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SUSTAINABLE DEVELOPMENT OF REGIONAL HEAT SUPPLY SYSTEMS IN THE CONTEXT OF THE EURASIAN ECONOMIC UNION ENERGY MARKETS ASSOCIATION

Evgeny Lisin[1], Vladimir Kindra[1], Zuzana Horvathova[2]

[1]National Research University "Moscow Power Engineering Institute", Russia 111250, Moscow, Krasnokazarmennaya st., 14
[2]Metropolitan University Prague, Dubečská 900/10, 100 31 Praha 10, Prague, Czech Republic

E-mails: [1]lisinym@mpei.ru; kindravo@mpei.ru; [2]zuzana.horvathova@mup.cz

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Abstract. The paper analyses possible directions for sustainable development of heat supply systems of the countries participating in the Eurasian Economic Union when creating a united electricity market. The present problem is subject to the fact that the key technology for the energy products production which forms the basis of the energy systems of the former Soviet Union countries is combined generation of electric and heat energy at the CHP. At the same time, this type of combined production is ineffective in the energy market conditions, and creation of a unified energy market can significantly affect the energy and economic efficiency of regional heat supply systems and energy security of states. In this regard, possible ways of sustainable development of regional heat supply systems in the context of integration of market pricing mechanisms are proposed and risks of various business models of commercial activity in the sphere of heat supply are identified.

Keywords: Eurasian Economic Union, united energy market, regional heat supply systems, sustainable development, heat energy marketing models, commercial risks

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JEL Classifications: F15, L22, L97, L98

1. Introduction

In order to develop international economic activity and build resource and production potential necessary to overcome the global economic crisis phenomena and create a driver for the growth of national economies, the countries unite their efforts in the economic sphere and form common economic spaces that essentially represent a common market. This common market ensures movement of the goods, capital, services and labor between the countries participating in the common economic space. At the same time, the economic policy of the participating states is coordinated with respect to the macroeconomic and financial sectors, trade and industry, transport and energy. Economic policy is implemented throught variety of economic tools, one of which is project financing prioritized activities, one of which is e.g. energy efficiency for sustainability (Traversari et al. 2017; Ahmed et al. 2017; Mouraud 2017; Barberis et al. 2017; Passerini et al. 2017; García-Fuentes, de Torre 2017; Oates et al. 2017; Daher et al. 2017; Prause, Atari 2017; Dobrovolskienė et al. 2017).

In 2012, within the framework of the international treaties on the Eurasian integration, a common economic space was formed between Russia, Kazakhstan and Belarus, known as the Eurasian Economic Union (Blockmans et al., 2012). In 2015, the Eurasian Union also included Armenia and Kyrgyzstan. It is planned that integration of the economies of ex-USSR countries through creation of a common market will lead to the following macroeconomic effects (Blockmans et al., 2012; Lagutina, 2014; Tarr, 2016):

- Decrease in the price of the goods due to reduction in transportation costs for transport of raw materials and equipment necessary for production.
- Increase in competition in the common market of the Eurasian Union by ensuring an equal level of economic development.
- Increase in the average salary by reducing costs and increasing workforce productivity.
- Increase of production capacities due to increased demand for the products.
- Increase in people welfare of the Eurasian Union countries by reducing prices for the goods and increasing employment in the foreign economic sphere.
- Reduction of the payback period of new technologies and goods due to increase in the volume and capacity of the market.
- Growth of the gross domestic product of the Eurasian Economic Union countries no less than by 25%.
- Creation of a common market among the countries participating in the Eurasian Economic Union implies consolidation of national commodity markets in all spheres of social production, including organization of a united electricity market (Khitakhunov et al., 2017; Pastukhova et al., 2016; Vinokurov et al., 2016).

The United Electric Power Market (UEPM) represents a system of relations between the subjects of domestic electricity markets of the countries participating in the common economic space associated with purchase and sale of electricity (power) and related services operating on the basis of general rules.

Consolidation of electric power markets will contribute to (Khitakhunov et al., 2017; Pastukhova et al., 2016; Oseni et al., 2016; Guliyev, 2017):

- Increase in economic efficiency and reliability of electric power complexes operation of the participating countries,
- Update of the electric power wholesale market operation model,
- Increase in the volume of cross-border trade in electricity, both within the common economic space and beyond,
- Stabilization (reduction in) of electricity prices and, as a result, creation of a favorable investment climate,
- Additional growth of the gross product of the countries participating in the common economic space due to the synergetic effect.

Energy systems of the Eurasian Economic Union countries were formed according to a unified concept during the times of the Soviet Union and constituted a unified energy system that, after the collapse of the USSR, was artificially divided. This fact also contributes to creation of a unified energy market, since it can be said about the existence of the necessary technological infrastructure (Pastukhova et al., 2016):

- Presence of high-voltage cross-border transmission networks with the current excess capacity of the export-import section,
- Energy systems of the participating countries operate in parallel mode with the same characteristics and requirements for the quality of energy products.

At the same time, the key technology for production of energy products, which forms the basis of energy systems of ex-USSR countries, is heating system introduction which assumes centralized power supply to consumers on the basis of combined generation of electric and heat energy at the CHP. In Russia, more than 40% of electricity is produced at the CHP, with 36% in Kazakhstan and 56% in Belarus. The role of CHP in the centralized heat supply is even more significant: in Russia, about 46% of heat is produced at the CHP, with 74% in Kazakhstan and 83% in Belarus. At the same time, it should be taken into account that the main consumer of CHP energy products is the population, which determines the significant social role of heating system introduction.

Despite the advantages of combined generation of electric and heat energy in a single production cycle, expressed in saving fuel for regional consumers by 20-30%, under the conditions of the market model of the electric power industry, in particular, the wholesale energy market, this type of generation faces significant challenges of maintaining competitiveness in comparison with separate production and individual heat supply to consumers (Lisin et al., 2015; Lisin et al., 2016).

