International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2020, 10(3), 37-44.

Potential and Development Prospects Assessment of Electric Power Integration of the Eurasian Economic Union Countries

Natalya Yuryevna Sopilko[1]*, Natalia Anatolyevna Navrotskaia[2], Olga Yuryevna Myasnikova[3], Nataliya Vital'evna Bondarchuk[4]

[1]Russian State Social University, Moscow, Russia, [2]Saint Petersburg University, Saint Petersburg, Russia, [3]Peoples' Friendship University of Russia (RUDN University), Moscow, Russia, [4]Nataliya Vital'evna Bondarchuk, Financial University under the Government of the Russian Federation; Russian Academy of National Economy and Public Administration under the President of the Russian Federation, Moscow, Russia. *Email: o_myasnikova@mail.ru

Received: 13 November 2019 **Accepted:** 01 February 2020 **DOI:** https://doi.org/10.32479/ijeep.9154

ABSTRACT

Existing approaches to the analysis of countries economic integration processes in international practice are investigated in the paper. Evaluating methodology of the long-term integration processes in the electric power sector is offered for the EAEU countries in three scenarios: High, low and medium, based on the synergy of various economic and mathematical methods. The actual methodology is formed in accordance with special macroeconomic scenario conditions and includes the final energy consumption forecast with division by the types of energy sources in the context of consumers categories of the EAEU countries based on generated scenario conditions using econometric methods (growth curves, Cobb-Douglas production function, regression analysis, simulation methods), as well as the development forecast of electric power industry concerning the EAEU countries reasoning from perspective dynamics of generating capacities of these countries. Project growth of electric power sector development founded on suggested method was made for the EAEU countries for the period of 2018-2040, specifically, electricity consumption projection, electricity consumption increasing, as well as capacity increasing of NPGS, HEP and RER in these countries. The necessity of further efforts to develop the common electric power market in the EAEU countries in order to obtain possible long-term integration effects are emphasized.

Keywords: International Economic Integration, Electric Power Market Development, Electric Power Integration, The Eurasian Economic Union
JEL Classifications: F02, F63, O13

1. INTRODUCTION

Creation of regional energy markets is a driver and a necessary condition for successful economic integration of different countries. Integrated electric power markets are the basis for sustainable economic development and economic security for member-countries of regional unions. Association processes of national and regional energy complexes and systems are objective feature of current development stage of the world energy markets in the context of regional economic integration.

Fuel and energy complex is one of the most important bases for the integration development in the post-Soviet space. At the time of the USSR there was formed a single energy system built on administrative relations. After the breakup of the Soviet Union, many industrial and infrastructural links have survived and are still developing in this region (Guliyev and Mekhdiev, 2017; Sopilko et al., 2019). A new impact to energy integration was given to it thanks to the Eurasian Economic Union (the EAEU) formation. Now that means a creation of effective common energy market in the Union, based on the market principles.

Energy sector of economy is one of strategically important sectors of economic development for the EAEU countries. About a quarter of all proven world mineral reserves are concentrated on the territory of the EAEU countries, including about 40% of gas, 25 % of coal, 20% of oil and uranium, respectively (BP Statistical Review of World Energy, 2018). The share of fuel and energy industry in structure of GDP of the EAEU countries is about 17 %, and it reaches a third quarter – 33 % in total industrial production. According to the statistics of the Eurasian Economic Commission (EEC), the EAEU region is the leader in the production of many types of minerals in the world. Dynamics of total resource energy potential indicators of the EAEU countries is presented in Table 1. According to Table 1, an increasing in the dynamics of mining is observed, as well as in electricity generation indicator.

It should be noted that the main producers, net exporters and consumers of energy resources in the EAEU are Russia and Kazakhstan, and the rest countries of the EAEU are net importers of energy resources. The predominance of own or acquired resources in the energy balance of a country determines its role in integration association as a net consumer or as a net producer of energy resources. That, in turn, determines the necessity, scale and forms of energy resources redistribution within the framework of energy integration in accordance with general distribution mechanism.

In our view, and in the opinion of many authors, experts in the field of international energy integration (Telegina et al., 2019; Dynkin et al., 2018; Pastukhova and Westphal, 2018; Telegina and Khalova, 2017), the regional energy market development of the Union, as well as the effective redistribution of energy resources will allow the EAEU countries to get additional economic effects and benefits, will promote sustainable economic development and energy security strengthen in the region.

