# WAYS TO ENSURE ENERGY SECURITY IN UZBEKISTAN

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**Annotation.** *This article explores the concept of energy security in the country, the experiences of foreign countries of the factors influencing energy security. Ways to ensure energy security, types of security, stages of their management, the current situation in the region and in Uzbekistan, proposals and recommendations on energy security have been developed.*

**Keywords:** *energy security, energy supply, electricity, competitive environment, production, transmission, sales, market principles, management mechanism, thermal power plants, thermal power centers, regional energy market, vertical integration, tariffs, regulatory methods, management methods, economic risks.*

## I. Introduction.

Ensuring energy security is one of the most pressing issues in countries around the world. The concept of energy security is evaluated in conjunction with the concept of national security of the country. The concept of security and national security incorporates concepts and processes that are multifaceted and complex. The energy security of any country is an integral part of its national security.

Ensuring energy security in the country is the main task of the national economy and plays the most important role in the development of society and the economy. The energy sector provides a reliable and quality energy supply for all other industries and sectors. In recent years, the level of energy security of the country has a significant impact on the growth of the world's economies, gaining a high political position among the states.

The problem of energy security is determined by the uneven distribution of natural fuel and energy resources on earth and the regional disparities between energy-consuming and energy-producing countries in the socio-economic development of countries. Within the framework of energy security, countries are divided into two groups. In the first group - energy-exporting countries, that is energy-producing countries, in the second group - energy-importing countries, that is energy-buying countries. Countries in both groups strive for economic development.

Energy security and energy efficiency are the main strategic goals of any state’s energy policy. In order to increase the level of energy security, it is necessary to include in the main components of the state energy policy: introduction of an effective management mechanism for the use of mineral resources in the country; continuous structural changes in the energy sector; organization of the fuel and energy market on the basis of market principles; formation of a rational fuel and energy balance, improvement of domestic and foreign energy policy; development of modern scientific and technical policy in the field of energy; formation of a competitive environment in the regional energy market and a regulatory framework that meets international

standards.

In this regard, a number of measures are being taken in the country, including the Presidential Decree of March 27, 2019 "On the strategy for further development and reform of the electricity sector in the Republic of Uzbekistan" [1], based on JSC "Uzbekenergo" JSC "Thermal Power Stations", JSC "National Electric Networks of Uzbekistan" and JSC "Regional Electric Networks" were established. In addition, in order to establish an effective management system in the energy sector and accelerate the development of the sector, increase its competitiveness and investment attractiveness, the President of the Republic of Uzbekistan on February 1, 2019 "On measures to radically improve the management system of the fuel and energy sector." Decree No. PF-5646 was adopted. This decree identifies the following as priorities for further development of the fuel and energy sector of the Republic of Uzbekistan [2]:

first, to pursue a unified energy policy aimed at ensuring the country's energy security, meeting the growing needs of the economy and the population in energy resources;

secondly, state regulation of the energy sector and clear delineation of economic functions, improvement of the legal and institutional framework of social and public-private partnership, development of clear market mechanisms for the implementation of tariff policy and on this basis to promote the principles of a healthy competitive environment;

third, to create conditions for the active attraction of investments in the construction of infrastructure facilities, as well as the modernization, technical and technological re-equipment of enterprises, especially foreign direct investment;

fourth, the implementation of state policy in the field of energy saving and reduction of energy consumption of the economy, encouraging the introduction of advanced resource and energy-saving technologies in sectors of the economy and the domestic sector, the widespread development of alternative energy sources;

fifth, the widespread introduction of modern means of automation of technological processes in the energy sector, systems of accounting for the volume of production, supply and consumption of energy resources;

sixth, optimization of the management system of network enterprises, their structures and divisions, introduction of modern methods of work organization aimed at achieving concrete results and target indicators (quality management, indicative planning).

Reforms in the country to ensure energy security are aimed at meeting the needs of the population in energy resources, effectively meeting the demand for fuel and energy in all sectors of the economy.

**II. Analysis of the relevant literature.**

The concept of "energy security" is being studied by a number of economists. Energy security is one of the most discussed topics today. However, there is no generally accepted definition of “energy security”. Therefore, both the concepts of “Energy Security” or “Energy Security” are widely used in practice.

Energy security primarily refers to the availability of energy needed to accelerate economic growth: accordingly, energy security is the supply of energy to sectors of the economy. [3,4] This

definition was later studied by several studies over time. Some studies have tried to distinguish between safe and unsafe levels by introducing certain concepts such as energy prices. Based on this, it was determined that "Energy Supply Security" will ensure the uninterrupted availability of energy sources at low prices. [5] However, there is no specific international standard for energy cheapness, which is studied among countries in terms of gross domestic product (GDP), inflation rate, and per capita [3].

Factors that significantly affect the energy security of regions can be divided into current and strategic development of the region - management problems (energy shortages, equipment deterioration, financial aspects) and long-term and indirect (environmental problems, limited resources, etc.) controllable factors) [6 ].

Energy security is related to the energy independence of a state or its subject matter, which is primarily a political issue. Sustainable development and sustainability of energy-producing countries play an important role in ensuring economic energy security. Such sustainability can be threatened by the need to mine and produce energy resources in increasingly complex conditions, which can only lead to difficulties with the use of modern technology, environmental damage and transportation. There are many formulas and interpretations of the concept of "Energy security" today [7].

Although there are many studies, there is no single general definition of the term “energy security”. This concept was first used in the United States in 1947 as a law regulating public policy in the field of national security. However, the concept of "Energy security" emerged in 1973 after the oil crisis [8]. At the same time, the International Energy Agency states: energy security - "Confidence in the availability of energy in the quantity and quality required in a given economic environment" [9].

The issue of security is central to the theory and practice of international relations, and from the point of view of researchers and statesmen, the problem is complex in nature, and its content and methods of support depend on the historical stage of society’s development [10].

For energy-exporting countries, demand security can be as important as ensuring supply reliability and security. In these countries, the economy and the state budget are highly dependent on revenues from energy exports. For example, in the oil industry, Saudi Arabia accounts for 42 percent of GDP, 87 percent of budget revenues, and 90 percent of exports [11].

However, there may be conflicting opinions among producers and consumers about the price level and the optimal rate of discovery. The International Energy Agency, which unites energy-consuming countries, believes that the concept of energy security is to obtain energy resources at low cost and ensure continuity [12].

The assessment of the status and level of energy security should be carried out using a number of indicators, namely: energy supply, energy dependence, economic feasibility, social stability. [13]

## III. Research methodology.

Research in the field of electrical safety, the formation of a free electricity market, the study and research of energy production potential, comparative analysis and synthesis, induction and deduction, expert evaluation, scientific abstraction, statistical grouping, correlation, regression, risk determination and other methods widely used.