This phenomenon is associated with a variety of reasons, the main one of which is low flexibility of CHP, which consists in the absence of the opportunity to reduce generation of electricity while maintaining a constant heat load. This leads to a price failure in the electricity market during night hours (sometimes to zero), when heat production is significant, but the demand for electricity is low enough. Often, CHP can not execute the System Operator's command and respond to uneven electricity consumption, which prevents them from participating in various competitive electricity trade sectors and speaks of their inability to be used in an energy market environment. Displaced from the energy market, CHP are essentially converted into large boiler houses. All advantages of combined production of energy products and centralized heat supply to consumers are lost (Lisin et al., 2016).

Spread of the market model of electric power industry operation in the Eurasian Economic Union countries and creation of a unified energy market can exacerbate the above-described problem and significantly affect energy and economic efficiency and sustainability of regional heat supply systems development.

In this regard, it becomes relevant to consider possible ways of sustainable development of regional heat supply systems in the context of integration of market pricing mechanisms for energy products in the countries participating in the common economic space and identify risks of various business models of commercial activity in the sphere of heat supply.

2. Analysis of power supply service of the countries participating in the Eurasian Economic Union

Despite the fact that energy systems of the Eurasian Economic Union countries were formed within the framework of the same concept laid down in the GOELRO plan adopted in the RSFSR in 1920, after the collapse of the Soviet Union, the countries developed various strategies for power supply service development. Implementation of these strategies in recent decades has led to the emergence of significant differences in structure and approaches to management of the energy systems of the states.

At present, the energy system of Russia consists of 70 regional power systems which form 7 united energy systems: East, Siberia, the Urals, the Middle Volga, South, Center and North-West. All power systems are connected by inter-system high-voltage transmission lines with a voltage of 220-500 kV and above and operate in a synchronous mode (in parallel).

The united energy systems form a unified energy system of the country, within which about 700 power plants with a capacity of over 5 MW operate. As of the beginning of 2017, the total installed capacity of power plants of the unified energy system of Russia amounted to 236 343.6 MW.

Every year all stations produce about one trillion kWh of electricity. At the same time there is an increase in electricity generation. In 2016, the power plants of the unified energy system produced 2.1% more electricity than in 2015.

The power supply network of the unified energy system of Russia has more than 10,700 transmission lines of voltage class 110-1 1150 kV which cover a territory of 12.2 million km2 with 143.3 million people (more than 98% of the population). The rest of the country (about 29%) is provided with energy by means of geographically isolated power systems.

The unified energy system of Russia produces more electricity than it consumes. The positive balance of electricity makes about 21.6 million kWh per year. This electricity is exported to neighboring countries.

The structure of electricity production in the framework of the unified energy system of Russia is presented in Figure 1.

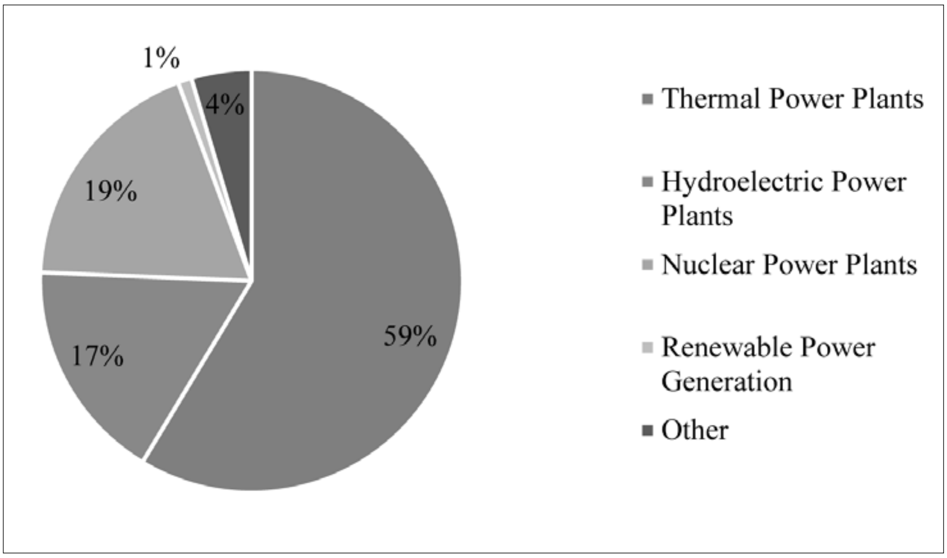

Fig. 1. Structure of electricity production in Russia

Source: own development based on (Lisin et al., 2015; Chernenko, 2015)

The main consumers of electricity are such energy-intensive industries as oil and gas industry (mining and processing), metallurgical plants, aircraft industry and rocket and space production, transport, road and agricultural machinery industry, light and food industry.

The unified energy system of Russia operates according to the rules of the market model of the electricity and power wholesale market. The state's natural monopoly extends only to transmission services. The model of the wholesale energy market represents a centralized auction of bids for supply and purchase of electricity in the energy system grids organized according to similar principles as PJM, the American energy market.

The wholesale energy market is divided into trade segments: market of free contracts, day ahead market, balancing market, regulated contracts. More than 72% of electricity is sold on the day ahead market.
The structure of the wholesale energy market in Russia is presented in Figure 2.

