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Electricity Market Prices and Georgia's Energy Security

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1. INTRODUCTION

Electricity supply security is an important component for shaping Georgia's overall energy policy. Security of electricity supply is a complex multidimensional topic that requires an understanding of technical operation and control of the electricity system, its commercial viability, geopolitical aspects of electricity trade and environmental outcomes of power generation. All these aspects of electricity supply security are comprehensively summarised by Larsen, Osorio and Ackere (2017). Prices are an important component of security of the electricity supply. In most cases, they reflect tendencies of development in many aspects of security of electricity supply. Through, prices for different services on the wholesale electricity market, participants could be incentivised for actions that ensure greater security of supply. In the short and medium-term (over seasons), these incentives could be leading to selling as much power on the spot as possible or saving potential generation to provide ancillary services. In the long-term, this could be reflected in investment patterns in power generation that are based on ongoing and potential needs of the power sector (that are reflected in different prices on the wholesale market) rather than simply trying to utilize the full power generation potential of the resource.

Demand for electricity in Georgia has been increasing at an average annual growth rate of 4% per year over the past decade. On the one hand, electricity demand is very peculiar, since it cannot be substituted with other energy sources for many applications (for example lighting, or electricity supply for different household and industrial devices). On the other hand, electricity can substitute other energy sources for most uses (such as heating and transportation). Consequently, observing developments in the electricity market is vital for overall energy security. In the context of Georgia, a potential abundance of renewable energy resources makes the electricity market a very important component of overall energy security[1]. This is particularly true considering the trilemma of energy policy (World Energy Council), that unites the dimensions of energy security, energy equity and environmental sustainability.

Since signing a treaty with the European Energy Community in 2016, Georgia has been going through an active reform process of its electricity market. These reforms entail the liberalisation of the electricity market, the introduction of short-term electricity

[1] Based on 2019 energy balance published by Georgia's national statistics office, electricity represents 20% of the country's total primary energy supply (TPES). Furthermore, 76% of energy is generated using renewable hydropower and wind (with 75% coming from hydropower and 1% from wind energy). Unfortunately, there is no viable research measuring Georgia's renewable energy potential. However according to the government website energy.gov.ge (accessed 28th October 2021), Georgia has potential to build 1,450 MW of wind power plants; there is significant amount of hydropower potential hydropower as well with Georgian State Electrosystem (GSE) identifying around 123 prospective projects with total installed capacity of 3,865 MW in its 10 year network development plan (GSE TYNDP 2021-2031).

exchange, as well as supporting greater transparency in the sector. These planned reforms create a unique opportunity for Georgia to build a resilient electricity market that enhances all aspects of energy security from affordability to environmental sustainability. Prices on the wholesale electricity market are potentially one of the most important tools to achieve this goal as they signal priorities of development through adjustments and reflection of changing circumstances.

This policy research paper aims to draw attention of stakeholders in Georgia's energy sector to the issue of prices, their importance in energy security and security of electricity supply. To meet the aim, this work firstly reviews the existing academic and policy literature. Afterwards, the current structure of the wholesale electricity market in Georgia is analyzed to identify different prices and payment schemes. Along with current data and tendencies, this analysis of the Georgian regulatory framework allows the identification of some fundamental issues, that are inherent in the ongoing wholesale electricity market structure in Georgia. As the result, this policy research highlights some challenges that need to be resolved to strengthen security of supply in the electricity market.

Based on the existing frameworks suggested in recent research, we try to link different dimensions of electricity security to their respective prices. This is done in section 2 of the policy paper. Afterwards, in section 3 the typologies of prices on the Georgian wholesale electricity market are discussed, and critical issues of regulation are identified. Furthermore, in section 4, the existing data showing tendencies of development in the different layers of the wholesale electricity market are presented. The descriptive analysis of available data allows the identification of potential challenges associated with especially missing data, that limit the ability to conduct more comprehensive analyses. Based on these observations, a problem tree approach is used in section 5 to map existing challenges to electricity security of supply (SoS) related to price incentives and transparency on the wholesale electricity market. In section 6, conclusions are made and three key recommendations for policymakers in the electricity market are developed based on the mapping of electricity market-related challenges in section 5.

