

GEORGIA - THE CROSSROADS OF EUROPE AND ASIA - AN IMPORTANT FACTOR IN THE REGIONAL ENERGY LANDSCAPE

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Abstract

Since independence, Georgia's full-fledged integration into the European Union is not only the foreign policy goal of our country, but also the driving force for the construction and development of a democratic state. Georgia's strategic location and possession of rich renewable, unconventional energy resources give us a unique chance to become a hub, a "middle corridor" and a conduit for "green energies". Georgians are ready to use this opportunity for further alignment with the ambitious energy goals of the European Union and the "Green Agreement" of Europe.¹

Our push towards the European Union has been preceded by intensive communication and cooperation on energy legislation, regulations and energy policy, as well as improving energy infrastructure. This is how the so-called mega-project of the 21st century - the Black Sea submarine cable project - was created. The initiative involved in the project is more than simple infrastructure development; It is a symbol of Georgia's integration and interconnection with the European Union. The Black Sea submarine cable will not only enhance energy security and diversity, but also serve as a renewable energy exchange channel between Asia and Europe.

The idea of the Black Sea submarine cable project was born in Georgia, and Georgian geologists carried out technical works to explore the bottom of the Black Sea. At the next stage, Azerbaijan, Romania and Hungary were included in this project. The most important agreement was signed by the representatives of all four countries.

The purpose of our research is to determine in advance what economic benefits Georgia will receive during the implementation of this important project, and we will be able to export the energy of renewable resources of our country, if we remain only as a transit corridor, which is also very attractive, although less profitable.

While working on the article, we evaluated the potential of Georgia's renewable, non-traditional energy sources, their target indicators and characteristics. Based on the researched information, we developed conclusions and recommendations.

Keywords: renewable, non-conventional energy resources, Black Sea submarine cable, energy security, "green energy", European integration.

Introduction

In June 2020, the World Bank studied and based on a preliminary economic analysis confirmed the feasibility of a strategic project of the 21st century - laying an underwater cable in the Black Sea.

On December 17, 2022, the leaders of Georgia, Azerbaijan, Romania and Hungary signed an agreement on "strategic partnership in the field of green energy development and transmission".

¹ Vezirishvili-nozadze, K., Pantskhava, E., Kanashvili, T., European "Green Agreement" and its impact on the energy sector of Georgia, „Vectors of Social Science“ 3, 2022. <https://doi.org/10.51895/VSS3/Vezirishvili-nozadze/Pantskhava/Kanashvili>.

It should be noted that at the initial stage there was no such interest in this project, although many things have changed geopolitically in the background of the Russia-Ukraine war, including in the European Union, 2024 will be a turning point for this project. Since this project has already become a subject of mutual interest - two EU countries are involved in the implementation of the project, we hope that it will be given a special status by the EU.

1. European market - myth or reality?

Currently, economic studies of the Black Sea underwater project are conducted by Italian specialists (GESI). The Ministry of Finance of Georgia is on full alert and is negotiating with the World Bank. Azerbaijani green energy will pass through Georgia, the Black Sea and Romania and will be sold in Hungary. Brussels is trying to overcome its dependence on Russian energy with this project, the European market is opening for us and we are given the opportunity to sell the energy of renewable sources that are abundant in our country.

This project is very important for Georgia both from the point of view of improving the economic conditions and from the political point of view. Georgia is becoming necessary for Europe as a transit corridor. Until now, gas and oil supplied from Azerbaijan have entered Europe via Turkey, but the transfer of electricity (also obtained in a green way) presents other challenges.²

During the period of water abundance, our country sold 800 million kilowatt hours of electricity to Turkey, if the same energy was sold in Europe, three times more money would have entered the budget of Georgia.

Georgia hopes that this project will be given the green light, because the European Union has allocated 2.3 billion dollars, and two EU countries - Hungary and Romania - are part of this path.

Georgia is a country rich in hydro resources. Only 20% of the hydro potential of 40 billion kWh has been utilized.

Georgia is an import-dependent country in terms of energy. We have to cover the winter deficit from three countries - Russia, Turkey, Azerbaijan. That's why we should adopt local energy sources and remove dependence on neighbors.

Considering the relatively small size of the country, high indicators of ease of doing business and convenient location, Georgia has the opportunity to become the best place for energy project start-ups and pilot projects.