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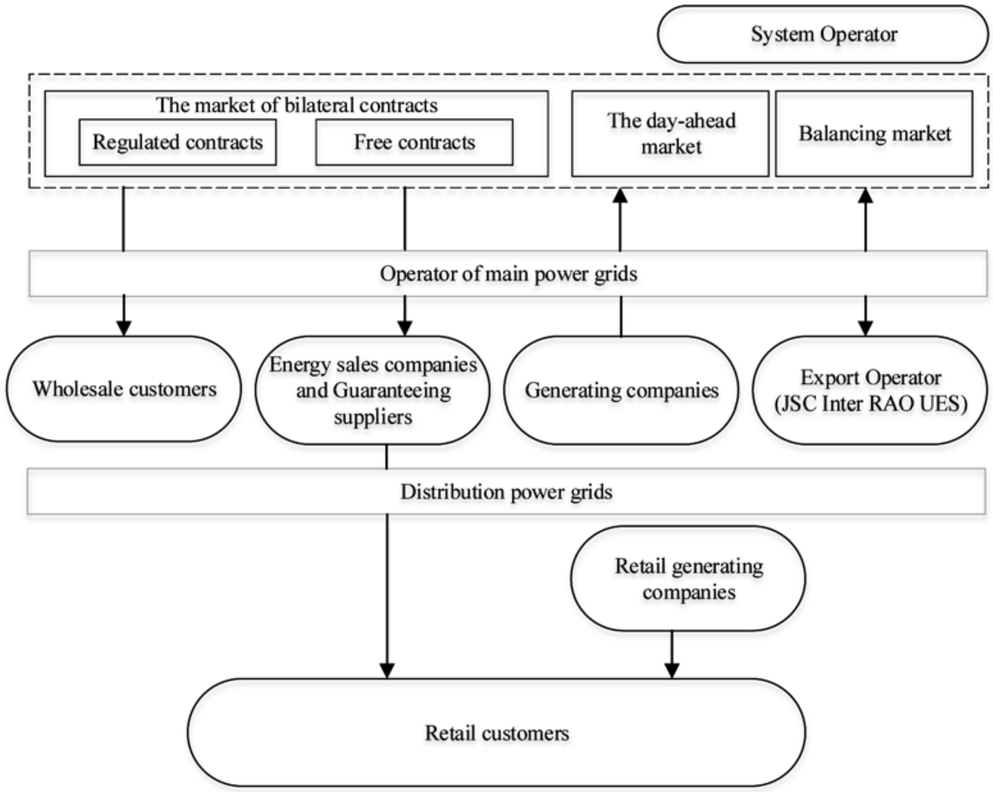

Fig. 2. Structure of the wholesale energy market in Russia

Source: own development based on (Lisin et al., 2014; Lisin et al., 2015)

The unified energy system of Kazakhstan covers an area of about 2 million km^2 (74% of the country's territory) with a population of 16 million people (89% of the population). The power system of the country is conditionally divided into three zones: North, South and West. The North zone is energy-excessive, covers its own demand for electricity and transfers excesses to the South zone and to export to Russia. The West zone is characterized by both energy-excessive and energy-deficient regions. Existing restrictions on permissible flow in cross-sections of electric networks do not allow to provide energy-deficient regions of the West zone due to its energy-excessive regions.

Similar to the energy system of Russia, the energy system of Kazakhstan is energy-excessive. In 2016, Electricity generation in Kazakhstan amounted to 94076.5 million kWh while its consumption made 92597.1 million kWh (the balance equals to 1.6%).

Power generation in Kazakhstan is carried out by 119 power plants with a total installed capacity of 21,307.2 MW. The structure of electricity production in Kazakhstan within the framework of a unified energy system is presented in Figure 3.

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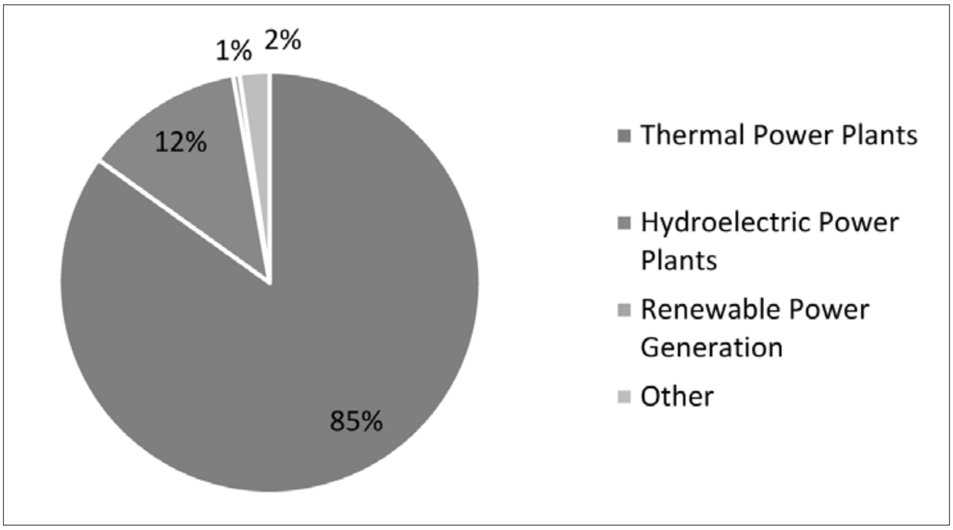

Fig. 3. Structure of electricity production in Kazakhstan

Source: own development based on (Karatayev et al., 2016; Boute, 2014)

The power supply network of the unified energy system of Kazakhstan consists of overhead transmission lines with dimensions of 0.4-1150 kV. The length of the main trunk transmission lines of 35-1150 kV makes 370.2 km. The trunk power transmission lines of Kazakhstan are connected to external power systems (power system of Russia in the north and the united power system of Central Asia in the south). Transmission and distribution of electricity implies large losses, 21.5%

In the structure of the country's electricity consumption, the largest share is taken by the industrial sector (more than 68% of total consumption), agriculture consumes less than 1.5%. The main consumers are such industries as non-ferrous and ferrous industry, chemical industry, machinery-producing industry, oil refining and production of construction materials.

Dynamics of electricity consumption by the industrial sector reflects the annual growth of electricity consumption by 5% which characterizes Kazakhstan economy as energy-intensive and energy-consuming.

The rules for the Kazakhstan unified energy system operation include market pricing mechanisms. At the same time, the system operator of the power system is integrated with the operator of trunk networks (KEGOC JSC). The electricity market is represented by a decentralized model based on bilateral contracts. Trade on the wholesale energy market is carried out only by one commodity, electricity. The balancing market functions in a simulation mode. More than 90% of electricity is sold within the framework of the trade segment of free bilateral contracts.

The structure of the wholesale energy market of Kazakhstan is presented in Figure 4.

