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***Abstract*— Energy management that certificated by an international standard system named ISO 50001 can be implemented in industry such as food and beverage industry and this has investigated in this study by review on recent advances and researches. ISO 50001 certificate can assure the energy efficiency and management in food manufacturer unit during producing process. PDCA system (Plan, Do, Check and Act) that considered as protocol for ISO 14000 and 9000 also has used for ISO 50000. Pepsi Company is the first manufacturer that has implemented the ISO 50001 protocol.**

Keywords: ISO 50001; Food industry; Energy management

I. INTRODUCTION

A. *Energy management*

The principal business of an industrial facility is making a profit through production of goods and services, not energy efficiency. While there has been movement in industrial markets over the past few years to attribute a higher value to energy efficiency as a pathway for addressing climate change, typically in response to emissions trading schemes or shareholder activism, the fact remains that the first priority of industry is to remain profitable. Recent revival of arguments about how industry cannot afford to deal with climate change during the current economic downturn brings this duality sharply into focus. Energy efficiency has demonstrated, time and again, that it saves industrial firms money while having a positive effect on productivity [1].

The industrial sector in particular offers tremendous opportunity for energy savings, and a significant opportunity to instill the tenets of energy efficiency within facilities that, in turn, employ and influence millions of people. The industrial sector has thus been an attractive target sector for states looking to reach new levels of energy savings through efficiency. The sector itself, working constantly to increase shareholder value and reduce expenses, has found energy efficiency investments to be an attractive avenue to achieve those ends. Additionally, as climate change awareness and mitigation strategies increase, energy efficiency will likely be increasingly prioritized as a critical solution to reduce greenhouse gas emissions, and the potential financial risks associated with regulation [2].

The energy crisis of the late 70's of the XX century in Europe and the United States and growing competition from Asian producers predetermined the need to urgently Address the problems accumulated for years in the field of energy efficiency and the rational use of energy resources. The industrialized countries of the West, which have traditionally been the world leaders in the manufacture of various types of products, including, above all, high-tech goods, began to experience strong competition from producers in Asia. Chinese, Indian and Taiwanese companies, having, on the one hand a powerful high-tech industrial base and on the other hand, cheap labor, began to actively position themselves in foreign markets. However, access to world markets for European and American companies was conjugated with difficulties. To a great extent, this was due also to the high labor costs in Europe and the U.S. This situation initially put producers under a disadvantage relative to their competitors from the developing countries. In these circumstances, the emphasis on saving energy, consumed in the production process, became very logical for Western companies and as it turned out, a very effective way of development [3].

There is currently a growing need for manufacturing plants to improve competitiveness by reducing costs in all categories. These same plants also desire to sell more. Two strategic initiatives can support these objectives. First, reducing costs by eliminating waste in all forms and improving product quality. Second, certifying under the impending international standard for energy management, ISO 50001, will provide competitive advantage through product labeling with the expectation of driving increased sales. This paper will focus

specifically on analyzing energy waste and how it is impacted with changes in product demand [4].

B. ISO (International Organization for Standardization)

The ISO [International Organization for Standardization] is a global network that identifies the standards that are required by the society, the government and for business interactions. ISO standards are applicable to all regions of the world, developed, developing and transitional economies. ISO is a non - governmental organization comprising of a network of the national standard bodies of about 160 countries [5].

It was founded in 1947, and since then it has published more than 19 000 International Standards covering almost all aspects of technology and business. Today there are members from 164 countries and about 150 people work full time for the Central Secretariat in Geneva, Switzerland [6].

ISO collaborates with its partners in international standardization, the IEC [International Electro technical Commission] and the ITU [International Telecommunication Union] particularly in the field of information and Communication technologies. The World Standards Cooperation [WSC] has been established by them as their focus of combined strategic activity. By accessing the World Standards Services Network [WSSN], users can have access to the development of standards. A just and free trading system is being promoted by the ISO with its partnership with the World Trade Organization. ISO also cooperates with UN organizations that provide assistance and support to developing countries. More than 700 international and regional organizations have a formal working relationship with the ISO [5].

A standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose. ISO has published over 19 000 International Standards that can be purchased from ISO or its members.

Popular ISO standards:

- ISO 9000 - Quality management
- ISO 14000 - Environmental management
- ISO 22000 - Food Safety Management
- ISO 26000 - Social responsibility
- ISO 31000 - Risk management
- ISO 50001 - Energy management
- ISO 3166 - Country codes
- ISO 4217 - Currency codes
- ISO 639 - Language codes

ISO International Standards ensure that products and services are safe, reliable and of good quality. For business, they are strategic tools that reduce costs by minimizing waste and errors and increasing productivity. They help companies to access new markets; level the playing field for developing countries and facilitate free and fair global trade. Professional colleges, whose mandate it is to protect the public from inferior products and services, should have well-established systems for evaluating complaints related to health care delivery, and disciplining their members [7].

