

# REVIEW AND ESTABLISHING FRAMEWORK MODEL TO AN ADOPTION OF ISO 50001 ENERGY MANAGEMENT SYSTEM IN POWER STATIONS

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**ABSTRACT:** The energy sources around the world become scarce with increased prices. Governments and companies seek to develop technologies for energy management including ISO 50001. Nowadays, the reduction in the electricity consumption and the increase in energy efficiency have become very important. To achieve these criteria, the organizations tend to adopt ISO 50001 in every operational and organizational structure. ISO 50001 assists large and small organizations to achieve the highest of the efficiency of the energy produced and an increase in the stability of organizations in private or public sectors. The ISO 50001 is able to establish and create the framework model for any organization to improve the full energy management. This paper aimed to identify the most important variables in ISO 50001 that affected energy management in any power station to increase the performance and efficiency of Power Stations. This paper presented a systematic review of the literature that has relation with an adoption of ISO 50001 in power stations. This paper proposed a new conceptual framework for ISO 50001 adoption and presented the ISO 50001 as a system for energy management in order to increase the efficiency of the energy of organization in various fields. The conceptual framework is able to analyze the relationship between energy performance and ISO 50001 adoption and analyze a set of factors that affect the efficiency of energy in power stations like Sustainability of Economic, Improvement the Quality, Performance of Environmental, Reduce of the costs and reduction of energy. The framework creates the check and balance for each factor to support the power stations in creating sustainable energy.

**KEYWORDS:** *ISO 50001, Integrated Framework, Quality, Power Stations, SPSS.*

## **1.0 INTRODUCTION**

ISO50001:2011 is developed by (ISO) Organization. The standard indicates the prerequisites for building up, keeping up and enhancing an energy administration framework, whose object is to empower an association to take after an orderly approach to accomplish a persistent change of energy execution, including energy proficiency, energy security, and utilization of energy. ISO 50001 provides a full support to small or large companies to create energy with high efficiency. ISO 50001 adoption helps organizations to decrease the consumption of energy.

ISO 50001 suggests a set of technical and management steps to the organizations to improve energy use and reduce the costs, many researchers confirm that the ISO 50001 can affect the 60% of the world energy demand positively. Hence, the adoption of ISO 50001 can stabilize the production of electrical energy globally [1].

The aims of standard ISO 50001 are to establish a framework in any organizations, integrate the performance of energy management and improve the energy efficiency of organizations [2].

Developers of ISO 50001 combine between ISO 9001, the quality system specialization, and ISO 14001, the environmental specialization, to produces standard ISO 50001. The ISO 50001 depends on the Plan, Do, Check and Act (PDCA)

The Plan- Plan, Do, Check and Act (PDCA) apply to all types of ISOs for the management of the system including ISO 50001. This cycle assists the organizations on the effective management and assists on continuous improvement for any type of organizations [3]. ISO 50001 has seven main elements:

- i. The General Requirements
- ii. Responsibility By the Management
- iii. Policy of Energy
- iv. Action Plan for Energy
- v. Audits of the Performance
- vi. Review of Management

## 2.0 COMPARISON BETWEEN ISO 50001 AND OTHER STANDARDS

ISO 50001 is a very important standard compared with the ISO 9001 and ISO 14001 because the ISO 50001 was modeled in 2011 by integrating the ISO 9001 with the ISO 14001 to establish a uniform standard for the management of energy [4]. An overview of the ISO 50001 and other standards is illustrated in Table 1.

Table1: Comparison between ISO 50001 and other standards

Content	ISO 50001	ISO14001	ISO 9001
<b>Core concept for establishing guidelines</b>	For compliance with ISO 50001 system must cover all your organization.	Based on relevant environmental aspects	Based on clients' quality requirements
<b>Policy</b>	The policy provides the framework for setting up associated objectives and targets to enhance energy performance	Environmental policy illustrates how the organization handles environmental matters, commitment to environmental protection.	Meet the clients' requirements
<b>Strategy</b>	Conducting energy reviews to identify significant energy use activities and set up energy baseline as well as energy performance indicators.	Compliance with relevant environmental regulatory requirements. Setting up environmental objectives, targets, and implementation plans.	Setting up quality objectives and quality management plans.
<b>Baseline</b>	Energy baseline is foundation to establish the system	No such requirement	No such requirement

### **3.0 THE PRINCIPLE OF THE ENERGY MANAGEMENT**

An energy management system can be defined as the set of sequences or practices to increase the efficiency of energy by the systematic analysis and perfect planning. One of the principles of Energy management systems (EnMS) is an unending quest for reduction of energy prices through implementing ISO 50001 and getting to lowest cost to energy supply and developing appropriate environmental policies of the organization. [5].

