EXISTING WAYS TO INCREASE ENERGY EFFICIENCY IN INDUSTRIAL ENTERPRISES

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Annotation

Increasing energy efficiency in industry is crucial for reducing operational costs and promoting sustainability. This abstract provides recommendations for enterprises to implement strategies and measures to improve energy efficiency. These include conducting energy audits, implementing energy management systems, upgrading equipment and systems, optimizing processes, engaging employees through training and awareness programs, participating in demand response programs, integrating renewable energy sources, entering into energy performance contracts, implementing continuous monitoring and maintenance, and benchmarking and sharing best practices. By following these recommendations, enterprises can enhance their energy efficiency, reduce costs, and contribute to a more sustainable future.

Keywords: technological system, energy saving, energy management, energy balance, energy losses.

To increase energy efficiency in industry, enterprises can implement various strategies and measures. Here are some recommendations:

1. Conduct Energy Audits: Perform comprehensive energy audits to identify energy-saving opportunities, assess current energy usage patterns, and prioritize areas for improvement.

2. Implement Energy Management Systems: Establish an energy management system (EMS) that includes regular monitoring, analysis, and reporting of energy consumption data. This will help identify trends, track progress, and make informed decisions regarding energy efficiency measures.

3. Upgrade Equipment and Systems: Replace outdated and inefficient equipment with energy-efficient alternatives. This could include upgrading lighting systems,

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HVAC systems, motors, and machinery to reduce energy consumption.

4. Optimize Processes: Analyze production processes to identify inefficiencies and implement measures to optimize energy usage. This may involve process redesign, equipment modifications, or implementing advanced control systems.

5. Employee Engagement and Training: Educate employees about energy conservation practices and encourage their active participation in energy-saving initiatives. Provide training programs to enhance their understanding of energy management and efficiency.

6. Demand Response Programs: Participate in demand response programs offered by utility companies. These programs incentivize businesses to reduce electricity consumption during peak demand periods in exchange for financial benefits or other incentives.

7. Renewable Energy Integration: Explore opportunities to integrate renewable energy sources into the energy mix. This could involve installing solar panels, wind turbines, or utilizing geothermal energy to reduce reliance on grid-supplied electricity.

8. Energy Performance Contracts: Enter into energy performance contracts with service providers who guarantee energy savings through the implementation of energy-efficient measures. These contracts often include financing options that allow businesses to fund energy upgrades without upfront capital investment.

9. Continuous Monitoring and Maintenance: Regularly monitor and maintain equipment and systems to ensure they operate at peak efficiency. Implement preventive maintenance programs to address potential issues before they lead to energy waste or equipment breakdowns.

10. Benchmarking and Sharing Best Practices: Engage in benchmarking activities to compare energy performance with similar industries or facilities. Share best practices and success stories to encourage knowledge sharing and continuous improvement.

By implementing these strategies and utilizing generalized indicators of electricity consumption, enterprises can significantly enhance their energy efficiency, reduce operational costs, and contribute to a more sustainable future. The current situation in the field of energy consumption assessment in the technological system, identification of low-efficiency consumers from a technological point of view, as well as the search for optimal regimes of energy consumption does not meet the

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modern concept of energy saving.

Unfortunately, to date, neither technological system any of its individual components have accurate, nor rigorous methods of analyzing energy costs. This makes it impossible to define an energy management strategy when operating conditions change. Often, such a change in conditions is due to the influence of the market, which in this case acts as a breach of the load. This can lead to a conflict between the structure, technological principles, technical means and loading of vehicles, i.e. it can lead to a violation of their original calculated unit. This situation is technologically limited.

The capabilities of the vehicle and does not allow it to adapt to the market in accordance with the basic criteria set by the consumer. To solve this problem, a systematic approach to technological system is needed in terms of evaluating energy consumption efficiency.

Energy management is an effective tool for adapting a car to changing operating conditions. Rational use of energy improves the company's performance not only in terms of energy, but also in terms of environmental and overall economic. Energy balance is the basis of energy consumption accounting policies. It is the main and so far the only tool for energy management. However, the actual energy balance only makes sense at the process level. His calculations help to identify the main "eaters" of energy in large systems. This is based on the fact that theoretically the income of energy is equal to its consumption. The calculation of the balance involves the following steps:

1. Define the boundaries of the system.
2. Determine the numerical values of the parameters that characterize the input and output currents.
3. Convert the parameters of these energy flows to the corresponding equivalents in a single system of units of measurement.
4. Estimation of energy losses. The energy balance serves as the basis for analyzing the technical or economic feasibility of various projects. To do this, its data are presented in tabular or diagrammatic form. They provide an overall stationary picture of energy consumption in the enterprise, which does not allow to determine the dynamics of their redistribution when external or internal operating conditions change.

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Energy consumption is closely related to production. The correlation is determined by statistical calculations of the energy expended and the product produced, expressed in numbers. This sets the parameters for the energy efficiency level. Often this correlation is not linear. For enterprises that produce different products, this method requires establishing a relationship between the numerical values of energy consumption and production capacity.

Solve a system of equations describing these relationships separately for each product, as well as based on statistics collected in previous periods with different levels of production. In making such calculations, it is necessary to take into account discrete variables that affect energy consumption, such as changes in environmental conditions, power outages, etc., which increases their accuracy, but the calculations leads to significant complication. In the efficiency assessment, the estimated indicators of energy consumption are compared with the actual production volumes. The large number of random factors affecting the targets, as well as the fact that all costs are the same.

