National programs to build capacity for effective ISO 50001 implementation in North America

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Abstract

Achieving robust implementation of ISO 50001 presents a number of challenges for implementing organizations, energy efficiency service providers, management system experts, and policymakers. ISO 50001's data-driven approach to continual improvement of both an organization's energy management system (EnMS) and energy performance requires a unique combination of skills not common in most markets. Building this capacity requires integrating the technical expertise of an energy efficiency service provider with the business process expertise of a management system expert. Innovation is also needed in policy and program design to support the necessary shift in organizational culture from energy efficiency as a technical matter dealing with energy projects to energy management as a business process.

A number of countries across the world are developing programs to build capacity for effective ISO 50001 implementation. Many public policy initiatives have been implemented, including regulation, tax incentives, facility certification programs, personnel certification programs, and technical assistance such as training, tools, and guidebooks. On the leading edge, some countries are using ISO 50001 as a compliance mechanism for greenhouse gas (GHG) reporting.

This paper will present activities across North America related to effective implementation of ISO 50001. The range of program activities will be described, with a special focus on 1) personnel credentialing programs, and 2) developing a methodology to predict energy savings and GHG reductions resulting from future ISO 50001 implementation. Analysis of data will be provided, supporting the value of competency-based personnel certification in achieving robust implementation outcomes. Additionally, a methodology for predicting ISO 50001 GHG impacts, developed the Lawrence Berkeley National Laboratory (LBNL) and under review by the ISO 50001 Global Research Network, will be presented.

Introduction

ISO 50001 is a flexible standard that can be an important tool to assist countries in meeting energy efficiency and climate change mitigation goals, usually on a voluntary basis. Global energy consumption is the biggest contributor to anthropogenic greenhouse gas (GHG) emissions, and implementation of ISO 50001 has a significant potential to be the largest driver in efforts to reduce these emissions.

The business context and the management support required for implementation of an ISO 50001-conformant EnMS can help overcome a number of the most common barriers to improving energy performance in organizations. For this reason, many governments are currently using policies that enable implementation of ISO 50001 as a mechanism for meeting national targets to reduce energy consumption, improve energy security, and reduce GHG emissions.

Policy actions in North America have taken various approaches to promoting ISO 50001. In Canada, the ecoENERGY Efficiency Program for Industry offers technical outreach, including activities and tools products that support ISO 50001. In Mexico, the National Program for Energy Management Systems (PRONASGEn) was launched to overcome the main barriers and poor practices that prevent energy users from the

systematic adoption of energy efficiency measures, and formal adoption of an EnMS. In the United States, the Superior Energy Performance (SEP) requires certification to ISO 50001 and achievement of a specified level of energy performance improvement.

National Programs to Build Capacity for Effective ISO 50001 Implementation in North America

CANADA

In 2011, Canada implemented a voluntary program to increase the energy efficiency of all Canadian industry, regardless of size. The industrial energy efficiency program operates in conjunction with the Canadian Industry Program for Energy Conservation (CIPEC), a government-industry partnership that has been helping organizations improve energy efficiency since 1975. It offers networking opportunities through conferences and meetings; and produces technical guides, case studies, videos and newsletters to increase awareness and uptake of industrial energy efficiency, while also reducing greenhouse gas emissions. In addition, the program provides CIPEC members with financial assistance to perform ISO 50001 implementation pilots, energy management projects, process integration studies and/or computational fluid dynamics studies. Computational fluid dynamic studies result in significant energy efficiency gains, and assistance is given to many sectors.

To date, 17 facilities have been certified to ISO 50001, and two organizations are certified to SEP, with one organization implementing an Enterprise solution covering four of its facilities. In 2013 – 2014 alone, CIPEC organizations achieved total annual energy savings of 1.65 petajoules (PJ) – enough to power about 19,200 households – and reduced annual GHG emissions by an estimated 170 kilotonnes (kt).

MEXICO

The Government of Mexico is aware of the importance of energy efficiency measures. The National Commission for the Efficient Use of Energy (CONUEE) is the technical organization responsible for promoting energy efficiency and sustainable use of energy across the country.

Mexico currently has 27 official (mandatory) energy efficiency standards for equipment and energy consuming systems. There are also voluntary standards based on international standards, e.g. the ISO 50001, which in 2011 was adopted as a national standard (NMX-J-SAA-50001-ANCE-IMNC-2011).

