ENERGY-MANAGEMENT IN SMALL SCALE INDUSTRIES: A VITAL TOOL FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Risk of continuous depletion of natural resources of energy has led to a greater awareness for energy management throughout the world. Energy should not only be used wisely and economically, it should also be conserved effectively for future generations. Industry, being one of the major users of energy, by adopting energy conservation, can contribute substantially for social and economic development of a country. Small and micro industries often exist in the form of clusters and act as an important component of Indian economy. Energy being an vital input, enhancing its utilization efficiency not only helps in improving competitiveness of Small scale industries through cost reduction but also aids in improving energy linked environmental pollution. A survey has been conducted on energy practices being adopted by some cluster industries in Haryana and Punjab and a six-stepped Plan has been proposed for improving performance of energy management programme in these industries.

Keywords: Energy Management, Energy Audit, Energy Conservation, MSMEs, Sustainable Development.

1. INTRODUCTION

The Micro Small and Medium Enterprises (MSMEs) play a crucial role in the overall industrial economy of the country. In current years, the MSME sector has constantly registered superior growth rate compared to the overall industrial sector. The major benefit of the sector is its employment probable at low capital cost [1]. For a nation, economic development crucially hinges on both increased supply and efficient use of energy inputs. Energy saving helps in...
cutting down costs of production and hence raises levels of productivity. There is lack of concern among Indian industries, especially small scale sector, to organise themselves as a sequel to energy crisis for reducing their energy intensity [2]. Recognizing the scope and potential for energy conservation and the urgency to outline specific programmes in this field, National Productivity Council recently carried out energy audit studies in 1200 industrial units covering 12 sectors of Indian industries. These studies indicated that there is a potential of saving of energy up to 15 percent of the energy consumed in the industrial sector [7]. The potential for energy savings in the process modification is placed around additional 15 percent. The R&D programmes that could be adopted in the long term are to yield further 15 percent more energy savings. Thus the need to conserve energy, particularly in industry and commerce is strongly felt as the energy cost takes up substantial share in the overall cost structure of the operation. Hence it calls for management of energy[3].

2. AN INVESTIGATION ON ENERGY MANAGEMENT PRACTICES ADOPTED BY SMALL SCALE INDUSTRIES

A Preliminary survey on energy practices being used has been carried out in two cluster industries, (1).Textile and Spinning Units in Ludhiana (Punjab) (2). Foundry Units in Ambala and Garaunda (Haryana). Information was collected personally and through questionnaires on measures being adopted for energy audit and energy conservation in these industries. Some of the findings are

(a) Decreasing use of oil and coal has been offset by substantial increase in electricity consumption over last ten years.
(b) Awareness on energy-management was lacking, (65 percent industries never, 20 percent industries seldom and 15 percent industries regularly carried out an energy audit).
(c) Resource allocation for effecting energy conservation is almost nil in most of the industries
(d) Almost all industries (95 percent) admitted that energy waste always led to a hike in cost of production, though action plan was mostly missing.
(e) In almost all units, poor availability of electricity affected production and resulted in poor utilization of resources. So self-generation of power and use of renewable energy sources was on priority plans but lack of funds and information was retarding its implementation.
(f) Some broad areas and opportunities for energy conservation which can be effected in these industries can be identified as:

- Adoption of direct saving techniques that help avoid wastage and wasteful uses such as good housekeeping measures and regular maintenance;
- Changeover of costly and exhaustible sources of energy such as oil, by new and renewable energy sources and by relatively abundant energy sources like coal.
- Implementation of total energy systems in industrial process such as co-generation, integration of all thermal operations etc.
- Reconditioning of energy wastes through various waste heat recovery systems.
- Retrofitting of old industrial machinery to achieve optimal energy utilization.
• Improving efficiency of conversion of primary fuels into secondary forms of energy, ensuring the quality of energy supplied and minimizing transmission and transport losses.
• Adoption of material conservation measures to reduce the consumption of energy intensive materials and products along with recycling of materials, re-using of components, etc.
• Embracing of preventive maintenance techniques to cut down the energy and material costs involved in routine overhauls and breakdowns.
• Arrangement for industrial processes to monitor energy use.
• Rigorous research on viable energy alternatives and less energy intensive techniques.

3. SIX STEPPED PLAN FOR ENERGY MANAGEMENT IN SMALL INDUSTRIES

Energy used in industries is basically in three primary forms: electricity, coal and oil. All these three sources need conservation for sustainability and growth [4]. In both industrial and commercial operations, energy is a critical input that is used in numerous site-specific applications, such as transforming raw material, operating computing and communication equipment, and providing comfort and lighting. While successful organizations always pay particular attention to their primary factors of production, energy inputs are often overlooked because they are complicated to understand and easy to take for granted. Taking a laissez-faire approach to the management of energy is the easy way out, but it can have significant bottom-line consequences. Effective energy management offers a range of advantages including reduced operating cost, mitigated environmental impact, and improved conversion efficiency. It can provide a measured operating cost advantage over competitors and increased sustainability of operations [5]. Although implementation requires both commitment and investment, most companies can develop and put into practice an effective energy management plan, creating major impacts to a company’s bottom line [5].

