Priorities for the Energy Sector of Buryatia in Long-Term Socio-Economic Development Plans

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***Abstract* — This study examines the stages of the energy sector development in the Republic of Buryatia alongside the relevant strategic planning documents. The conclusion is made about the decisive role of the energy sector in the long-term development plans of the Republic. The main challenges facing the energy sector in the Republic of Buryatia are identified, highlighting the importance of completing the construction of the Ulan-Ude combined heat and power plant -2 as a solution.**

***Index Terms* — Hydrogen infrastructure projects, hydrogen technologies, Baikal region.**

I. Introduction

Energy sector is the most important branch of the economy, determining the prospects for the development of the entire economic complex of the country and its regions. Since the launch of the state plan for the development of the electric power industry (GOELRO), the significance of the energy sector in long-term planning has become increasingly undeniable [1, 2]. Strategic planning of energy development at the federal and regional levels, along with the planning at the level of energy companies, serves as an essential tool for determining the prospects of the sector [3].

The creation of long-term energy development plans as an integral part of strategic planning documents is crucial for the subjects of the Russian Federation that are economically underdeveloped. These areas often rely heavily on federal financial support, lack local resources for energy advancement, and do not have significant energy companies based within the region. One of these regions is the Republic of Buryatia.

II. Literature Review

The fundamental document of strategic energy development planning in Russia is the Energy Strategy of the Russian Federation until 2035 (hereinafter referred to as the Energy Strategy). This document outlines the long-term goals, priorities, and pathways for the sector development [4].

The scientists from leading specialized scientific institutes and universities analyze the development scenarios, identifying priorities and outlining key directions for the energy sector development in Russia, particularly regions of Siberia and the Far East, including the Republic of Buryatia [5–10]. The challenges and prospects for the energy development in the Republic of Buryatia were explored by G.O. Borisov and other employees of the Department of Regional Economic Research of the Buryat Scientific Center, Siberian Branch of the Russian Academy of Sciences in the 2010s [11–13].

At the same time, recent years have seen significant transformations in the strategic planning framework for energy development, including the adoption of the Energy Strategy, initiation of federal projects, and formulation of long-term plans for the comprehensive socio-economic development of cities in the Far East. There is a growing interest in the previously suspended major investment projects in the Republic of Buryatia. These factors underscore the significance of investigating the future prospects of the Republic's energy sector.

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III. Methodology

The methodological framework of the study is strategic planning, considered in two aspects: sectoral (energy) and territorial (Republic of Buryatia). The information support relies on the data contained in the sectoral strategic planning documents of the Russian Federation. These documents encompass the Energy Strategy, the schemes and programs for the development of electric power systems of Russia (SPD EPS of Russia), as well as the strategic planning documents formulated at the level of the constituent entities of the Russian Federation, such as Strategies for the socio-economic development of the Republic of Buryatia, implementation action plans, and the state programs of the Republic.

This paper highlights the main stages of the energy sector development in the Republic of Buryatia:

- The early stage of the energy sector of the Republic (1923–1933);
- The establishment of the energy sector of Buryatia (1934–1963);
- The integrated development of the energy sector of the Buryat ASSR (1964–1991);
- The transformation of the energy system of the Republic of Buryatia (1992–2016);
- The evolution of the energy sector of Buryatia in the new paradigm of the Republic's development (since 2017).

The main avenues for the sector's development in the long-term plans for the socio-economic development of Buryatia over the last three periods are analyzed.

This work is a continuation of a series of studies aimed at substantiating prospective pathways for the development of the energy sector in the Republic of Buryatia and analyzing its interaction with the energy systems of neighboring regions of Russia and Mongolia. It was conducted by the Department of Regional Economic Investigations of Buryatia Scientific Center of SB RAS within the framework of a state assignment, in response to official requests from the Federation Council of the Federal Assembly of the Russian Federation, and with the support of several grants from the Russian Foundation for Basic Research.

IV. Results and Discussion

By the time the Buryat-Mongolian ASSR was formed in 1923, there had been virtually no industry in the Republic. The Republic's energy sector was in its infancy during the first 10 years. Electricity production, which amounted to 0.3 million kWh in the first year of Buryat-Mongolia's existence, increased only slightly [14].

The second stage of the energy sector development began in 1934 with the construction of the first major energy facility (Ulan-Ude combined heat and power plant-1) and the launch of a turbogenerator with a capacity of 12 thousand kW. The electricity generated met the needs of the largest enterprises in Buryatia, including the Ulan-Ude locomotive plant, a meat processing facility, a flour mill, and a glass factory [15].