Since its foundation, CONUEE has led the implementation of energy efficiency measures for industrial facilities of the public and private sectors. In 2015, the Commission launched a new strategy to support all energy users based on the application of EnMSs.

EnMSs are key for the energy user's empowerment in order to implement their energy efficiency opportunities in a systematic manner according to the ISO 50001 standard. They can increase their competitiveness and productivity through the continuous improvement of energy performance, and at the same time, achieve sustainable energy use nationwide.

CONUEE, as a technical body that designs and implements national programs on energy efficiency, generates synergies between different stakeholders, ensuring quality products, systems and processes, where implementation is supported by domestic and/or international funds.

CONUEE has launched in 2014 the National Program for Energy Management Systems (PRONASGEn) that seeks to overcome and/or minimize the main barriers and poor practices that prevent energy users from the systematic adoption of energy efficiency measures, and it also aims to support the formal adoption of EnMSs.

The program objective is to promote the improvement of energy performance among energy users, through the implementation of an EnMS that establishes technical and managerial measures to raise competitiveness.

In order to achieve this objective, CONUEE has taken the initiative to coordinate the support offered by the following international cooperation agencies/bodies: the German International Cooperation Agency (GIZ), the Danish Energy Agency, the United Nations Industrial Development Organization (UNIDO), the Commission for Environmental Cooperation of North America (CEC), the US Department of Energy (USDOE), the Ministry of Natural Resources Canada (NRCan), and the National Metrology Institute of Germany (PTB).

The activities focus on the most energy intensive industrial sectors, small and medium-sized enterprises, municipalities, and public buildings. Specialized training of human resources in establishing EnMSs is also considered a priority, as well as the development of technical measures for energy conservation, by national and international experts.

In addition, the establishment and promotion of "learning networks" integrated by consulting firms, education and research institutions, and program participants, are assisting in the development of activities related to training and implementation of EnMSs. Currently, there are 50 companies who are implementing an EnMS, through 5 learning networks in Mexico.

PRONASGEn is collaborating with the main industrial chambers and trade associations in Mexico and it has the support and participation of leading educational and research institutions in the country, both public and private, so the program can strengthen the infrastructure for EnMSs in Mexico. Finally, the PRONASGEn is expected to have a significant impact on the energy consumption of the participants. Moreover, the Programme will have a strong impact on the environment due to a direct reduction of GHGs associated to the energy performance improvement. The PRONASGEn is part of the ISO 50001 Global Impacts Research Network, where the IET 50001 software is key to calculate the uptake and impacts of all this activities.

UNITED STATES

In the United States, the US Department of Energy's Advanced Manufacturing Office developed Superior Energy Performance (SEP), a voluntary program where facilities meet the ISO 50001 standard and have energy performance improvements verified by a third-party auditor, quantifying energy savings using a standardized approach.

In 2007, USDOE started development of SEP using a national energy management standard that pre-dated ISO 50001. USDOE tested SEP at several industrial facilities in an initial Texas pilot project, and had subsequent pilot demonstration projects. These gave DOE feedback to refine SEP, and modify the associated standards, tools, and other resources. These pi-

lots also allowed an assessment of the cost-effectiveness of SEP. SEP is a standards-based system, and USDOE collaborated with standards developers in the development process. USDOE also built the national infrastructure needed to support SEP, including funding to establish professional training and certification programs focusing skills and expertise needed to assist with ISO 50001 and SEP implementation and to conduct SEP audits.

SEP was designed to drive deeper, sustained savings by encouraging a rigorous data-driven approach. It provides a credible transparent record of energy performance improvement. USDOE also developed numerous tools designed to help implement SEP that equip organizations with the tools needed to employ the program.

Over 50 industrial facilities are participating in SEP, and over 35 facilities are currently certified [USDOE 2016]. These facilities find value in the data-driven energy performance improvement that results from SEP. Analysis of the costs and benefits associated with the SEP certification show significantly improved and sustained energy performance and energy cost savings, with a highly attractive return on investment. Currently, 15 facilities have achieved the Platinum level, showing improved energy performance of at least 15 percent, most over a 3 year period. Additionally, 6 facilities have successfully recertified to SEP upon expiration of their initial certification, illustrating the connection between SEP and continual improvement in energy performance.

Results from previous USDOE SEP implementations show that SEP certified facilities have improved their energy performance by 10 percent on average above business-as-usual in the first 18 months of SEP implementation, with an average payback of 1.7 years [ACEEE 2016].

