

Innovative energy policy of the of the Eurasian Economic Union member countries

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Abstract. CIS countries gained independence in the early 1990s. Prior to this, they were republics within the Soviet Union, on the territory of which the Unified Energy System functioned. After the collapse of the USSR, each country in the post-Soviet space was forced to independently solve the problems of supplying its economy with energy. They will build relations with their neighbors in a new way, including in the energy sector. This article presents an analysis of the situation in alternative energy of the EEU member countries (Russia, Kazakhstan, Belarus, Armenia and Kyrgyzstan). At the same time, Russia and Kazakhstan have their own energy resources and even export surplus hydrocarbons. Therefore, they are less concerned about the development of alternative energy. At the same time, Belarus and Armenia are forced to import energy resources. And in the energy sector of Kyrgyzstan, the production of electricity at hydroelectric power plants predominates. Therefore, these states, which are experiencing a shortage of energy resources, are interested in the development of alternative energy. But these states have difficulties financing alternative energy. In general, a situation has developed in the post-Soviet space when foreign investors are actively investing in alternative energy. All projects are aimed at reducing dependence on energy supplies from Russia. At the same time, Russia practically does not take part in investment projects to develop alternative energy for neighboring countries. The article analyzes the mechanisms for implementing investment projects in alternative energy using the EEU countries as an example.

1 Introduction

Russia and other EEU countries have very significant renewable energy resources. But while the contribution of solar, tidal, wind, geothermal, hydro and biofuels is a very insignificant fraction of the total primary energy consumption, as there are also very significant hydrocarbon reserves (especially in Russia and Kazakhstan). Alternative energy is an innovative solution to energy policy, although it still requires significant investment. The national energy development programs of the EAEU countries currently set the goal of

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increasing the share of renewable energy in their energy balances.

The EEU member states have great, diverse and unrealized potential for the use of alternative energy sources, which can lead to important benefits for their environment and energy security. However, do not forget that the integrated Unified Electric Power System in the post-Soviet space (in the territory of the former USSR) makes it easy to transfer electricity throughout the region, including very remote areas.

Modern energy policies include liberalization and the development of alternative energy. The purpose of the article is to study the energy policy in the field of alternative energy and relevant mechanisms for the implementation of investment projects. We studied the energy politics of the countries formed on the territory of the former Soviet Union (on the example of EAEU member countries). The EAEU includes - Russia, Kazakhstan, Belarus, Armenia and Kyrgyzstan.

International projects in alternative energy are most common. It is important to study how the cooperation of the CIS countries with foreign partners occurs.

The implementation of investment projects in alternative energy requires significant investment. Therefore, energy policy should consider the following factors. On the one hand, the state collects additional fees from the population and pays the investor for the development of alternative energy. Thus, the state guarantees the profitability of investments. On the other hand, the future owner himself is looking for investment to launch the project. At the project launch stage, the problem of capital search is a problem on the part of the investor, not the state and the problem of finding start-up capital it is great problem. In the post-Soviet states (in the CIS and Baltic states), foreign investors usually are implementing alternative energy projects. It's difficult to find money from compatriots inside the country. In foreign markets, financial loans are cheaper. Moreover, a foreign investor wants to spread its technology. Therefore, foreign investors are so active in new markets. The following is valid for post-Soviet states. If the country is located in Asia (for example, Kazakhstan and others), the investors are from China, the USA, Saudi Arabia etc.

At the same time, Russia does not involve in alternative energy projects in the neighboring countries. For Russia it is politically unprofitable, because the objective of these projects is to reduce the energy dependence of neighboring countries on Russia. These measures have led to changes of the energy balance structure of the post-Soviet states, and of the structure of energy suppliers too.

For example, the Prime Minister of Armenia N.Pashinyan claims that the main problem of Armenia is energy dependence on Russia. He also said: "the main task of the Armenian government is to ensure the country's energy security" [1].

The development of alternative energy leads to some dependence of national economies at the foreign technology suppliers, foreign investors. Nevertheless, the created infrastructure (new power plants, new technologies) remains inside of the country. Electricity is generated through the use of local energy sources (wind, solar, biomass, etc.). In other words, the development of alternative energy is contributed to the energy independence of a state and its national security. On the contrary, programs to increase energy imports lead to increased dependence.

