ТЕХНИКАЛЫҚ ҒЫЛЫМДАР ЖӘНЕ ТЕХНОЛОГИЯЛАР

UDC 620.9
МРНТИ44.01

DOI: https://doi.org/10.37788/2021-3/64-71

R.E. Baizakov[1*], E.V. Ivanova[2]
[1]Innovative University of Eurasia, Kazakhstan
[2]Siberian State University of Water Transport, Russia
[*](e-mail: rbayza@mail.ru)

Development and research of means and methods for improving the efficiency of heat stations in the Republic of Kazakhstan

Annotation

The main problem: This article is devoted to the key problems of the fuel and energy complex of the Republic of Kazakhstan:

1) lack of production capacity to meet the growing demand for energy and fuel from the economy and the population. Increased demand for electricity and heat, which will require the commissioning of new generating capacities.There is already a shortage in the fuel markets. Modernization and bringing the existing oil refineries (hereinafter referred to as refineries) to full capacity will not allow providing the domestic market until 2030;

2) the export orientation of raw materials, the dependence of the economy on the export of energy resources. In order to attract technology and investment in the oil and gas and nuclear industries, agreements on the extraction of energy resources were concluded with international export companies. In the medium term, Kazakhstan may face a shortage of oil for domestic refineries, if measures are not taken to stimulate its refining within the country. The uranium mined is fully exported;

3) high energy intensity of the economy, low level of energy efficiency. There is a high potential for increasing the efficiency of energy use both in the electric power industry and fuel production, and at the level of final consumption – in industry and housing and communal services;

4) decrease in the replenishment and quality of the resource base in the oil and gas, coal and nuclear industries;

5) low environmental friendliness of technologies used in the fuel and energy complex.

Purpose: The purpose of the article is to reveal the problem in the field of ensuring the fulfillment of international obligations between different countries and their own energy sufficiency by gradually changing the structure of energy production.

Methods: Studying the experience of increasing the efficiency of the use of energy resources and energy saving as a priority of the state policy of the country. Analysis of production capacity with a constantly forecasted shortage of primary energy resources and insufficient growth of capacity for the production of electricity and heat. Consideration of the possibility of compensating for the shortage by saving energy resources, increasing tariffs for energy carriers, as a stimulating factor for their effective use.

Results and their significance: The results of this article will reflect the problems of energy, as the most important driving force of global economic progress. The well-being of the people depends on the state of the country's energy sector, therefore there is an urgent need to solve the emerging problems. The global energy problem is, first of all, the issue of stable and efficient supply of fuel and energy to mankind. Today, the energy sector of Kazakhstan is focused on fuel resources, since the country is provided with hydrocarbons and other energy resources. About 72 % of electricity in Kazakhstan is generated from coal, 12,3 % from hydro resources, 10,6 % from gas and 4,9 % from oil. Thus, the four main types of power plants generate 99,8 % of electricity, while alternative sources account for less than 0,2 %.

Keywords: efficiency of CHPP operation, energy efficiency, station, operation.

Introduction

The main problem when conducting energy audits is the lack of a full-fledged methodology for conducting an energy audit of thermal energy consumers, while providing consumers with thermal energy for the needs of heating, ventilation and hot water supply is the main item of expenditure of fuel and energy resources. For these purposes, about twice as much fuel is consumed as for the production of electricity. This makes it relevant to develop a methodology for conducting an energy audit of thermal energy consumers.

In the process of performing this work, the author developed and approved a methodology for conducting an energy audit of thermal energy consumers. In contrast to the many already existing methods and standards for assessing energy efficiency given in the work and considered earlier, this method contains an interconnected complex.

The equipment of thermal power plants in Kazakhstan is represented by a wide range of power units and turbine units with a single capacity from 25 MW and less to 250 MW. Due to the use of various types of equipment at the stations, there is a problem of ensuring a non-uniform load [1].

On the other hand, each station is faced with the task of reducing fuel costs, which can be provided by the most effective combination of working equipment and specified loads (thermal and electrical). Solving the problem of optimal load distribution of the station provides an increase in the efficiency of the CHPP.

