

## Lesson 4: energy management

### 1. Defining energy management:

Energy management is a critical aspect of both individual and organizational sustainability, encompassing a wide range of strategies aimed at optimizing energy use while minimizing waste and environmental impact. The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect.

The term energy management means many things to many people. One definition of energy management is the judicious and effective use of energy to maximize profits (minimize costs) and enhance competitive positions.

It is the strategy of adjusting and optimizing energy, using systems and procedures so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems.

Energy management began to be considered one of the main functions of industrial management in the 1970s as the result of the rising price of energy and reports about the approaching exhaustion of world energy resources.

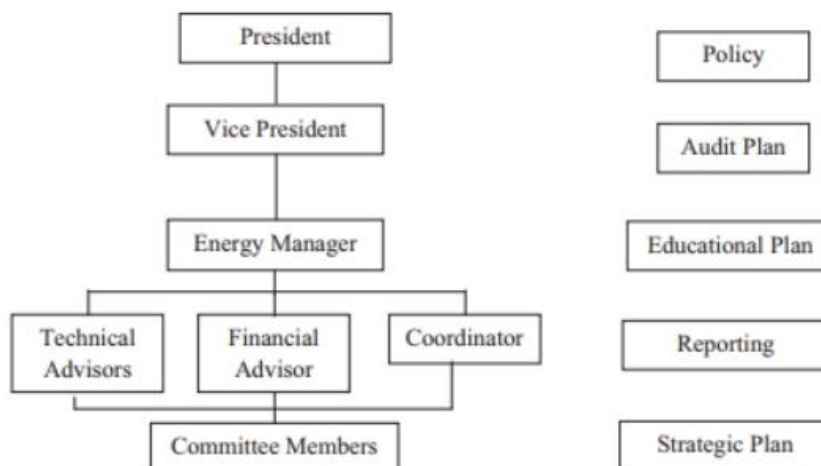
Nowadays, the role of energy management has greatly expanded in industries. Top management of the company participates in planning various energy management projects on a regular basis. The annual reports of the many companies should mention the details of energy conservation activities and various achievements by the company regarding energy conservation projects. To be effective, energy management programs should include four main sections: (1) Analysis of historical data; (2) Energy audit and accounting; (3) Engineering analysis and investments proposals based on feasibility studies; (4) Personnel training and information.

### 2. Energy management program:

An Energy Management Program is a strategic approach that organizations use to systematically monitor, control, and improve energy consumption, thereby reducing costs and environmental impacts.

All the components of a comprehensive energy management program are depicted in Figure 1. These components are the organizational structure, a policy, and plans for audits, education, reporting, and strategy. It is hoped that by understanding the fundamentals of managing energy, the energy manager can then adapt a good working program to the existing organizational structure.

**Fig 1: energy management program and organizational structure**



### 3. Organizational structure:

The organizational chart for energy management shown in Figure 1 is generic. It must be adapted to fit into an existing structure for each organization. For example, the presidential block may be the general manager, and VP blocks may be division managers, but the fundamental principles are the same. The main feature of the chart is the location of the energy manager. This position should be high enough in the organizational structure to have access to key players in management, and to have a knowledge of current events within the company.

- **Top Management (President and Vice President):** ISO 50001 emphasizes the role of senior leadership in supporting and approving energy management goals, policies, and resources.
- **Energy Manager:** This position is crucial forming all EMP activities, including audits, reporting, and engaging with departments. An energy manager is responsible for overseeing energy use, identifying savings opportunities, and implementing energy efficiency projects.
- **Technical Advisors:** These individuals provide specific knowledge and insights. Technical advisors are key for implementing changes in energy-intensive processes, such as manufacturing.
- **Financial Advisor:** This role is vital for ensuring that energy iterative align with the organization's financial goals. Financial considerations often determine the feasibility and prioritization of energy projects.
- **Coordinator:** Responsible for daily operations and inter-departmental con, this role ensures that energy management practices are consistent and integrated into organizational processes.

### 4. Importance of energy management:

Effective energy management is essential for organizations to control both energy procurement and consumption sustainably and economically. This involves utilizing reliable, affordable, and sustainable energy sources while optimizing their use through specialized managerial techniques that combine technical knowledge with personnel skills. The increasing significance of energy management can be attributed to several trends:

- Current energy consumption is unsustainable, relying on limited fossil fuels and contributing to greenhouse gas emissions, which threaten climate stability and the ability of future generations to meet their own energy needs.
- Poor energy management often correlates with inefficient resource and waste management, indicating that organizations reducing raw material, water, and energy usage are generally more efficiently run.

The benefits of effective energy management for organizations include:

- **Cost Savings:** Results in financial benefits for both companies and taxpayers and supports effective management strategies and incentives.
- **Improved Corporate Reputation:** Enhances brand loyalty and sales, while showcasing responsible and sustainable practices.
- **Long-term Energy Security:** Particularly important for developing countries, as it bolsters the reliability of energy services and infrastructure.

