An Empirical Study on Energy Management Standard (ISO 50000): Effectiveness Performance Evaluation for Steel Plants and Comparison with ISO 9000, ISO 14000, ISO 18000 & ISO 22000

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Abstract

The majority of business organizations of developing countries have problems achieving and maintaining competitive ability on international markets. Those organizations which actively and permanently applied modern management methods and techniques have much better chances of strengthening their competitive abilities on the global market and also taking a stable market position with good perspectives for striving for excellence. This paper is a study of various ISO (International Organization for Standardization) is the world's largest non-profit organization to develop and publish international management system standards such as ISO 9001, ISO 14000, ISO 18000 and ISO 22000 etc., this paper presents the effective implementation of ISO 50000 in two different steel plants along with to evaluate the performance of the system and comparison with above ISO standards which influence in organization. These standards are generically defined to suit any organization in the world regardless of their size, scope and location in organization along with the management. The purpose of an energy management system standard is to provide guidance for industrial and commercial facilities to integrate energy efficiency into their management practices, including fine-tuning production processes and improving the energy efficiency of industrial systems. This paper is a study on the aim to promote the development of international standards to facilitate the exchange of goods and services worldwide along with organizational effectiveness and comparisons with other standards such as ISO 9001, ISO 14000, ISO 18000 and ISO 22000 etc., which results the enhancement of socioeconomic value and better scope, effectiveness, standards of production activities, brand value and quality of product in competitive worlds.

Keywords: *ISO 5000, ISO 50001, Energy Management, OHAS 18000, ISO 22000*

1. Introduction

The purpose of an energy management standard is to provide an organizational framework for industrial facilities to integrate energy efficiency into their management practices, including fine-tuning production processes and improving the energy efficiency of industrial systems. Energy Performance value or measure as defined by the organization. Significant energy use, energy use accounting for substantial energy consumption and/or offering considerable potential for energy performance improvement [1], which is shown in Firgure1. Energy management seeks to apply to energy use the same culture of continual improvement that has been successfully used by industrial firms to improve quality and safety practices [2]. In organizations without a plan in place, opportunities for improvement may be known but may not be promoted or implemented because energy management is not part of the organizational culture and the normal planning

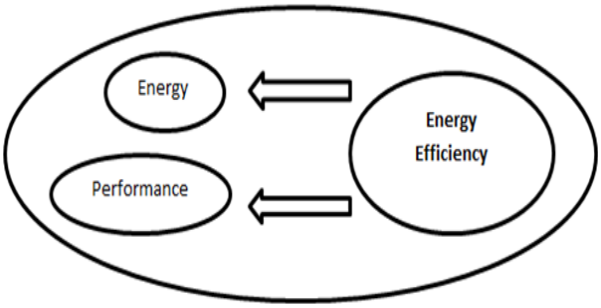

Figure 1. Energy Performance vs. Energy

process Efficiency (Source Edwin Pinero.). This failure to plan reinforces traditional barriers, which include lack of communication among sites, poor

understanding of how to create support for an energy efficiency project, limited finances and financial data, poor accountability for measures and perceived risk from changing the status which is shown in Figure 2.

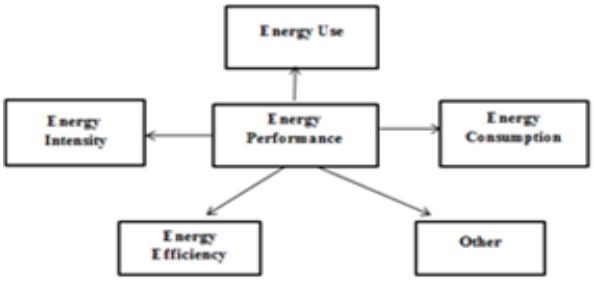

Figure 2. Energy Performance

In addition, business metrics ISO identifies energy management as one of its the top five priorities based on its enormous potential to save energy, increase profitability, and reduce greenhouse gas (GHG) emissions worldwide. A successful program in energy management begins with a strong commitment to continual improvement of energy efficiency. In this paper a brief study about ISO 50000 was presented and in the next step two nos. of case study of steel plants was taken and how energy management was implemented for the performance evaluation. The effectiveness of an action plan depends on the involvement of personnel throughout the organization, who need to be aware of energy use and performance objectives. Staff and those who work on behalf of the organization need training in both skills and day-to-day practices to improve energy performance. The results should be regularly evaluated and communicated to all personnel, recognizing high achievement [3, 4 ,8,9 & 10]