Currently, many methods have been developed that lead to an increase in the energy efficiency of thermal power plants.

First, it is the optimization of the load distribution between the boiler and turbine equipment. But the solution to this problem depends on many factors:

– uncertainty of the source data;
– a large number of variables involved in calculations
– many restrictions;
– the need to take into account the actual condition of the equipment;
– selecting the most appropriate optimization size;
– a large number of optimized parameters.

Currently, many stations are not used in terms of heat due to the large number of consumers in the 1990s, especially those that use industrial choice vapors. In this regard, the fuel consumption at the plant increases, i.e. the cost of production increases, which affects the distribution of electricity.

In terms of electricity production, it should be noted that the specific fuel consumption for the production of electric and thermal energy on average in Kazakhstan exceeds the level of developed countries, which is primarily due to equipment wear, low efficiency and operating modes of power plants covered with thermal energy of thermal power plants. According to experts, the implementation of low-cost measures to optimize the operating modes of power equipment at power plants, optimize the number of starts and shutdowns of boilers, taking into account the forecast heat load, will reduce fuel consumption by up to 10 %. On average, the technically available level of reduction in the share of electricity losses in distribution networks, depending on the configuration of electrical networks, is 4-5 %. The current modernization of the RES will allow to reduce the specified level of costs by 1 % as much as possible. Further reductions will require large capital expenditures and will be inefficient. The shortage of own generating capacities in the Southern Energy Zone is primarily due to the underutilization of the Dzhambulskaya GRES, which, due to the high cost of gas, as well as the lack of its volumes, has the highest cost of electricity in Kazakhstan, especially in winter, which determines its low competitiveness. Of the six power units of the station, five remained in working condition, and two are operating with a relatively low load. As a result, the capacity deficit of the Southern Energy Zone will be covered by unloaded flows of its own capacity from the north and Central Asian countries, which will contribute to an increase in electricity losses during transmission along long transit lines (North-South) [2].

Methods

Based on the analysis, the following conclusions can be drawn:

1. There is no local legislative framework and energy saving management bodies, a small number of specialized organizations that are able to professionally deal with the problem of energy saving, and there is also no unified methodological and instrumental base for energy saving.

2. The availability of heat energy metering devices for consumers as of July 1, 2017 did not exceed 15 %, which indicates that the provisions specified in the law «On Energy Saving» were not fulfilled. According to the calculations carried out in this work, only 35 % of their total number will be equipped with metering devices by the end of 2016, which is also not enough.

3. The analysis of the heat consumption of objects equipped with metering devices showed that, as a rule, the actual heat consumption is lower than the calculated one by 27 %, which indicates either the effective energy consumption of consumers, or an error in the calculation of thermal loads and a violation of the operation of heat supply systems by consumers.

Based on the above, we can conclude about the unsatisfactory state of affairs in the field of organization of heat energy accounting and energy saving.

Recommendations for improving the organization of energy saving and accounting of thermal energy:

1) Development of a methodological base for energy saving (methods of conducting energy audits, textbooks on energy saving, etc.);

2) Determination of the nomenclature of heat energy metering devices recommended for implementation;

3) Creation of a unified tool base for conducting an energy audit of enterprises;

4) In addition to the development of heat energy accounting at the subscriber entrances of buildings, it is necessary to organize accounting in the following areas:

– in the nodes of the division of heat networks between owners;

– installation of metering devices on groups of buildings;

– organization of apartment-by-apartment accounting;

5) Mandatory energy audit at enterprises that allow overspending of thermal energy;

6) Introduction of modern energy-saving technologies for heat supply systems (automation of heat supply systems, plate heat exchangers for hot water supply systems, etc.);

7) Creation of a local center and an energy saving fund;

8) Review and adoption of the local law and the energy saving program.

Results

There is a somewhat contradictory situation in the industry. Despite the fact that electric power plants in the north and east of Kazakhstan have an excessive potential for generating and consuming electricity, due to the current scheme of electric distribution networks, the Southern and Western regions are forced to import electricity. Along with the increase in energy consumption, the reserves of hydrocarbon fuel are gradually decreasing. Thus, the energy deficit will only grow.

