## Control Structure and Functions of the Unified Electricity System of the Republic of Kazakhstan

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**Abstract.** The control procedure and functions of the national energy system have been considered. The regional grids, which ensure the electrical connections within the regions, as well as the transmission of the electric energy to the retail consumers. Energy transmission companies. The power supply sector. The electricity market, which consists of two levels: wholesale and retail electricity markets and the thermal energy market, which consists of one level - the retail market. The stable and proper operation of the Unified Electricity System of the Republic of Kazakhstan and the further development of the market relations in the field of the electricity distribution.

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## Introduction

The fundamental provisions of the control structure and functions performed by the Unified National Electricity System (UNES) of the Republic of Kazakhstan are enshrined in the Law # 588-II dated 9th July 2004 "On the Electric Power Sector" (as amended as of 29.12.2008). This Law governs the social relations arising during the generation, transmission and consumption of the electric and thermal energy [1].

The Unified Electricity System of the Republic of Kazakhstan is a set of the power plants, power lines and substations, which ensure the proper and high-quality power supply of the Republic consumers.

According to the Law, the competence of the Government of the Republic of Kazakhstan in managing the Unified Electricity System of the Republic of Kazakhstan, includes the following control functions:

- the development of the main trends in the state policy in the field of electricity;

- the implementation of the state programs of the electric power sector development;

- approving the Statute of the State Energy Supervision of the Republic of Kazakhstan;

- establishing the procedure of defining the accounting electricity tariff, approving the maximum and individual tariffs;

- approving the standard investment contract and agreement;

- making a decision on putting electricity in the list of the acquired property (assets), sold at tendering (auctions) in accordance with the legislation of the Republic of Kazakhstan;

- approving the technical instructions in the field of electricity.

The Agency of the Republic of Kazakhstan for Competition Protection (the Antimonopoly Agency) is the state authority, which manages in the field of the natural monopolies and in the regulated markets (including the electric power sector) in the manner stipulated by the Kazakhstan Republic legislation [2].

According to the Paragraph 2 Art. 15 of the Law of the Republic of Kazakhstan "On the Electric Power Sector" the main functions of the market operator of the centralized trade in electricity ("KOREM" JSC) are [3]:

- the organization and execution of the spot tendering;

- the organization and execution of the centralized trade in electricity during the mediumterm (week, month) and long-term (quarter, year) periods;

- ensuring the equal terms of access to the market of the centralized trade in electricity for the wholesale electricity market entities;

- establishing the compliance of the wholesale electricity market entities with the requirements, stipulated by the rules of the centralized trade in electricity;

- the registration and accounting the power purchase-and-sale contracts made at the centralized electricity tendering;

- within one's competence the provision of the wholesale electricity market entities with the information on the current electricity indicative prices at the centralized tendering and other market information.

«KEGOC» JSC is the transmission system operator of the Unified Electricity System of the Republic of Kazakhstan (the Order # 198 of the Ministry of Energy and Mineral Resources dated 27th August 2004) and performs the following functions [4]:

- renders the system services in the electric energy transmission through the national electrical

grid under the contracts, ensures its maintenance and operating status;

- renders the system services in the technical supervision, while exerting the centralized real-time operations control over the operation modes of the Unified Electricity System of the Republic of Kazakhstan under the contracts, including the completion of the actual balances and daily schedule of the electric energy generation and consumption.

The function of the supergrid in the Unified Electricity System of the Republic of Kazakhstan is exercised by the national electrical grid (NEG), which ensures the electrical connections between the regions of the Republic and the energy systems of the neighbouring states (the Russian Federation, the Kyrgyzstan and Uzbekistan Republics), as well as the electric energy output by the power plants and its transmission to the wholesale customers. The substations, electricity distribution plants. interregional and/ or international power lines and the power lines, which output the electric energy of the power plants, with the voltage of 220 kV and higher, which form NEG, are on the balance sheet of "KEGOC" JSC, the Kazakhstan electricity grid operating company.