2. Literature Review

Brief review of literature survey shows that a lot of works concerning ISO-50000. The early pioneering work in ISO-50000 was reported by Jeremy Lagorse et al. [1], had studied the energy management and hence found that, most solutions are based on centralized systems and barely fulfill criterion like fault tolerance or adaptability. Also, these systems are often difficult to design because of the ‘‘top–down’’ approach used: the designer generally knows how each component has to respond separately, but a centralized management system focuses his attention solely on the overall reaction of the system. In addition to a more natural conception, based on a ‘‘bottom–up’’ approach, this solution ensures better system reliability and results show that this approach is perfectly valid and can respond to most problems of centralized energy management systems (EMSs). Aimee McKane et al.[2], an energy management system standard is to provide guidance for industrial and commercial facilities to integrate energy efficiency into their management practices, including fine-tuning production processes and improving the energy efficiency of industrial systems. The International Organization for Standardization (ISO) has identified energy management as one of its top five priorities for standards development. The new ISO 50001 will establish an international framework for industrial, commercial,or institutional facilities, or entire companies, to manage their energy, including procurement and use. This standard is expected to achieve major, long-term increases in energy efficiency in industrial, commercial, and institutional facilities and to reduce greenhouse gas (GHG) emissions worldwide. Eeva Määttänen et al [3], had presented a simple and effective approach to building energy efficiency by optimizing building processes throughout the operating phase of the building, hence the function of a remote energy management control center and presents the benefits it can bring for the environment, property owner and property user. As a result, that consumption of electricity can be decreased and heating energy decreased and finally reduction in CO2 emissions and thus the implementation of a continuous and regular energy monitoring and control of building systems and equipment. UNIDO, Dubai [4], the report describes that global sustainable development by focusing on three closely related issues: energy efficiency, water and climate change; and highlighting the opportunities and benefits that international standards can bring in the management of these issues. Edwin Pinero [5], energy efficiency achieved through changes in how energy is managed rather than through installation of new technologies e.g. energy management system provides a method for integrating energy issues into existing management systems for continual improvement and a PDCA model of management systems has proven successful for quality, health and safety, and environment (changes culture, engages management, changes behavior) for improving energy management standards. Pengiran Shamsuddin and Ake Chaisawadi [6], managed energy consumption of road lightings in Brunei Darussalam, flux regulation technique had been used to perform the energy-saving task of the lightings involved in trial. As a result, it was found that from the trials demonstration that electrical energy can be saved from the implementation of the method with an illumination’s reduction at the end of lightings’ lines. The associated energy-cost savings and will also help reduce CO2 emission annually. Paul Scheihing [7], energy efficiency in industry is achieved through changes in how energy is managing a facility, rather than through

installation of new technologies; An energy management standard provides a method for integrating energy efficiency into existing industrial or commercial management systems for continuous improvement; All existing and planned energy management standards are compatible with ISO 9000/140001; Companies who have voluntarily adopted an energy management plan (a central feature of an EnMS –Standard) have achieved major energy intensity improvements. B Avramovic and L H Fink [8], FACTS technologies promise a variety of opportunities for significant advances in the delivery of power and flexibility of power system control. A large portion of these opportunities is realized through thorough design of FACTS devices, with recognition of the characteristics of the system in which they' are installed. However, a portion of these opportunities can only be realized through control and coordination from the energy management system (EMS) centre.

3. Why an Energy Management Standard?

Most energy efficiency in industry is achieved through changes in how energy is managed in a facility, rather than through installation of new technologies because an energy management standard provides a method for integrating energy efficiency into existing industrial or commercial management systems for continuous improvement. All existing and planned energy management standards are compatible with ISO 9000/140001.Companies who have voluntarily adopted an energy management plan (a central feature of an EnMS –Standard) have achieved major energy intensity improvements due to the above important factors energy management standard is to provide an organizational framework for industrial facilities to integrate energy efficiency into their management practices, including fine-tuning production processes and improving the energy efficiency of industrial systems [4 ,7,9& 10].

4. An Overview of ISO 50001: Global Standard for Energy Management

ISO 50001 is a foundational tool that any organization can use to manage energy. However, most solutions are based on centralized systems and barely fulfil criterion like fault tolerance or adaptability. Also, these systems are often difficult to design because of the ‘‘top–down’’ approach used: the designer generally knows how each component has to respond separately, but a centralized management system focuses his attention solely on the overall reaction of the system [1], which is shown in Figure3.

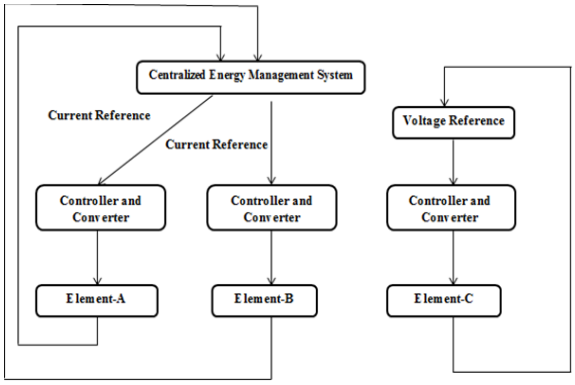

Figure 3. Centralized Management System of Energy Management (Source Jeremy Lagorse et al.)

ISO 50001 energy management standard is an international framework for industrial plants, commercial facilities or entire organizations to manage energy, including all aspects of procurement and use. The standard provides organizations and companies with technical and management strategies to increase energy efficiency, reduce costs, and improve environmental performance [1]. To qualify for Superior Energy Performance, a facility will have to demonstrate conformance to ISO 50001, with additional requirements to achieve and document energy performance improvements. ISO 50001 was published as an International Standard in June 2011 and is now available from the American National Standards Institute (ANSI) for purchase. The U.S. TAG led international negotiations to ensure that ISO 50001 preserves the U.S. emphasis on management support and data-driven energy performance. Georgia Institute of Technology developed the first comprehensive, ANSI-compatible energy management standard (MSE 2000) for industry in 2000. The ANSI Management System for Energy, ANSI/MSE 2000:2008, was revised in 2008 and represents a standardized approach to manage energy supply, demand, reliability, purchase, storage, use, and disposal (applicable to both primary and secondary energy sources).For the purposes of this International Standard, energy refers to the various forms of energy, including renewable energy, that can be purchased, stored, treated, used in equipment or in a process, or recovered. In physical terms, energy can be defined as the capacity of a system to produce external activity or perform work [3, 5, 7,8 & 10].