2. ENERGY SECURITY, ELECTRICITY AND PRICES

There are several definitions of energy security, that are based on the availability, affordability and acceptability framework suggested by Hughes (2012). Availability indicators refer to the possibility to supply the needed amount of energy to satisfy demand. This indicator is concerned with the diversification of energy sources (where more diversity of sources and suppliers is better) and the stability of their supply (less variability is better). Affordability is related to the level of prices and their affordability for customers. Although this indicator is relatively vague, since it entails the existence of a certain benchmark, that will serve as a metric compared to which affordability of energy sources will be measured. This could be, for example, the share of energy costs in total operational costs of companies or household expenditures. The acceptability indicator is concerned with the environmental impact from the use of different energy sources. This could be measured utilizing different indicators of environmental impact from energy generation and use, such as CO2 emissions, costs imposed on the ecosystem and others.

Recognising energy security at large is one of the major dimensions of the energy policy, many international organisations suggest the ways to measure it, that follow a similar framework as Hughes (2012). For instance, the World Energy Council (WEC) has the energy trilemma index, which entails aspects of secure supply, energy equity and environmental sustainability (WEC 2021)[2]. Furthermore, the World Economic Forum (WEF) has suggested the energy triangle as a set of indicators used to analyse energy security, which includes energy access and security, environmental sustainability and economic development and growth (WEF 2020). The International Energy Agency (IEA) also has a model of short-term energy security (MOSES), that suggests indicators for assessing security of supply using the analysis of primary energy sources (IEA 2011). Relevant for Georgian circumstances, this entails assessing electricity SoS, looking at multiple indicators of external and domestic risks, as well as external and domestic resilience of supply in the natural gas sector. Furthermore, it also assesses supply security for hydropower with a simplistic approach of calculating the annual volatility of production. However, the MOSES index is too simplistic to clearly identify issues of electricity SoS, and does not yield a clear enough picture of the bottlenecks characterizing the sector.

Some academic researchers go in greater detail in the assessment of energy security. Eisel, et al. (2016) suggest an energy security matrix that includes indicators for operational resilience to internal and external dependencies, technical resilience, technical vulnerability, economic dependence, and political affectability, to assess energy se-

2 In 2021 World Energy Trilemma Index, Georgia is ranked 44th among 101 countries.

curity conditions in the country. All these indicators discussed are useful for analysing the big picture of energy policy, however small details in the design and operations of different energy markets could have a vital impact during specific contingencies both in the short and long-term. This is especially true for the electricity sector.

To ensure overall energy security, it is vital to consider the multidimensional aspects of security of electricity supply. This is particularly important for those sectors where electrical energy has no substitute. SoS for electricity is relatively more complicated to analyse compared to SoS for other energy sources. For those energy sources that are easily transportable, substitutable, and are traded on global commodity markets, SoS is primarily analysed through the level of diversification of suppliers, affordability of prices, and environmental impacts. For the electricity sector, however, demand has to be balanced every second. Thus, along with the simple availability of energy, it is also important to have technical capabilities and flexibility to quickly adjust supply levels to match demand. This could be technically hard for a different type of power generation technologies, both for variable renewable energy sources and conventional power generators, such as gas turbines. Furthermore, since the structure of the electricity sector entails a centralized grid, network capacities also play a vital role. From the trade perspective, most countries (like Georgia) are limited with bordering countries and their power networks. Thus, unlike many other energy sources that can be transported across the world where supply and demand times can be adjusted, the electricity sector is more constrained in terms of diversification of suppliers.

For the electricity sector, several global indicators can be proposed. Neelawela, et al. (2019) suggest indicators for the assessment of electricity SoS, that can be compared across countries. Authors propose five dimensions of electricity SoS: (i) system stability/reliability, (ii) accessibility, (iii) economic impact of electricity prices, (iv) sustainable development of the electricity sector, (v) quality of governance. For these dimensions, authors collect different indicators from IEA, OECD and the world bank to assess electricity SoS for the USA, Australia, South Africa, India and Germany.