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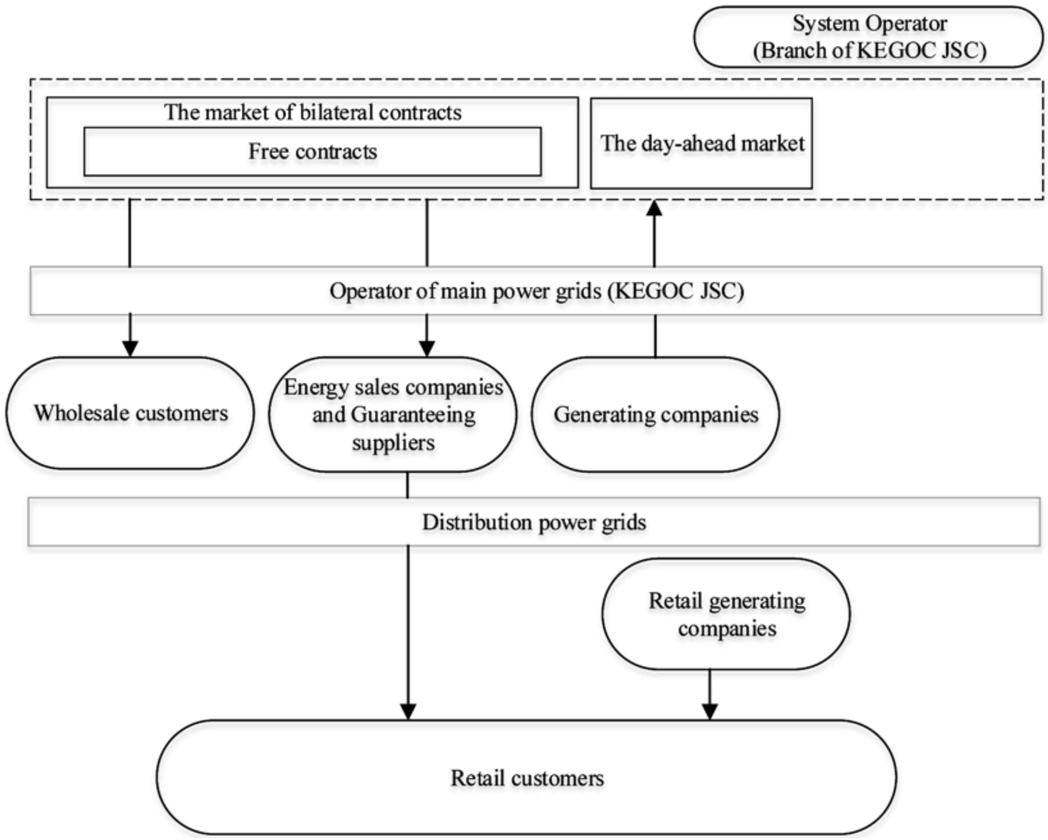

Fig. 4. Structure of the wholesale energy market in Kazakhstan

Source: own development based on (Karatayev et al., 2016; Sarbassov et al., 2013)

The unified energy system of Belarus consists of regional power systems with a single centralized operational dispatch management. General management of the energy complex is carried out by the Ministry of Energy. The Belarusian energy management functions are carried out by the State Production Electric Power Association, Belenergo (Belenergo SPA), subordinate to the Ministry of Energy. The energy sector is completely owned by the state. There are no market mechanisms in the electric power industry.

Belenergo SPA includes six regional republican unitary electric power enterprises, RUE-oblenergo, which are responsible for functioning and development of regional power systems, as well as RUE-ODU, which performs centralized dispatch management of the unified energy system of the country.

Regional RUE are formed on a territorial basis and are vertically integrated companies which include power stations, electric and heat networks. They cover the entire territory of the state (207.6 thousand km^2) and provide energy supply to the population (9.5 million people) and industrial enterprises.

The main production capacities of the united energy system of Belarus are represented by 36 heat power plants with an installed capacity of 8.8 thousand MW. The power system is characterized by a high proportion of combined electric and heat energy production (33 out of 36 heat power plants are CHP) (Vatin et al., 2015; Grainger et al., 2015).

The structure of electricity production within the framework of the unified energy system of Belarus is presented in Figure 5.

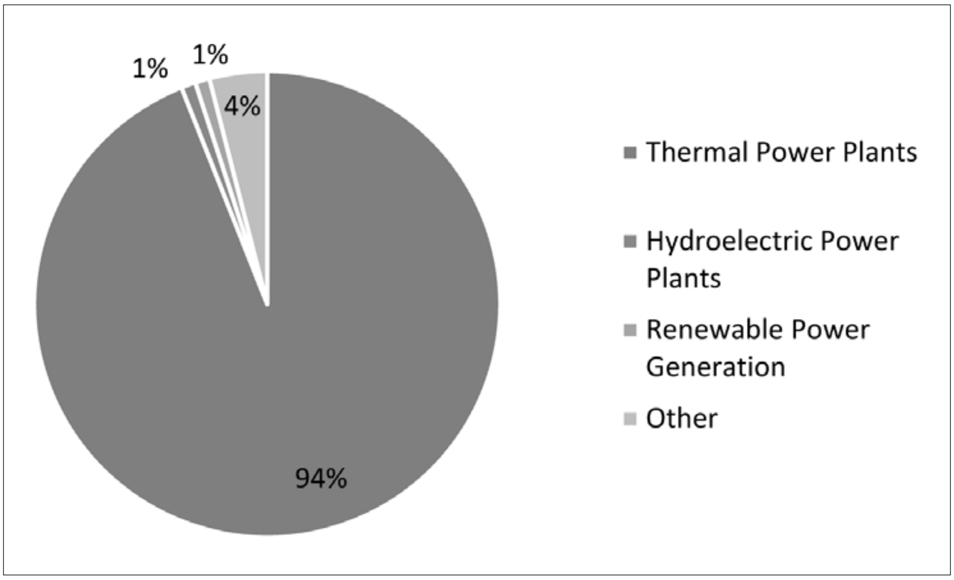

Fig. 5. Structure of electricity production in Belarus

Source: own development based on (Cherp et al., 2013; Vatin et al., 2014)

The power supply network is represented by a backbone network with a voltage of 220-330-750 kV, the transmission lines of which have a length of about 7 thousand km. Cross-border and inter-system transmission lines are quite well developed and allow import and export of electricity over a broad area.

