Leveraging ISO 50001 for Utility and Government Program Evaluation

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ABSTRACT

For years, energy efficiency programs have included industrial efforts, and these have raised foundational questions regarding the longevity of energy conservation measures (ECMs) and the confounding influence of short-lived workarounds that undermine actual energy savings. In addition, a significant program expense is the industrial management engagement to make energy productivity a top priority in the initial engagement and beyond the first project. Finally, there has been no methodology to connect expenses with measurable improvements in long-term performance.

Global Energy Partners and the Natural Resources Defense Council (NRDC) have worked on the creation of the ISO 50001-Energy Management Systems standard for the past several years, focusing on making and then demonstrating measurable improvements in industrial facility energy productivity. The draft standard requires that these improvements are continuing activities that meet targets.

In addition to benefiting the facilities, this systematic approach to energy improvement can also provide assurance to program administrators and their regulators that the ECMs they promote are maintained over time. The continuous improvement culture required by the standard can also be leveraged by program administrators to obtain participation in additional programs. Finally, program administrators can rely on the standard's certification requirements to reinforce the desired facility behavior.

The standard can be integrated into evaluation, measurement and verification protocols used to evaluate industrial energy efficiency programs, opening up new opportunities for program designs that have not been judged effective when evaluated using existing approaches.

Introduction

This paper presents the potential of the ISO 50001 Standard for Energy Management Systems to support energy efficiency program goals. Organizational behavior is a component of every energy measure, and having a management system in place that supports energy-efficient behavior will increase energy savings confidence and persistence, increasing savings reliability over time. This type of emphasis will drive the organization to make improvements that increase efficiency in demonstrable ways for certification, ways that program administrators can use for their own efforts.

The paper begins with background information on standards, including how energy efficiency program administrators use product standards to support their efforts. Next, energy management systems and their standards are discussed, and the background is completed with the development and status of ISO 50001. The link between ISO 50001 and the efforts and challenges of energy efficiency program administrators is presented. The paper concludes with specific next steps program evaluators and designers can take to leverage ISO 50001.

Background on Standards and Program Use

According to the National Institute of Standards and Technology, 80% of world merchandise trade is estimated to be affected by standards or regulations that reference or incorporate standards. In the United States alone, there are approximately 50,000 private sector voluntary standards developed by more than 600 organizations. This number does not include the more than 44,000 distinct statutes, technical regulations or purchasing specifications developed and used by federal regulatory and procurement authorities.

Use of Standards by Energy Efficiency Programs

Energy efficiency program administrators include several types of organizations, including traditional utilities (e.g. Idaho Power, Oklahoma Gas and Electric), state agencies (e.g. Maine, New Jersey), efficiency utilities (e.g. Efficiency Vermont), and regional/national coordinators (e.g. Northwest Energy Efficiency Alliance). Most of these organizations' energy efficiency programs center on specific end uses, such as light bulbs or other equipment and devices, wherein the program administrator encourages the adoption of more efficient end-use technologies, possibly via some type of financial incentive or educational program. Along with the design and implementation of energy efficiency programs, an equally important component of the effort is evaluation of program results to ensure that energy savings did, in fact, occur. Where utilities use the energy efficiency programs as an energy resource, that evaluation takes on an additional level of importance to ensure the reliability of power.

Program administrators have seen standards as a valuable resource and cornerstone of their efforts. From a program design perspective, the administrator can know what a standard requires and then build a program that leverages that standard. For example, if the standard such as ENERGY STAR mandates a specific energy efficiency level for a product, then the administrator can use that standard as a reference point for their work, either directly or by requiring products to exceed the standard. From a program implementation perspective, the administrator can take advantage of the marketing aspects of the standard, using the brand or label that can come with the standard, such as the blue ENERGY STAR label, to provide consumers a way to understand if products are efficient. Finally, from a program evaluation perspective, the administrator can know that the standard requires thorough development and/or testing to ensure standard compliance, and thus count on a certain degree of reliability and predictability around the actual performance.

Increasingly program administrators have begun to pay attention to more holistic standards that apply to more than a single product. One example of this is the ENERGY STAR New Homes certification, which is based on the energy efficiency of the entire house as a system. This program has gained strong acceptance in the residential building market. Program administrators can use ENERGY STAR's New Homes program requirements, certification process, and overall structure as a basis for their current and new energy programs.

