



Assessing the driving factors for energy management program adoption



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ABSTRACT

The concept of energy management (EnM) became a topical issue in industrial settings as a result of the energy crises that affected the global community in the 1970s. However, EnM was not implemented within industry with all its potential to improve energy security, raise the maturity level of EnM and increase sustainability. According to the results of previous empirical investigations, the expected interest in energy programs is not found and there is no clear understanding about program adoption criteria within an industry. Keeping in mind the adoption of energy investment through conformation with financial analysis and choosing the investments through contextual factors in the organization (e.g. organizational energy culture, power relationships, EnM system, expertise availability, managers' mindset) together with characteristics of EnM program as two macro perspectives in energy efficiency literature, this paper aims to understand the main driving factors which lead organizations to either adopt or not adopt a particular program (always with respect to energy management). Moreover, it aims to express the impact of those driving forces of implementing a successful EnM program which could contribute to better understanding of suitable EnM configuration. The investigation has been conducted as a multiple case study involving 15 manufacturing companies of varying size and in different sectors located in Sweden. After analyzing the minimum required steps to establish EnM, assessing the adoption of practices according to their energy strategy, and through assessing EnM maturity level, we found a low level of risk (which arises from lack of certainty and awareness) and the program's alignment with the core business as prominent driving factors for all sizes which foster positive investment decision making through top management. On the contrary, complexity of industry (for large manufacturing companies) and access to capital (for small and medium-sized companies) are the main barriers to adopting those programs.

1. Introduction

Believing energy to be finite and nature as a place to live not only for the present generation, but for future generations increasingly leads us to use energy smarter and more efficiently. Meanwhile, industry, especially energy-intensive industries, as a major energy user receives relatively more attention. While according to an International Energy Agency report in 2007 [1], industry in all sectors had made successful improvements, Hirst and Brown's claim in 1990 [2] about the existence of the gap between the actual level of Energy Efficiency (EE) and its potential still remains strong [3]. According to IEA, if current trends continue, two-thirds of the economic potential to improve EE will remain untapped until 2035 [4]. Several researchers addressed barriers to implement EE measures, namely the complexity of energy efficient technology [5], and implementing EE measures is a challenge because of industry's complexity (an industry's characteristics) [6]. Therefore, this challenge makes it difficult to generalize any success stories or

programs. Researchers addressed Energy Management (EnM) as a tool for overcoming EE barriers. Energy management means to optimize one of the most complex and important managerial and technical creations that we know: the energy system.

The necessity of EnM for those industries willing to be and stay competitive is mature enough, according to the different type of drivers which lead a particular industry to adopt EnM. Within the last twenty years, with increasing energy prices and a global energy crisis, previous studies addressed its strategic and efficient role in improved energy systems. Fig. 1 shows the most discussed drivers for EnM adoption within industry. Drivers can be classified through EnM's capability to overcome barriers related to implementing EE measures, energy fluctuation trends, through its capability to increase a company's focus on improving energy system and other external pressures like environmental legislation (Fig. 1). To establish a proper EnM program in the body of EnM literature, certain minimum steps must be implemented. Those elements, illustrated in Table 1, are addressed in previous

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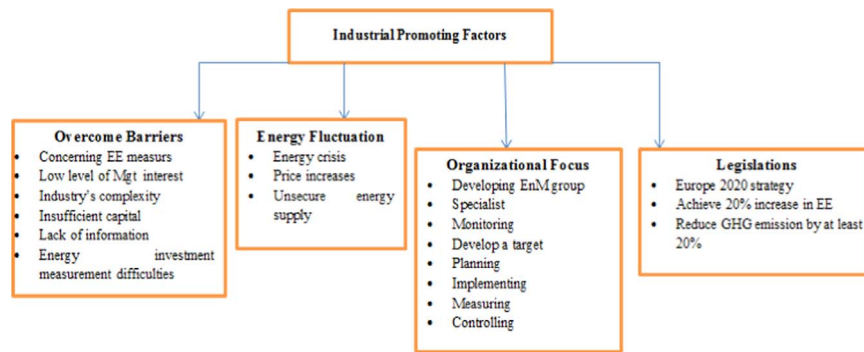


Fig. 1. Industrial drivers to adopt EnM.

