Institutional structure of the energy industry in the Baikal region

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Abstract. The paper considers the conditions for solving the energy sector of the Baikal region problems related to the development of small-scale distributed energy generation and decentralization of energy supply within the expected energy transition. The institutional structure of energy production and transmission enterprises is analyzed, a group of companies and organizations associated with the local community is identified. A high degree of centralization and the prevalence of vertical ties in the industry management is highlighted, as well as dependency on structures external to the regions. Among the independent enterprises, organizations founded by the individuals prevail. Most of these companies have reduced their economic efficiency over the past five years. Difficulties are expected in the transition to a distributed architecture and horizontal principles of industry management due to the weakness of the sector that is not associated with vertically integrated companies, as well as the preservation of the industrial structure in the region, laid down in previous decades.

1 Introduction

The topic of the energy transition, caused by the change in the technological paradigm in the knowledge society, is the main one in the discussion of the challenges the energy industry is currently facing. One of the problems of this transition is the development of small-scale distributed energy generation and decentralization of energy supply [1]. This is especially relevant for the Siberian regions with significant distances between the centers of economic activity and a sparse settlement system. To solve these problems, as well as to build systems with evenly distributed generation sources, which is especially important for the local production and settlement systems, it is necessary to form an appropriate institutional structure for those enterprises and organizations involved in the generation, transmission and distribution of energy, which are open to new trends in the management of the industry complex and relationship with the environment. The problem is not only technological, but also economic in nature, since the new management system built on the principles of distributed architecture allows for more optimal involvement of the local resource and, most importantly, human potential. This is the basis for the development of local business initiatives, which provides employment to the residents of the region in the field related to energy industry.

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The paper considers current structure of energy industry enterprises in the Baikal region, which will allow predicting the development of certain trends associated with the energy transition, the restructuring of the management system and the development of horizontal ties in the industry. The Baikal region includes both energy-surplus and energy-deficient subjects of the Russian Federation - the Irkutsk region, the Republic of Buryatia and the Trans-Baikal Territory. The Irkutsk region is one of the largest producers of power in Siberia, while the two federal subjects of Transbaikalia receive a significant amount of power generation from the outside. An analysis of the structure of enterprises related to the power industry was carried out on the basis of "Prime" Economic Information Agency database at the beginning of 2023 [2]. A particular attention was paid to the economic entities, establishment of which is associated with the local community and which reflect the prospects for the development of the territory based on its entrepreneurial potential.

2 Power industry enterprises of the Irkutsk region

The Irkutsk Region is one of the leading power producers in the country. There are 156 companies registered in Irkutsk Oblast that have energy generation, transfer or distribution as their main field of economic activity. Some of them are widely known – these are the backbone enterprises of PJSC Irkutskenergo, which is a part of the En + holding: branches of the Bratskaya HPP, Irkutskaya HPP, Ust-Ilimskaya HPP, in addition, through the subsidiary Baikal Energy Company Irkutskenergo manages 11 thermal power plants in the region. Despite the presence of such a major energy generation company, due to a big area with large parts of it having low density population, it is necessary for the region to spread energy production and related energy transfer infrastructure. In reality, significant volumes of the centralized power generation system capacities are used for the holding's production of aluminium [3]. Among the independent power companies hydro generation is also used, while one enterprise in the Olkhonsky district has declared the use of solar energy and most of the rest of these companies use diesel generators.

Management-wise, out of 58 enterprises claiming their main activity as the power generation, half are accounted for by organizations associated with PJSC Irkutskenergo. Among the rest, the largest one is JSC Mamakanskaya HPP, created by gold mining companies in the north of the region. Three enterprises are owned by municipal authorities – in Katangsky, Nizhneudinsky and Olkhonsky districts of the region, the rest are established by individuals. The emphasis in the work is just on these latter companies. Their composition is very heterogeneous, according to the data they provide to the general system, the number of employees varies from one to several dozen people. At the same time, a significant part of them has a long list of additional activities, the number of which exceeds 20-30, ranging often from timber harvesting to wholesale and retail trade and other activities typical for remote areas. However, a number of companies registered in the regional center have activities related to the provision of services in the energy industry. It should also be noted that small companies established by various property management partnerships or horticultural non-commercial associations are present in the field. More than a half of all independent private enterprises have experienced a decrease in revenue over the past 5 years (2021 in comparison with 2017), or did not receive profit at all. During the same period of time, about a third of such organizations have changed.

The region's 60 enterprises claim energy transmission as their main activity, about twenty of them are connected to the Irkutsk Electric Grid Company, an open joint-stock company established on the basis of the grid assets of OJSC Irkutskenergo. The company includes five branches – Eastern, Western, Northern, Central and Southern electric networks serving various areas of the region. The company's revenue in 2022 amounted to more than 27 billion rubles. The proceeds of the second largest energy transmission

organization, the Bratsk Electric Grid Company, did not exceed 3 billion rubles, so this type of activity is also largely centralized, and vertical links prevail in its management system. In addition to the above-mentioned power grid companies, more than 40 companies owned by individuals directly or through self-established companies, as well as 9 individual entrepreneur-founded companies work mainly in the field of energy transmission. Such small enterprises are registered in cities and district centers and operate throughout the region. However, more than a half of the small companies that reported financial results, had a decline in revenue or profit over the past five years.