The unified energy system of Belarus is energy-deficient. Despite the fact that it is believed that at present the installed capacity of Belarusian power plants is sufficient to fully meet its electricity demand, the country annually imports electricity from 2.5 to 8 billion kWh of electricity (Russia is the main energy donor). This is partly explained by the structure of the power capacities of the country's power system, the overwhelming part of which is represented by the CHP. Features of operation of power plants in the combined production of energy products lead, from the standpoint of economic efficiency, to optimize loading of their power equipment in accordance with the heat schedule (the main product is heat energy). Thus, the maximum fuel efficiency of power plants operation is ensured. Peaks and half-peaks of electricity consumption are covered by electricity import.

The achieved structure of energy supply is favorable for ensuring high technical and economic and environmental indicators of energy products production, however it does not provide the necessary level of energy security. In 2016, the generation of electricity by Belenergo SPA power plants amounted to 28.5 billion kWh and electricity consumption made 37.6 billion kWh. The negative balance was 24%.

In the structure of electricity consumption, industry makes 56%, agriculture makes 5%, population makes 23%. The main consumers in the industry are machinery-producing industry, metal processing, chemical and petrochemical industry, agroindustrial complex.

Despite the fact that the draft concept of the law has been developed which provides for division by the types of economic activity (production, transmission, sale of electricity) of the electricity complex, at present there is no liberalization of the country's electricity market.

The electric power market represents a vertically integrated structure, a unified (republican) energy system unites six regional (local) energy systems corresponding to the administrative and territorial structure of the state. Regional management companies function within each of the regional power systems, they are responsible for power stations and networks forming the power system. They carry out production, transmission, distribution and sale of energy in the region.

Economic relations when buying and selling electricity are as follows. Belenergo SPA buys all imported electricity and all excessive electricity from the regions of the country and sells it to the energy-deficient regions of the country. The structure of economic relations in the electric power industry of Belarus is presented in Figure 6.

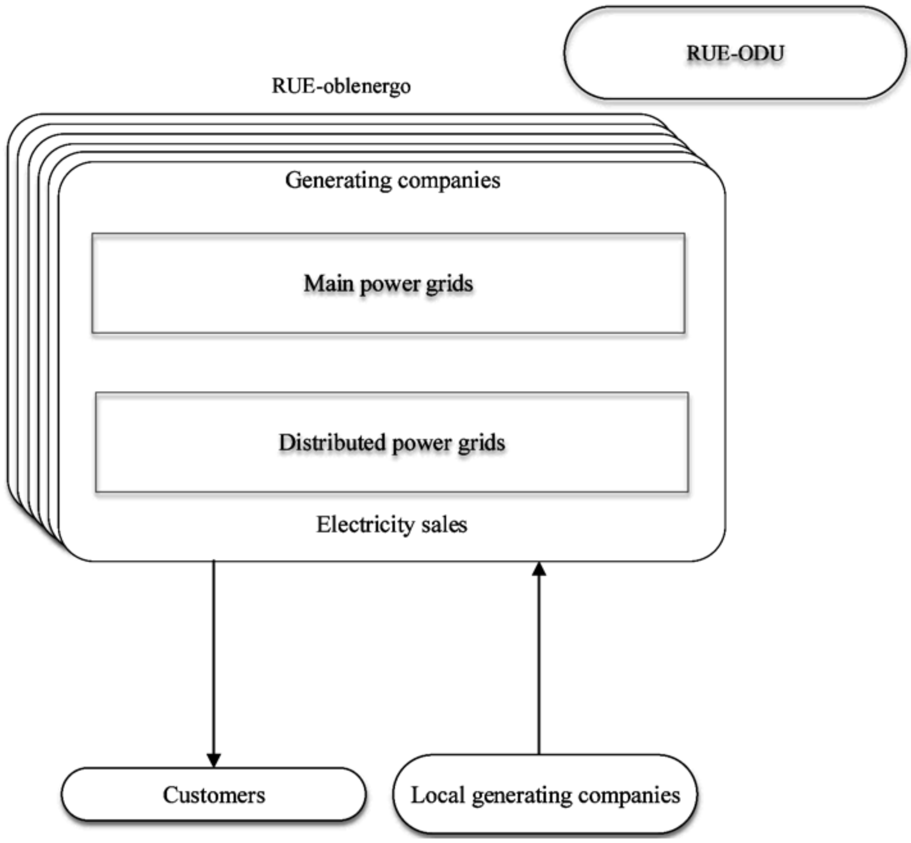

Fig. 6. Structure of economic relations in the electric power industry of Belarus

Source: own development based on (Cherp et al., 2013; Grainger et al., 2015)

3. Analysis of heat supply systems of the countries participating in the Eurasian Economic Union

The heat supply systems of the Eurasian Economic Union countries are mainly built according to a centralized scheme, within which a single heat energy source (CHP or a district boiler house) supplies heat to a large number of consumers through a central heat station. About 63% of the housing stock is provided with heat and hot water from district heating systems in Russia, with at least 50% in Belarus and Kazakhstan (Stennikov et al., 2016; Karatayev et al., 2016; Zhang et al., 2015).

Heat supply consists of three main processes: heat transfer to the heat carrier, its transport and use of the heat potential. Accordingly, in each heat supply system, it is possible to isolate a heat source, a heat network and a heat consumption system with heating appliances.

The most common heat supply system in the European Economic Union countries is an independent heat supply system in which the heat network piping systems form several independent circuits separated by an intermediate heat exchanger transferring heat upon contact with the coolant. The coolant is usually represented as delivery water, the temperature regimes of which are set by the temperature chart. The temperature chart varies depending on the region and corresponds from 105 to 150° C for direct delivery water (determined under the average climatic temperature level) and 70° C for the reverse one.

A schematic circuit of an independent heat supply system is shown in Figure 7.