At the same time, nowadays the assessment of the economic potential and prospects for countries energy integration is urgent and complex issue. In-depth researches in the field of international integration requires a comprehensive analysis of qualitative and quantitative effects of market integration, however there are no generally accepted methods for this problem solving in world practice (Guliyev and Mekhdiev, 2017).

2. LITERATURE REVIEW

Deeper insight into development processes of mutual relations and concepts formation of economic integration makes the question of how to assess the effectiveness of these processes more relevant. It means whether it is possible to talk about the integration goals achievement and how to evaluate the integration effects in quantitative and qualitative way.

Table 1: Energy potential indicators of the EAEU by types of mining for the period of 2015-2018

Extraction of some types of mineral resources and electricity production	2015	2016	2017	2018
Oil, million tons	615	627	634	648
Gas, m^3	679	687	744	783
Coal, million tons	481	491	524	560
Electric power, billion kilowatt hour	1214	1239	1255	1278

Source: According to Eurasian Economic Commission, 2019

As it's well known, thanks to the integration processes, enterprises expand their activities and save on scale due to costs avoidance.

Savings on scale is a long-term concept of country development. It refers to the cost value reduction with object size increasing and other resources exploitation rising (Stigler, 1958; Krugman, 1980). As it serves as indicator of economic integration feasibility, considering that larger market may be required for some scales of savings (O'sullivan and Sheffrin, 2003).

It should be noted that at the initial stages of integration, the mutual trade sphere is mainly affected, and at the same time, the assessment of countries comparative advantages within the framework of integration association according to the Liesner method (1968) is recognized as the most relevant. The Liesner's index is calculated as the ratio of product's export from the specific country to total export volume of this product by the group of countries. In this way, it allows to determine the presence of the country's comparative advantage (CA, Comparative Advantage) in export compared to the group of countries.

Further, Liesner's theory was developed and the indexes for evaluation of mutual trade effects, Grubel and Lloyd (1975), Balassa (1978), Greenaway and Milner (1993) were offered, the issues of integration effects assessing were widely covered in Robson's works (2002), etc.

However, it became apparent that the quantitative economic effects of integration are not limited to extension of mutual trade because of integration processes development in Europe and other regions of the world. In this regard, in early 2000s, the European Central Bank worked out a comprehensive methodology for assessing of countries economic cooperation effectiveness within the framework of integration, based on quantitative and qualitative analysis (Feng and Genna, 2003). According to this methodology, in various blocks such indicators as mutual trade, capital mobility, labor mobility, level of supranational institutions effectiveness, tax coordination, monetary, financial policies between member countries, etc. can be used as key factors.

The OECD methodology of integration union's analysis is one of the most famous. It's based on system of economic indicators (internal and external regional trade, the share of regional trade in world trade and the market share export of the region, etc.) characterizing the development of intra-regional trade (OECD, 2005). Methodology of the Asian Development Bank (Asian Development Bank, 2006), UNCTAD indicators (total share of domestic trade, average share of domestic trade, regional trade intensity index, etc.) (UNCTAD, 2008), etc. are also widely used.

In addition, gravity models are currently relevant for researchers. Such models allow predicting trade volumes in proportion to the volume of countries GDP and inversely to the distance between them (Sopilko et al., 2017).

As a result of many theoretical and practical studies, it was found that trade volume increasing and economic institutions development as an effect from economic integration can lead to the annual GDP growth rate of involved countries by 1.5-3.0% (Daumal, 2013).

In relation with classical and neoclassical schools of economic theory, the effects from integration can be explained by production efficiency increasing caused by the relocalization of economic resources, which becomes possible because of barriers removing during integration development (Nunn, 2007). It allows to realize the comparative advantages of countries which are participants of integration and to deep their specialization in system of economic relations within the integration association.

Integration development of energy markets, as a complex technical and economic system, is due to many external and internal factors related with changes in demand and supply, the appearance of substitutes, changes in capital intensity and energy efficiency, etc. In this regard, many existing methods which were used to analyze commodity flows within regional unions are not detailed enough. Hereafter, a methodology for prospects assessing of electric power integration development of the EAEU countries will be presented.

3. METHODOLOGY OF THE RESEARCH

Potential and prospects assessment of integration development of electric power markets in the EAEU countries is carried out using predictive analysis. Basically, the scenario approach was used (Bradfield et al., 2005; Börjeson et al., 2006). Three forecast scenarios are offered for energy and macroeconomic sectors development of the EAEU countries for long term: high, low and medium.

