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Energy Management Maturity Model: an organizational tool to foster the continuous reduction of energy consumption in companies

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ABSTRACT

Energy has recently become one of the key aspects that companies should improve and keep monitoring, due to the related economic costs and the significant environmental impacts, to which today's society is paying more and more attention. An Energy Management System could offer many advantages, such as energy consumption and cost reductions, improvement of corporate image, environmental impact reduction. Organizations have therefore developed more comprehensive approaches to Energy Management, aiming at reducing energy waste, but also at managing energy use by applying specific focused programs. Maturity Models are tools used to assess the level of maturity of an organization, providing a systematic framework for carrying out benchmarking and performance improvement. With regards to Energy Management, existing tools are still not well-structured and do not allow a deep analysis of the level of maturity of an organization and of how this maturity develops along with its dimensions. In this article the described general Maturity Model tools are implemented, providing an innovative method in order to apply those concepts to the Energy Management field, aiming at bridging the aforementioned gaps. A user-friendly tool, focused on the company and its organization, is provided to allow practitioners to easily and autonomously assess their company's maturity level, drawing a first growth plan draft. This method represents a new way to lead the organization to a proper management of its energy needs, and is alternative or complementary to the certification of the Energy Management System of the organization, being consistent with the ISO 50001 standard.

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1. Introduction

Energy is a critical resource for any kind of organization. Indeed, besides its economic costs, energy entails additional expenses, mainly environmental and societal, related to its waste and due to resource depletion and contribution to climate change (Amundsen, 2000; Robèrt, 2000), and can also have a deep impact on the company's image. Improved energy performance can provide rapid benefits for an organization (Laitner, 2013; Dobes, 2013; Pye and McKane, 2000), maximizing the use of its energy sources and energy-related assets, thus reducing both energy costs and consumptions (Bunse et al., 2011). Energy is therefore becoming an increasingly critical production factor: its proper management can give companies an important competitive advantage and strategic asset, enabling them to react to changing development scenarios flexibly (Laitner, 2013). A deep adoption of Energy management practices represents a far-seeing management view and can be considered an effective indicator of future profitability. Despite this, there are companies where energy management still has low priority and isolated attempts to reduce consumptions, rather than a systemic approach to the problem, are often found in practical applications.

Although a few Energy-intensive industries have been applying Energy management prior to 1973, it was for the most part unheard of until then. In order to deal with rising energy costs, organizations started to develop more comprehensive approaches, which went from programs to reduce energy use, to programs that managed energy use (Piper, 1999). When a greater awareness about greenhouse gas emissions started to spread all over the world, the Kyoto protocol was negotiated, and subsequently adopted in Europe through the 2006/32/CE regulation, mainly emphasizing:

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- the need for member states to clearly define the objectives, incentives and mechanisms to facilitate the diffusion of Energy Efficiency measures, and
- the importance of developing and promoting a market for energy services and products that increase energy performance.

This regulation led to the adoption of European technical regulations: the UNI-CEI-EN 16001:2009, that for the first time attempted a unifying process at supranational level (and merged in the ISO 50001 international standard), and the UNI-CEI-EN 15900:2010.

Piper (1999) stated that "economic considerations have always been the primary driving force behind energy management […]. Energy management has repeatedly demonstrated itself over the past twenty years to be one of the most cost-effective means of profit improvement-cost reduction". The aim of this paper is, therefore, to provide an easy-to-implement tool to help companies self-assess their own Energy management maturity level (i.e. the depth of the adoption of Energy management practices), hence making it possible for them to autonomously start dealing with the development of a proper growth plan, and contribute to the spreading of Energy Efficiency practices to all levels of the organization and in any industrial sector, fostering compliance to international cogent and voluntary regulations.

