

# Promoting Strong ISO 50001 Outcomes with Supportive National Infrastructure

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## ABSTRACT

The ISO 50001 standard is a key mechanism for reducing greenhouse gas emissions and improving energy efficiency globally. An increasing number of companies are seeking certification, creating the need for personnel that are competent to conduct ISO 50001 certification audits. The growth of ISO 50001 is expected to accelerate as more companies integrate ISO 50001 into their corporate sustainability strategies and supplier requirements.

Robust implementation of ISO 50001 represents an important tool for countries with climate change mitigation goals. Because of its dual focus on continual improvement of an organization's energy management system (EnMS) and its energy performance improvement, ISO 50001 requires skills of both implementers and certification auditors that are not well-supported by current credentials and training. This paper describes an effort to address skill gaps of certification auditors, a critical factor to ensure that ISO 50001 implementations are robust and result in continued energy performance improvement.

A collaboration of governments through the Energy Management Working Group (EMWG), formerly under Global Superior Energy Performance (GSEP), has formed to build workforce capacity for ISO 50001 certification audits. The EMWG is leading the development of an internationally-relevant certification scheme for ISO 50001 Lead Auditor that meets requirements for ISO/IEC 17024 accreditation and ISO 50003 for defining ISO 50001 Lead Auditor competency. Wider availability of competent ISO 50001 Lead Auditors will ultimately increase the impact and market value of ISO 50001 certification and improve consistency of ISO 50001 certification outcomes by establishing a standardized and high level of knowledge and skills globally.

## Introduction

### ISO 50001 and Climate Change

The *ISO 50001–Energy management systems standard*, published in June 2011, is a flexible, voluntary standard that is an important tool to assist countries and their industries in meeting climate change mitigation goals. Since global energy consumption represents the largest contributor to greenhouse gas emissions, effective and robust implementation of ISO 50001 has the potential to be a significant driver in efforts to reduce these emissions.

The 2013 ISO Survey of Management System Standard Certifications reports 4,826 ISO 50001 certifications, eighteen months after the standard's initial publication (ISO 2013).<sup>1</sup> Public sources of more recent data indicate that there are now more than 10,000 ISO 50001

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<sup>1</sup> 2013 is the most recent Survey available.

certifications.<sup>2</sup> The growth of ISO 50001 is expected to continue to accelerate as more companies integrate ISO 50001 into their corporate sustainability strategies and supplier requirements.

ISO 50001 is a key energy efficiency strategy that governments are using to meet national targets to reduce aggregate energy intensity, increasing competitiveness and energy security, and reducing greenhouse gas (GHG) emissions in the manufacturing sector and other key economic sectors. Several national programs—including mandatory, incentive-based, and market-based programs—are using ISO 50001 to promote energy efficiency in industry, and these programs are successfully increasing the uptake of ISO 50001 (Dahlgren, et al 2014).

### **Critical Role of Specialized Skills**

ISO 50001 is structured to support a data-driven approach to continual improvement of both the organization's EnMS and reported energy performance improvement; however, realization of its full potential requires a combination of skills not commonly found in current markets. The skills required—in the business processes of a management system and in the technical requirements of energy performance—bring together two different communities. Management system experts have a background in implementing and certifying management systems, but they are usually not familiar with energy issues. Energy efficiency experts have a background in identifying, developing, and implementing energy efficiency projects, but are usually not familiar with continual improvement management system process.

Both sets of skills are required for the robust implementation of ISO 50001. They are equally important for effective auditing of organizations seeking to certify to ISO 50001 through the process known as conformity assessment. Management system auditors lacking in the knowledge and confidence to assess an organization's continual improvement in energy performance risk certifying an organization with an acceptable EnMS that lacks measurable energy performance improvement outcomes. Measurable and meaningful improvements in energy performance are needed to realize the potential of ISO 50001.

