016; e-mail: simonc@ctc.com.