Another principle of the energy management system is continue to develop policies and adhering to the energy policy due to the policies of energy for any organization can assist in improving the energy management in all aspects of this organization. The standard ISO 50001 presents a full guide to Energy management systems and acts as a basis to EnMS to integrate with other international standards.

There are many barriers facing the energy improvement efforts within organizations. These barriers include:

- i. Cost related matters to the energy management system adoption with constraints capital and the culture of the companies.
- ii. Indigence in the information of energy efficiency.
- iii. Lack of awareness on financial benefits resulting from the use of energy management systems.

The perspectives of the barriers facing the energy efficiency and their ability to prevent the development of energy management systems differ from study to another, the following figure illustrates some perspectives concerning energy barriers [6].

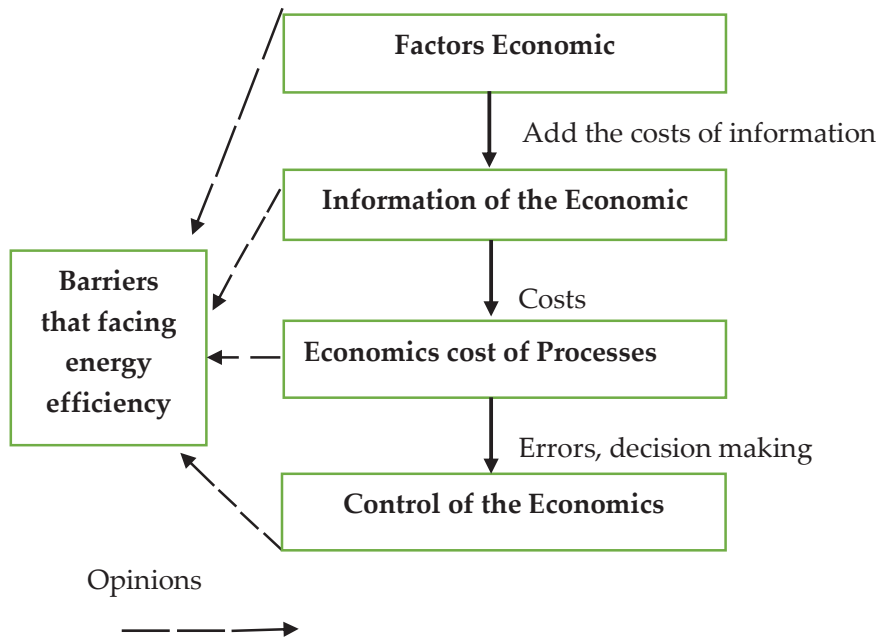


Figure 1. Opinions regarding barriers of energy [6].

#### 4.0 PROGRAMS OF GOVERNMENTS IN THE ENERGY MANAGEMENT

Most governments gear toward the compliance with the energy management systems through an implementation of ISO 50001 in organizations. The governments consider the compliance with the energy management program is a successful way to reduce energy consumption as well as reduce the cost of energy production.

The programs that are implemented by the governments are better than the ones implemented by companies and are also most effective. Providing the power according to the energy management system by the governments support the companies that have collaborated with the government sectors. [7]. Figure 2 shows the countries that implement the energy management system by adopting the ISO 50001. In addition, the figure also shows the countries that have ISO 50001 Certification. The number of the countries that has been integrated with the energy management system are 7560 countries until February 2015. The countries that have obtained the ISO certificate number increased in recent years as shown in Figure 3 [8].

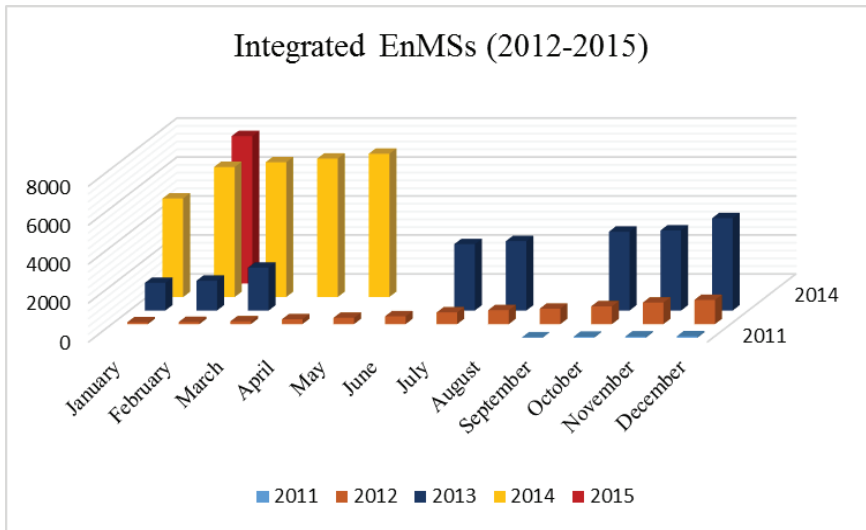


Figure 2. The countries that have integrated EnMSs [8].