5. Energy Management Principles

Technology alone cannot achieve optimal savings, but when coupled with O&M practices, as well as, management systems can lead to significant savings:

i. Commitment by upper level management
ii. Development of management strategies
iii. Clearly stated goals on energy efficiency, waste reduction, and sustainability
iv. Communication of goals, tactics, and achievements throughout all levels of the firm
v. Delegation of responsibility and accountability to the appropriate personnel
vi. Sustained tracking and assessment of energy use and technology application
vii. Continuous investigation of potential energy reduction projects
viii. Application of business investment models to energy technology projects
ix. Establishment of an internal recognition and reward program for achieving energy goals [7 &10].

6. Components of an Energy Management Standard (ENMS)

Typical features include:

a) A strategic plan that requires measurement, management, and documentation for continuous improvement for energy efficiency;
b) A cross-divisional management team led by a representative who reports directly to management and is responsible for overseeing the implementation of the strategic plan;
c) Policies and procedures to address all aspects of energy purchase, use, and disposal;
d) Projects to demonstrate continuous improvement in energy efficiency;
e) Creation of an Energy Manual, a living document that evolves over time as additional energy saving projects and policies are undertaken and documented;
f) Identification of key performance indicators, unique to the company, that are tracked to measure progress; and
g) Periodic reporting of progress to management based on these measurements [5, 6, 7 & 10].

7. Energy Management – Step By Step

Typically energy management standards provide for:

Implementation and Operation: It includes the Competence, Training, and Awareness. Communication, Documentation requirements and Operational Control, Design of facilities, equipment, systems, and processes, Procurement of Energy Services, Products, Equipment, and Energy.

Checking: It includes the Monitoring, Measurement, and Analysis; Evaluation of compliance with legal and other requirements; Internal Audit of the EnMS; Non-conformance, Correction, Corrective action, Preventive Action; Control of records.

Management Review: In this step involves General requirements, Input to Management Review, Typical management systems items, including performance information, Output from Management Review, Changes and actions that address performance of the EnMS and energy performance

First Steps: Further familiarization with the standard and what it requires, Assess value to the organization- do you want to go down this path?, Get management on board, Assemble the right team, Train the team, Begin policy development and initial reviews- "where are we?"

Construct the Pieces: Identify key roles and responsibilities, Determine training and awareness needs, Start the communication process- raise awareness, build capacity, Fill in the blanks- procedures and processes, Deploy expectations- objectives and targets, Let the system gel and evolve.

Continual Improvement: Conduct management reviews, Make decisions that support the commitment to continual improvement, Enhance and modify the system as needed

Implementation of an energy management plan assists a company to: Develop a baseline of energy use, Actively manage energy use and costs, Reduce emissions without negative effect on operations, Continue to improve energy use/product output over time, Document savings for internal and external use [2, 5, 6 & 7].

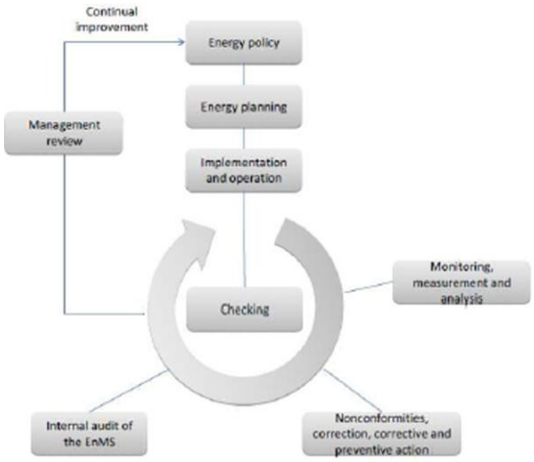

Figure 4. Steps involves in Energy Management (Source Edwin Pinero)

8. Energy Planning Process

A. **Energy Planning:** Need to define the energy planning process that will lead to conformance with the policy and continually improve energy performance.

Legal and Other Requirements, Energy Review, Energy Baseline, Energy Performance Indicators, Energy Objectives, Targets, Energy Management Action Plans.

B. **Energy Review:** Define a methodology to do the review, Analyse energy use and consumption, Determine significant energy use based on use and consumption, Estimate future uses Identify, prioritize, and record opportunities for improving energy performance, To occur at set intervals and whenever major changes occur to facilities, equipment, systems, or processes.

C. **Energy Baseline:** Sets the baseline, or reference point, against which performance will be measured, determined based on information from the initial energy review, Can be updated if appropriate based on changes to conditions [2, 5, 6, & 8].

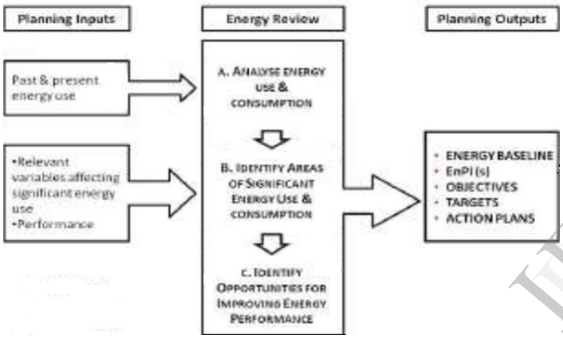

Figure 5. Energy Planning Process
(Source Edwin Pinero)

9. Scope of ISO 50001- Energy Management System

Energy Standardization in the field of energy management, including:

1. energy supply,
2. procurement practices for energy using equipment and systems,
3. energy use, and
4. any use-related disposal issues.