The data from the Organization for Economic Co-operation and Development (OECD), International Energy Agency (IEA), other foreign national and international analytical and statistical organizations and publications was applied as sources of information, as well as from EEC, etc. The materials of specialized international organizations, authoritative international research centers and consulting organizations, as well as Russian scientific institutes – the world economy and international relations of Russian Academy of Sciences (IMEMO), energy research of the Russian Academy of Sciences (ERI RAS), energy and geopolitics of Russia, etc. were observed.

The materials from Rosstat, the Ministry of Economic Development, the Ministry of Energy of Russia, the Central Dispatch Department of the Fuel and Energy Complex under the Ministry of Energy of Russia, the Federal Antimonopoly Service of Russia and other Russian departments were used as statistical data, as well as the information from similar Ministries and Departments of other countries and the Statistics Department of the EEC.

Predictive analysis was performed in stages:
1. The forecast of final energy consumption with breakdown by types of energy products (including electric and thermal energy), by categories of consumers of the EAEU countries based on formed scenario conditions using econometric methods
2. The forecast for development of electric power industry in the context of the EAEU countries based on prospective dynamics of generating capacities
3. The formation of forecast results for electric power sector development of the EAEU.

3.1. The First Stage of Predictive Analysis

Within the framework of the first stage, the forecast of final energy consumption was formed in the context of consumer categories and was carried out using the following methods:
- Extrapolation based on growth curves (S-shaped curves) using the functions of the Pearl curve (Pearl, 1924) and the Gompertz curve (Winsor, 1932) for prediction of consumption in transport, housing and commercial sectors (except electricity and heat)
- Cobb-Douglas production function (Douglas, 1976) for energy consumption forecasting in industry for energy needs
- Regression analysis for electricity consumption predicting
- Simulation modeling for consumption predicting of thermal energy in housing and commercial sectors, as well as the consumption of energy resources for non-energy needs in industry.

Such approach assumes that output in the industrial sector depends on accumulated capital, technological coefficient and energy consumption. This dependence has the form of Cobb-Douglas production function:

$$Ind = \tau \cdot C^{\lambda} \cdot E^{1-\lambda} \quad (1)$$

where: Ind – industrial output; C – volume of industrial capital assets, E – energy consumption in industry; τ – technological coefficient.

The dependence of energy consumption in industry on other parameters is evaluated as follows:

$$E = A \cdot C^{\alpha} \cdot Ind^{\beta} \quad (2)$$

where: A,α,β – coefficients to be determined.

After taking of logarithms, the model turns into a standard linear multiple regression model.

$$lnE_i = \ln A + \alpha \cdot \ln C_i + \beta \cdot \ln Ind + \varepsilon_i, i = 1,\ldots,N \quad (3)$$

where: ε_i – independent in total, equally distributed random variables having a normal distribution with zero mean and final dispersion.

Forecast of energy demand is forming on the obtained values of A,α,β coefficients. The maximum energy efficiency level of industrial sector to which this forecast dynamic will be approached in future, is determined on the basis of parameters for introducing the best available technologies in world practice.

The forecast of electricity demand is reported on regression analysis of the rate of change dependence on GDP power intensity (by final electricity consumption) from the growth rate and GDP per capita in the world. The annual growth rates of GDP power intensity in different countries of the world are forecasted in accordance with expected GDP dynamics (scenario macroeconomic conditions) and the parameters of regression curve corresponding to the level of GDP per capita of this country for a specific year (for countries with GDP per capita above 50 thousand dollars per person at 2017 prices the parameters are applied as for the curve which is formed for countries with a level of 20-50 thousand dollars per person at 2017 prices), taking into account additional country factors.

The forecast of energy consumption in industry for non-energy needs is carried out by simulation methods. Energy requirement for non-energy needs is formed by forecasting of final products production and expected levels of specific consumption of raw materials (based on expenses for own needs). In its turn, the forecast of the final products production is formed by modeling of country respective markets, considering planned investment projects for capacities construction in the EAEU countries in the fields of petrochemistry, gas and coal chemistry.

The forecast of heat demand in housing and commercial sectors is based on the dynamics:

- Population, including able-bodied
- Urban population
- Energy efficiency level of housing fund.

The forecast for energy efficiency level of housing fund is formed on indicators implemented from the best available technologies, including IEA forecasts (Energy Technology Perspectives).

