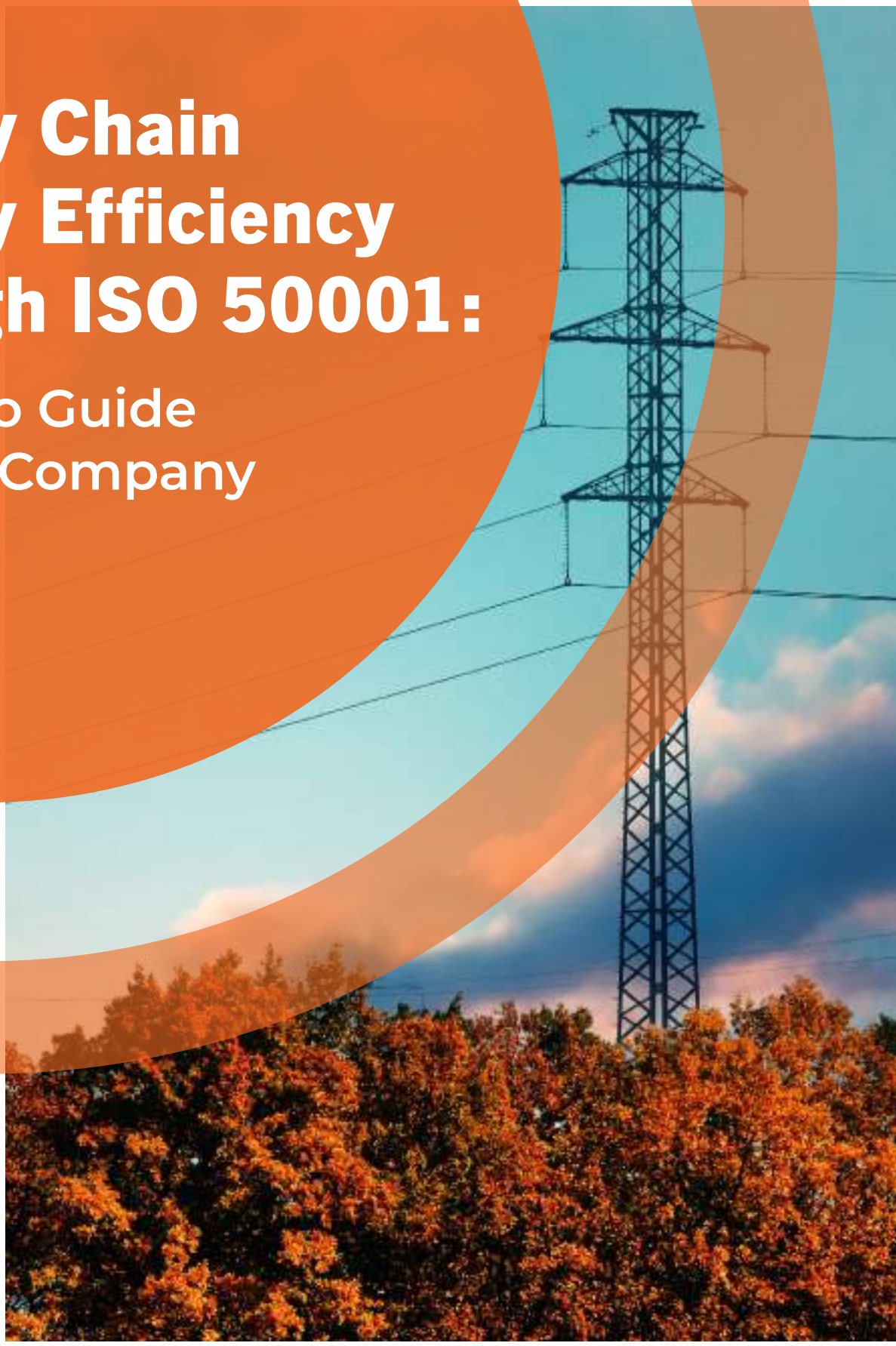
Supply Chain Energy Efficiency through ISO 50001:

A How-to Guide for Your Company

May 2019



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LIST OF ABBREVIATIONS AND ACRONYMS

CDP	Carbon Disclosure Project
CEC	Commission for Environmental Cooperation
CO_2	carbon dioxide
Conuee	*Comisión Nacional para el Uso Eficiente de la Energía*
CP EnMS	Certified Practitioner in EnMS
DJSI	Dow Jones Sustainability Indices
EnPI	energy performance indicator
EnMS	energy management system
GJ	gigajoule
ISO	International Organization of Standardization
NRCan	Natural Resources Canada
OEM	original equipment manufacturer
SEnPI	Superior Energy Performance 50001 Energy Performance Indicator
SEP 50001	Superior Energy Performance 50001
SEU	significant energy use
US DOE	United States Department of Energy

ABSTRACT

This guide is intended to guide original equipment manufacturers (OEM) and supplier organizations in establishing and institutionalizing the organizational structures and management systems needed to effectively and efficiently achieve their desired energy performance goals and objectives. Central to this approach is the recognition that the ISO 50001 Energy Management System is internationally recognized as the best vehicle to drive continual improvement in energy performance and achieve long-term results. As such, energy end-user organizations and their supply chains are provided with the necessary information, strategies, and access to detailed training and tools to successfully implement ISO 50001. Appendix A compiles the links to the key resources referenced throughout this document.

EXECUTIVE SUMMARY

This guide is offered to organizations desiring to pursue and/or optimize energy performance improvement. Some organizations employ an "*ad hoc*" approach to energy efficiency that may produce short-term improvements, but may not be effective or sustained because the organization's top leadership is not actively involved in establishing or supporting improvement efforts. Instead, the "management systems" approach to energy efficiency is much more effective because the top leadership establishes and formalizes both the improvement objectives and the means by which to achieve them. This document highlights ISO 50001 as the framework for a comprehensive, systematic approach to energy management, initially within the boundaries of the organization, followed by a logical and natural expansion of the supply chain. Complementary tools and training support implementation and outline a proven, comprehensive system for achieving continual and sustained energy improvement.

This document identifies barriers to effective energy management and optimizing energy performance and discusses strategies to overcome them. Top management's role is shown to be critical to the development and sustainability of a successful energy management system (EnMS). Points reinforcing the business case for improved energy performance are provided to help organizations overcome a lack of awareness or the belief that their energy footprint may be too small to justify the economics of even minimal efforts. Additionally, broad-based participation from relevant departments—including marketing and sales, environmental and sustainability, investor relations, and customer support—can help the organization more fully realize not only the potential monetary value, but also the strategic value from offering of low carbon, low–energy-branded products and services, enhanced company reputation, and positive sustainability index recognition. This document also highlights case studies of companies that achieved business benefits from ISO 50001 and their strategies for success. Their examples can provide insights into the benefits and methods of implementing ISO 50001.

An effective, step-by-step implementation approach blends a staff training program and the application of specific ISO 50001 tools and resources. Organizations are encouraged to utilize 50001 EnMS Qualified Instructors, who are professional trainers on ISO 50001 implementation methodologies, to educate, coach and guide the organization to successful implementation. The training leverages web-based software tools specifically focused on ISO 50001, including the 50001 Ready Navigator, which provides step-by-step guidance on all aspects of the ISO 50001 implementation process, as well as other supporting tools.

Recognition from national energy agencies can provide motivation to pursue energy efficiency efforts. This training culminates in preparing the organization to self-attest conformance to ISO 50001 and receive recognition through the 50001 Ready program. The US Department of Energy (US DOE) developed 50001 Ready to recognize organizations that establish an energy management system, measure and improve energy performance over time, and self-attest to the structure of ISO 50001. The *Comisión Nacional para el Uso Eficiente de la Energía* (Conuee) of Mexico and Natural Resources Canada (NRCan) are in the process of adapting 50001 Ready to their national recognition programs. Achievement of 50001 Ready prepares organizations to take further, optional steps in energy management, which could include third-party certification to ISO 50001. More advanced energy management systems could pursue Superior Energy Performance 50001 (SEP 50001), US DOE's certification program with a higher focus on measurement and verification.

ACKNOWLEDGMENTS

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This guide is offered to organizations desiring to pursue and/or optimize energy performance improvement.

INTRODUCTION

Today, more than at any other time, business and social norms require us, as we consume natural resources and have the potential to negatively impact the environment, to conduct our business affairs in a responsible and sustainable manner. That is, in our manufacturing, construction, transportation, and service activities, we must intentionally and diligently endeavor to reduce both our resource consumption and potential harm to the environment. The vast majority of midsize to large organizations have now embraced sustainability principles and have incorporated them into their business models. As a result, many have developed and publicized their own sustainability goals to demonstrate their support for these principles and to incentivize positive behaviors internally. Efforts aimed at minimizing fuel consumption and the corresponding release of carbon dioxide gases are commonly referred to as Energy and Greenhouse Gas (GHG) Sustainability Goals. In response to these recent trends, an extensive array of technologies, strategies, methods, tools, best practices, and management systems have been developed to help organizations meet or exceed their sustainability objectives. Energy Management, therefore, can also be understood as an organization's active pursuit of energy and GHG sustainability goals through the application of these tools and methods in order to reduce GHG emissions. These aids, for the most part, have been developed collaboratively by governmental energy and environmental agencies, end-user groups, nongovernmental organizations, universities, and standards groups and committees: all in an effort to make advancements in this area for the common good. In this spirit and for this purpose, this guide has been developed and is offered to organizations desiring to pursue and/or optimize energy performance improvement. Here, we will highlight ISO 50001 as the centerpiece of a comprehensive approach to energy management within the boundaries of the organization, and then the logical and natural expansion to their supply chain. We will also describe the coordinated use of other complementary tools and training that together outline a proven, comprehensive system for achieving continual and sustained improvement.

We will begin the discussion by first doing a bit of level-setting, establishing a common understanding of some of the concepts and terms used both in ISO 50001 and also in today's energy discussions.

- **Energy Performance** – This is a general term used to describe results or outcomes against a variety of energy metrics, including energy efficiency, energy consumption, energy conservation, etc. It is often used as the umbrella term to describe or discuss the overall state, or change in state, of an organization's energy use over a given time period. The term can also be used, and often is, to describe specific results against a particular referenced energy performance indicator (EnPI). For example: gigajoules (GJ)-in/GJ-out, GJ/day, GJs/unit, GJ/lb, GJ/km or % change in consumed GJs, etc.

- **Energy Management** – This refers to an organization's collective efforts in establishing and pursuing energy performance improvement goals and objectives.

- **Energy Management System** – This refers to a formal, comprehensive approach to drive energy performance improvement. It makes use of policies, procedures, and established rules and conventions to guide and direct the entire organization.

- **Energy Footprint** – The energy footprint is primarily used in describing the magnitude and nature of energy consumption over a fixed period of time, usually a year. It can have different energy components, such as fossil, renewable, or fuel from raw materials.

