



## Ways of Introduction of Modern Management Mechanisms in the Electric Power Sector of Uzbekistan

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**Abstract:** This article examines the potential and future goals and objectives of the Republic of Uzbekistan in the field of electricity generation among Central Asian countries. In addition, the problems in the processes of electricity generation and supply to consumers, shortcomings in the management mechanisms of organizations in the electricity generation sector and ways to address them are highlighted.

**Key words:** power generation, power, solar energy, wind energy, hydropower, renewable energy sources, energy resources, management concept, management mechanism, management methods, control elements, management methodology.

### INTRODUCTION

The electricity sector of Uzbekistan has historically been one of the countries in Central Asia that is able to fully meet its needs at the expense of its own energy resources. No state can ever develop as an independent state without an independent electricity grid.

The electricity sector of our country exports not only its local market, but also to neighboring countries Kyrgyzstan, Tajikistan, Afghanistan, Turkmenistan and Kazakhstan.

The electricity market of any country has historically been under state control, and the regulation and management of network activities has been governed not by market mechanisms but by public administration mechanisms. Over-centralization of the process of electricity generation and supply to consumers will keep the network in a monopoly position. As a result, it hinders the use of more flexible and diverse forms of electricity generation and sales management, as well as various forms of barriers to market liberalization and the effective formation of a competitive environment.

The existing problems and shortcomings in the electricity sector or the ongoing economic reforms in this sector will certainly have a negative or positive impact on other sectors. Because without electricity, no industry or network can plan its future. In this regard, a number of resolutions and decrees of the President of the Republic of Uzbekistan have been developed to radically reform the electricity sector.

In order to increase the efficiency of energy resources, we need to reform the energy system of our country and develop a clear strategy in this regard. First of all, it is necessary to privatize inefficient and unprofitable enterprises, to end the monopoly. It is also necessary to create a competitive environment in the supply of electricity and encourage the use of alternative energy sources. This will require a transition to market mechanisms for financing production with greater involvement of the private sector [1].

The introduction of modern management mechanisms in the electricity sector, the formation of a competitive environment in the industry, attracting foreign investors, achieving savings in production, improving the environment, improving the supply of cheap and quality electricity.

In order to introduce and accelerate the development of an effective management system of the energy sector, to increase its competitiveness and investment attractiveness [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;
- **second**, 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, as well as 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).

Without ensuring the reliable operation of the electricity sector, it is impossible to increase the industrial potential of industries and regions of the country, stimulate the development of entrepreneurship, increase the welfare of the population and improve the quality of life. In modern conditions, the development of a competitive environment in the electricity sector and the attraction of investment requires a radical improvement of the institutional and organizational and legal framework for activities in the field of electricity generation and supply [3].

Among the Central Asian countries, the geographical location of the Republic of Uzbekistan is located in the center, and given the historical level of experience and potential in the production and supply of electricity, it can be recognized that it has great potential for today and the future.

The implementation of radical reforms in the electricity sector, the introduction of modern management mechanisms in the industry using the principles of methodological system approach, the formation of a modern competitive environment by attracting foreign investors, not only quality domestic but also foreign markets it can be seen that the export potential is high. These and other circumstances determine the relevance of this topic for today and for the future.

## ANALYSIS OF THE LITERATURE ON THE SUBJECT

The countries of the world are economically divided into three groups, they are economically underdeveloped, economically redeveloping, and economically increasing to develop and the demand for electricity also increases with the development of countries, there is a demand for electricity in less developed countries, the demand for electricity in developing countries is high, the demand for electricity in developed countries is very high.

If we analyze the research of economists who have studied the problems of reforming and managing the power grid, we can see them through the data below.

In the management of electricity in different countries, it is distinguished by the diversity of public administration bodies. At the same time, in most cases, an independent body is established, which is responsible for the implementation of reforms and the normal functioning of the market [5].

Another important improving of technological progress is the emergence of small-scale electricity generation, which is becoming increasingly popular in the world. The small-scale power grid is based on gas mini-power plants, diesel power plants and others. Using this, environmentally friendly alternative methods of generating electricity using solar energy, wind, waves, etc. are becoming increasingly competitive [6].

