

Innovation through improvement in the energy efficiency of business processes

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Abstract. The energy industry is regarded as a leader in introducing innovations among other industries. Solutions are proposed to reduce energy consumption. The features of energy supply to consumers in difficult conditions of economic, technical and climatic nature are identified, provided that large systems with a high level of complexity of system interconnection are integrated. The main focus is on the use of technology "smart home". The use of Smart Grid and Smart Home technologies significantly improves the efficiency of business processes, which in turn allows you to more accurately plan energy consumption. Studies have shown that the use of innovative technologies can save up to a third of the energy consumed, but the population has no significant motivation to plan and save energy. However, there is a positive trend in the use of Smart Grid and Smart Home technologies in optimizing the management of business processes by business structures, for example, in optimizing security tools, managing household engineering systems, etc.

1 Introduction

In the modern global economy, the state's position in the international arena is becoming increasingly dependent on its overall competitiveness. Nevertheless, it is obvious that the state's competitiveness directly depends on the structure and effectiveness of its innovation system. It is the state innovation system that provides it with an opportunity to take a certain niche in the system of international division of labor and acquire a certain status in the system of international relations, as well as ensure a high level of welfare of the population. The current modernization of the Russian economy is aimed at ensuring the compliance of its properties with the global trends of transition to an innovation-type economy; it places increased demands on the infrastructure, models and methods of managing innovation activity, especially in the field of energy.

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2 Materials and methods

The goal of the development strategy of many states is to move away from a “raw material economy” to a “innovative” economy (article The role of international clusters). For the successful functioning of an innovative economy, any country needs energy; Energy nourishes all processes of economic activity and society. Energy producers are faced with the complex task of responsibly addressing the management of natural resources and ensuring the distribution of wealth among the population in a balanced and fair manner. The availability of affordable and clean energy is one of the necessary conditions for solving any problem of innovative energy management. Comfort and safety in homes, transportation services and industry - all this requires energy.

One of the important problems in the energy sector, in addition to receiving energy, is to ensure its storage and transmission possibilities and balanced consumption (reasonable economy).

The diagram shows that energy, as the industry takes a leading position in introducing innovations among the sectors of the national economy.

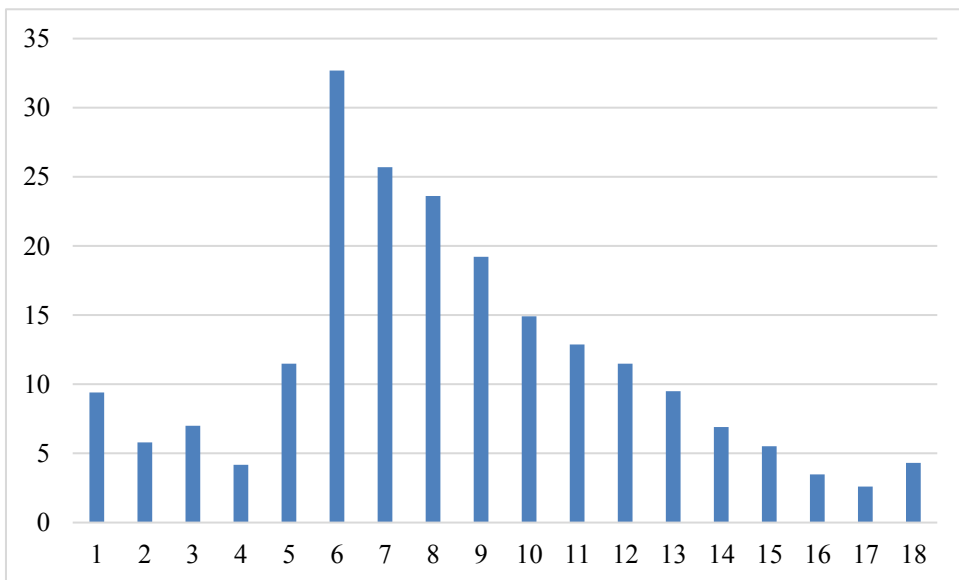


Fig. 1. Share of industrial organizations in Russia that carried out technological innovations, by type of economic activity. Where: 1. Total 2. Mining 3. Extraction of fuel 4. Mining, except fuel 5. Manufacturing 6. Production of coke and petroleum products 7. Manufacture of electrical and optical equipment 8. Chemical production 9. Manufacture of vehicles 10. Machine manufacturing 11. Metallurgical production 12. Manufacture of rubber and plastic products 13. Production of food, beverages, tobacco 14. Textile and clothing manufacture 15. Production of leather, leather goods, shoes 16. Production of wood, wood products 17. Pulp production, publishing 18. Production and distribution of electricity, gas and water [1].