Many scientific papers are devoted to the study of this topic. Different sides of the problem are considered. Scientists calculate economic benefits and analyze the legislative framework of alternative energy support in different states [2], [3], [4], [5]. Alternative energy is booming not only in developed countries. For example, China pays a lot of attention to the development of alternative energy. China implements projects both domestically and abroad [6], [7], [8].

Many scientific articles are devoted to the forecasting alternative energy use, as well as to the analysis of the alternative energy use at the regions and countries [9], [10], [11], [4],

[12]. The articles raise the problem that CIS countries (Russia, Kazakhstan, Ukraine, Tajikistan, Uzbekistan and Turkmenistan) have significant energy reserves on their territory. Perhaps that's the reason, why the CIS countries do not pay the necessary attention to the accelerated development of alternative energy use [13], [14], [12].

The purpose of this article is to identify the mechanisms for the implementation of the investment projects in the field of alternative energy of the post-Soviet state (case study the EEU member countries).

2 Materials and methods

To achieve the purpose of the article, among which is the goal to identify features of the development of alternative energy of the CIS countries, the following research methods were used: comparative, analytical, mathematical-statistical, multi-attribute classification method, typological. We used data of international organizations (IRENA, REN21, IEA, UNECE, UNSD, BP, etc.), as well as data from official websites of state authorities of the CIS countries. Several indicators of energy development of the CIS countries (and specifically the EEU countries) were selected for analysis.

State programs in the field of alternative energy use in the EEU member countries were analyzed. The results of energy policy in this area were investigated. In addition we examined features of the supply of countries with local energy resources. We did this in order to find out if this country needs to use alternative energy sources or not. Then we selected indicators to characterize the conditions and results of energy policy in the field of alternative energy development. Based on calculations and grouping of countries, we have created a typology of CIS according to the level of alternative energy development. But only EEU member countries were analyzed in our paper. These indicators are presented in the table 1, 2.

3 Results and Discussion

Until now, almost all CIS states retain their dependence on energy imports from Russia [15]. But the situation is constantly changing and differs from country to country. The development of alternative energy in the post-Soviet states contributes to changing the situation in the fuel and energy balance, as well as helps reduce energy imports from Russia. But at the same time, the development of alternative energy is associated with an increase of technological and economic dependence and of foreign suppliers.

Let us characterize the process of liberalization of the electricity market in Russia and analyze the legislative framework for privileged access of new electricity producers to the electricity market. Liberalization of power (electricity) markets is necessary to support the use of alternative energy in the electricity generation in the condition of natural monopoly. Independent alternative energy producers can only gain access to the market after liberalization of power markets. After liberalization, any electricity producer connects to the network, sells electricity on the stock exchange and delivers it to consumers anywhere in the country. This is impossible, when the market is dominated by natural monopoly.

This mechanism opened great opportunities in the USA and Western Europe, because "natural monopoly" was prevailed in those regions earlier. The networks belonged to several companies (monopolists) and the emergence of new electricity suppliers in the market was impossible. The liberalization of the electricity market and the above measures has allowed new suppliers to enter the electricity market of USA and Western Europe. In Russia, a historically different situation has developed.

The Soviet Union is designed and created a unified energy system (USSR Unified Power System). Such problems, when some owner of the power line does not give permission to

another person (to the owner of the power plant) to transfer electricity to the consumer, could not arise here in principle [12]. The power market was liberalized in Russia, in the 1990s. The liberalization led to the division of the market into segments (production, transmission and distribution, as well as sale of electricity), as well as in the privatization of the power industry. But the transmission and distribution (power lines) was remained in Russia in the state (government) ownership.

Then, in accordance with the European model, Russia began to create legislative framework for support of independent electricity producers – primarily for the alternative energy. The mechanism is as follows. The result - an investor to build alternative energy facility (solar power station, wind farm, small hydropower facility or incinerator) is selected. The investor offers the lowest price, and the state concludes a contract with him. Subsequently, this investor erects an object and becomes the owner of this object. The cost of creating a power plant is determined by the investor at a tender. In order to guarantee cost recovery, the state undertakes to buy the capacity of this alternative energy power plant from the investor. The government payments to an investor are distributed over 15 years. Investments are returned with additional profit for the investor (12-14% per annum). Thus, at the start-up stage, the investor is confident in the profitability of the business.