## IV. Analysis and results.

While ensuring energy security is not easy, it is important to take steps to achieve it. Energy security is a multifaceted concept that has dimensions of particular importance: technical and physical obsolescence resulting from infrastructure breakdowns, natural disasters, social unrest, political actions, or acts of terrorism; long-term physical availability of energy supply to meet future growing demand; harmful effects on economic activity and the population due to energy shortages, prices or price changes; serious consequences affecting human health, damage from terrorist acts that damage various forms of property.

The most important task of ensuring energy security is to achieve the energy independence of the state. A state without independent energy can never be independent. To achieve this goal, you need to do the following:

- organization of reliable supply of energy required for the needs of the real sector of the economy and the population;
- ensuring the reliable operation of thermal power plants, power plants and power transmission substations, as well as organizations in the fuel and energy sector;
- reduction of harmful environmental impacts through the widespread use of modern technologies in the fuel and energy sector;
- Improving organizational and economic mechanisms to increase government guarantees in order to attract more foreign investment in the fuel and energy sector.

In order to ensure energy security, the first steps have been taken in our country. The main ones are the Uzbekenergo JSC, which has a unified management in the country, and the Thermal Power Stations JSC, which is an independent power generation company. Supply of electricity to consumers is entrusted to the joint-stock company "Regional Electric Networks". This is, of course, a structural change made with the present and the future in mind. These changes are aimed at creating a competitive environment in the field of electricity generation and supply of electricity to consumers in order to ensure energy security in the industry, to meet the growing needs of the population in energy resources. The field of transmission of electricity through the main power grid - retains the nature of a natural monopoly. This is because creating a competitive environment is not economically feasible.

Regarding the work carried out in the field of electricity in the country, we can cite the following diagram.

### 1. JSC "Thermal Power Stations" carried out the following work.

We analyze the situation with the installed capacity and production capacity of electricity generation in our country. To do this, the data presented in Figures 1 and 2 can be used to compare the potential of the Central Asian countries and the Republic of Uzbekistan in this area.

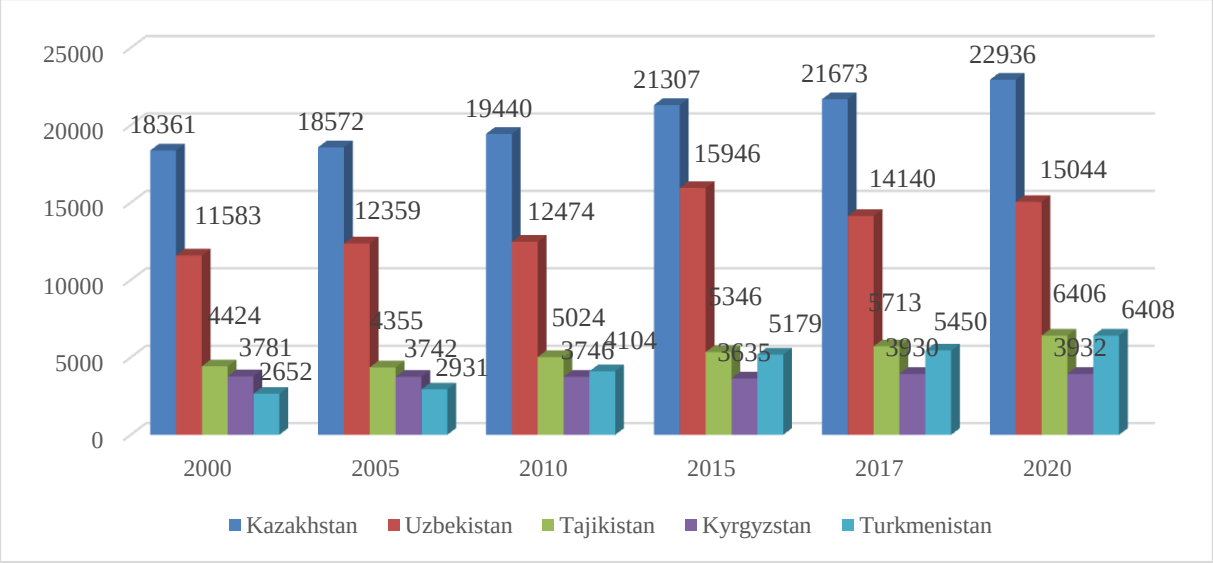



**Figure 1. Dynamics of total installed capacity in power plants in Central Asia, MW**

**Source: https://unece.org/sites/default/files/2021-01/ Data compiled by the author.**

The data shown in Figure 1 show that the Republic of Uzbekistan ranks second in Central Asia in terms of total installed capacity for electricity generation. At the same time, the total installed capacity for electricity generation in the Republic of Uzbekistan in 2000 was 11,583 MW, in 2010 it was 12,474 MW, and by 2020 it was 15,044 MW. That is, in 2020, compared to 2010, 3461 MW of additional capacity was installed.

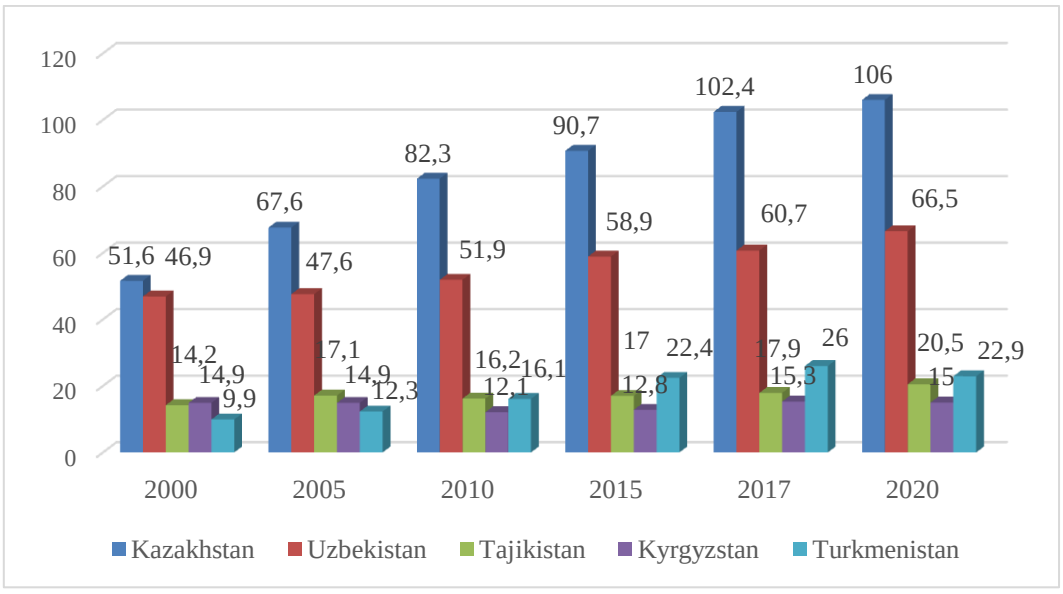



**Figure 2. Electricity generation in Central Asia, billion kWh**

**Source: https://unece.org/sites/default/files/2021-01/ Data compiled by the author.**

As shown in Figure 2, Uzbekistan is the second largest producer of electricity in Central Asia. In particular, electricity generation in Uzbekistan in 2000 amounted to 46.9 billion kWh. 51.9

billion kWh in 2010. hours, and by 2020, it increased by 14.9 billion kWh compared to 2010 and amounted to 66.5 billion kWh.