In the following 30 years, the Timlyui combined heat and power plant was the only significant energy generation facility constructed and commissioned in Buryatia. This was largely due to the relatively low rates of growth in industrial production, which is the main sector of the national economy that determines the demand for electricity. Thus, over 25 years, starting in 1940, the growth rates of gross industrial output in the Buryat ASSR were almost 1.5 times lower than in the RSFSR and 2 times lower than in the East Siberian Economic Region, including the Irkutsk Region and Krasnoyarsk Territory, where the construction of major industrial facilities began in the post-war years (Table 1).

A new stage in the development of the energy sector in Buryatia began in the mid-1960s with the commissioning of the largest 100 MW turbogenerator in Transbaikalia at the Ulan-Ude cogeneration heat and power plant (CHPP)-1 and the start of construction of the Gusinoozerskaya State

Table 1. Growth Rates of Industrial Production in the RSFSR and Its Individual Regions [16, 17]

Administrative-territorial entities	Growth rates of gross industrial output for 1940–1965, %	Growth rates of overall industrial output for 1965–1975, %
Russian Soviet Federative Socialist Republic (RSFSR)	715	211
East Siberian Economic Region	947	239
Buryat Autonomous Soviet Socialist Republic (ASSR)	498	241
Chita Region	312	202

District Power Plant (SDPP).

An indicator of the importance of an industry in a planned economy was the inclusion of construction projects of specialized facilities in the "Main Directions for the Development of the National Economy." In the Buryat ASSR, the first such facilities were energy enterprises. In accordance with the documents adopted at the XXV–XXVII Congresses of the Communist Party of the USSR, the list of the most significant construction projects in the USSR included projects for the construction of the Gusinoozerskaya State District Power Plant and the Tugnuisky coal mine, along with the commissioning of capacities at the Ulan-Ude CHPP-2 [18–20].

With the collapse of the planned economy in the early 1990s, the unified electric power system of Buryatia was liquidated. The restructuring of the energy sector led to the emergence of various owners within generation: Gusinoozerskaya SDPP became the property of Wholesale Generating Company No. 3, Territorial Generating Company No. 14 acquired ownership of Ulan-Ude CHPP-1 and CHPP-2, Selenginskaya CHPP became the property of OJSC Selenginsk Pulp and Cardboard Mill, and the grid assets went to the branch of Interregional Distribution Grid Company of Siberia, i.e., Buryatenergo.

The general decline in industrial production in Buryatia resulted in the suspension and freezing of major investment projects in the energy sector, including the completion of the construction of Ulan-Ude CHPP-2 and the construction of the Mokskaya hydropower plant with the Ivanovo hydropower plant serving peak loads.

At the same time, the government of the Republic of Buryatia took various actions to stimulate the development of the region's economy, including repeated appeals to the leadership of the Russian Federation. In 1996, the Federal Program for the Socio-economic Development of the Republic of Buryatia until 2005 was adopted with the subprogram "Energy Sector" being its integral part [21]. It provided for the implementation of several large investment projects in the energy sector, including the reconstruction of Ulan-Ude CHPP-1, the construction of the 1st stage of Ulan-Ude CHPP-2, and the construction of the 2nd stage of Gusinoozerskaya State District Power Plant (SDPP). In addition, non-conventional energy was recognized as a separate strand of the subprogram. The list of investment projects included micro hydropower plants on small rivers in the Bauntovsky, Okinsky, and Kurumkansky districts of Buryatia. It is important to note that all of the specified investment projects were never implemented. The main reason for this was the lack of financial resources for the Federal Program, which led to its cancellation in 2002 [22].

Another attempt to revive investment projects in the energy sector was made in 2007, when the government of the Republic of Buryatia approved a long-term strategy for the development of the region, which included the construction of the Mokskaya hydropower plant, the construction of the 7th power unit at the Gusinoozerskaya State District Power Plant, and the installation of two 220 MW power units at the Ulan-Ude CHPP-2. In the context of the global financial crisis of 2008–2009, which also affected Russia, investors chose to curtail the planned projects [23]. The Russian Government returned to these projects in 2016, including them in the "Scheme of territorial planning of the Russian Federation in the field of energy" [24]. Until recently, however, there have been practically no real progress on them. As a result, the general state of the industry worsened.

V. Energy Development Challenges in Buryatia and Possibilities for Coping with Them

Currently, the energy sector of the Republic of Buryatia is in a pre-crisis state. One of the main problems facing the industry is the alarming state of energy security [25].

