

## Development of the Energy Sector and Energy Security of Kazakhstan

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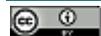
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### Abstract

In the current conditions of the economic development of the Republic of Kazakhstan, the energy sector is one of the most important directions of the national economy, which is undoubtedly interest for conducting research in the field of sectoral economics. In this article, is given a literature review of domestic and foreign authors, which conducted research on the development and improvement of the management of the energy system. The article explores one of the topical problems - reforming and modernizing Kazakhstan's energy sector. The characteristic regularities and features of the republic's energy system are shown. The authors of the article conducted a study of Kazakhstan's energy industry in various aspects of sectoral management, including energy security. As a result of the studies, the theoretical and methodological aspects of the study of the management of the national economy are systematized, on the basis of which conclusions are drawn.

**Keywords:** Energy; Energy security; Energy policy; The market; Modernization; National policy.



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### 1. Introduction

The energy sector of Kazakhstan is one of the leading links in the socio-economic life of the country. In this sector, a large part of industrial production is produced, and the country is largely developed through the export of energy. In this regard, it is very important to determine the main strategy for sustainable energy development for a long time.

The energy policy of Kazakhstan is contained in a number of documents. One of the most important documents, "Kazakhstan Development Strategy until 2030", where energy is noted as one of the most important industries, which determined by the need for "rapid growth in the production and export of oil and gas to generate income to ensure sustainable economic growth and improve living standards Population ". "Strategy 2030" was developed for two main periods: until 2015 and 2030. The document represents a strategy for the development of the fuel and energy sectors of the country (Bhuiyan, 2011; Cohen, 2008; Mantel, 2015; Palazuelos and Fernández, 2012; Somuncuoğlu, 2011).

The energy security of any economic system should be understood as the minimum probability of manifestation of external and internal threats to the process of its energy supply, in which the long-term stable functioning of the system is not violated (Bodnar and Hopwood, 2012).

The study and research of international experience in the field of energy security has shown that it is more acceptable for Kazakhstan to study the mechanisms of state support in the field of social and economic development of the republic, which will not only ensure environmental protection, but will also improve the management of the national economy.

These circumstances, as well as the need to search for more effective approaches to improving the national economy for implementing and securing strategic tasks of energy policy, predetermined the relevance of the author's research (Lavenex, 2004; Zhu *et al.*, 2013).

### 2. Literature Review

The analysis of publications in the field of development of the energy system showed that the approaches used in world practice are quite diverse and specific for each individual country. Therefore, they are interest of conducting research work.

The studies of foreign and Kazakh scientists are aimed at a multivariate study of the development of the national economy.

Kretinin VA, Bordyashov ES [Novakovskaya and Mityukhin \(2015\)](#) studied the regional economy from the point of view of economic geography, which uses the notion of a regional environment, which is directly related to issues of economic security.

The measures necessary to ensure energy security at the global level, the level of states and territories within states, certainly differ. Some territories lack own energy resources, others, on the contrary, are redundant. Territories have different levels of socio-economic development, are differently integrated into the world and / or national economy, differ in many other features.

V.V. Bushuev, N.I. Voropai, A.M. Mastepanov, Yu. K. Shafranik and others ([Anatol'Evich et al., 2012](#)) believe that energy security implies a state of security of the country (region), its citizens, society, state, economy. From the threat of a deficit in providing their justified energy needs with economically accessible fuel and energy resources of acceptable quality, as well as protection from violations of stability, uninterrupted fuel and energy supply.

Kondratieva O.E. ([Shvartsev et al., 2007](#)) conducted an analysis of the required frequency and duration of measurements, the selection of marker substances for a system of continuous monitoring and accounting of emissions was reasoned, and the expediency of using various monitoring methods in the designed systems was investigated.

The international mechanism of global energy security could become the authority that, on behalf of the international community, managed both similar international energy centers and other organizations or forms aimed at creating a global balanced energy potential, say researchers such as A. Yanagisama ([Richard et al., 2016](#)), Q. Zhang, KM Ishihara, BC McLellan, T. Tezuka ([Zhang et al., 2012](#)).