Of course, the country's energy resource potential plays an important role in ensuring energy security. Energy resource potential includes coal, oil, gas, uranium, wind, water, solar and renewable energy sources. The greater the amount of manashu resources in the country, the higher the level of energy security. The energy resource potential of the Central Asian states is shown in Table 1.

**1-table. Energy resource potential of Central Asian countries [16]**

| Countries / year | | Coal* billion tons. | Petroleum* million tons. | Gas* billion. m3 | Ratio** thousand tons | Hydroelectric power *** billion kW.s/y | REC**** billion. kW.s/y |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 2000 | 34,1 | 2760 | 1841 | 601 | 27 | 66 |
| | 2020 | 34,1 | 2760 | 1841 | 601 | 27 | 66 |
| Kyrgyzstan | 2000 | 1,34 | 11,5 | 6,54 | - | 52 | - |
| | 2020 | 1,27 | 1,2 | 6,2 | - | 99 | - |
| Tajikistan | 2000 | 0,67 | 5,4 | 9,2 | - | 317 | 18,4 |
| | 2020 | 1,0 | 10 | 10 | - | 317 | 18,4 |
| Turkmenistan | 2000 | - | 75 | 2860 | - | 2 | - |
| | 2020 | - | 75 | 2860 | - | 2 | - |
| Uzbekistan | 2000 | 2 | 350 | 2000 | 83,7 | 15 | - |
| | 2020 | 2 | 350 | 2000 | 83,7 | 15 | - |
| Central Asia | 2000 | 38,11 | 3261,9 | 6716,7 | 684,7 | 413 | 84,4 |
| | 2020 | 38,37 | 3205,2 | 6716,2 | 684,7 | 460 | 84,4 |

** given the volume of renewable reserves approved for coal, oil and natural gas;*

*** World Energy Council (WEC) rated proven uranium reserves with production costs up to 30 doll/kg;*

**** Hydropotential-cost-effective. Uzbekistan-technical hydropotential;*

***** REC-renewable energy sources.*

Analyzing the data presented in Table 1, the largest coal reserves in Kazakhstan are 34.1 billion tons. The largest oil reserves are in Kazakhstan - 2760 million tons, followed by Uzbekistan - 2 billion tons. tons, oil reserves -350 million. tons. In terms of gas reserves, Turkmenistan ranks first with 2860 billion cubic meters, followed by Uzbekistan with 2,000 billion cubic meters and Kazakhstan with 1841 billion cubic meters. m³. In terms of uranium reserves, Kazakhstan ranks first with 601.0 thousand tons, followed by Uzbekistan with 83.7 thousand tons, and the rest of the republics do not have uranium reserves. In terms of hydroelectric power, that is hydroelectric power stations, the Republic of Tajikistan is in the first place with -317 billion. kWh, in second place the Kyrgyz Republic in 2020 -99 billion. kW. hours. In terms of renewable energy sources, first of all

in the Republic of Kazakhstan 66 billion kWh per year/hours of electricity is generated. In second place in the Republic of Tajikistan is 18.4 billion kWh. hours of electricity is generated.

Electricity generation in Uzbekistan is mainly due to thermal power plants (TPP), which are part of JSC "Thermal Power Stations". In 2020, the country produced 66.5 billion kWh of electricity, of which 81.8%, or 54.42 billion kWh, fell to the share of thermal power plants, which are part of JSC "Thermal Power Stations". In Table 2, JSC "Thermal Power Stations" includes 6 thermal power plants and 3 thermal power plants.

**Table 2. Power installed at the stations that are part of JSC "Thermal Power Stations" (2021 year).**

| № | Name of stations | Installed power, MW | Number of workers, person | Location of stations |
|---|---|---|---|---|
| 1 | Sirdarya (TPS) | 3165 | 1619 | Syrdarya region |
| 2 | Tashkent (TPS) | 1860 | 1860 | Tashkent region |
| 3 | Navoi (TPS) | 2068 | 1565 | Navoi region |
| 4 | Talimarjan (TPS) | 1700 | 1700 | Kashkadarya region |
| 5 | Taxiatosh (TPS) | 1190 | 860 | The Republic of Karakalpakstan |
| 6 | Turaqurgan (TPS) | 900 | 320 | Namangan region |
| 7 | Fergana (TPC) | 329 | 800 | Fergana region |
| 8 | Mubarak (TPC) | 60 | 476 | Kashkadarya region |
| 9 | Tashkent (TPC) | 57,15 | 398 | Tashkent city |
| | Total | 11329,5 | 9598 | |

**Source: compiled on the basis of data from JSC "Thermal power station".**

Table 2 shows the number of employees working at the power plants and stations installed in 2021 at the thermal power plants and centers that are part of JSC "Thermal Power Stations". In 2021, 11329.5 MW of electricity was generated by the stations, while a total of 9598 people worked at the stations. The highest capacity of the stations and centers of JSC "Thermal Power Stations" is Syrdarya TPP, which is 3165 MW. The largest number of employees was the Tashkent Thermal Power Plant, that is 1,860 people.

JSC "Thermal Power Stations" regularly updates all organizations in the system with modern energy-saving devices on the basis of investment projects. This, in turn, will provide the population with quality and uninterrupted electricity and heat on a regular basis.

Fuel consumption in the production of 1 kW of electricity by thermal power plants and centers under JSC "Thermal Power Stations" is shown in Figure 3.

