

# ISO 50001:2011 Energy Management System at Auto-ancillary Industry: A Survey

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**Abstract**— An auto-ancillary industry set up a dedicated Energy Management Department to focus on implementing an energy management system to improve energy performance year on year. This paper presents a case of an auto-ancillary industry which implemented ISO 50001:2011 Energy Management System (EnMs) based on the Plan-Do-Check-Act (PDCA) approach which is a continual improvement framework and incorporates energy management into everyday organizational practices. The ISO 50001:2011 enables organizations to achieve a sustainable energy reduction by systematic energy controlling, documentation and raising the awareness of all personnel involved. From the analysis of an Energy management team, auto-ancillary industry achieved an energy saving up to 7% and CO<sub>2</sub> emission reduction up to 32% over past few years since implementing an EnMS which is appreciable.

**Key words:** ISO 50001:2011, Energy Management System, PDCA

## I. INTRODUCTION

The purpose of this International Standard is to enable organizations to establish the systems and processes necessary to improve energy performance, including energy efficiency, use and consumption. Implementation of this International Standard is intended to lead to reductions in greenhouse gas emissions and other related environmental impacts and energy cost through systematic management of energy. This International Standard is applicable to all types and sizes of organizations, irrespective of geographical, cultural or social conditions. Successful implementation depends on commitment from all levels and functions of the organization, and especially from top management [1,6,15].

This International Standard is based on the Plan - Do - Check - Act (PDCA) continual improvement framework and incorporates energy management into everyday organizational practices, as illustrated in Fig. 1.

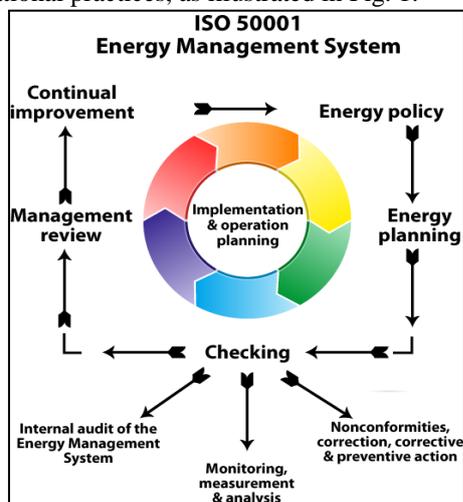


Fig. 1: ISO50001 EnMS Model [15].

In the context of energy management, the PDCA approach can be outlined as follows:

- Plan: conduct the energy review and establish the baseline, energy performance indicators (EnPIs), objectives, targets and action plans necessary to deliver results that will improve energy performance in accordance with the organization's energy policy;
- Do: implement the energy management action plans;
- Check: monitor and measure processes and the key characteristics of operations that determine energy performance against the energy policy and objectives, and report the results;
- Act: take actions to continually improve energy performance and the EnMS [5,6,15,16].

Worldwide application of this International Standard contributes to more efficient use of available energy sources, to enhanced competitiveness and to reducing greenhouse gas emissions and other related environmental impacts. This International Standard is applicable irrespective of the types of energy used. This International Standard can be used for certification, registration and self-declaration of an organization's EnMS. This International Standard is based on the common elements of ISO management system standards, ensuring a high level of compatibility notably with ISO 9001 and ISO 14001[3,16].

## II. LITERATURE REVIEW

### A. Energy Management System

An energy management system is a series of processes that enables people of varied responsibilities across an organization to use data and information to maintain and improve energy performance, while improving operational efficiencies, decreasing energy intensity, and reducing environmental impacts [3,12].

To uphold the need of this study, the gap in the previous studies were identified through the review of literature which is divided into the following categories. The research problem is multi-angled and required study on the following themes.

- 1) Energy and its environmental, social and economic benefits
- 2) Need for Energy Management
- 3) Energy conservation opportunities in industrial utilities
- 4) Energy Efficient Technologies
- 5) Performance Assessment of utility systems and equipment
- 6) Utility costing
- 7) Barriers to Energy Efficiency in industries.
- 8) Energy Management awareness training.

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 [6,15].

The implementation of this International Standard intend to reduce in greenhouse gas emissions and other related environmental impacts and energy cost through systematic management of energy [5].