In this regard, the development of nuclear energy in Kazakhstan is becoming more and more relevant, given that the republic occupies the 2nd place in the world in uranium production and has significant development prospects. The only nuclear power plant in Kazakhstan was located in the city of Aktau with a fast neutron reactor with a capacity of 350 MW. The NPP operated in 1973-1999.

At the moment, nuclear energy is not used in Kazakhstan, although the country's uranium reserves are estimated at 900 thousand tons. The main deposits are located in the south of Kazakhstan (South Kazakhstan and Kyzylorda regions), in the west of Mangystau, in the north of Kazakhstan (the Semizbai deposit). Currently, the issue of building a new nuclear power plant with a capacity of 600 MW in Aktau is being considered.

There are about 5 research nuclear reactors in operation in the country. In 2018, 2 nuclear power plants are expected to be built in Kazakhstan – in the East Kazakhstan region in the city of Kurchatov and in the Almaty region on the shore of Lake Balkhash, in the village of Ulken.

Along with the possibility of using nuclear energy, Kazakhstan has significant hydro resources, theoretically, the capacity of all the country's resources is 170 billion kWh per year.

The main rivers with a large hydropotential are the Yertys, Ile and Syr Darya. The largest hydroelectric power plants are Bukhtarma, Shulbinskaya, Ust-Kamenogorsk on the Ertys River and Kapchagayskaya on the Ile River, providing 10 % of the country's needs. In the future, it is planned to increase the construction of hydroelectric power plants.

Along with the active involvement of hydro resources in the country's economy, Kazakhstan is switching to the use of non-traditional energy sources. The share of renewable energy resources is not more than 0.2 % of the total electricity generation. Wind energy is poorly developed, despite the fact that 90 % of the territory of Kazakhstan is subject to winds having a speed of more than 4 m/s.

In the area of the Dzungarian Gate and the Chilik corridor, it reaches up to 30 m/s. Despite this, the advantage of the development of wind energy requires a qualified approach, besides, the dispersion of wind energy threatens with extreme unevenness of production, and the occurrence of hurricanes and ice destroys the aerodynamic devices of wind power plants.

Thus, the peculiarities of natural conditions create a number of difficulties in the development of efficient wind power plants. The use of solar energy in Kazakhstan is also insignificant, despite the fact that the annual duration of sunlight is 2200-3000 hours per year, and the estimated power is 1300-1800 kW per 1 mI per year. However, the prospect of using solar energy is difficult due to the lack of own production of solar cells and batteries, the lack of support from the state, since the relative cost of electricity on fuel resources is cheaper.

Discussion

For the effective development of Kazakhstan's energy sector in the country, there are advantages associated with natural conditions for the construction of wind and solar power plants, the availability of resources for the construction and operation of nuclear power plants.

Thus, the development of alternative methods of obtaining electricity, the connection of the north and the west by distribution energy systems (Northern Kazakhstan - Aktobe region), the north and the south (North-South) can eventually solve the problems of electricity and expand the electric power industry in Kazakhstan.

When planning state energy saving programs, it is necessary to take into account the following effects: a significant reduction in the load with an increase in coal-fired generating capacities can negatively affect not only the economic performance of coal-fired power plants, but also the specific fuel consumption, since a reduction in the load affects the efficiency of the plant; * a reduction in the load in the energy deficit zone has a multiplier effect by reducing the volume of losses during electricity transmission. Thus, when improving the state policy in the field of energy saving, it is necessary to take into account the structure of electricity consumption in the country. The Southern Energy Zone should have the highest priority in implementing and promoting energy conservation measures, and the highest priority measures are those that lead to lower energy consumption. Recommendations: * Kazakhstan needs to develop the practice of attracting investments in the modernization of outdated infrastructure in the sectors of electricity production, transmission and distribution in order to reduce costs. * Amendments to the legislation of the Republic of Kazakhstan in terms of ensuring the reliability and quality of electricity supply, providing for an increase in the degree of responsibility for non-compliance with the requirements for the quality of electric energy on the part of electric conducting, power

transmission companies, as well as on the part of large consumers of electric energy. Since electricity is a commodity, it is recommended to study the issues of REQv certification of electricity in large consumption centers. * Gradual transition from coal-fired power plants to new regulatory requirements for emissions of harmful substances. Reorientation of the greenhouse gas emissions management system.