C. ISO 50001

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 offers up a potential solution, an international energy management standard, ISO 50001: Energy management and guidance for use, suitable for any organization, whether industrial, commercial, or institutional [8].

To build context, an overview will be provided of the current status of energy management standards, regulations, and specifications in a number of countries as well as examples of enabling policies and programs used to promote adoption of these standards by industry. 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 [9].

The process of developing ISO 50001 will also be described, including international participation and a discussion of some of the core issues under consideration by the ISO committee responsible for this work, Project Committee 242 (ISO PC 242). The paper will conclude with a discussion of the anticipated impact of the standard in international markets, industrial decision making, and industrial energy policy [10].

In February 2008, the Technical Management Board of ISO approved the establishment of a new project committee (PC 242 – Energy Management) to develop the new ISO Management System Standard for Energy. ANSI and the Associação Brasileira de Normas Técnicas (ABNT) jointly serve as the Secretariat to PC 242 to lead development of ISO 50001. This standard will establish an international framework for industrial, commercial, or institutional facilities, or entire companies, to manage their energy, including procurement and use. The standard will provide organizations and companies with technical and management strategies to increase energy efficiency, reduce costs, and improve environmental performance. Corporations, supply chain partnerships, utilities, energy service companies, and others are expected to use ISO 50001 as a tool to reduce energy intensity and carbon emissions in their own facilities (as well as those belonging to their customers or suppliers) and to benchmark their achievements. To foster development of the standard, UNIDO and the Standardization Administration of China (SAC) jointly

hosted an international meeting in Beijing in April 2008 to initiate a dialogue on harmonization of national and regional standards in preparation for the first meeting of ISO PC 242. The first meeting of ISO PC 242 was held in September 2008 in Washington, DC with participation by delegates from 25 countries from all regions of the world, as well as representation from UNIDO, which has liaison status. The goal of ISO PC 242 is to develop the new management system ISO 50001 on an accelerated schedule. Between the first meeting in September and the second meeting in March 2009 in Rio de Janeiro, Brazil, ISO PC 242 produced two working drafts for expert review and comment by member countries (35 as of March 2009). At the March meeting, a decision was made to go to Committee Draft (CD) in June 2009, following additional expert review and input. This puts development of ISO 50001 on track for publication in early 2011 [11].

Some of the major issues being addressed by ISO PC 242 include:

- The definition of energy and energy performance, with the term "energy performance" encompassing energy efficiency, energy conservation, and increased use of renewable energy, as determined by the implementing organization in their policy, targets, and objectives;
- The role of top management in setting policy and empowering staff to implement it;
- The term "team" as applied to persons responsible for carrying out the energy Management policy. Team describes the personnel resources necessary to implement and maintain the action plans and objectives of the organization and could be one person;
- An approach for energy planning that focuses on the process an organization would use both to implement and to maintain their management system;
- The appropriate role of purchasing for energy efficient supply, equipment, products, and services in a globally relevant standard;
- The role of renewable energy in energy management and energy performance, and
- The need for an annex that helps small and mid-size organization.

Existing ISO standards for quality management practices (ISO 9001) and environmental management systems (ISO 14001) have successfully stimulated substantial, continual efficiency improvements around the globe. The emergence of ISO 50001, the international energy management standard is anticipated to have far-reaching effects on the energy efficiency of industry when it is published in early 2011. This will be especially true in developing countries and emerging economies that still lack national energy management standards as well as policies and mechanisms to achieve improved efficiency in the industrial sector. Past experience with environmental management standards shows that the ISO standards have provided stimulus and a framework for the development of national standards, policies, laws and regulation. In addition, all indications are that ISO 50001 will become a significant factor in international trade, as ISO 9001 has been. ISO 50001 has the potential to impact 60% of the world's energy use, including not only industry, but also the commercial and institutional sectors. Based on demonstrated savings that have been achieved by organizations that have implemented energy management plans and a continual improvement framework, energy intensity improvements of greater than 2.5% per year are achievable and can be sustained for the next decade [9].

II. MATERIALS AND METHODS

In this study most recent advances and researches in the field of ISO 50001 in food industries have been analyzed and reviewed. Also, literature in this issue has investigated.

III. RESAULTS AND DISCUSSIONS

A. *Energy management in food industry*

The food industry is anon-energy intensive industrywhere energy is only a small part of the total cost of production (approximately 3%). However, it is an important energy consumer in the industrial sector due to its size. For example, in 1998, food industry accounted for 4.4% of the energy consumption of the US industry sector. It was the fifth biggest consumer (out of 20 sectors) after petroleum and coal products, chemicals, paper and primary metals. Thus, the potential energy savings achievable through an efficient energy management program can be significant. Furthermore, taking into account the number of similar processes in the same sector, most of the saving opportunities can be replicated from one production site to the others. This provides greater overall opportunities for corporations having a large number of production sites [12].