NORTH AMERICAN ENERGY MANAGEMENT PILOT PROGRAM FOR INDUSTRIAL AND COMMERCIAL

Facilities – Commission for Environmental Cooperation

The Commission for Environmental Cooperation (CEC), along with energy agencies in Canada, Mexico, and the United States, is currently implementing the North American Energy Management Pilot Program to help organizations in North America with the resources needed to implement ISO 50001 and the SEP program in their facilities. The program centers around a cohort approach, using a series of training workshops and coaching. The cohort approach involves bringing together a group of organization to participate in the workshops and training, with peer-to-peer learning opportunities as well. The participating companies will learn to apply a corporate-level energy management system, have selected facilities certified, and share best practices.

These pilots strengthen national programs, expand public–private engagement to promote ISO 50001 implementation, provide technical and financial resources that empower industry to implement and sustain an EnMS, while demonstrating the business value of ISO 50001. 14 facilities (all located in Canada, Mexico, or the United States) from 9 companies have committed to the program. Together, these facilities have over $500 million USD in annual energy spending and represent a range of key economic sectors such as steel, cement, automotive, chemicals, and food processing.

The following companies are participating: 3M, ArcelorMittal, BMW, Cargill, Cummins, Ingersoll Rand, Intertape Polymer Group, New Gold, and Titan America.

Resources being offered include three 2½ day workshops over 18 months, designed to help facilities implement ISO 50001 and meet criteria for Superior Energy Performance. Each phase is shown below [CEC 2016].

1. **Plan.** First workshop defines key elements of planning:
   - Understand facility's current energy management environment.
   - Develop energy policy and set organizational goals to adhere to it.
   - Establish a baseline of energy consumption.
   - Set performance indicators and review processes.
2. **Do.** Second workshop focuses on successful tactical implementation:
   - Use baselines to set targets and implement action plans.
   - Build energy awareness throughout the organization.
   - Advance energy management system competencies through training.
3. **Check/Act.** Third workshop applies measurement to check your improvement curve:
   - Use performance indicators to measure success.
   - Create corrective and preventative action processes.
   - Prioritize objectives.

In addition, one-on-one monthly coaching is provided by certified energy consultants. ISO 50001 implementation tools and related resources are also provided and introduced during the training workshops and monthly webinars. These include forms, samples, and guidance to assist with the implementation.

Organizations participating are expected to commit personnel time and other resources to take part in the three phases of training and implement an energy management system. Upon successful completion of the program, organizations will be ready for certification to ISO 50001 or SEP through a third-party audit.

Specialized Skills Needed for ISO 50001

ISO 50001 is structured management system standard with requirements for both improving the management system itself and also a data-driven approach to improve energy performance. A distinct combination of skills is required: the business processes of a management system and the technical requirements needed to improve a facility's energy performance. ISO management system specialists understand management systems, but are usually not familiar with energy fundamentals. Energy efficiency professionals know how to implement energy efficiency projects, but structured management systems are usually foreign.

Both skills are needed for implementation or auditing of ISO 50001. An important aspect of ISO 50001 is the third-party

audit conducted by certification bodies that employ or contract personnel to perform the audits. Also, facilities implementing ISO 50001 need to implement and maintain the EnMS and prepare for the audit, and typically hire a consultant or use competent internal staff. The following programs were designed to certify these auditor and consultants/internal staff.

CREDENTIALS TO SUPPORT SEP

In North America, three personnel credentials have been developed to support SEP.

Certified Practitioner in Energy Management Systems

Those that hold the Certified Practitioner in Energy Management Systems (CP EnMS) credential have been certified to have the knowledge and skills needed to: 1) Work with an organization to establish and/or maintain an energy management system that meets the requirements of ISO 50001; 2) work with an organization to establish an energy management system that meets ANSI MSE 50021[1]; and 3) work with an organization to integrate ISO 50001 with their existing management systems [IEnMP 2016].

This credential was designed for both internal staff and consultants to demonstrate the competency required to implement ISO 50001 or SEP.

SEP Performance Verifier

Those that hold the SEP Performance Verifier (SEP PV) credential have been certified to have the knowledge and skills needed to: 1) Review and evaluate calculations supporting a client's application of the SEP energy performance claim; and 2) work with the audit team to communicate and justify the audit findings related to energy improvement calculations.