According to experts, 20 % of all losses are accounted for by the main distribution networks, and 80 % – by the distribution networks. The main problems from the point of view of operation of boiler houses: [3]

* significant wear and tear on most equipment whose actual service life exceeds that specified in the technical documentation;

• lack of quality measuring instruments, manufactured, and implemented energy meters, automation (including equipment fuel) and equipment for control of technological processes and modes of heat supply; * high level of negaranya of coal in coal boilers; * no automatic fuel feed a breakdown of boilers, and therefore, a significant impact of human factors on the reliability of the production of heat;

* the use of unconventional fuels (sewage sludge, a mixture of different grades of coal, etc.).

* lack of the necessary number of control and measuring devices and metering devices on part of the boiler rooms. In addition, the low level of training of working personnel leads to inefficiency, even if the relatively new equipment is in good technical condition. As already noted, heating networks have the highest energy consumption of housing and communal services. The exact losses in the heat networks are unknown due to incomplete equipment of measuring instruments. According to experts, they can range from 18 % to 42 %, which is significantly higher than acceptable values.

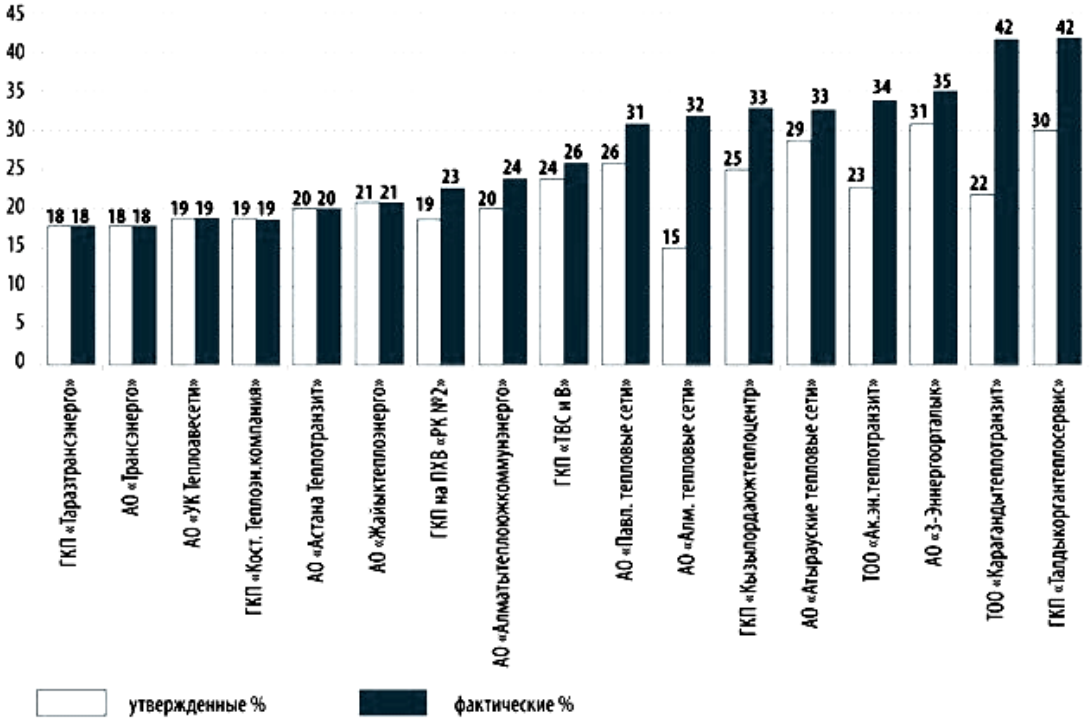

Figure 1 – Duration of operation of GRES andCHP in the Republic of Kazakhstan

With the adoption of the Strategy «Kazakhstan-2050» and the concept of transition to a «green» economy, the country has chosen a fundamentally new path of development of society. According to the concept, the focus of state policy on reducing the impact on the environment, saving resources and achieving a high level of quality of life for the population will play a crucial role. The main key area of work will be their modernization in order to increase the efficiency of existing thermal power plants.