- **Energy Efficiency** – The term most often associated with the measurement of energy input against a desired output. In energy performance improvement activities, it is used to indicate lowering energy consumption while achieving the desired output or outcomes. The simple example being a vehicle traveling the same distance from A to B under identical road conditions, but consuming less fuel, or a manufacturing system producing the identical product as another system, but using less energy to produce it. Improved efficiency is usually associated with making changes to the design of the system, restoring it to its initial design, maintaining it, or changing the manner in which it is operated.

- **Energy Conservation** – This term refers to the activities aimed at reducing energy consumption by reducing or doing without certain outputs or outcomes. A few simple examples of energy conservation include turning off lights, raising/lowering the control setting on thermostats, reducing the number of trips or travel miles, or even reducing or eliminating low margin products from the production wheel. In all these cases, energy consumption was avoided or saved by reducing or eliminating that which the system was designed to produce and therefore doing without that output.

- **Carbon Footprint** – The carbon footprint is primarily used to describe the amount of carbon dioxide and other carbon compounds emitted by an organization during a fixed period of time, usually one year. Although carbon emissions can result from other activities, our focus here is on those due to the consumption of fossil fuels. The 2004 *Greenhouse Gas Protocol—A Corporate Accounting and Reporting Standard, Revised Edition* classifies a company's GHG emissions into three "scopes" as follows:
  - Scope 1 emissions are direct emissions from owned or controlled sources.
  - Scope 2 emissions are indirect emissions from the generation of purchased energy.
  - Scope 3 emissions are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions (WRI and WBCSD 2004).

- **Product life cycle emissions** – "All the emissions associated with the production and use of a specific product, from cradle to grave, including emissions from raw materials, manufacture, transport, storage, sale, use and disposal" (WRI and WBCSD 2011).

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IMPORTANCE OF ENERGY MANAGEMENT

Companies or organizations that desire to effect an improvement in their energy and GHG performance will engage in energy management in one form or another. Energy management is a means to an end: that of pursuing an organization's energy and GHG goals and objectives. Positive results, and particularly long-term results, depend entirely on the effectiveness of the organization's approach. Typically an organization will use one of two types of approaches to energy management: The first might be called the "*ad hoc*" approach, in which the organization's top leadership is not actively involved in establishing or supporting the specific means by which to pursue or achieve improved energy performance. The second is the "management systems" approach, in which the top leadership establishes and formalizes both the improvement objectives and the means by which to achieve them. Even a cursory overview of these two approaches reveals the vast superiority of the management systems approach.

Energy management refers to an organization's effort in establishing and pursuing energy performance improvement goals and objectives.

1.1 *Ad hoc* Approach to Energy Management

An *ad hoc* approach refers to a bottom-up effort in which energy management largely depends on the initiative of one or a few individuals, growing somewhat organically from there. It typically lacks the support of organizational structures or policies traceable to the corporate or home office. There is usually no formal directive or mandate prioritizing energy performance improvements on a broad organizational basis. Rather, it is the work of a few individuals and there is no official management requirement for active employee participation. Efforts tend to consist of individual or discrete improvement projects, usually involving modification or replacement of equipment.

Disadvantages of an *ad hoc* approach include the following:

- Because this approach relies so heavily on the enthusiasm, expertise, and commitment of individuals to drive and sustain the effort, the effort itself is only as strong as the commitment of its proponents. Furthermore, the retirement, reassignment, relocation or reprioritization of certain employees can spell the untimely demise of an energy management initiative.
- Without the support of formal policies, procedures, or established requirements traceable to a higher-level authority, the effort becomes ineffective in providing a clear and sustained call to action. Activity is limited to the sphere of influence of individual proponents. It therefore precludes a more comprehensive approach involving the various functions and work processes across the organization, engaging only a relatively small segment of the available employee population. With no formal budget to support the necessary roles and responsibilities, opting out becomes the default position for individuals or entire departments. The approach also fails to provide needed administrative structures and work processes that enable continual improvement.
- The informal, and often localized, nature of the approach suffers from a lack of consistency across facilities, locations, and organizational functions. The lack of consistency ultimately makes this approach inefficient and ineffective, resulting in:
  - widely varying levels of commitment to the effort;
  - inconsistent application of measurement, tracking, and reporting rules, resulting in poor quality energy data and information;
  - missed improvement opportunities due to inconsistent use of leveraging or sharing mechanisms;
  - ineffective project funding schemes due to inconsistent application of valuation protocols; and
  - poor use of available improvement best practices.
- The approach is susceptible to the "on-again, off-again" syndrome as its priority becomes linked to energy price fluctuations, with a high priority when prices are high, and low priority at times of low energy prices.

Ultimately, gains in energy performance are much harder to achieve and sustain because this approach does not produce a cohesive, comprehensive effort. Activities are *ad hoc* and not integrated into the organization's primary work processes where managing energy is a natural extension of daily work activity throughout the organization, not merely the oft-disjointed work of a few individuals. Under the *ad hoc* approach, the improvement effort becomes a constant struggle for resources and priority.

1.2 Management Systems Approach to Energy

A management systems approach is one in which top management establishes and endorses a formal, comprehensive approach to drive energy performance improvement. Unlike the *ad hoc* approach, this approach makes use of policies, procedures, and established rules and conventions to guide and direct the entire organization. It formalizes supporting organizational structures, roles and responsibilities, minimum requirements and funding mechanisms to sustain the work. Through these documented sets of requirements, methods, protocols and organizational structures, improvement opportunities can be identified, prioritized and pursued in a systematic manner. Energy performance improvement can be built into the company's strategic business plans, the procurement process, engineering and design requirements, and day-to-day operational control and maintenance of facilities and equipment. Through a comprehensive, well-established, well-integrated energy management system, an organization's energy sustainability goals and objectives can be achieved efficiently and effectively.

Advantages of a management systems approach to energy include the following:

- It provides a systematic and logical approach traceable to high-level goals and objectives.
- Similar to environmental health and safety requirements, energy management requirements are integrated into the primary work process of an organization, becoming a natural part of individuals' job duties.
- Requirements and expectations are made clear and consistent across the organization.Employees within the organizational functions and departments understand and have established work processes by which to perform their required activities.
- Roles and responsibilities are established, avoiding redundancy, responsibility gaps, and confusion.
- It provides the means for broad-based participation, expanding opportunity identification and multiplying results.

Through a comprehensive, well-established, well-integrated energy management system, an organization's energy sustainability goals and objectives can be achieved efficiently and effectively.

THE CASE FOR ISO 50001

Given that a management system approach provides an organization the best option for sustained energy performance improvement, the next important question that must be considered is this: Are all management systems equal, or is there one that can be considered superior?

The answer is no; they are not equal… and yes, there is one, or at least a type of management system, that is overwhelmingly superior to all others.

Since management systems are largely homegrown, they can vary significantly, tending to be unique to an organization. Some will be more narrowly focused on particular aspects of energy use and consumption while others will be broader in scope. Some will include only certain aspects of the overall work process, while others will be more encompassing. Crafting an effective and efficient system for managing energy is a challenging undertaking. Careful consideration must be given on how best to arrange a number of elements that together will provide a comprehensive and cohesive means by which to produce and sustain positive gains. As a result, not all management systems are created equal.

Fortunately, individual organizations no longer need to develop their own best management systems to achieve their desired energy and GHG goals. The International Organization for Standardization (ISO) published the ISO 50001—Energy Management System (EnMS) Standard in 2011 and issued a revision in 2018. ISO 50001 was developed for energy end users by an historic ISO initiative, which brought together experts from around the globe, specializing in energy, management systems, industrial and commercial processes, and other related fields. Today, it is universally recognized as the best framework upon which to build an effective and efficient EnMS. The Standard provides the framework "to enable organizations to establish the systems and processes necessary to improve energy performance, including energy efficiency, use and consumption." [1]

1 ISO 2018. ISO 50001—Energy Management Systems Requirements with Guidance for Use. Geneva: International Organization for Standardization. ‹https://www.iso.org/obp/ui/#iso:std:iso:50001:ed-2:v1:en›.

The United States Department of Energy (US DOE) describes it in this manner:

"ISO 50001 is a voluntary International Standard developed by the International Organization for Standardization (ISO) to provide organizations an internationally recognized framework to manage and improve their energy performance. The Standard addresses the following:

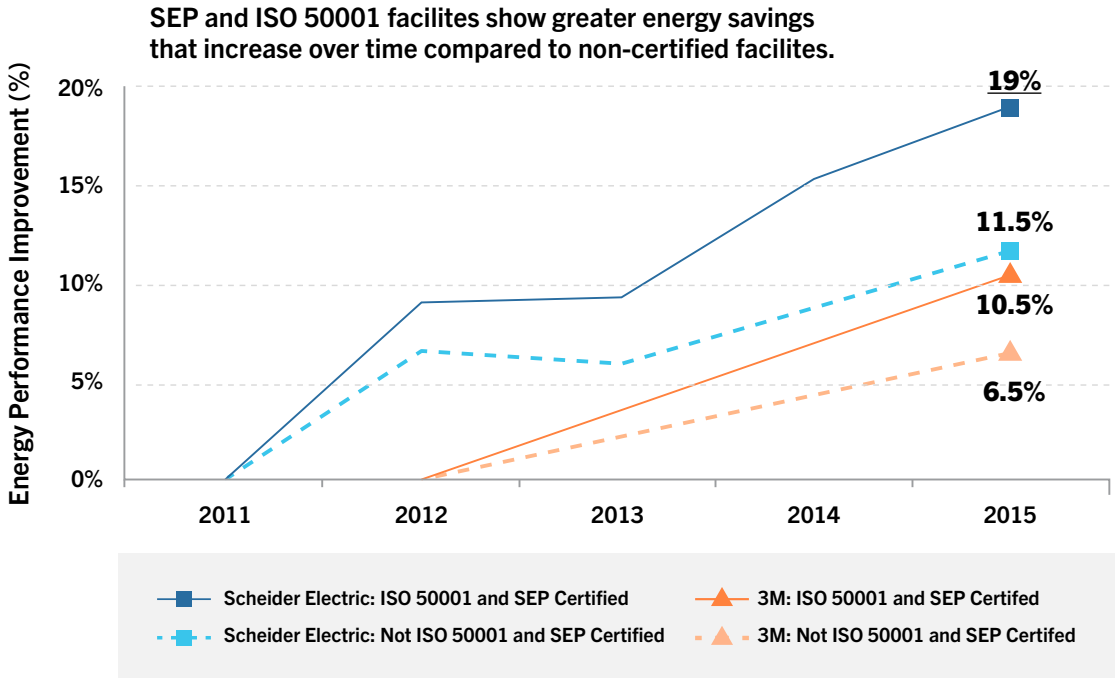
- Energy use and consumption
- Measurement, documentation, and reporting of energy use and consumption
- Design and procurement practices for energy-using equipment, systems, and processes
- Development of an energy management plan and other factors affecting energy performance that can be monitored and influenced by the organization[2].

