



Energy Market Liberalization, Electricity Shortage, Subsequent Challenges and Renewable (Solar) Energy's Role

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Abstract

The research paper attempts to explore the ways to develop a state strategy for renewable energies and establish preferential systems. The study results are based on the Desk Study methodology. The paper uses the quantitative method through statistical data gathered from reliable sources such as state agencies and publicly accessible official sources.

The international experience on the topic has been well-researched and the necessary components needed to rehabilitate the global energy industry in the post-pandemic period have been identified. The general list of literature includes scholarly articles from international peer-reviewed publications, legislative and sub-legislative acts of the country, strategic documents, results of international relevant research, and information requested from state agencies.

Keywords: Renewable energy; Energy market; Electricity shortage; Net Metering

Introduction

In the digital age, a world without technology seems very difficult to imagine. The ongoing process of technology development makes devices more compact that dramatically increases the demand for high-quality electric power. Consequently, energy consumption demand is on a rise and the trend is expected to be upward. In comparison with 1990, the global energy consumption has doubled (Table 1).

[Electricity Consumption Trend 1990-2018](#)

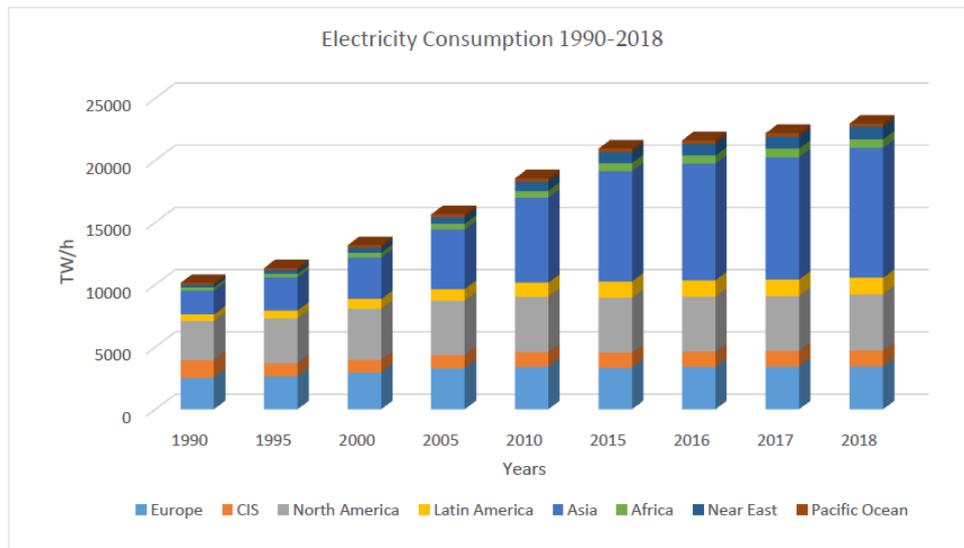
[Europe / CIS / North America / Latin America](#)

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As the diagram depicts, global demand for energy is increasing rapidly each year [1], and Georgia is not an exception. In the 1990s the bulk of total energy was consumed by North America which was later outstripped by Asia consuming 2.32 times more electricity according to the 2018 statistics. The similar marked increase can also be observed in Latin America, Africa and the Middle East.

The aim of the research is to identify the challenges facing Georgia's energy sector, explore ways to respond to them, determine the development opportunities in the field, and tackle the issues related to the energy market liberalization [2]. Based on the analysis of European experience, the paper attempts to define the stakeholder collaborative system in new business ecosystem and offer development prospects both for businesses and the state.

Table 1: Electricity Consumption Trend.



Source: Enerdata, 2018 statistics

Results and Analysis

Balance and Solar Energy Potential

Georgia is characterized by almost every climate zone existing on the earth, ranging from humid subtropical to eternal snow and glacial zones [3]. Due to its relatively low latitude and moderate cloudiness, Georgia receives significant warmth from the sun. The average annual sunlight is 1,350-2,520 hours. (http://energy.gov.ge/energy.php?id_pages=60&lang=geo)

According to the Galt & Taggart research report published on October 3, 2019, electricity import increased by 20.5% in 2019 [4]. Azerbaijan was the main provider of import with 91.1% share in total; the rest was imported from Russia. (<https://galtandtaggart.com/upload/reports/18281.pdf>) (Table 2).

