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**IMPLEMENTING MODERN ENERGY MANAGEMENT
TECHNOLOGIES AT RUSSIAN INDUSTRIAL ENTERPRISES**

The article examines the issues of implementing modern energy management technologies at Russian industrial enterprises. Energy management is the financial instrument which can provide enterprises with cost savings by means of smart principles for both production and use of energy resources. Successful practice of applying energy management technologies (such as benchmarking, outsourcing, monitoring, crowdsourcing and coaching) are analyzed.

Keywords: industrial enterprise; energy saving; energy efficiency; energy management; benchmarking; outsourcing; crowdsourcing; coaching.

JEL classification P28, P48, Q47, Q57.

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**ЗАСТОСУВАННЯ СУЧАСНИХ ТЕХНОЛОГІЙ
ЕНЕРГЕТИЧНОГО МЕНЕДЖМЕНТУ НА РОСІЙСЬКИХ
ПРОМИСЛОВИХ ПІДПРИЄМСТВАХ**

У статті розглянуто проблеми застосування сучасних технологій енергетичного менеджменту на російських промислових підприємствах. Доведено, що енергетичний менеджмент є фінансовим інструментом, який здатен забезпечити підприємствам економію коштів за рахунок проведення грамотної політики виробництва та використання ресурсів. Проаналізовано успішні приклади впровадження сучасних технологій енергетичного менеджменту: бенчмаркінг, аутсорсинг, моніторинг, краудсорсинг та коучинг.

Ключові слова: промислове підприємство; енергозбереження; енергоефективність; енергетичний менеджмент; бенчмаркінг; аутсорсинг; моніторинг; краудсорсинг; коучинг.

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**ПРИМЕНЕНИЕ СОВРЕМЕННЫХ ТЕХНОЛОГИЙ
ЭНЕРГЕТИЧЕСКОГО МЕНЕДЖМЕНТА НА РОССИЙСКИХ
ПРОМЫШЛЕННЫХ ПРЕДПРИЯТИЯХ**

В статье рассмотрены проблемы применения современных технологий энергетического менеджмента на российских промышленных предприятиях. Доказано, что энергетический менеджмент является финансовым инструментом, который может обеспечить предприятиям экономию средств за счет проведения грамотной политики производства и использования энергоресурсов. Проанализированы успешные примеры внедрения современных технологий энергетического менеджмента: бенчмаркинг, аутсорсинг, мониторинг, краудсорсинг и коучинг.

Ключевые слова: промышленное предприятие; энергосбережение; энергоэффективность; энергетический менеджмент; бенчмаркинг; аутсорсинг; краудсорсинг; коучинг.

Introduction. The issues on energy saving and energy efficiency increase are always on the agenda under the conditions of both economic growth and economic recession. Historically, Russian industrial enterprises have been paying particular attention to meeting the needs of the industrial process in energy and almost ignoring the efficiency of its transfer and use.

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In the last decade, managers of several Russian industrial holdings and enterprises (e.g., EvrazHolding, SIBUR Holding etc.) have been trying to develop reliable organizational and technical structures (systems) to manage the efficient use of energy resources, also referred to as energy management systems (Eremeeva et al., 2011: 10–15).

Energy management is a goal-directed activity of management structures aimed at saving energy and increasing company's energy efficiency. Employee motivation for energy saving is an integral component of energy management.

As shown by the world experience and Russia's practice, energy efficiency can only be achieved and maintained on the long-term basis at a rather high level if employee motivation (stimulation) and interest take place, significantly affecting enterprise's energy consumption and energy efficiency (Eremeeva et al., 2011: 10–15).

Unfortunately, during the 1990s the motivation systems established at enterprises were liquidated and only now such systems, in some form or other, are again coming into use at some companies. Organizing personnel motivation is a very difficult process which should be solved at every enterprise, with due account of the specific nature of management structure and personnel features.

Foreign companies use various techniques to motivate their employees for energy saving. Along with financial encouragement, they widely implement employee engagement in the process of energy saving management and other "non-cash" types of stimulation. They orient employees to define the goals, and a goal put correctly by arousing interest in its achievement is reasonably supposed to become a strong incentive for employees. Analyzing motivation is focused on the factors which either motivate one to act, or intensify actions.

Implementing an efficient energy management system at Russian enterprises seems to be possible in case the achievements of domestic and foreign management science are actively used. Company's high-quality energy system should be based on modern technologies of both energy efficiency and energy saving. Such technologies include energy benchmarking, energy outsourcing, energy monitoring, energy crowd-sourcing, and energy coaching. Let us consider these technologies more closely.

Energy benchmarking. At present, energy saving involves a wide range of various methods, instruments, and practices. One of such relatively new management instruments is benchmarking, i.e., the process of comparing a company's key operation indices with those of other participants engaged in the same activities in order to determine possibilities for further improvement. Possessing such an instrument allows carrying out a specific strategic planning for increasing energy efficiency and choosing optimal points of application for corresponding energy saving measures.