The regional electrical grids ensure the electrical connections within the regions, as well as the transmission of the electric energy to the retail consumers. The regional electrical grids are on the balance sheet and in operation of the regional grid companies (RGCs).

Under the contracts the energy transmission companies (ETC) transmit the electrical energy to the customers of the wholesale and retail markets or the power supply companies through its own or used (rent, leasing, trust management and other types of use) electrical grids.

The power supply sector of the Kazakhstan Republic electricity market consists of the power supply companies (PSC), which carry out the electric energy purchase from the power generation companies or at the centralized tendering and its subsequent sale to the ultimate retail customers. Some PSCs perform the functions of the "guaranteed" power supply companies.

The Kazakhstan Republic power supply is carried out in the context of the electric and thermal energy market operation. The electricity market consists of two levels: the wholesale and retail electricity markets, the thermal energy market consists of one level - the retail market (ref. Fig. 1).

The power generation and power supply companies, as well as the guaranteed power supply companies should purchase or sell the electricity at the centralized tendering in the manner, determined by the state authority, which manages in the field of the natural monopolies and in the regulated markets.



Fig. 1. A Diagram of the Power Purchase and Sale in the Kazakhstan Market

A transmission system operator, regional grid companies and other companies, which maintain the grids, provide all the market participants with a free access to the electricity market in the manner determined by the state authority, which manages in the field of the natural monopolies and in the regulated markets.

The wholesale electricity market includes:

- the market of the decentralized power purchase and sale, which operates on the basis of the power purchase-and-sale contracts concluded by the market participants at the prices and on the supply terms, required by the agreement of the parties;

- the market of the centralized trade in electricity, which is an organized trading platform for the power purchase and sale on the short-term (spot tendering), medium-term (week, month) and longterm (quarter, year) basis;

- the balancing on-line market, which operates for the physical and subsequent financial regulation of the hourly imbalances arising in an operating day between the actual and contractual amounts of the electric energy generation and consumption in the Unified Electricity System of the Republic of Kazakhstan, approved by the transmission system operator in the daily schedule of the electric energy generation and consumption;

- the system and ancillary service market, which operates on the basis of both purchasing from the wholesale electricity market entities and providing the wholesale electricity market entities with the relevant services by the transmission system operator in order to ensure the operational reliability of the Unified Electricity System of the Republic of Kazakhstan and the electric energy quality, stipulated by the state standards. The power purchase and sale, rendering the services of the electric energy transmission, the technical supervision, the electric power regulation, balancing the electric energy generation and consumption, the management and operation of the centralized electrical tendering in the wholesale electricity market are carried out under the contracts made in accordance with the Civil Code of the Republic of Kazakhstan and other laws and regulations.

The procedure of the access to the retail electricity market is determined by the state authority, which manages in the field of the natural monopolies and in the regulated markets. The regional grid companies perform the functions of the electric energy transmission through the electrical grids in the context of its balance sheet attribution. While conducting the economic activity the advantages over the other power supply organizations could not be got by the guaranteed power supply companies.

The purchase and sale of the electric and thermal energy in the retail market is carried out under the power supply contracts made by the consumers with the power supply companies. The contracts made by the power supply and power transmission companies in the retail market should embody the equal terms for all the participants of the retail market of the electric and thermal energy.

The prices and supply terms for the electricity, which is provided by the power supply companies are set under the purchase-and-sale contract by the agreement of the parties, subject to the tariffs of the energy transmission companies.

The electric energy transmission through the regional electrical grids is carried out under the contract on the services for the electric energy transmission, made by the power supply company or a consumer with the regional grid company, in a standard form, stipulated by the Government of the Republic of Kazakhstan.

A transmission system operator, regional grid companies and other companies, which maintain the electrical grids, provide all the market participants with a free access to the electricity market in the manner determined by the state authority, which manages in the field of the natural monopolies and in the regulated markets.

The relations arising during the generation, transmission and consumption in the market of the electric and thermal energy, are governed by the relevant contracts in the electric power sector.