A consistent, robust approach to ISO 50001 auditing is also important, particularly to multinational organizations seeking to certify sites around the world. New personnel certification programs for ISO 50001 auditors are necessary to build the auditor capacity necessary to conduct technically robust and consistent conformity assessments of ISO 50001. Meeting these needs requires an international approach.

To address the skills gap associated with ISO 50001 conformity assessment, the Energy Management Working Group (EMWG) launched an activity in 2014 to establish consensus-based, international certification schemes that will support greater consistency in ISO 50001 certification outcomes, thus increasing the impact of ISO 50001 and, more generally, demonstrating the value of EnMS business practices to industrial, commercial, and public sector organizations. The initial focus of this effort is the development of an ISO 50001 Lead Auditor certification scheme, 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 are also developing an international exam based on the certification scheme.

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<sup>2</sup> R. Peglau (German Federal Environment Agency) April 2014 [7100 sites] plus recent press reports by large multinational companies announcing they have certified their entire organization (e.g.-Hilton [4100 sites], Samsung)

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 but regionally consistent. By ensuring technical consistency, this project will increase confidence of ISO 50001 personnel certification schemes, and help fully realize the potential of the standard to improve competitiveness while reducing energy use and GHG emissions. This project also aims to build regional capacity, particularly in developing economies, to ensure robust implementation of the standard. The ISO 50001 Lead Auditor certification scheme and international exam are in the final stages of development and will be made available to interested countries under a licensing agreement.

## **Background**

The EMWG is an initiative of the Clean Energy Ministerial (CEM), a global forum for encouraging and facilitating the transition to a global clean energy economy, and the International Partnership for Energy Efficiency Cooperation (IPEEC). The EMWG seeks to accelerate the adoption and use of EnMS, such as ISO 50001. EMWG member governments engage partners from a range of other organizations to promote energy efficiency and energy management. A key focus of the EMWG is helping countries better prepare their workforces to support successful EnMS programs (Siciliano 2013).

Participation in and administrative support for the EMWG initiative to develop an internationally relevant ISO 50001 Lead Auditor certification scheme is only one of several initiatives undertaken by the U.S. Department of Energy (US DOE) to improve outcomes from the implementation of ISO 50001. These additional initiatives include Superior Energy Performance® (SEP) and support for the U.S. to chair ISO Technical Committee 242- Energy Management (ISO TC 242), which is responsible for developing ISO 50001 and related standards. The Secretariat to ISO TC 242 is shared by the American National Standards Institute (ANSI) and Associação Brasileira de Normas Técnicas (ABNT) of Brazil.

As part of the SEP initiative, US DOE established the Institute for Energy Management Professionals (IEnMP) to manage professional certifications associated with implementation of and certification auditing for the SEP program. Early on, the SEP program design team decided that these professional certification programs should align with international best practices as set forth in ANSI/ISO/IEC 17024:2012 Conformity assessment -- General requirements for bodies operating certification of persons. Additional details are provided on these SEP-related certifications (Certified Practitioner in Energy Management Systems, SEP Lead Auditor, SEP Performance Verifier) in an ACEEE paper on SEP (McKane, et al 2015).

The US DOE identified a need for an ANSI/ISO/IEC 17024- accredited ISO 50001 Lead Auditor certification to complete the suite of professional certifications associated with ISO 50001. Since ISO 50001 is an international standard, a global approach to developing this credential was sought through the EMWG.

## **Defining the Project**

The EMWG is not the only international forum that recognizes the need for qualified experts and professionals to conduct ISO 50001 audits. The United Nations Industrial Development Organization (UNIDO) addressed this issue during its 2014 Expert Group Meeting in Vienna, Austria, noting that a new set of competencies and skills is needed beyond those of

existing energy efficiency or management system auditors. New training curricula and personnel certification programs are needed to ensure that experts and auditors possess the technical background and are competent (UNIDO 2014).