The Energy Management Standards EN 16001 and ISO 50001:2011 don't require benchmarking. Nevertheless, the Annex to ISO 50001:2011 underlines benchmarking is one of the instruments for maintaining and continually improving energy performance being a part of such energy management element as energy planning.

The results of benchmarking can provide valuable information for an objective energy review to set further logical energy objectives and energy targets.

Benchmarking can be of two types, i.e., internal and external. The external type is focused on applying such an energy-efficiency equipment, product, service, which is the best in a specific industry/sector.

Internal benchmarking is oriented at seeking differences in energy efficiency within a single organization for best practices to be extended from one company to another. Benchmarking can give answers to the following important questions: "How much better/worse are my ratios of material input per unit of product as compared to other enterprises in the industry?" "How much electrical energy is spent by industry leaders for manufacturing a single unit of product, and on what level is my factory in comparison with theirs?".

The experience of "Sibur Holding" can be a practical example of implementing energy benchmarking technologies (Kazantsev, 2012).

The company's benchmarking project on sharing experiences in both energy saving and energy efficiency engaged "Tobolsk-Neftekhim" (a leader in implementing the energy management system within the framework of a comprehensive energy audit) and "Tomskneftekhim" (a leader in energy efficiency within the framework of the project on introducing the SIBUR Production System supported by "DuPont").

"Sibur Holding" obtained the following benchmarking results on the introduction of energy management system (Kazantsev, 2012):

- Common system approaches to energy saving activities were worked out.
- Leading practices in energy saving and energy efficiency were adopted.
- New targets for 5% energy saving were set.
- Top managers were involved in developing the energy management system.

Energy outsourcing. Outsourcing is the contracting out of definite business processes or business functions to another company specializing in rendering services in a definite area.

Concerning energy economy at an industrial enterprise, there are the following types of outsourcing:

- Outsourcing in producing energy resources by a specific company.
- Outsourcing in transporting energy resources.
- Outsourcing in repairing (servicing) energy equipment.
- Other outsourcing, i.e., information technologies, energy management etc.

Depending on its volume, outsourcing can be of two types:

Maximum or complete outsourcing is used to define a contract under which employees or assets related to a company's main business operations (i.e., information technologies or funds) are transferred to a vendor for a period of this contract.

Partial or selective outsourcing means that by the contract, most functions of a company are still under client's responsibility.

Joint outsourcing is the term that describes one of the variants of outsourcing at which contracting parties are partners. Some specialists use this term to determine subcontracts that involve several vendors.

Transiting to outsourcing can be reasonable in case a company gains definite competitive advantages and achieves established goals. Outsourcing efficiency is affected by many factors which must be taken into consideration and precisely assessed.

As a successful example of energy outsourcing, let us discuss the experience of "Trubnaya Metallurgicheskaya Kompaniya" (Trubnaya Metallurgicheskaya Kompaniya, 2014).

The outsourcing activities resulted in the reorganized structure for maintenance services at the factory including its mechanical, electrical and energy services.

System reorganization for technical maintenance and repair management involved the following 3 stages:

1st stage – Establishment of centralized repair services at the enterprise.

2nd stage – Development and regulation of a proper cooperation between the company's centralized repair services and its technical, economic, commercial and other services.

3rd stage – Establishment of legally independent repair and service offices (of different affiliations) regarding different business activities on the basis of centralized repair services (Dvorkin, 2012).

Outsourcing some repair and service functions of the centralized management structure resulted in reduced management levels, from 4 levels to 2.

The positive results of the implemented energy outsourcing are as follows:

- Better manageability.
- Elimination of doubled and inefficient functions.
- Accelerated order fulfillment speed.
- Staff reduction.
- Specification of managers' responsibilities.
- Lower maintenance expenses.
- Higher equipment safety resulted in higher production outputs.

The disadvantages of the implemented energy outsourcing by this enterprise concern a longer psychological distance of maintenance staff from the production process (Dvorkin, 2012).

Energy monitoring. Energy monitoring, as a branch of energy saving motivation, is widely implemented, for instance, by British industrial enterprises. British authorities pay particular attention to promoting energy saving, publishing and widely expanding information on the best practices in this area. In the 1990s the details of Rover's successful energy saving (a Longbridge plant) gained popularity thanks to these publications (Berner et al., 2008: 44–48).

The mentioned plant manufactures cars of mini- and mid-sizes, as well as the Land Rover engines and gearboxes. Due to smartly organized motivation system and energy saving promotion, the enterprise managed to save 1.5 mln USD during one year at the costs of 10 ths USD. Moreover, the annual costs of energy resources (natural gas, fuel oil, electricity, water) for the enterprise amounts to 20 mln USD (Berner et al., 2008: 44–48).