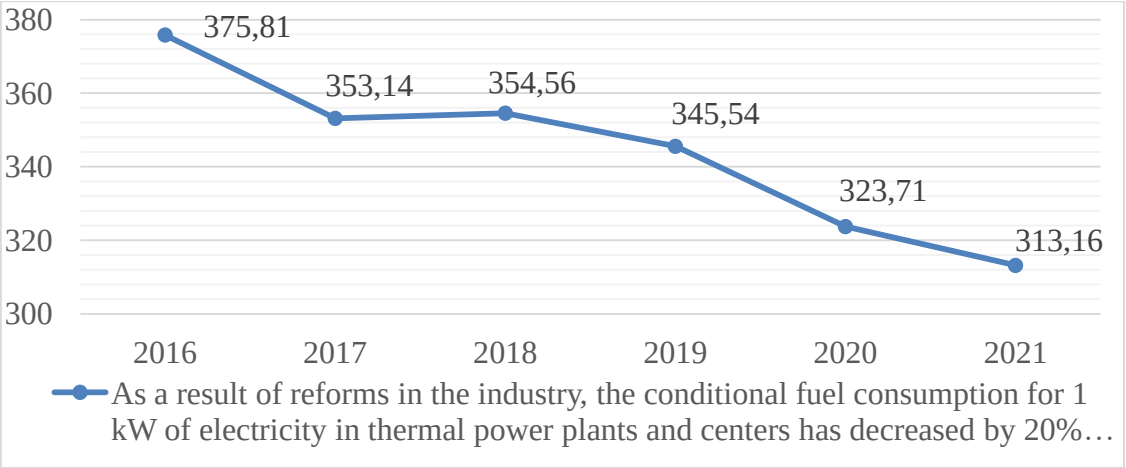



**Figure 3. Fuel consumption in the production of 1 kW of electricity by thermal power plants and centers of JSC "Thermal Power Stations" (compared to 2016, g / kW / h)**

**Source: compiled on the basis of data from JSC "Thermal power station".**

Figure 3 shows the fuel consumption used by thermal power plants and centers of JSC "Thermal Power Stations" in the production of 1 kW of electricity for 2016-2021. Fuel consumption in the production of 1 kW of electricity in 2016 amounted to 375.81 g / kW / h, in 2017 - 353.14 g / kW / h, in 2018 - 354.56 g / kW / h, in 2019 - 345.54 g / kWh, 323.71 g / kWh in 2020 and 313.16 g / kWh by 2021.

The forecast of production of thermal power plants and centers of JSC "Thermal Power Stations" for 2022-2026 is shown in Figure 4.

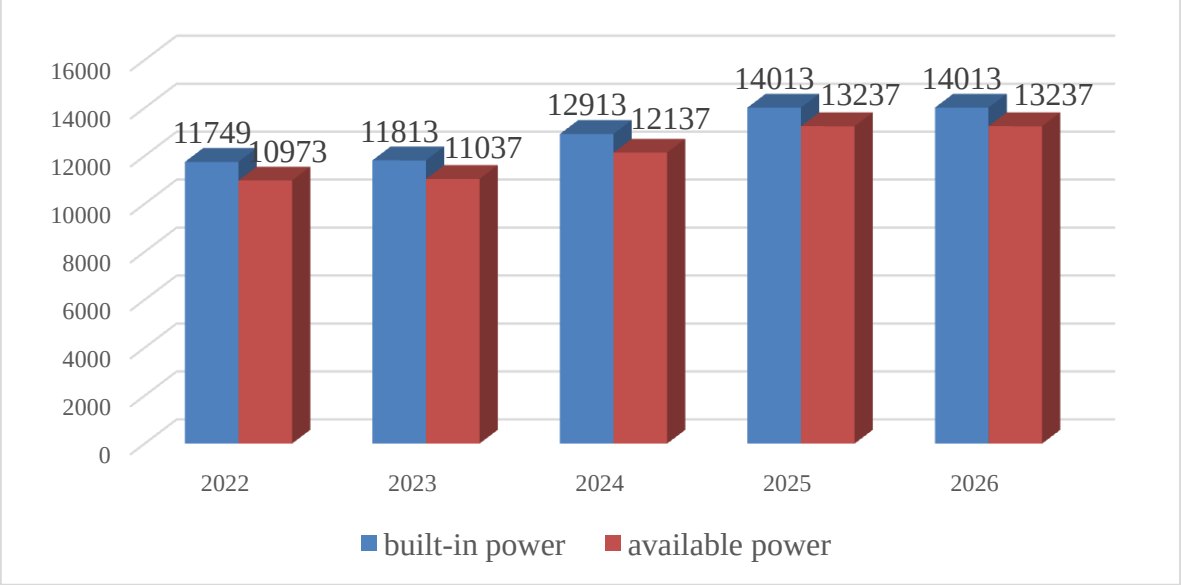



**Figure 4. Forecast indicators of production by thermal power plants and centers under JSC "Thermal Power Stations", MW**

**Source: compiled on the basis of data from JSC "Thermal power station".**

Figure 4 shows the forecast of production by thermal power plants and centers of JSC "Thermal Power Stations". The installed capacity in 2022 of thermal power plants and centers under the management of JSC "Thermal Power Stations" is 11749 MW, the available capacity is 10973 MW, the installed capacity in 2024 is 12913 MW, the available capacity is 12137 MW, and the installed capacity in 2026 is 14013 MW, The existing capacity is projected at 13,237 MW. If we take into account that in 2021 the installed capacity of thermal power plants and thermal power plants at the disposal of JSC "Thermal Power Stations" amounted to 11329.5 MW, by 2026 we can expect an increase of 2683.5 MW.

**2. On the example of JSC "National Electric Networks of Uzbekistan" the following was done.**

In order to meet the consumption of electricity in recent years, JSC "National Electric Networks of Uzbekistan" created 680 MVA (megavolt - ampere) of new capacity in 2012-2016, and in 2017-2021 - 5621 MVA of additional capacity. We can see them through Figures 5 and 6 below.

