

## Chapter 2

# Energy Management

The effective management of energy costs has gained an increasing importance for European Industry because of the difficulties that they faced by the recession which followed the international energy and financial crisis.

The compression of the energy costs for businesses becomes imperative. In this way, resources are saved and this is beneficial for businesses and their customers.

However, there are additional reasons that require companies to be more aware of energy saving. The global reserves of energy raw materials are getting dry. At the same time, international efforts to reduce the wasted energy which is responsible for adverse climatic changes become more intense.

Consumers are fully aware of the need for effective protection of the environment. They will increasingly prefer companies that provide services and products more environmentally friendly and contribute to the saving of valuable energy sources.

The adjustment of businesses to this new situation, which requires the rational use of energy, is a necessity.

### 2.1 Basic Principles of Energy Management

Energy Management is the judicious and effective use of energy to maximize profits (minimize costs) and enhance competitive positions. The objective of Energy Management is to achieve and maintain optimum energy procurement and utilization, throughout the companies and:

- To save energy
- To minimize energy costs
- To waste without affecting production & quality
- To minimise environmental effects.

## **2.2 Principles, Terms and Operation of Energy Management in Industry**

The principles of Energy Management involve the following steps:

- I. Adopting a policy for rational use of energy and implementation of such a policy
- II. Procure all the energy needed at the lowest possible price (example: buy from original sources, review the purchase terms)
- III. Manage energy use at the highest energy efficiency (example: improving energy use efficiency at every stage of energy transport, distribution and use)
- IV. Reusing and recycling energy by cascading (example: waste heat recovery)
- V. Use the most appropriate technology (select low investment technology to meet the present requirement and environment condition)
- VI. Reduce the avoidable losses (make use of wastes generated within the plant as sources of energy and reducing the component of purchased fuels and bills)
- VII. A strong proof of the environmental awareness of businesses

## **2.3 Energy Saving Management Strategy**

Energy management should be seen as a continuous process. Strategies should be reviewed annually and revised as necessary. Adopting a policy for rational use of energy requires a long term commitment of the administration, of the staff and the operational personnel of the company in order to implement an integrated program which, after a careful study, should be fully adjusted depending to the needs.

The implementation of such a policy of energy saving is an important issue for large industries that have significant electricity costs. Investments on equipment have already taken place and this means that important decisions must be made because the replacement of this equipment requires considerable costs.

In small businesses and individual companies things may be easier, because the owner—manager can directly take decisions.

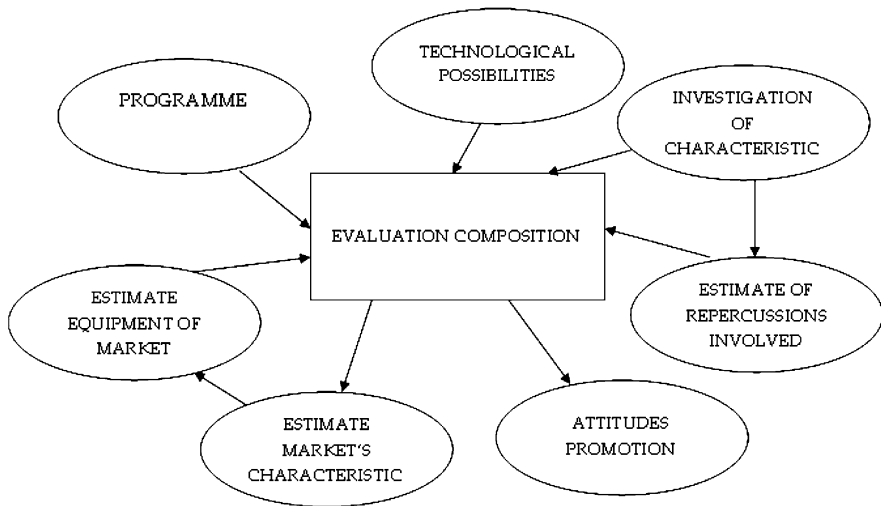
To convince them all—large and small businesses—that must permanently exercise a policy of control and suppression of energy costs, we have to assess the benefits arising from a standard and adjustable policy depending on the conditions of energy management.

Thus, the first step of a business administration—regardless of the size—is to take the decision to implement a policy of energy management.

To ensure commitment to a consistent policy of rational use of energy, all the benefits that will result in a short or in a long term for the business must be presented and evaluated.

The personnel which is going to undertake the task of planning a policy of energy saving should collect important information and present the reasons and advantages for adapting such a policy.