Energy Management System Standards

Organizations seeking a more strategic approach will invest time in systematic solutions to their issues and goals. For example, with regard to safety issues, a non-strategic organization will take a reactive approach and resolve safety issues as they produce injuries, whereas a strategic organization will proactively establish a team and culture that encourages identifying and fixing hazards before they produce injuries. This type of approach is deployed in a continuous improvement model, popularized by the Plan-Do-Check-Act (PDCA) cycle, where teams methodically work to plan, execute and refine their approaches.

Management systems can be established to improve product quality, environmental impact, safety, and social accountability.

A relatively recent entry into the management systems space is energy. Although management system approaches have been applied to energy since at least the late 1980s, over the past ten years there has been increased emphasis by numerous groups:

- US Department of Energy Federal Energy Management Program – Resource Energy Manager (REM) Program
- Puget Sound Energy – Resource Conservation Manager (RCM) Program
- Northwest Energy Efficiency Alliance (NEEA) – Strategic Energy Management efforts
- California Public Utilities Commission – statewide initiative for Continuous Energy Improvement, based on NEEA's work

In 2000, the United States established the first national standard to codify the management system approach toward energy. This was done with the American National Standards Institute (ANSI), resulting in the ANSI Management Systems for Energy (MSE) 2000 standard, last revised in 2008. Also in 2000, Denmark created the first national standard in Europe, and over the next decade other countries joined in the creation of standards, including Ireland, Sweden, and China. In 2009 the European Union standards bodies — European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC) — jointly created a regional energy management systems standard EN 16001.

In 2007, the United Nations Industrial Development Organization (UNIDO) conducted a stakeholders meeting that determined the need for an international standard. ISO created a Task Force on Energy Efficiency and Renewable Energy Sources, and this group stated, "National energy management standards have been developed and are in use in various countries, resulting already in significant savings in energy consumption and reductions in greenhouse gas emissions. Regional and national standards development is underway in Europe, China, USA and other countries. The increasing interest in this field, and the explicit requests received by ISO, have led the Technical Management Board to already address the matter and the Task Force recommends that ISO moves forward expeditiously." From this international discussion, ANSI and Brazil's national standards organization Associação Brasileira de Normas Técnicas (ABNT) jointly proposed to lead the effort to create an international standard for energy management systems. ISO accepted the proposal and initiated Project Committee 242 to create the ISO 50001 Energy Management Systems Standard.

Scope of the International Energy-related Efforts

Within the area of energy, there are multiple current or proposed standards which will address various aspects of energy management. Similar to ISO 9000 and ISO 14000, ISO 50000 is a family of standards in which ISO 50001 is oriented towards the organization and its management; over time other ISO 50000 standards will be developed in the series following 50001, that is, they would be 50002, 50003, etc. Potential topics include Guidance for Implementation; Implementing Energy Management Systems for Small to Medium Enterprises (SMEs); and Calibration of Energy Measurement Equipment. In addition, other efforts currently exist to develop standards for energy savings calculations.