In effect, ISO 50001 establishes an organized, systematic approach for the implementation of internationally recognized best practices in the pursuit of continual energy performance improvement.

The clear advantage of ISO 50001 EnMS comes into sharp focus with a direct comparison between ISO 50001-conformant facilities and non–ISO 50001-conformant facilities within the same company. As Figure 1 shows, facilities that conformed to the ISO 50001 Standard achieve markedly greater improvement in energy performance compared to facilities—within the same company—that did not pursue ISO 50001.

FIGURE 1.

Energy performance improvements greater with ISO 50001



Source: US DOE 2016.

2 US DOE. 2018a. United States Department of Energy's Advanced Manufacturing Office. 2018. ISO 50001 Frequently Asked Questions. Retrieved from: ‹https://www.energy.gov/eere/amo/iso-50001-frequently-asked-questions›.

3

STRATEGY FOR THE ADOPTION OF AND CONFORMANCE TO ISO 50001 ENERGY MANAGEMENT SYSTEM

In almost all cases, failure to conform the organization's energy management efforts and activities to the framework provided by the ISO 50001 Standard is due to either internal organizational barriers or uninformed decision-making. The choice of the organization to reject the ISO 50001 Standard is generally the result of either misconceptions regarding the Standard and its advantages over alternative approaches or low prioritization of energy performance improvement and associated GHG reduction.

The first step, then, is to determine whether energy performance improvement and GHG reductions are a priority to the executive leadership. In other words, ask:

Is energy and GHG emissions sustainability a corporate value or even a social responsibility element of the organization?

3.1 Elevating Energy and GHG Sustainability as a Priority

If the answer is an unambiguous "no," then the organization is, at best, operating in the *ad hoc* mode of energy management. Any discussion of adopting the Standard is premature until a transformation of corporate values and/or priorities is effected. Without executive-level support and commitment, any energy improvement effort is handicapped and at risk. Reasons why energy and GHG emissions improvement is not a corporate priority will need to be fully explored, understood, and addressed. Some possible reasons and remedial strategies might include the concepts described in the following section.

3.1.1 Overcome Organizational Lack of Awareness and Apathy on Energy Management

Lack of awareness and/or apathy at the executive level regarding energy management processes within the organization may explain why some organizations do not prioritize energy management. Appropriate executive-level leadership must understand how energy, even at its most basic level, is managed, and be provided with a clear description of what aspects of energy are being managed, as well as what aspects are not. The department or group that manages energy must articulate their mission, responsibilities, and objectives, as well as any limitations from which the current management system or organization suffers.

A quick and effective tool available to identify which aspects of energy are being managed and which are not is the 50001 Ready Navigator, described in the section on Supporting Tools and Resources in this document. It lists activities such as energy purchase, energy measurement, tracking and monitoring, performance improvement, operational control, etc., to aid in identifying gaps.

The objective here is to establish a necessary link between executive leadership's sustainability values and expectations and the processes and organizational structures needed to bring about a realization of the same. Alignment sessions can help analyze and understand the methods currently used to manage energy in contrast to a more comprehensive, systematic energy management system approach, paving the way for introduction of the ISO 50001 as a ready framework for closing any gaps and aligning the organization.

IBM plant in Bromont, Québec, Canada

3.1.2 Build the Value Proposition for Energy Management

Another barrier to energy management is a lack of appreciation for the potential benefits and rewards available in the marketplace for corporate behaviors that support sustainability values, norms, and expectations. Individuals seeking to engage top management on optimizing energy management can build and communicate the value proposition to highlight the business benefit.

A "voice of the customer" type of survey or study should be conducted to assess whether, and to what extent, customers, trade organizations, advocacy groups, investors, and sustainability rating organizations, such as the Carbon Disclosure Project (CDP) and Dow Jones Sustainability Indices (DJSI), expect and value corporate energy and GHG sustainability improvement behaviors.

With the involvement and input from relevant departments within the organization, including marketing and sales, environmental and sustainability, investor relations, and customer support, among others, the findings should be used to, as much as possible, determine the potential value to the organization, both in direct monetary value as well as strategic value. Strategic value opportunities, such as customer incentives, market preferential treatment, enhanced company reputation, product branding, and market gain or expansion in recognition of sustainable performance, are often overlooked or undervalued by the organization.

Using energy more efficiently translates into lower overall energy consumption, which in turn results in lower energy expenses. It also, except in the case of fully renewable energy, results in lower GHG emissions. In addition to directly reducing the amount spent on energy, there are several other ways in which improved performance through implementing the ISO 50001 Standard can add value to the organization:

- Improved margins for some or all product lines.
- Greater profitability of the enterprise: every dollar not spent on energy goes directly to the enterprise's bottom line.
- A more cost-competitive position in the market place.
- Enhanced company and product sustainability branding.
- External recognition by energy and climate advocacy organizations such as the CDP and DJSI, who rate and publically report the sustainability performance of organizations.
- Overall or specific product/services differentiation in the market, based on energy and carbon sustainability attributes.
- Increased attractiveness to sustainability-minded investors, customers, advocacy organizations and employees.

The estimated value, both direct and strategic, can be used to put forth the potential value proposition available to the company.

The best way to achieve the performance results that would enable an organization to reap the aforementioned value proposition benefits is a comprehensive and systematic energy management system such as the one framed in ISO 50001.

3.1.3 Organizations with Small Energy/ GHG Footprints

Some organizations maintain that their energy/GHG footprints are too small to justify the economics of even minimal efforts. At a minimum, the organization should conduct a high-level assessment of its energy use and consumption to either validate or dispel this position. This assessment should include information such as:

- How much energy is consumed annually and the corresponding GHG emissions?
- What are the forms or type of energy consumed?
- How is the energy being used?
- What are the largest or most significant uses of energy?
- Are energy use and energy costs trending upward or downward and why?
- How much of the final product cost and/or margin is attributed to energy costs?
- With a proper understanding of the energy use and consumption, potential value opportunities can be articulated and quantified.

Once the overall state of energy and potential added value is understood, an informed decision can be made regarding the scope and focus of an energy performance improvement effort. It is important to understand that potential added value and benefits may accrue in a variety of ways; see the preceding section on building the value proposition.

3.2 Reinforcing Existing Corporate Energy and GHG Values with ISO 50001

Alternatively, if corporate leadership values energy and GHG sustainability and improved performance, the strategy is to argue for a proper view and understanding of ISO 50001 and its advantages and benefits versus the current approach. In the Management Systems Approach section, we outlined some of these advantages. In the Case for ISO 50001 section, we make the case for the superior position of an EnMS that conforms to the Standard. A proper view of ISO 50001 conformance would include the following points:

It is not an end, but a means to an end. It is a means by which the organization's stated energy goals and objectives can be achieved.

- By the nature of its development, it is internationally recognized as the most comprehensive, cohesive, efficient and effective approach to managing energy and optimizing performance improvement results.
- The most efficient way to establish or upgrade to an effective EnMS is through adoption of ISO 50001. The 50001 Ready Navigator provides an easy to use, step-by-step tool that can be utilized to either upgrade an existing EnMS or develop it from the ground up.
- End-users who have adopted the ISO 50001 attest to both its effectiveness in optimizing results and the organizational efficiency and consistency that it provides. See the Case Study section.
- The Standard is not a "one size fits all" proposition. Rather, it allows the end-user's tremendous flexibility with a commonsensical application of many of its elements.
- Although some organizations find certification to the Standard to provide additional external stakeholder benefits or find it helpful for maintaining internal accountability, certification is not a requirement in order to reap the performance improvement benefits. The US Department of Energy's "50001 Ready" program provides such a pathway by which energy end-users can achieve conformance to the Standard and accrue the energy savings benefits of ISO 50001 and national recognition opportunities.

Therefore, a proper understanding of the Standard, and a careful consideration of the value and benefits that it affords, should make a compelling case for adoption of ISO 50001. Once an organization's leadership embraces continual energy performance improvement through the use of the ISO 50001 EnMS, a variety of tools, training plans, and guides are available to assist in the adoption process. See the sections in this document on Training Approach and Supporting Tools and Resources.

ISO 50001 is not an end, but a means by which the organization's stated energy goals and objectives can be achieved.

4

SUPPLY CHAIN ENGAGEMENT

Thus far, we have described the incremental advantages and benefits in the progression from an *ad hoc* energy management approach to a generic or homegrown management system approach to an ISO 50001 EnMS approach, with the latter representing the internationally recognized best practice. The next logical step in the progression is to leverage this effort across the supply chain in order to multiply the benefits. Extending the ISO 50001 EnMS approach beyond the company's or original equipment manufacturer (OEM)'s operational boundaries to include service and material suppliers can add significantly to the value proposition, particularly in the product sustainability, branding, and life cycle emissions characterization areas.

Generally, the OEM company will be in the best position to engage suppliers and lead the supply chain's ISO 50001 leveraging initiative. Here, it is vital that the OEM's executive leadership—such as the Chief Sustainability Officer or Head of Procurement—be fully supportive, if not the initiative's main sponsor. This is because it not only represents a time and effort investment by both OEM and supplier organizations, but also because it represents an enhanced customer-supplier relationship, even partnership, approach to sustainability. It is important to note that success does not necessarily mean the engagement and participation by all suppliers. It does, however, mean engagement and participation of all significant suppliers. A successful implementation strategy might include the following steps:

1. Ascertain executive-level commitment on the following:

a) Energy performance and GHG emission reductions as a corporate sustainability value

b) Conformance to the ISO 50001 EnMS as a top leadership priority

c) Engaging and leading a supply chain initiative for adoption of the ISO 50001 EnMS

2. Identify, assess, and prioritize significant suppliers:

a) Identify those suppliers that contribute materially to the production and distribution of product(s).

b) Determine which suppliers are significant in their contribution and in their potential to impact energy and GHG emission reductions.

c) Assess the desire and the readiness of the supplier's top leadership to adopt continual energy performance improvement through the ISO 50001 EnMS and prioritize accordingly. Where a given supplier ranks low in readiness, the OEM will have to conduct some preliminary work to address the misalignment in sustainability values and priorities.

3. Identify the key stakeholders within the company that will either play a part in the supplier engagement process and/or in shaping the engagement strategy.

It will be important for the strategy to articulate the use of incentives and/or requirements for supplier participation as well as the overall perceived added value of the initiative to both. Potential roles might include members of the following functions:

a) Procurement Department—possible involvement would be developing or amending procurement policy, supplier incentives and/or requirements, preferential contract offerings, and likely leading negotiation and execution of participation agreements with suppliers.

b) Legal Department—ensuring limits of liability and non-disclosure agreements are in place as needed to alleviate any legal issue concerns.

c) Sales and Marketing Department—assessing the incremental added value in marketing and sales offering more energy- and GHG-sustainable products and services, the added positive product and company branding, and recognition due to potential supply chain-wide sustainability improvements. The department would also develop a marketing sales strategy and plan to reap potential value.

d) Sustainability Department—valuing potential positive impact of added recognition by advocacy groups and organizations such as DJSI, CDP, and others.

e) Energy Performance Improvement Team—valuing the improvement opportunity from potential energy cost reductions in total and as it relates to products or product families.