All these earlier discussions show that evaluation of electricity SoS goes beyond the more general framework created for evaluating energy security and requires explorations in greater detail. Larsen, Osorio and Ackere (2017) provide a comprehensive list of electricity SoS dimensions. These include a wide variety of topics such as power system planning, technical capabilities of the system, price incentives for the market participants, geopolitics and even national security. Specifically, these factors are summarised in Table 1:

Table 1. Factors influencing electricity SoS

	Factor	Description
1	Generation adequacy	underlines the importance of the system's ability to meet local demand.
2	Resilience	ability of electricity system to reduce duration and size of disruptive events.
3	Reliability	quality of service and capability of the system to provide uninterrupted service.
4	Supply flexibility	vital for very short-term variations in electricity demand and underlines the importance of generators, that can meet sudden imbalances.
5	Conditions of the grid	conditions of transmission and distribution networks is vital for the smooth operation of the whole electricity network to avoid power outages, line congestion and other similar issues.
6	Demand Management	demand side management approaches, especially with greater decentralisation of power supply, improvement of information flows and liberalisation of the electricity market.
7	Regulatory Efficiency	parts of electricity markets, such as the operation of transmission and distribution network still represent a natural monopoly. This is since unit costs of transmissions and distribution decrease with a larger size of the network. It is vital to ensure that these monopolies are regulated in a transparent and efficient manner.
8	Sustainability	power sector sustainability entails producing such developments that decrease fossil fuel dependence of the power sector, ensuring a smaller environmental footprint while sustaining the profitability of suppliers.
9	Geopolitics	political concerns and relations between countries can be an important determinant for electricity SoS. Therefore, dependence on a small number of partners is undesirable, especially considering highly regulated markets in most countries.

10	**Socio-cultural factors**	are ones that can influence investment climate in electricity, through raising environmental concerns within communities, issues of land ownership and others. Socio-cultural factors can also be used for influencing energy policies in countries through soft power.
11	**Access**	represents the physical availability of electricity to a large share of the population. Easy access to population and business are also vital for ensuring security of the electricity system.
12	**Terrorism**	centralisation makes the electricity system vulnerable to terrorist attacks that could cause large losses in economy and society.

Source: (Larsen, Osorio and Ackere 2017)

By listing and discussing all these dimensions Larsen, Osorio and Ackere (2017) highlight the multidimensional nature of electricity SoS. When reviewing these dimensions, it is important to note that some issues create disruptions of supply in the short-term after which the system can fully recover to its normal operation. These are factors such as resilience, reliability, conditions of the grid and terrorism. While others, such as sustainability, regulatory efficiency, generation adequacy and geopolitics can create long-term issues for the electricity SoS that could be reflected in a decrease in availability, frequent disruptions, or load shedding.

In addition, these dimensions by Larsen, Osorio and Ackere (2017) show several potential trade-offs between different goals of SoS. For instance, supply flexibility is often provided with conventional power generators, such as combined cycle gas turbines (CCGT)[3]. However, this negatively influences the environmental sustainability goal and creates the demand for natural gas, supply which might be related to geopolitical issues[4].

An interesting paper studying tradeoffs that are inherent to different electricity policy choices is that by Ropke (2013), which studies some of these trade-offs for electricity SoS in Germany. Specifically, the author develops a methodology for a cost-benefit analysis to compare policies for integrating a larger share of variable renewable energy sources (VRES) in the power system. In the model, the benefits are quantified as value for a more secure electricity supply, while costs refer to the additional investment needed in the grid for integrating VRES. To apply this approach, the author develops an indicator for the value of security of supply (VoSS).

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[3] This is particularly true for the approaches used in the Georgian electricity market.

[4] Recent developments on Europe's gas crisis is problematic for electricity supply security as well, since prices have been substantially rising due to supply disruptions induced by Geopolitical factors.

The VoSS requires estimates of load, system average interruption duration index (SAIDI) and value of lost load (VoLL)[5]. Simple multiplication of these three estimates is suggested to yield VoSS that could be used as a measure of benefits from a more secure electricity supply.

The trade-off between environmental sustainability of electricity supply and SoS is underlined on a residential customer level by Motz (2021). The author uses a survey approach and gives respondents alternatives for different renewable and non-renewable supply mix. This is done to estimate willingness to pay (WTP)[6] for a more sustainable electricity supply. The research uses the contingent valuation method using a discrete choice experiment conducted in Switzerland. Such surveys and experiments are important for anticipating and addressing challenges related to the opinion of the general public associated with different electricity generating sources. Furthermore, estimated WTP and WTA values can be used for different modelling and decision-making processes, such as conducting a cost-benefit analysis of projects.