2. Adequacy of generation

Georgia consumes the maximum amount of electricity in the winter months. During this period, there is a period of water scarcity on the rivers, and therefore, it is not possible to provide the total demand with the generation of HPPs. Therefore, a significant increase in the import of fuel required for the production of electricity or its thermal plants is necessary.

The minimum demand for electricity is fixed in the spring period, when the generation of HPPs, on the contrary, is maximum and exceeds the consumption. During this period, there is a similar situation in the region of the Republic of Turkey bordering Georgia.

The rates of construction of renewable energy stations, especially of strategic importance regulating hydroelectric power plants, cannot keep up with the rates of consumption growth. Therefore, the share of fuel import required for generation by electricity and its thermal plants in covering electricity consumption is increasing. This situation is aggravated by the lack of sufficient strategic reserves in the country, both in the form of sources of generation and in the form of fuel stocks necessary for generation.

² Vezirishvili-Nozadze, K., "Black Sea Submarine Cable - Road to Georgia's Economic Recovery", International Conference, 2023.

3. Non-technical challenges

Despite the rather powerful inter-system infrastructure of Georgia, electricity trade between Georgia and European countries cannot be carried out through Turkey. There is no transit of large capacities from Azerbaijan to Turkey, despite the existing powerful transmission infrastructure.

Two regions of Georgia are occupied by the Russian Federation: Abkhazia and Samachablo (so-called "South Ossetia"). The engine room of the largest Georgian power plant Engurhesi is located in Abkhazia (the dam is in unoccupied territory). Samachablo is 40 km from Tbilisi, and it is just a few kilometers from the energy and transport infrastructure connecting East-West.

The energy system includes large-capacity cryptocurrency servers. The consumption of which depends on the price of cryptocurrency, which in itself is unpredictable. Therefore, even short-term (up to 1 year) system usage planning is associated with difficult challenges.

The construction of strategic facilities in the country is delayed, both in terms of hydropower plants and transmission infrastructure, which has a direct negative impact on the energy security of the country. Plans for the construction of announced free (and other) industrial zones and centers are also being delayed, due to which part of the energy facilities intended for their energy supply are working in an unloaded mode (eg: K/S Khorga), which puts an excessive burden on the system.

The implementation of the electric energy market is being carried out, which requires a qualitatively short response time from the National Center for the Management of the Energy System and suppliers of electric energy products.

4. Factors determining strength

HPPs provide 75-80% of the country's total electricity production, more than half of which are regulatory HPPs, which provide the ability to cover peak capacities.

All 500/400/330/220 kV substations of system importance are upgraded and their proper functioning is ensured.

The 500 kV electrical network of the eastern part of the system has the shape of a ring, which ensures that the loss of any line in this section does not result in interruption of power supply to customers.

The electric power system is equipped with modern and reliable management, protection and automation systems.

Georgia is a leader in the Caucasus region in introducing innovations and using modern technologies in the field of electric energy. Also, it is a leader in the growth of a new generation of professionals and in the occupation of advanced positions by this generation.

The electric power system of Georgia will technically have the ability to perform synchronous parallel work simultaneously with the systems of Russia and Azerbaijan, which will dramatically increase the reliability and stability of our system. Regardless of the loss of any inter-system connectivity between these countries, Georgia (as well as Azerbaijan) will be instantly rebalanced from the IPS/UPS (CIS-Baltic-Ukraine) synchronous zone. Realization of this possibility will be possible in case of regulation of non-circulating capacities generated in the ring of Georgia-Russia-Azerbaijan systems.

Georgia has the opportunity to connect to the Central European synchronous zone (European frequency on the 400 kV substations of Akhaltsikhe) in a technically possible short time (in case of installation of appropriate autotransformers in the Akhaltsikhe substation).

The electric energy sector of the country is provided with technical standards, norms and regulations, among which "Network Rules" and "Technical Operation Rules" have been implemented; which establish the technical parameters to be ensured by the system participants, including the transmission system operator, consumers, generation sources and distribution system operators. In addition, a ten-year plan for the development of the transmission network and a five-year plan for the development of the distribution network have been prepared, which outline the country's electric power system

development projects and provide adequate signals to potential investors of potential consumption and generation.