4. Implement the engagement strategy, making sure that agreements with suppliers are executed at the appropriate level of the organization.

The concern is that local supplier organizations may agree to participate, but they may lack the authority to establish policy or effect changes to management systems such as those needed for the implementation of the ISO 50001 EnMS.

5. Organize training program to implement ISO 50001

Once appropriate customer-supplier agreements are in place and there is strategic alignment around the objectives and goals of the supply chain ISO 50001 implementation initiative, a training program to implement the Standard can be organized and delivered using the Training Approach and Supporting Tools and Resources provided in this document.

5

IMPLEMENTATION APPROACH

The Implementation model described in this section has been developed to provide organizations and their enterprises and/or suppliers with the necessary training, tools, and resources to develop and implement an ISO 50001-conformant energy management system and receive 50001 Ready Recognition. The program will strengthen internal expertise and create an implementation model that can be sustainably replicated across an enterprise or supply chain. The implementation model is provided as a suggested approach, which organizations can modify to best suit the enterprise and its supply chain(s), as appropriate.

This model includes in-person and remote training to assist participants in learning and implementing the ISO 50001 framework in their organizations, utilizing the 50001 Ready Navigator. Organizations are encouraged to seek training and implementation guidance from 50001 EnMS Qualified Instructors (preferred)—or experienced 50001 Certified Practitioners in EnMS (50001 CP EnMS)—herein after referred to as "trainers." The program coordinator will oversee the trainers. Although this approach assumes, as is recommended and is the logical progression, that the OEM has already established an ISO 50001-conformant EnMS within its organization, the approach can be modified to include an OEM implementation team, as appropriate.

5.1 Structure and Curriculum

5.1.1 Organizing the Implementation Teams

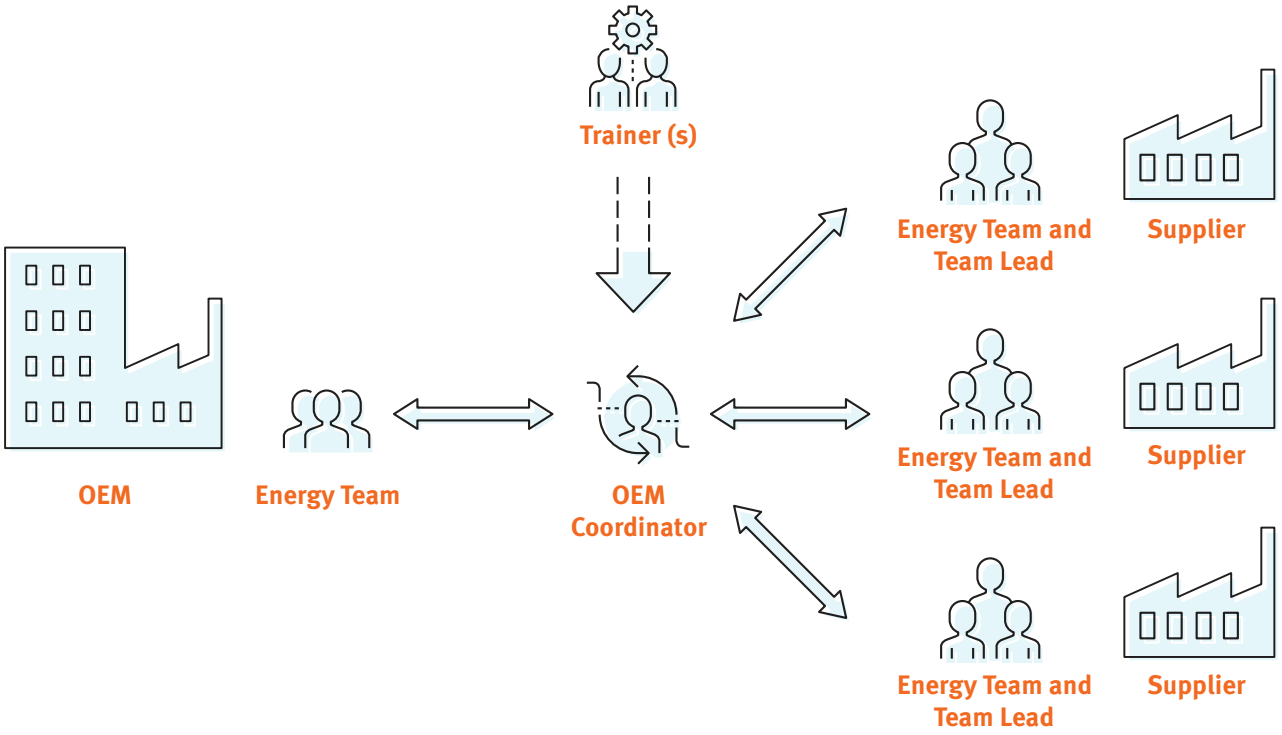
The overall training and implementation, whether within the OEM's enterprise or involving the OEM plus its suppliers, will be coordinated by an assigned member of the OEM organization, hereafter referred to as the **OEM coordinator**. The OEM coordinator will assume overall responsibilities for organizing the OEM and supplier teams, ensuring coordinated communications, arranging for trainers, setting up and maintaining the overall training and implementation schedule, providing the teams with an overview of the program, milestones, outcomes and expectations as well as monitoring progress and helping to resolve issues. A description of key roles and responsibilities is described below and illustrated in Figure 2.

- Implementation teams
  - The OEM and/or each of the participating supplier organizations will form an energy management team in accordance with the ISO 50001 EnMS, "Leadership" Section.
  - Implementation of the Standard within each organization will be led by the respective energy management team, but will necessarily involve other members of the organization, as needed.
  - In the case of ISO 50001 implementation across the supply chain, each supplier team will include an implementation team lead who will liaise with the OEM coordinator. Note that this role could be filled by the Energy Manager or leader of each energy management team.
  - The main role of the implementation teams is to attend and complete both the training and to complete each of the implementation steps, as prescribed during the training/ guidance sessions.

- Trainers
  - **The OEM coordinator** will make arrangements to engage and contract the 50001 EnMS Qualified Instructors, or an experienced 50001 CP EnMS that will serve as program trainers. The number of trainers needed will depend on whether the implementation is an OEM Enterprise-only implementation or a supply chain implementation, as well as on the number of suppliers participating. In the case of a supply chain implementation, this can be done in consultation and involvement with the supplier team leads and can include agreements on cost sharing for the trainer services.
  - **Preparation of trainers**. The OEM coordinator will convene and prepare the trainers who will be working with the program participants. The OEM coordinator will conduct an introductory (estimated 1.5-hour) webinar to review the program's scope, requirements, enrolled facilities, timeline, deliverables and training materials needed. If in-house trainers will be utilized, it is recommended that they be well qualified and participate under the direction of a 50001 EnMS Qualified Instructor or 50001 CP EnMS, as described in the Trainer Qualification section of this document. Although, not required, in-house staff could pursue 50001 CP EnMS training and possibly achieve professional credential certification.

FIGURE 2.

Structure of implementation teams



5.1.2 Participant Preparation Phase

- **One-hour introductory webinar**. After team participants have been selected, the OEM coordinator will hold a one-hour introductory webinar to present the training team to the participants and provide an overview of the program, milestones, outcomes and expectations.

- **Online preparatory course**. All energy management team leader(s) and at least two staff from each team will complete the six-hour introductory online course, Understanding ISO 50001. The course must be completed prior to the first classroom training. Participants will learn the following:

  - ISO 50001 terms and definitions
  - Energy use, consumption, and performance
  - The Plan-Do-Act-Check model for improving energy performance
  - Data management
  - Energy performance metrics
  - ISO 50001 registration criteria

- **"Getting started" webinars for each team**. Assigned trainers will meet with each team via webinar for 1.5 hours to introduce the Energy Footprint Tool, describe the gap assessment process and plan the on-site gap assessment visit.

- **On-site gap assessment**. The trainer will lead an on-site, 1.5-day gap assessment session with each team. A gap assessment tool, which consists of a questionnaire with a scoring system, will be used to determine the organization's current organizational structures and energy management practices and identify gaps that will need to be filled in order to have a 50001-conformant energy management system.

5.1.3 Training and Implementation

Each company's implementation team will use the 50001 Ready Navigator to complete the 25 tasks leading to develop an ISO 50001-based EnMS, and receive the following support:

- **2.5-day in-person training session**. At a minimum, assigned trainers will conduct on-site workshops providing an overview of the 50001 Ready Navigator and an in-depth description of the Planning and Energy Review tasks within the tool (Tasks 1 to 13). The location of each in-person session will be determined jointly by the trainers, the OEM coordinator and supplier team leads based on convenience and cost. The workshops will define key elements of planning to:
  - Understand the 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
- **Monthly group support (webinars)**. Starting shortly after completing the in-person training session, each implementation team will work through the 25 tasks in the 50001 Ready Navigator. The trainers will provide a list of monthly deliverables that each team must submit to demonstrate their progress toward completing the 25 tasks. Trainers will hold one-hour group webinars with all teams to review issues and discuss selected topics. Elements of tactical implementation to be addressed are:
  - Use baselines to set targets and implement action plans
  - Build energy awareness through the organization
  - Advance energy management system competencies through training
- **Remote facility coaching**. Additionally, the trainers will hold monthly one-hour calls with each facility to track progress and provide support as needed.
- **On-site coaching**. Trainers will help facilities check their improvements and take necessary actions. Facilities will be able accomplish the following:
  - Use performance indicators to measure success
  - Create corrective and preventative action processes
  - Prioritize objectives.
- **Quarterly coordination webinars**. On a quaterly basis, the trainers will engage the OEM coordinator to discuss progress, challenges and feedback on the program.
- **Optional resource**. Facilities may hire a 50001-Certified Practitioner in Energy Management Systems to supplement the training and/or have in-house staff receive 50001 CP EnMS training and possibly certification.

This training structure supports the ISO 50001 Plan-Do-Check-Act structure. Table 1 suggests a schedule for deploying these trainings, though the implementation timeline can be adapted based on the organization's schedule.

Training session

TABLE 1.