The term "innovation" comes from the Latin "novatio", which means "update" (or "change"), and the prefix "in", which translates from Latin as "in the direction", if you translate literally "Innovatio" - "in the direction of change".

Innovations seriously increase the efficiency of the current system, in this case, the efficiency of business processes using energy.

Efficiency of business processes in the field of ensuring rational energy consumption is of paramount importance, because the economic effect of the use of new technologies in the field of energy can reach high levels.

The society is ready to start implementing large-scale projects in the innovative energy sector in order to create and develop fundamentally new business processes of energy use. Thanks to this, an important condition will be created for the transition, both of the energy sector and of the whole economy to the innovation track.

Systematic work in the field of increasing energy efficiency in various sectors of the Russian economy began after the adoption of the federal law [15]

In 2010, the Ministry of Energy of Russia, together with CJSC APBE, CENEF LLC and FGU REA, developed the State Program of the Russian Federation “Energy Saving and Energy Efficiency Up to 2020” (“GEPE-2020”), which was approved for the meeting of the Government of the Russian Federation on October 21, 2010 and approved by the decree of the Government of the Russian Federation of December 27, 2010 No. 2446-p. [14]

Energy saving - implementation of organizational, legal, technical, technological, economic and other goals aimed at reducing the amount of energy resources used while maintaining the corresponding beneficial effect from their use (including the volume of products produced, work performed, services rendered) [3].

The most important tool for improving the energy efficiency of the domestic economy is the introduction of innovative technologies in the field of energy saving [4].

The objects of energy saving can be:

- Buildings (schools, hospitals, kindergartens, residential apartment buildings, office buildings);
- complexes of objects (sanatoria, settlements, residential areas, manufacturing enterprises);
- technological processes (production of heat, water, minerals, electricity, other production processes).

Today, there are various technologies that can significantly reduce the loss of heat and electricity at all stages - from production, transportation of various types of energy, and ending with their consumption.

One of the innovative technologies that allows to significantly reduce energy losses is Smart Grid and Smart Home technologies.

As a rule, specialists in Europe strive for an orderly interconnection of the functioning and interaction of compactly located generating facilities, power grids and consumers through intellectual capabilities, resiliency and two-way data exchange at the territorial-organizational level of municipalities. They are primarily interested in the possibility of connecting small generating sources of electricity, adapting to the dynamics of consumption and ensuring energy savings with a decrease in greenhouse gas emissions. Their market dictates demand for local smart networks; management tasks at the interregional, national and international level of the functioning of energy systems are still less concerned with them.

And in Russia, energy supply of consumers occurs in difficult conditions of an economic, technical, climatic nature, we focus on large generating facilities, we have a different level of integration of large systems with a significantly higher level of complexity of system interconnections. Accordingly, we will need to restructure the entire global power grid on the principles of multifunctional automation. Including taking into account the long-term objectives of the phased restoration of the coordinated management of the functioning of the energy systems of the CIS countries on bilateral and multilateral basis. In Russia, the approach to the task of connecting small and alternative energy facilities and associated local power grids to existing networks is different.

By the way, precisely because of this, purely Russian, specifics in many achievements, we have always been ahead: Krasnoyarsk Hydroelectric Power Station was the most powerful, Sayano-Shushenskaya is the most high-altitude, the first wind turbine engine was built here, the longest energy system 2.5 million kilometers first The USSR, the most

economical steam-gas cycle with an efficiency of 62%, was invented by a Russian scientist, Academician Sergei Alekseevich Khristianovich, our first nuclear power plant, etc. etc. In electronic science and in the energy sector, Russia has never had such a large lag, as, for example, is now in computer science, in medicine. The smart grid program was launched in the United States just four years ago - for Russia, this is a small odds.

The expected reduction in electric power losses from complex modernization and innovative development of all subjects of the electric power industry based on advanced technologies in the networks of all voltage classes is about 25%, i.e. the savings will be about 35 billion kWh per year.

3 Results

Consider an example of upgrading a house 200 square meters.