For temperature-dependent consumer categories, in addition to macroeconomic parameters differentiating, the variability of climatic factor based on the degree-days theory (Day and Karayiannis, 1998) has been additionally taken into account due to scenarios.

In accordance with retrospective data, the demand elasticity for various types of energy was estimated by change of degree-days of heating and degree-days of cooling. Then, expected deviation of energy consumption under the influence of climatic factor was calculated.

3.2. The Second Stage of Predictive Analysis

At the forecasting stage of electric power industry development, the transition from consumption parameters to electricity generation parameters was carried out taking into account information on existing projects for development of intercountry electricity transmission (Nazarova et al., 2017).

The determination of dynamic development of generating capacities was determined in medium and long term. Their requirement is assessed on the basis of electricity balance, in consideration of forecasting demand level for electricity and already made decisions about commissioning and dismantling of capacities, as well as it is oriented towards target share of RER (Renewable Energy Resources) in electricity generation, established due to the national energy policy.

In case of additional power inputs requirement, composition choice of new fuel generation inputs besides already adopted investment decisions is carried out with reference to generation types ranking in accordance with the criterion of long-term marginal cost minimizing for electricity generating. Long-term marginal costs in compliance with electricity generation technologies are calculated in terms of their typical physical, technical and technical-and-economic indexes using following formula:

$$Cost_{TOT}=Cost_{Fuel}+Cost_{Var}+Cost_{Fix}+Amort+Cost_{Ecol} \quad (4)$$

where: $Cost_{TOT}$ – total costs; $Cost_{Fuel}$ – fuel costs; $Cost_{Var}$ – variable costs; $Cost_{Fix}$ – fixed costs, $Amort$ – amortization expenses; $Cost_{Ecol}$ – carbon component (based upon the prices of CO_2 emissions and specific emission indicators).

Also, investment conditions in electric power industry of the respective country are taken into account during forecast generating for capacities development in both medium - and long-term period. The shares of renewable energy sources in electric power generation are established by national legislation or energy strategies, and also by development decisions connected with nuclear power plants and hydroelectric power stations due to political and environmental factors.

While using generating capacities, the distribution of electric and thermal load between different types of generating capacities is observed as well as between similar generating capacities. Load distribution between the types of generating capacities is made on the basis of merit order by level of short-term marginal costs for electricity production, considering prices and environmental conditions (prices for main types of boiler and furnace fuel and prices for CO_2 emissions). At the same time, the merit order for capacities is also formed on predictive assessment of the base, half-peak and peak loads.

Fuel supply forecast of electric power plants is formed due to obtained values of installed capacity hours of generating facilities according to their thermal and electrical efficiency.

Fuel supply dynamics for boiler houses is determined on expected heat demand and expected thermal efficiency level of boilers using different types of fuel. Forecast assessment of power efficiency of boiler plants is founded on actually achieved level and implementation indicators of the best available technologies, including IEA forecasts (Energy Technology Perspectives).

Energy distribution forecast follows on from the results of transport problem solution (which is a particular case of linear programming problem).

The formulation of transportation problem under the indicated restrictions has the following form:

$$\begin{cases} \sum_{i=1,j=1}^{n,m} c_{ij} r_{ij} \to \min \\ \sum_{i=1}^{n} r_{ij} = x_j, j = 1,...,m \\ \sum_{j=1}^{m} r_{ij} \le y_i, i = 1,...,n \\ \sum_{j \in J_i} r_{ij} \le R_i, i = 1,...,n \\ \sum_{i \in I^j} r_{ij} \le R^j, j = 1,...,m \\ r_{ij} \ge 0, \forall i, j \end{cases} \quad (5)$$

where: $y_1, y_2, ..., y_n$ – productive capacities of n suppliers of this energy resource;; $x_1, x_2, ..., x_m$ –requirements of m consumers in this energy resource; c_{ij} – offer price of this energy resource of i-th supplier for j-th consumer, $i=1,...,n$ and $j=1,...,m$; r_{ij} – volume of energy resources supply from i-th supplier to j-th consumer, $i=1,...,n$ и $j=1,...,m$.