Based on the data available on trends in energy costs, especially electricity, to domestic and international market we can present the following:



The fast growth in international demand for energy raw materials (oil, gas, coal) compared to the total supply, inevitably leads to a continuous increase in electricity costs as well in the price of electricity.

- The EU policy to reduce emissions of carbon dioxide (CO<sub>2</sub>) will create new additional price increases in electricity prices in 2013.
- The constantly growing environmental awareness of public opinion will benefit those companies that follow “green policies” in comparison to the pollutants ones and will contribute to energy saving.

Therefore, the benefits that will be obtained for the companies, regardless of size, from an energy saving policy are:

1. Reduction or maintenance of the total energy expenses as a percentage of the total expenses of the company.
2. Reduction or maintenance of the energy cost as a part of the average production cost of a product or a service.
3. Reinforce competitiveness against companies who are not following energy saving policies.
4. A strong proof of the environmental awareness of businesses through their participation in joint efforts for an effective protection of the environment by saving energy.

This argument can fully support a report to the management of the company for the adaptation of a standard energy saving policy and ensure the necessary commitment.

Thus, the first step of the management of a business—regardless of the size—is to take the decision to pursue a policy of energy management.

The key activities involved in the process are outlined below:

### ***2.3.1 Identify a Strategic Corporate Approach***

The starting point in energy management is to identify a strategic corporate approach to energy management. Clear accountability for energy management needs to be established, appropriate financial and staffing resources must be allocated, and reporting procedures initiated. An energy management program requires commitment from the whole organization in order to be successful.

Depending on the productive activity of the company, and on the energy expenses as a part of the total expenses, the pursued targets should be defined. Such targets may be:

- Development of an efficient energy management in a central level as well as in various activity fields of the company.
- Reducing overall energy costs over time.
- Direct reduction of the current energy expenses in the production levels, central offices, branches etc.
- Potential finding of substitutes of the supplied electric power through investments for self generating energy.
- Planning new investments in a less energy wasting equipment. Such planning is very important as it is connected to the artisanal and industrial businesses with future purchases of expensive machinery and equipment.
- Continuous improvement of environmental performance with significant reduction of pollutant emissions, etc.
- Reducing the cost of energy consumption per product and Services.

### ***2.3.2 Commitment of the Personnel and Appoint Energy Manager***

The most important step in designing and implementing a policy of energy saving management is the commitment of the executives who will be assigned to perform the operation. The executives should have a high level of technical knowledge and wider knowledge of the company's activities as well as a proved interest in introducing new innovations providing best technical performance with the lower costs for the business.

In large companies the employee who is designated to plan and execute this project should work within a strict timetable informing the administration of the company about the progress of the undertaken task during every step.

The administration of the company should monitor the relative works so as to be sure that the best practices are adopted. This is necessary because the decisions taken must be fully aligned with the future investment plans of the company.

The administration must also ensure that:

- All of the executives will contribute to the implementation of the undertaken project.
- All of the executives will contribute with their knowledge so as to adopt common solutions to promote short and long-term investments relying on a continuous cost reduction of the consuming energy.

Therefore it is necessary to create a working group with someone on top, who will be responsible for coordinating the actions of all team members.

All these procedures require decisions, reports, assignment of responsibility tasks and most of all a strict timetable of actions.

The energy manager, who should be a senior staff member, will be responsible for the overall coordination of the program and will report directly to top management. Energy managers need to have a technical background, need to be familiar with the organization's activities and have appropriate technical support.

### ***2.3.3 Set up an Energy Monitoring and Reporting System***

Successful energy management requires the establishment of a system to collect analyze and report on the organization's energy costs and consumption. This will enable an overview of energy use and its related costs, as well as facilitating the identification of savings that might otherwise not be detected. The system needs to record both historical and ongoing energy use, as well as cost information from billing data, and be capable of producing summary reports on a regular basis. This information will provide the means by which trends can be analyzed and tariffs reviewed.

The cost of electricity is the main energy cost and its share to the final product or service differs from company to company.

While the annual cost for electricity can be calculated based on current prices, there are difficulties in assessing long-term costs based on future prices of electricity. Here, we must take into account various factors such as:

The variation of energy prices in energy-wasting industries and in large or small businesses

- The benefits for the companies will emerge through the competition between suppliers of electricity or gas.
- The business plans for new investments to modernize or (and) for the expansion in the area of Renewable Energy sources, as well as the development of collaborations with other businesses for the development of self generating electricity systems.

All these parameters should be taken into account in order to form a long-term planning for the development of European Industries of any size.