Poorly predictable factors such as inflation, this approach has not found application in local practice.

The best results in operational management and long-term planning of costs, in particular energy consumption, are given by technical criteria: energy density, reduction of energy consumption, and so on.

They have good enough visibility and clarity to convince the enterprise management to implement energy saving measures and implement energy efficiency programs. However, they are only effective for analyzing past or present events.

Industrial enterprises often underestimate the potential savings from energy management programs. They involve a certain amount of technical and financial risk and have a lower priority than traditional commercial offerings. It is also difficult to convince management with relatively low energy costs of the need for complex projects. It is known that energy efficiency programs are also needed in enterprises where the cost of energy is about 5% of the cost of production.

No system, no matter how well designed be effective in all conditions. To increase efficiency, flexibility and dynamism must be incorporated into its structure. At present, from the management point of view, the problem of increasing labor productivity and energy efficiency is the most serious problem.

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Optimizing equipment location and space use is an important source of cost savings and in many ways a waste of energy.

The production area is capital. A rational scheme of equipment placement reduces the volume of transportation of materials and finished products, reduces time and energy losses for transport operations. About 20-25% of energy efficiency increases depend on industrial buildings, machinery and equipment.

Adaptation of the existing system is achieved mainly through a rational technical approach:

- quantitative changes in the existing structure that do not lead to qualitative changes in the structure and parameters of the system (e.g. increase or decrease the amount of technological equipment used;
- replacing some system components that do not change their functionality (e.g., replacing old equipment with new ones, as a rule, leads to an increase in energy costs, as the latter has a higher power and weight ratio);
- improve by changing the functionality of some components without changing the overall structure and operating principles (e.g., replacing multiple universal machines into a single multi-purpose machine may also not result in reduced energy consumption);
- restructuring by changing unit sizes, number of hierarchical levels, and introducing new functional elements (e.g., decentralization of the secondary supply system) energy carriers, as a rule, incur certain costs because it only provides consumers who need them);
- innovations include changing the basic principles of organization and management, procedures and structure of the enterprise, its business policy and strategy (e.g., disassembly or modular design of the vehicle, which allows you to save energy because the independence of the units produce simplifies the organization of the process, minimizes traffic;
- exclusion of energy losses due to the human factor;
- self-development involves changing the purpose and basic concepts of the enterprise at the expense of its own resources.

The development of an organization goes through certain stages and crises. It is not just a repetition of the same pattern, but the development of the ability to manage problems of increasing complexity.

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From the point of view of this approach, it seems expedient to determine the position of a particular technological system in the developmental stage. This allows the identification of adequate ways to increase the efficiency of the entire enterprise and in particular energy consumption.

Enterprises with a subject structure can be defined as a set of independent production units organized and equipped in such a way that individual finished products or their families can be created. In other words, the purpose of applying such a production method is to combine all the things, physical capabilities, material resources, and energy needed to produce a particular product or group of products.

In such circumstances, the responsibility for orders for materials, including energy carriers, as well as for the planning of the production process within the unit, rests with the production units themselves. They operate on the principle of in-line production, which reduces production time, and hence energy consumption per unit of production.

For example, in foreign firms, the structural unit of the entity is the company within the company. It builds relationships with organizations in the external environment, independently obtaining all the initial resources needed to produce a particular end product.

The object method of production can be effective only when the structure has all the necessary production equipment. Its utilization rate is usually lower than that produced in functional workshops. In such circumstances, the load factor of the equipment can be considered as a key indicator that determines the efficiency of the unit, which is the structure of the entity. Its value should be compared with other indicators that reflect the advantages of such a structure, i.e. ease of management and a small amount of "dead" capital in inventory.

The division of complex systems into such subdivisions - modules (modularity) with a certain degree of flexibility means that there can be several options for building a system due to the combination of a certain number of known modules. The principle of modular construction of TS, which has the necessary degree of autonomy and independence in the local industry, is not properly distributed.

This is due to their over-centralization, not only organizationally but also technically, in particular, the centralized system of resources, including energy supply. This should be compounded by the lack of ways to divide them into functionally separate modules, their capabilities and the level of interaction.

This method involves finding ways to give small systems more independence in the organizational structure of the enterprise. This should be understood as the ability of relatively large production units operating independently within a large system. Dividing an enterprise into smaller production units reduces the need to coordinate them and consequently simplifies management problems.

The decentralization that results from this type of technological system organization is also valuable in encouraging local initiative and increasing the ability of different departments to adapt to changing conditions.

The following system capabilities should be considered in decentralization:

1) divide them into smaller ones;

2) division of a large production unit into smaller parts in such a way as to reduce the need to communicate with neighboring enterprises;

3) ensuring the self-sufficiency of units in relation to production resources, support operations, etc.;

4) reduce the direct intervention of senior management so that the independence of subdivisions is not compromised due to control from the upper links of the management hierarchy.

World practice shows that such an organization of the EU has led to one of the biggest changes in recent years - a clear reduction in work in progress and dead capital, which is very important for the overall economic results of the enterprise. .

The analysis revealed the following points:

- currently there are no methods and tools for normalizing the energy costs of technological system, linking the effects, technological processes and equipment parameters that determine the order of communication between domestic energy suppliers and consumers when ordering energy carriers;
- the most optimal structure of technological system, including in terms of energy consumption, is to build it from fan units - modules with relatively high independence.

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