Regardless of these potential benefits, multiple barriers have to be overcome in order to put in place an efficient energy management program. Since energy is only a small part of the total cost of production, it is not considered as a core business. Thus, it is not regarded as a priority in daily management. It is only when an increase in energy costs is observed that an energy management program is set up. This course of action will often lead to short-term results, which will once again relegate energy management to a position of secondary importance. Consequently, after a short period of time, energy costs will increase again and the cycle will repeat indefinitely. To be effective, energy management needs constant attention. For this reason, top management commitment is a necessary condition for an effective energy management program [13].

Another frequently encountered difficulty is the lack of resources for energy monitoring as well as for implementing energy efficiency projects. Most of the time, resources allocated to energy management are accounted as operating costs, while these should be considered as an investment directed at increasing the factory productivity. Another consequence of the secondary role played by energy is the low level of energy metering and recording frequently done in the factories. The few pieces of information available are often spread all over the factory and are neither centralized nor allocated to business units due to the lack of human resources. The availability of reliable data is usually a bottleneck when implementing an energy management program [14].

Today, even if the food industry is a non-energy intensive industry, higher energy prices and the Kyoto Protocol have attached an increased importance to energy efficiency. As a consequence, top management is making resources available to set up energy management programs and to coordinate the agents involved in these programs: factory manager, technical manager, maintenance and project engineers, production and utility operators. These agents have different visions and expectations. According to O'Callaghan, the goal of an energy management program is to monitor, record, analyse, critically examine, alter and control energy flows so that energy is always available and utilised with maximum efficiency. The needed knowledge to fulfill these goals includes engineering, economics, management and information technology [15].

In the field of engineering, a wide range of methods andtools are available to support energy management programs:

- energy monitoring tools;
- process modelling, simulation and optimisation tools;
- process integration;
- energy and exergy analysis; and
- decision support tools: best practices, literature, etc.

The first method can be considered as a top-down approach while the three following ones are considered as bottom-up approach, since they are focused on the process itself. In the industry sector, only one of these two groups is often used for energy management purposes. The last method compiles general conclusions and pieces of advice available in previous studies. This paper presents an energy management method that combines a top-down approach which offers a holistic vision of the energy consumptions in the factory with a bottom-up approach which determines the efficiency gaps between the thermodynamic requirements of the process operations and their technological implementation in production. Together with the best practices, this method will help in defining road maps towards energy efficiency measures [16].

B. ISO 50001 in food industry

Energy and resource management is playing more and more of a fundamental role in companies in the F&B industry. On the one hand, increasing energy expenses are becoming noticeable in production costs, and on the other hand profitable margins can only take effect if costs are reduced. In more and more countries measures are also being taken in the area of energy efficiency and the sustainable use of resources according to legal guidelines or requirements for financial support [17].

The new standard not only answers the question: "What should an energy management system be able to accomplish". It also supports companies in achieving successful implementation by means of guidelines and instructions. Management needs to give clear specifications of their goals and implementation requirements and, where possible, all employees should be involved in the realization and the ongoing process [18].

It is not strictly about quantitative decisions, or lowering energy consumption at all costs, because a decrease in production volume and quality should also be avoided. It is about specifically analyzing energy data, discovering and utilizing optimization potential – and steadily continue the process [9].

A central part of the ISO 50001 certification can already be derived from the familiar PDCA cycle of the ISO 9001 (quality management systems) and the ISO 14001 (environmental management systems) standards:

- Plan: Understand the situation and create goals and plans for improvement on the basis of energy output performance indicators (ENPIs).
- Do: Put plans into action.
- Check: Measure results, monitor, document and evaluate.
- Act: Strengthen positive experiences and continue development across the entire organizational system and over various production teams [19].

The zenon Product Family has already proven itself as the centerpiece of an EDMS during running operations. Why is zenon particularly suited as the core component of an energy data management system? Well, zenon:

- Provides over 300 communication protocols: so data can be easily collected from the entire system infrastructure.
- Can process the collected data in real time, analyze and prepare as well as archive in various formats, including SQL.
- Can display information logically and clearly.
- Can integrate any desired amount of employees or data sources, also via the web.

- Can be integrated into any system without the need for revalidation and saves training costs [20, 21].

Finally, some factories such as Pepsi implement ISO 50001 by zenon measurement so can be considered as an example of energy managed system that implemented in a food industry [22].

IV. CONCOLUSION

Energy management that certificated by an international standard system named ISO 50001 can be implemented in industry such as food and beverage industry and this has investigated in this study. ISO 50001 certificate can assure the energy efficiency and management in food manufacturer unit. PDCA system (Plan, Do, Check and Act) that considered as protocol for ISO 14000 and 9000 also has used for ISO 50000. Pepsi Company is the first manufacturer that has implemented the ISO 50001 protocol.

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