According to the data published by Kaznipienergoprom Institute JSC, by 2012, Kazakhstan had widely used district heating systems based on 40 thermal power plants (mixed heat power) operating in 29 cities of Kazakhstan. District heating systems based on thermal power plants are represented by the northern, southern and western regions.

CHPP in the northern region of Kazakhstan accounts for 64% of the total available heat capacity of the CHPP of the Republic of Kazakhstan, the heat capacity of the central heat supply systems based on CHPP in the southern region is 19 %, in the western region – 17 %.

First of all, it should be noted that the efficiency of the CHPP depends on:

– operating mode of the station. Due to the lack of sufficient heat load, the CHPP is forced to switch to the condensing mode, which is characterized by very low efficiency (compared to traditional condensing stations). In addition, from the point of view of electricity generation, the efficiency of thermal power plants is always lower than that of condensing plants, as a result of which thermal power plants are often «lost», despite the overall efficiency of the co-generation cycle at the cost of electricity.

– technological component. The existing thermal power plants in Kazakhstan were built mainly in the 60-80s of the last century. In the period from 1990 to 2010, the commissioning of capacities at the CHPP was carried out on a limited scale. There is a technological gap in terms of world experience.

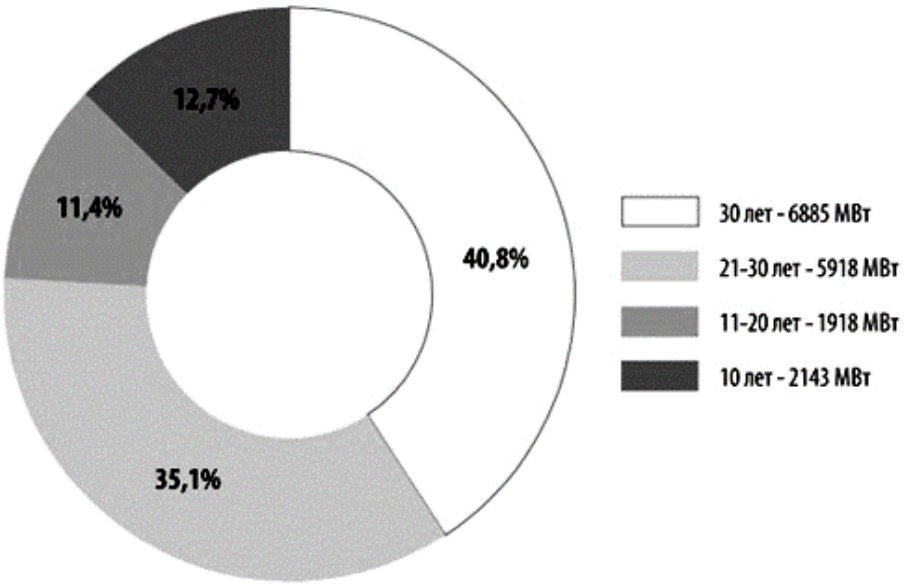

Figure 2 – Duration of operation of CHPP in the Republic of Kazakhstan

As can be seen from the diagram (Fig. 1), the service life of 41 % of the TPP capacities involved is 30 years or more, and 35 % of them are operated for 20-30 years [4].

– insufficient level of ash accumulation in coal-fired power plants, which creates a high level of negative impact on the environment;

– lack of reserve and maximum closing capacity;

– Lack of sufficient heat load on the CHPP compartments and their operation in the condensation mode.