The standard will also address measurement of current energy usage, and implementation of a measurement system to document, report, and validate continuous improvement in the area of This international standard specifies requirements for establishing, implementing, maintaining, and improving an energy management system, for achieving continual improvement of energy performance, including energy efficiency, energy use and consumption, measurement, documentation and reporting, design and procurement practices for equipment, systems, processes and personnel that contribute to energy performance . It is applied to all variables affecting energy performance that can be monitored and influenced by the organization. This International Standard has been designed to be used independently, but it can be aligned or integrated with other management systems. This is applicable to any organization wishing to ensure it conforms to its stated energy policy and wishing to demonstrate this to others, such conformity being confirmed either by means of self-evaluation and self-declaration of conformity, or by certification of the energy management system by an external organization [5, 6, 7 & 10].

10. Benefits of ISO 50001

Energy management standard will demonstrate that the plant or company implemented sustainable energy management systems, completed a baseline of energy use, and committed to continuously improve their energy performance. The standard, which is compatible with the widely used ISO 9001 (quality management) and ISO 14001 (environmental management), also accomplishes the following:

i. Assists organizations in optimizing their existing energy-consuming assets.
ii. Offers guidance on benchmarking, measuring, documenting, and reporting energy intensity improvements and their projected impact on reducing GHG emissions.
iii. Creates transparency and facilitates communication on the management of energy resources.
iv. Promotes energy management best practices and reinforces good energy management behaviours.
v. Assists facilities in evaluating and prioritizing the implementation of new energy-efficient technologies
vi. Provides a framework for promoting energy efficiency throughout the supply chain.
vii. Facilitates energy management improvements in the context of GHG emission reduction projects [2, 7 & 8].

11. Training of ISO-50000

Training has been designed to help you understand the requirements for an organization to establish, implement, maintain and improve an Energy Management System (EnMS). The ISO 50001 is a new international standard that provides a framework to help you manage the energy supply and consumption in organizations. The ISO 50001 Energy Management System standard applied to all aspects of energy use and enables you to help an organization take a systematic approach to achieving continual improvement of energy performance [2&5]. By the end of this training, participants will be able to:

i. Understand the guidance and application for energy management systems provided by ISO 50001
ii. Explain the purpose of ISO 50001 and the benefits to an organization of using the standard
iii. Outline key concepts and approaches to an energy management system
iv. Describe, with reference to Plan – Do – Check – Act cycle, the structure, scope and purpose of ISO 50001
v. Outline key ISO 50001 definitions and terminology
vi. Briefly summarized relevant energy management legislation
vii. Identify sources of law and sources of information on energy management legislation
viii. Outline the key requirements of ISO 50001.

12. ISO 9000: Overview

ISO 9000 quality system which is generic in scope, the series can be tailored and fit any organization's needs whether it is large or small, a manufacturer or a service organization. It is applied to construction, engineering, health care, legal and other professional services as well as the manufacturing. Its purpose is to unify quality terms and definitions used by industrialized nations and use those terms to demonstrate a supplier's capacity of controlling its processes. The ISO 9000 family of standards is related to quality management systems and designed to help organizations ensure that they meet the needs of customers and other stakeholders while meeting statutory and regulatory requirements related to the product. ISO 9000 deals with the fundamentals of quality management systems, including the eight management principles on which the family of standards is based. ISO 9001 deals with the requirements that organizations wishing to meet the standard have to fulfil. There are two main points which should be understood in order to undertake ISO 9000 implementation, in first, to promote development of standardization so as to facilitate international exchange of goods and services. Basically, allow international companies to compete on the same level in regards to goods and services and in second, to promote cooperation in intellectual, scientific, technological, and economic activity. Sharing information allows organization to growth. ISO 9000 having a positive effect on investment, market share, sales growth, sales margins, competitive advantage, and avoidance of litigation. The quality principles in ISO 9000 which provide a guidelines of comprehensive model for quality management systems that can make any company competitive." Implementing ISO often gives the following such as : Creates a more efficient, effective operation, Increases customer satisfaction and retention, Reduces audits, Enhances marketing, Improves employee motivation, awareness, and morale ,Promotes international trade ,Increases profit, Reduces waste and increases productivity, Common tool for standardization [2 ,9& 10].

13. ISO 14000: Overview

ISO 14000 is a family of standards related to environmental management that exists to help organizations (a) minimize how their operations (processes etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land); (b) comply with applicable laws, regulations, and other environmentally oriented requirements, and (c) continually improve in the above. ISO 14000 is similar to ISO 9000 quality management in that both pertain to the process of how a product is produced, rather than to the product itself. ISO 14001 can be used in whole or in part to help an organization, for profit or not-for-profit, better manage its relationship with the environment. If all the elements of ISO 14001 are incorporated into the management process, the organization may prove that it has achieved full alignment or conformity with the international standard, ISO 14001, by using one of four recognized options. These are (1)make a self-determination and self-declaration, or (2) seek confirmation of its conformance by parties having an interest in the organization, such as customers, or (3)seek confirmation of its self-declaration by a party external to the organization, or (4) seek certification/registration of its environmental management system by an external organization. Basic principles and methodology depends on PDCA cycle. The core requirement of a continual improvement process (CIP) is different from the one known from quality management systems. CIP in ISO14001 has three dimensions which are (1) Expansion: More and more business areas get covered by the implemented energy management standards (EMS).(2) Enrichment: More and more activities, products, processes, emissions, resources etc. get managed by the implemented EMS.(3)Upgrading: An improvement of the structural and organizational framework of the EMS, as well as an accumulation of know-how in dealing with business related environmental issues [2,9 & 10].