The transition to modern forms of management of the power grid, the emerging new methodology in the management of the power grid, will be carried out continuously with the previous methodology, centralized using the principles of systematic approaches. This is primarily due to the integrity of the physical and technical condition of thermal power plants, and secondly due to their territorial and technological hierarchical structure [7].

The ongoing reforms require the qualitative development and management of the electricity sector in our country. It should take into account the following aspects: priority provision of social needs through the creation of a base of convenient raw materials and strategically important industries in the sustainable supply of fuel and energy resources to all sectors of the economy; efficient use of energy resources and creation of necessary conditions for the implementation of energy-saving measures aimed at increasing the export potential of the country's energy independence; support the financial stability of the electricity sector and attract large investments; improvement of the regulatory framework and the improvement of the tax system, which takes into account the specifics of the interaction of the electricity sector with joint networks, etc. [8].

In order to fulfill the main tasks of changing the power system and create a competitive environment in the market, it is necessary to create favorable conditions for the emergence of new generalized companies. It is difficult to say how expedient it is in our practice to separate owners to eliminate stratified access to infrastructure networks. The different geographical location of electricity generating entities in the country and their low population density lead to cases of functional or rapid distribution in the industry [9].

There is a comprehensive economic literature on the methodology and practice of energy sector management in a market economy, in which the problems of increasing the economic efficiency and social responsibility of the state in the fuel and energy sector are considered mainly in isolation [10].

The complete restructuring of the power industry envisaged in the most radical model of industrial reform has resulted in the liberalization of potential competitive activities (production and supply) from vertically integrated monopolies, resulting in a competitive environment in these areas. In this case, the monopoly is maintained only in the field of transmission and distribution of electricity. Countries such as the United Kingdom, Italy, Portugal, the Netherlands, Sweden, Denmark, Spain, and Luxembourg have embarked on a path of complete reconstruction.

Creating conditions for the development of competition, prevention of abuse of market power are new tasks of state regulation in this area, which requires regular monitoring of energy markets. The experience of foreign countries shows that often the results of competition between energy companies are their mergers in various forms of horizontal and vertical integration [12]. Transnational trading platforms are being formed that unite large producers and consumers of electricity not only within one country but also in neighboring countries [13].

Regardless of the state system and type of economy, it is necessary for the state to manage the fuel and energy sector [14].

Lafta J. to the control mechanism. defines it as “a unit of means of influence used in management” and “a set of supports used in management” [15].

According to Barlukova. A.V. “the control mechanism is a tool of influence of the control system on the controlled object. In the management process, it performs two main functions: it provides the

governing body with information about the status of the governing body and ensures the implementation of the decisions made by the governing” [16].

P. Cramton, and A. Oskenfels proved the “missing money” theorem, according to which prices in a competitive electricity market are always too low to pay for sufficient power [17].

Electricity trading has many features due to its physical properties [18]. One of the important features is that the electricity is not stored enough. This means that electricity sales are high and directly dependent on production conditions, so it is not possible to meet it at the peak of demand when demand is low.

Electricity market mechanisms designed to manage sustainable electricity generation play an important role in energy exchange to mitigate climate change. One of the main problems is related to the operational flexible power reserves of variable renewable energy [19].

If the production and distribution of electricity is organized on the basis of market principles, the most important problem in designing the mechanism of the electricity market in the future is effective pricing to encourage the adoption and use of electricity generation and renewable energy sources [20].

The use of renewable energy sources in the development of the energy sector is becoming a component of the overall strategy of the sector. One of the most important characteristics of renewable energy sources is their energy potential - an indicator that determines the amount of energy specific to the respective type of renewable energy sources [21].

The oil and gas industry are one of the leading sectors of our country's economy. Uzbekistan ranks among the world's leading natural gas producers. During the years of independence, fundamental changes were made in the oil and gas industry of our country. Our country has become a major exporter of gas, polyethylene and refined petroleum products. Special attention is being paid to the liberalization of the economy and the creation of a favorable investment environment that serves to further develop all its sectors, including the oil and gas industry. Construction of new buildings and structures, reconstruction and modernization of the existing ones based on the requirements of the times are in full swing. Favorable conditions, opportunities and benefits are being created in the oil and gas industry for increasing production efficiency, increasing the share of local products in the domestic market, expanding localization, and developing cooperative relations [22].