### ***2.3.4 Conduct Energy Audit***

An energy audit establishes both where and how energy is being used, and the potential for energy savings. It includes a walk-through survey, a review of energy using systems, analysis of energy use and the preparation of an energy budget, and provides a baseline from which energy consumption can be compared over time. An audit can be conducted by an employee of the organization who has appropriate expertise, or by a specialist energy-auditing firm. An energy audit report also includes recommendations for actions, which will result in energy and cost savings. It should also indicate the costs and savings for each recommended action, and a priority order for implementation.

An effective energy saving policy has as a base the creation of a system of continuous monitoring of all the activities designed and already taking place during an implementation phase of the project.

A very common phenomenon is to take decisions at a highest level for the implementation of an energy saving policy and then, these decisions are fading away because there is always a focus on the daily operation and production of products and services. Energy management policies are concerning long-term future planned activities and therefore are in a lower level in the agenda of the administration.

In order to avoid the possibility of fading away the energy saving policy it is necessary to inform the administration on a regular, monthly or other time, basis.

These information reports will include:

1. Actions implemented since the beginning of the integrated program.
2. Identify problems or delays, analyzing the causes and finding the necessary solutions. While remaining problems are gathered, there is a danger of a failure for the long-term program.
3. Short and long-term actions that have not been implemented yet. Practically this procedure allows not only the evaluation of the progress of the energy saving and environment protection program, but also the evaluation of the work undertaken to implement by the authorized executive and the committee that has been established for the same reason.

The controlling mechanism of the energy management effectiveness should be in a continuous operation and give clear answers to the following key issues:

1. Report on the developing costs of the provided energy overall and by the supplying source, with a comparison of the relevant data through time. Analysis of the results that come out of these comparisons.
2. The level of implementation of the overall policy that has been scheduled so as to be clear and understandable if there are small or large delays concerning the program.

3. Evaluation of the current relation of the financial efficiency of the desired objectives. At this point, it is investigated whether the policy followed is efficient and reduces the energy costs in relation to the total expenses for this purpose (payments, energy/environmental managers, investment costs etc.)
4. Performance in environmental terms in accordance to the goals that have been achieved.
5. Evaluation of the participation of managers and personnel in the efforts to reduce energy costs by product, service, activity sector, etc.
6. Data on current prices and predictions of future prices of energy raw materials and electricity, based on the latest reports collected from various sources.
7. The level of implementation of educational programs that have been planned for energy saving.
8. Detailed presentation of the investment program that has been scheduled and approved by the administration of the company. With quantification of all the elements so as the level of implementation to be understood and easily identify deviations from the original program.
9. Report by the energy manager on the effectiveness of the external consultant and evaluation of his participation based on what is stated in the contract agreement that has been signed with the company.
10. Report by the external consultant on the progress of the project, the effectiveness of his cooperation with the work team for the energy saving and the head energy manager. This report is very important for the administration so as to have an independent opinion on the difficulties faced for the implementation of the long-term planning.

Based on the reports and data that will be presented, it is responsibility of a company's administration to make a total and individual evaluation of all the participants that have been assigned to implement the project of energy saving.

The administration must undertake all these activities that will allow overcoming any delays or to adopt changes that are feasible or necessary because of significant changes to key parameters.

If necessary, changes may be required concerning persons if found failing in performing their obligations or concerning the external partner if he has not fully met his obligations.

### ***2.3.5 Formalize an Energy Management Policy Statement***

A written energy management policy will guide efforts to improve energy efficiency, and represents a commitment to saving energy. It will also help to ensure that the success of the program is not dependent on particular individuals in the organization. An energy management policy statement includes a declaration of commitment from senior management, as well as general aims and specific targets relating to:

- Energy consumption reduction (electricity, fuel oil, gas, petrol etc.)
- Energy cost reduction (by lowering consumption and negotiating lower unit rates)
- Timetables
  - Budgetary limits
  - Energy cost centers
  - Organization of management resources.

### ***2.3.6 Prepare and Undertake a Detailed Project Implementation Plan***

A project implementation plan should be developed as part of the energy audit and be endorsed by management. The plan should include an implementation time table and state any funding and budgetary requirements. Projects may range from establishing or changing operational procedures to ensure that plant and equipment use minimum energy, renegotiating electricity supply arrangements etc. to adopting asset acquisition programs that will reduce energy consumption. An overall strategy could be to introduce energy management projects, which will achieve maximum financial benefits at least cost to the organization.

### ***2.3.7 Implement a Staff Awareness and Training Program***

A key ingredient to the success of an energy management program is maintaining a high level of awareness among staff. This can be achieved in a number of ways, including formal training, newsletters, posters and publications, and by incorporating energy management into existing training programs. It is important to communicate program plans and case studies that demonstrate savings, and to report results at least at 12-month intervals. Staff may need training from specialists on energy saving practices and equipment.