14. OHSAS 18000(Occupation Health and Safety Assessment Series): Overview

OHSAS 18000 actually forms part of the acclaimed Health and Safety Electronic Kit. This includes not only the text from OHSAS 18001/2, but a safety manual, and implementation guide and various other materials and information. OHSAS 18001 is a British Standard for occupational health

and safety management systems. It exists to help all kinds of organizations put in place demonstrably sound occupational health and safety performance. It consists of two publications, as follows: OHSAS 18001 & OHSAS 18002.OHSAS 18001, This is the "Occupational Health and Safety Management Systems specification". It was developed in response to urgent demand for a recognized standard against which occupational safety management systems can be assessed. It is compatible with ISO 9001 and ISO 14001.It covers issues such as planning for hazard identification, risk assessment/control, OHS management, awareness and competence, training, communication, emergency preparedness and response, performance measuring and improvement. OHSAS 18002, which provides guidelines for the implementation of OHSAS 18001.Its proponents claim that an occupational health and safety management system (OHSMS) promotes a safe and healthy working environment by providing a framework that helps organizations to: consistently identify and control health and safety risks; reduce the potential for accidents; aid legislative compliance; and improve overall performance. The OHSAS 18000 standards provide organizations with the elements of an effective OHSMS that can be integrated with other management requirements and help organizations achieve better occupational health and safety performance and economic objectives which can be cost-effective and minimizes disruption [9 &10].

15. ISO 22000: Overview

The term Food safety management systems implementation and certification has significantly increased during the last decades, thus reflecting the importance that those standards have assumed in some activity sectors. The ISO 22000 international standard specifies the requirements for a food safety management system that involves the following elements: (1) Interactive communication, (2) System management, (3) Prerequisite programs, (4) HACCP principles. Therefore, the Communication along the food chain is essential to ensure that all relevant food safety hazards are identified and adequately controlled at each step within the food chain. This implies communication between organizations both upstream and downstream in the food chain. ISO 22000 requires that all hazards that may be reasonably expected to occur in the food chain, including hazards that may be associated with the type of process and facilities used, are identified and assessed. Thus it provides the means to determine and document why certain identified hazards need to be controlled by a particular organization and why others need not. During hazard analysis, the organization determines the strategy to be used to ensure hazard control by combining the prerequisite programs and the HACCP plan. The main goals of ISO 22000; food safety management systems are; First, to identify ISO 22000 implementation and certification motivations; Second, To identify ISO 22000 implementation benefits and difficulties; third, To identify ISO 22000 market evolution perspectives; and fourth, To identify the costs and benefits directly related to the implementation and certification of food safety management systems. The implementation of the HACCP (hazard analysis and critical control point) system, that is standard ISO 22000:2005– Food safety management systems Requirements for any organization in the food chain, represents one of many requirements directed towards companies in the function of customer health care. Initially, HACCP consisted of the following three principles which are: (1) Identification of hazards, (2) Determination of critical control points to control any hazard, (3) Establishment of monitoring systems. The ISO 22000 is a standard developed by the International Organization for Standardization dealing with food safety. This is a general derivative of ISO 9000 [9 &10].

16. Case Study-I

Powmex GKW Limited (formerly Guest Keen Williams Limited) was a subsidiary of the U.K. based engineering giant GKN plc. In 1994 GKN plc. divested its stake in GKW Limited. GKW is now a part of a large industrial group. Valve Steels, High Speed Steels, Tool, Alloy Steels, and Powder Metallurgy Steels are manufactured by GKW in its Powmex Steels Division, located at Titilagarh, in Bolangir district in the state of Odisha. Its contains 8 MT GEC Alsthom electric arc furnace, GFM, Austria Long Forging Machine, 9 Stand Rolling Mill, Holding, Re-heating, Pre-heating and Annealing Furnaces, Peeling, cold drawing and center less grinding machines, Nitrogen Plant and 2MT Induction Furnace. Largest manufacturer of High Speed Steels in India which have the Capacity of 6750T per annum and Commenced production in 1992. The case study was investigated in the Rolling Mill shop where the data are collected during the year-2012. Energy saving for fume exhaust system blower in 4HI Rolling Mill which include, Motor rating : 3-PH,AC Induction motor of 50 HP, 415 V, 1460 RPM.

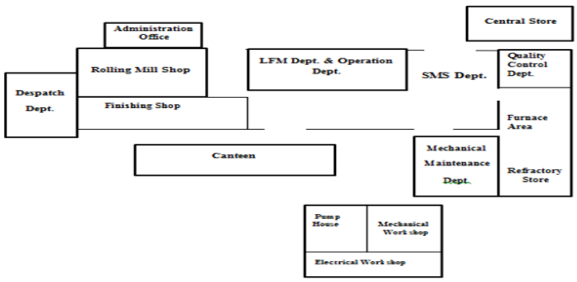

Figure 6. Layout of Plant (Powmex GKW Ltd)

Previous System:

In the present system, star delta starter for motor operation was and it had belt pulley system for power transmission to fan and it was observed that first blower fan kept working continuously at a constant speed and second Blower fan working at full speed irrespective of fumes generated or not at rolling mill. During Process study & experimentation, it was observed that the fume generation was very low during first pass rolling, No fumes generation during coil handling , the actual rolling duration at full and hence maximum fume generation takes place only 65% of the total duration of mill operation and finally manual control of inlet valve of blower fan was impractical.