5. Main risks and threats

It is worth noting the following main risks of the safe operation of the electric power system of Georgia:

- Loss of Engurhesi. This danger originates from the occupied Abkhazia region, where the engine room of the Enguri power plant is located (the Enguri dam is in the controlled territory of Georgia).
- Disruption of the gas pipeline, which may occur in case of various technical malfunctions or sabotage. The occurrence of this risk, especially in winter, will lead to the termination of operation of thermal power plants.
- Sabotage on any 500 kV power line (corridor) connecting East-West. The occurrence of the mentioned risk can be dangerous during the period of water abundance, when this highway is busy.
- Increasing the share of constant current conversion and unstable generation sources in the energy system. Such sources do not have inertia, therefore, an unjustified increase in their share in the energy system of Georgia will significantly deepen the problem of inertia.
- A sharp increase in electricity consumption, which may occur as a result of intensive replacement of internal combustion engine cars with electric cars.
- Strong volatility of cryptocurrency prices, which leads to a sharp change in electricity consumption, which will complicate both short-term and long-term balancing of the energy system.
- Prosumers and autonomous users are synchronized with the main system and have their own generation source, usually in the form of small wind or solar plants. In the case of storms or sudden changes in weather, there is a sudden change in the electricity produced by these sources of generation, which causes a significant imbalance of electricity in the system.
- As a result of the Earth's global climate change, anomalous temperatures (cool summers, warm winters, extremely cold or hot autumn and spring days) are increasingly occurring. At the same time, the hydrology of rivers is becoming increasingly unpredictable and chaotic, which affects the generation of hydropower plants.
- During a critical natural-climatic condition (storm, ice cover, avalanche, landslides, very high or very low temperature), one or, in some cases, several power transmission lines may be out of order.
- Depreciation of the GEL due to the devaluation of the currencies of the neighboring countries. Investments, as well as payments for imported energy resources, are mainly made in US dollars and euros in Georgia. Therefore, the devaluation of the GEL leads to an increase in the cost of natural gas, the main fuel resource for electricity and thermal power plants. In addition, the devaluation of the currency puts a heavy burden on JSC "State Electric System of Georgia", as well as JSC "Georgian Oil and Gas Corporation" (the main supplier of natural gas for TPPs), which are financed by foreign financial institutions in euros and dollars.
- Cyber attacks on power system management systems.

6. Strategic directions of development

6.1. Increasing security of supply

Two criteria are used to assess the safety of electric power system supply:

- Adequacy of generation – the ability of generation sources to continuously meet the demand of consumers for electricity, both in the conditions of scheduled and unexpected outages of the network element;

- Reliability of the network - the ability of the transmission network to provide power to consumers in the event of loss of any single element without limitation and deterioration of the quality of electricity.

The consumption of electricity in the country is growing steadily within the range of 5-7% annually, while the construction of generation facilities, especially strategic hydroelectric power stations with reservoirs, is delayed, which causes significant challenges.

In order to correct the situation, in the short and medium term, the integration of highly efficient gas-fired combined cycle thermal power plants will be implemented in the system, as well as the construction of solar and wind plants, within the framework of system reliability.

In the long term, hydroelectric power plants with strategic purpose will be included in the system.

To ensure the reliability of the network, based on the best European experience, the operator of the transmission system of Georgia (JSC "State Electric System of Georgia") annually develops, and the Ministry of Economy and Sustainable Development approves the ten-year plan for the development of the transmission network of Georgia (Figure 1).