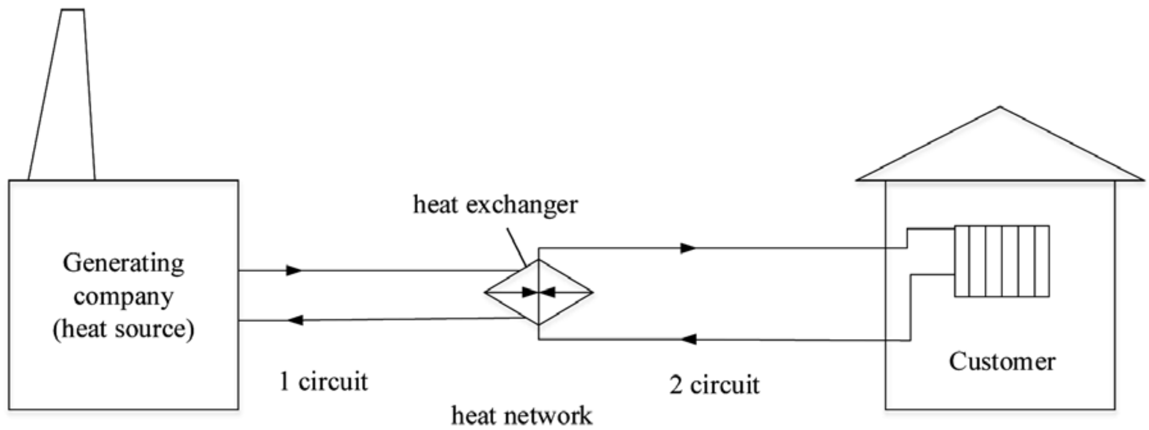

Fig. 7. Schematic circuit of an independent heat supply system

Source: own development based on (Lisin et al., 2016b; Stennikov et al., 2016)

The heat supply system is designed to provide the population and industrial facilities with heat for the needs of heating and hot water supply. Figure 8 shows the graphs reflecting the dynamics of heat consumption in Russia, Kazakhstan and Belarus.

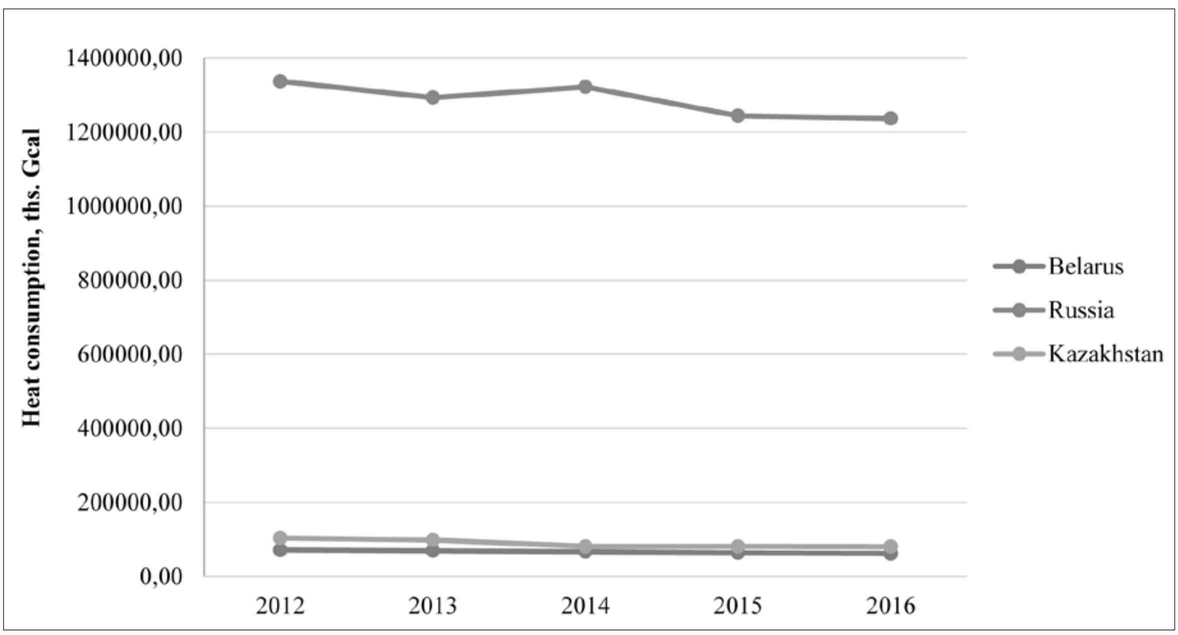

Fig. 8. Dynamics of heat consumption in the Eurasian Economic Union countries

Source: own development based on (International Energy Outlook, 2016; Karatayev et al., 2016; Zhang et al., 2015)

As can be seen from the graphs, heat consumption in the Eurasian Economic Union countries is decreasing. At the same time, if we analyze the change in heat capacity of GDP, we can observe a reverse picture (Figure 9). This indicates a crisis phenomenon in the economies of countries, caused by a decline in the volume of output of gross product. At the same time, the reduction in heat consumption due to the modernization of heat supply systems and the reduction of heat losses do not allow to compensate for the negative trend in the heat capacity growth of production.