The EnMS implementation model also applies Plan-Do- Check-Act (PDCA) cycle as shown in Fig.2 which consists of five clauses i.e. Energy Policy, Planning, Implementation, Monitoring and Corrective Action and Top Management Review [2,13,15].



Fig. 2: PDCA Cycle [15].

The standard addresses the following:

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

ISO50001 is a standard that increases energy efficiency and improves energy performance [1]. The design of ISO50001 that is based on PDCA Cycle is a proven method of other most successful management system in organizations' i.e. ISO9001 for Quality Management System and ISO14001 Environmental Management System [3, 4].

### III. SYSTEM DESCRIPTION

An ISO50001 energy management system (EnMS) would enable organization to achieve its policy commitments, take action as needed to improve its energy performance and demonstrate the conformity of the system to the requirements of the International Standard [1,4]. It is also an instrument to quantify the energy use and consumption, and to plan energy efficient practices by fine-tuning the operational controls and organizational behavior. Optimal energy performance should be achieved using existing resources, with minimum or low cost investment [13,15].

Adoption of ISO 50001 provides proof that a facility has implemented sustainable energy management systems, completed a baseline of its energy use, and committed to continual improvement in energy performance. The value of certification will be driven by market forces within supply chains, potential utility incentive programs requiring ISO 50001, and the standard's relation to future carbon mitigation policies. ISO 50001 applies to industrial plants; commercial,

institutional, or governmental facilities; and entire organizations [12,13,14,15].

#### A. Procedure for adopting ISO50001 EnMS

- 1) Purchase ISO50001 Energy management System.
- 2) Take preparatory steps toward establishing an energy management system (EnMS):
  - Develop an energy policy that includes commitment to the EnMS from top management.
  - Identify a management representative to lead implementation of the EnMS
  - Establish a team of representatives from major functional areas of the organization
  - Decide on the boundaries of the EnMS
- 3) Once prepared, get started with implementing an EnMS:
  - Undertake an energy review to identify significant energy uses, their energy consumption and opportunities for improvement
  - Establish an energy baseline
  - Identify energy performance indicators for tracking energy performance improvement against the baseline
- 4) For additional guidance, other organizations offer technical resources to assist with implementation with energy management.
- 5) Consider Superior Energy Performance (SEP) certification early on in the process of implementing an EnMS. SEP provides guidance, tools, and protocols to drive deeper, more sustained savings from ISO 50001.

The ANSI-ASQ National Accreditation Board (ANAB) assesses and accredits certification bodies that are competent to certify organizations conforming to ISO 50001. ANAB-accredited ISO 50001 Certification Bodies employ certified ISO 50001 Auditors to assess an organization's or facility's conformance to ISO 50001[1,2,5,6,15].

### IV. METHODOLOGY

#### A. Energy Efficient Technologies in industrial utilities

Numerous studies conducted in the field of industrial energy efficiency shows that there are tremendous saving potential that can be achieved through the effective implementation of energy management in industries. A study revealed that industrial energy management has the potential of saving about 40% of energy use in an industrial facility.

Based on available technologies relating to, in order of impact, compressed air management, variable speed drives, efficient motors, efficient lighting, load shifting, heating, ventilation, cooling and other thermal measures, they estimate annual energy savings of 5% and a 7% reduction in total projected national emissions by 2020 [9,10,11,14].

##### 1) Energy Auditing with external professional agencies

Energy auditing is nothing but it is the systematic inspection of existing energy systems to reduce overall energy inputs to the systems. An energy audit is a thorough accounting of the energy use of industries. Energy Audits are a powerful way to improve the energy efficiency of a industrial plant. The energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programs [15].

## 2) Energy Efficient Electrical Motors

Electric motor systems account for about 60% of global industrial electricity consumption. Electric motors drive both core industrial processes, like presses or rolls, and auxiliary systems, like compressed air generation, ventilation or water pumping [10].

## 3) Replacing Pneumatic operated tools with electric operated tools

With a typical system efficiency of 10–15 %, compressed air systems are among the least efficient industrial motor systems. Efficiency improvements are practically available everywhere in the system. Hence, replacing compressed air-driven tools by motor-driven ones can improve energy efficiency considerably [10,11].

## 4) Compressed Air leak detection

A very small air leakage in compressed air systems can cause several thousand dollars of additional annual costs. Leak detection and prevention programmes can avoid these unnecessary expenses and increase energy efficiency [11].