The EMWG initially raised the concept of an internationally-relevant professional credential for conducting conformity assessments of ISO 50001 during its June 2013 strategic planning session in Cape Town, South Africa. With the U.S. and Canadian governments as co-sponsors and interest from several other countries, the EMWG identified the development of an ISO 50001 Auditor Certification Scheme as a high-priority activity.

The EMWG fact sheet (DOE 2014) that communicates the purpose and proposed activities is excerpted as follows:

#### *Project Goal*

“The EMWG is establishing an internationally relevant certification scheme for ISO 50001 Lead Auditor meeting the requirements for ISO/IEC 17024 accreditation and suitable for adaptation to country-specific needs.

The project *will improve consistency of ISO 50001 certification outcomes* by establishing a standardized and high level of knowledge and skills for ISO 50001 Lead Auditors globally.”

#### *Project Outputs*

The intended outputs of this EMWG activity include a certification scheme and implementation principles for ISO 50001 Lead Auditor. Implementation principles will also be developed to guide the use of the certification scheme in participating countries, maintain the consistency of certification outcomes, and prepare countries to meet the requirements of ISO/IEC 17024 accreditation.

The resulting package of materials will initially be implemented by the countries participating in the development phase of this activity and then made available to any interested country under a licensing agreement.

#### *Benefits*

- Builds on and is consistent with the requirements of ISO/DIS 50003 – Energy management systems -- Requirements for bodies providing audit and certification of energy management systems
- Opportunity to exchange international best practices in this emerging area
- Opportunity to influence development of professional qualifications critical to the success of ISO 50001
- Leverages existing efforts among EMWG participants in professional qualifications and training
- Provides access to a package of materials to support national implementation of an ISO 50001 Lead Auditor program that meets rigorous international requirements

## Defining Certification Requirements

### Getting Started

Following the June 2013 meeting in South Africa, the EMWG conducted webinars to plan the activity to develop an internationally-relevant certification scheme for ISO 50001 Lead Auditor that met the requirements of ISO/IEC 17024 and built on ISO 50003, which was under development at the time. A subset of these countries interested in actively contributing to this activity held a kick-off meeting in Washington, DC in March 2014. The timing of this meeting was intended to align with the release of ISO 50003 as a Final Draft International Standard—the final stage before publication in which substantial edits are rarely made. Activity co-sponsors US DOE and Natural Resources Canada hosted representatives from Chile, Korea, Mexico, South Africa, and UNIDO at the kick-off meeting. This informal group of participants included subject-matter experts from government, standards authorities, accreditation bodies, certification bodies, and personnel certification bodies. Participants signed a non-disclosure and participation agreement to ensure that the JTA and certification scheme remained confidential during development and to avoid potential conflicts of interest.

Key elements of the certification scheme include a job scope, job task analysis (JTA) of defined knowledge and performance topics for testing competence, a blueprint of weighted topics from the JTA, education and experience requirements, and any prerequisites.

Outcomes of the meeting included a draft job scopes, education and experience requirements, and JTAs for ISO 50001 Auditor and Lead Auditor, which were later combined into a single credential of ISO 50001 Lead Auditor based on market needs and ISO/IEC 17024 certification requirements. Additional outputs of the meeting included a preliminary framework for governance of the international certification scheme and next steps for conducting a JTA validation survey.

The JTA describes specific knowledge and performance requirements that build on the general competence requirements included in ISO 50003, as described in Table 1 on the following page.

ISO 50003 has identified seven separate technical areas of competence for which an ISO 50001 Lead Auditor could be qualified. Since competency for each technical area will have some unique JTA topics and associated exam questions, the group determined that the initial EMWG ISO 50001 Lead Auditor JTA should be targeted to three areas that addressed the broadest group of organization types without requiring skills that were highly specific to a technical area. The selected areas are: industry-light to medium, buildings, and building complexes. The U.S. and Canada acknowledged that there would be a near-term need to address the additional category of “industry-heavy” by developing an additional JTA segment and exam as soon as work on the initial credential was completed. Additionally, Canada, Chile, and South Africa have expressed an interest in doing the same for mining. The remaining categories of transport and agriculture could be added later based on market needs and the interests of participating countries. Table 2 lists the technical areas for ISO 50001 Lead Auditor competency from ISO 50003, with the shaded areas indicating those being addressed by the initial ISO Lead Auditor certification scheme.