For any energy management programme to be successful, a rational approach to energy measurement, evaluation, planning and improvement is essential. Energy-waste has assumed alarming proportions and to check further degradation, conservation measures ought to be adopted and reported on a mandatory basis by the industries [6]. Based on the present scenario, six stepped Plan have been proposed for the energy-management. This model can be effectively adopted step by step by small industries to achieve tangible results.

Step-1: Generating Awareness

Awareness on energy-management in an organization can be created by explaining and defining various aspects of energy. Both management and employees should understand and appreciate the benefits of energy conservation in qualitative as well as quantitative terms [5]. Various tools like posters, graphs, slogans, questionnaires and inter-firm comparison reports can be used for creating an effective environment for better awareness in energy management [8]. Benefits of energy conservation to employers, to employees, to society and to consumers of products must be cited separately for better appreciation by all. Everyone should actively participate in energy management and like TQM; the process should be treated as "TOTAL ENERGY MANAGEMENT"(TEM) programme.
Step-2: Energy Audit (Inspection)

Energy measurement involves a systematic selection of an approach and inputs - outputs for an organisation. Several factors like nature of inputs and outputs of energy, the complexity of operations, the period of study etc. affect measurement process [9]. Energy measurement constitutes a vital part of Energy Audit” which serves to identify all energy streams into a facility and to quantity energy use according to discreet functions. This step identifies the costs of energy and where and how it is used. A base is created from which results can be measured and further programmes can be developed.

Step-3: Energy Assessment

After measurement of inputs-outputs and costs of energy, existing performance levels are analyzed. Energy wastes are identified and quantified for setting further modalities. Energy measurement and evaluation creates a platform for setting realistic targets of energy utilization and makes available several alternative options towards achieving the same. Generally those options which meet the financial / techno-managerial criteria of the companies are pursued to their implementation stage [8]. A rational energy evaluation imparts credibility to the "Energy Audit" being carried out by the firm and this further helps in providing sustainability to energy conservation programmes likely to be implemented.

Step 4: Energy Scheduling (Energy Conservation)

The evaluation and measurement steps complete the energy audit process and this must be followed by some scheduled actions which are understood and supported by both management and employees. Effective planning is a major determinant for the success of improvement programmes and all these improvement programmes are modelled with some targets or objectives to be achieved. Planning basically decides on nature, timing, costs and action areas for different strategies to be adopted to improve energy utilization levels, keeping in mind the existing organizational constraints [11]. This step must involve SWOT (strengths, weaknesses, opportunities and threats) analysis of the organization, active workers’ participation and external expert support for deciding future energy conservation programmes.

Step 5: Energy Enhancement

Improvement of energy utilization relates to putting into action the various plans and strategies to be adopted for improving conservation levels. These improvement plans can be broken down into following objectives:

a) Improving efficiency ("Working right")
b) Improving effectiveness ("Doing right things")
c) Improving quality of work life

- For improving efficiency, abroad-based traditional industrial engineering approach is always most acceptable. This involves auditing, process simplification, ‘work standard development and use of technology [9].
- Effectiveness means achieving desired goals and for this objectives must be:
  - Clearly stated.
  - Measureable.
  - Consistent with goals.
  - Timely.
Improving quality of work life means maintaining management commitment to and support of employees' involvement in the decision-making process [10]. This includes training and development, recognition and sense of accomplishment, rewards and incentives, team building for cause and safe physical environment. Energy improvement plans vary from industry to industry and from unit to unit.

**Step 6: Consistent Monitoring**

This step involves reporting the success rate of various energy improvement programmes being adopted. This is periodically done to check reliability and robustness of all improvement programmes [12]. All plans need careful implementation and careful implementation needs regular monitoring. The monitoring reflects achievements or failures and hence serves as a feedback mechanism for the system. Some important practices for this step are:-

- Goals and performance must be reported comparatively.
- Periodic energy reports are prepared to check utilization levels.
- Trend charts be prepared to evaluate past present performance.
- A consolidated report to be prepared summarizing significant dates and performance of sector-executives.
- An inter-firm and intra-firm comparison to be carried out as far as possible [13].

**4. CONCLUSIONS**

In recent years, we have been facing "Energy Crisis" and this not only poses a threat but is also a challenge to all nations. All fossil fuels will eventually be exhausted and world is haunted by the specter of oil ravenous civilization. It is this fear which turns our attention towards proper "Management of Energy" in all sectors, especially the industries which account for using 60% of electricity generated in India. A lot of scope exists for conservation of energy by using appropriate methods and better housekeeping "Energy Management" has probably received better attention, mainly because of:

- Reasonably low cost of energy, as compared to other inputs to production systems.
- Ignorance on effective use of energy and its resultant benefits.
- Freedom of passing on higher costs of production to the consumers of industrial goods and household items.
- Lack of maintenance policies, especially in small scale units.
- Availability of ample resources for energy generation in the past.

Industries must adopt energy regular auditing practices and conservation measures to increase their productivity levels. Based on energy practices in some cluster industries in Haryana and Punjab, a six-stepped plan has been proposed which when used will bring in simplification, rationality and effective diagnosis in overall energy management programme being adopted by an industry.
5. REFERENCES