In the works of domestic scientists, the problems of choosing priority areas for reforming the national economy and the energy system that will ensure a significant increase in the management efficiency of industries in Kazakhstan are considered ([Akhmetov et al., 2011](#); [Baizakova et al., 2016](#)).

The analytical substantiation of strategic directions of formation of reforms of the energy system influences the development of the national economy and requires further theoretical, methodological and applied scientific developments. In particular, it is important to determine the economic priorities for the long-term development of Kazakhstan's energy industry in accordance with state programs and public-private partnership mechanisms in implementing state programs.

Despite the research conducted by economists in the context of theoretical and methodological aspects, studying the problems of managing the energy sector, taking into account the competitiveness of national economies, is insufficiently studied and creates ample opportunities for further research.

All this has determined and determined the study of modern approaches in the management and improvement of the energy industry.

### 3. Discussion

The development of electric power in Kazakhstan is based on scientific principles, that is, in many regions large power plants are being built that use cheap fuel and hydroelectric power.

The purpose of the energy policy of the Republic of Kazakhstan is to maximize the efficient use of natural energy resources.

At the moment, the country is largely using thermal power plants. Thermal power plants operate mainly on the Karaganda and Ekibastuz coal and give over 90% of all electrical energy.

In each regional city and in many industrial centers, powerful TPPs and CHPPs have been created. The largest of them are located in Ekibastuz, Aksu, Taraz, Karaganda, Almaty.

In 1973, a nuclear power plant was built in the city of Aktau on the shore of the Caspian Sea. It is used with a fast neutron reactor that produces electricity and fresh water simultaneously, since the system is connected to a desalination plant. One of the most important tasks of the development of the electric power industry in Kazakhstan is the creation of a unified energy system. The unified energy system should unite all the currently operating power stations in one high-voltage network.

The territory of the country has a special geographical location, it connects Europe and Asia, the Russian Federation and Central Asia, and serves as a bridge between these regions. At the moment, there are several local power systems in the country, Almaty, Altai, Central-Kazakhstan, Pavlodar, etc. In the 1970s, the construction of the North Kazakhstan power system was completed. It unites all power plants in Northern Kazakhstan, which includes six regions. The North-Kazakhstan energy system is also connected with the power plants of Eastern and Central Kazakhstan, and with neighboring regions of Russia. In the southern part of the country, the Almaty energy system through Bishkek is connected to Zhambyl, South-Kazakhstan regions and the Republic of Uzbekistan. In the western part of the country, the Aktyubinsk energy system operates, which is connected to the Ural power system, and the Ural power system, in turn, is connected to the power system of the European part of Russia through the Volga region. And, as we mentioned above, the creation of the unified energy system of Kazakhstan is one of the important tasks for the development of the country's energy system, and for this it remains only to link the individual energy systems of the republic that operate at the moment.

The Unified Electric Power System of the Republic of Kazakhstan (EEC RK) is a term that unites a complex of power plants, power transmission lines and substations. It provides reliable and high-quality power supply to Kazakhstan consumers.

Under the laws of the Republic of Kazakhstan, the electric power system is regulated by the state. Regulation is carried out in order to:

- Full satisfaction of consumers' demand, protection of rights of participants in the electricity market, creation of competitive conditions in the market, guaranteeing consumers the right to choose the supplier of electricity;
- Guarantee of reliable and stable activity of the energy complex of the Republic of Kazakhstan
- Management of the energy complex of the Republic of Kazakhstan, as it is a particularly important system of economic development of the country.