The stable and proper operation of the Unified Electricity System of the Republic of Kazakhstan and the further development of the market relations in the field of the electricity distribution and the consumers' power supply are concerned with the solution of some issues, which are managerial, legal, economic and investment in nature.

The efficient market operation could be both in case of privatization, this is exemplified in the United Kingdom [5], Chile and Argentina, and the administrative and economic separation of the generation, transmission and distribution sectors in the context of the state or mixed property - this is exemplified in France and the Scandinavian countries [6].

In most countries, involved in restructuring, the wholesale electricity market, including the direct supplies, the spot, balancing and reserve markets, has been occurred. Each one is characterized by the method of arranging the power supply. In the context of the power supply three market types are identified: the spot one, where the power supply is carried out for the current consumption, the futures one - is the supplies for the future consumption, and the bilateral contracting market - is the supplies for both the current and future consumption. Thus, in Australia, the United Kingdom and Norway all the three market types are used, in Argentina - the spot market and the bilateral contracting market are used [7], in the United States - the spot market is primarily used [8].

Over the last years, the need for separating the vertically integrated energy companies has been called into a question. There is a risk for the power system become unreliable. The negative results concerning the electricity separation have been already seen in New Zealand and Brazil. The issues concerning the social tasks failure under the new conditions should be noted as the other negative factors: the rise in unemployment due to the trend in the sectoral employment reduction (the USA, the United Kingdom, Argentina), increasing the arrearage in payments for electricity among the disadvantaged population. The trend to decline in the electricity prices (Australia [9]), improving the plant operating efficiency, the economical use of fuel, the investment inflow (Argentina, the USA, Chile) could be seen amid the positive factors.

Thus, the direct control methods do not provide the sufficient motivation for the power system development. Therefore, in the foreign countries the trend to the restriction of the direct state control has been evolved, and the emphasis is on the use of the market methods of the indirect tariff control: the new systems of the power purchase and sale, which result in decreasing the price burden on the consumers; the development of the economically favourable operational conditions for the power generators in the wholesale and regional electricity markets; the establishment of the uniform pricing rules and the compound tariffs for the consumers with the mode differentiation; the implementation of the market pricing elements: the electricity exchange, the futures market of the electricity contracts - as a result of which the actual market rates are imposed; developing the system of the state investment priorities, intended to the electric power sector development; ensuring the stable tax regime, which guarantees the enforcement of all the investors' rights and interests; the public lending and the support for the efficient investment programs implemented with the predominance of the advanced technologies.

The main trends in developing the theory of economics and management are the managerial innovations in the field of the energy conservation and increasing the energy efficiency. There is a need for soluting the issues of constructing the effective energy management systems for the electric power complex subject to the requirements of ISO 50001:2011 [10] and the specifics of the electric power complex operation.

The following programs of the sectoral development were adopted for soluting the issues of the stable and proper operation of the Unified Electricity System of the Republic of Kazakhstan:

- The State Program of the Electric Power Sector Development until 2030 was approved by the Resolution # 384 of the Government of the Republic of Kazakhstan dated 9th April 1999. The program was adopted according to the strategy for developing the Republic of Kazakhstan in order to gradually solute the tasks of ensuring the proper power supply of the country, creating the export-oriented, technology-related fuel and energy complex [11];

- The Sectoral Program of Developing the Unified Electricity System of the Republic of Kazakhstan for the Period until 2010 with an outlook for 2015, approved by the Order # 160 of the Ministry of Energy and Mineral Resources dated 22nd May 2006, has been amended according to the assignment of the President of the Republic of Kazakhstan with the involvement of the project institutions, "KEGOC" JSC and other energy companies, as well as the local administrations of the regions [12];

The general strategy for the electric power sector development is intended to ensure the energy independence and energy security of the country, to form the proper energy base for the further sustainable economic growth. When making amendments the higher rates of the projected growth of the electric energy consumption and loads in accordance with the proposed rates of the electric energy consumption growth have been taken into account, the sectoral problematic issues have been determined, the state of the energy companies, the possible scope and timing of the extension of the existing power generation assets and the construction of the new ones have been considered.

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