Present System:

In the present situation, the AC electronics speed variable drive installed along with Thyristor Voltage controller, drive operation studied & optimize the power consumption during idling of mill and finally optimization done to reduce the power consumption in accordance with fumes generation. In addition to the merits of new system it includes the Smooth start resulting in increased life of motor and mechanical system and energy saving due to speed / voltage variation during idling of the mill.

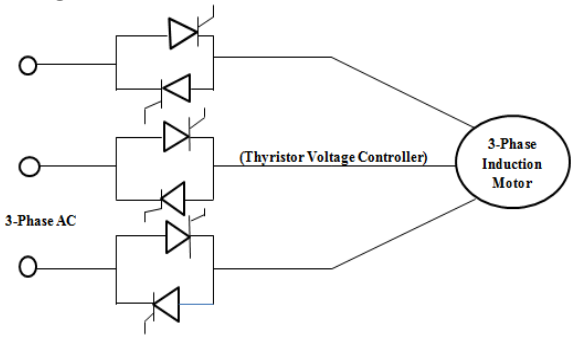

Figure 7. Circuit Diagram of Present System

Cost Benefit Analysis:

Previous System (Without Drive): Speed=50 Hz, Kw (Consumption) = 30

Present System (With Drive): Speed=0-20-45Hz, Kw (Consumption) = 15

Energy Saving per year: 15 Kw X 20 X 300 = 90,000KwH

Investment: Rs. 1, 50,000 /-

Saving in Rupee Terms / Year: 90,000 X 2 = 1,80,000 /-maintain and improve an Energy efficiency.

17. Case Study-II

Rathi Steel And Power Ltd (erstwhile Rathi Udyog Ltd) is a part of the Rathi Group of Delhi. The Company was founded by Shri Punam Chand Rathi (1934-2010) who was well known in the Steel Industry with experience of over six decades in steel melting and rolling/re-rolling. The major products are engaged in manufacturing of Rebars and Wire Rods which are broadly categorized as the Long Products in the Steel Industry. Company was set up process of setting up a backward integration project at Odisha (Odisha Project) to manufacture Steel Billets through DRI-captive power-CCM route in the year 2006, which includes the total project of4,50,000 TPA of sponge iron, 70MW of power generation & 3,00,000 TPA of steel billets production. The company includes three nos of division such as Power plant division, DRI division & SMS division including other correlated department with plant premise.

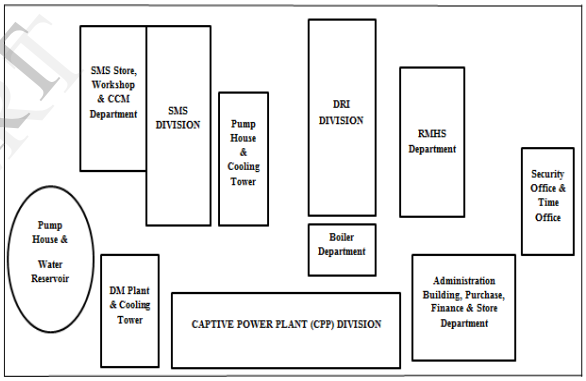

Figure 8. Layout of Plant.(Rathi Steel And Power Ltd)

A case study of transfer of hot return water from Reheating furnace to the cooling tower fans was taken for investigation of the energy saving purpose in SMS division during the year 2011-12.

Previous System:

The system equipped with several motors which includes 3-phase AC induction motors (37 kw, 415 v, 1460 rpm = 2 nos & 2. 22 kw, 415 v, 1440 rpm = 1 no) for Star Delta starter for motor operation & Flange coupling for operating the centrifugal pumps and observed were taken such as one centrifugal pump was being operated with 60% outlet valve opening; Cooling Tower Tank level was not maintained with the operation of single pump; Second pump was being operated to maintain to Tank level for short intervals. It was operated 40 times (approx.) in 24 hrs. and Sometimes, second pump was being operated with by-pass valve half open to drain tank to avoid the

over flow of Cooling Tower Tank. Pump was operated at full capacity to realize the increased flow to cooling tower. Motor got overloaded. Observations were done physically about Tank levels with one pump in operation. Psychological fear of lower water level was taken and range of water level was given. It was observed that the standby pump needs to operated only 6 to 7 times in a day (24 hrs.). Further low & high level switch was installed with an Alarm & Indicator to take care of manual labour & manpower wastage.

Present System:

To utilize the motor power effectively a VFD was installed and operated at 30 Hz frequency. The pump RPM takes as 900 and outlet valve was operated fully. Power consumption reduced from 32 kw. to 16 kw. And it was observed that the standby pump needs to operate only 6 to 7 times in a day (24 hrs.). As result the merit of new system have firstly Mechanical & Electrical stresses during starts of the motor reduced to negligible. Hence the life of the equipment increased, secondly Presence of a supervisor or monitoring of the level got avoided. Hence the manpower cost reduced, thirdly System power consumption reduced and finally No churning of water in the pump & hence increases life of impeller.