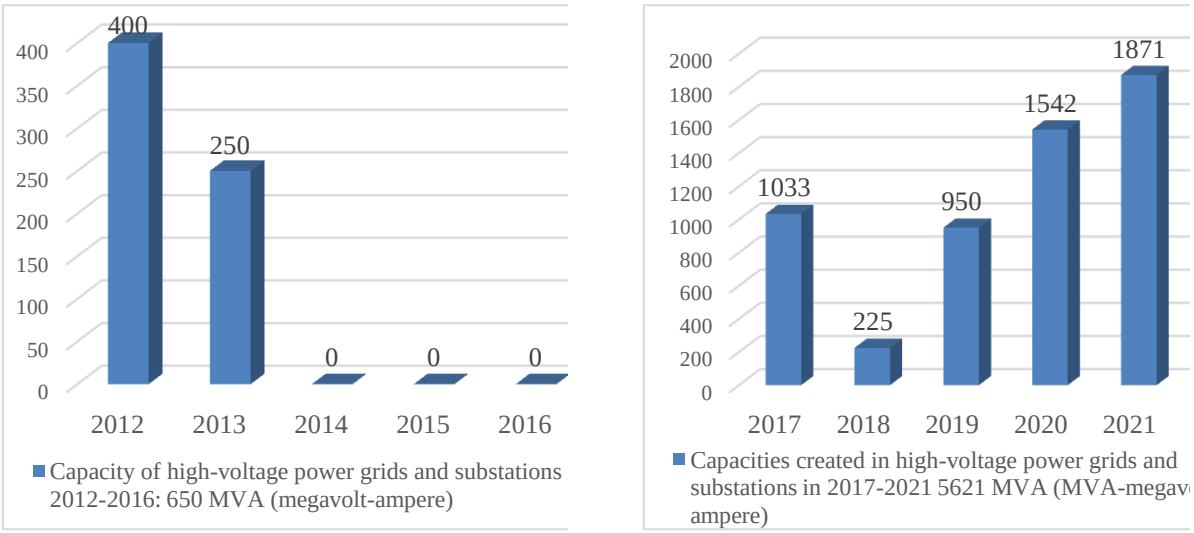



**Figure 5. Dynamics of capacities at high-voltage substations in 2012-2016 (5 years) and 2017-2021 (5 years) [14]**

Figure 5 shows the dynamics of capacity generated at high-voltage substations in 2012-2016 (5 years) and 2017-2021 (5 years). In 2012-2016 (5 years), the capacity generated in high-voltage power grids and substations was 650 MVA (MVA-megavolt-amperes). In 2017-2021 (5 years), the capacity generated in high-voltage power grids and substations was 5,621 MVA. In the first 5 years it was 650 MVA, while in the second 5 years it was 5621 MVA, i.e. 4971 MVA multi-capacity was created.

Figure 6 shows the total increased capacity of JSC "National Electric Networks of Uzbekistan" in 2019-2021.

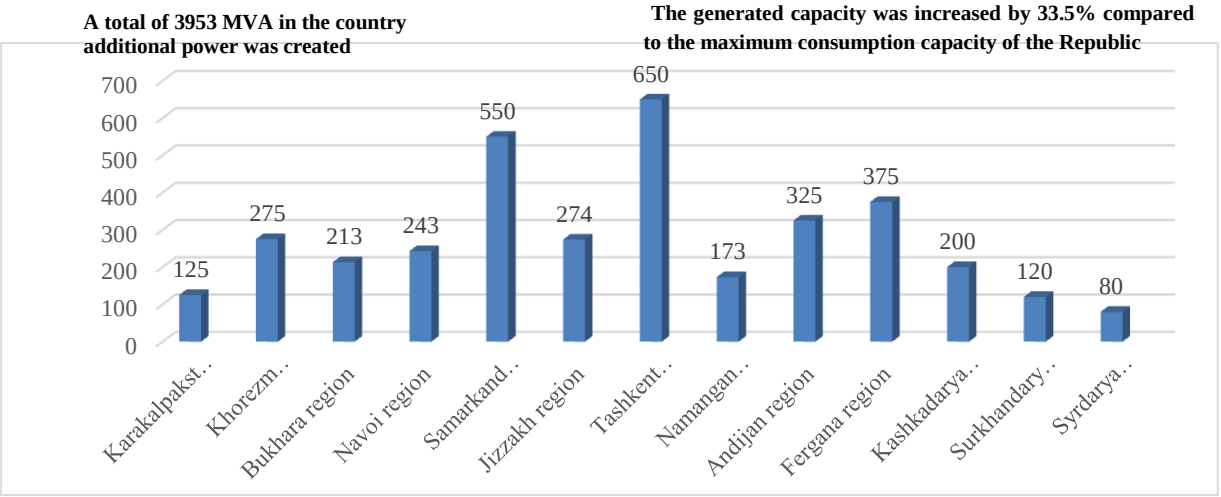



**Figure 6. Total capacity indicators increased by JSC "National Electric Networks of Uzbekistan" in 2019-2021, MVA [14]**

Figure 6. JSC "National Electric Networks of Uzbekistan" has shown the total increased capacity in 2019-2021 in the country. According to the total increased capacity for 2019-2021, the highest capacity is 650 MVA in Tashkent region, followed by Samarkand region with 550 MVA, and the lowest capacity is 80 MVA in Syrdarya region.

**3. The following works are planned to be carried out on the example of JSC "Territorial Electric Networks".**

The following are the priorities for the development of distribution networks by JSC "Territorial Electric Networks" [15]: reduction of technological and commercial losses in the process of distribution of electricity; increase the reliability and quality of power supply. In the process of transition to a competitive wholesale electricity market, the functions of operating the distribution network and selling electricity to consumers will be separated, while the distribution networks will remain state-owned. Also, with the adoption of the relevant state program for 2022-2025, work will continue on the modernization and reconstruction of low-voltage distribution networks. Modernization and construction of existing 110/35/10/0.4 kV power grids will be carried out on the basis of the following principles: increase in the number of 110/35/10 kV substations through the construction of new substations and the transfer of 35/10 kV substations to the high voltage class; construction of 10, 35 and 110 kV power transmission lines within the boundaries of cities and settlements by laying underground cables or laying self-insulated wires; indoor switching of 35 kV and 110 kV PS in cities and large settlements; wide use of 35 / 0.4 kV transformers in cities and large settlements; Decommissioning of 6 kV power lines by switching to 10 kV and 35 kV; Replacement of 0.4-10kV overhead transmission line wires with self-supporting insulated wires and simultaneously reducing the length of 0.4 kV power transmission lines; Software packages "Billing" and "Analysis and forecasting of electricity consumption" will be developed and launched. Financing of construction, modernization and reconstruction of power transmission lines and substations is carried out at the expense of long-term loans from international financial institutions and JSC "Regional Electric Networks".

*In ensuring energy security, we analyze the data on the supply of energy resources, the concept of electricity supply of the Republic of Uzbekistan in 2020-2030.*

Domestic demand for energy resources is determined by the expected dynamics of economic development, changes in the structure of the economy and its specific level of energy intensity. Reducing energy consumption in the economy is a key task of electricity policy, and failure to do so will inevitably hamper the energy sector's socio-economic development. The forecast dynamics of electricity generation and consumption until 2030 is shown in Figure 7.

Figure 7 shows the forecast dynamics of electricity generation and consumption until 2030. At the same time, in 2022, electricity generation will reach 79.5 billion kWh. hours, electricity consumption by sectors of the economy is 49.3 billion kWh. hours, electricity consumption by the population is 16.1 billion kWh. electricity generation is projected to reach 120.8 billion kWh by 2030. hours, electricity consumption by sectors of the economy is 85 billion kWh. hours, electricity consumption by the population is 21.9 billion kWh. hours.