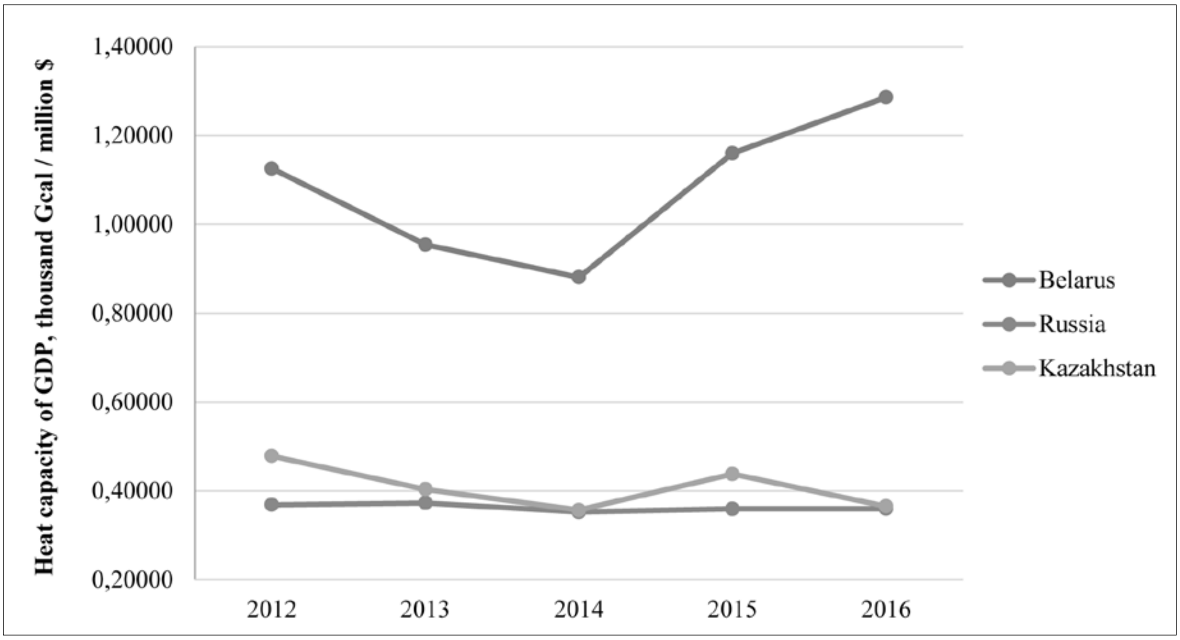

Fig. 9. Dynamics of heat capacity of GDP of the Eurasian Economic Union countries

Source: own development based on (International Energy Outlook, 2016; Karatayev et al., 2016; Zhang et al., 2015)

The countries of the Eurasian Economic Union are characterized by two options for heat supply of residential and industrial facilities (Stennikov et al., 2016):

- centralized heat supply systems from CHP or large boiler houses, when heat for several buildings is supplied from a single source,
- individual, when the heat source is in a heated building or annex.

Heat supply systems have a complex disparate structure defined by different stages of their development.

In the period of planned economy, heat supply systems of residential and industrial facilities were aimed to be implemented through centralized systems based on heating technologies, centralized heat supply to consumers subject to production of electricity and heat in a single technological cycle at the CHP. At the same time, small-scale power generation facilities (mostly small and roof boiler houses) were liquidated, where possible, with transfer of their heat load to centralized sources. Thus, it was possible to achieve energy savings and reduce the working cost of heat energy and, ultimately, the rate for consumers.

Upon transition to a market economy, production, transmission and distribution of energy in most of the countries of the Eurasian Economic Union turned out to be in different ownership, many intermediaries appeared between the generating companies (heat sources) and final consumers, which at the moment has a significant impact on the final cost of consumed heat.

Introduction of market relations in the heat supply led to emergence of various business models for rendering services to provide consumers with heat. In the future, mass distribution of a particular market model of heat supply, which driver will be represented by a common energy market, will lead to a significant change in heat sources structure and consequently to a serious restructuring of the country's heating network.

As a perspective development of district heat supply, the business model of a single heat supply organization is considered that implements heat energy at fixed rates for end users, collects payments, and has the authority to optimize capacity utilization. At the same time, it enters into unregulated contracts with organizations, sources of heat supply, proceeding from the principle of an alternative boiler house.

An alternative boiler house is understood as a set of typical technical and economic parameters for a model heat source operation. In accordance with this concept, an alternative boiler house is a local source of heat supply which can be used by the consumers of the region to replace third-party heat supply organizations. The boiler house parameters are determined on the basis of the premise of applying the most modern and economical technologies as well as taking the maximum effective use of the installed capacity of the facility in order to exclude excess capacity payment. During the process of modeling, based on a number of input parameters (technological and economic) in accordance with the payback period and rate of return acceptable for the investor, threshold levels of rate for the heat energy produced in the region (necessary gross revenue) are calculated. This value is used to determine the maximum possible rate for district boiler houses. The threshold level of rate for the heat energy generated by the CHP is assumed to be equal to the rate of the boiler house, excluding the cost of heat transportation through the main pipelines. The final rate for the consumer is defined as the rate of the boiler house with the extra charge for transportation through distribution networks.

$$Tariff_{CHP} = Tariff_{Boiler} - C_{lines}^{magistral} + C_{lines}^{distribution}, \tag{1}$$

where $Tariff_{CHP}$ is the maximum rate for the heat energy generated by the CHP, $Tariff_{Boiler}$ is the rate of the ideal boiler house, $C_{lines}^{magistral}$ is the cost of heat energy transportation through the main networks to the heat point, $C_{lines}^{distribution}$ is the cost of heat energy transportation through distribution networks to the consumer.

At the same time, increase in energy efficiency of small and roof boiler houses leads to spread of the individual heat supply business model which in a number of cases is more effective for urban and housing and communal services due to the lack of maintenance costs for heating systems.

Market mechanisms contribute to introduction of energy-saving solutions, in particular, their development will facilitate the transfer of hot water preparation equipment for household needs to buildings, that is, gradual abandonment of central heat points in favor of individual ones.

The choice of this or that business model for regional heat supply systems development in the context of the unified energy market creation will largely depend on the entrepreneurial risks of rendering services to provide consumers with heat energy. In view of the fact that organization of reliable and efficient heat supply to consumers is one of the key tasks of the countries participating in the Eurasian Economic Union, their assessment in regard to each of the business models is relevant not only for enterprises of the entrepreneurial type in the form of heat supply organizations, but also for the subject ministries and regional administrations which need to predict the development and monitor the entrepreneurial activity in this vital sphere of economic relations.

4. Business models for regional heat supply systems development in the context of unification of energy markets and the risks associated with selling of heat energy

Based on the above system analysis of the organization and energy systems operation of the key countries participating in the Eurasian Economic Union, it can be assumed that liberalization of economic relations in the heat supply, which will contribute to creation of a unified energy market, can lead to emergence of the following business models for regional heat supply systems development and provision of heat energy services:

1. The model of the heat supply system development based on sale of heat energy through a wholesale reseller.
2. The model of the heat supply system development based on direct provision of heat supply services using own or leased networks.
3. The model of the heat supply system development based on direct provision of heat supply services to consumers with transit through the networks of a third-party organization.