Scope of ISO 50001

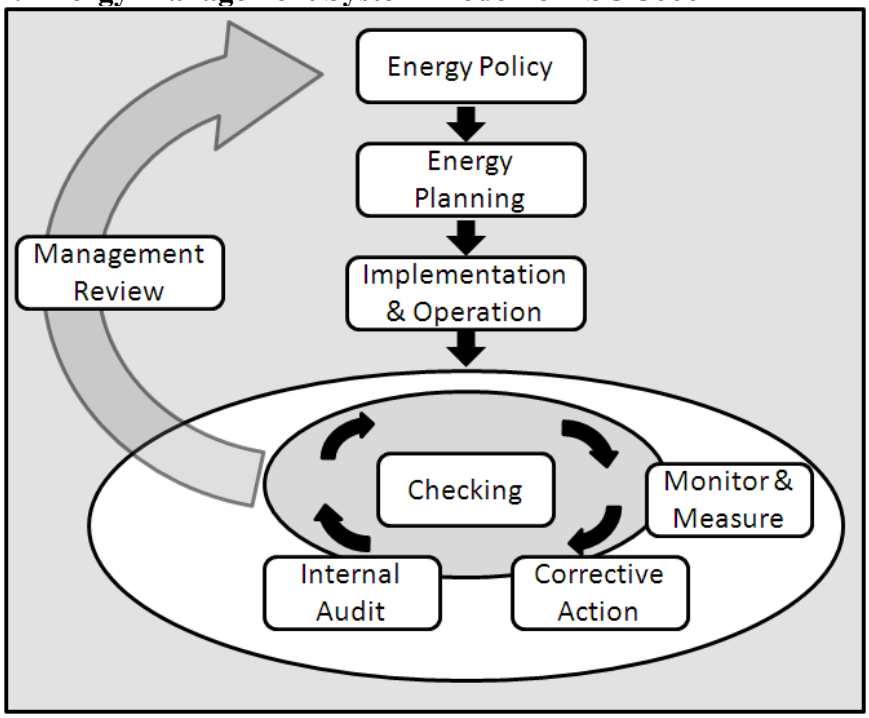
ISO estimates that the ISO 50001 standard will affect up to 60% of the world's energy use. This will come from companies that directly certify to the standard, as well as those that push the usage of the standard through their supply chain to control costs, reduce energy price risks, and manage environmental impact.

Similar to the ISO 9001 and 14001 standards for Quality Management Systems and Environmental Management Systems, respectively, ISO 50001 will have core management system elements that will drive continuous improvement. These elements include:

- Formal energy management planning process
- Management commitment and involvement
- Organization policy that commits to the process as well as to improving energy performance
- Energy team establishment and leadership
- Organization awareness and training
- Addressing of business areas that influence energy performance, such as procurement, training
- Energy performance indicators, baselines and goals

These elements are encapsulated within an Energy Management System Model that is implemented along a PDCA cycle similar to other management systems. The specifics of the model are shown graphically in Figure 1.

Figure 1. Energy Management System Model for ISO 50001



It is important to note that the elements of the ISO 50001 standard apply to the organizational side of energy, unlike other energy related standards, such as those which apply to more technical topics, such as:

- Energy calculations – the work of ISO Technical Committee (TC) 257 will include efforts to standardize how energy efficiency is calculated. See the section below for more information on TC 257.
- Energy using equipment – the Illuminating Engineering Society (IES) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) have efficiency standards that affect devices such as linear fluorescents, windows, fans, and pumps.

ISO 50001 will not be a technical document, but an organizational document that outlines how management interacts with energy through business practices.

On June 15, 2011, the ISO 50001 document was published as an International Standard. After publication, two activities will occur. The group of authors of the initial standard will continue writing and refining the adjacent subjects that support the core management system standard. The second activity will be the implementation and certification of the standard itself. Consultants and other groups will work with organizations to apply the management systems approach to energy, specifically to the levels required for ISO certification; certification bodies (CBs) will follow behind the implementation efforts, validating the management systems and providing the certification. These CBs will also conduct formal audits every three years as well as impromptu spot-audits in the timeframe between for the organizations to maintain their certification. Closing the loop in the whole effort, both the implementation and certification groups will provide feedback to the authors so that the standard can be refined and augmented as necessary.

One important topic is the difference between compliance and certification. It is possible for an organization to establish a management system for energy that is ISO compliant, and they can even declare this in a public fashion. However, they will not be able to say that they are ISO certified, which requires an independent, third party CB to conduct audits, validate the system and provide the certification. In theory these two categories are in line, such that the certified company is of course already compliant, but there is some nuance between them. Companies who seek to improve their energy performance may see value in establishing a management approach, but they may or may not see value in becoming ISO certified. Conversely, companies may see market value in becoming ISO certified, but they may or may not have established a management system for energy without the market demand for the certification. In the ISO industry, the latter example is referred to as a "paper system", wherein the management system only exists minimally to meet the auditors' requirements for certification, but no real positive results are expected. Program administrators and evaluators who utilize the ISO standard should pay attention to the real difference between compliance and certification, and should also understand that organizations deploy the management systems for different reasons.