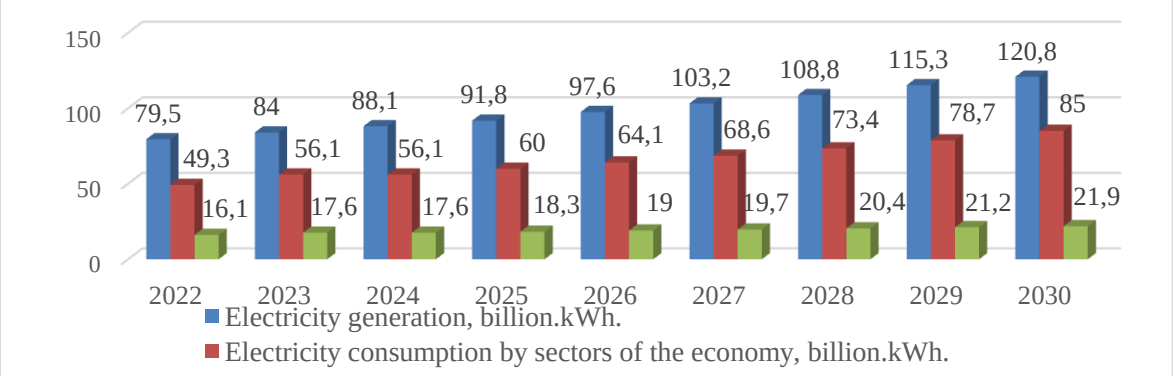



**Figure 7. Forecast dynamics of electricity generation and consumption until 2030, billion.kWh. [15]**

Renewable energy sources (RES) play an important role in shaping energy resources today. RESs include hydroelectric power plants (HPPs), photovoltaic plants (PP), and wind power plants (WPPs). The RES-based power generation structure for the period up to 2030 is shown in Figure 8.

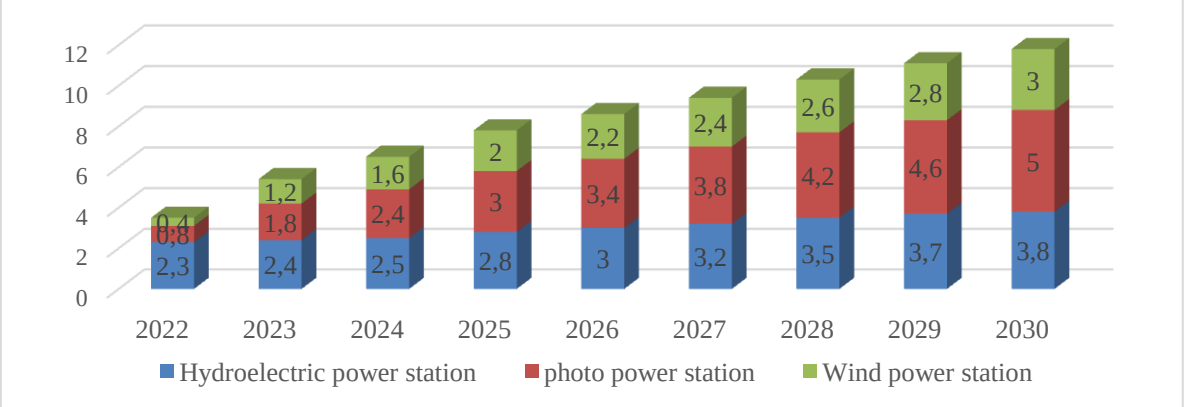



**Figure 8. Diagram of energy production based on renewable energy sources until 2030, MW [15]**

Figure 8 shows the structure of energy production based on renewable energy sources by 2030. According to this diagram, hydropower plants in the country are projected to produce 2.3 MW of electricity in 2022, 3 MW in 2026 and 3.8 MW in 2030. Photoelectric power plants are

projected to generate 0.8 MW of electricity in 2022, 3.4 MW in 2026, and 5 MW by 2030. Wind power plants are projected to generate 0.4 MW of electricity in 2022, 2.2 MW in 2026 and 3 MW by 2030.

At the same time, the forecast indicators for the dynamics of power changes in the country in 2019-2030 are shown in Figure 9. The figure shows the forecast for 2030 on gas and coal for thermal power plants, hydroelectric power plants, wind power plants, solar power plants, nuclear power plants.

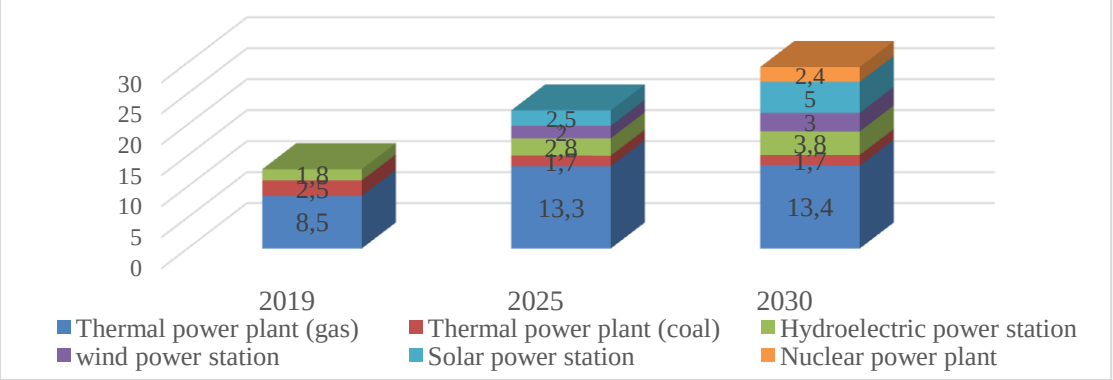



**Figure 9. Forecast of dynamics of installed capacity change in 2019-2030, MW [15]**

Figure 9 shows the forecast of dynamics of installed capacity change in 2019-2030. At the same time, thermal power plants (gas) are expected to be installed at 13.4 MW in 2030, compared to 8.5 MW in 2019. Thermal power plants (coal) will have a capacity of 2.5 MW in 2019, and by 2030 it will increase to 1.7 MW. The capacity of hydropower plants is expected to reach 1.8 MW in 2019, and 3.8 MW by 2030. Wind power plants are projected to have a capacity of 2 MW in 2025 and 3 MW by 2030. The installed capacity of the solar power plant in 2025 is projected at 2.5 MW, while by 2030 it is projected at 5 MW. By 2030, nuclear power plants are expected to install 2.4 MW of electricity generation capacity.

Concepts about the reliability and sustainability of energy supply in the country are of concern to the public. The higher the value of the indicator, the more respondents are concerned about possible power outages and, for one reason or another, energy security. The greater the concern for "sustainability and reliability of energy supply" in the country, the higher its importance (Figure 10).