Training description and suggested timeline

Training Phase	Months	Activity
Phase 1: Preparation	1	Introduction webinars with all participants to introduce the trainer(s), program steps, timeline, expectations and requirements (1 hour)
		Each team completes an online preparatory course that provides basics of ISO 50001 (6 hours)
	2	"Getting started" webinar - Assigned trainers will meet with each team to introduce the footprint tool, describe the gap assessment, and plan the trainer's visit at the facility (1.5 hours)
		Trainers visit the facility and performs gap assessment (1.5 days)
Phase 2: ISO 50001 implementation	3	In-person training session to provide an overview of the 50001 Ready Navigator and resources and discuss key topics (2.5 days)
		Each team works through the 25 steps of the 50001 Ready Navigator
		Follow-up call with each team and their trainer (1 hour)
		Monthly webinar with all teams and trainers to discuss key topics, as needed (1 hour)
	4-11	Teams continue working on the 50001 Ready Navigator (self-paced) and share progress updates and questions during monthly call (1 hour)
		Monthly webinar with all facilities and trainers to discuss key topics, as needed (1 hour)
Phase 3: Wrap-up	12	Teams complete the 25 steps of the 50001 Ready Navigator and self-attest to 50001 Ready Recognition
		Wrap-up webinar with all participants and trainers (1 hour)
		End of training program

5.1.4 Conclusion and Self-Attestation

- **Wrap-up webinar**. At the end of the program, the OEM coordinator and supplier team leads will schedule one-hour wrap-up webinars for all participants. The webinars will cover shared learning, readiness and plans to either self-attest to the 50001 Ready Recognition Program, pursue ISO 50001 certification, and plans for ongoing maintain conformance to the Standard. Following the webinar, facilities will take final steps, if any remaining, to self-attest to the 50001 Ready program or pursue other recognition as well as to institutionalize ongoing sharing, and communicating and assistance among and between the OEM coordinator and supplier team leads.
- **Self-attestation.** Facilities submit self-attestation and receive 50001 Ready Recognition. US DOE, Conuee, and NRCan will provide 50001 Ready Recognition to facilities from their respective countries.
- **Optional readiness review**. Facilities may pay a fee to have two trainers conduct an "audit" that checks the facility's EnMS to determine if it is ready for certification. This option is only for companies that plan to pursue certification.

5.2 Training Materials

Trainers should make training materials easily available to participants, for example, using an online file-sharing mechanism, e.g., Dropbox or Google Drive. A wide selection of training materials is also available on US DOE's Tools, Expertise, & Training web page at https://betterbuildingssolutioncenter.energy.gov/tools-expertise-training.

5.3 Trainer Qualifications

Engaging 50001 EnMS Qualified Instructor(s) to provide the training is highly recommended. These instructors are active 50001 Certified Practitioners in EnMS (CP EnMS) who have demonstrated mastery of ISO 50001 methodology and instruction techniques and have passed a selective US DOE training session. US DOE is currently reviewing the qualification process to expand the availability of these professionals. However, if engaging a 50001 EnMS Qualified Instructor is impractical, a suitable alternative is to work with a practicing 50001 CP EnMS that has experience leading teams through the ISO 50001 implementation process. The Institute for Energy Management Professionals maintains a list of current 50001 EnMS Qualified Instructors and 50001 CP EnMS on its website at: https://ienmp.org/certifications/find-a-professional/.

General Motors de México, San Luis Potosí, Mexico

6 SUPPORTING TOOLS AND RESOURCES

6.1 50001 Ready Navigator

6.1.1 Overview

The 50001 Ready Navigator is an online, self-paced guide for establishing an energy management system to plan, identify, prioritize, and implement projects that will improve a facility's energy performance. The Navigator is designed to help organizations build toward all parts of ISO 50001. Using the Navigator ensures that organizations share a consistent definition of energy management systems, and facilitates a team-based approach to their implementation (US DOE 2019a).

Once all 25 tasks have been completed and designated as such in the tool, the facility can self-attest to their completion and request recognition for having implemented a 50001 Ready energy management system. Completion of the 50001 Ready Navigator prepares facilities to pursue certification to ISO 50001 or Superior Energy Performance 50001™ (SEP 50001™). Depending on how much experience a facility has with energy management and the complexity of its operations, implementing a 50001 Ready system may take between 6 and 18 months (US DOE 2019b).

6.1.2 Description

The 50001 Ready Navigator comprises 25 tasks, as listed in Table 2. Each task corresponds directly with establishing the energy management system requirements specified in ISO 50001. The 25 tasks are grouped into four sections:

- Planning (tasks 1-5)
- Energy Review (tasks 6-13)
- Continual Improvement (tasks 14-18)
- System Management (tasks 19-25)

While tasks are numbered 1 through 25, they do not have to be completed sequentially and many of them can be worked on in parallel, especially those in the Continual Improvement and System Management sections (US DOE 2019c).

The Navigator contains extensive guidance on how to complete all the necessary tasks, with worksheets, templates, and other resources available, depending on the task. Each task includes the following tabs, providing guidance to help complete the task:

- "Getting It Done" – High-level bullet points summarizing the key accomplishments of the task.
  - "Task Overview" – General synopsis and explanation of the task's objectives. Also identifies which numbered sections of the ISO 50001 Standard are relevant to the guidance provided.
  - "Full Description" – Technical requirements and detailed tips.
  - "Resources" – links and description to relevant work-sheets, templates, and resources.

TABLE 2.

List of tasks in the 50001 Ready Navigator

Section: Planning		
Task 1	Scope and Boundaries	We have defined, documented and approved the scope and boundaries of our 50001 Ready energy management system.
Task 2	Energy Policy	We have developed an energy policy statement, which has been approved by top management.
Task 3	Management Commitment	Our top management has expressed its commitment to the 50001 Ready system and is aware of its roles and responsibilities.
Task 4	Energy Team	We have established an energy team that meets regularly and includes a management representative. Roles and responsibilities have been defined for the energy team and all affected personnel.
Task 5	Legal Requirements	We have identified energy-related legal requirements that apply to our operations, have a process to evaluate and update these over time, and evaluated our compliance with them.
Section: Energy Review		
Task 6	Data Collection	We have identified all our energy sources and uses and accurately collected the related energy consumption data.
Task 7	Data Analysis	We have analyzed our energy consumption data at the system/equipment level.
Task 8	Significant Energy Uses (SEUs)	We have determined our significant energy uses (SEUs) and determined their energy performance, estimated future consumption, and have a plan for reviewing and updating them.
Task 9	Relevant Variables	We have determined the relevant variables that affect energy consumption of each SEU and collected the associated data.
Task 10	Performance Indicators (EnPIs)	We have identified energy performance indicators (EnPIs) and developed a methodology for determining and updating them.
Task 11	Baselines, Objectives and Targets	We have established an energy baseline(s), approved objectives and energy performance improvement targets, and set timeframes for their achievement.
Task 12	Improvement Opportunities	We have identified and prioritized energy performance improvement opportunities and have a process in place to continue to update them.
Task 13	Improvement Projects	After using a documented project selection process, we have developed action plans and implemented energy improvement projects.

Section: Continual Improvement		
Task 14	Monitoring	We have ongoing monitoring and analysis of our energy consumption, SEUs, relevant variables, and action plan progress and effectiveness.
Task 15	Measurement	We have an energy measurement plan, reviewed periodically, which defines, organizes and documents our monitoring and measurement activities, and ensures they are accurate and repeatable.
Task 16	Operational Controls	We have set operations and maintenance criteria for our SEUs, operate them accordingly, and communicate these controls to relevant personnel.
Task 17	Corrective Actions	We investigate and respond to significant deviations in energy performance and potential issues with the 50001 Ready system, taking corrective and preventative actions, as needed.
Task 18	Energy Consideration in Design	We consider energy performance opportunities when designing new, modified, or renovated facilities, equipment, systems and processes.
Section: System Management		
Task 19	Documentation and Records	We have developed and put in place processes to control the 50001 Ready system's documents and records.
Task 20	Communications	All organizational personnel have been informed about our energy policy, made aware of their roles and responsibilities, and solicited for suggestions. We have determined the policy and method (if applicable) for external communications about our energy policy/performance.
Task 21	Training	Training needs for the 50001 Ready system and the SEUs have been identified, and staff and contractors have been trained as needed to ensure they are qualified for their energy management role.
Task 22	Procurement	We have established energy performance criteria spanning the operating life for purchases affecting energy performance, informed suppliers that this is a factor in procurement, and have defined and currently use specifications for energy supply purchases.
Task 23	Internal Audit	We have conducted internal audits of the 50001 Ready system and reported those results and corresponding corrective/preventive action items to top management.
Task 24	Calculate Energy Savings	We have determined our energy performance improvement.
Task 25	Management Review	Top management has established periodic reviews of the ISO 50001 energy management system and our organization's energy performance.

Source: US DOE 2019d.

6.1.3 How to Get Started

A member of the facility energy team will set up an account in the 50001 Ready Navigator to access the step-by-step guidance and track progress. A good first step is to review the full task list to understand the overall scope of the effort, then begin inviting colleagues within the organization to set up Navigator accounts as part of the implementation team. Personnel who may not typically have a day-to-day energy focus, such as those in purchasing, communications, and top management, will need to be involved at various times (US DOE 2019c).

Team members can be assigned to tasks as Approvers—those with the authority to mark a task as Complete—or Contributors, who will work with the Approver to complete a task(s). By default, the project creator is assigned as the Approver for all tasks until he/she designates other team members to fulfill those roles (US DOE 2019c).

The status of each task is visible to all team members and marked as Not Started (the default setting), In Progress, Ready for Review, or Complete. Users who are logged in can use the Navigator to track progress on the completion of each task, and of the project as a whole. Multiple projects can be set up in the Navigator, with each project being a facility as defined in Task 1: Scope and Boundaries. The project creator can also assign tasks to members of the energy team, and use the 50001 Ready Navigator to coordinate and streamline the team's efforts.

The 50001 Ready Navigator can also be used in a "Multi-site" mode, in which the implementation team could cooperatively use the Navigator and share results of the ISO 50001 implementation across many facilities or sites. Multi-site implementation helps to reduce time and effort of 50001 Ready across multiple facilities, tracks 50001 Ready status of all sites, and allows for a "central function" review of tasks.

Interested, prospective users can explore the 50001 Ready Navigator online (no login required) prior to setting up an account.

6.2 Energy Footprint Tool

6.2.1 Overview

The DOE Energy Footprint Tool can help manufacturing, commercial and institutional facilities to track their energy consumption, factors related to energy use (relevant variables like production levels and weather), and significant energy end-use. This is collectively referred to as the facility's energy footprint. The Energy Footprint Tool is designed to be easy to use with significant built-in documentation.

While the tool can be used by anyone interested in tracking their energy footprint, it specifically focuses on implementing energy management plans through 50001 Ready or implementing energy management through SEP 50001. Use of the tool is optional for participation in either program. The US Department of Energy developed this tool, which is built into a single Microsoft Excel file. Detailed labels and pop-up help windows on all sheets allow users to quickly begin using all features. A "Lite" version of the tool, called Energy Footprint Lite, is also available at https://enpilite.lbl.gov/.

6.2.2 Description

The Energy Footprint Tool can actively track up to 20 types of energy consumption (electricity, natural gas, etc.) and 20 related relevant variables (production levels, degree days, operating hours, occupancy rates, etc.) for up to a 10-year period. Customized energy types and related factors can easily be added as needed.