Table 1
Minimum required steps to establish the EnM.

Refs.	Required steps	Code
[7,11,36]	Long-term strategic planning	S1
[36]	Energy practices by allocating responsibilities and tasks	S2
[7,10,36]	Establish energy management team by energy manager	S3
[10]	Developing procurement policies	S4
[7,10,36]	Conducting initial energy audit	S5
[7–11,36]	Implement energy-saving projects	S6
[10,36]	Monitoring the project's progress	S7
[11,36]	Monitor energy use by main energy user equipments	S8
[7,10,36]	Develop report documentation	S9
[11,36]	Top management support	S10
[36]	Awareness and training	S11

Table 2
Strategic investment descriptions.

Refs.	Description of strategic investment
[25–27]	Decisions as vital importance.
[28]	Decisions which have a significant effect on the organization as a whole.
[25,28,29]	Decisions which have a significant potential for improving corporate performance.
[30]	Strategic means important and not secondary issue.
[31]	Decisions regarding the goals, domains, technologies and structure of a firm.
[32]	Decisions regarding a firm's development through products-market-technologies triplets
[33]	An investment is "strategic if it contributes to create, maintain or develop a sustainable competitive advantage"

studies [7–11] and cited in [6]. However, improving energy system through EnM is also difficult because of many misconceptions between practitioners (e.g. only big companies can do it, only plants with new equipment can do it, large capital budgets are required, we don't have enough time and staff, we already do everything we can, and everybody manages energy) and the barriers which depend on the geographic location and nature of the industry itself (such as energy intensity and size) [12,13]. Therefore, the maturity level of EnM programs (which can be assessed through EnM programs for policy, organizing, training, performance measurement, communication and investment [Appendix B] with its huge potential for improved energy systems is still far from what it should be in practice based on the adopted highest success levels. That remaining potential has been untapped not only because of the mentioned barriers, but also because of lack of understanding about *how* an EnM program should be planned. Consequently, it causes a weak alignment between energy programs and the company's total strategy or the company's macroeconomic policy and also because of lack of transparency which accordingly increases the nature of risk at different levels.

In EE literature, EnM through its systematic programs and more precisely through its practices is characterized as an industrial energy system support function. However, EnM is not properly implemented and/or not fully adopted in practice, with all its potential, to help companies improve their EnM maturity level and, as a consequence, to enhance the energy system. In a macro perspective, there are two different perspectives in the body of EE literature about investment decision making. A number of earlier researchers [14–17] believe EE investments would be decided upon if the financial analysis conforms

to the investment for a particular program (which is in line with finance theory). However, others [18–21] emphasize other contextual factors, such as organizational energy culture, power relationships, EnM system, existence of expertise, managers' mindset as well as external factors such as energy price. Moreover, earlier researchers [13,19,22,23] addressed strategic links between any EE investment with the company's core business as an important driving factor. Fleiter et al. [5] in a study about the low adoption rate argued that the characteristics of EE measures can enhance the adoption rate. Therefore, among other driving factors, the strategic characteristic of an investment is essential to foster its adoption through top management [24]. However, strategic decision making literature did not provide a clear and applicable answer about what makes an investment strategic. Some researchers in this field have described strategic decisions as follows in Table 2.

The definitions provided by strategic process research are not comprehensive enough to understand the strategic character of investment decisions because the aspect of the scope and content of investments is not properly taken into account. Adopting a practice based on how it is aligned with an organization's strategy would not lead us to clear and proper selection and would leave us in a vague situation. The reason is that either the firm's strategy is not often identifiable or it is nonexistent [33]. Cooremans [33] and Sa et al. [34] argued in their papers about enhancing the understanding of the scope and/or target of each practice or investment to make it more strategic and aligned with organization's total strategy. Sa et al. [35] argued that without understanding the scope and target of a particular energy management practice (EnMP) it is not possible to avoid an overlap

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