Relying on the calculations, you can get that for the modernization of the house an area of 200 square meters, and specifically on the example of the installation of the "Smart Home" system of ABB i-Bus KNX the cost of the equipment starts from 2000 euros. At the same time, Table 1 shows the calculated data of electricity consumption without installing an intelligent system, which are compared with the counters of this private house using the Smart Home system [12].

ABB provided 9-month energy consumption statistics for the system using an intelligent system.

Table 1 presents the calculated data of electricity consumption without the introduction of an intelligent system, which are compared with the counters of this private house using the Smart Home system.

Table 1. Comparison of energy consumption with and without an intelligent system.

Consumption using intelligent systems						
№	Description	without, kW	with ABB KNX	Hours per month	Economy	Ammount, €
3	April	601.92	423.19	300	178.73	12.5111
4	May	621.984	358.21	310	263.774	18.46418
5	June	601.92	334.65	300	267.27	18.7089
6	July	621.984	348.44	310	273.544	19.14808
7	August	621.984	361.43	310	260.554	18.23878
8	September	601.92	424.84	300	177.08	12.3956
9	October	621.984	448.54	310	173.444	12.14108
10	November	601.92	450.11	300	151.81	10.6267
11	December	621.984	471.42	310	150.564	10.53948
					Total:	132.7739

The study revealed that the savings from the use of technology "smart home" in the house saves about 35%. The payback period of such a system in Russia is about 11 years. This means that the introduction of such a system is not as promising as in Europe, but if we consider that this system provides not only savings, but also a high level of comfort and safety, it starts to look more positive. Smart home systems eliminate the wasteful use of electricity that modern standards require. Although, today their installation is expensive, but due to the constant increase in electricity prices, it pays off in real terms. It was also revealed that the more fully the system is used, the more savings it gives and, accordingly, the faster it pays off.

4 Discussion

Cities play a key role in achieving energy efficiency goals, but still face serious challenges in order to achieve sufficient energy efficiency. The existing building stock and infrastructure in cities have a great influence on the final energy consumption of the City [5]. Approximately 65% of Russia's population lives in cities and urban areas, and they concentrate the largest share of current energy consumption. By installing automatic control at home, a consumer can get serious energy savings, since heating and electricity are consumed in accordance with his actual needs.

The systems offered today in the Russian market have the same structure: thermostats, motion sensors, window sensors, etc. serve as control sensors. They transmit certain information to the central control unit, which in turn controls the actions of so-called receivers, which for example, adjust the brightness of the lamps, turn on and off electrical appliances, raise and lower the shutters, monitor the temperature of the central heating batteries, or unlock and lock the doors. The user determines what and when he must perform the central control unit, which is programmed from a computer via a local network or the Internet or from a tablet or smartphone using the appropriate software. The site of the Smart Electronics online store [6]. Therefore houses with such an automated control system, or "smart houses", are one of the foremost innovations of our century.

"Smart Home" is a single system, as if united into one common organism. Or in a common computer, it works according to a predetermined algorithm, in which the consumer can always, at any time and from anywhere in the world, intervene and reconfigure individual functions in accordance with his wishes or needs. Such management makes it possible to significantly increase the efficiency of managing energy consumption business processes.

There are several ways to manage your smart home:

1. computer;
2. wall mounted consoles (common and in every room, if you wish);
3. remote controls;
4. touch panels;
5. voice commands;
6. use of electronic keys;
7. use of dactyloves;
8. telephone control;
9. management via the Internet.

Interactive management capability allows you to:

1. To increase the level of security of the building. The smart home system is designed to optimize the operation of security equipment (video surveillance, alarms, motion sensors, etc.)

2. Optimally organize the management of household and engineering systems. Programming "smart" equipment is aimed at automatically performing tasks without human intervention. The work of all building systems is controlled by a single control center.

3. Reduce the cost of utility maintenance of the building. Intellectual equipment optimizes the operation of household and engineering systems at home, thus reducing the cost of electricity, water and heat.

The feasibility of implementing the Smart Home system in Russia is obvious, it is made up of a number of factors. Thus, the reduction of electricity costs can reach 30%, water - 41%, heat - 50%. Due to the constantly rising tariffs for gas and electricity, the question of saving operating costs becomes the most urgent. It is clear that with an increase in the area of real estate, the investment attractiveness of introducing intelligent systems also increases many times over. That is why, according to forecasts, the main part of the demand for "Smart Home" systems will fall on owners of private cottages with an area of more than 300 sq.m. [7].