Energy end-use is tracked on an annual basis. Users can create up to 10 major energy end-use groups (process areas, building areas, boiler room, etc.), each of which can include up to 30 individual components (boilers, fans, pumps, lights, etc.).

The Tool contains the following worksheets:

- Main – Overview of footprint tool with key settings
- Energy Consumption – Monthly energy consumption and cost data
- EC Charts – Energy consumption charts
  Note: Worksheet becomes visible after tracked energy sources are added to the Energy Consumption sheet.
- Relevant Variables – Monthly and yearly data for relevant variables
- RV Charts – Relevant variable charts
- EC-RV – Charts comparing selected energy consumption with relevant variables.
  Note: Worksheet becomes visible when the Energy Consumption and Relevant Variables sheets are populated, and relevant variables are selected in the RV Chart sheet.
- Energy Uses – Yearly energy uses tracked by group and specific use
- EU Charts – Charts of energy uses
  Note: Worksheet becomes visible after tracked energy sources are added to the Energy Consumption sheet
- EnPI Table – Exportable data table compatible with the full EnPI analysis Excel (offline) tool—not the EnPI Lite online Tool
- Raw Data – All energy consumption data and relevant variables entered in one large table. This entire sheet can be exported to the EnPI Lite Tool to estimate energy savings.

The Energy Footprint "Lite" version includes the same worksheets, except for Energy Uses, EU Charts, and EnPI Table (US DOE 2017a).

6.2.3 Data Gathering Needs

The following data can be used as inputs to the Energy Footprint Tool:

- Monthly energy bills should provide all of the required data for the Energy Consumption sheet.
- Data for Relevant Variables depends on the facility and may include data that it tracks, such as production or operating hours. Or, the facility might provide certain data that needs to be looked up, such as local facility weather data; heating and cooling degree days.
- Inputs for the Energy Uses sheet, which may or may not be individually tracked, could potentially be estimated based on energy consumption or possibly directly measured.

6.2.4 Outputs

The tool generates a series of charts and graphs based on the entered data. This allows for the comparison of energy types, monthly and yearly trends, and entered energy consumption (in BTUs) versus energy end-use (application of energy). Comparing consumption to tracked end-use can help to determine how accurately the total "bottom-up" end-use compared to the "top-down" metered consumption and how much end-use energy consumption may be unaccounted for. Outputs of the Energy Footprint Tool can be exported, or copied and pasted, into the EnPI Lite Tool to estimate energy savings based on the normalization of energy consumption to the most statistically significant relevant variables.

6.2.5 How to Get Started

The Energy Footprint Tool is built into a single Microsoft Excel file that can be downloaded at: https://www.energy.gov/eere/amo/downloads/energy-footprint-tool. The tool does not need to be installed, but macros must be enabled in Excel for the tool to be fully functional. Using the tool without enabling macros may cause the tool to function incorrectly. The tool is NOT password protected. The macros may be fully reviewed, the worksheets can be unprotected, and anything can be freely modified. Users choosing to modify this tool do so at their own risk.

Guidance on using the Energy Footprint Tool is available in multiple formats:

1. Tool example with data – a Microsoft Excel file of the Footprint Tool populated with sample data is available for download.

2. Reference guide – a PDF designed to be used as both a comprehensive presentation and quick reference for the Energy Footprint Tool. Used as a quick reference, the hypertext document is based around a table of contents, which serves as a main page, and provides links to guidance on each of the key sheets. Each page within the document provides a direct link back to the table of contents. Guidance on the key sheets includes the following:

   a) Layout: Screenshot of the sheets provide details about the layout. Includes visual diagram and description of key features and functions.

   b) Notes: Bulleted list of functions, features, and tips related to the sheet

3. Video tutorial: The Energy Footprint Tool Overview Video, provides a guided walk-through of the tool and its features.

IBM plant in Bromont, Québec, Canada

6.3 Energy Performance Indicator (EnPI) Lite Tool

6.3.1 Overview

The Energy Performance Indicator Tool Lite (EnPI Lite) is an online regression-based calculator for modeling energy performance at the facility level. EnPI Lite has been designed to follow the *50001 Ready Measurement and Verification Protocol*, which follows a top-down approach for determining facility-wide energy performance based on energy consumption and relevant variables. EnPI Lite determines energy performance improvement for one, multiple, or all energy types (source) for the established facility boundaries. EnPI Lite is recommended but not required to meet the 50001 Ready energy reporting requirement (US DOE 2019e).

6.3.2 Inputs

The EnPI Lite can currently analyze data generated through the Energy Footprint Tool (or "Lite" version), or ENERGY STAR Portfolio Manager. To upload data from the Energy Footprint Tool (or "Lite" version), copy and paste the entire Raw Data worksheet into the EnPI Lite. The data from the Energy Footprint Tool must include at least one energy source and one relevant variable for at least two years.

To upload data from the ENERGY STAR Portfolio Manager, a facility will need to download the *50001 Ready Energy Report for Portfolio Manager* directly to its account. Participants will need to run the report for one full year of data, with the starting date being no more than 23 months from the submission date. It is recommended but not required for the data to cover the 12 months leading up to the implementation of the EnMS. ENERGY STAR Energy Performance Indicator reports may also be submitted (US DOE 2019e).

6.3.3 Outputs

The EnPI Lite uses the data to find valid energy consumption models. The results page shows a line graph comparing actual and projected energy consumption over time. The difference between actual and projected consumption represents the relative energy saving. If no valid forecast or backcast model can be found, the tool may offer tips to find a valid model.

The results page also generates tables summarizing energy consumption, energy savings, and percentage of energy savings by source. The tables also list the relevant variables, along with their impact on energy savings. The tool also estimates carbon dioxide (CO_2) emissions savings, which are based on national, regional, and/or user defined CO_2 coefficients. If onsite emission controls are in use, actual emissions could be different.

Users may choose to adjust the baseline year and/or reporting year, if desired, and the tool will automatically update the model. The tool also allows the user to omit energy sources included in the model or to switch between valid models, customize the units, and add the name/location of its facility to display at the top of the page.

The tool generates an EnPI Lite output file, a PDF of the results, which is one option for reporting energy performance for 50001 Ready Recognition.

6.3.4 EnPI Lite Results for 50001 Ready

The 50001 Ready Recognition is available for qualifying EnPI Lite results through the 50001 Ready Navigator. Recognition is requested through the 50001 Ready Navigator upon completion of the Navigator tasks and submission of the qualifying EnPI Lite output file.

The requirements for a qualifying EnPI Lite result include the following:

- Results must be based on a statistically-valid forecast or backcast model
- Most recent data must be no more than 11 months old
- Baseline and reporting years must be consecutive (US DOE 2019f)

6.3.5 Beyond EnPI Lite

For a more advanced view of energy performance, the full EnPI tool is also available in a Microsoft Excel-based format. This version of the tool is recommended for facilities pursuing SEP 50001 program certification and DOE recognition, or for corporate energy managers seeking to roll up individual facility energy data and metrics to determine corporate energy performance. The tool calculates EnPIs specific to the SEP 50001 program (SEnPIs), cumulative improvement, annual improvement, and normalized energy savings for the SEP 50001 certification program. Other optional outputs include cost savings and avoided CO_2 emissions (US DOE 2018b).

7 ISO 50001 CASE STUDIES

7.1 Overview

Case studies offer practical insights into ISO 50001 implementation, present the business case for EnMS, and highlight benefits such as realized energy and cost savings. Real-life examples can be a valuable source of information that informs an organization's strategy for developing an EnMS. This section highlights facilities in Canada, Mexico and the United States that self-attested implementation through 50001 Ready, along with organizations that achieved third-party certification to ISO 50001. Several ISO 50001 case studies also achieved certification to the US DOE Superior Energy Performance (SEP) [4] program, which requires ISO 50001 certification and third party energy performance improvement verification. ISO 50001 delivers value to organizations, whether they implement ISO 50001 internally or pursue third-party verification.

4 Prior to 2019, the SEP 50001 program was titled Superior Energy Performance (SEP).

7.2 ArcelorMittal Cleveland: 50001 Ready Facility

ArcelorMittal USA is one of the largest steel producers in the world and serves many critical economic areas, from automotive manufacturing to construction. The responsible use of energy is a key business tenet for the company—one that is embedded in its sustainability framework. The company has a long track record of energy efficiency and became the first steel company to win Energy Star Partner of the Year (2008) and the Sustained Excellence in Energy Management award (2010–2013). ArcelorMittal's plant in Cleveland, Ohio, completed US DOE's 50001 Ready program over a four-month period, relying on a robust energy team, US DOE software tools, and strong employee engagement. 50001 Ready's self-paced approach with internal staff was highly attractive to the company, rather than initially pursuing a more rigorous third-party certification process (US DOE 2018c).

ArcelorMittal USA supplemented its long history of facility-level energy performance improvements with US DOE software tools. The plant uses the 50001 Ready Navigator tool to gain a broader energy perspective and pursue a more systematic approach in the mold of ISO 50001. The company also revised its procurement procedures to extend energy efficiency requirements to low-cost items as a result of using the tool. ArcelorMittal's team also relied on the US DOE EnPI Tool to conduct energy performance modeling and regression analysis on its energy and production data (US DOE 2018c).

50001 Ready supported ArcelorMittal USA in developing a practice of energy management across all employee levels, which helped raise awareness of its energy management activities both internally and externally. The energy team believes this will help the plant get approvals for implementing more energy-saving capital projects in the future. The Cleveland plant has always been able to identify worthwhile energy-saving projects, though securing capital through competitive internal channels can be challenging. Due in part to the implementation of 50001 Ready, the plant was competitive and secured the resources for four new energy projects in 2018 (US DOE 2018c).

In addition, ArcelorMittal views 50001 Ready as a mechanism to further increase their already strong business value because it enhances the company's appeal to key customers that have adopted ISO 50001 or are expecting excellence in energy management from their key suppliers. Rishabh Bahel, Energy Manager at ArcelorMittal Cleveland explains,

> ***"Many of our automotive customers are ISO 50001-certified and have highly accomplished energy management programs in place; thus getting this designation makes ArcelorMittal Cleveland more competitive in the marketplace."*** [5]

ArcelorMittal plant in Cleveland, Ohio, United States

5 US DOE. 2018c. *ArcelorMittal Cleveland – 50001 Ready Facility*. US Department of Energy, Office of Energy Efficiency and Renewable Energy. ‹https://betterbuildingssolutioncenter.energy.gov/iso-50001/showcase-projects/arcelormittal-cleveland-%E2%80%94-50001-ready-facility›.