Scope of Technical Committee 242

The original Project Committee (PC) 242 was established to create the ISO 50001 international standard, and as that group completed this effort, it transitioned to become a standing Technical Committee (TC) that exists to maintain the initial standard as well as develop any standards that support the vision of 50001. The group is establishing their scope and developing a work plan to address that scope. From the original PC/TC transition proposal, the scope of additional work includes:

1. Guidance on implementation of an energy management system, as well as specific implementation guidance for small and mid-size enterprises, including considerations for phased implementation;
2. Guidance on Implementation specific to an economic sector (e.g., industrial sub-sectors, commercial buildings, etc);
3. Establishing and tracking energy performance indicators (EnPIs) appropriate to an organization;
4. Developing benchmarking best practices and inclusion of benchmarking in guidance documents
5. Technical elements of energy management such as assessments and assessment results, the energy review, baselines, and asset management;
6. Energy management related elements including supply, demand issues, storage, and disposal as well as appropriate selection of objectives and targets,

7. Ensuring that energy performance improvements made are sustained and that these improvements capture the full range of cost-effective opportunities available within the facility or organization including considerations of energy use in the supply chain,
8. Measurement and verification of energy performance improvements compatible with internationally acceptable practices, including connections to greenhouse gases,
9. Establishing recommended education requirements and competencies for certified personnel providing energy management system development, implementation, and assessment services to provide competent assistance to organizations effective development and implementation their energy management systems,
10. The relationship to and comparison of an energy management system with other management systems standards, including potential opportunities for integration of Management System Standards (e.g. ISO 9001, ISO 14001), taking into consideration the work of the ISO Technical Management Board Joint Technical Coordination Group on Management Systems as appropriate.

Each of the above work elements can be addressed singly as additional "sub-standards" to ISO 50000, such as ISO 50002, or they could be developed in concert with another group. Paying attention to this scope of work and the TC's progress can provide benefits to program administrators, as their challenges are addressed by the international energy community.

Scope of Technical Committee 257

In summer of 2010, the China Standards Agency (SAC) submitted a proposal to create a Technical Committee (TC) that is dedicated to development in the area of energy savings determination. The proposed scope included:

- Standardization of the general technical rules for measurement, calculation and verification of energy savings in renovation projects, industrial enterprises and regions.
- The standard specifies the general technical rules for measurement, calculation and verification of energy savings applicable in energy efficient renovation projects on existing or new building facilities, industrial utilities and processes.
- It also specifies the general technical rules for measurement, calculation and verification of energy savings of industrial enterprises. It can be used in evaluating energy efficient activities of industrial enterprises in voluntary or mandatory mechanisms.
- It may reduce the technical barriers in energy savings trade such as energy performance contracting.
- Finally, it is also applicable to determine the energy savings of regions which implementing energy efficient policies and measures, such as mandatory standards, tax rebates, subsidy programs, propagation programs and so on.

This group was approved by the ISO member nations, and is slated to have their initial meeting in summer 2011. There has been much development in many areas that will apply to the scope of this group. For example, the Northwest Energy Efficiency Alliance has funded an effort to establish a common methodology for facility-wide baselines; this type of baseline is a requirement to prove energy performance improvements that are required in ISO 50001. Liaisons between TC 257 and TC 242 will improve both groups' standards and guidance, and ultimately lead to improved energy performance for those who utilize those standards and guidance. Program administrators can benefit from monitoring and guiding the efforts of TC 257.

How ISO 50001 Can Be Leveraged

As the ISO 50001 standard moves closer to publication, energy efficiency program administrators are planning, or already implementing, efforts to leverage the standard. These can provide a number of benefits depending on the administrator's priorities, the maturity of energy management within their programs, the depth of their customer relationships to deploy deeper programs, and their proximity toward embracing the standard. The standard can be leveraged in three ways: increasing traditional energy measure reliability, improving the organization's energy efficiency culture, and ensuring that organizational improvements themselves are reliable.