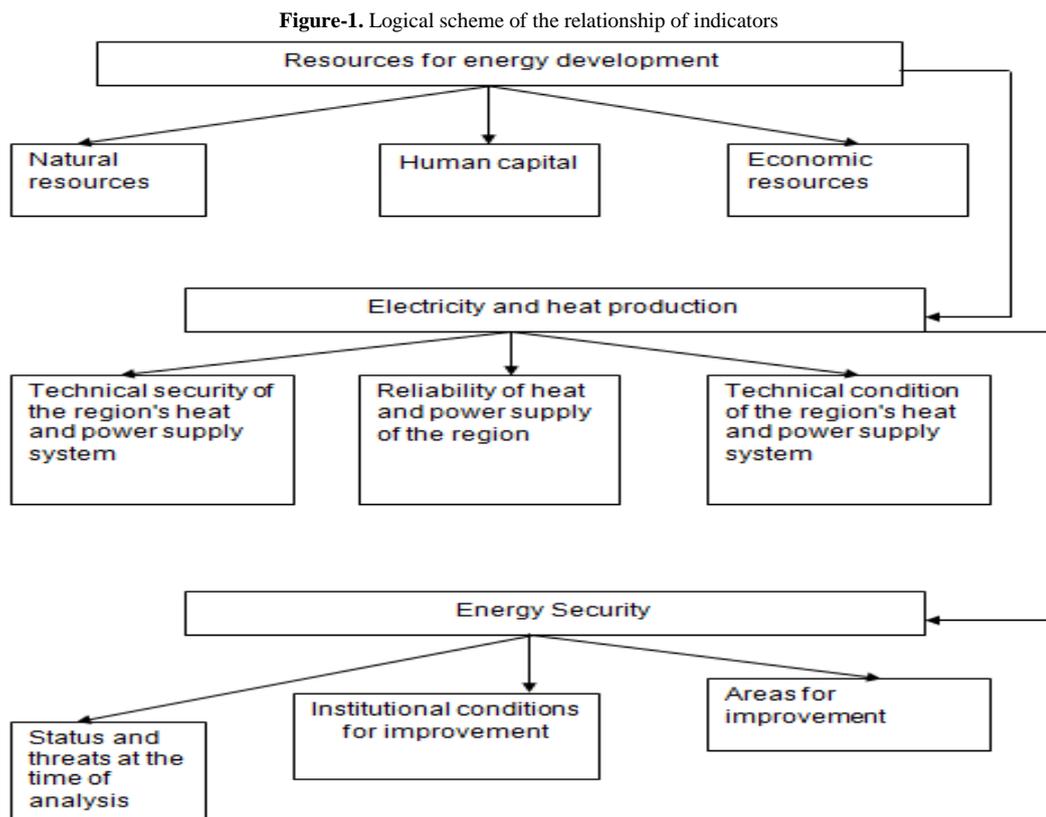
The strategic guidelines for the long-term state energy policy are: energy security; Energy efficiency of the economy; Economic efficiency of energy; Ecological safety of power engineering.

*Consider one of the landmarks.*

The assessment of the level of energy security of the country should be based on the use of the following block indicators:

- Block of production and resource provision of the region's fuel and energy supply system;
- Unit of reliability of fuel and energy supply in the region;
- A block of state of the main production assets of energy systems located in the region.

The logical scheme of the interconnection of indicators is shown in [Figure 1](#).



It is advisable to analyze the energy security of the region when considering such problems as ensuring the regional economy with energy and economic resources, matching human capital parameters to the requirements of sectoral development, and the possibility of increasing investment. It is also necessary to consider the problems of electricity and heat production, which are among the main threats to the energy security of the region.

For Kazakhstan, the possible threats to energy security are: a certain degree of dependence of the republic on the supply of electricity from outside the region, a significant depreciation of fixed assets.

In addition, the introduction of new technologies for Smart Grids and modern digital systems for automation of production process control (SCADA) contributes to the growth of multilateral risks.

To ensure the safe functioning of existing and newly created complex and highly efficient intelligent energy systems, the following complexes of different types of functional protection are needed ([Cheng et al., 2011](#); [Liu et al., 2010](#)):

- From violations of the integrity of modes of operation of network communications;
- From hostile insiders;
- From the opening and malicious adjustment of equipment.

The technical potential is shown in [Table 1](#).