SEP PV requires the CP EnMS credential as a prerequisite to ensure the candidate has demonstrated competency in energy fundamentals and knowledge of ISO management systems.

SEP Lead Auditor

Those that hold the SEP Lead Auditor (SEP LA) credential have been certified to have the knowledge and skills needed to: 1) Lead and manage an SEP audit team effectively to ensure the audit objectives are met; 2) Assess the conformance of the energy management system to SEP requirements; 3) Plan and conduct the SEP audits and report the organization's implementation of ISO 50001 and ANSI/MSE 50021 and associated normative documents.

SEP LA has both CP EnMS and ISO 50001 Lead Auditor as prerequisites. The CP EnMS credential ensures competency in fundamental energy knowledge and ISO 50001 implementation, while the ISO 50001 Lead Auditor credential is specific to ISO 50001 certification audits. An SEP LA has additional skills associated with leading an SEP certification audit, with its strong focus on energy performance outcomes. An audit team of an SEP PV and SEP LA is required for an SEP audit.

USDOE also funded development of training programs that are aligned with these three certifications.

1. ANSI MSE 50021 includes the additional requirements beyond ISO 50001 that must be met to become SEP certified.

COMPETENCY CAN MAKE A DIFFERENCE

SEP is currently implementing an SEP Enterprise-wide Accelerator, which offers an opportunity to implement SEP enterprise-wide, such as across a corporation, business unit, or in multiple plants to achieve greater energy cost savings at lower implementation costs.

An outcome of the Enterprise-wide Accelerator will be a system to support sampling of energy performance improvement verification across multiple SEP candidate facilities within a single enterprise. The goal is to use energy performance verification sampling to reduce external costs and barriers to certification for those enterprises with the demonstrated internal capacity to conduct energy performance verification of their facilities at a level of accuracy commensurate with energy performance verification by an SEP Verification Body.

Initial analysis is showing facility staff training and personnel certification matters. When SEP implementation was facilitated by professionals certified to one of the SEP credentials (either directly, indirectly via consultants, or through USDOE cohort training), facility-reported energy performance improvement and energy performance verification are approximately 90 percent aligned. Less alignment occurs when this level of support is not available [LBNL 2016].

INTERNATIONAL EFFORT – ISO 50001 LEAD AUDITOR

A consistent, robust approach to ISO 50001 third-party auditing is important, and to respond to this need, a new international personnel certification program for ISO 50001 auditors was developed to build the auditor capacity needed to conduct consistent and high quality ISO 50001 conformity assessments.

The Energy Management Working Group (EMWG) of the Clean Energy Ministerial provides an international forum for member governments to collaborate on activities to accelerate broad use of EnMS in industry and commercial buildings worldwide. In 2014, the EMWG launched an activity to establish a consensus-based, international certification scheme for ISO 50001 Lead Auditor which builds on the general competency requirements of ISO 50003 *Energy management systems – Requirements for bodies providing audit and certification of energy management systems*. Several countries collaborated to develop a job task analysis and an international exam to ensure these competencies are met, including Mexico, Canada, United States, Korea, and South Africa [USDOE 2016].

The development of an ISO 50001 Lead Auditor certification scheme is intended to build capacity among accreditation and certification bodies in participating countries to establish new personnel certification programs that are nationally relevant and internationally equivalent. By ensuring technical consistency, this credential will increase confidence in ISO 50001 personnel certification schemes, and help fully realize the potential of the standard to reduce energy consumption and GHG emissions. The certification scheme is being made available to interested countries under a licensing agreement. Countries can also choose to separately license use of an exam that meets the scheme requirements.

In 2015, EMWG partners created the Energy Professionals International (EPI) to manage the ISO 50001 Lead Auditor Program, which became available in early 2016. To date, 12 individuals have been certified under this credential in the United States, and additional certifications are pending in Canada and Mexico.

The EPI credential is the first of its kind to combine the knowledge and skills from the two fields of management system auditing and energy efficiency. This combination of skills was not well-supported by existing credentials and training. The job task analysis includes the following high level topics (also known as "domains"):

1. Energy Performance Auditing
2. EnMS Auditing
3. Management Systems Auditing (general)
4. Auditing (general)
5. Pre-Audit Team Leader Duties
6. Stage 1 Auditing Team Leader Duties
7. Stage 2, Surveillance, and Recertification Auditing Team Leader Duties
8. Communication for Team Leader Duties
9. Energy Fundamentals and Technical Knowledge Areas for Light to Medium Industry, Buildings, and Building Complexes
10. General ISO 50001 Audit Knowledge
11. Leading Audit Team Knowledge

The credential also has education and work experience prerequisites to ensure the candidate is competent. The EPI credential addresses skill gaps of certification auditors, a critical factor to ensure that ISO 50001 implementations are robust and result in continued energy performance improvement.