Table 2.

Generation	9914.3
Import	1273.5
Delivery to the network	12166.8
Total Consumption	11950.1

Source: Actual Energy Balance of Georgia 2019.

Currently, the installed capacity of the Georgian electric power system amounts to 4166 MW, of which 2381 MW is generated by regulated HPPs, 839 MW by 'seasonal' (run-of-river) HPPs, 110 MW by Gas Turbines, 21 MW by wind farms, and 925 MW by thermal power plants and combined-cycle gas turbines (Fig.1). Roughly 77% of the total in-country installed capacity is provided by HPPs. It should be noted that by 2029 share of wind and solar power plants will reach 10% and its growth is expected to remain on an

upward trend (Ten Year Network Development Plan of Georgia 2019-2029, p. 10). (Fig 1&2)

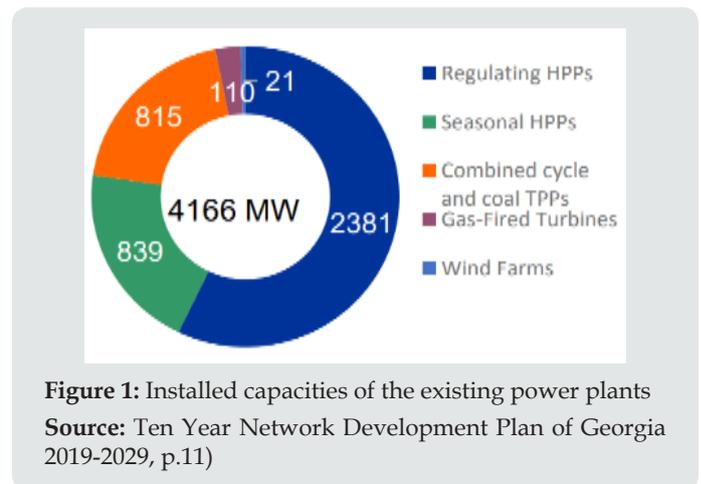


Figure 1: Installed capacities of the existing power plants
Source: Ten Year Network Development Plan of Georgia 2019-2029, p.11)

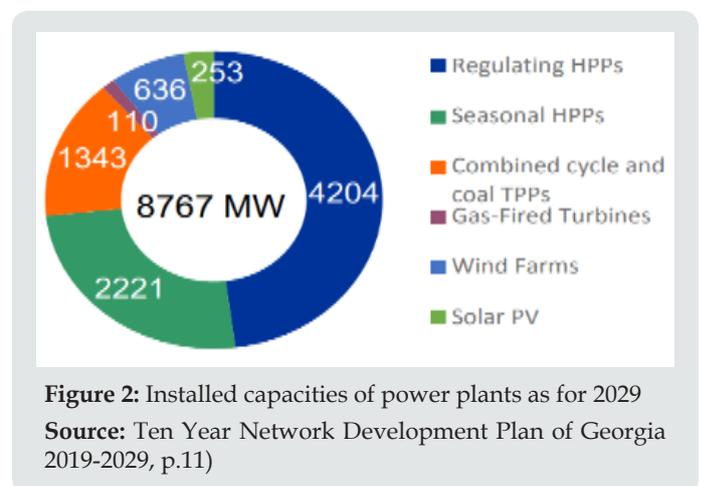


Figure 2: Installed capacities of power plants as for 2029
Source: Ten Year Network Development Plan of Georgia 2019-2029, p.11)

4166MW – regulating HPPs / Seasonal HPPs / Combined cycle and coal TPPs / Gas-fired Turbines /c Wind Farms

8767 MW – regulating HPPs / Seasonal HPPs / Combined cycle and coal TPPs / Gas-fired turbines / Winds Farms / Solar PV

According to ESCO data, electricity supply (million kWh) for eleven months of 2019 is as follows: the share of solar energy is quite limited [5]. However, this table shows the potential solar power plants and their possible maximum power output in the future.