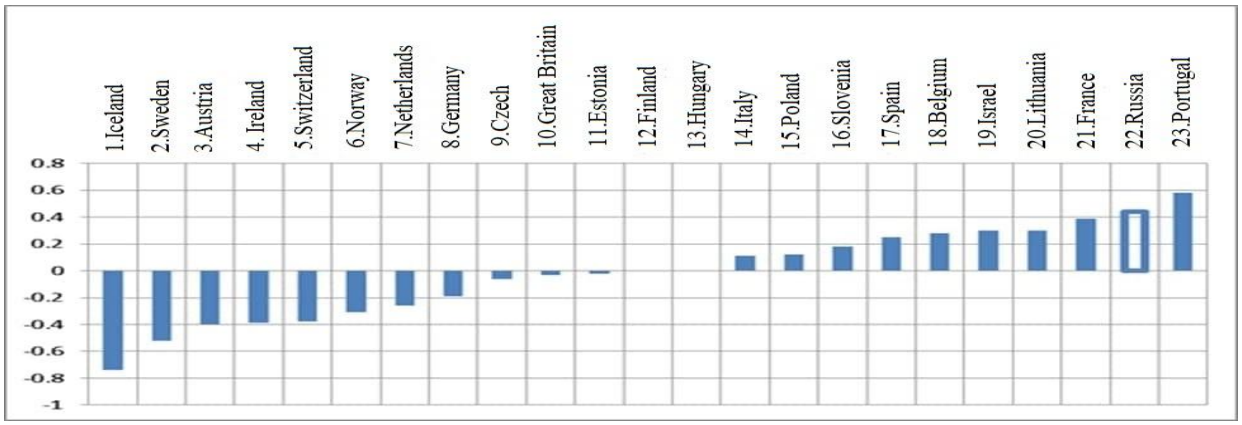



**Figure 10. Energy security indicator in European countries [17]**

As can be seen from Figure 10, the people of Iceland, Sweden, Austria, Ireland, Switzerland, and Norway across European countries are not concerned about energy security or energy supply. Unfortunately, we can see that there are problems with the stability and reliability of energy supply in Portugal, France and Russia.

The country's energy security management methodology will include identification, assessment, production of energy resources, transmission through main power grids, use of consumer supplies, and development of energy infrastructure (Table 3).

This table outlines the steps to be taken in energy security management, management, and the organization of management.

**Table 3. Stages of energy security management**

| № | Management stages | The content of the organization of management |
|---|---|---|
| 1 | Determining energy needs | Forecasting economic development.<br>Forecasting innovations in the economy.<br>Balance of fuel energy resources. |
| 2 | Determining and analyzing the availability of energy resources | Structuring of energy resources.<br>Assessment of resource base (stocks, production (expansion), delivery).<br>Forecasting innovations in the energy sector. |
| 3 | Assessment of the potential for the formation of energy resources | Forecasting the development of the resource base.<br>Resource database development and planning.<br>Resource database development design. |
| 4 | Establish a policy of efficient use and conservation of energy resources | Modernization of the energy resource base and the economy as a whole.<br>Implementation of energy saving policies in the regions |
| 5 | Formation of energy resources | Production of energy resources.<br>Purchase of energy resources. |
| 6 | Use of energy resources | Modernization of energy resources and the resource base of the economy as a whole.<br>Energy conservation. |
| 7 | Development of energy resources base | Formation of innovations in the development of the resource base.<br>Investing in resource base development.<br>Organizing the integration of energy resources. |
| 8 | Efficient organization of energy supply | Achieving energy efficiency.<br>Flexibility to the system.<br>Self-sufficiency in energy resources.<br>Provide interterritorial materials to the field.<br>Interstate supply of energy resources. |
| 9 | Ensuring the stability of power transmission | Formation of a modern legal framework.<br>Renewal of production assets.<br>Provide the fuel industry with approved fuel reserves.<br>Increasing production capacity in the fuel and energy sector.<br>Increasing the volume of capital investments in the sector.<br>Introduction of energy-saving technologies. |
| 10 | Management of environmental and man-made hazards in energy production | Improving the efficiency of natural resource use.<br>Reducing the level of pollution of the natural environment.<br>Prevention of natural disaster consequences and technical accidents. |

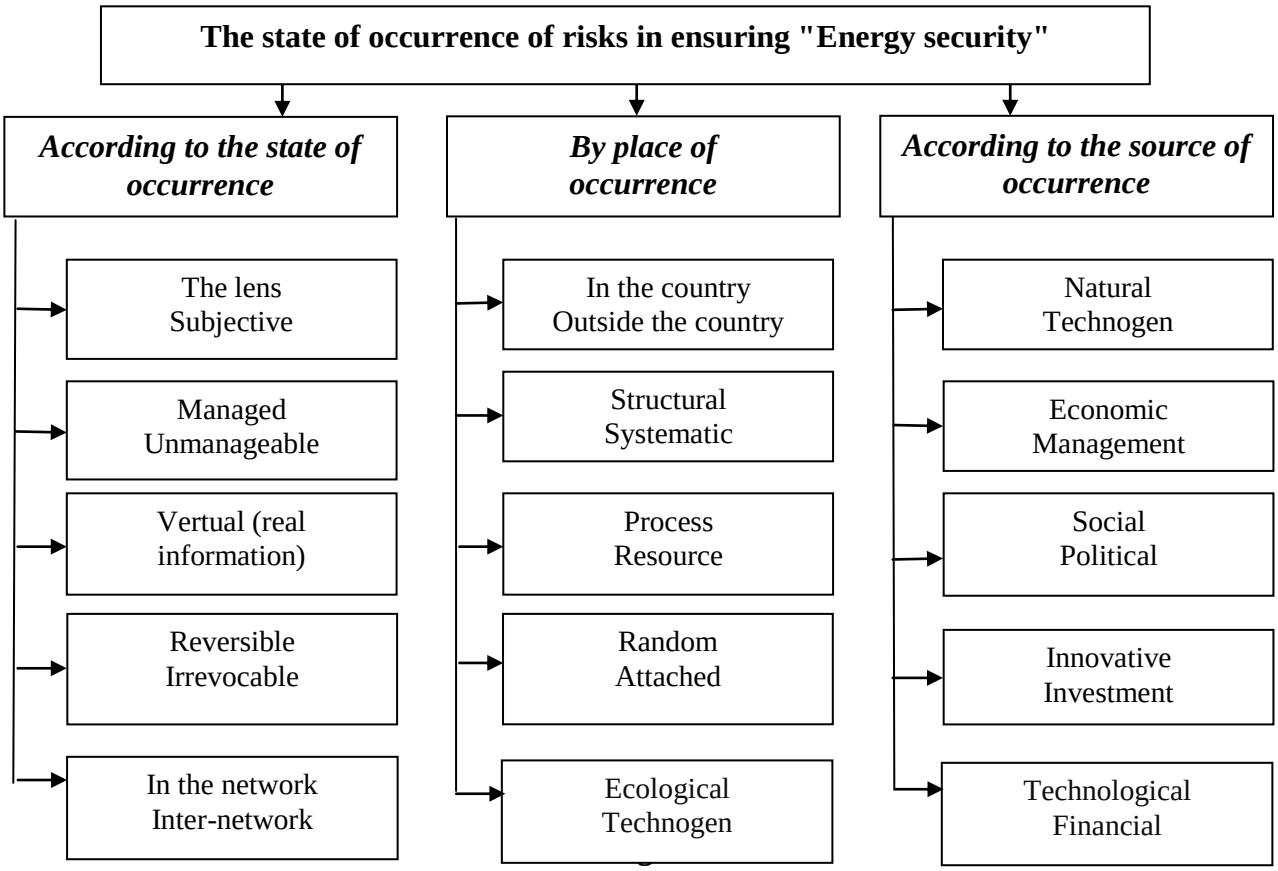
**Source: Developed by the author.**

Energy security in the country includes general economic and specific risks inherent in the energy sector. The energy sector faces economic, natural, managerial and socio-political risks.