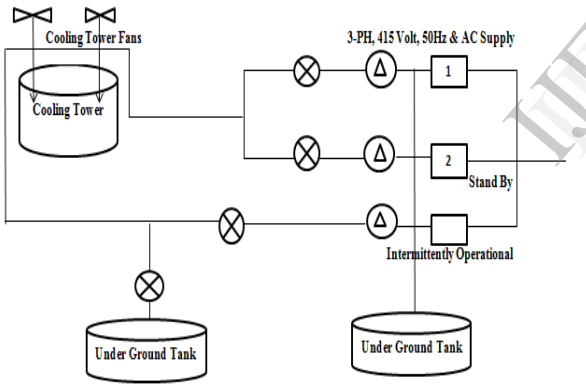

Figure 9. Present System Block Diagram

Cost Benefit Analysis:

Previous System (Without Drive): Speed=50 Hz, Kw (Consumption) =32
Present System (With Drive): Speed=30 Hz, Kw (Consumption) =16
Energy Saving per year: 16 Kw X 20 X 300 = 96,000 KwH
Cost incurred in the installation of New VFD: 2 X 1,50,000 = Rs. 3,00,000
Saving in Rupee Terms / Year: 96,000 X 2 = 1,92,000/-

18. Result & Discussion

In this paper it was found from the above case studies that energy management standard is to provide an organizational framework for steel plants to integrate energy efficiency into their management practices, including fine-tuning production processes and improving the energy efficiency of industrial systems which results that more profits was made through the addition to the merits of new system it includes the Smooth start resulting in increased life of motor and mechanical system and energy. When these standards are implemented in productive organization for their continuous improvement in various process areas [9 &10] ,the following points to be consider for achieving the production oriented goals;

Brand Image & Ease of Marketing: Organizations are positive to agree that their brand image and ease of marketing were improved after getting certified to ISO.

Cultural & Behavioural Issues: people need to work as a team.

Customer Satisfaction: maintain the same level of customer satisfaction before and after ISO Certification.

Continual Improvements: organizations denied of any continual improvements after ISO certification.

Customer Complaints: To reduce the customer complaints after certification.

Documentation Issues: organizations were happy to streamline and reduce the paperwork after ISO certification.

Internal Audits: Adding value to their business linking ISO with Business Strategy it means ISO model in their organization had no interface to Strategy and vice versa.

In-process Quality & Efficiency: A clear improvement in the in process quality and efficiency since getting certified.

Internal Communication: Organizations were happy with a well-established internal network of communication through Telephones, E-mails, Newsletters, meetings, seminars including the state of art technologies like GPRS.

ISO Awareness: facing a challenge in promoting the system awareness by the help of ISO Standards.

Key Performance Reporting System: To Analysis of the Management System Certifications – Reasons behind the Failure of ISO Certified Organizations.

Motivation & Recognition: Organization is happy to get motivated and recognized for their contribution related to Quality improvements.

Management Review: company conducted professional reviews beyond the minimum requirements of ISO and its effectiveness within the organization.

Overall System Effectiveness: Organization has effective quality systems after certification to achieve the product oriented goals.

19. Conclusion

High energy prices or constrained energy supply will motivate industrial facilities to try to secure the amount of energy required for operations at the lowest possible price. But price alone will not build awareness within the corporate management culture of the potential for energy reduction and cost savings, maintenance savings, and production benefits that can be realized from the systematic pursuit of industrial energy efficiency. To be effective, energy efficiency programs need to engage industry at the management level as well as facilities engineering. Because industrial decision making is largely driven from the top, failure to engage management results in missed opportunities for energy efficiency improvement, even when technical staff is educated and aware of the opportunities. This paper presents a potential solution, of an international energy management standard, ISO 50001: Energy management and guidance for use, suitable for any organization, whether industrial, commercial, or institutional. Because of its importance to future climate change mitigation efforts, particular attention will be given to existing and planned efforts to address barriers to future adoption of ISO 50001 by industries in developing countries. Finally In this paper it gives the brief ideas about different ISO standards such as IS0-22000, ISO-9000, ISO-14000 and ISO-18000etc along with their correlation and comparisons with ISO-50000,which is shown in Table-1 & Table-2 .When these standards are implemented in an organization for their continuous improvement in various process areas along with cost-effective and minimizes disruption.

TABLE 1. Comparison of ISO-50000 with ISO-22000 and ISO-9000

Deals with	ISO-50000	ISO-22000	ISO-9000
	Energy Management	Food Safety Management	Quality Management Systems
Theory	Energy management standard will provide the plant or company implemented sustainable energy management systems, completed a baseline of energy use, and committed to continuously improve their energy performance	ISO-22000integrates the principles of the Hazard Analysis and critical Control Point (HACCP) system	The quality principles in ISO 9000 which provide a guidelines of comprehensive model for quality management systems that can make any company competitive
Principles	Development of management strategies and Commitment to upper level; Clearly stated goals on energy efficiency, waste reduction , Communication, energy use and technology application; Continuous investigation of potential energy Establishment of an internal recognition and reward program for achieving energy.	Interactive communication System management Prerequisite programs HACCP principles	ISO 9000 having a positive effect on investment, market share, sales growth, sales margins, competitive advantage, and avoidance of litigation.
Application Guidelines	Standardization in the field of energy management, including: energy supply, procurement practices for energy using equipment and systems, energy use, and any use-related disposal issues.	Standard specifies the requirements for a food safety management system implementation, certification and maintenance.	Commitment of senior management to monitor, control, and improve quality. How well the ISO system integrates into current business practices. How well the ISO system focuses on improving the customer experience .How well the auditor finds and Communicates areas of improvement.

Focus	Plan that requires measurement, management for continuous improvement for energy efficiency; cross-divisional team management; Policies and procedures to address all aspects of energy purchase, use, and disposal; Creation of an Energy Manual, a living document that evolves over time as additional energy saving projects and policies are undertaken and documented; Identification of key performance indicators, unique to the company, that are tracked to measure progress; and Periodic reporting of progress to management based on these measurements.	Both Upstream & down streams Hazards Analysis & Control conditions and hygiene measures Planning of preventive actions with the aim of eliminating any possible failures.	Creates a more efficient, Effective operation Increases customer satisfaction and retention Reduces audits Enhances marketing Improves employee motivation, awareness, and morale Promotes international trade Increases profit Reduces waste and increases productivity Common tool for standardization
Organization	Any Organization or Industry.	Any Organization related with food Technology	Large or small, a manufacturer or a service Organization.