The Role of the State and the Net Metering System

No significant state-level steps have been taken so far towards the solar energy sector development. It is at the expense of enthusiasts the field is evolving. It is noteworthy that in 2016 [6] GNERC launched the Net Metering Regulation according to which individuals can generate their own electricity and sell the excess electricity to the operator. As of the end of 2019, 131 customers had been connected to the system. It is significant that solar panels are being installed in highland settlements of Georgia. On the report of National Statistics Office of Georgia, in 2018, 128,6 Tj electricity was generated, which represents 0.348% of the total production.

It is a well-established method for customers to meet their consumption needs through utilizing micro-capacity renewable energy sources, which are supported by various international level incentive policies. According to the information available to the GNERC Commission, by the end of 2018, through Telasi JSC 27 subscribers had been participating in the net metering system with total capacity of 358.15 kW, while 40 subscribers through EnergoPro Georgia JSC with total capacity of 381.61 kW. Overall, in 2018, 67 subscribers were participating in the net metering [7] system with total capacity of 739.75kW. Compared to the previous year, net metering in 2018 can be characterized with the following indicators: there was a 2.4 fold increase in the number of subscribers and the installed capacity grew 2.7 times. Not only does the net metering program enable the customers to generate increased amount of electricity for self-consumption, but also supply the excessive electricity to the relevant distribution network for the corresponding payment. 2018 was marked with the intensive work of the Commission to elaborate and further develop net metering regulation allowing a collective involvement of the group of customers in the net metering program.

Solar power plant generation can be correlated with the country's overall consumption in order to reduce daytime peak loads. On the other hand, when clouds pass over a solar power installation, the efficiency of the latter can drop which will create the need for additional high-capacity power reserves to offset the solar generation instability [8]. In conjunction with solar power plants, battery energy storage can be used to tackle this challenge.

With its optimal settings, these batteries can bolster the country's use of solar energy efficiency and provide optimal supply option such as solar energy converters.

In recent years, the interest in wind and solar power plant construction has increased dramatically. Hence, Georgian Electricity Transmission System JSC 'Georgian State Electro system' with the support of European consultants' consortium DigSILENT-DMCC-R2B has studied the possibilities of integrating variable renewable energy sources in the Georgian power system. The outcome of the study reveals that, by 2020-2021 (after implementation of balancing mechanisms), [9] Georgian power system can integrate 333 MW wind and 130MW solar power plant (25% of potential); (GNERC Solar energy incentive mechanism – net metering, p.25, 2018)

Liberalization of the Energy Market and Its Accompanying Challenges

The global energy market liberalization process took place around 30 years ago with the UK being one of the pioneers to revamp its energy system, which nowadays is considered to be a standard model for electricity liberalization worldwide. British model was pursued by many countries and successfully implemented. In 2001, Norway was first to offer a European power exchange Nord Pool which is now owned by Euronext and the continental Nordic and Baltic countries' Transmission System Operators (TSOs). Nord Pool delivers power trading across Europe.

Market liberalization is a process that accompanies a free market economy. It is the process of lessening the burdens of government control, lifting various barriers and deregulating established tariffs. It is worth noting that the level of liberalization greatly depends on the legislature which tightens or relaxes restrictions at its discretion. Georgia is planning to fully liberalize its energy market in 2021. Georgia became committed to these reforms once it joined European Energy Community and has been actively involved in the preparation process since 2017 to start full liberalization of the market. Drawing upon the world energy market experience, energy liberalization has a favorable impact on the efficient and ecological functioning of stable, energy-efficient electricity system [10]. The energy market liberalization will entail more transparent, diversified energy system focusing on promoting greater energy system efficiency. In order for Georgia to achieve this result, it is important to have stable macroeconomic environment, attract investments and adopt complex approaches towards electricity supply companies.