Table 1 — Required EnMS general knowledge from ISO 50003:2014

Knowledge	Certification functions		
	Conducting the application review to determine required audit team competence, to select the audit team members, and to determine the audit time	Reviewing audit reports and making certification decisions	Auditing
EnMS principles	X	X	X
Energy specific terminology	X	X	X
Basic energy principles	X	X	X
Energy related legal and other requirements	X	X	X
Energy performance indicators, energy baseline, relevant variables and static factors		X	X
Energy performance evaluation and related basic statistics		X	X
Common energy systems For example: steam systems, refrigeration systems, motor systems, process heat, etc.		X	X
Energy performance improvement actions (EPIA)		X	X
Energy performance improvement technology		X	X
General measurement and verification (M&V)		X	X
Measurement, monitoring and analysis of energy data		X	X

Table 2: Technical areas requiring demonstration of competence, highlighting the three areas that the EMWG identified as addressing the broadest group of organization types

Industry-light to medium
Industry- heavy
Buildings
Building complexes
Transport
Mining
Agriculture

After the kickoff meeting, a series of follow-along activities included: conducting a validation survey for the JTA, refining the certification scheme and implementation principles, and designing and vetting a governance structure based on the initial framework. The initial work on the certification scheme did not include developing a common exam; however, the U.S., Canada, South Africa, and Mexico are jointly developing an international exam that will be made available for licensing.

### Refining the Certification Requirements

The JTA validation survey was issued in English, Spanish, and French and attracted input from nearly 80 experts representing eighteen countries in Europe, Asia, Africa, North America,

and South America<sup>3</sup>. Analysis of the survey inputs were used to shape the final JTA and blueprint. The high level topics (also known as “domains”) in the final Blueprint are:

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 EMWG countries participating in this activity held discussions to refine and finalize the education and experience requirements for the certification scheme, specified in Table 3.

Table 3: ISO 50001 Lead Auditor Education and Experience Requirements<sup>4</sup>

ISO 50001 Lead Auditor Prerequisite for the Qualifying Exam		
Path	Educational Credential	Work Experience <sup>1</sup>
1	Technical academic degree 3 or more year academic degree from accredited educational institution in one of the following technical fields - energy management, engineering, architecture, science, or math.	4 years
2	Non-technical academic degree 3 or more year academic degree from accredited educational institution in other disciplines.	5 years
3	Technical vocational degree Minimum 2 year degree from accredited educational institution in a technical field.	5 years
4	Other	8 years

<sup>1</sup> Management system experience and/or energy management experience:

- Management system experience is defined as implementing or auditing a management system standard (ISO or equivalent).
- Energy management experience is defined as energy efficiency experience in facilities, projects, or programs.

Minimum of 15 on-site audit days achieved through a combination of:

- A. Audit days as an ISO 50001 audit team member (minimum 5 audit days)
- B. Audit days as an ISO 14001 lead auditor (Audit days must be within the last 5 years.)

<sup>3</sup> Respondents identified themselves from Portugal, United Kingdom, Italy, France, Spain, Slovenia, Romania, Republic of Korea, India, Japan, Turkey, South Africa, Chile, Colombia, Argentina, Canada, Mexico, and United States.