TABLE 2. Comparison of ISO-50000 with ISO-14000 and ISO-18000

	ISO-50000	**ISO-14000**	**ISO-18000**
Deals with	Energy Management	Environmental Management System.	Occupational Health and Safety Management System.
Theory	energy management standard will provide the plant or company implemented sustainable energy management systems, completed a baseline of energy use, and committed to continuously improve their energy performance	minimize how their operations negatively affect the environment comply with applicable laws, regulations, and other environmentally oriented requirements, continually improve in the above.	It was developed in response to urgent demand for a recognized standard against which occupational safety management systems can be assessed. It is compatible with ISO 9001 and ISO 14001.
Principles	Development of management strategies and Commitment to upper level; Clearly stated goals on energy efficiency, waste reduction, Communication , energy use and technology application; Continuous investigation of potential energy Establishment of an internal recognition and reward program for achieving energy.	Plan – establish objectives and processes required Do – implement the processes Check – measure and monitor the processes Act – take action to improve performance	Consistently identify and control health and safety risks Reduce the potential for accidents Aid legislative compliance Improve overall performance.

Application Guidelines	Standardization in the field of energy management, including: energy supply, procurement practices for energy using equipment and systems, energy use, and any use-related disposal issues.	Expansion: More and more business areas get covered by the implemented EMS. Enrichment: More and more activities, products, processes, emissions, resources etc. get managed by the implemented EMS. Upgrading: An improvement of the structural and organizational framework of the EMS, as well as an accumulation of know-how in dealing with business related environmental issues.	Risk assessment /control, OHS management, Awareness and competence, Training, Communication , Emergency Preparedness and response, Performance measuring and improvement.
Focus	Plan that requires measurement, management for continuous improvement for energy efficiency; cross-divisional team management; Policies and procedures to address all aspects of energy purchase, use, and disposal; Creation of an Energy Manual, a living document that evolves over time as additional energy saving projects and policies are undertaken and documented; Identification of key performance indicators, unique to the company, that are tracked to measure progress; and Periodic reporting of progress to management based on these measurements.	Higher conformance with legislative. Regulatory requirements by utilizing the ISO standard. Minimizing the risk of regulatory and environmental Liability. Improving an organization's efficiency Reduction in waste and consumption of resources, Operating costs can be reduced Positive impact on a company's asset value Improved public perceptions.	Reduced risk Competitive Improved performance Reduced costs Human health factors Safety management
Organization	Any Organization or Industry.	Any Organization or Industry.	It exists to help all kinds of organizations put in place demonstrably sound occupational health.

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21. References

[1] Jeremy Lagorse, Damien Paire & Abdellatif Miraoui., "A multi-agent system for energy management of distributed power sources", Interntional Journals on Renewable Energy(Elsevier) 35 (2010) 174–182,2010.
[2] Aimee McKane, Deann Desai, Marco Matteini, William Meffert, Robert Williams & Roland Risser., "Thinking Globally: How ISO 50001 – Energy Management can make industrial energy efficiency standard practice", Environmental Energy Technologies Division, USA, August 2009.
[3] Eeva Määttänen, Riikka Kyrö, Anna-Liisa Lindholm, Seppo Junnila., "Savings for Retail Properties through Active Energy Management", 2011 2nd International Conference on Environmental Science and Technology, IPCBEE vol.6, IACSIT Press, Singapore, 2011.
[4] A survey report on "Standards for Energy Efficiency, Water, Climate Change, and their Management", Background Paper prepared by UNIDO for 42nd Meeting of ISO DEVCO, Dubai, United Arab Emirates,12-13 October 2008.
[5] Edwin Pinero, "Energy management system standards ISO 50000" Veolia Water North America, 2012..
[6] Pengiran Shamsuddin and Ake Chaisawadi , "Lighting Energy Management: In the case of road lightings in Negara Brunei Darussalam", Asian Journal on Energy and Environment ISSN 1513-4121, 2005.
[7] Paul Scheihing, "Energy Management Standards (EnMS)", U.S. DOE,January, 2009.
[8] 8. B Avramovic and L H Fink, "Energy management systems and control of FACTS", Electrical Power & Energy Systems, Vol. 17, No. 3, pp. 195-198, 1995.
[9] 9. M. K. Rout , P. R. Biswal & S. Das, "A Study on ISO 22000 with HACCP. Assessment, Correlation and Comparison with ISO 9000, ISO 14000, ISO 18000 and their Influence in an Organization", published in national conference on New Approaches of Basic Science Towards the Development of Engineering & Technology (NABSET-2013), Don Bosco College of Engineering & Technology, Assam, during 01-02 March, 2013.
[10] 10. N. D. Badgayan, M.K.Rout and S.K.Pattnaik, "Study on Energy Management Standard- ISO 50001: Comparison with ISO 9000, ISO 14000, ISO 18000, ISO 22000 and their Impact, Effectiveness in Manufacturing Environment", will be published in International Conference on on Emerging Trends in Renewable Energy (ICETRE-2013), C.V. Raman College of Engineering , Bhubaneswar, Odisha, during 27th -28th December, 2013.

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