The feed data in optimization problem for the period (year) is:

- Suppliers' production capacities of this energy resources type in the context of development (production)
- Volumes of necessary goods delivery of this energy type for consumers (in the context of "country – consumers' category")
- Offer prices of this energy resource from the i-th supplier for the j-th consumer, $i=1,...,n$ and $j=1,...,m$.
- Infrastructure restrictions R_i for the volumes of energy resource delivery from the i-th supplier to a number of consumers J_i, $i=1,...,n$
- Infrastructure restrictions R_j on supply volumes of the energy resource for the j-th consumer from a number of suppliers I_j, $j=1,...,m$.

Buying prices of this energy resource from the i-th supplier for the j-th consumer in the k-th year are generally calculated by formula:

$$c_{ij} = Prod_i + \sum_s Transp_s \quad (6)$$

where: $Prod_i$ – extraction (production) costs for the energy resource of the i-th supplier (in the context of development (production) objects), with tax component; $Transp_s$ – costs for energy supply from the i-th supplier to the j-th consumer.

Transportation problem is to determine the optimal volume of energy distribution by consumers costs minimizing. The following conditions should be fulfilled:

- Full coverage of all consumers demands for energy supplies
- Not to exceed the limits of production capacities
- Compliance with infrastructure restrictions.

The result of this problem solution is matrix of optimal energy supplies volumes. Non-zero volumes of energy resources, which are the solution to this problem, also determine the "marginal costs" for each consumer:

$$\hat{c}_j = \max_i \left\{ c_{ij} : r_{ij} \ne 0 \right\} \quad (7)$$

Elements of energy supply costs $Transp_s$ from the i-th supplier to the j-th consumer include (if necessary):

- The costs for energy transporting from the producer to the shipping port (export) by land (by rail, pipeline or other mode of transport)
- The costs for energy transshipment in the shipment port (export)
- The costs for ships freighting for energy transportation from the port of shipment (export) to the port of unloading (import)
- The costs for energy transshipment in the port of unloading (import)
- The costs for energy transporting from the port of unloading (import) to consumer by land (by rail, pipeline or other mode of transport)
- The costs for energy transporting from the producer directly to the consumer by land (by rail, pipeline or other mode of transport)
- The costs for energy reprocessing (enrichment)
- Tax and customs payments related to supply (export) of energy resources.

When setting the optimization task, infrastructural restrictions on supply volumes of energy resource are considered, both individual (for deliveries from the i-th supplier for the j-th consumer) and collective (on total supplies from the i-th supplier to some consumers or for the j-th consumer from a number of suppliers). Infrastructure restrictions are based on data obtained from existing capacities, capacities under construction, projected and planned facilities for liquefying and regasification of LNG. These restrictions are also referred to pipeline transportation of gas, crude oil and oil products, as well as transshipment and railway transportation of energy resources.

Costs estimation of energy resources extraction (production), cost elements for energy resources supply, as well as production capacities for the extraction (production) of the main types of energy resources for the forecast period should be reduced to a single energy equivalent. Production capacities forecast for oil has been formulated for all types of liquid hydrocarbon feedstocks (including condensate), for coal - including both thermal and coking coal, with differentiated restrictions on possible directions of supplies. Production capacities of energy resources extraction for each coming year are adjusted in accordance with the depletion of reserves based on the results of their development in the previous year.

When assessing costs for energy resources extraction (production) and elements of costs for energy resources transportation, operating costs and capital investments should be differentiated. Operating costs (OPEX) are used to estimate the short-term marginal costs for existing exploitation project sites, transportation and processing of energy resources. Capital investments (CAPEX) are used to assess long-term marginal costs for new facilities. As well as the tax take should also be considered in accordance with current tax treatment of different countries.

4. THE RESULTS OF RESEARCH

Obtained forecast for electric power industry development of the EAEU countries includes the expected parameters of electricity demand, investment conditions regarding non-fuel generation capacities development, and the parameters of intergovernmental regulation of general electricity market within the region (Table 2).

In terms of potential macroeconomic conditions for prospective development of energy sector of the EAEU countries, demand increasing for electric and power in these countries is expected.

Aggregate energy consumption of the EAEU countries may increase by 277.6-471.4 TW-h in 2018-2040, or by 22.5-38.3% compared to the level of 2017 (1229,3 TW-h). Electricity consumption is expected to increase by 23-38% (in the average scenario – by 31%) in Russia by 2040 in comparison with 2017. Significant increase in electricity demand is also expected in Belarus (by 4.0-9.8 TWh, or 11-26%) and Kazakhstan (by 28.9-54.3 TWh, or 24-46%) in 2018-2040. Due to smaller population size and economy volume, the contribution of Armenia and Kyrgyzstan to electricity demand increasing will be less significant (3.3-4.9 TWh and 10.2-14.7 TWh respectively). At the same time, a significant underutilized potential of electrification in these countries allows to expect high relative rates of electricity consumption increasing (50–74% and 76–110%, respectively).