<sup>4</sup> © Lawrence Berkeley National Laboratory, by permission of US Department of Energy

## Managing and Implementing the Certification Scheme

### Forming the Collaborative

Participants of the kickoff meeting agreed that the project would be delivered by offering the final Certification Scheme, including Implementation Principles, to any interested country under a licensing agreement. To enable licensing and distribution of the scheme, the informal group of countries recognized the need to develop a governance structure and an identity. Interested countries are formalizing their participation in this activity as *founding countries* of a “Collaborative” (formal name to be decided). The following countries are currently committing time and resources to develop this activity:

- Canada (co-sponsor): Natural Resources Canada
- United States (co-sponsor): U.S. Department of Energy
- Mexico: Comisión Nacional para el Uso Eficiente de la Energía
- South Africa: South African National Energy Development Institute and National Cleaner Production Centre
- United Nations Industrial Development Organization (observer)

The EMWG Secretariat is recruiting additional countries (e.g., Italy and India) to broaden geographical representation from key ISO 50001 markets.

The Collaborative will oversee the development, implementation, and modifications to the scheme. A Global Program Administrator, currently the IEnMP, will conduct overall management of Collaborative activities. As part of its formation, the Collaborative countries agreed to collectively:

- Form a Global Certification Scheme Committee.
- Establish a Global Program Administrator.
- Establish and approve policies and procedures for the Collaborative that will establish the principals, guidance, contributions and administration of the Auditor Certification program.
- Develop ISO/IEC 17024-accreditable Global Certification Scheme (all parts of the scheme required by ISO/IEC 17024, excluding the exams) for ISO 50001 Lead Auditor.
- Establish a process and procedures for the development of additional certifications deemed necessary by the Collaborative (e.g. ISO 50003 technical areas not currently included in the ISO 50001 Auditor JTA).
- Develop a licensure agreement for use of the outputs from this Collaborative by personnel certification bodies
- Develop implementation principles for use of these schemes, which each participating country and licensee will follow.
- Decide whether to develop international exams or pursue this work at the national or regional level.

The Collaborative will also define how to structure its committees and subcommittees. Its anticipated structure is summarized in Figure 1.





Figure 1: Anticipated infrastructure of the Collaborative

Considerable effort is in progress to develop a process for licensing the outputs from the Collaborative – the certification scheme and implementation principles and the international exam. The certification scheme is designed to be adaptable so that any country can pursue implementation in a manner fitting its specific national needs.

Multilateral interaction through the Collaborative provides a forum for countries to create joint opportunities to promote the certification scheme and leverage resources effectively. For example, Canada, Mexico, and the United States recognize great value in aligning national strategies to promote ISO 50001 in North America. Key elements of this cooperation include an accreditation system for ISO 50001 auditors in North America, joint development of end-user tools and training, harmonized measurement and verification, and pilot projects. Regional consistency of ISO 50001 auditor skills will build greater confidence in ISO 50001 outcomes.

Further multilateral dialogue will also help the Collaborative identify effective communications and outreach strategies and partners needed to promote worldwide use of the scheme.

## Exam

The development of an international exam represents another way that countries are leveraging expertise and resources toward a common need. The international exam is not a required part of the ISO 50001 Lead Auditor certification scheme. A country also has the option to create its own national exam that meets scheme requirements, demonstrate equivalence of its exam, and obtain ISO/IEC 17024 accreditation.

The United States, Canada, Mexico, and South Africa recognize the benefit of jointly developing an exam, rather than developing national exams individually. The international exam concluded the beta testing process to establish a cut score in May 2015. The final exam is expected to be available in the following months and will be made available to additional interested countries under a licensing agreement.

## Conclusion

ISO 50001 enables organizations to assess and better manage energy on an ongoing basis. Certification to ISO 50001 provides assurance that organizations have implemented an effective

EnMS and are continually improving their management system and energy performance. Robust auditor training and credentialing programs are needed to ensure that ISO 50001 certifications are credible and valuable in the market.