The main accomplishment that the energy market liberalization will bring about is freedom of choice. New companies will emerge that will stimulate healthier competition and market regulated prices. In addition, market liberalization will attract more foreign players to invest which, in turn, will encompass increased electricity production. Another outcome of the energy market liberalization

will be tariff change. One of the primary goals of the reform is to create fair and healthy business environment; therefore, as implied by free-market economy [11], tariffs will be set by the forces of supply and demand. Hence, the new concept of 'hourly pricing' will be introduced to the Georgia's electricity sector and the whole population. The notion signifies that there is positive correlation between energy consumption and tariff; this means when consumption is high, tariffs grow correspondingly, and when it is low (mostly during the night hours), price drops accordingly. The abovementioned factors will boost foreign investment in energy sector as the higher business income, the greater stimulus is has to increase its production.

In the first stage of market liberalization, tariff hike is inevitable. Due to its electricity generation deficit, Georgia greatly relies on import. The situation can be further aggravated by volatile national currency which tends to fluctuate continually. The regulation strategy will develop a competitive market; however, the factors that hinder the process are the existence of supply and distribution monopoly. Retail customers are deprived of a chance to change their suppliers based on quality, price or other inadmissibility. [12] In December 2019, the Parliament of Georgian made an initial step forward by passing a relevant legislation as a result of which the Energy Exchange was established by the Georgian Government. The primary aim of the Energy exchange is to ensure the process

of energy transfer, delivery and distribution so that the consumers can be entitled to choice and create ample opportunities as well as desire for other companies to operate. Therefore, [13] the state needs to adopt a new approach which will reduce government intervention and allow all stakeholders trade at real market prices.

The liberalized energy platform will encompass two markets: Day-Ahead Market (DAM) and Intra-Day Market (IDM), where the latter supplements the first one and helps to keep demand and supply in balance. Single price coupling algorithm EUPHEMIA (acronym of Pan-European Hybrid Electricity Market Integration Algorithm) was developed in Europe to calculate [14] day-ahead electricity prices across Europe and allocate cross border transmission capacity on a day-ahead basis.

Georgia's emerging market economy which is still in the process of formation is frowned upon by some who strongly and openly oppose its way of development. Their concerns are fueled by unstable political environment and inconsistent legislature that pose the treat to the country. This so-called 'transition economy' is the period when a country undergoes a process of market liberalization during which any change in legislature and its political will can put investors in vulnerable position and leave them increasingly exposed. [15] Furthermore, there is a possible threat posed by cartel deals that can roughly intervene in the emergence of energy resources' market value. (Fig 3)