– high specific fuel consumption. A significant problem is the high specific fuel consumption characteristic of most Kazakhstan thermal power plants, which, due to the lack of the necessary amount of heat load, are forced to work part of the time in a non-economic condensation mode. The loss of load volume is also related to the historical prerequisites for the design of thermal power plants, many of which were created in the Soviet era, and the value of thermal loads was completely different, the economic downturn of the nineties led to a reduction in the number of large industrial heat consumers.

One of the solutions to these problems will be the search for the optimal level of heat energy losses, which should take into account the need to maintain the thermal load of the CHPP. The existing imbalance between the design and actual thermal load of the CHPP may lead to a further decrease in the efficiency of the CHPP due to the forced increase in working hours in the condensation mode with its further decrease [5].

Conclusion

The main scientific and practical results of the work are as follows:

– as a result of the review of the existing state, the problems and prospects of improving the energy efficiency of the enterprise are identified, aimed at the quality of implementation of energy-saving measures and increasing their reliability.

– a comparative analysis of boiler equipment was carried out to select the optimal one for installation in order to increase the heat load due to a shortage of steam;

– a thermal verification calculation of the furnace and the convective part of the selected boiler, as well as a constructive calculation of the tail surfaces, was performed;

– based on the calculations, it was revealed that the CHP has a significant energy-saving potential, which, with technically competent use, can significantly increase the energy and economic efficiency of both the fuel economy and the entire heat source as a whole.

– the theoretical foundations of economic indicators have been studied and the capital investments of the proposed reconstruction of the CHPP have been determined.

Assessment of the completeness of solutions to the tasks set. The set goal of the work has been achieved, the research tasks have been completely solved. The results of the study are fully brought to a logical conclusion in the form of calculated values of the corresponding conclusions.

Development of recommendations for the use of the results.

In general, the proposed measures to improve the CHP of the Republic of Kazakhstan, as well as measures to increase these indicators, will significantly increase the efficiency of this enterprise and create favorable conditions for further capacity increase in accordance with the energy needs of the city.

Assessment of the technical and economic efficiency of the implementation.

The implementation of the obtained research results will allow us to develop measures to improve the efficiency of the CHPP and improve the quality of energy saving of energy enterprises as a whole.

Evaluation of the scientific level of the work performed in comparison with the best achievements in this field. The conducted review of the literature, the results of theoretical and applied research allow us to conclude that the provisions corresponding to the current level of development of heat engineering and heat technology are used in the dissertation work.

THE LIST OF SOURCES

1 Афанасьева О.В. О возможности производства энергии и побочных продуктов на автономных источниках питания, работающих на твердом топливе: учеб. пос. – Усть-Каменогорск, 2013. – 216 с.
2 Кузнецов М. Л. Вопросы проектирования ТЭЦ. учеб.пос. – Актау, 2015 – 166 с.
3 Перспективы энергетического сектора Казахстана глобальных тенденций развития энергетики.- [Электронный ресурс]. Режим доступа: https://unece.org/fileadmin/DAM/energy/se/pdfs/gee21/projects/ Study_KZ.pdf
4 Журнал для стран Евразийского экономического сообщества «Энергетика и электрооборудование». – [Электронный ресурс]. Режим доступа: http://www.eurasiancommission.org/ru/nae/news/Documents/
5 Приоритеты социально-экономических факторов в региональной политике. – [Электронный ресурс.] Режим доступа: https://adilet.zan.kz/rus/docs/P960001097

REFERENCES

1 Afanasyeva, O.V. (2013). On the possibility of energy production and by-products on autonomous power supply sources operating on solid fuel .Ust-Kamenogorsk [in Russian].
2 Kuznetsov, M.L. (2015). Questions of design of CHPP. Aktau [in Russian].
3 Prospects of Kazakhstan's energy sector in the light of global trends in energy development. - [Electronic resource]. (n.d.). https://unece.org. Retrieved from: https://unece.org/fileadmin/DAM/energy/se/pdfs/gee21/ projects/ Study_KZ.pdf [in Kazakh].
4 Journal for the countries of the Eurasian Economic Community «Energy and Electrical Equipment». – [Electronic resource].(n.d.). http://www.eurasiancommission.org. Retrieved from: http:// www.eurasiancommission.org/ ru/nae/news/Documents/ [in Kazakh].
5 Priorities of socio-economic factors in regional policy. – [Electronic resource]. (n.d.). Retrieved from: https://adilet.zan.kz/rus/docs/P960001097_ [in Kazakh].