Investment conditions for electric power industry development of the EAEU countries, primarily the forecast for generating capacities commissioning of non-fuel generation (nuclear power plants, hydroelectric power stations, renewable energy sources), are formed relying on adopted investment decisions of generating companies taking into account the provisions of current strategic documents concerning the electric power industry development. Mechanisms of government regulation of generating capacities construction and modernization are also recognized in investment conditions which are statutorily required in the EAEU countries.

According to expected commissioning and dismantling of generating plants (based on the standard terms of their service), total increase in capacity of nuclear power plants in the EAEU countries may be 5.0 GW for 2018-2040. Commission of Belarusian nuclear power plant with a total capacity of 2.4 GW (2 power units) is expected in 2020-2021 in Belarus. Armenian NPP will continue to operate in Armenia. Capacity growth of nuclear power plants is expected from 2.6 GW to 29.8 GW in

Table 2: Forecast for electric power industry development of the EAEU countries in accordance with common market formation

Indicator mane	Low	Medium	High
Electricity consumption forecast by 2040, GW			
Armenia	10,0	10,7	11,6
Belarus	41,6	44,2	47,4
Kazakhstan	147,0	158,8	173,4
Kyrgyzstan	23,6	25,6	28,1
Russia	1 295,6	1 375,7	1 454,2
Electricity consumption growth for 2018-2040, %			
Armenia	49,7	60,6	74,1
Belarus	10,7	17,5	26,1
Kazakhstan	23,5	33,3	45,6
Kyrgyzstan	76,2	91,5	110,0
Russia	23,1	30,7	38,1
Capacities increase of NPP for 2018-2040, GW			
Armenia		0,0	
Belarus		2,4	
Kazakhstan			
Kyrgyzstan			
Russia		2,6	
Capacities increase of HPP for 2018-2040, GW			
Armenia		0,1	
Belarus		0,1	
Kazakhstan		–	
Kyrgyzstan		1,3	
Russia		5,4	
Capacities increase of RER for 2018-2040, GW			
Armenia	0,3	0,3	0,3
Belarus	0,7	0,8	0,9
Kazakhstan	2,8	2,5	2,3
Kyrgyzstan	–	–	–
Russia	12,2	12,2	12,2
Operating conditions of common electric power market of the EAEU			
Generating capacities access of the EAEU countries to the electricity market of Russia	Since 01.07.2019	Since 2022	Since 2025
Volume of additional electricity supplies from the EAEU to Russia, TWh	25	20	12
Empowerment of opportunity for the companies from the EAEU countries to purchase Russian gas on conditions similar to the domestic market	Since 2025 г.	Since 2030 г.	Not expected

Source: Author's calculations

Russia for the period of 2018-2040. Nuclear energy development is not supposed in Kyrgyzstan and Kazakhstan.

Total growth of hydropower plants capacity in the EAEU member countries could be 6.9 GW for 2018-2040. The bulk of its growth will be provided by Russia (5.4 GW) and Kyrgyzstan (1.3 GW). Increasing of HPP capacities is insignificant in other countries (in Armenia and Belarus – by 0.1 GW, in Kazakhstan no growth is expected).

Total growth of renewable energy capacities in the EAEU member countries may come to 15.6–16.2 GW for 2018-2040. Active development of renewable energy capacities is expected in Russia (growth by 12.2 GW) and in Kazakhstan (growth by 2.3-2.8 GW).

In terms of common electric power market functioning in the EAEU, the access conditions of generating capacities of member countries to Russia's electricity market are of determine importance, as well as to certain segments of Russian power market.

International agreement on common electricity market (CEM) formation, according to the Treaty on the EAEU of May 29, 2014, which was scheduled on the 1st of July, entered into force. This deadline was confirmed in the Concept and Program of CEM formation. It is supposed that the following trading instruments will be used at CEM: Free bilateral contracts, fixed-term contracts (for a month, a week, etc.), as well as electricity supplies on a "day-ahead" basis.