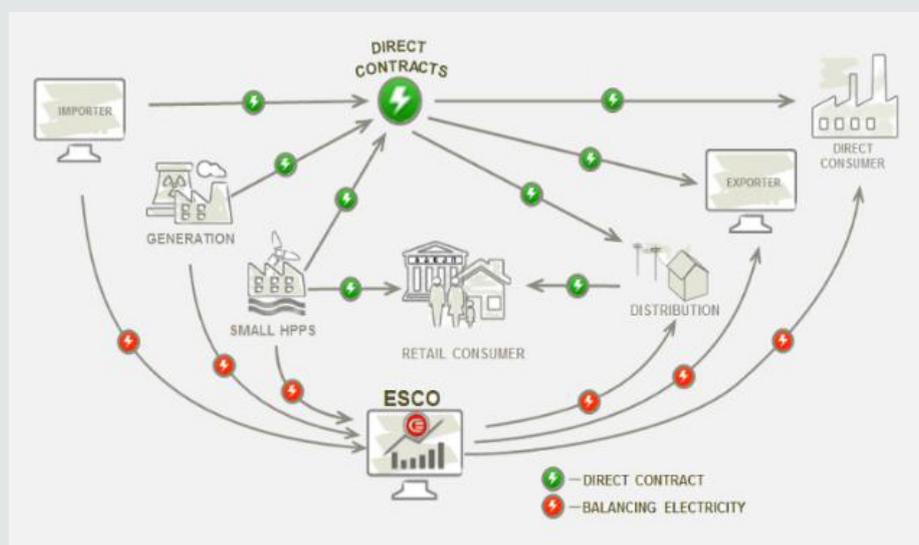


Figure 3: Electricity Market Scheme

Importer / Direct Contracts / Direct Consumer

Generation / Exporter /

Small HPPS / Retail Consumer / Distribution/

ESCO

Direct Contract / Balancing Electricity

As mentioned above, by establishing Energy Exchange that is planned to launch its operation in 2021, Georgia has moved one step closer to energy liberalization; and in cooperation with Electricity System Commercial Operator (ESCO), it will ensure energy sector development and power sustainability. Energy trading is expected to be conducted by financial instruments, [16] such as energy derivatives, that will provide a considerable impetus

not only towards the energy sector but also towards Georgia's Financial Exchange. On its part, the development of the financial market ensures foreign investment inflow that entails capital market accessibility for local businesses.

ESCO will serve as a guarantor to have all the duties and obligations met. Customers are entitled to choose own suppliers and individually agree on tariff and delivery terms. [17] This will contribute to a healthier competition and market diversification.

Conclusion

Renewable energy development is primarily the main determinant of environmental and economic upswing. For our country, eliminating heavy reliance upon foreign oil and imported energy remains the major challenge; thus, gaining energy independence can lead to more stable environment.

After signing the Association Agreement with the European Union, Georgia has made commitments in the energy sector which is in need of systematic reforms. Due to the significance of renewable energy development, the government expresses its readiness to counter the existing challenges in the energy sector.

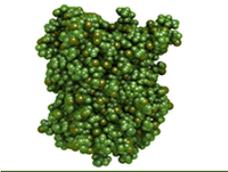
Of vital importance is for the state to provide economic stimulus targeting at increasing 'Green Energy' demand and provide effective mechanisms that facilitate renewable energy generation. Relevant and effective legislation will contribute to more secure environment for investors. Furthermore, conducting researches and collecting data together with mapping out viable long-term strategies and development schemes will induce more active involvement of stakeholders.

References

1. Bochorishvili, E, & Chakhvashvili M. (2019) Electricity Market Watch (brief overview),
2. Change Measures in Georgia – Policy Indicators.
3. (2019) Energy Exchange Established in Georgia.
4. (2017) Electricity Market Liberalization, prospects and challenges.
5. (2016) Euphemia Public Description PRC Market Coupling Algorithm.
6. GNERC Solar Energy Incentives – Net Metering, (2018); Ten Year Network development Plan of Georgia 2019-2029; transmission System Operator JSC 'Georgian State ecosystem'.
7. (2017) How the European day-ahead electricity market works. ELEC0018-1 - Marche de l'energie Pr. D. Ernst Bertrand Cornelusse.
8. (2017) International experience of Electricity Market Liberalization.
9. Ksovreli T, Gogoladze M, Mokia K, Kinsturashvili M, Nonikashvili L, et al. (2019) Energy Balance of Georgia.
10. Margvelashvili M (2015) Georgian Energy Sector in the Context of EU Association. World Experience for Georgia (WEG), Tbilisi, Georgia.
11. Mukhigulashvili G, Kvaratskhelia T (2013) Renewable Energy Sources and Energy Efficiency. World Experience, Tbilisi, Georgia.
12. (2020) Nord Pool Group.
13. OECD (2018) Environmental Directorate. Mobilizing Financial Recourses for Climate.
14. Tatarshvili, Zurabishvili N (2019) Natural Resources and Environmental Protection of Georgia. National Statistics Office of Georgia, Tbilisi, Georgia.
15. (2019) The Electricity Market Operator, Electricity Balance.
16. Tsurtsumia T, Janelidze S Energy Obligations Defined by the Georgia's accession protocol to the Energy Community Treaty.
17. World Energy Statistical Yearbook, Domestic Electricity Consumption.

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