Р.Е. Байзақов[1*], Е.В. Иванова[2]
[1]Инновациялық Еуразия университеті, Қазақстан
[2]Сібір мемлекеттік су көлігі университеті, Ресей

Қазақстан Республикасы жылу станцияларының тиімділігін арттыру құралдары мен әдістерін әзірлеу және зерттеу

Бұл мақала Қазақстан Республикасының отын-энергетикалық кешенінің негізгі мәселелеріне арналған:

1) Экономика және халық тарапынан энергия мен отынға өсіп отырған сұранысты жабу үшін өндірістік қуаттардың болмауы. Электр және жылу энергиясына сұраныстың артуы, бұл жаңа өндіруші қуаттарды енгізуді талап етеді. Отын нарығында тапшылық байқалуда. Жұмыс істеп тұрған мұнай өңдеу зауыттарын (бұдан әрі-МӨЗ) жаңғырту және толық қуатқа шығару 2030 жылға дейін ішкі нарықты қамтамасыз етуге мүмкіндік бермейді;

2) Шикізат салаларының экспорттық бағдарлануы, экономиканың энергия ресурстарының экспортына тәуелділігі. Мұнай-газ және атом салаларына технологиялар мен инвестициялар тарту мақсатында экспортпен айналысатын халықаралық компаниялармен энергия ресурстарын өндіру туралы келісімдер жасалды. Егер ел ішінде оны өңдеуді ынталандыру жөнінде шаралар қолданылмаса, Қазақстан Орта мерзімді перспективада отандық мұнай өңдеу зауыттары үшін мұнай тапшылығына тап болуы мүмкін. Өндірілген уран толығымен экспортталады;

3) Экономиканың жоғары энергия сыйымдылығы, энергия тиімділігінің төмен деңгейі. Электр энергетикасы мен отын өндірісінде де, өнеркәсіп пен тұрғын үй – коммуналдық шаруашылықта да түпкілікті тұтыну деңгейінде энергия ресурстарын пайдалану тиімділігін арттыру үшін жоғары әлеует бар;

4) мұнай-газ, көмір және атом салаларында ресурстық базаның толықтырылуын және сапасын төмендету;

5) Отын-энергетика кешенінде пайдаланылатын технологиялардың нашар экологиясы.

Мақаланың мақсаты – энергия өндірісінің құрылымын біртіндеп өзгерту арқылы әртүрлі елдер арасындағы халықаралық міндеттемелердің орындалуын және олардың өзіндік энергетикалық жеткіліктілігін қамтамасыз ету саласындағы мәселені ашу. Елдің мемлекеттік саясатының басымдығы ретінде энергетикалық ресурстарды пайдалану және энергия үнемдеу тиімділігін арттыру тәжірибесін зерделеу. Бастапқы энергия ресурстарының ұдайы болжанып отырған жетіспеушілігі және электр энергиясы мен жылу өндіру жөніндегі қуаттардың жеткіліксіз өсуі кезіндегі өндірістік қуатты талдау. Энергия ресурстарын үнемдеу, оларды тиімді пайдаланудың ынталандырушы факторы ретінде энергия көздеріне тарифтердің өсуі есебінен кемшілікті өтеу мүмкіндігін қарау.

Мақаланы жазу кезінде энергетикалық ресурстарды пайдалану және энергия үнемдеу тиімділігін арттыруда практикалық тәжірибені жалпылау әдісі, деректерді статистикалық өңдеу әдісі қолданылды.