Increasing Reliability of Energy Savings from Traditional Measures

Estimates of the energy saved from energy efficiency programs have a range of confidence regarding the reliability of savings based on the type of program and its ECMs. These measures' savings can be deemed, wherein the approach to calculating the savings is pre-determined. Deemed savings approaches are prevalent for common measures such as lighting. For measures that are more variable, a custom approach with some type of pre- and post-metering is used to validate the energy savings. In either case, the program administrator may discount the total program savings based on degree of certainty. The adjustment may consider the level of confidence that the customer's organization will maintain the measure in a way that preserves the savings. For example, if a facility manager installs a high efficiency fluorescent light system, the program administrator assumes that the facility manager will not go back to using less efficient lamps in the system; however, if the facility is not supported by procurement policies that support energy efficiency, a facility purchasing agent may buy the less efficient lamp to save upfront purchasing costs. Another example is in the emerging area of Operations and Maintenance (O&M) measures, where equipment is operated or maintained in a different way to produce energy savings. If the facility is not supported by operating procedures that support energy efficiency, a facility operations manager may make decisions that undo the savings improvement. For this reason, program administrators typically do not rely on savings from improved O&M, thereby missing some substantial efficiency opportunities.

Within the energy efficiency program evaluation area, this topic is described as the behavioral aspect of Technical Degradation Factors (TDF). To date there is a shortage of primary research on this topic. Program administrators are becoming aware of the challenge and are adding concepts such as periodic problem checking to look for early measure removals or new technology failures so that these measures can be corrected and appropriate accounting of savings can occur. Customer management support of energy efficient operations can reduce these challenges.

Creating Cultures of Energy Improvement

With energy efficiency programs widespread, it is increasingly common to see energy efficiency measures deployed at facilities. The initially deployed measures are typically the ones that offer short payback or small upfront costs, such as lighting. In subsequent years, as additional measures are targeted by program administrators, they find that organizations can push back, because they feel they are already efficiently operating their facility. Even when supported by solid technical information on the economic case for the measures, the program administrator must market the business case for the subsequent projects. Essentially, the initial effort does not reduce the time the administrator must spend on the successive engagement (see Figure 2). In contrast, organizations with a systematic culture of continuous energy performance improvement will frequently have a more proactive relationship with program administrators and will reach out to them with ideas for new and creative energy efficiency solutions (see Figure 3). They

will become partners who look to the program administrator for resources, and will often engage in a mutually beneficial attitude, participating in program pilots or focus groups.