Experts prove that one of the solutions to complex issues such as ensuring sufficient energy balance in the world, mitigating climate changes, and reducing environmental problems is to increase the size of nuclear power based on modern technologies. NPP is a part of green energy. We are referring to the green four, water, sun, wind and atom. Nuclear energy allows to drastically reduce the emission of SO<sub>2</sub> into the environment. It is recognized that the development of nuclear energy in the world is influenced by the task of reducing the anthropogenic load on the environment. It is assumed that they can be solved by transitioning to a "green" economy [23].

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 [24].

Management mechanism is an environment in which the enterprise carries out management activities in organizations. Management environment - integrates management system and management technology.

Management methods can be divided into the following main groups:

- ✓ organizational and administrative methods of separate management.
- ✓ This method is reflected in the regulatory support of a particular type of activity (international regulations, international treaties and agreements);

- ✓ economic methods (credit, tariff, tax, customs standards and other types of macroeconomic indicators and requirements);
- ✓ socio-psychological methods (serves to achieve the goals set by the management system).

**METHODOLOGY OF RESEARCH.** In the course of the research, the methods of studying and researching the power generation network, comparative analysis and synthesis, induction and deduction, expert evaluation, scientific abstraction, statistical grouping, correlation and regression analysis and other methods were widely used.

**ANALYSIS AND RESULTS.** Central Asian countries are characterized by high energy consumption: For example, Uzbekistan is on the second place for electricity consumption per individuals in the world in terms of energy intensity relative to the World Bank [21]. According to the World Bank, such energy consumption accounts for at least 4.5% per year in the Uzbek economy [22]. Compared to other countries in the region, Uzbekistan consumes twice as much energy as Kazakhstan. The volume of electricity used by the economy of Kazakhstan is twice the average efficiency of electricity consumption in the Commonwealth of Independent States (CIS) [23].

In the Republic of Uzbekistan, the total electricity consumption by regions is recorded in different forms. We can see this in Table 1 below.

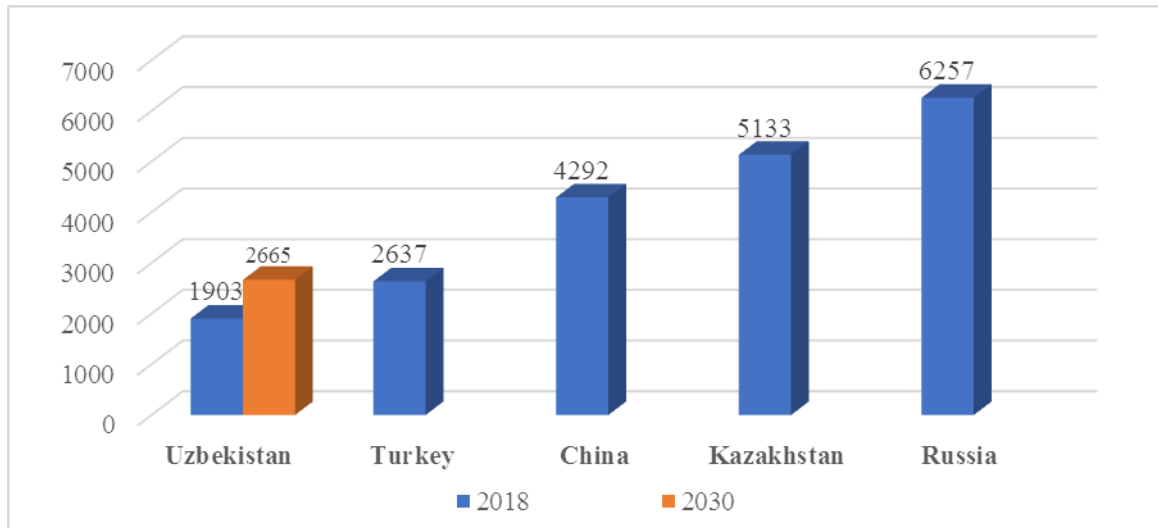
**Table 1. Gross electricity consumption by regions, billion kilowatts**