Осы мақаланың нәтижелері жаһандық экономикалық үрдістің маңызды қозғаушы күші ретінде мәселелерді, энергетиканы көрсетуге мүмкіндік береді. Халықтың әл-ауқаты елдің энергетикалық жағдайына байланысты, сондықтан туындаған мәселелерді шешудің аса маңызды қажеттілігі бар. Жаһандық энергетикалық мәселе – бұл, ең алдымен, адамзатты отын және энергиямен тұрақты да тиімді қамтамасыз ету мәселесі. Бүгінгі таңда Қазақстанның энергетикалық секторы отын ресурстарына бағдарланған, өйткені ел көмірсутектермен және басқа да энергетикалық ресурстармен қамтамасыз етілген. Қазақстанда электр энергиясының шамамен 72 %-ы көмірден, 12,3 %-ы гидроресурстардан, 10,6 %-ы газдан және 4,9 %-ы мұнайдан өндіріледі. Осылайша, электр станцияларының төрт негізгі түрі электр энергиясының 99,8 %-ын өндіреді, ал баламалы көздерге 0,2 %-дан аз келеді.

Түйінді сөздер: ЖЭО жұмысының тиімділігі, энергия тиімділігі, станция, пайдалану.

Р.Е. Байзаков[1*], Е.В. Иванова[2]
[1]Инновационный Евразийский университет, Казахстан
[2]Сибирский государственный университет водного транспорта, Россия

Разработка и исследование средств и методов повышения эффективности тепловых станций в Республике Казахстан

Данная статья посвящена ключевым проблемам проблемам топливно-энергетического комплекса Республики Казахстан:

1) отсутствию производственных мощностей для покрытия растущего спроса на энергию и топливо со стороны экономики и населения. Увеличение спроса на электрическую и тепловую энергию, что потребует ввода новых генерирующих мощностей. На рынках топлива уже наблюдается дефицит. Модернизация и вывод существующих нефтеперерабатывающих заводов (далее-НПЗ) на полную мощность не позволят обеспечить внутренний рынок до 2030 года;

2) экспортной ориентации сырьевых отраслей, зависимости экономики от экспорта энергоресурсов. В целях привлечения технологий и инвестиций в нефтегазовую и атомную отрасли были заключены соглашения о добыче энергоресурсов с международными компаниями, которые занимаются экспортом. В среднесрочной перспективе Казахстан может столкнуться с дефицитом нефти для отечественных нефтеперерабатывающих заводов, если не будут приняты меры по стимулированию ее переработки внутри страны. Добытый уран полностью экспортируется;

3) высокой энергоемкости экономики, низкому уровню энергоэффективности. Существует высокий потенциал для повышения эффективности использования энергоресурсов как в электроэнергетике и производстве топлива, так и на уровне конечного потребления – в промышленности и жилищно-коммунальном хозяйстве;

4) снижению пополнения и качества ресурсной базы в нефтегазовой, угольной и атомной отраслях;

5) низкой экологичности технологий, используемых в топливно-энергетическом комплексе.

Цель статьи раскрыть проблему в области обеспечения выполнения международных обязательств между различными странами и их собственной энергетической достаточности путем постепенного изменения структуры производства энергии.

При написании статьи применялся метод обобщения практического опыта в повышении эффективности использования энергетических ресурсов и энергосбережения, метод статистической обработки данных.

Результаты по настоящей статье позволят отразить проблемы, энергетики, как важнейшей движущей силы глобального экономического прогресса. От состояния энергетики страны зависит

благосостояние народа, поэтому существует острая необходимость решения возникающих проблем. Глобальная энергетическая проблема — это, прежде всего, вопрос стабильного и эффективного обеспечения человечества топливом и энергией. На сегодняшний день энергетический сектор Казахстана ориентирован на топливные ресурсы, так как страна обеспечена углеводородами и другими энергетическими ресурсами. Около 72 % электроэнергии в Казахстане вырабатывается из угля, 12,3 % – из гидроресурсов, 10,6 % – из газа и 4,9 % – из нефти. Таким образом, четыре основных типа электростанций вырабатывают 99,8 % электроэнергии, в то время как на альтернативные источники приходится менее 0,2 %.

Ключевые слова: эффективность работы ТЭЦ, энергоэффективность, станция, эксплуатация.

Date of receipt of the manuscript to the editor: 2021/06/21