The Collaborative seeks to uphold the value of ISO 50001 certifications by promoting wide use of the ISO 50001 Lead Auditor certification scheme and international exam, particularly in countries and regions experiencing high ISO 50001 implementation rates, and in developing countries. The certification scheme is the first of its kind that combines business expertise in management systems with technical expertise in energy efficiency.

The certification scheme and implementation principles will help countries determine how refine their existing ISO 50001 auditor training and credentialing programs or design new ones that are consistent with international best practices. The availability of robust training and personnel certification programs that support ISO 50001 conformity assessments will increase the number of qualified ISO 50001 auditors in the market. Governments will be able to engage existing technical experts and develop new experts who can help industry improve energy efficiency and reduce energy intensity. Individuals that obtain certification as an ISO 50001 Lead Auditor in accordance with this scheme will have expertise in energy efficiency and management systems that is consistent with international best practices, which will broaden their career opportunities.

Ultimately, robust ISO 50001 Lead Auditor personnel certification programs will increase the uptake of ISO 50001 certification. In addition to government initiatives to promote ISO 50001, Certified ISO 50001 Auditors will be eager to market their services to organizations. The availability of certified ISO 50001 auditors will also benefit organizations seeking ISO 50001 certification. Robust ISO 50001 audits provide proof that the organizations are making measurable and meaningful improvements in energy performance.

As the number of ISO 50001 certifications grow around the world, economies will experience an ongoing reduction of energy intensity and improvement of energy performance. The robust qualifications for ISO 50001 conformity assessments will help APEC economies demonstrate their continued leadership in reducing energy intensity and improving energy performance in the region.

## References

- Dahlgren, et al. 2014. *Models for Driving Energy Efficiency Nationally Using Energy Management*, Proceedings of 2014 European Council for an Energy Efficient Economy, Papendal, Arnhem, the Netherlands
- DOE (U.S. Department of Energy). 2014. Fact sheet: *ISO 50001 Lead Auditor Certification Scheme*. October 2014. Washington, D.C.: U.S. Department of Energy. [http://www.cleanenergyministerial.org/Portals/2/pdfs/GSEP\\_EMWG\\_ISO50001\\_auditor\\_cert\\_scheme\\_factsheet.pdf](http://www.cleanenergyministerial.org/Portals/2/pdfs/GSEP_EMWG_ISO50001_auditor_cert_scheme_factsheet.pdf).
- International Organization for Standardization (ISO). 2013. ISO Survey of Management System Standard Certifications. Geneva, Switzerland [http://www.iso.org/iso/iso\\_survey\\_executive-summary.pdf?v2013](http://www.iso.org/iso/iso_survey_executive-summary.pdf?v2013)

ISO 2014. ISO 50003:2014 Energy management systems- Requirements for bodies providing audit and certification of energy management systems. Geneva, Switzerland  
[http://www.iso.org/iso/catalogue\\_detail.htm?csnumber=60089](http://www.iso.org/iso/catalogue_detail.htm?csnumber=60089)

McKane, et al. 2015. *The Business Value of Superior Energy Performance®*, Proceedings of 2015 ACEEE Summer Study for Industry, Buffalo, NY

Siciliano, et al. 2013. *Management System Implementation in Industry and Commercial Buildings: Results from a Global Superior Energy Performance Multi-Country Analysis*, Proceedings of 2013 ACEEE Summer Study for Industry, Buffalo, NY

United Nations Industrial Development Organization (UNIDO). 2014. UNIDO Energy Management System /ISO 50001 Programme Issue Paper, 8-10 April 2014 Expert Group Meeting  
[http://www.unido.org/fileadmin/user\\_media\\_upgrade/Media\\_center/2014/Events/ISSUE\\_PAPER\\_-\\_EnMS\\_Vienna\\_Meeting\\_05032014.pdf](http://www.unido.org/fileadmin/user_media_upgrade/Media_center/2014/Events/ISSUE_PAPER_-_EnMS_Vienna_Meeting_05032014.pdf)