Firstly, the share of the largest generating source, Gusinoozerskaya State District Power Plant, is too high in the energy sector of Buryatia. As a result, emergency situations periodically occur in the Republic. For example, an accident in June 2022 de-energized almost all of Buryatia. It should be noted that Ulan-Ude is the only city in Siberia and the Far East that is not balanced in terms of electricity consumption. With a consumption capacity of 450 MW, generation is 148 MW. In the context of growing demand for electric and thermal energy, the energy security issue is becoming increasingly acute. Secondly, the depreciation of the main production assets in the energy sector of the Republic is extremely high. In 2022, it amounted to 50.6%, despite the reconstruction of power unit No. 4 of the Gusinoozerskaya SDPP and the replacement of turbogenerator No. 7, which was disabled due to a fire at Ulan-Ude CHPP-1.

Another challenge facing the energy sector of Buryatia is its low efficiency, due to the insignificant share of cogeneration. The Ulan-Ude CHPP-2 construction has not been completed and the plant is operating as a peak boiler.

The thermal capacity is 380 Gcal/hour. According to the original project, however, the electric capacity of the 1st stage of construction was 360 MW and the thermal capacity – 930.2 Gcal/hour. The full designed electric capacity was 720 MW and 1 840 Gcal /hour. In the coming years, a significant increase in electricity consumption is expected in the Republic (see Table 2). In this regard, the energy capacity shortage is becoming a more acute issue.

In recent years, the Republic has made significant strides in the development of solar energy. In 2017, the Bichurskaya solar power plant (SPP) with a capacity of 10 MW was built. In 2019, SPPs were commissioned in the Khorinsky, Kyakhtinsky, Tarbagataisky, and Kabansky districts with a capacity of 15 MW each. Solar power plants, while beneficial, cannot fully meet the growing electricity demand of the Republic. Thus, the need to establish new generation sources in Buryatia persists.

The urgency of addressing air pollution in the city of Ulan-Ude is difficult to overstate. The main polluter is the private sector, which numbers 67 274 households using coal and firewood as fuel. It is worth noting that Ulan-Ude is included in the federal project “Clean Air.”

Given the uncertain prospects for gas infrastructure expansion in Buryatia, one of the pathways to address this issue is to transition private households to electric heating. At the same time, the city's power supply network is currently facing significant challenges, including:

• severely depreciated fixed assets, such as equipment, building structures, and others;

• outdated and technically obsolete equipment;

• chaotically built distribution networks in the area of private residential development;

• overburdened power supply centers.

Under these circumstances, it is essential to undertake reconstruction, major repairs, or new construction of power grid facilities in the city. For these purposes, the Government of the Republic of Buryatia adopted a regional program for the modernization of the power grid, which involves reconstruction and construction of power grids in suburban areas of Ulan-Ude, and provides subsidies to residents for the costs associated with connecting their homes to the grid as they transition to electric heating [27].

The key strategy for addressing the challenges in Buryatia’s energy sector is the completion of the Ulan-Ude CHPP-2 construction project [28]. Following a long and intricate discussion that harmonized the interests of the project stakeholders, the Government of the Russian Federation decided to include the design and survey work, the development of documentation, and construction of the second stage of the Ulan-Ude CHPP-2 with a steam boiler with a capacity of 360 Gcal/h in the “Long-Term Plan for the Comprehensive Socio-economic Development of the Ulan-Ude Urban Agglomeration until 2030,” which was adopted in July 2023 [29]. In early 2024, the Ulan-Ude CHPP-2 reconstruction project won a competition held by the Russian Ministry of Energy. A 65 MW power unit will be installed at the plant, which will improve the reliability of the city's energy supply.

VI. Conclusion

The conducted study allowed us to draw the following conclusions:

1. Strategic planning of energy development plays a crucial role in shaping the future of the entire economic landscape of the country and its individual regions.

2. Analysis of the primary trajectories of energy development in the long-term socio-economic development plans of Buryatia revealed the features of the pivotal stages of the energy sector evolution: energy as a driver of economic growth in the Republic during the 1970s and 1980s; the transformation of the regional energy system marked by a production decline and a halt in investment projects (1992–2016); a new paradigm for the Republic's energy sector (since 2017).

3. The main challenges facing the energy sector of the Republic of Buryatia are described. These are the

Table 2. Projected Electricity Consumption in the Energy System of the Republic of Buryatia [26].

Indicator	2024	2025	2026	2027	2028	2029
Electric energy consumption, million kWh	6 859	7 383	8 415	9 473	9 699	9 745
Absolute increase in electric energy consumption, million kWh	476	524	1 032	1 058	226	46
Annual growth rate, %	7.46	7.64	13.98	12.57	2.39	0.47

precarious energy security state; the low efficiency stemming from an insignificant share of cogeneration; a critical shortage of energy capacities; and the deteriorating condition of the power grid in the city of Ulan-Ude.

4. The identified pathway to address Buryatia's energy challenges is to finalize the construction of the Ulan-Ude CHPP-2 project.

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