CEM starting will allow some countries from the EAEU to increase electricity supply from Russia in relation to the level of 2017. Belarusian NPP starting will be the main factor in supplies growth from Belarus. It is expected that nuclear generation capacities increasing will lead to generating capacities surplus in the country, which will not be fully in demand on the domestic market in conditions of Poland and Lithuania refusal of electricity import from Belarus. Electricity supplies from Belarus can be up to 10 TWh. The potential supplies growth from Kazakhstan, primarily to Siberian Unified Energy System, is determined by the possibility of reloading of coal-fired power plants capacities with low level of electricity generation costs, firstly on Ekibastuz Regional Power Station-1 (4.0 GW) and Ekibastuz Regional Power Station-2 (1.0 GW). These power plants are using cheap coal resources of Ekibastuz field with minimal transport and logistics costs due to favorable location directly next to coal opencasts. In general, power exchange from the EAEU countries to Russian electricity market is 12–25 TWh.

Regulation of the common electric power market of the EAEU member countries is very important in conditions of its development. This regulation system will determine gas prices for electric power facilities and competitiveness on global energy market. Russian electric power industry is gaining an advantage now due to regulated wholesale gas prices, which will remain low until 2040 with the expected indexation parameters. At the same time, generating companies in Belarus and Kazakhstan purchase gas at higher prices. Possibility for companies from the EAEU countries to buy Russian gas on similar contract conditions to their domestic markets will lead to additional deterioration in working conditions of Russian electric power industry (primarily due to competition from gas generation in Belarus).

5. DISCUSSION

As a part of the EAEU integration, the processes of common markets formation have been successfully started. Despite of criticism and doubts of some experts concerning success of integration processes in the EAEU region (Kirkham, 2016; Aldokhina, 2017; Perskaya, 2020), the data obtained on the first results of regional union work (Telegina et al., 2019) indicates the development prospects of the EUEA.

But at the same time, existing problems in the Union are also emphasized. It is noted that even in conditions of high scenario implementation, structural imbalances between economies of the EAEU countries will not be fully overcome even despite possible and achieved economic effects. It means that it is necessary to implement appropriate regulatory measures at the supranational level, the development of "road maps," etc.

The goal of electric power integration is effective use of domestic and export opportunities of the common market of the EAEU countries, raising of trade efficiency in electricity, fuel and energy resources and products of their processing, development of interstate electric networks, affordable technologies and innovative solutions in the fields of energy security, energy efficiency and energy saving, etc. Therefore, it is necessary to solve many problems related to technical, legal and economic regulation of general electricity market for successful implementation of planned integration projects in electric power sector. Constant macroeconomic indicators monitoring and evaluation of the EAEU is required along with development of various directions of integration processes efficiency increasing in the electricity industry, based on existing techniques and offered methods, taking into account the peculiarities of regional and sectoral structure of the Eurasian Economic Union.

Such work should be systemic, it should include global legislation monitoring and legislation harmonizing of the EAEU countries, flexible economic policy creating for integration processes development on the competitive regional electric power market, including antitrust, financial and investment policies.

6. CONCLUSIONS

Regional energy markets creation is a driver and a necessary condition for successful economic integration of different countries. Electric power sector one of strategically important sectors of economic development in Eurasian region.

Integration development of energy markets as complex technical and economic systems is caused by many external and internal factors connected with changes in supply and demand, substitutes appearance, changes in capital intensity, energy efficiency, etc. In that case, it is especially important to assess possible integration effects of these processes taking into account all factors and trends.

On the basis of proposed methodology, founded on synergy of various economic and mathematical methods, predictive assessments of future development of common electricity markets in the EAEU countries were made and the results of aggregate consumption and domestic demand for electricity in the period 2018-2040 were obtained. Increase in electricity demand of economies and population of these countries is expected. Its total consumption may increase in the period of 2018-2040 by 277.6-471.4 TW-h, or by 22.5-38.3% compared to the level of 2017.

In accordance with the results of development prospects assessing of common electric power market of the EAEU member countries, almost all indicators are expected to grow under different scenario conditions. In the context of production and consumption increasing of energy resources in the EAEU countries, the united electric power market is able to provide flexibility of demand satisfaction for energy resources, reliable supplies and energy security of the EAEU. Sharing of load and risks in energy sector helps the EAEU countries to set sustainability and stability ensuring in these issues throughout the region.

7. ACKNOWLEDGMENT

The publication has been prepared with the support of the "RUDN University Program 5-100."

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