Different types of literature on different indicators of electricity SoS are comprehensively reviewed in Spersad, Degefa and Kjolle (2020). Fundamentally, they group the potential issues affecting SoS in the electricity sector in two main categories: **power supply interruptions** and **power quality phenomena**. *Supply interruptions* include issues of energy availability, capacity, and possible component failures. *Power quality phenomena* include: voltage magnitudes, voltage waveforms and frequency quality. Interestingly, in this framework of electricity SoS one can potentially identify both short-term issues, such as capacity shortages, and long-term issues of energy availability. The authors of the paper provide relatively limited analysis of the literature regarding the commercial viability of the power systems and their impact on electricity SoS. However, the framework suggested by Spersad et al. (2020) remains very useful for the purposes of analysing electricity SoS issues. Thus, in this policy paper, we will be building on this framework, integrating it with the addition of commercial viability both to short-term and long-term issues of electricity SoS in Georgia. It is also noteworthy, that the quality phenomenon of electricity SoS is primarily dependent on transmission and distribution networks that represent natural monopolies. Consequently, commercial viability in relation to power quality is an issue of a stricter regulatory environment with less space for incentives through prices. As a result, in this policy paper, we are primarily concentrated on power supply interruptions and the role of commercial viability to review these issues of Electricity SoS. Figure 1 summarises this modified framework.

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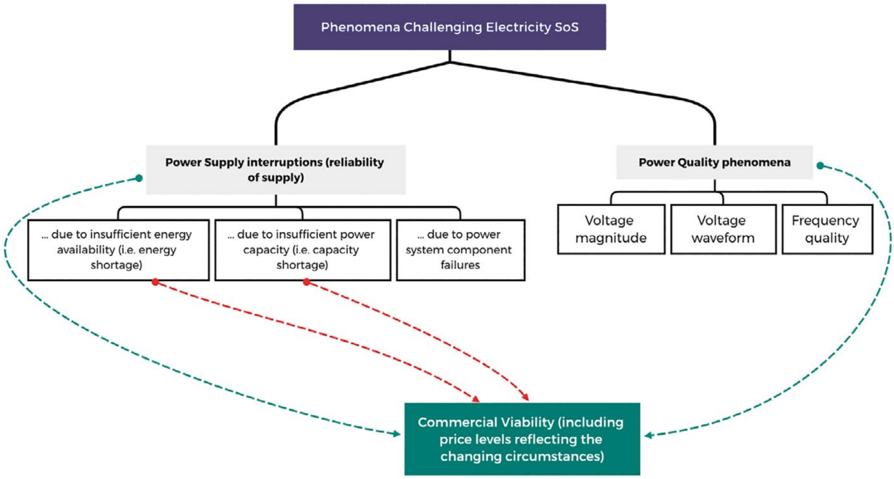
5 SAIDI measures the average amount of time per year that the power supply for a customer is interrupted (CEER 2008). As for VoLL the author uses estimates of value added of economic sectors and their respective electricity use to calculate the value added generated per kWh, that represents VoLL.

6 Or willingness to accept (WTA) for lower SoS.

Figure 1 – Framework of Electricity SoS



Source: Adapted from (Spersad, Degefa and Kjolle 2020)

Electricity SoS consists of many different short-term and long-term aspects, that could determine supply security. For example, in the short-term (e.g. during daily and hourly market operations), conditions on the market can determine capacity shortage, that might not be available due to issues of supply flexibility. In the long-term, due to a lack of investments, issues of energy availability and power capacity could arise as well. Thus, to assess electricity SoS it is important to observe both short-term and long-term issues, that are normally reflected in details of how electricity markets are operating technically and commercially. Furthermore, understanding linkages between commercial outcomes of the market, their influence on future technical conditions and capabilities of the electricity system is important as well.