Name of regions	2016	2017	2018	2019
<b>In The Republic of Uzbekistan</b>	<b>45058,8</b>	<b>46746,3</b>	<b>60744,8</b>	<b>54174,8</b>
Republic of Karakalpakstan	1041,9	1088,7	1578,3	1690,1
Regions				
Andijan	2406,3	2639,5	3975,4	2627,3
Bukhara	2580,3	2678,2	3338,8	2437,0
Jizzakh	1518,8	1581,4	2177,8	1924,4
Kashkadarya	4857,6	5116,1	5561,3	5594,6
Navoi	6895,0	7002,6	7431,4	8775,3
Namangan	2612,9	2789,6	3898,9	3099,1
Samarqand	2947,5	3247,8	4425,8	2769,7
Surhandarya	2148,1	2230,9	5653,0	2364,3
Syrdarya	1177,3	1159,4	1455,1	1748,9
Tashkent	6981,3	7235,1	8868,5	9253,6
Fergana	3829,4	3534,0	4965,3	4591,8
Khorezm	1090,6	1118,1	1799,3	1765,7
Tashkent city	4971,7	5325,0	5615,8	5532,9

**Source:** Data of the State Statistics Committee of the Republic of Uzbekistan

According to Table 1, the highest electricity consumption is in Tashkent, Navoi region and Tashkent city. The reason is the large number of manufacturing and industrial enterprises in Tashkent, Navoi and Tashkent. The lowest electricity consumption is in the Republic of Karakalpakstan, Syrdarya, Khorezm and Jizzakh regions. This can be explained by low electricity consumption, low population, lack of manufacturing and industrial enterprises.





**Figure 1. Electricity consumption per year**

**Source:** CONCEPT of electricity supply of the Republic of Uzbekistan in 2020-2030

Figure 1 above shows the per individual electricity consumption in Uzbekistan and other countries. At the same time, per individual electricity consumption in 2018 is 1903 kilowatt in Uzbekistan, 2637 kilowatts in Turkey, 4292 kilowatts in China, 5133 kilowatts in Kazakhstan and 6257 kilowatts in Russia. By 2030, Uzbekistan is projected to have 2,665 kilowatts.