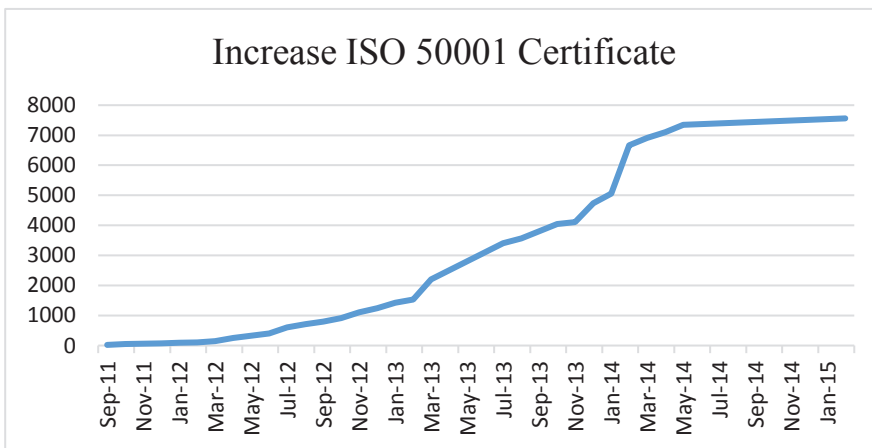


Figure 3. Certificate ISO 50001 [8].

## **5.0 A SYSTEMATIC REVIEW**

This paper presents a review on successful adoption of ISO 50001 in power stations. A systematic review methodology was used and the results were presented below.

- ❑ The scholars study the challenges that face the power industry in the electricity markets and they affirm the importance of energy management in all sectors that lead to the creation of renewable energy sources. These studies confirm the possibility of a full integration between planning for energy production and management of this energy by ISO 50001 adoption [9].
- ❑ Murray, Walsh and O’Sullivan, studied ISO 50001 in the sector of power production namely the Water and also Water treatment. The findings of this study prove the ISO 50001 adoption in the sector of Water power lead to creating a balanced state between an increase of planning in the future and demands [10].
- ❑ The establishment of an integration-energy-practice model for improving energy performance indicators in ISO 50001 energy management systems has been evaluated by Tsai and Chiu in 2012 , and they investigate the processes that have merged with the ISO 50001 standard by improving practice energy and completion of the procedures for obtaining the international ISO 50001 certificate. This study confirms the possibility of calculating the rates of an annual performance of the energy that has increased, improvement and increment of energy efficiency [11].
- ❑ The objectives programs of the production efficiency of power had been clarified by Richard Hart and others in 2013 by the adoption the ISO 50001 and established a system energy this system seeking to save energy and improving the knowledge of the customer .This system is the type of the energy management that had been used and help to identify the level of the knowledge of the customer about ISO 50001 can influence the planning and production for the energy [12].
- ❑ There are a lot of scholars including Quispe, Castrillón and González who study whether statistical and oversight device, the indicators of the energy efficiency has the agreement with the Standard ISO 50001 requirements. Using this technology in the industrial processes can measure the efficiency of energy.

The SGIE technology has been used in the sectors of diverse industrial since 2007. This study has been used in the industry of cement line. The findings yield that the SGIE system increases the efficiency power. The results show 4.6% reduction in the energy of electricity consumption in this plant [13].

- In 2012, Paul studied and analyzed the management of energy in accordance to ISO 50001. The author uses a novel process as a model. These operations include the management of all energy policies, system design, adoption and audit. For these policies, big and small companies tend to adopt the ISO 50001 to improve the quality factors and increase the practice of sustainable energy and reduce the waste of energy as well [14].

### **5.1 Summary of previous studies**

In summary, energy management has been studied at length by various studies for diverse sectors. The previous studies show great importance of ISO 50001 adoption for energy management in the industrial sectors. Adoption of the ISO 50001 standard in organizations leads to the reduction of costs for energy and increment of energy efficiency as well. According to previous studies, the expected rate of an increase in energy efficiency can go up to 50% [15].

Many studies have been conducted in the energy management systems in relation to the ISO 50001, and they have proven the ISO 50001 is able to increase the energy efficiency and reduce the cost. However, literature on this system in the field of the power stations and power production is scarce.