Let us look at the successful experience of Russia in creating power plants using alternative energy to generate electricity. From 2013 to 2019 In Russia, more than 200 investment projects in alternative energy were selected. They will receive state support [16]. But since 2015, international economic sanctions apply to Russia (from the United States and Western European countries). It is difficult to purchase equipment, as well as attract funds from foreign investors today. In addition, Russia responded to the sanctions with the norm that 65% of the equipment of new power plants should be domestic (it is import substitution).

However, the solar panels and engines for wind farms were not produced in Russia. Foreign companies had to create new plants in Russia after the collapse of the Soviet Union. Russia also took part to the construction of new plants to produce equipment for alternative energy. For example, the «Hevel» company (a subsidiary of «Rusnano»), which is engaged in the production of photovoltaic panels in Russia, appeared in the solar power industry. It's much more difficult to develop wind farm equipment at home, in Russia. Blades and turbines are high-tech equipment. It is difficult to organize domestic production and even open a branch in Russia. Chinese investors work most in the Russian alternative energy market. However, the German (formerly Danish) company «Vestas» has opened its own production in the Volga region. Thus, the subsidiaries of the «Chinese Amur Sirius Power Equipment Co., Ltd» built wind and solar power plants in the regions of the Russian Federation. The names of these subsidiaries are «LLC Solar Systems» and «Solar Silicon Technologies LLC» [16].

In addition, the China is supplying equipment for alternative energy to Russia. But in general, it became more difficult to build an alternative energy enterprise (especially after the imposition of sanctions). Projects have become much more expensive, and government of Russia cannot fully compensate investors for their costs. There are bureaucratic barriers. It is difficult to obtain ownership or lease land for construction of new power plants. According to the calculations of the authors, more than 200 new alternative energy power plants were planned and approved for the construction of Russia in 2013-2019. Among them, about 25% were completed. But a third of the contracts were not fulfilled. 62% of contracts are contracts for the construction of solar power plants and 35% are contracts for the construction of wind power plants. About 3% - amounted to mini-hydro plants. In addition, the construction of several waste incineration plants is planned. They also fall under the state subsidy program for alternative energy.

At the same time, about 70% of wind power plants are being built in the Southern Federal District of Russia (primarily in the Krasnodar and the Rostov Regions). But the timing of their commissioning is violated. Solar power plants are being built mostly on schedule, and the main work is ongoing in three federal districts of Russia. These are the Volga region (primarily in the Orenburg region and the Republic of Bashkortostan), the Southern federal district (Volgograd region) and the Siberian federal district. The solar power plants only of three federal districts of Russia account for 85% of the total capacity of all solar power plants planned for construction in our country [16].

The EEU member countries are very different from each other in terms of economic development (Table 1).

Table 1. Selected indicators of economic development of EEA countries, 2018 [17], [18].

| Country | GDP PPP per capita (\$US) | People (billion) | GDP PPP (billion \$US) | Value added o manufacturing industries (billion \$US) | Value added o manufacturing industries per capita (\$US) |
|------------|---------------------------|------------------|------------------------|---|--|
| Russia | 27 900 | 142,12 | 4 016,0 | 228,1 | 1585 |
| Kazakhstan | 26 300 | 18,74 | 478,6 | 20,4 | 1110 |
| Belarus | 18 900 | 9,53 | 179,4 | 14,8 | 1563 |
| Armenia | 9 500 | 3,04 | 28,34 | 1,3 | 459 |
| Kyrgyzstan | 3 700 | 58,5 | 23,15 | 0,9 | 146 |

The leaders in the post-Soviet space (as in the EEU) in almost all socio-economic indicators are Russia, Kazakhstan and Belarus. So, the share of Russia in the population of the CIS is just over 50%, in the total GDP of the CIS and in the production of manufacturing products (value added of manufacturing industries) - more than 70%. Over 60% of the population of CIS, almost 75% of GDP and almost 85% of the volume of manufactured products are spent on the total share of Russia, Kazakhstan and Belarus. Accordingly, in the EEU, Russia, Kazakhstan and Belarus are very different in their economic indicators from Armenia and Kyrgyzstan. This is also reflected in the data in table 1. Moreover, these data are indicative, since the main consumers of electricity in countries are industrial production.

State programs in the field of alternative energy use in the EEU member countries were analyzed. Note: 1) the indicator “Primary energy self-sufficiency” calculated. It is the ratio of “Total primary energy production” to “Total primary energy supply”; 2) the indicator “Total primary alternative energy supply” was calculated. It is the difference between “Total primary renewables energy supply” and “Hydropower electricity generation”; 3) the indicator “Alternative energy electricity generation” was calculated. It is the difference between “Renewables energy electricity generation and Hydropower electricity generation. 2017 data are presented. These indicators are presented in the table 2.