**Table-1.** Technical potentials of primary energy sources. The need for integration of sources for energy security

Type of primary energy source	Technical potential (billion toe)
Traditional sources of energy	
Coal	480
Oil	140
Natural gas	225
Peat	80
Uranus	35
Hydropower per year	9,4
New energy sources	
Renewable energy sources without bioenergy per year	205
Bioenergetics per year	40-60
Oil shale and oil sands	700
Methane hydrates	218
Thermonuclear fuel (FTC)	10000
TOTAL	
Renewable	265, when possible 70
Non-renewable (without TCB)	1878, when retrieving 1300
Currently consumed 14,5 billion tons of oil equivalent per year.	
Target Consumption 65 billion tons of oil equivalent per year.	
Data of the International University of Nature, Society and humanity "Dubna"	

International research shows that the structure of the potential of primary energy sources in the world is such that the cumulative mass of non-renewable energy sources is 7-10 times higher than the size of renewable resources.

The distribution system of electrical energy must meet the requirements of safety standards.

The development plan for the electricity distribution system must meet a number of criteria. First and foremost, electricity distribution organizations must fulfill their customer service obligations, so that they have sufficient capacity to meet growing needs. Substations, power lines and distribution transformers should not be overloaded. Electric substations must have reserve capacities for emergency situations, whereas under normal conditions they can be loaded up to 70% of maximum capacity.

### 3.1. Sustainability of Energy Development in a Particular Country Suggests

- Ensuring acceptable quality, required volume and price availability of various types of energy in all regions of the country for all consumer groups for the forecast period, which is an indicator and guarantee of energy security of the country;
- Achievement and preservation of the required level of provision of primary and final energy with significant changes in internal and / or external conditions, which characterizes the energy independence and energy sustainability of the country;
- Ensuring the level of energy consumption is not lower than the social minimum in critical and emergency situations.

### 3.2. Sustainable Energy Development also Provides

- Achievement in the country of the world level of efficiency of extraction, transformation, transportation and use of fuel and energy resources;
- reducing the impact of energy facilities on the environment to a level that provides self-recovery or recovery using special technologies;
- achievement of the optimal technological and technical structure of the energy system with forecasted energy needs;
- achievement of a high level of interchangeability of energy resources in the joint functioning of various energy supply systems.

The energy interests of the state and its citizens are, of course, vitally important and long-term. The essence of energy interests, in the final analysis, is reduced to rational use of available energy resources and all types of energy received at their expense, as well as to production, preservation and accumulation of energy potential and high-quality energy resources, including through alternative sources of energy. A special role in the system of energy interests belongs to scientific and technical progress, since it is he who determines the level of development of the energy, industry and transport system of the country and, ultimately, the well-being of citizens, genuine independence, international prestige and economic power of any state.

Kazakhstan's electricity market can be divided into two levels: the wholesale and retail electricity market.

The establishment of authorized bodies, providing free access to the electricity market of all participants is carried out by system operators, regional grid companies and other companies that own electric grids.

Production, transmission and consumption of electricity are carried out and regulated by the relevant contracts established under the Law of the Republic of Kazakhstan on Electric Power Industry.

The functional structure of the wholesale electricity market of Kazakhstan consists of the following items:

- Decentralized market for the sale and purchase of electricity;
- centralized market of electricity trade. On the centralized market, electricity purchase and sale agreements are being implemented, which are based on short-term, medium-term and long-term periods. The centralized market works to ensure the access of all participants to the electricity market and the indication of the fair current market price of electricity;
- A balancing market in real time, acts to regulate some of the imbalances that occur during production and consumption. In the unified electric power system of the Republic of Kazakhstan, the contractual values of energy production and consumption are indicated, and the balancing market controls the implementation of this contract;
- The market of system and support services, the market providing the provision of system services and the purchase of ancillary services.

Thus, the processes of development and improvement of the energy system are, on the one hand, an inevitable and mutually beneficial phenomenon, which on the other hand creates a number of additional tasks for their implementation.

#### 4. Methods

With the acquisition of independence, the Republic of Kazakhstan annually develops international cooperation with foreign countries. In the field of electrical energy, it is possible to note the deepening of the integration of the CIS countries. Within the framework of this cooperation, a joint strategy for the creation of a common electricity market in the Eurasian space was developed.