### ***2.3.8 Financing of the Investment Cost***

Savings in recourses through the development of a policy for rational use of energy can be achieved through simple acts such as the awareness among executives and employees to reduce the consumption of electricity or other types of energy to the minimum.



However, in the case where it is intended to make investments with an additional target to reduce the cost of the consuming energy per produced product, a key factor is to find the necessary capital.

Here, the entrepreneur must consider a number of factors relating to the benefits resulting from an investment made which will ensure a significant reduction of the energy cost of the produced product.

The specific issues to be resolved are:

- The total amount of the capital need to be invested in order to replace the mechanical equipment, upgrade the electronic and electrical equipment, etc.
- Coverage of part of the total capital requirements by equity capital and bank loans.
- Estimations for the variance of the interest rates in the case it is designed to take out a very large bank loan.
- Market research among banks to identify those offering better loan conditions.
- Annual and monthly calculation of the financial burden from the interest rates until the fully repayment of the loan.
- Calculation of the financial benefit that will arise for the company after obtaining a bank loan for the future profitability of the company.
- Calculations of the economic benefits resulting per produced product after making an investment for the purchase of new machinery etc., in comparison with the current cost which is particularly aggravated by the cost of energy consumed.

### ***2.3.9 Annual Review***

An energy management program will be more effective if its results are reviewed annually. Review of energy management policy and strategies will form the basis for developing an implementation plan for the next 12 months.

### ***2.3.10 Communicative Policy***

Once a decision is taken by the administration of the company to undertake an energy saving program, key success factor is the promotion in two levels:

#### **2.3.10.1 Internal Communication**

The administration of the company informs the executives and the personnel about the advantages that will arise from implementing a series of measures to save energy. The extension of this communication will depend on the importance of the

actions that will be developed, especially if the company is planning to become a “green company” by extending its operations not only in saving energy but also in waste recycling areas, etc. contributing in that way to the saving of various raw materials.

Thus, based on the scale of these actions they can take various forms such as:

- Simple instructions for more limited use of air conditioning, personal computers, lights, etc.
- Circulars for participation of the staff in specific investment plans related to savings in order to be trained in new systems, machinery etc. that are less energy consuming.
- Motivating the executives and the technical or other type of personnel to suggest practical ideas for the reduction of the energy cost.
- Put up posters with slogans, exhortations, etc. for the rational use of energy.

### **2.3.10.2 External Communication**

The announcement of decisions made by the administration about energy saving, takes place when these decisions are related with new investments that ensure better environmental and energy performance. These announcements made by large companies are mainly addressed to:

- Mass media
- Customers, particularly sensitive to environmental issues.
- Shareholders, who weigh the benefits from investments in energy saving and environmental protection.
- International institutional investors who invest great amounts in “green companies” based on internationally accepted indicators.
- Local communities where the company has a heavy productive activity that cause environmental pollution which are going to be limited through the new actions and investments.

#### **ATTENTION:**

Since there is publicity through the external communication of the activities for large energy savings and environmental protection, the company is committed to implement them within the determined deadlines. Otherwise, any delays are creating a negative image for the company. Accordingly, the public announcement is made under the following basic requirements:

1. To provide a fully integrated energy saving program.
2. To be fully compatible with the overall investment and operational plan of the company.
3. To have ensured the funding for the relevant investment.
4. The working group to be fully operational and have the necessary skills and experience to carry out the operation.

## 2.4 Questions

1. Define the Energy Management.
2. What is the objective of Energy Management?
3. What are the principles of Energy Management?
4. What characteristics can be used to describe the commitment of the personnel?
5. Define financing of the investment cost and indicate how it is calculated.
6. Briefly describe the major stages in controlling mechanism of the energy management effectiveness.
7. What factors can influence an organization's choice of appoint energy manager?
8. Give a brief description Energy Saving Management Strategy.
9. Identify the benefits that will be obtained for the companies, regardless of size, from an energy saving policy.
10. How an organization does conduct energy audit?
11. Identify a Strategic Corporate Approach.
12. How does an organization formalize an Energy Management Policy Statement?
13. Prepare and Undertake a Detailed Project Implementation Plan.
14. Implement a Staff Awareness and Training Program.
15. What are internal and external communication policy?



<http://www.springer.com/978-3-642-16300-5>

Photovoltaic Industrial Systems

An Environmental Approach

Papadopoulou, E.

2011, XII, 161 p., Hardcover

ISBN: 978-3-642-16300-5