7.3 Nissan North America: Three 50001 Ready and SEP-Certified Facilities

Nissan North America achieved US DOE recognition through its 50001 Ready designation and SEP program certification at three of its facilities. 50001 Ready enabled the company to explore a no-cost way to promote energy management practices across its supply chain. The organization committed to a 15% reduction of energy consumption by 2022 in its three US manufacturing facilities after having previously achieving a 25% reduction in five years, affecting over 12 million square feet of plant space. Corporate goals and customer expectations drive the company's strong commitment to energy efficiency (US DOE 2018d).

Nissan's three US manufacturing facilities—two automotive assembly facilities and a powertrain facility—are using 50001 Ready to build on their certification to ISO 50001 and SEP. In 2017, Nissan participated in DOE's enterprise-wide accelerator approach to ISO 50001 and SEP certification, contributing to annual savings of US$9.4 million. Nissan has continued to build upon its certified energy management system by using the 50001 Ready Navigator to train new staff and to engage its supply chain (US DOE 2018d).

The 50001 Ready Navigator proved an effective tool to train new staff on the organization's energy management processes. Over the course of approximately one week, a new hire on Nissan's energy team used and completed the 25 tasks in the 50001 Ready Navigator to familiarize himself with ISO 50001, in general, as well as on Nissan's SEP-certified energy management system. Following his successful use of the Navigator as a tool for self-paced training, Nissan intends to continue to use the Navigator to educate and engage staff—and increase awareness and buy-in (US DOE 2018d).

Participating in 50001 Ready also helped Nissan to understand first-hand the value of the designation and the steps to achieve it, so that the firm can promote the program throughout its supplier facilities, many of which are small and medium-size enterprises. By encouraging the adoption of energy management systems through 50001 Ready, Nissan expects to continue to drive down its corporate carbon footprint via suppliers that establish structured management practices to improve energy performance. This should be especially the case with smaller suppliers that ordinarily might not have the internal resources for ISO 50001 certification to be cost-effective (US DOE 2018d).

Nissan plant in Smryna, Tennessee, United States

7.4 General Motors de México SLP: ISO 50001-Certified Facility

General Motors de México San Luis Potosí (SLP) Manufacturing Complex gained international recognition in 2017 as a winner of the Energy Management Insight Award, which recognizes ISO 50001-certified entities that share their ISO 50001 implementation experiences and benefits in a published case study. By competing in the Clean Energy Ministerial's Energy Management Leadership Awards, the complex helped to build insight into the benefits of ISO 50001 and set an example for organizations worldwide. As a result of its ISO 50001 certification, the manufacturing complex achieved US$6.6 million in cost savings over four years and reduced its CO_2 emissions by 62,542 metric tons. With a payback period of 0.1 years, the investment in ISO 50001 paid off quickly (CEM 2017). Table 3 summarizes the company's ISO 50001 results.

TABLE 3.

Metrics from ISO 50001 implementation at General Motors de México SLP

Metric	Amount
Energy management system	ISO 50001
Energy performance improvement period	4 years
Energy performance improvement (%) over improvement period	7.3% at assembly plant 7.0% at transmission plant
Total energy cost savings over improvement period	US$6.6 million
Cost to implement EnMS	US$0.12 million
Payback period on EnMS implementation (years)	0.1 years
Total energy savings over improvement period	691,457 gigajoules
Total CO_2-e emission reduction over improvement period	62,542 metric tons

Source: CEM 2017.

General Motors' corporate goal of reducing facility energy usage by 20% from 2010 to 2020 motivated the SLP Manufacturing Complex's decision to seek approval from top management to pursue ISO 50001. Once approved, the complex hired an engineer and developed a master plan to initiate the implementation process. The plan called for engagement of key staff at all levels, which was a top contributor of the complex's success. A central coordination team was formed with members of top management and key energy conservation personnel to lead and oversee EnMS development. This group also assembled a multidisciplinary implementation team, which integrated key staff from operations and support areas to reach all areas of the complex and carry out requirements of the EnMS. The teams quickly realized that ISO 50001 shares many common elements with ISO 9001, ISO 14001, and General Motors' Global Manufacturing System, so their implementation strategy leveraged these existing systems to support the new EnMS (CEM 2017).

The SLP manufacturing complex identified its significant energy uses through its annual process for establishing the necessary operational controls to reduce energy consumption and achieve its targets. The complex conducts two energy-saving workshops throughout the year to identify energy conservation initiatives and energy efficiency projects that are integrated into a sufficiency plan. With a monitoring and measuring infrastructure already in place, the team was equipped to track energy indicators on a daily basis. Daily tracking enables the team to control energy use more closely and to take corrective action if increases in energy consumption are detected. The team compiles these results each month to review progress toward the targets (CEM 2017).

General Motors' San Luis Potosí manufacturing complex pursued certification to ISO 50001 to validate the results of its EnMS and to reinforce General Motors' positive corporate image as a socially responsible, environmentally conscious company.

7.5 Ingersoll Rand Manufactura S. de R.L. de C.V.

Ingersoll Rand Manufactura S. de R.L. de C.V. achieved annual energy savings of 8.1% and annual cost savings of US$152,000 by adopting and sustaining an ISO 50001 EnMS. ISO 50001 complements the corporation's climate commitment to reduce the GHG footprint of its operations by 35% by 2020. Ingersoll Rand's location in Monterrey, Nuevo Leon, Mexico, implemented ISO 50001 through its participation in the CEC's North American Energy Management Pilot Program, with assistance from Conuee and EnMS training from the Georgia Institute of Technology. Through this effort, the Monterrey facility became the organization's first location in the Americas to achieve certification to both ISO 50001 and the SEP program.

The Monterrey plant developed a multidisciplinary team supported by top management to develop the EnMS. An internal energy committee at the plant deployed the implementation strategy throughout the facility. Energy audits collected energy data and enabled the facility to identify its SEUs. Using tools provided by the CEC pilot program, the facility identified its three most important energy-using systems, their variables, and simple energy performance indicators to track. A review of historical consumption revealed a stable cyclical trend and enabled them to establish an energy baseline.

Ingersoll Rand found that ISO 50001 supports the organization's operational methodology for effective management to define the problem, measure the impacts, analyze the causes, implement the improvements, and control the solutions. ISO 50001 served to identify and address potential improvements continuously over time—step-by-step, phase-by-phase throughout the cycle. Ingersoll Rand summarizes that successful control of energy in an operational context:

- Deploys a culture of strong energy performance in all manufacturing operations as a component of the operational excellence already existing in the organization.
- Raises awareness to the importance of operational control among persons directly responsible for or involved in SEUs.
- Facilitates intensive communication among staff concerning the EnMS goals, objectives, and benefits—including the importance of their participation in order to achieve these ends.

Staff training on ISO 50001 was also a critical component of Ingersoll Rand's success. As part of the CEC pilot program, Ingersoll Rand joined other participating companies in a series of EnMS training workshops. Training developed the competencies needed to bolster and sustain energy management in their facilities, ensure continual progress, analyze the results of their actions, and correct any actions before they adversely affected the EnMS. The firm continues to enhance this expertise by participating in other Conuee initiatives and learning networks.

TABLE 4.

Metrics from ISO 50001 implementation at Ingersoll Rand Manufactura S. de R.L. de C.V

Metric	Amount
Energy management system	ISO 50001
Energy performance improvement period	4 years (2014–2018)
Energy performance improvement (%) over improvement period	29%
Total energy cost savings over improvement period	US$0.61 million
Cost to implement EnMS	US$0.06 million
Total energy savings over improvement period	1.55 gigajoules
Total CO_2-e emission reduction over improvement period	3,147 metric tons

Source: CEM 2019. *Ingersoll Rand Manufactura S. de R.L. de C.V.: Global Energy Management Implementation Case Study* (not published).

7.6 Hilton: Portfolio-wide ISO 50001 Certification

With 14 brands comprising more than 5,100 properties in 103 countries, Hilton became the first hospitality company to achieve portfolio-wide certification to ISO 50001 in 2014. The company built on its long history of managing energy consumption to implement ISO 50001 and achieve greater savings. Hilton gained international recognition for its accomplishments as a recipient of the Clean Energy Ministerial's Energy Management Insight Award in 2018 (CEM 2018).

Hilton applies comprehensive corporate strategies to manage energy and reduce energy costs. In 2008, the company set a five-year sustainability goal to reduce energy consumption, carbon emissions, and waste by 20% and water consumption by 10%. When ISO 50001 was published in 2011, the company was eager to implement an EnMS to achieve its energy reduction target. Hilton implemented ISO 50001 across its global portfolio, realizing significant energy and cost savings (Table 5). In addition, six hotels in the United States also achieved SEP program certification to drive further energy performance improvements with external verification (CEM 2018).

TABLE 5.

Metrics from ISO 50001 implementation across Hilton's global portfolio

Metric	Amount
Energy management system	ISO 50001
Energy performance improvement period	8 years
Energy performance improvement (%) over improvement period	18.60%
Total energy cost savings over improvement period	US$783.7 million
Cost to implement EnMS	US$0.12 million
Payback period on EnMS implementation (years)	Less than 1 year
Total energy savings over improvement period	5,752,611 gigajoules
Total CO_2-e emission reduction over improvement period	769,356 metric tons

Source: CEM 2018.

As it is a large company, collaboration across many business units was key, and Hilton benefitted from having centralized all of its functions at the corporate headquarters, where different team members could work together to provide oversight of the certification process. Hilton assembled a six-person central team from key stakeholders across many departments of the business, including property operations, engineering, guest satisfaction, quality, legal, and supply chain. Maxime Verstraete, Hilton's Vice President of Corporate Responsibility, characterizes Hilton's team approach:

> ***"ISO 50001 provides a clear framework that encourages our team members to identify opportunities for improvements and efficiency projects. This process helps them see how important their individual roles are to reaching our goals."*** [6]

Hilton relied heavily on its proprietary, corporate sustainability measurement system, which enables every hotel to track and analyze more than 200 sustainability-related metrics, including energy. This central system enables Hilton to maintain operational control and sustain energy performance over time across its large global portfolio. Hotels are required to enter energy and other sustainability-related data into the system on a monthly basis. Leadership at the corporate and individual property levels use this system to track property-level energy performance indicators, efficiency projects, action plans, and measurement initiatives. To avoid any potential data inaccuracies, an independent third party conducts annual assurance processes on the data. The system is also configured to identify inaccurate entries, based on historical performance and other factors. Together, these processes provide validation of the system's energy data as a foundation for the company's analysis (CEM 2018).

The corporate tracking system also contains interactive features that connect the properties with the corporate offices. The system delivers training modules and collects a library of energy improvement projects that properties can reference as best practice examples. The system also scores properties on their performance, which helps to foster friendly competition among peer hotels and incentivize them to continually improve performance (CEM 2018).

6 CEM. 2018. *Hilton: Global Energy Management Implementation Case Study.* Clean Energy Ministerial, Energy Management Working Group. Available online: ‹http://www.cleanenergyministerial.org/publications-clean-energy-ministerial/hilton-global-energy-management-implementation-case-study›.