At the same time, if in a private house we speak, as a rule, about an individual project, typical solutions can be used in apartments to reduce the cost of implementing the "Smart Home" systems and thereby make them accessible to a wider range of clients.

Experts predict that the demand for “smart” real estate in Russia will grow as installer companies and architects join together to create turnkey projects. (Official site of the company Intellecthouse [8].

“Smart Grid” is a complex of technical means that make up the entire power grid system, which allows to quickly change the characteristics of power grids, thereby optimizing energy costs, and promote the redistribution of electricity. In other words, “smart grids” are an automated system whose elements are electrical grids, electricity producers and consumers. This system allows on-line to monitor and control the modes of operation of all participants in the process [9].

The implementation of a smart grid across the country will achieve the following goals:

1. to increase the reliability of power supply to consumers and ensure trouble-free operation of power systems;
2. smart grids will improve the efficiency of energy consumption while maintaining the required parameters of the quality of electrical energy;
3. due to the increase in the share of the use of non-conventional energy sources, the ecological situation will improve.

The use of Smart Grid technology applicable to buildings and structures, opens up prospects for energy savings with the help of intelligent installation systems [10].

The use of innovative business processes based on Smart Grid makes it possible to significantly reduce losses in the transmission of electrical energy from the generator to the consumer, a multiple increase in the reliability of power supply, and makes it possible to optimally redistribute energy flows and thereby reduce peak loads. If before the consumer took electricity from one seller, now he is in market conditions: he can choose any generating company [11].

But in order for a consumer to analyze - where it is cheaper for him to buy and take energy, he must know for sure - where and at what prices it is sold, where today is its surplus, and where is lack. Accordingly, if the company has its excess, it should reduce prices - this is an economic and social motive, which was not there before.

There is another problem associated with the consumption of electrical energy. For example, you bring the electrical network to a house where, say, two hundred apartments, of which twenty apartments do not pay for electricity, the rest pay regularly. To force these twenty - and in a store without money you will not receive a product, electricity is the same product - you have to turn them off, but for this you need to know exactly who does not pay and turn off the "non-payers", while not turning off the neighbors. Today, alas, such an opportunity exists only in modern houses, in old buildings, if disconnected, then the whole house.

In the foreseeable future, power grids should be:

- a) flexible in order to predict possible changes, problems and react to them,
- b) accessible so that all network users (generators and consumers) can connect to them with the priority of renewable energy sources, as well as hydrocarbon resources are most efficiently used,
- c) reliable, i.e. ensuring the safety and quality of power supply,
- d) economical - due to new technologies and effective network management,
- e) and finally, centralized and local control in normal and emergency modes should be covered by an adaptive system, while state and control on -line and off-line should be made using high-speed programs.

To modernize the Russian electric power industry, this is a new challenge - it should form into an integrated multi-level management system with an increase in the automation of business processes, increase their efficiency, with anticipation of systemic risks and threats and with rapid response to incidents and accidents.

5 Conclusion

Today, for the majority of the population of Russia, this innovation Smart Grid and Smart Home is something new and not fully understood. The slow implementation of "Smart Home" systems is explained by many factors, one of which is the lack of understanding of the principle of operation of such technologies and the sense of real economic gain.

The feasibility of implementing projects "Smart Home" in the future should prove the collected statistics. In countries where the Smart Home has long been an everyday reality, economic calculations speak of the benefits of investments and their quick return.

The consumer's lack of awareness of new innovative energy saving systems, the lack of stimulation of progressive construction technologies by the state, the fragmentation of interests and the inconsistent work of various administrative services hamper the large-scale implementation of integrated management systems and intelligent systems.

However, if the modernization of the Russian economy continues to develop in the direction of compliance with global trends of transition to an innovative type of economy, then Smart Grid and Smart House technologies are an effective tool for turning the Russian economy into an innovative and sustainable one, this is a peaceful solution to the conflict between artificial and natural habitat.

Summarizing all the above, we can conclude that the use of Smart Grid and Smart Home technologies significantly increases the efficiency of business processes using different types of energy. In the future, this will allow better planning of energy consumption and energy efficiency in modern conditions, as well as using pre-defined algorithms to optimize the entire energy system in accordance with actual consumer demand.

The large-scale implementation of integrated management systems and intelligent systems in the business processes of energy use in an innovative economy is the only possible variant of our future comfortable existence in the future.

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