## **6.0 CONCEPTUAL FRAMEWORK MODEL TO ADOPTION ISO 50001 IN POWER STATIONS**

This paper proposed a framework to understand the most important factors in the sectors of power stations. The conceptual framework has been developed in this paper according to the factors that affect an adoption of ISO 50001. The framework has been built according to a set of concepts that relate to energy efficiency in terms of physical, descriptive and qualitative model without any calculations [16].



The framework creates a correlation between different variables that have relation with the ISO 50001 in any power stations

This framework consisted of a set of variables (dependent and independent) toward implementing ISO 50001 in the power station. The five independent variables are as follows:

- i. Reduction Costs
- ii. Improvement Quality
- iii. Performance Environmental
- iv. Sustainability Economic
- v. Reduction Energy

This model has five hypotheses and one variable (a dependent variable) in the ISO 50001 adoption as shown in figure 4.

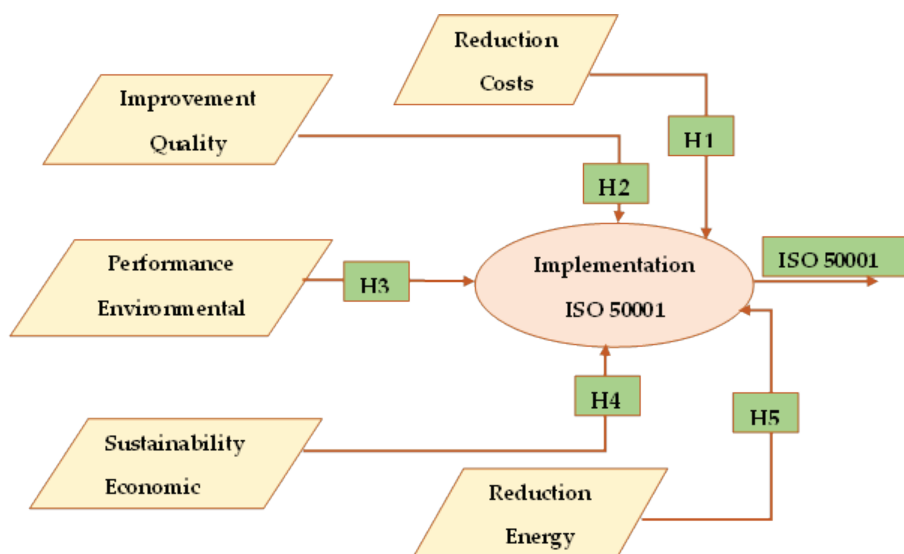


Figure 4: Conceptual Framework Model to adoption ISO 50001 in power stations

## 6.1 Research Hypothesis

1. **Hypothesis 1 (Reduction Costs):** The relation between reduction of costs and implementation ISO 50001 in the power plants is positively related toward implementing ISO 50001.
2. **Hypothesis 2 (Improvement Quality):** The relation between improvement Quality and implementation ISO 50001 in the power plants is positively related toward implementing ISO 50001.
3. **Hypothesis 3 (Performance Environmental):** The relation between Performance Environmental and implementation ISO 50001 in the power plants is positively related toward implementing ISO 50001.
4. **Hypothesis 4 (Sustainability Economic):** The relation between Sustainability Economic and implementation ISO 50001 in the power plants is positively related toward implementing ISO 50001.
5. **Hypothesis 5 (Reduction Energy):** The relation between Reduction Energy and implementation ISO 50001 in the power plants is positively related toward implementing ISO 50001.

## 7.0 CONCLUSION

Increased demand for energy leads us to think about reducing the energy consumption rate, cost savings, low maintenance, and production benefits that can be realized from the systematic pursuit of energy efficiency through ISO 50001 adoption. The paper has investigated in adoption ISO 50001 in power stations by establishing new framework model to improve the efficiency of power plants, the conceptual model was designed to test the relationship between dependent variable (i.e. implementation ISO 50001) and independent variable (i.e. Reduction Costs, Improvement Quality, Performance Environmental, Sustainability Economic, Reduction Energy) to test the hypotheses and correlation between the factors by using the software SPSS. Adoption of variables that have been developed in the conceptual framework will assist organizations and companies in both the private and public sectors to assess and prioritize technologies to increase the energy efficiency and provide a conceptual framework model to improve the performance of energy. The proposed framework will contribute to reduction of cost and time by implementing ISO 50001.

## ACKNOWLEDGMENTS

The authors gratefully acknowledge the Ministry of Electricity of Iraq (MOE) for the fund and its continuous support and encouragement. The authors would also like to acknowledge UTeM for the research support.

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