An overarching indicator that should ideally reflect developments in different layers of the electricity market (e.g., intra-day, day-ahead, markets for different ancillary services) are prices. In an ideal setting, prices for different services (such as ancillary services, imports etc.) on the electricity market derive from the state of the system and functioning of the market. The evolution of these prices influences investment patterns in the long-term. Ideally, this incentivises the optimal development of the sector. For this to work, the development of prices should be able to provide vital signs for future developments of the sector in agreement with electricity SoS needs. For instance, assume the shortage of capacity (or existing generators are not able to provide supply flexibility), this should be reflected in higher prices for ancillary services. If this tendency is sustained in the long-term, it will signal the investors which type of power plants to develop. Although, in many markets, this is easier to conceptualise, then observe in practice, since prices arising at various layers of the power market are highly regulated, especially in Georgia.

In a regulated environment, it is very hard to properly estimate future developments, navigate among conflicting interests and trade-offs. From the regulator's perspective, there can be a substantial number of changing circumstances, that cannot be fully reflected in any tariff setting methodology (e.g. exchange rate fluctuations, peak loads, insufficient supply flexibility). Furthermore, while setting the tariffs many conflicting interests can arise that can influence the final tariff outcome. For instance, it might be important to properly remunerate hydropower plant with the ability to save energy over seasons, or months, however, due to power affordability goal, the regulator might decide not to have different prices over seasons. Thus, without proper price signals, the existing market operators and potential investors might not have enough information to act for the needs of the market. More importantly, without proper price incentives that will be reflected on different layers of the electricity market, participants and investors might not act to increase electricity SoS.

To identify the existing bottlenecks in a regulatory framework and incentives for market participants in the provision of greater electricity SoS, it is important to analyse the existing prices and development tendencies on the wholesale electricity market. In an ideal setting with well-functioning wholesale electricity markets, information about prices are available on its different layers. Information about energy availability in Figure 1 can be analysed by looking at tendencies in price data on intra-day and day-ahead electricity markets, as well as in long-term bilateral contracts. As for sufficiency of capacity and flexibility of supply in Figure 1, those can be observed by analysing price tendencies from the market for ancillary services, such as contingency and regulating reserves[7].

In a highly regulated electricity market like Georgia, this price data is not yet available. However, a tentative analysis can be conducted on the existing regulated prices to identify the current tendencies, drawbacks in regulation and incentive framework for different market participants. Although this analysis will not allow to precisely identify all existing challenges for electricity SoS, the most important drawbacks can be highlighted. It is also important to mention that we do not analyse prices on the part of the market that can be considered as a natural monopoly, such as power transmission and distribution tariffs. Our aim is to keep in the framework of supply interruptions in Figure 1 and analyse the price factors that influence the availability of energy and needed capacity at each period. As explained earlier, commercial viability is vital for this part of the market, where many different participants are involved and competition for the provision of different services could lead to important price signals in the long-term. This is unlike quality phenomena that represent natural monopolies on the electricity market and its commercial aspects are fully regulated. Thus, we do not analyse aspects of grid resilience and issues of commercial viability of its current tariff regulations.

7 In some markets with nodal prices, even more comprehensive information about developments in different locations of the system could be reflected in prices.

3. TYPOLOGY OF PRICES ON GEORGIAN ELECTRICITY MARKET

Currently, on the Georgian power market trades happen either through direct contracts or as balancing electricity, through the market operator[8]. Direct contracts are signed between power generators and wholesale customers (including utilities). Prices for direct contracts are not public and, to the best of our knowledge, no policy research is available in Georgia that provides any statistical analysis of those prices. Balancing electricity aims to cover variability in load. However, on the Georgian electricity market, it also includes ancillary services, capacity reserves and part of imports purchased by the electricity system commercial operator (ESCO). As a result, prices for balancing electricity reflect a common price for the mix of different services and regulated tariffs.

The formation of the balancing electricity price is regulated by the decree of the Minister of Energy #77 from the 30th of August 2006, Article 14. The decree sets the market rules for all types of power plants including ones providing guaranteed capacity (contingency or regulating reserves) and imports. For the power plants (mainly HPPs) that are regulated by GNERC with fixed price or price ceilings, balancing price is set to their respective regulated tariffs. For those providing guaranteed capacity (TPPs), the price is set to the price ceiling set by GNERC. The balancing electricity also includes purchases of power within the framework of power purchase agreements signed with the newly built power plants. Furthermore, for the purchase of balancing electricity from deregulated plants, from September to May of each year the purchase of electricity happens with the highest price ceiling set to the regulated HPP, while for the rest of the year, the lowest fixed tariff of regulated HPP applies. A similar rule applies for the purchase of balancing imported electricity, however, in this case, seasonal prices apply so that ESCO should not pay the importer a larger price than the one set by GNERC's price ceiling[9]. While technically GNERC sets a price ceiling for electricity imports the regulation is non-binding.