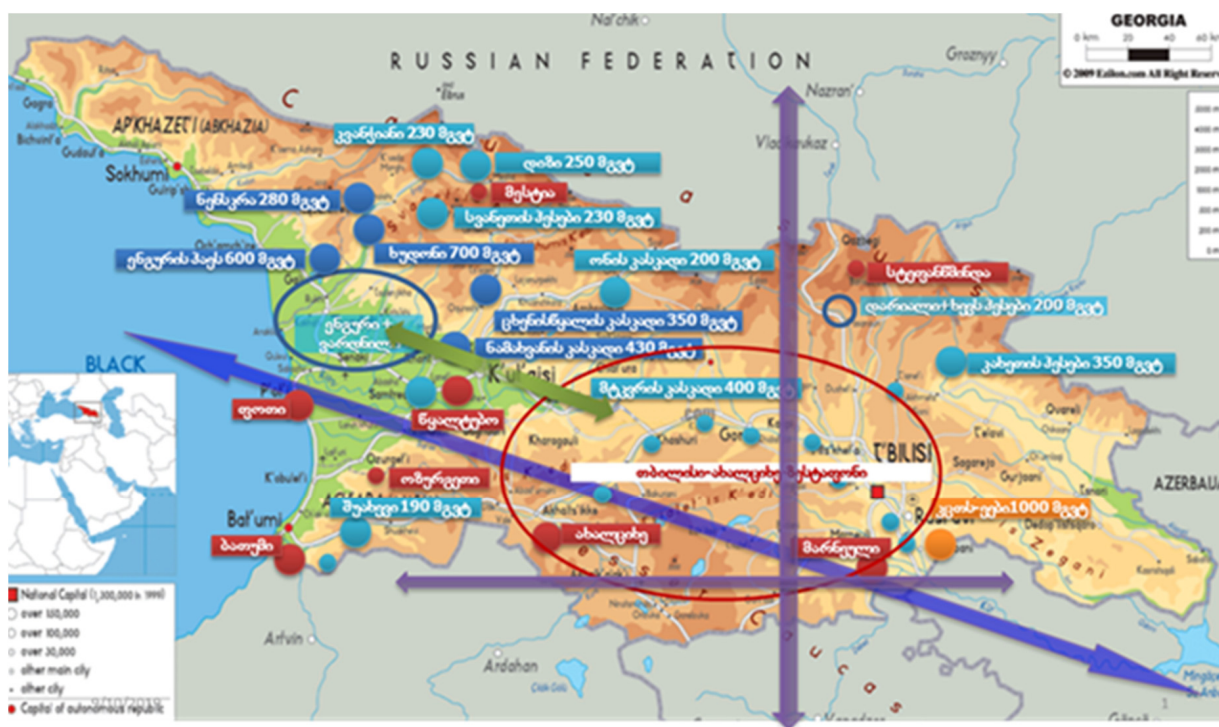


Fig. 1. Map of the driving forces of the development of the electric network of Georgia

- Prospective regulatory power plants;
- Prospective seasonal power plants;
- Prospective load increase;
- Transit withdrawal of heat stations;
- New gas stations ○ Existing generation region;
- Existing strong consumption region;
- ⇔ The need to strengthen inter-system connection;
- ⇔ The need to strengthen intra-system connection;
- ⇔ Possibility of intercontinental trade.

6.2. The process of integration with European energy systems

Georgia is a member of the European Energy Union, which helps to stimulate the projects of strengthening the inter-system electricity transmission infrastructure of neighboring countries with Georgia and increases the transit potential of Georgia. Joining European structures will be a prerequisite for overcoming non-technical challenges with neighboring countries. In addition, European support will mitigate the risks associated with the occupied regions. The membership of the European structures in itself means the implementation of the best standards and the continuous development of the electric energy structure.

Work is underway within the framework of the cooperation project with ENTSO, the goal of which is to join JSC "Georgian State Electric System" as an observer.