Figure 2. Traditional EE Project Effort

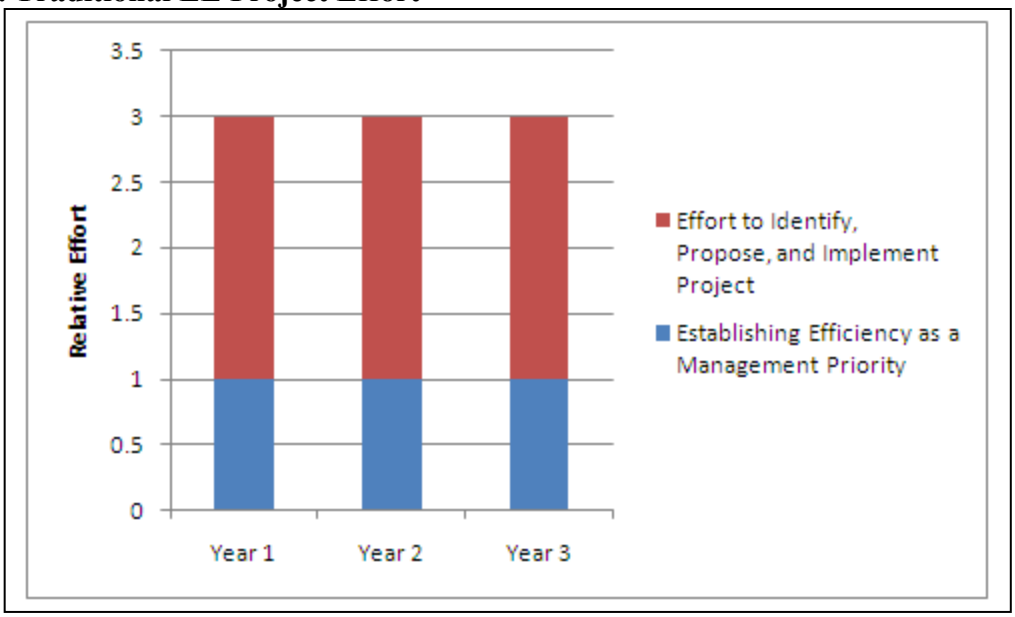
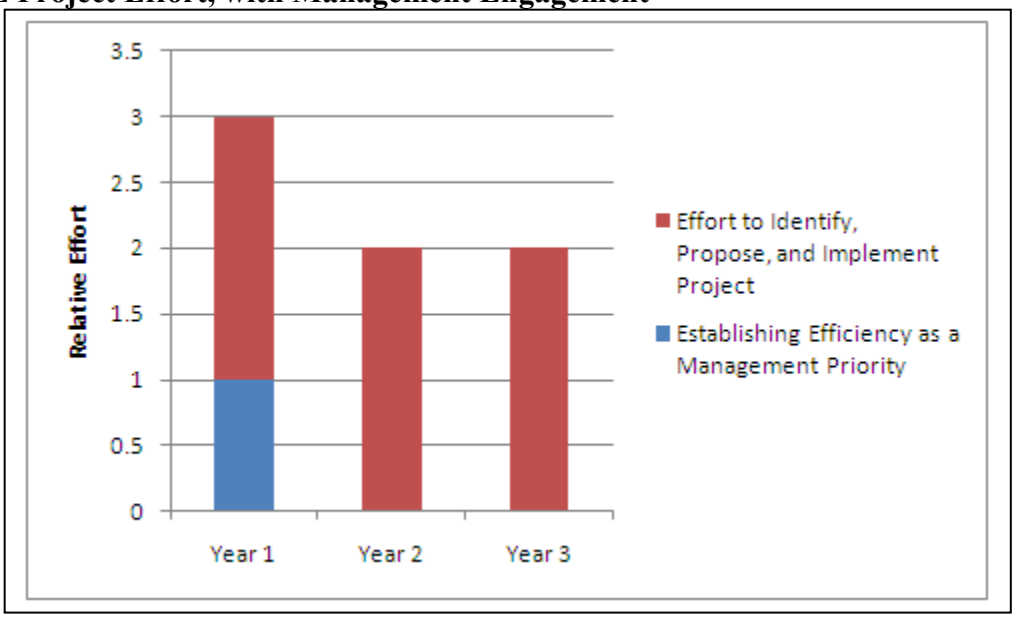


Figure 3. EE Project Effort, with Management Engagement



Establishing Reliability of Energy Management

For program administrators, the previous two methods increase the value of adding management system elements to their energy efficiency programs. However, the organizational changes that support energy efficiency can require some additional structure to ensure that the resulting energy savings are

delivered. For example, a company may deploy a management system approach in one year, maintain that approach for a second year, but then, in year three, other operational priorities may override some of the decisions made previously to support efficiency. To avoid this kind of backsliding and ensure savings reliability, program administrators may find that the ISO 50001 standard, with its built-in processes for certification and re-certification every three years, can be a viable method to ensure that the organizational improvements are occurring and being independently verified. In addition, the standard can enable comparisons between energy management efforts; the elements codified within the standard will be the same from organization to organization, so that program administrators can have confidence that the practices are implemented in a consistent and reliable fashion. Emerging efforts will be able to use the standard as a basis from which incentives can be paid for energy savings demonstrated by the organization as a result of its ISO standard energy management system implementation and subsequent certification.

As a reference point, quality management systems have existed for decades, and the ISO 9001 Standard for Quality Management Systems has seen widespread adoption, with over 1 million organizations certified by 2009. In that time, organizations that have chosen to go beyond implementation of their quality management system and actually pursue certification have seen benefits including:

- Fixed date review of the management system — rather than having a management system that merely has expectations on revising the plan, presenting to management and improving the system, certified companies also have a fixed year, three years after the initial certification, in which they must re-certify. This presents a goal that can be placed on the organization calendar and which management can drive toward.
- Greater executive commitment to the management system — internal audits required by the system can drive management to maintain focus on the management system and ensure that performance is sustained.

In organizations that have adopted ISO 50001, executives may also pay attention to the public benefits of being certified. Organizations can claim that they are efficient with energy or that they responsibly manage energy use, but if they can point to an external certification such as ISO they then are at a different level with stakeholders and customers, a level which executives seek to maintain.