7.7 The 3M Company: Enterprise-wide ISO 50001 and SEP Certification

As of end of 2018, 30 of the 3M Company's locations are certified to ISO 50001 or working toward certification. The 3M Company's first success with ISO 50001 began in 2012 with certification of two plants in Canada and the United States (3M 2018a, US DOE 2017b). The Brockville, Ontario, tape plant improved its energy performance by more than 15 percent over three years and became the first Canadian facility to achieve ISO 50001 and Platinum-level SEP certification. These efforts gained recognition from Natural Resources Canada's Canadian Industry Program for Energy Conservation in 2016 (3M 2018b, 31). The Cordova, Illinois, facility achieved Silver-level SEP certification, with an energy performance improvement exceeding 6% over three years. These accomplishments provided a foundation for 3M to replicate ISO 50001 across the organization and achieve enterprise-wide certification in 2016 (US DOE 2017b).

7.7.1 Central Function, Enterprise-wide Approach

> ***"Through the enterprise-wide approach, 3M improved its competency to manage energy at the plant level and helped better engage corporate management in plant-level energy improvements." (Steve Schultz, 3M Corporate Energy Manager[7])***

The initial successes at the Brockville and Cordova facilities motivated 3M to expand ISO 50001 to other facilities and to pursue ISO 50001 certification at the enterprise level. This approach saved the company US$3.6 million in energy costs, with 69 percent of these cost savings resulting from operational changes with little capital expenditure. The enterprise approach also reduced 3M's implementation timeline by six months, and generated savings of US$23,000 and more than one full-time staff equivalent per site (Liu, et al. 2017). Table 6 summarizes enterprise-wide savings at 3M.

7 US DOE. 2017b. *Case Study: 3M Leverages SEP Enterprise-wide Approach*. Washington, DC: United States Department of Energy, Advanced Manufacturing Office. Available online: ‹https://www.energy.gov/sites/prod/files/2017/05/f34/3M_EWA_Case_Study_5-12-17.pdf›.

TABLE 6.

Summary of enterprise-wide savings at 3M

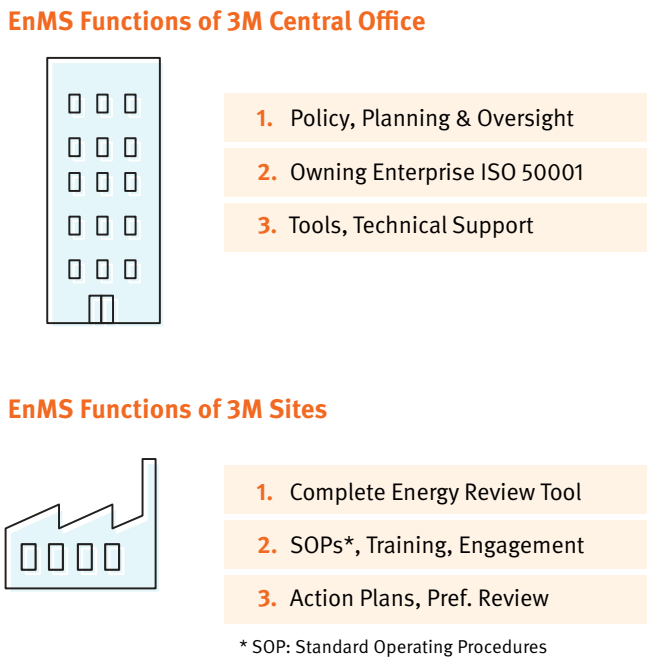
Savings	Description
Energy and cost savings	636 Btu in energy consumption and US$3.6 million in energy costs
Implementation cost reduction	Reduced US$23,600 in implementation costs and more than 1 full-time equivalent in labor per site; condensed the implementation timeline by six months

Source: US DOE 2017b.

Enterprise-level implementation consisted of a "central function" that took responsibility for setting up a shared EnMS across multiple sites. The central function reported to a corporate-level leadership committee consisting of the Chief Sustainability Officer, the Vice President of Engineering, and the company's manufacturing directors. The central function staff, consisting of existing staff with EnMS expertise, guided and streamlined activities in order to reduce the level of effort at each site and to keep the sites on schedule. ISO 50001 implementation and maintenance responsibilities were divided between the central function staff and those at the individual sites in order to ensure that sites met their performance goals (Figure 3). Management review meetings, held twice a year at the site level and annually at the corporate level, ensured that the sites, central function, and corporate levels remained engaged and committed to their energy goals (US DOE 2017b).

FIGURE 3.

EnMS functions of 3M central function and 3M sites



Source: US DOE 2017b.

The central function staff developed the tools, trainings, and technical assistance that the sites would need for ISO 50001 implementation. Tools included multiple systems for tracking energy consumption and cost, energy projects, and corrective/preventative actions as well as a proprietary corporate review and planning tool to streamline and guide ISO 50001 implementation at the sites. This tool provided step-by-step guidance for energy review and planning, and enabled the sites to store energy performance data for use in corporate management reviews. One person from each site was required to be certified to manage and use the tool. The central function also developed a *Corporate Energy Manual* that described how 3M addresses ISO 50001 requirements. The manual describes corporate- and site-level standard operating procedures that address different components of the ISO 50001 EnMS. The sites had flexibility to tailor these procedures to their own circumstances (Liu, et al. 2017).

7.7.2 Cost Reduction

The enterprise-wide approach enabled 3M to save US$23,600 and the equivalent of more than one full-time staff position at each site (US DOE 2017b). These savings are due to streamlining the training process and to reduced third-party audit and certification costs. The training approach leveraged both in-house and external expertise to help the sites implement ISO 50001. The company hired an external consultant and held training sessions at a common location with staff from each site. This collective training approach saved US$4,000 per site compared to the cost for the consultant to train each site individually. The in-person training also provided staff from the multiple sites to collaborate on issues, share best practices, and leverage resources across the sites (Liu, et al. 2017).

The cost and duration of third-party audits were reduced by use of universal templates and audit sampling. The audit time was shortened because the facilities shared a common EnMS, documentation, and tools. In addition, the third-party auditors used "sampling" as defined in ISO 50003 to verify the EnMS at a subset of the multiple sites. 3M also negotiated a lower fee for its audits from economies of scale (US DOE 2017b).

7.7.3 Lessons Learned

3M Canada's National Energy Manager, Andrew Hejnar, summarizes the company's approach in four high-level steps that other companies can follow:

4. Build the energy measurement plan and support training.
5. Communicate the plan to employees and deliver training.
6. Set up projects that improve energy performance and engage employees in these activities.
7. Measure results from each activity, and make any necessary tweaks to help achieve goals (3M 2018a).

Additionally, Hejnar identified tips that any organization can use for successful ISO 50001 implementation:

- **Build on existing foundations:** 3M took advantage of its long history of energy management processes and integrated those into its ISO 50001 EnMS. Incorporating legacy systems into the EnMS helps to retain corporate knowledge and enable a smooth transition to new ISO 50001 goals.
- **Integrate energy management into organizational culture**: Employee engagement at all levels is critical for driving and maintaining energy efficiency practices that contribute to ISO 50001 certification. Energy efficiency practices was integrated into employees' day-to-day activities in order to embed them into routines. 3M also communicated the impact of these practices, which helped to encourage employees to sustain their efforts.
- **Measure, improve, repeat**: Training and monitoring enabled the team to obtain results that measured how well the system was working, provided insight on progress, and helped staff identify areas needing improvement. Regular feedback facilitates the ability to make changes, measure, and adjust in order to meet performance goals (3M 2018a).

These tips and 3M's results highlight the importance of a balanced approach to continual improvement. ISO 50001 leverages an organization's existing systems and expertise to develop an energy management system structure that can be sustained over time. Central function guidance, common tools and training, and regular engagement between the sites and management levels were among 3M's keys to success.

APPENDIX A:
LIST OF KEY RESOURCES

TABLE 7.

Links to key ISO 50001 resources referenced to in this document

Resource	Website Address
Software Tools	
50001 Ready Navigator	https://navigator.lbl.gov/
Energy Footprint Tool	https://www.energy.gov/eere/amo/downloads/energy-footprint-tool
Energy Footprint Tool Guidelines	https://www.energy.gov/sites/prod/files/2017/11/f39/EnergyFootprintGuide.pdf
Energy Performance Indicator Tool Lite (EnPI Lite)	https://enpilite.lbl.gov/
US DOE Tools, Expertise, & Training	https://betterbuildingssolutioncenter.energy.gov/iso-50001/tools-expertise-training
ENERGY STAR Portfolio Manager	https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager
ENERGY STAR Energy Performance Indicator	https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/measure-track-and-benchmark/energy-star-energy
Qualified Instructors	
50001 Certified Practitioner in EnMS; 50001 EnMS Qualified Instructors	https://ienmp.org/certifications/find-a-professional/
Online Training Courses	
Understanding ISO 50001	https://pe.gatech.edu/courses/introduction-iso-50001
50001 CP EnMS Online Training	https://pe.gatech.edu/courses/50001-cp-enms-online-training

Recognition Programs and National Energy Agencies	
50001 Ready Program	https://www.energy.gov/eere/amo/50001-ready-program
Superior Energy Program 50001	http://www.energy.gov/SEP50001
Canadian Industry Partnership for Energy Conservation	https://www.nrcan.gc.ca/energy/efficiency/industry/cipec/20341
Programa Nacional para Sistemas de Gestión de la Energía	https://www.gob.mx/conuee/acciones-y-programas/programa-nacional-para-sistemas-de-gestion-de-la-energia-2018
Case Studies	
General Motors de México SLP	https://www.cleanenergyministerial.org/sites/default/files/2018-12/GM_Mexico.pdf
Hilton	http://www.cleanenergyministerial.org/publications-clean-energy-ministerial/hilton-global-energy-management-implementation-case-study
Nissan North America	https://betterbuildingssolutioncenter.energy.gov/iso-50001/showcase-projects/nissan-north-america-%E2%80%94-three-50001-ready-facilities
ArcelorMittal USA	https://betterbuildingssolutioncenter.energy.gov/iso-50001/showcase-projects/arcelormittal-cleveland-%E2%80%94-50001-ready-facility
3M	https://www.energy.gov/sites/prod/files/2017/05/f34/3M_EWA_Case_Study_5-12-17.pdf

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Commission for Environmental Cooperation

The CEC was established by the governments of Canada, Mexico, and the United States through the North American Agreement on Environmental Cooperation, the environmental side agreement to NAFTA. An intergovernmental organization, the CEC brings together citizens and experts from governments, nongovernmental organizations, academia and the business sector to seek solutions to protect North America's shared environment while supporting sustainable economic development. Find out more at: www.cec.org.

CEC initiatives are undertaken with the financial support of the Government of Canada through Environment and Climate Change Canada, the Government of the United States of Mexico through the *Secretaría de Medio Ambiente y Recursos Naturales* and the Government of the United States of America through the Environmental Protection Agency.

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