The price ceiling is calculated with the following formula:

$$T = \frac{T^{IMP}E + U^{cust} + U^{reg} + U^{serv} + U^{bank}}{E}$$

[8] Georgian Energy exchange is already established and is being tested with simulated trades taking place. After energy exchange becomes operational, electricity will be also traded on intra-day and day-ahead markets.

[9] It must be noted, that electricity can be imported by other customers of wholesale electricity market as well, however since this is not going to be balancing electricity, those import prices and conditions will be agreed through bilateral contracts.

Where, T is the import price ceiling, T^{IMP} import price set in the bilateral agreement between ESCO and electricity importer, E is the factual amount of imported electricity, U^{cust}, U^{reg}, U^{serv}, U^{bank} are fees paid for customs, regulation, ESCO services and bank services. It is evident from the formula, that this price ceiling does not set any limitations on actual prices for which imports can be made in Georgia if the imports are planned and with a pre-agreed bilateral agreement. As for the imports made during the market operations without a bilateral agreement signed, those are treated with the same regulation as the purchase of balancing electricity from deregulated power plants outlined earlier.

Guaranteed capacity is a form of ancillary service provision on the current Georgian electricity market (along with balancing electricity). Provision of this service is regulated with government decree #193 of 15th of June 2010 which sets both specific power plants[10] that are remunerated for provision of guaranteed capacity and respective amount (i.e. MW) of guaranteed capacity for each power plant selected. Guaranteed capacity payments are provided per day of readiness of the guaranteed capacity provider. It is at the disposal of the dispatcher to use it based on operational needs and the dispatcher confirms the readiness of the power plant for each day. Based on the amount of guaranteed capacity the GNERC calculates daily payments. Furthermore, for the sale of electricity, the above amount of guaranteed capacity GNERC regulates the prices for thermal power plants with price ceilings. The guaranteed capacity rules are summarised in Table 2 below:

Table 2 – Amount of guaranteed capacity and daily guaranteed capacity payments[11]

Thermal Power Plant (TPP) Name	Guaranteed Capacity (MW)	Daily Guaranteed Capacity Payments (GEL)	Unit Price of Guaranteed Capacity (GEL / MWh)	Price Ceiling (GEL / MWh)
Gardabani Energy block #9	180	69,649	16	158
Gardabani Energy block #3	100	21,635	9	172
Gardabani Energy block #4	100	23,594	10	172
Air Turbine Power Plant	60	40,585	28	149
Gardabani CCGT	162	423,289	109	113

Source: GNER, government decree #193 of 15th of June 2010

10 All generators providing guaranteed capacity are thermal power plants.

11 For per MW price ceiling on thermal power plant maximum price is taken from those set with GNERC methodology.

In guaranteed capacity payments ESCO serves as an intermediary, while the responsibility for payment of guaranteed capacity lies on buyers of guaranteed capacity that are distribution licensees, direct customers, and exporters. The payment is made proportionally based on their factual total consumption of electricity or share in exports. Table 2 demonstrates that even if guaranteed capacity is fully utilized[12], the unit prices of guaranteed capacity per MWh are low (except for Gardabani CCGT). However, since guaranteed capacity payments are made regardless of using contracted energy during the day, with larger idle capacities the unit prices per MWh could increase substantially compared to other regulated prices (more details below) and price ceilings for TPPs.