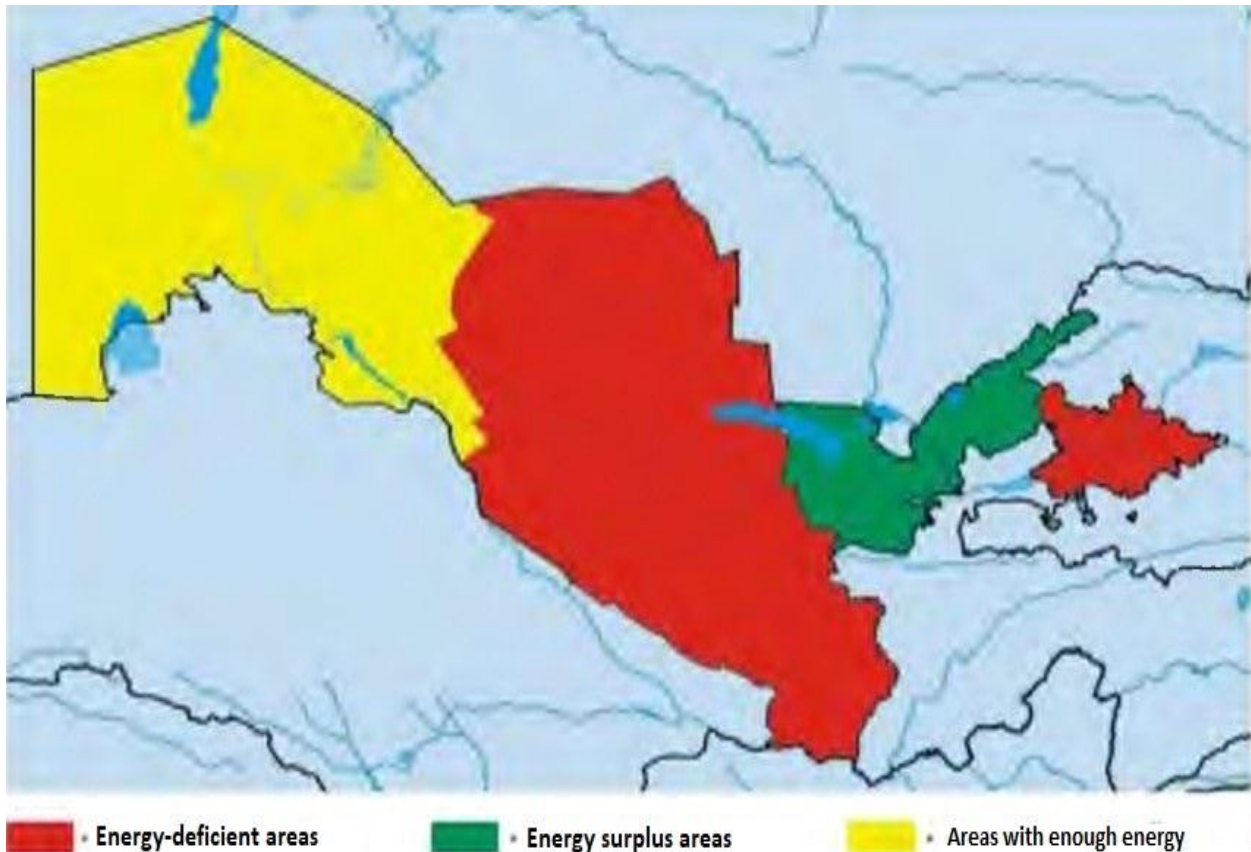
Table 2 shows the installed capacity of electricity generation in Central Asian countries. At the same time, Uzbekistan produces 920 MgW of electricity, Kyrgyzstan 666 MgW, Tajikistan 318 MgW, Tajikistan 4,772 MgW, Kyrgyzstan 3,070 MgW and Kazakhstan 2,264 MgW.

**Table 2. Electric power**

Types	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan
Coal	14.090 MWt	666 MWt	318 MWt	920 MWt
Gas	2.684 MWt	-	-	9.740 MWt
Hydro	2.264 MWt	3.070 MWt	4.772 MWt	1.807 MWt

**Source: Fichtner**

Figure 2 shows a schematic map of Uzbekistan on energy shortages and energy surpluses. The red areas are the areas with electricity shortages, the yellow areas are the areas with sufficient electricity, and the green areas are the areas with excess electricity. In the Republic of Uzbekistan, the excess of electricity is a small amount compared to the total area. Areas with electricity shortages are larger than the rest. It is obvious that the demand for electricity is growing from year to year.



**Figure 2. Schematic map of energy shortages and energy surpluses in Uzbekistan**

The capacity and year of establishment of thermal power plants (TPPs) and thermal power plants (TPPs) generating electricity in the Republic of Uzbekistan are given in Table 3.

The first Tashkent TPPs was launched in 1939 and installed 30 MW, and in 2014 - 27 MW. The second Fergana TPPs was established in 1956 with a capacity of 305 MWt. The third was Angren Thermal Power Plant, commissioned in 1957, with a capacity of 484 MWt. The last Talimarjan thermal power plant was commissioned in 2004 with a capacity of 800 MWt. Navoi TPP was originally commissioned in 1961, and by 2013 an additional 478 MWt of units had been commissioned.