### 5. Objectives of energy management:

The primary objective of energy management is to maximize profits or minimize costs. Some desirable sub objectives of energy management programs include:

- **Improving energy efficiency and reducing energy use, thereby reducing costs:** Improving energy efficiency means using less energy to perform the same tasks, which reduces energy consumption and lowers costs. Efficient energy utilization aims to significantly reduce energy costs, a primary goal of energy management strategies. Programs in this area could potentially save more than 30% of energy usage, equating to savings that surpass pollution abatement costs. Organizations are required to identify high-energy-consuming areas through audits and industrial accounting, necessitating comprehensive planning rooted in an understanding of various policy alternatives and technological advancements. Implementing best practices in energy audit methods can lead to utility

bill reductions of 20% to 30%. A culture of continuous improvement is essential to identifying and addressing inefficiencies; neglecting this can perpetuate mediocrity.

- **Reducing greenhouse gas emissions and improving air quality:** Energy consumption, especially from fossil fuels, generates greenhouse gases (GHGs) that contribute to climate change and air pollution. Reducing energy use and increasing efficiency lowers GHG emissions, helping the organization meet environmental regulations, minimize its carbon footprint, and contribute to better air quality. This can also enhance the company's reputation as a sustainable, environmentally conscious organization.
- **Cultivating good communications on energy matters:** Effective communication about energy management helps ensure that everyone in the organization understands the importance of energy efficiency and their role in achieving it. Good communication channels allow employees to stay informed about energy-saving practices, goals, and progress. This could involve regular updates, training sessions, or a platform for sharing energy-saving ideas across departments.
- **Developing and maintaining effective monitoring, reporting, and management strategies for wise energy usage:** Monitoring and reporting on energy consumption allows organizations to track their energy usage patterns, identify inefficiencies, and measure the impact of energy-saving measures. Effective management strategies ensure that energy goals are set, and performance is regularly evaluated, fostering a culture of accountability and continuous improvement in energy management.
- **Finding new and better ways to increase returns from energy investments through research and development (r&d):** Investing in R&D can lead to innovative solutions that further optimize energy use and improve returns on energy-related investments. R&D might involve exploring new energy-efficient technologies, renewable energy sources, or process innovations. By continuously finding better ways to manage energy, organizations can stay competitive and sustain long-term profitability.
- **Developing interest in and dedication to the energy management program from all employees:** Employee involvement is crucial for the success of an energy management program. When employees are committed to the program's goals, they are more likely to adopt energy-saving behaviors, identify opportunities for improvement, and contribute to achieving the organization's energy objectives. Encouraging a culture of energy responsibility across all levels of the organization fosters collaboration and collective dedication.
- **Reducing the impacts of curtailments, brownouts, or any interruption in energy supplies:** Energy interruptions, such as curtailments (forced reductions in energy consumption) or brownouts (temporary reductions in electrical power), can disrupt operations and lead to financial losses. Effective energy management prepares organizations to minimize the impact of such interruptions by ensuring backup systems are in place, reducing dependency on unreliable energy sources, and optimizing energy use to lessen the risk of operational downtime.

## 6. Energy management strategies:

Both sections cover energy management strategies, but they address different contexts and levels of complexity:

### – Organizational energy management strategies:

These strategies focus on organizational and operational energy management and are designed to improve energy efficiency within facilities or buildings through monitoring, control, behavior change, and regular evaluations.

- **Regular energy auditing:** Conducting audits to pinpoint areas of energy wastage.
  - **Utilization of control systems:** Using control systems to monitor and control daily energy use.
  - **Behavioral change promotion:** Focusing on changing behaviors and attitudes through communication and training.
  - **Measurement and verification:** Tracking energy use over time and monitoring the impacts of specific energy-saving initiatives.
- **Technical energy management strategies:**

These strategies are typically used in advanced energy management systems that require dynamic, adaptable, and data-driven methods to manage energy more efficiently. They are often applied in technical and engineering contexts, where real-time adaptation and optimization are essential.

- **Rule-based strategies:** These strategies rely on predefined rules to manage energy distribution among various sources. They are straightforward but may not adapt well to changing conditions
- **Optimization-based strategies:** These strategies utilize mathematical models to determine the most efficient energy distribution, often incorporating factors like cost, demand, and supply forecasts. For instance, dynamic programming is a common optimization technique used in hybrid electric vehicles to minimize fuel consumption.
- **Learning-based strategies:** Employing machine learning algorithms to adapt to changing energy needs based on historical data and predictive modeling.

☞ **To sum up:**

First section presents organizational energy management strategies aimed at improving energy efficiency within buildings or facilities through auditing, control systems, behavioral changes, and measurement.

Second section describes technical energy management strategies used in advanced applications like hybrid vehicles and complex energy systems, relying on predefined rules, optimization models, and machine learning for dynamic energy management.

## 7. Principles of Energy management:

- Control the cost of energy service provided and not the BTU: Instead of merely tracking how much energy (like BTUs) is used, concentrate on the actual cost of the energy services. This means looking at how much you are spending to power your operations and finding ways to reduce those expenses without compromising on performance.
- Manage energy function as a product cost and not as a general expenses: Consider energy expenses as a direct part of your production costs, similar to raw materials, rather than lumping them into general overhead. This approach helps in accurately assessing the true cost of producing your goods or services and highlights areas where energy efficiency can lead to cost savings.
- Manage only major energy functions: Focus your energy management efforts on the processes or equipment that consume the most energy. By targeting these significant areas, you can achieve more substantial energy savings and make a bigger impact on overall efficiency.
- Concentrate energy management program on installing contracts and achieving results: Develop formal energy management programs that include specific contracts or agreements outlining responsibilities and objectives. This structured approach ensures that everyone involved understands their roles and works towards achieving measurable results in energy savings.