Estimating Future Energy Savings from ISO 50001 – Tool and Estimate

Estimating the future impacts of adoption of ISO 50001 is a challenge, but provides critical information required by policy makers. With USDOE support, Lawrence Berkeley National Laboratory has developed the ISO 50001 Impacts Methodology which has been embodied in a software format as the ISO 50001 Impact Estimator Tool (IET 50001), to assist policymakers with these estimates. The output from IET 50001 can form a foundation to help countries and businesses design commitments that position ISO 50001 as a key strategy for meeting climate and energy goals.

ISO 50001 GLOBAL RESEARCH IMPACTS NETWORK

In 2016, the EMWG formed the ISO 50001 Global Impacts Research Network (Impacts Network), made up of an international group of more than 20 academics, researchers, and policymakers, including members from North America, to provide input on the methodology and facilitate discussion of policy drivers and impacts of energy management.

ISO 50001 IMPACT ESTIMATOR TOOL (IET 50001)

An Excel-based software tool, IET 50001 uses the transparent and consistent ISO 50001 Impacts Methodology to estimate the potential of greater ISO 50001 adoption for reducing energy consumption, GHG emissions, and energy costs. IET 50001 is a computational model developed to assist researchers and policy makers determine the potential impact that ISO 50001 implementation will have in the industrial and service (commercial building) sector for a given region or country.

The ISO 50001 Impacts Methodology that IET 50001 is based upon was initially developed by the Lawrence Berkeley National Laboratory, and improved upon and vetted by the Impacts Network. The methodology was designed based on the following criteria:

- the use of accepted, existing data sources (e.g., International Energy Agency);
- the use of transparent, testable assumptions, and
- the ability for users to customize inputs.

Methodology users must identify a region of interest, gather relevant input data including projected energy consumption on a delivered basis and carbon emission factors for various energy types, establish a projection of ISO 50001 uptake for the time period of interest, and select what level of annual savings will be realized from ISO 50001 implementation. These inputs are used to determine the amount of energy under the management of an ISO 50001 EnMS and the resulting energy, energy cost, and CO_2 emissions savings. By using a commonly accepted and transparent methodology, users of the IET 50001 Tool can easily and clearly communicate the potential impact of ISO 50001 for a region or country.

As with any methodology, ensuring that data inputs and assumptions related to ISO 50001 adoption rate and future energy consumption are of high quality and well-founded is critical to obtaining a meaningful result. Making systematic changes to the methodology input data provides the ability to understand the range of potential impacts that would result from different policy scenarios as well as determine the sensitivity of results to changes in inputs.

INITIAL ESTIMATES

Assuming a 50 % uptake level of ISO 50001 in the industrial and services sectors by 2030, along with other documented assumptions, IET 50001 projects that in 2030 ISO 50001 will result in 15 EJ of annual primary energy savings, and 1,000 Mt of CO_2 emissions will be avoided in 2030. This scenario results in cumulative primary energy savings of approximately 93 EJ, delivered cost savings of nearly $600 billion (discounted to 2016 net present value), and an associated 6,300 Mt of avoided CO_2 emissions. Actual uptake will depend on a number of factors, and will increase as more enabling policies are established. As countries work towards meeting climate change mitigation goals, policymakers and other stakeholders can utilize the ISO 50001 Impacts Methodology and associated IET 50001 software to estimate country- and regional-level impacts of ISO 50001.

Conclusion

ISO 50001 presents a number of challenges and opportunities for policymakers and implementing organizations. Robust personnel credentialing programs will help ensure a workforce is available that has the required skills to maximize the potential energy savings from ISO 50001 implementation. Understanding how ISO 50001 implementation will change energy consumption and impact GHG emissions is also important to

policy makers. Having an estimate of future impacts will help determine how programs targeting increased ISO 50001 implementation will help to meet overall goals for GHG reduction. Programs in North America are achieving robust implementation of ISO 50001 by addressing these two issues, and also through other public policy initiatives.

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