**Table 3. Capacity and year of establishment of thermal power plants (TPPs) and thermal power plants (TPPs) generating electricity in the Republic of Uzbekistan**

№	Names	Year of Establishment	Power, MWt
1	Syrdarya TPPs	1992	3000
2	Tashkent TPPs	1963	1860
3	New Angren TPPs	1985	2100
4	Navoi TPPs	1961 and 2013	1250+478
5	Talimarjan TPPs	2004	800
6	Takhiyatosh TPPs	1961	730
7	Angren TPPs	1957	484
8	Muborak TPPs	1985	60
9	Tashkent TPPs	1939 and 2014	30+27
10	Fergana TPPs	1956	305

**Source: Third National Communication of the Republic of Uzbekistan on the UN Framework Convention on Climate Change. Tashkent, 2016. P-31.**

Local 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. Reduction of consumption of natural gas, coal and fuel oil in electricity generation is shown in Table 4.

**Table 4. Fuel consumption in electricity generation**

№	Fuel name	2019	2025	2030
1	Natural gas (mln.m <sup>3</sup> )	15,8	12,7	12,1
2	Coal (mln. tons)	3,6	8,5	8,5
3	Fuel oil (thousand tons)	204	50	50

**Source: CONCEPT of electricity supply of the Republic of Uzbekistan in 2020-2030**

The main pressing issues are the limited resources of raw materials in production and the growing demand for electricity from year to year. Therefore, by 2030, the use of natural gas will reach 12.1 mln. m<sup>3</sup>, the use of coal is 8.5 mln. tons, it is planned to reduce the use of fuel oil to 50 thousand tons.

In 2020-2030, special attention will be paid to the development of electricity generation through renewable energy sources, especially solar energy. These projects will be implemented only at the expense of investors - independent electricity producers.

The assessment of the feasibility of introducing renewable energy sources (RES) for electricity generation in Uzbekistan by 2030 is given in Table 5.

**Table 5. Assess the feasibility of introducing renewable energy sources (RES) to generate electricity by 2030**

RES types	Suggested areas of implementation	Planned power, MWt	Planned production bln.kwt.s	Annual gas savings, bln. m <sup>3</sup>
Sun	Karakalpakstan, Navoi region	2000	5	1,517
Wind	Karakalpakstan, Navoi region	40	0,08	0,024
Hydro	Tashkent, Surhandarya, Namangan va Fergana regions	938	2,60	0,788
Extraction of biogas from animal and poultry wastes	All regions	450	3,60	1,092
Biogas from wastewater treatment plants	Wastewater treatment plants in large cities	15	0,12	0,0036
<b>Total</b>		<b>3443</b>	<b>11,40</b>	<b>3,457</b>

**Source: “Towards Sustainable Energy: A Strategy for Low-Hydrocarbon Development of the Republic of Uzbekistan”, UNDP / Ministry of Economy of the Republic of Uzbekistan. - Tashkent, 2015**

In the period up to 2030, the efficient use of renewable energy sources in the production of electricity, solar energy, wind energy, hydroelectric power stations are aimed. As a practical result, the President of Uzbekistan in his speech on the occasion of the 30th anniversary of independence of the Republic of Uzbekistan said that indicates that the planned work in the system is being carried out gradually.



## CONCLUSIONS AND RECOMMENDATIONS.

At present, electricity is generated and supplied to consumers in Uzbekistan by the independent joint-stock companies "Thermal Power Stations", "National Electric Networks of Uzbekistan" and "Regional Electric Networks". These three joint stock companies are managed by the Ministry of Energy of Uzbekistan.

From the above data, it can be seen that the demand for electricity is growing from year to year. Creating a competitive environment by attracting local and foreign investment in the electricity sector, adapting the regulations in the field to our current and future strategic plans, using the experience of developed countries. This will require the effective use of modern management mechanisms in the power generation system.

Management mechanisms consist of organizational, economic and legal mechanisms. Depending on their goals and objectives, organizations form a number of economic elements for the effective functioning of organizational, economic and legal mechanisms. In order to effectively use the control mechanisms in the power system, it is necessary to:

### *a) organizationally:*

The formation of a competitive environment in the power system should be divided into three stages.

#### ***Phase 1 (1-5 years)***

- ✓ construction of small hydropower plants by local investors;
- ✓ establishment of solar and wind power plants in cooperation with foreign investors;
- ✓ Establishment of small-scale electricity generation on the basis of public-private partnership (PPP);
- ✓ Transition to the system of automation of technological processes at power plants;
- ✓ optimization of the management system of power generation enterprises (regardless of the form of ownership), their structures and divisions, introduction of modern methods of work organization aimed at achieving concrete results and target indicators (quality management, indicative planning).