Managers have traditionally been paying much attention to the issues of energy saving and to those of energy management. The enterprise has implemented and is successfully operating the Target Energy Monitoring System (TEMS). The data on consuming energy resources are highlighted in weekly reports of every subsidiary, as well as of the whole enterprise. These reports comprise not only the data on energy consumption expressed in both energy and cost units but also consumption deviation from target values per reported week and savings from the beginning of a fiscal year (expressed in energy units, currency and %). Target consumption values are calculated, using the regression analysis of statistical energy consumption data and target parameters. As target parameters, the TEMS system uses the most simple and obvious ones:

- number of produced cars;
- number of produced engines;

- number of produced gearboxes;
- number of work hours;
- number of degree-days (to monitor heating facilities and conditioning systems) (Berner et al., 2008: 44–48).

For the purposes of better illustration, such reports give weekly results in a table and savings from the beginning of a fiscal year in a diagram.

Though technical measures allowed a better energy economy to be achieved, the enterprise's energy manager assumed there was more potential for extra economy of energy resources by improving operations of the energy management system with the company's staff. This was evidenced by the results of the energy consumption-target parameter correlation analysis.

The enterprise developed a special program on increasing both employee motivation and awareness; moreover, to achieve the maximum economic effect of this program, they decided to minimize the expenses on its implementation. This was resulted in the system that comprised only organizational activities and some work with the enterprise's staff and didn't require extra labour and material resources (Berner et al., 2008: 25–27).

One of the key targets of the program was to achieve control over energy consumption and to reduce it within a shorter period. This was achieved during less than 6 month, i.e., a significant improvement of correlation between energy consumption and target parameters, along with reduced energy consumption took place. These improvements were due to some simple zero-cost technical and organizational measures and to a stricter control over the use of energy-consuming equipment. As a regular practice, most subsidiaries conduct weekly audits to reveal the cases of irrational energy consumption (Berner et al., 2008: 25–27).

Energy crowdsourcing. Crowdsourcing refers to transferring certain business functions to an undefined group of people on the basis of public offering that doesn't imply any employment contract. For the purposes of crowdsourcing, a collective intellect and a synergy of cooperation among a large number of people are used. Crowdsourcing allows aggregating information, experience, ideas, forecasts, preferences and estimates.

Russia applied this technology in the process of realizing the "Program on Energy Saving and Energy Efficiency Improvements till 2020". Within the framework of this program, the crowdsourcing project "Energoideya" (Energy Idea) was implemented aimed at finding and maintaining the best innovative, organizational and technological energy-saving and energy-efficient projects developed by students, post-graduates and young scientists from different regions of Russia (Energy Idea, 2013).

Those university students whose scientific and technical creative projects were indeed rational energy-saving and energy-efficient proposals participated in the competition. Implementation of such projects would contribute to lower energy consumption at industrial enterprises, educational and scientific institutions, and in daily life. The projects dealt with such urgent issues as the analysis of fuel and energy security in the Sakha Republic (Yakutia), the development of the cooling system for electric arc furnaces (EAF) or the improvement of vehicle's energy efficiency by using its inner reserves etc.

Energy coaching. Coaching refers to traditional training techniques. According to the scientific data of the Chartered Institute of Personnel and Development (CIPD, Great Britain), coaching became one of the most popular techniques for employee development (The Chartered Institute of Personnel and Development, 2014).

Within the framework of consulting projects, coaching is defined as a form of individual work on the professional basis, professional development and socio-cultural adaptation with newly recruited employees or those transferred to another position. A coach in this case an experienced specialist who shares knowledge and experience with other employees at a working place, provides an overview of production process, and contributes to proper relations among staff (Stashenko and Cheglakova, 2008: 37–49).

Coaching is widely used at Russian large industrial enterprises. It is particularly important for energy saving and energy efficiency. Coaching has successfully proven itself as a form of work with young employees within the framework of the "Program on Maintaining and Developing Human Resources" of MRSK Tsentr and Privolzhye at Tulenergo Office (MRSK Tsentr and Privolzhye, 2014).

And "Lenenergo" has a special provision on coaching. It was developed and came into force at the enterprise to implement the system approach to adaptation and professional training of recruits, entrants and those transferred to another position, as well as to train students doing practical work at "Lenenergo" (Lenenergo, 2010).

One of the main targets of coaching is to attract skilled workers and young specialists to developing and proposing innovative projects related to energy saving and energy efficiency within more general socioeconomic programs.

Coaches are appointed from highly skilled experts that feature stable work indicators, are able and ready to share their experience, have system vision of their working responsibilities and the enterprise's operation process, and possess communication skills.

Conclusions. The issue of both energy saving and improved efficiency in using various energy resources is becoming one of the priority directions for developing Russia's industrial enterprises. Implementation of current management technologies and measures related to energy saving allows significantly decrease costs of energy resources, thus increasing company's real profit.

Achieving real improvement of energy efficiency under current conditions should be based on not only technical solutions but also more sophisticated management. The process of energy efficiency improvement shouldn't be a one-time undertaking, with a limited period of validity. It is necessary to define a long-term system of measures based on full-time energy management system at an enterprise.

Successful introduction of energy management particularly depends on managers' attitude to this phenomenon. Real results can be achieved if top managers understand and consider improvement in energy efficiency as a part of activities on reducing corporate financial costs, supporting and developing energy management by implementing most advanced energy-saving and energy-efficient management technologies.

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