One can especially note the work of interstate institutions such as the Eurasian Economic Community (EurAsEC), the Shanghai Cooperation Organization (SCO), the activities on the creation of the Common Economic Space (CES) and other communities and unification. The work of these interstate institutions is aimed at developing the economies of the participating countries, in many sectors, including the electric power industry.

To create such a common market of electric energy was that the energy systems of the participating states are working in parallel, as well as ensuring the cooperation of system operators of the energy systems of countries. At the moment, 11 energy systems operate parallel to the CIS countries and, accordingly, they are interconnected. In 2007 representatives of system operators of the participating countries took part in the meeting of the Electric Power Council of the CIS Executive Committee in Yerevan, Dushanbe.

Further, work was continued to create a regulatory and legal framework that implements the organization of the creation of a common electricity market of the CIS countries.

The market of electric energy is connected with almost all other markets, for example, the market of metal, oil, transport, industry. Note that the electrical energy is a special product. Electricity has some specific characteristics. For example, electrical energy can not be placed in a warehouse, and its consumption occurs simultaneously with production. This means that in the UPS of Kazakhstan it is always to control the balance between the production and consumption of electric energy.

To ensure a stable growth of the country's economy, it is necessary to outstrip the development of the electric power industry as a whole. The main factor in determining the perspective scheme for the development of the NES is the forecast balance of power and electricity. According to the forecast balance, in the long term up to 2025, an excess of electricity production is expected to reach about 3.9 billion kWh. (Shown in [Tables 3, 4](#)).

**Table-3.** Forecast balance of electricity from the UPS of Kazakhstan  
billion kWh \* h

	2013	2015	2020	2025
Power Consumption	93,3	100,9	116,0	129,9
Power generation	93,2	102,7	120,5	133,8
Deficiency (-), excess (+)	-0,08	1,8	4,5	3,9

**Table-4.** Forecast balance of capacity of the UPS of Kazakhstan  
MW

	2013	2015	2020	2025
Maximum load	14700	15920	18530	20500
Generation	14620	16220	18930	21000
Deficiency (-), excess (+)	-80	300	400	500

In this connection, the following projects are included in the portfolio of priority projects for the development of the NES:

1. The project "Construction of 500 kVA KVA with connection to 500 kV, 220 kV voltage lines in Kazakhstan will ensure reliability of electricity supply in Almaty and Almaty region, and delivery of capacity of the first stage of Balkhash Thermal Power Plant (1,320 MW). The implementation period is 2009-2014. The cost of the project is 30 billion tenge.

2. The project "Modernization of the National Electric Network of Kazakhstan, Phase II", is aimed at raising the technical level And ensuring the reliability of the operation of the NES of Kazakhstan. Term of realization - 2010-2016 years. The project cost is 52 billion tenge.

3. The project "Granting the capacity of the Moinak HPP" will allow the delivery of the capacity of the Moinak HPP in the amount of up to 300 MW in peak modes. The implementation period is 2010-2012. The cost of the project is 9.8 billion tenge.

4. The Balkhash TPP capacity release project is necessary to ensure the capacity of the Balkhash TPP (2,640 MW). The implementation period is 2011-2020. The project cost is 31.3 billion tenge.

5. The project "Reconstruction of HVL 220 kV CCPP-Osakarovka" is aimed at improving the reliability of electricity supply to consumers in Astana. The implementation period is 2010-2014. The cost of the project is 4.0 billion tenge.

6. The project "Construction of an interstate transmission line 500 kV Kazakhstan-Kyrgyzstan" further connects the energy systems of Kyrgyzstan and Kazakhstan. The intention to consider the implementation of this project was announced at a meeting of the Heads of Governments of Kyrgyzstan and Kazakhstan on December 1, 2009 in Astana. If the project is implemented, it is possible to create a new energy ring, which provides alternative power distribution capacities in the Central Asian region. The project will provide additional export and transit opportunities for Kazakhstan, will allow to optimize water and energy issues in the interests of Kazakhstan. The implementation period is 2013-2018. The cost of the project is 22.5 billion tenge.