1 type of EEU countries (Russia, Kazakhstan and Kyrgyzstan) includes countries with an excess of energy sources at the country's territory.

Only Russia and Kazakhstan among the first type of countries liberalized power market. The leadership of other countries does not intend to liberalize this branch. Russia and Kazakhstan have a constant inflow of currency. Therefore, they are developing alternative energy as an experiment in order to keep up with global trends.

Russia has a constant inflow of currency from energy exports. This country is creating expensive power plants operating on alternative energy sources. However, it is worth noting that some power plants are located not in energy-deficient, but in energy-surplus areas of Russia. So, for example, the Samara Solar Power Plant was built near the Zhigulevskaya Hydroelectric Power Station (which generates 30 times more electricity than the Samara

Solar Power Plan). Thus, in this region there is an excess of energy. But the place was not chosen by chance. Here is a special economic zone in which investors are offered a "gentle" tax regime. This factor was the main one for the construction of the Samara Solar Power Plant.

Table 2. Typology of the EEU states on the development of alternative energy [19], [20], [21].

| Country type | Country | Primary energy self-sufficiency (%) | Total Primary Alternative Energy supply of GDP, TJ | Share of biomass in all renewable energy consumption (%) | Share of alternative energy in electricity generation (%) | The degree of liberalization in the state electricity market |
|--------------|------------|-------------------------------------|--|--|---|--|
| Second | Belarus | 15 | 1146 | 96 | 1,0 | Not provided |
| Second | Armenia | 32 | 390 | 1 | 0,1 | In progress |
| First | Russia | 195 | 103 | 25 | minimum | Completed |
| First | Kazakhstan | 212 | 41 | 10 | 0,5 | Completed |
| First | Kyrgyzstan | 78 | -453 | 2 | minimum | Not provided |

The electricity market is liberalized in Kazakhstan. A number of large-scale alternative energy development projects have already been implemented (most often with the participation of European and Asian investors). Thus, Kazakhstan until recently had the largest in the post-Soviet states solar power plant named "Burnoye" with a capacity of 100MB [22]. Kazakhstan has many wind farms. There is an auction system for the selection of cheapest alternative energy projects.

Kyrgyzstan is nowadays energy-deficient countries, but this country has great hydropower potential. Electricity for industry and peoples in this country is the cheapest among the CIS states. So, market liberalization can lead here to a social explosion. Indeed, by liberalization implemented in other post-Soviet states, prices of electricity were raised.

Type 2 of EEU countries includes countries with energy shortages, and these countries have not some financial resources to develop alternative energy (Table 2). Among them are Belarus and Armenia. These countries import energy (primarily from Russia). They want to follow the policy of ensuring their energy independence, and want to develop of alternative energy. They are interested in replacing the imported energy with local energy sources. But they lack financial resources for construction of expensive solar or wind power plants. Therefore, these states invest to biomass energy production. However, most often biomass is used only for heat production.

Belarus are not liberalized its electricity market. The alternative energy policy of the Belarusian leadership is separate from other post-Soviet states. However, Belarus (as well as Moldova and Ukraine) is part of the Central European Initiative and interact with European partners within this organization, including in the development of alternative energy. Belarus has a legislative framework to subsidize the production of electricity generated from alternative energy sources. The efforts of the Belarusian government are aimed at the supporting the cost-effective conversion of wood fuel to energy. Such projects require the least amount of investment and have a short payback period. It is appreciated that timber processing industry of Belarus uses modern domestic technology [23].

4 Conclusion

As a result, we would like to highlight the following. The degree of internationalization of alternative energy projects depends on the degree of power market liberalization in the CIS states. In order to promote the use of alternative energy sources in post-Soviet states (according to the Western model), it is necessary to ensure free access of the electricity supplier to the work of the power exchange, to ensure free access to the energy system, and also to raise electricity prices.

The study of the development of alternative energy policy in post-Soviet states and the grouping of countries by type of this policy led us to the following conclusion. New independent CIS countries have to re-build the economic relations with their neighbors. But the leaderships of the Caucasus and Central Asia countries want to increase the energy independent and diversify energy suppliers as well as the structure of energy sources. Also they hope to redistribute energy flows in the region and to become an energy hub. The role of foreign capital there is significant.