#### ***Phase 2 (5-10 years)***

- Introduction of preferential credit lines to electricity generating organizations on the basis of renewable energy sources (RES) and preferential tax payment (up to 50% due to non-payment of taxes for up to 3 years and increase in production capacity in subsequent years);
- Establishment of tax incentives for solar, wind and hydro power plants, the transition to a mechanism to encourage purchase tariffs for additional generated electricity;
- reduction of "natural losses" by renewing the fixed assets of state-owned thermal power plants and RES and providing financial assistance;
- creation of mechanisms to provide economic incentives, economic security and financial stability to organizations operating in the private sector engaged in the production and supply of electricity to consumers.

#### ***Phase 3 (10-20 years)***

- ✓ coordination of implementation of investment projects in the field of electricity generation, active involvement of private capital in energy extraction and production processes, establishment of cooperation with international financial institutions, donor countries, companies, banks and other structures;
- ✓ Involvement of modern financial institutions in the denationalization and privatization of state-owned thermal power plants and RES and the use of highly cost-effective mechanisms;

- ✓ Increasing the investment attractiveness of the electricity generation sector through the development of the private sector, improving tariff policy, which stimulates the formation of a favorable competition and business environment in the market of energy resources;
- ✓ development of ways to reduce management costs between state-owned producers and sellers of electricity;
- ✓ full liberalization of an effective export policy in the sale of electricity, regardless of the form of ownership;
- ✓ creation of an effective mechanism of economic interest of payment relations between sellers and consumers of electricity.

**b) economically:*****Phase 1 (1-5 years)***

- to provide tax benefits (exemption from taxes for 1-3 years, the possibility of paying taxes in the amount of 50 percent in subsequent years) for electricity generating organizations established on the basis of public private partnerships (PPP);
- to provide tax benefits on solar, wind and hydroelectric plants with the form of private property (xm) (when capacity is increased, the possibility of not paying taxes for up to 1-5 years);
- using the experience of advanced foreign countries in the financial support of electric generating thermal power plants and thermal power centers.

***Phase 2 (5-10 years)***

- ✓ allocation of preferential credit lines to electricity generating organizations on the basis of renewable energy sources (QTEM) and setting rates of preferential tax (up to 50 percent preferential due to non-payment of taxes for up to 3 years and then increasing production capacity for years;
- ✓ introduction of benefits for taxation of enterprises and organizations producing electricity using renewable energy sources;
- ✓ improvement of leasing relations in the state guarantee for the renewal of fixed assets used in the production of electricity in state-owned thermal power plants and thermal power centers.

***Phase 3 (10-20 years)***

- development of effective mechanisms for attracting foreign investment in the field of electricity production and the establishment of private entrepreneurial activity in the formation of reserves of energy resources in the future;
- involvement of international financial organizations in the decentralization and privatization of state-owned IES and IEM, as well as the establishment of the use of highly economically effective mechanisms;
- reduction of management costs due to the production of electricity, transmission through main lines and the organization of modern management in the areas of territorial power lines;
- increasing the range of services in the field of electricity generation, transmission through territorial power lines and creating an entrepreneurial environment in the industry.

**c) legally:**

- ✓ harmonization of free bilateral agreements in the production and sale of electricity, regardless of the form of ownership, with international legal norms;
- ✓ creation of mechanisms of electronic trading system in the production and sale of electricity (certain types of trade are not defined by protocols and rules of mutual trade) based on electronic regulatory framework;
- ✓ development of strict legal requirements for saving and rational use of energy resources;

- ✓ harmonization of legal norms of industrial and ecological safety in the production of electricity with international requirements;
- ✓ Strengthening the legal framework for "ensuring economic and technical safety of consumers" in accordance with international standards for the sale and continuity of electricity to consumers;
- ✓ its legal improvement, taking into account the mechanisms of prepayment for electricity (features of economic incentives).

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