How ISO 50001 Can Be Integrated Into Design and Evaluation

The ISO 50001 standard, as well as its adjacent standards and projects, should be of interest to energy efficiency program designers and evaluators. For both groups, gaining familiarity with the core standard is recommended; the International Standard is currently available for download at the ISO website (www.iso.org) for a nominal fee. This document explains the standard's requirements, enabling one to plan for ways that the standard's elements can support their initiatives. Also, it is recommended that both groups support the continued development of knowledge around industrial facility-wide energy savings determination methodologies; one of the first documents in this area is "*A Generalized Method for Estimation of Industrial Energy Savings from Capital and Behavioral Programs*" by NEEA's Bob Luneski. Beyond this, currently there is little other available information, and the facility approaches of the International Program Measurement and Verification Protocol, Volume 1, are more appropriate for commercial buildings. In addition, though currently in draft form, the Measurement and Verification Protocol of the Superior Energy Performance Program will have much that can be applied to program design and evaluation; after its publication in 2011, program professionals are encouraged to review it to inform their efforts. Beyond those awareness and development steps, there are specific ways to integrate the standard into design and evaluation.

Design

Program designers currently have a few options to apply ISO 50001 to their future program efforts. They can design traditional incentive programs with ISO standard added on as a way to increase savings reliability. For example, programs can have a greater confidence in energy savings reliability in facilities that are ISO-compliant or ISO-certified; should the more efficient equipment unexpectedly fail resulting in a procurement agent making a replacement purchase under duress, they will have a greater chance of purchasing an efficient replacement. For measures that utilize operations and maintenance (O&M) improvements or organizational approaches such as facility-wide energy management programs, designers can use the ISO standard as a way to ensure that the O&M improvements and management programs persist. And to look at new markets, ISO 50001-certified facilities can be targeted by programs that use traditional and O&M measures.

Program designers concerned with program free-ridership should account for the question of whether their program would have influenced a program participant's decision to deploy ISO 50001 itself or for the participant to deploy energy efficiency projects. Both of these can be managed by capturing sufficient program participant information, including the status of current energy projects and management initiatives, done in the form of initial screening, documentation of the status of current energy projects and management initiatives, and surveys.

Evaluation

Program evaluators have a more straightforward application of the ISO 50001 standard to their work. Primarily, the ISO certification should be an indicator of the increased likelihood of energy savings. This likelihood applies to the reliability, as in, the standard will require that the organization make improvements that produce actual savings. In addition, the increased likelihood applies to savings persistence, as in, the certification will drive the organization to repeatedly examine their energy performance and make improvements to maintain their certification; due to the certification pressure, facilities will be more aware of their improvements and will be more likely to maintain them over time. In addition to program evaluators that are tied to specific efficiency programs, agencies such as Public Utilities Commissions can also review ISO 50001 and evaluate how compliance can increase confidence about the reality and sustainability of energy savings estimated on a whole-facility basis.

Compliance with ISO 50001 allows a program administrator and its regulators to track the progress that a customer is making towards improving energy efficiency in the context of programs. The evaluation process will still require methods for estimating what would have happened without the program. But this evaluation may be easier to perform on a facility-wide basis than it is if the question is applied separately to each capital improvement that is made. Moreover, if data on measured rates of improvement over a wide sampling of a given become available, the range observed may offer additional insights into what would have likely happened without the program.

Conclusion

At a minimum, the upcoming ISO 50001-Energy Management Systems Standard should be a resource for energy efficiency program designers and evaluators from utilities, government agencies, and other organizations. Whether the standard is used as an indicator of reliable savings, or used as a core evaluable part of the energy efficiency program, the standard should be highly supportive of energy efficiency. It is a valuable exercise to gain familiarity with the currently available draft version and share information with program leaders in such groups as NEEA. If the measurement requirements in ISO 50001

are deemed sufficient for evaluating realized savings, the standard can open up new potentials for savings based on operational improvements in addition to capital improvements. Conversely, if there are concerns over the adequacy of the Standard's requirements for this sort of evaluation, these issues can be raised not only within the utility regulatory forums but also in the context of the regular updating of ISO 50001 and the related standards. Deploying the management system approach combined with the certification elements of the standard will create more reliable energy savings, both in the near- and long-term, and will support the mission of energy efficiency programs.

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