In other words, post-Soviet states in their energy policy are moving farther and farther away from Russia. We believe that the alternative energy policy has become one of the measures used by both national governments and foreign countries to reduce the dependence of CIS states on energy imports from Russia, and, therefore, to reduce the integration process in the post-Soviet area.

At the same time alternative energy is called upon to play the role of a catalyst for the development of high-tech industries in the national industry and intelligent electricity. This will increase the reliability of power supply. It will help strengthen local budgets through the use of local renewable energy resources and effectively address environmental issues. And the integrated Unified Electric Power System in the post-Soviet space (in the territory of the former USSR) still makes it easy to transfer electricity throughout the region, including very remote areas.

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References

1. The Office to the Prime Minister of the Republic of Armenia, Report of the Prime Minister of Armenia Nikol Pashinyan on the theme "Armenia after the velvet revolution - Fulfilling the Promise of the Digital and Technological Age" at the Technical University of Cologne (2019).
2. N. Anglani, & G. Muliere, *International Journal of Energy and Environmental Engineering*, **2(5)**, 83-94 (2011)
3. A. Lombard, & S. L. Ferreira, *Bulletin of Geography. Socio-economic Series*, **30(30)**, 71-86 (2015). DOI: 10.1515/bog-2015-0036.
4. B. Paulos, *The Global Energiewende* (2017)
5. I. A. Rodionova, M. V. Chernyaev, & A. V. Korenevskaya, *International Journal of Energy Economics and Policy*, **7(3)**, 216–224 (2017).
6. Y. Li, D. Nie, X. Zhao, & Y. Li, *Renewable and Sustainable Energy Reviews*, **70**, 78-82 (2017)
7. J. Liu, *Renewable and Sustainable Energy Reviews*, **99**, 212-219 (2019)

8. Y. Zhao, X. Liu, S. Wan, & Y. Ge, *Renewable and Sustainable Energy Reviews*, **107**, 133-144 (2019)
9. E.A. Antipova, L.O. Zhigalskaya, I.A. Rodionova, & M.V. Chernyaev, *Journal of Environmental Management and Tourism*, **5(21)**, 1101-1114 (2017)
10. C. Croonenbroeck, G. Stadtmann, *Renewable and Sustainable Energy Reviews*, **108**, 312-322 (2019)
11. N. Mararakanye, B. Bekker, *Renewable and Sustainable Energy Reviews*, **108**, 441-451 (2019)
12. O.V. Shuvalova, M.V. Chernyaev, I.A. Rodionova, & A.V. Korenevskaya, *International Journal of Energy Economics and Policy*, **8(4)**, 199-206 (2018)
13. P. Willems, International Finance Corporation (IFC) World Bank Group (2015)
14. V. Likhachev, *Sustainable Energy for Sustainable Development*, **8(2)**, 13-16 (2015)
15. United Nations Conference on Trade and Development, UNCTAD Statistics (2020). Available at: <https://unctad.org/en/Pages/statistics.aspx> (Accessed on 25.01.2020).
16. Trade System Administrator of the Wholesale Power Market (2020). Available at: <http://www.atsenergo.ru/vie/proresults>. (Accessed on 25.01.2020).
17. The World Facebook. Central Intelligence Agency. URL: <https://www.cia.gov/library/publications/the-world-factbook/>
18. UNIDO. Industrial Statistics Database. INDSTAT4 (2020). URL: <https://stat.unido.org/app/country/Basic.htm?Country=372&Group=null>
19. International Energy Agency, IEA Data and Statistics (2020). Available at: <https://www.iea.org/data-and-statistics> (Accessed on 25.01.2020).
20. International Renewable Energy Agency, IRENA Query Tool (2020). Available at: <https://www.irena.org/Statistics/Download-Data> (Accessed on 25.01.2020).
21. World Bank, World Development Indicators (2020). Available at: <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD> (Accessed on 25.01.2020).
22. Solar power company “Burnoye Solar-1” (2020). Available at: <http://bs-1.kz/>. (Accessed on 25.01.2020).
23. The Ministry of Energy of the Republic of Belarus (2020). (Ministerstvo Energetiki Respubliki Belarus) (In Russ.) Available at: <http://minenergo.gov.by/>. (Accessed on 25.01.2020) (In Russ.).