7. The project "Strengthening the connection of the Pavlodar energy node with the UES of Kazakhstan" is necessary to ensure the reliability of electricity supply to the consumers of Pavlodar and the power output of the city's power plants in the UPS of Kazakhstan. The implementation period is 2010-2016. The project cost is 5.5 billion tenge.

8. The project "Combining the power system of Western Kazakhstan with the UPS of Kazakhstan" will improve the reliability of electricity supply to consumers in the Western zone of the EES of Kazakhstan, provide power to the planned Aktau nuclear power plant, and also unite the Western zone from the UPS of Kazakhstan through the territory of the republic. The implementation period is 2013-2025 (depending on the term of commissioning of new generating capacities in the western region of Kazakhstan). The project cost is 100.7 billion tenge.

9. The project "Construction of 220 kV Uralsk-Atyrau and Kulsary-Tengiz lines" (625 km) to strengthen electrical connections between the regions of the Western zone of Kazakhstan. The implementation period is 2021-2025. The cost of the project is 21.3 billion tenge.

10. Project "Construction of 500 kV Substation Astana with the addition of 500 kV lines to the Kazakhstani NPS (250 km) to ensure the reliability of power supply in Astana and the Akmola region. The implementation period is 2021-2025. The cost of the project is 23.7 billion tenge.

11. The project "Construction of the 500 kV Nura-Zhezkazgan line" (550 km) to ensure reliability of power supply of the Zhezkazgan energy center. The implementation period is 2021-2025. The cost of the project is 27.0 billion tenge.

12. The project "Construction of 500kV North-East-South Transit" to strengthen the communication of the Eastern region with the UPS of Kazakhstan, ensure the delivery of the full capacity of the Shulbinskaya HPP with the introduction of a counter regulator - Bulakskaya HPP, improve the reliability of electricity supply in the Eastern Zone, Almaty region and strengthen North-South transit. The implementation period is 2011-2018. The project cost is 123.5 billion tenge.

13. Project "Issuance of capacity of Torgai TPP" to ensure the delivery of the capacity of the planned Torhayskaya TPP to the construction site. The implementation period is 2021-2025. The cost of the project is 12.8 billion tenge.

14. The project "Rehabilitation of the NES" (2,200 kilometers of 220 kV OHL, 404.3 km of VL 500 kV) will restore the technical characteristics of power transmission lines. The implementation period is 2013-2023. The cost of the project is 84.8 billion tenge.

## 5. Results

The global crisis is not the only problem in the development of the electricity market. In the development of the industry there are other problems that limit the industry to reach the maximum level.

The first is that the territory of the Republic of Kazakhstan is quite large, and by economic and geographical differences, the country's territory can be divided into five regions. In the centralized economy of the Soviet Union, development of output and infrastructure was carried out in connection with the territorial industrial complexes, which were created taking into account allied needs. In the end, three autonomous economic regions emerged in Kazakhstan: the Western, Northern and Central, Southern regions.

- The Northern and Central regions include the following regions: Akmola, East Kazakhstan, Karaganda, Kostanay and Pavlodar regions. 5 areas are interconnected by a common network and in addition have a common network with the Russian Federation;
- South region - Almaty, Zhambyl, Kyzylorda and South Kazakhstan regions, as well as the Northern region is united by a common network, but it is connected with Kyrgyzstan and Uzbekistan. Since 1998, the Southern and Northern zones have operated in parallel;
- Aktyubinsk, Atyrau, Western Kazakhstan and Mangistau regions, where the electric grid is connected to the European part of Russia. In turn, Mangistau, Atyrau and West-Kazakhstan regions are connected by one common electric grid, but the energy sector of the Aktobe region operates in isolation. Until recently, the Western and Northern zones had no overall and each region was connected with the Russian Federation. In the Northern region, electricity is produced in excess and is therefore exported to Russia, in the Western region the capacity of the power plant is insufficient, because of this, it is necessary to import electricity

from Russia. Also, the southern region does not generate enough electricity and it is necessary to import it, but from neighboring Kyrgyzstan and Uzbekistan. And in the end, it turns out that Kazakhstan, on the one hand, imports the current, on the other, we export it. In order to connect these regions

- among themselves to take a long time, in addition the territory of the country is very large and if we connect the regions, then probably the prices for electricity can increase.