The first model describes a situation when a heat source (heat power plant) releases heat energy from collectors in a wholesale reseller network. At the same time, the cost of the energy sold is calculated on the basis of the volumes actually released and the rates established by the regional energy commission or by the alternative boiler house method discussed in the previous section. In this case, the wholesale reseller, most likely, will also be the owner or operating organization of heat networks.

The second model implies the absence of any intermediaries between the heat source and consumers of heat energy. In order to implement this model, the generating company shall have both main and distribution quarter heating networks in ownership, lease or on the basis of operational management (concession agreement).

The latter model is the most difficult from the point of view of the regulatory system and the potential conflicts inherent in it between market participants. At the same time, in our opinion, it is the most likely one in the conditions of liberalization of economic relations in heat supply.

We describe the main entrepreneurial risks, the emergence of which is most likely subject to the choice of the above-listed business models for the heat supply systems development:

1. Risks associated with the use of a business heat energy marketing model through a wholesale reseller:
- Emergence of a conflict of interests of the generating company with a wholesale energy reseller.
- Possible deviation of sales volumes from the planned indicators of the generating company due to the high competition of heat energy producers for a single buyer on behalf of a wholesale reseller.
- Possible decrease in the incomes of generating companies when introducing a pricing method on the basis of an alternative boiler house or establishing a maximum purchase price by a regional energy commission.
- In the event that the limit value for the necessary gross proceeds is established by the regional energy commission for a wholesale reseller or vacation rates for consumers are approved, the revenue part of the wholesale reseller budget becomes a constant value. Consequently, the reseller has economic incentives to reduce costs due to measures to reduce heat losses in networks. At the same time, the volume of heat energy sales from generating companies can significantly decrease (by more than 20%). If, on the contrary, the rate is formed based on the costs of a wholesale reseller, this will lead to disappearance of incentives to reduce costs and efficient distribution of heat load. As a consequence, the choice of a heat source can be made not from the principle of its effectiveness, but from the affiliation and own business interests of the wholesale reseller.
- The risk of increase in accounts receivable of generating companies is growing substantially due to increase in the likelihood of cash gaps and non-payments in heat supply systems due to disagreement of rates at the regional and municipal levels, as well as increase in accounts payable to a wholesale reseller towards generating enterprises.

2. Risks when using the business model of direct provision of heat supply services using own or leased networks are the following:
- Probability of overhead costs for maintenance of operating heat networks.
- Emergence of financial losses when the actual energy consumption exceeds the planned (calcuated norms) energy consumption.
- Emergence of seasonal cash gaps due to non-conformity of the monthly dynamics of services payment with incurred operating costs for provision of heat supply services.

3. Risks when using the business model of direct provision of heat supply services with transit through the networks of a third-party organization.
- Emergence of a conflict of interests of the generating company with the heat distribution company in regard to distribution of heat losses (payment for excess losses).
- Emergence of financial losses when the actual energy consumption exceeds the calculated norms of energy consumption.
- Emergence of seasonal cash gaps due to non-conformity of the monthly dynamics of provision and payment for heat supply services.

Conclusion

Creation of the Eurasian Economic Union was aimed at formation of a driver for the growth of national economies of the participating countries by uniting efforts in the economic sphere and forming a common market ensuring movement of the goods, capital, services and labor between the countries participating in the common economic space.

Creation of a common market implies consolidation of national commodity markets in all spheres of social production, including organization of a united electricity market. The United Electric Power Market represents a system of relations between the subjects of domestic electricity markets of the countries participating in the common economic space associated with purchase and sale of electricity and related services operating on the basis of general rules.

Creation of a unified electricity market of the countries participating in the Eurasian Economic Union can not but affect the sustainable development and rules for regional heat supply systems operation which is associated with the fact that the the key technology for production of energy products, which forms the basis of energy systems of ex-USSR countries, is heating system introduction which assumes centralized power supply to consumers on the basis of combined generation of electric and heat energy at the CHP.

In Russia, more than 40% of electricity is produced at the CHP, with 36% in Kazakhstan and 56% in Belarus. The role of CHP in the centralized heat supply is even more significant: in Russia, about 46% of heat is produced at the CHP, with 74%in Kazakhstan and 83% in Belarus. At the same time, the main consumer of CHP energy products is the population, which determines the significant social significance of heating system introduction.

The implemented analysis of economic relations in the electric power industry of the Eurasian Economic Union countries showed that despite the fact that the energy systems of the states were formed within the framework of the same concept, after the collapse of the Soviet Union the countries developed various strategies for power supply service development. If Russia and Kazakhstan followed the path of liberalization of the electricity market, Belarus retained its planned power supply service management. Market mechanisms introduced in the energy sector of Russia and Kazakhstan are aimed at increasing the volume of electricity production in order to reduce its unit cost and increase exports to energy-deficient countries. The planned development of Belarusian power supply service presupposes rational use of heating capacities and extraction of maximum economic and environmental benefits from combined production of electric and heat energy. This leads to a conscious energy-deficient development of the unified energy system of the country. Despite the possibility of complete provision of the domestic market with electricity of own production, Belarus largely imports electricity from neighboring countries, which in the future may affect the energy security of the country. Implementation of these energy strategies in recent decades has led to the emergence of significant differences in structure and management of the energy systems of the states.

Creation of a unified energy market will lead to introduction of common market rules for operation of heat supply systems for the countries participating in a common economic space. At the same time, according to our opinion, the following business models for regional heat supply systems development and provision of heat energy sales services are possible:

- The model of the heat supply system development based on sale of heat energy through a wholesale reseller.
- The model of the heat supply system development based on direct provision of heat supply services using own or leased networks.
- The model of the heat supply system development based on direct provision of heat supply services to consumers with transit through the networks of a third-party organization.

The latter model is the most difficult from the point of view of the regulatory system and the potential conflicts inherent in it between market participants. At the same time, it is the most likely one in the conditions of liberalization of economic relations in heat supply and development of the unified energy market in spite of the allocated entrepreneurial risks.

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