Systemic risks are of particular importance.

The country's energy security management methodology will include the identification, calculation and evaluation of energy security indicators, the use of energy saving policies, as well as the development of the country's energy resource base.

Occurrence of energy security hazards: Figure 11 shows the occurrence status, location, and source of occurrence.




**The state of threats to energy security in the country**

**Source: Developed by the author.**

In Figure 11, “Energy Security” hazards are divided into three types according to their occurrence, location, and source. It shows the risks of energy security. In practice, energy security levels are determined in the above cases. At all times, it will be necessary to determine their levels of energy security risks.

The types of security that affect a country’s national security are shown in Figure 12. Among these types of security, energy security also requires special attention. This is due to the fact that energy security can lead to the development of all sectors and industries of the country's economy, as well as public outcry.

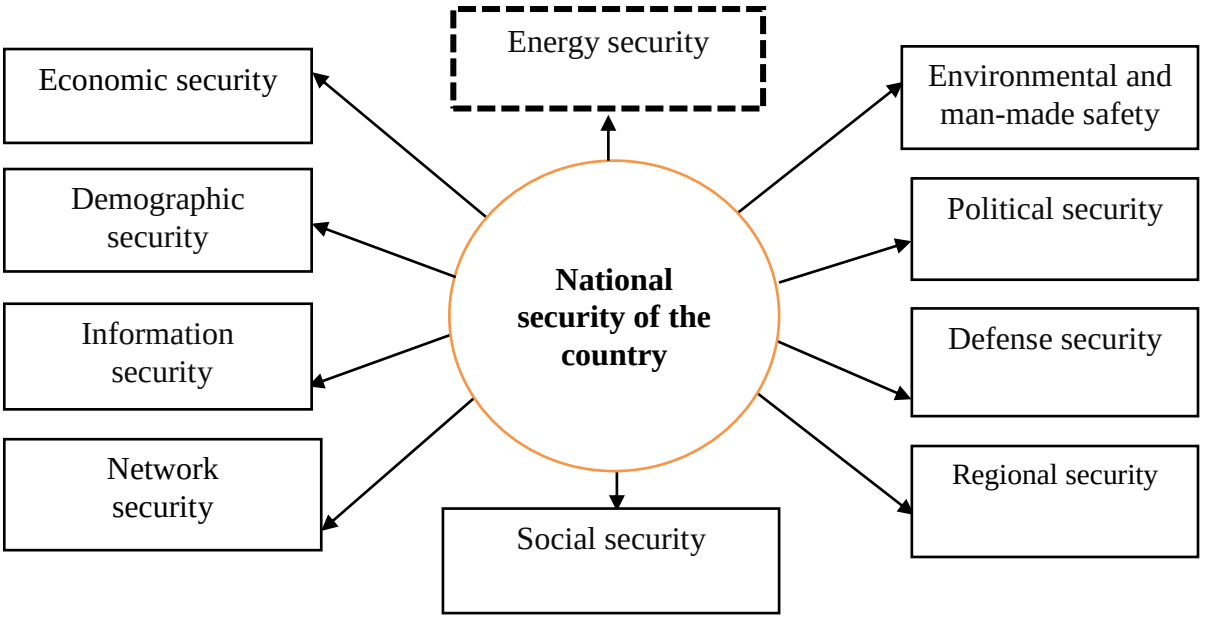



**Figure 12. The main types of security affecting the national security of the country**
**Source: Developed by the author.**

There is no regulatory framework for the formation of a single environment for energy security in the world. The nomenclature of indicators constituting the conditions of energy security includes: energy production capacity, energy resource reserves; constant obsolescence of fixed assets in the industry; the amount of investment involved in the creation of new capacity in the industry; a significant share of the dominant energy carrier in the structure of the fuel and energy balance; the ratio of gross domestic product (GDP) growth and energy consumption; marginal share of tax burden on fuel and energy companies, etc.

**V. Conclusions and suggestions.**

Ensuring the country's energy security is a necessary condition for maintaining national and economic security at the required level based on the efficient use of fuel and energy potential.

The concept of "Energy security" defines the ability of the fuel and energy sector at any time to reliably meet the needs of the state and regional economies with affordable fuel and energy resources, to withstand the negative effects of ever-changing internal and external threats.

To manage the state of energy security, first, to identify the state of potential threats to the state's fuel and energy sector, identify external and internal threats to the state's energy security, analyze the possible consequences of implementing these threats and eliminate them based on this analysis. Second, it is necessary to form management steps to ensure energy security and develop specific measures on them.

Overcoming the existing problems in the fuel and energy sector of any country requires the development of a balanced and effective energy security policy within the framework of the concept of protection of national interests, which should cover the following issues:

- formation of an effective legal framework in all areas of energy, management, coordination

and monitoring of natural monopolies;

- Ensuring guarantees and control by the relevant government agencies to ensure the full supply of reliable energy to all sectors of the economy and the population;

- Ensuring effective management of strategic energy resources in the energy sector, development of renewable energy sources;

- modernization of the obsolete technological base of the energy sector, effective implementation of investment policy in the field of science and technology and energy;

- Development of modern safety standards in the energy sector, development of a mechanism of state control to reduce environmental risks and prevent natural disasters.

The main goal of the state economic policy for the fuel and energy sector is determined by the ability of electricity generators to supply energy resources to consumers in accordance with their needs. As a guarantee of energy security of the country is to create economic, organizational and legal conditions that ensure the reliable operation of the energy supply system. To do this, it is necessary to ensure the implementation of the following priorities of energy policy at the regional level:

- Implementation of energy efficiency and energy saving policies at all levels of the economy;

-increasing the financial stability of the energy sector;

- increase the volume of investments in the electricity sector;

- reducing the man-made impact of energy on the environment through the modernization of the electricity sector and the use of new technologies;

- creation of energy safety monitoring system;

- support the prevention and elimination of crises in the energy system of the country.

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