From the perspective of electricity SoS, large values for guaranteed capacity payments provide a substantial incentive for this important role for both energy availability and power capacity. However, drawing a conclusion that guaranteed capacity payments lead to efficient investments for the provision of ancillary services could be a bit misleading. This is because guaranteed capacity regulation covers only TPPs and does not provide any incentives for other power plants that could potentially supply similar services to the electricity grid. In the context of the Georgian electricity sector, these could be large hydropower plants with energy storage capabilities. In addition, the TPPs benefit from a government-mandated low tariff for natural gas (that is USD 143 per thousand cubic meters of gas), that is provided only for the existing thermal power plants by the state-owned Georgian Oil and Gas Corporation (GOGC)[13]. Therefore, the profitability of any investor in thermal power plants fully depends on the government mandate. Thus, despite incentives through guaranteed capacity payments, the regulatory environment is such that it indirectly closes the market for new investments. Furthermore, guaranteed capacity payments are the only incentive scheme that is directly paid for the provision of ancillary services to the market. Consequently, there are no incentives for other power plants (i.e. hydro with storage) to plan their generation or invest in the provision of capacity services.

As mentioned earlier, the prices are also regulated for the hydropower plants. Specifically, GNERC sets tariffs for power plants with large installed capacity, that have been privatised or are in government ownership. Table 3 summarises these price regulations. This strict price regulation for hydropower plants aims to keep end-user prices relatively low. This serves the overall affordability goal of energy security. However, this indirectly prioritises usage of power and capacity from these power plants, crowding out deregulated and newly built power plants. Such a rigid prioritisation stimulates market operators to always use regulated cheap energy, rather than considering short and medium-term development of the load and trying to use storage capabilities optimally. Thus, while trying to achieve affordability goal, these price reg-

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12 Full utilization of guaranteed capacity is a rare occasion, since provision of contingency reserves is also vital for secure operation of the system.

13 The GOGC itself is also an owner of the largest Gardabani CCGT.

ulations also disincentivise energy availability through making new entrants on the market less competitive compared to regulated power plants. Furthermore, these tariffs also apply for selling balancing electricity that is one of the forms of providing ancillary services by HPPs with storage capabilities. However, such price regulation does not create an incentive for different ancillary services, such as seasonal storage or regulation from the perspective of power plants' operators as well. This is because despite the time when electricity is sold, the price will be the same. Thus, these power plants are incentivised to sell as much electricity as possible on the spot and preferably at the price ceiling level. As a result, these power plants with capabilities to store energy over seasons do not have incentives to move their generation to peak seasons. Consequently, despite supporting affordability component of electricity SoS, the current price regulations disincentivise components of electricity SoS, such as energy availability and sufficiency of power capacity.

Table 3 – Regulated prices for hydropower plants

Power Plant Name	Type	Ownership	Tariff Period	GEL / MWh	Installed Capacity (MW)
Enguri HPP	Fixed	Government	01.01.2021 – 01.01.2024	18.57	1,300
Vardnili HPP	Fixed	Government	01.01.2021 – 01.01.2024	25.65	220
Vartsikhe HPP	Ceiling	Private	Not Specified	12.50	184
Jinvali HPP	Ceiling	Private	Not Specified	27.21	130
Lajanuri HPP	Ceiling	Private	01.01.2021 – 01.01.2024	27.68	114
Gumati Cascade HPP	Ceiling	Private	01.01.2021 – 01.01.2024	24.94	70
Dzveruli HPP	Ceiling	Private	01.01.2021 – 01.01.2024	46.53	80
Rioni HPP	Ceiling	Private	01.01.2021 – 01.05.2022	14.36	51
Khrami 1 HPP	Ceiling	Private	01.01.2019 -31.12. 2021	91.47	113
Khrami 2 HPP	Ceiling	Private	01.01.2019 – 31.12. 2021	106.14	110

Source: GNERC, ESCO

For incentivising investments in the electricity sector, the Government of Georgia (GoG) gives power purchase agreements (PPAs) to investors. PPA tariffs reflect the price for which ESCO will purchase electricity from the power plants over a certain period of the year. Specifically, PPA fixes the specific one price and the months over which this price will apply for power purchased from the power plant. Observing the practice of PPAs, the price is always fixed in a year, however, these prices might adjust over the years of the agreement[14]. The months and duration over which electricity is purchased, as well as the PPA prices, are defined individually through negotiations with the government. The current framework of these negotiations with the government happens in the scope of several legal acts among which the most important are: (i) the law of Georgia on Public-Private Partnership and (ii) Government ordinance #515 of 31st October 2018[15]. This regulatory framework evolved after fiscal sustainability issues were raised regarding several PPAs by the International Monetary Fund in 2017 (IMF 2017).