3 Power industry enterprises of the Republic of Buryatia

In Buryatia, the biggest share of power is generated at thermal power plants. The largest power producer is Gusinoozerskaya SRPP (state regional power plant), owned by JSC Inter RAO - Electric Power Plants (78% of the total power generation capacity of Buryatia). Ulan-Ude CHPP-1 and Timlyuiskaya CHPP in the Kabansky district belong to PJSC "Territorial Generating Company No. 14", registered in the city of Chita (more than 11% of the capacity) [4]. A number of diesel power plants in the Severo-Baikalsky district belong to the grid company Buryatenergo, a branch of PJSC Rosseti Siberia. There are 11 independent energy companies registered in the republic itself, nine of them are individually-owned. The two remaining enterprises belong to the Swiss company and are located in Barguzin settlement, where the construction of a small hydro power plant "Barguzin-1" is planned. The rest of the small companies mainly use diesel generators as their source of energy, with just two of them using renewable energy sources (solar power plants). A significant part of Buryatia's area is assigned to the Baikal natural territory where activities that negatively affect the environment are restricted, so renewable energy generation is of great importance for the development of the energy sector in the region. One of these two companies is an enterprise with growing revenue of several tens of millions of rubles and employment of more than 60 people, but in 2022 its profit was negative. The company has a long list of additional activities related to agriculture (60 types of activities). The second company is a micro-enterprise with a staff of 1 person and zero revenue.

In addition to Buryatenergo, a branch of Rosseti Siberia, 32 local enterprises operate in the energy transmission system, of which one belongs to the administration of Ulan-Ude city, the rest are established by individuals or private companies created by them. Of 14 such enterprises, for which accounting data for 2021 is made known, 8 suffered losses, including the enterprise of the Ulan-Ude administration.

In general, there is a problem with the reliability of independent companies in the republic, a number of which serve various horticultural, gardening or dacha non-commercial associations of citizens in Ulan-Ude and its suburban area, and in recent years have gone bankrupt or ceased their activities. As such, more than 20 energy facilities of private grid organizations in Ulan-Ude remained out of service and were not maintained as of the beginning of 2022. In 2023, at the St. Petersburg Economic Forum, the head of Buryatia A. Tsydenov signed an agreement with Rosset Siberia on the reconstruction of Buryatia's capital city power grid facilities starting 2024, with their transfer to the local branch of the federal company [5]. The scope of Chitaenergosbyt JSC will expand accordingly through its local branch that collects power fees and settles accounts with grid organizations, which increases the dependency of the Buryatia energy industry on external management structures.

4 Power industry enterprises of the Trans-Baikal Territory

In the Trans-Baikal Territory, the centralized power producer is PJSC Territorial Generating Company No. 14, established as a result of the reform of RAO UES. At the beginning of 2022, Far Eastern Management Company (Vladivostok) received control over the company. The structure of TGC-14 includes 4 thermal power plants of the region – Chita CHPP-1 and CHPP-2, as well as Sherlovogorskaya CHPP and Priargunskaya CHPP, operating in the Borzinsky and Priargunsky districts. Outside of this structure, only two private enterprises with power generation as their main activity are registered, located in the settlements of Aginskoye and Novokruchininsky. At the beginning of 2022, Bystrinskaya Solar Power Plant LLC was registered, the founder of which is JSC Norilsk Nickel, however, in the first year of its existence, it was at the stage of still being set-up. Solar energy power usage is also claimed by another small company with 1 worker.

Transmission and distribution of power is carried out by 10 organizations, of which only one belongs to TGC-14, another one belongs to the municipality of Chita, and the rest belong to the individuals. The largest of the independent companies, Energostroy LLC, is located in Krasnokamensk, but the number of employees has decreased three times over five years – from 60 to 20 people, while company's revenue has remained stable and profits have increased.

5 Conclusions

Enterprises associated with independent sources of power are the basis for the implementation of the energy transition in terms of solving the problems of developing small-scale distributed energy generation and decentralization of energy supply. An analysis of the institutional structure of energy organizations shows that in all three federal subjects of the Baikal region, there is a high degree of centralization of activities in the production and transmission of energy field, provided with appropriate technological equipment, while there is also a dependency on companies external to the region. At the same time, each region is characterized by its own schemes of vertical interconnections in the energy complex management system, due to the nature of the territories' industrialization in previous periods. In the Irkutsk region, the foundation of the energy industry is hydropower, concentrated at three dam location points of the Angara river, initially meant to serve large industrial enterprises of the Bratsk-Ust-Ilimsk TPK, the location of which was determined by the proximity to hydro power stations. In Buryatia and the Trans-Baikal Territory, the thermal power industry was more focused on the existing settlement system, and specifically on large cities with a big industrial potential, in order to provide them not only with electricity power, but also with heat. The energy supply outside of the developed zone was carried out through small-scale power generation provided by out-of-region exported fuel. In the post-Soviet period, this small-scale energy industry was picked up by private business, which also constructed links between large producers and small consumers in industrially developed areas. It is this privately-owned business that builds objects which create new horizontal connections focused on the sphere that serves the individuals and local communities. The dynamics of the development of this small energy sector in all three regions shows its weakness, and even a decrease of its development level. Increasing the centralization of power production management and energy flows reduces the amount of resources available for the development of independent enterprises.

The proposed energy transition is based on the idea of the advent of a new post-industrial technological order which has all properties of "smart" energy industry, environmentally-friendly oriented, rationally distributed in space. At present, the economy

of the Baikal region is at the industrial stage of development, same as in previous years, which is also evidenced by the outflow of the population, especially the part of it that forms human capital. The energy complex is focused on industrial needs to a greater extent than on the other forms of economic activity. Under these conditions, the most promising direction for a small-scale, non-centralized energy industry is the greening of the industry, the transition to renewable energy sources, which is the most relevant for the Trans-Baikal regions. In general, the energy transition is only possible with a change in the development model of the territories themselves, where the well-being of regional communities will depend not only on the interests of external corporations, but on the possibilities of territories' own development, which is associated with the fundamental principles for region-federal relations in the country.

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