The second problem is worn out equipment. In many power plants, 70% of the equipment has been operating for more than 25 years, 30% for more than 30 years, by 2010 almost 90% of the main equipment of the CHPP has been exhausted. According to some reports from the Ministry of Energy and Mineral Resources about 22% of the generated electric energy is lost along the way. Their total length is about 400,000 kilometers. It is known that a significant part of the electricity is lost, passing the long paths. If we give an example, in 2005 the country produced about 66.7 billion kW / h. About 10 billion of them did not reach the end user. It turns out that end consumers received only 56.7 billion. A crisis in this situation can be said helped, as electricity consumption has decreased, and this has allowed to partially satisfy the needs of the end user.

And finally, the third problem is that cheap electricity will ever run out, and in this connection the government faces the task of finding an alternative way to generate electricity. The first thing, in Northern Kazakhstan, the main source of energy is the Ekibastuz coal deposit. It provides the entire Northern region with cheap coal. But everybody knows that coal and gas will be exhausted. These problems were discussed at the state level more than once. Measures have been taken to address them. For example, the construction of Balkhash TPP, Moinak HPP, the new block of Ekibastuz GRES-2, etc. This allows solving certain problems for the coming years. But the main problem remains - the search for alternative electricity production, which will allow regions to use cheap electricity. And, as is known, every year the electricity consumption increases, and it seems to me that the solution of the main problem should be considered in the near future.

One of the important and promising directions in search of alternative energy for today is the wind power industry. By 2009, wind power plants (WEC) were installed in 80 countries. Their capacity was about 90,000 MW, which is approximately 1% of the world's electric power industry. Exemplary calculations showed that by 2020 the total capacity of the wind farm will be about 3% of the world's total generating capacity. Kazakhstan, on the basis of its geographic location, is located in the wind zone, and quite a lot of air currents are observed in a significant part of the country's territories. It can be said that in all three economic regions of the country there are strong wind currents. And of course the construction of wind farms in all

regions of the country will allow the southern region to fill the deficit, the same in the western region, and the Northern region can increase exports.

The Government of the Republic of Kazakhstan drew attention to wind power in 2003, while the Government of the Republic of Kazakhstan adopted the Resolution "On Wind Energy Development" No. 857. "To approve the project proposal of the United Nations Development Program / Global Environment Facility (UNDP / GEF)" Accelerating the development of wind energy in Kazakhstan "and a proposal for the construction of a pilot 5 MW wind farm in the Dzungar Gate area with the participation and financial support of UNDP / GEF." [9]

In 2007, the project "Kazakhstan - Wind Power Market Development Initiative" of the GEF / UNDP was adopted. The total cost of the project was about \$ 2,644,000. The amount of funding from the GEF was about \$ 2.26 million.

There is also a connection of the electric power regions of Kazakhstan. And as a result, it allowed the country to reduce the import of electricity, and, accordingly, to increase the export of electricity. As we see in 2009, exports reached about 1.8 billion kW-h, and the import of electricity was about 900 million kW-h.

All these results are due to the fact that 2 system-forming lines were introduced: the first - North Kazakhstan - Aktobe region, the second - North-South.

According to experts, with full provision of domestic needs, by 2030 the volume of exported electricity will be about 6 billion kW / h. The implementation of these projects is planned to be completed before 2030, and the restoration of the existing power plant is required, as well as the construction of new power plants with increased capacity. An increase in capacity is expected, with the use of clean coal technologies, thermal power stations at 7.4 GW, hydroelectric power plants - 0.8 GW, renewable energy sources - 3.5 GW. In addition, it is planned to build a nuclear power plant, whose capacity is about 0.9 GW. As a result, in the future, electricity generation should increase by about 160%.

