Energy Management Practices in Energy Intensive Industries

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Abstract

Energy plays a key role in achieving the desired economic growth. The entire fabric of developmental goals is webbed around a successful energy strategy. Energy is a pivotal prerequisite of developed economy and social structures. The aim of this paper is to describe and analyze energy management practices in two different energy-intensive industries: the pulp and paper industry and the foundry industry. In this paper importance of energy management and its benefits are discussed.

1. Introduction

Effective energy management for facilities (e.g., hospitals, factories, malls, or schools) is becoming increasingly important in view of rising energy costs, the government mandate on reduction of energy consumption and human comfort requirements. The problem is to minimize the energy and demand costs while satisfying human comfort, system dynamics, load limit constraints, and other requirements.

Industrial energy efficiency is becoming increasingly important from the point of view of both public economy and business. Governments have instituted several incentives to increase energy efficiency in industry, since this is one of the most promising means to reduce CO2 emissions resulting from the use of fossil fuels [1]. From a business point of view, greater energy efficiency is of importance as it has direct economic benefits such as increased competitiveness and higher productivity. Research, however, has shown that despite the existence of cost-effective energy efficiency measures in industry, these are not always implemented due to various barriers to energy efficiency.

For industry there are two main means of coping with increase in energy price 1) supply side management, for example investment in new electricity production and negotiating lower prices with energy suppliers, and 2) demand side management, for example a greater focus on energy management. Recently, energy management has been the subject of considerably increased attention as regards policy formulation. It should also be noted that the paper does not aim to evaluate energy management standards and practices but more on an aggregated level describe and analyze how energy management is carried out in two highly energy-intensive industries.

2. Energy management in industry

The primary objective of energy management is to maximize profits and minimize costs. The main objectives of energy management programs include:

1. Improving energy efficiency and reducing energy use, thereby reducing costs.
2. Reduce greenhouse gas emissions and improve air quality.
3. Cultivating good communication on energy matters.
4. Developing and maintaining effective monitoring, reporting and management strategies for wise energy usage.
5. Finding new and better ways to increase returns from energy investments through research and development.
6. Reducing the impacts of curtailments, brownouts or any interruption in energy supplies

Energy management is a means to overcome barriers to energy efficiency. Research by has shown that industries who adopt energy management practices may save up to 40 percent of their total energy use [2]. Both top managements wholehearted support and a strategic approach are of outmost importance if an energy management programme is to succeed. Some other important elements include an initial energy audit, senior managements support, monitoring of energy use, an energy policy, a programme for energy saving projects, and staff motivation and training [3]-[4]

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3. Energy intensive industries

The energy intensive industries include paper and pulp industry and foundry industry considered in this paper. This research was carried

out as a case study of the pulp and paper and foundry industries. Case study research is especially advantageous when, how or why questions are asked about a contemporary set of events over which the investigator has little or no control. The research was carried out using a questionnaire focused on energy management practices.

Three issues of importance to energy management in industry were chosen as indicators, viz. the pay-back criteria for energy efficiency investments, the existence and duration of a long-term energy strategy, how the companies allocate their energy costs, and how various information sources for energy efficient technologies are valued.

In an attempt to categorize the studied industries, based on three of the chosen indicators, in terms of success or lack of success as regards energy management practices, three categories were chosen. The first category comprised those mills and foundries that answered affirmatively to having pay-off periods for energy efficiency investments of two years or more, having an energy strategy of three years or longer and allocating energy costs based on sub-metering. The second category comprised organizations that answered affirmatively to two of the statements and the third category comprised the remainder of the mills and foundries.

4. Energy management practices in energy intensive industries

The following section outlines and analyses the results of the study, beginning with results regarding the industries pay-back periods, followed by results regarding the existence and duration of a long-term energy strategy and the results regarding the allocation of energy costs. In the final part of the section, the companies are categorized in terms of successful energy management practices, and the industries view on various information sources is presented.

4.1 Pay off criteria

Several different ways of calculating potential energy efficiency investments exist, one of the most recognized and straightforward methods being the pay-off method. As it can be seen from Figure. 1, most of the companies apply a pay-off criterion of 3 years or less for energy efficiency investments, which can be compared with a general pay-off period of 4.1. It is often problematic to distinguish investments in energy efficiency.

This is due to the fact that an investment is in many cases related to both production efficiency and energy efficiency. Moreover, a discrepancy between operational and strategic measures should also be noted. Many of the energy efficiency investments related to the support processes, have lower initial costs compared to heavily capital intensive production processes.

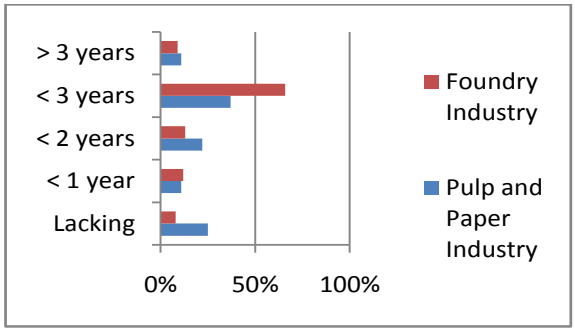

Figure.1 Payoff-criteria for energy efficiency investment shown as percentages of the total number of responses

This means that while the support process measures may be adopted on an operational level in the organizations, many of the heavily capital-intensive production process related investments are often related to strategic decision making. Though, 25 percent of the studied energy-intensive foundries lack investment criteria for energy efficiency investments, which may indicate an area for potential improvements concerning energy management practices.