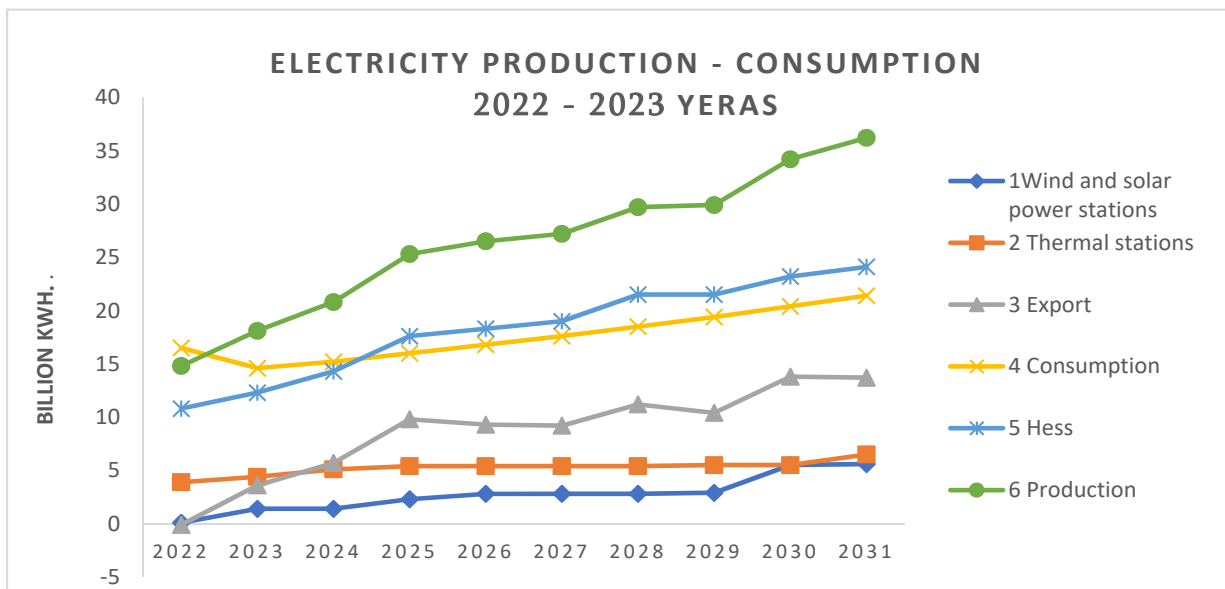
6.3. Utilization of energy resources

Only 20% of the economically justified part of the hydropower potential in Georgia has been utilized.

The country, which is trying to become energy-independent and has all the possibilities for this, does not use the existing hydro-resources, refuses not only to utilize the rivers with a small energy potential, but also to convert the potential of the country's most water-rich and energetically distinguished river - the Rion, into electrical energy. From the point of view of using the energy potential of Rion River, the village of Namokhvani is considered to be a strategically outstanding object. Namokhvanhesi project is suspended because the negotiations with the Turkish investor failed.

Georgia's energy is almost 80% dependent on the energy generated by HPPs. The deficit that the country has today is about one billion six hundred million kWh and if the blocking of projects continues, this deficit will increase year by year. Projects such as Khudong HPP, Namokhvani HPP Cascade, etc., are necessary to be implemented, as these are strategic facilities that ensure coverage of the current deficit, sustainable operation of the power system, and the quality of energy security. (see diagram 1).³

Diagram 1. Electricity production - consumption in 2022-2023



³ Chomakhidze D., Vezirishvili-Nozadze K., University of Science and Technology, I. Jordan's house Center for the Study of Production Forces and Natural Resources of Georgia, "Production Forces and Natural Resources of Georgia" - refereed and peer-reviewed scientific journal No. 1(3). Tbilisi, 2023.

6.4. Variable - renewable sources of energy

In Georgia, out of 365 days of the year, there are 280 sunny days on average. The annual duration of sunlight is 2200 hours.

According to current estimates, the wind energy resource in Georgia is 4 billion kWh, of which only 2% is utilized. According to optimistic estimates, the solar energy resource is about 1 billion kWh, the utilization of which is less than 1%.

The construction of solar and wind energy utilization facilities requires relatively little time compared to the construction of hydroelectric power stations, however, day-night and shorter-term generation based on these sources is highly variable and requires the mobilization of system reserves to stabilize the energy system.

One of the necessary conditions for the reliable integration of wind and solar generation into the network is the accurate forecasting of their output, which avoids the need to mobilize excess reserves in the system. With the support of Western partners, work has been started to implement the relevant unified forecasting system.

In addition, with the financial support of donors, it is planned to complete the study of the integration of energy storage sources in the energy system of Georgia, including storage batteries and hydroaccumulation stations, by 2024, one of the main goals of which is the maximum possible integration of wind and solar stations into the country's power supply system.

The most favorable areas for wind power plants are located in the highlands of the Caucasus, in the vicinity of the Ricoti pass (Mount Sabueti), on the Javakheti plateau, and in the southern and central parts of the Black Sea coast of the country.

Today, geothermal waters are mainly used for primitive household or agricultural purposes (in greenhouses). The share of geothermal energy in the energy balance of the country is very insignificant. Samegrelo is the richest region with these resources. There are so many geothermal waters in Tbilisi that it is possible to freely build two geothermal plants near the Lisi lake and in the old district near the colorful baths, thus Tbilisi would become a "green" city.

Conclusion

Until 2030, our country has the opportunity to include 1331 MW of wind power and 520 MW of solar power plants in the electric power grid. As for hydro resources, our government has announced that it will buy out the Khudon HPP project for 13.5 million dollars and will also implement the Namochvani project itself. Then we can truly say that the Black Sea submarine cable will become the most important guarantee of our economic strength, and Georgia will turn from a transit country into an exporting country and an energy hub between Asia and Europe.

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