Energy intensity of GDP is one of the important parameters that determines the efficiency of the energy sector of the economy.

As the national economic indicators show, the energy intensity of Kazakhstan's GDP is many times higher than those of developed countries. For example,

experts estimated that the energy intensity of Kazakhstan's GDP is 18 times higher than the same indicator of Japan. In January 2014, the Law of the Republic of Kazakhstan "On Energy Saving and Increasing Energy Efficiency" was adopted.

Within the framework of the law, a legal framework was created that addressed energy conservation and energy efficiency issues. Provision is made for the introduction of international standards for energy conservation and the introduction of a voluntary agreement in the energy-saving area, as is customary in countries. This agreement is concluded with organizations that include the country's energy registry. Under the agreement of the enterprise, at least once in five years to undergo mandatory energy audit. In addition, an amendment was introduced to the Tax Code, which allows state authorities to reduce the tax to enterprises for release into the environment for the amount

of costs that the organization will allocate for the implementation of a project to improve energy efficiency. These amendments, which were mentioned above, will allow:

- reducing the energy intensity of the state's GDP;
- increase the competitiveness of their goods and services;
- release of generating capacities;
- addressing the conservation of natural resources.

Problems of energy saving and energy efficiency are given special attention, since energy conservation and energy efficiency are national tasks. This process is one of the main directions of the development of the economy, which the President of the country has singled out, and to achieve this goal, not only economic entities, but the whole society are included in the process.

So, the main task is to create a highly effective and technological Kazakhstan intellectual energy system by 2030, by developing the country's strategy based on deep diversification of the country's economy, stimulating innovation, introducing and developing competitive industries. All this is allowed in the future:

- increase of competitiveness due to energy saving, resource saving, increase of energy efficiency;
- maximum use of the advantages of the country's geopolitical location, effective application of the country's transit and export potential;
- use of renewable energy sources;
- create energy security of the state.

## 6. Conclusions

In recent years, Kazakhstan has experienced a rapid

increase in the consumption of electricity and heat. Electricity consumption will increase to 116 billion kW / h by 2020, with an increase of 40%. Since more than 70% of electricity and the entire amount of thermal power is generated by burning coal, it is also the main source of emissions that pollute the atmosphere. As a result, carrying out annual emissions of 180-200 tonnes of CO<sub>2</sub> equivalent. Kazakhstan is the largest producer of anthropogenic greenhouse gas in Central Asia and is the third in the CIS. Excess greenhouse gas emissions lead to climate change, which can exacerbate desertification and land degradation processes, reduce agricultural productivity and increase scarcity of water resources. Stabilization of the amount of emissions can be achieved by introducing clean and energy efficient technologies in the energy sector, moving from solid fuel to the most environmentally friendly gaseous fuel, using alternative energy sources and using oil gas and coalmine methane.

In the field of energy supply, the task is set by 2020 to reduce the energy intensity of the gross domestic product by at least 25%. More significant is the implementation of projects on the involvement of hydropower in the energy balance. In the sectoral state program, up to 2030 there are plans to create 564 new HPPs and restore 14 HPPs with a total installed capacity of 5,700 MW.

The presence in Kazakhstan of large coal basins, natural gas reserves and uranium fuel significantly exceeding their own needs, created the potential for production and, subsequently, electricity exports, and the presence of interstate 220-500 kV transmission lines allows for the transmission of electricity to neighboring states.

Within the ongoing integration processes, the Customs Union, the creation of the Common Economic Space, work will continue in the following areas:

- assistance in the creation of a common electricity market of the CIS countries, assistance in organizing a reliable and mutually beneficial parallel operation of the integration of the energy systems of the CIS countries and the ECO Baltic States with the ECO countries of the European Union;
- participation in the formation of a common electric power market based on the conceptual provisions of the CIS integration association;
- development of regional electricity trade, assistance in attracting investments in the electric power industry, participation in the creation of an efficient electric power market in Central Asia;

Participation in the monitoring organization of the implementation of the Roadmap on key environmental issues of the integration of the electricity markets of the EU and the CIS.

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