4.2 Existence and duration of long term energy strategy

A long-term energy strategy should not be considered to be equivalent to an Energy Management System (EMS), which is adopted on a more operational level, lower down in the organization supporting the operation of energy management. Energy management should have the support of top management and adopting a long-term energy strategy is an important means of emphasizing this. However, successful energy management practices could be facilitated by an EMS.

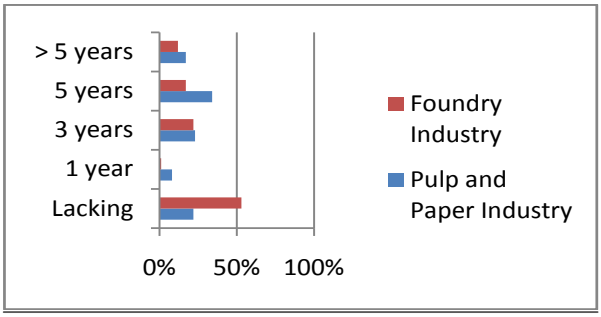

Figure. 2 Existence and duration of a long-term energy strategy

As shown in Figure. 2, about one fifth of the pulp and paper mills lack a long-term energy strategy, and more than half of the foundries lack such a strategy, indicating that these industries do not consider energy management to be a core activity. Moreover, Figure 2 also indicates that less than half of the pulp and paper mills and less than 30 percent of the foundries have an energy strategy of at least five years. Adopting an energy strategy of one to three years and calling it "long-term" is useless. This shows that most of the companies either lack a strategy or have a strategy with regard to energy of three years or less, indicating areas for improvement with regard to energy management practices. The explanation for this may be an increased focus on core business that may result in fewer resources being allocated to non-core activities such as energy management.

4.3 Allocation of energy costs

In many industries inadequate allocation of energy costs may lead to slack energy management [5]. A monitoring system using sub-metering at plant level is one of the major prerequisites for proper energy cost allocation, and successful energy management adoption. However, research shows that it is not always installed in manufacturing companies and even where it exists it is not always used for proper energy cost allocation.

Figure. 3 show that the majority allocate energy costs using sub-metering. However, about one fifth of the mills and about one third of the foundries do not allocate energy costs at all, and at about one tenth of the industries, energy costs are allocated per square metre and per number of employees respectively. This indicates that the split incentive problem may be of importance, even among the studied energy-intensive industries.

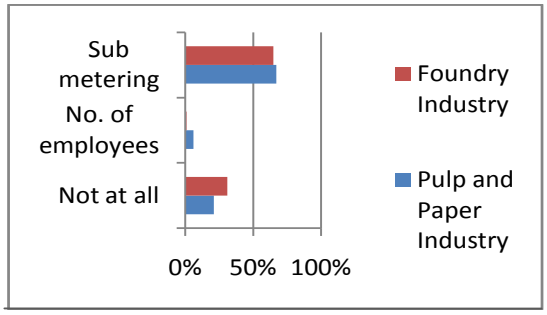

Figure. 3 Allocation of energy costs.

4.4 Categorization of successful management practices

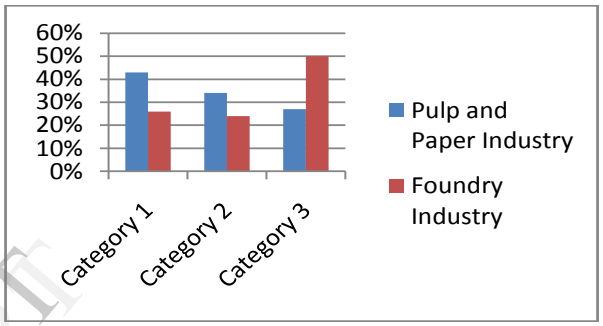

Figure. 4 Categorization of energy management practices

The first category includes those companies that answered affirmatively to having pay-off periods for energy efficiency investments of two years or more, having an energy strategy of three years or longer and allocating energy costs based on sub-metering. The second category comprises companies that answered affirmatively to two of the above outlined statements, and the third category comprises the remaining companies. As can be seen from Figure. 4, about 40 percent of the pulp and paper mills and 25 percent of the foundries may be considered successful, using the three indicators. The use of indicators is a very rough means of making such a categorization but it nevertheless gives an indication that a potential for improvement seems to exist as regards energy management practices in the studied industries.

5. Conclusion

Energy conservation ultimately leads to economic benefits as the cost of production is reduced. In energy- intensive industries like pulp and paper and foundry industry. The cost of energy forms a significant part of the total cost of product. Using energy efficient technologies will reduce the manufacturing cost and lead to production of cheaper and better quality products.

Based on the research results presented in this paper, even among energy-intensive industries, energy management does not seem to be fully prioritized at all the companies – around 40 percent of the mills and 25 percent of the foundries may be considered successful in terms of energy management. Moreover, the degree of adoption of energy management practices seems to increase with the size of the company and in particular increase with energy intensity.

If energy management is not fully prioritized in energy-intensive industries – the pulp and paper industry and foundry industry it will probably not be prioritized in less energy-intensive industrial sectors either. This indicates a large untapped potential with regard to achieving cleaner and more environmentally sound production in different industrial sectors.

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