2. Background: energy Management Systems and Maturity Models

According to Capehart et al. (1994) Energy Management (EM) is "the judicious and effective use of Energy to maximize profits (minimize costs) and enhance competitive positions". This becomes a critical concept when considering that energy costs are the highest of all costs incurred by an organization during the production phase. According to Petrecca (1992), "Energy management means ensuring that users get all the Energy necessary, when and where it is needed, and of the quality requested, supplied at the lowest cost. Of course, this aim must be achieved while duly safeguarding both production and environmental needs". Thus, the final goal of Energy Management is that supplied Energy is used as efficiently and effectively as possible (Piper, 1999), not only affecting energy supply and distribution, but also its final use (Carbon Trust, 2010c). Energy Management requires a systematic and continuous approach, and cannot be confused with programs or projects that are limited in time, as specified by Piper (1999).

The next paragraphs provide a brief introduction to both Energy Management Systems and Maturity Models, useful to better understand the application of maturity evaluation techniques to Energy management.

2.1. Energy Management System

An Energy Management System (EnMS) is a "set of interrelated or interacting elements to establish an energy policy and energy objectives, and processes and procedures to achieve those objectives" (ISO 50001:2011). EnMS starts with an energy policy, defines energy targets and roles for their achievement, establishes a system for monitoring energy performances and implements procedures for continuous improvement in energy performances.

The standard does not define specific performance criteria related to energy consumption and efficiency (it instead proposes a management model that contributes to develop and implement the energy policy and to establish targets, goals and action plans taking into account legal requirements and information coming from the analysis and control of energy consumption data) and is useful to identify requirements that should be adopted. It describes the end point, but not the path to reach it, and it does not allow an organization to clearly understand its position on this path. Even if it shows continuous improvement, an organization can be either complying with the standard or not, without the possibility to manage its progressive growth explicitly.

2.2. Maturity models

The origin of the concept of business "maturity" dates back to the development of the quality movement in the Thirties; but Phillip Crosby (1979), is often considered to be the real inventor of what would become the "maturity models". The concept of the maturity of an organization has been defined by De Bruin and Rosemann (2005) as "a measure to evaluate the capabilities of an organization in regards to a certain discipline". Typically, the maturing element is a person, an object or a social system. The focus area determines which indicators of maturity can be used to assess a maturing element.

The ability to explicitly recognize the existence of a path of gradual growth for the organization, given by the comprehension of its maturity level, allows a more effective and efficient identification of actions and directions to guide it towards excellence.

Maturity Models are tools used to assess the level of maturity of an organization. Kohlegger et al. (2009) defines them as follows: "A maturity model conceptually represents phases of increasing quantitative or qualitative capability changes of a maturing element in order to assess its advances with respect to defined focus areas". Maturity Models "allow individual and organizations to self-assess the maturity of various aspects of their processes against benchmarks" (Neuhauser, 2004); at the same time they provide "a systematic framework for carrying out benchmarking and performance improvement" (Demir and Kocabas, 2010).

Models generally structure the maturing elements' developments into a suitable number of phases, which are commonly separated by non-metric based trigger conditions and put into a sequential order (Kohlegger et al., 2009). The optimum level of maturity is recognized as being the level that delivers the organization's strategic objectives most effectively and efficiently, not necessarily corresponding to the highest level of the defined scale. The need to introduce the concept of maturity derives from the fact that the only theoretical or technical knowledge and the mere possession of all tools and resources needed for production activities (without considering the maturity of the environment) do not guarantee the company's success. In order for this to happen the organization has to move synergistically along certain directions, or dimensions, that generally regard: the strategic alignment, the presence of adequate technical and organizational skills, the method of application of acquired knowledge, the ability to performance management.

In fields such as Project Management, several researches (Stevens, 1998; Ibbs, 2002; PMI-RJ, 2008) conducted in recent years showed that maturity and success actually go at the same pace (Stevens, 1998).

The existing maturity models can be differentiated according to various criteria, related to the way organizations use them. Those criteria include (Introna, 2009):

- Model structure: continuous or in stages;
- Methodology of analysis: the way the maturity is determined;
- Reference to international standards;
- Mode of assessment: technical procedures through which the assessment is operationally conducted (including self-assessment);
- Results of assessment: the key elements to understand strengths and weaknesses of the organization, and