## 5) Variable Frequency Drive for electrical motors

Major option to considerably improve motor system efficiency is the application of frequency converters to adjust motor speed in accordance with the use-energy needed. These variable speed drives have the highest saving potentials in flow systems, like pumping or ventilation systems with high output variations [10].

## B. Empirical Barriers to Industrial Energy Efficiency

One of the major objectives of the present study is to identify the potential barriers in adopting energy efficient technologies in selected industries. This will help energy managers and policy makers to take corrective action against respective barriers to overcome these barriers and implement most energy efficient technologies in industries to reduce energy consumption. As shown in literature, the nature of these barriers varies widely among technologies and technology adopters [9].

### 1) Lack of awareness about Energy Conservation among the employees and top management

The lack of awareness of energy efficiency by top management of companies is an important barrier because without management commitment it is an uphill battle to improve energy efficiency. This appears to be the root cause of other barriers, such as the priority for production, lack of investment capital, and limited policies, systems and reporting processes to manage energy consumption, and hierarchical management structures [9].

### 2) Limited access to and availability of technical information

A second barrier is about knowledge and information. It covers limited information and (technical) knowledge at company level and facilitating organizations, but also a limited access to and availability of knowledge and information. Company information on energy and resources is crucial because only then the improvements after implementation of options can be measured, and management is more likely to continue with resource and energy efficiency if quantitative data on savings are available.

### 3) Difficulty in obtaining financing for Energy Efficiency Projects

Almost all companies mentioned the financial limitations of implementing energy efficiency options. The most common barrier mentioned was the lack of money to invest in options. Options with a payback period of more than two or three years were rarely implemented. Some options provide huge savings and a short payback period of often less than one year, but the option requires a high investment and the company simply does not have the money at hand.

### 4) Lack of Energy management Policies

While companies hold the key to reducing their energy consumption, government policy certainly has a big influence. Limited policies, poor enforcement and conflicting economic and environmental policies were identified as the fourth group of barriers [9].

## C. Training Programs on Energy Management

Employees in the manufacturing plants generally know more about their equipment than anyone else in the facility because they operate it. They know how to run them more efficiently. But there is no mechanism in place for them to have an input, their ideas go unsolicited.

Education and awareness are key components of any energy management program as raising the education/awareness level of the employees can have big dividends. Energy management programme will operate more effectively and efficiently if the employees in the organization understand the complexity of energy, particularly the potential for economic benefits. With the awareness about the latest technologies, the quantity and quality of employee suggestions on energy conservation will improve.

If the organization wants to save energy, it is important that everyone in the organization become aware of the energy consumption that they are responsible. Simple changes in people's behavior can quickly lead to significant energy savings but such changes will only happen if the people are aware of the energy consumption that they have the power to control. Therefore, one of the important job of any of the organization to provide some knowledge to the employees using energy. This can be better done through energy management training programs [12,13,14,15].

## V. CONCLUSION

This ISO50001 International Standard is based on the Plan-Do-Check-Act continual improvement framework and incorporates energy management in organization practices. Adoption of ISO 50001 by an organization reduces energy bills, makes manufacturing more sustainable, promotes energy efficiency throughout the supply chain, helps in meeting National greenhouse gas reduction targets. It is estimated that the standard could influence up to 60 % of the world's energy use. ISO50001 EnMS does not establish absolute requirements for energy performance beyond the commitments in the energy policy of the organization and its obligation to comply with relevant legislation.

#### ACKNOWLEDGEMENT

I would like to express my deepest sense of gratitude to Prof. S.S. Khairnar, Prof. S.M. Akolkar, Mr. A. N. Auradkar and Mr. D. M. Pimpalkar who offered their continuous advice and encouragement throughout the work. I thank them for the systematic guidance and great effort they put into training me in the scientific field.

I am thankful to Prof. A. M. Jain and Prof. (Dr.) B. E. Kushare Head of Electrical Engineering Department, Dr. K. N. Nandurkar Principal, K.K.W.I.E.E.& R., Nashik for the support and encouragement whenever I was in need.

I am thankful to all faculty members of K.K.W.I.E.E.& R., Nashik and my colleagues for their valuable time, support and encouragement.

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