The current regulatory framework for PPAs has a multi-step procedure, that makes the process of receiving these price guarantees increasingly complex (ISET-PI 2020). Despite the complexity of the current regulation, the PPAs represent the only mechanism for attracting investments in the sector to ensure energy availability. PPA prices are often an issue of active debate in the Georgian society discussing the viability of a specific project. This is because government involvement and the complexity of procedure often raises questions on corruption and unreasonably high remuneration for energy. An important challenge in these discussions is to find a reasonable benchmark to assess whether PPA price is reasonable considering the current market conditions. This entails analysing not only the current trends but also assessing future developments. Furthermore, there is a trade-off between meeting the electricity affordability goal in the context of SoS and providing reasonable incentives to investors.

Opponents of the projects, such as different non-government organisations, environmental groups and activists often cite different price levels. Import prices are often used as such benchmark even by government organizations (MoF 2019). However, since import capabilities are limited (due to limits on transmission network), this cannot serve as a substitute for a local generation, especially for large scale projects with energy storage capabilities. As for proponents of different projects, they often discuss the important functions of the specific project for energy security of the country. However, in this discussion electricity SoS is often seen

[14] Rules of price adjustments, if applied, are individual those could be increasing based on inflation rate, or decreasing as power plant's profitability increases.

[15] On Approval of Rules and Conditions for Submission to the Ministry of Economy and Sustainable Development of Georgia of Proposals about the Feasibility Study of Construction and/or Construction, Ownership and Operation of those Power Plants, which are not the Projects of Public and Private Partnership and Consideration of these Proposals.

as a conceptual term with very limited practical meaning. Therefore, none of the stakeholders of the sector can suggest a benchmark, that can reflect the full complexity of services that power plants (especially, hydropower plants) provide to the electricity sector.

The existence of one value that can represent such benchmark is questionable since it should include the cost of multiple services provided by a potential power plant. These should include both energy availability and power capacity-related services. In a setting of a developed electricity market, one could simulate an electricity sale by potential power plants on different layers of the wholesale electricity market (day-ahead, intra-day, or ancillary services) and assess the cost-effectiveness of the PPA price. However, in the Georgian market context where an assessment of costs for ancillary services is not available, while many prices on the wholesale electricity market are rigid to reflect the current development tendencies, it is impossible to conduct such a modelling exercise.

A more advanced structure for the PPAs could theoretically be a model with multiple prices over different seasons of the year and for the provision of different services e.g., energy availability, sufficient capacity, or idle capacity. Having different prices for the provision of different kinds of services and in different time periods could potentially stimulate more optimal planning of power generation from the perspective of power plant operators. This could incentivise power plants to operate electricity SoS needs of the system. Lastly, it could also support greater transparency on the market and in the society by demonstrating what are the payments provided for different activities of the power plants.

To summarise, the current regulatory framework on the Georgian electricity market does not reflect full costs for electricity SoS. These are services related to energy availability and the provision of sufficient capacity. Guaranteed capacity is not the unique mechanism for the provision of sufficient capacity (regulating, or contingency reserves), while the provision of these services by HPPs is not transparently reflected in their regulated tariffs. Furthermore, since regulated prices are fixed for the whole year, they do not create any incentives for moving generation between different time periods. Lastly, this lack of transparency on different layers of the wholesale electricity market creates an issue of selecting a proper benchmark for assessing PPA prices for new investments in the power generation sector.

4. ANALYSIS OF PRICE ON GEORGIAN WHOLESALE ELECTRICITY MARKET

Comprehensive analysis of the prices on the Georgian wholesale electricity market would require the existence of a publicly available dataset of all direct contracts with respective prices and quantities. Unfortunately, currently, direct contracts are treated as commercial secrecy and none of the Georgian electricity market authorities publishes this dataset. Thus, we base the discussion in this section of the report only on publicly available data sources. Data published by Electricity System Commercial Operator, Georgian State Electrosystem (GSE) and Georgian National Statistics Office (Geostat).

As discussed earlier, the electricity balancing price is a composite value that summarises prices for different services on the market. Figure 2 represents balancing electricity prices in USD per kWh and the share of balancing electricity in total supply. The monthly data is available from 2016, thus, it is not sufficient to conduct a more complex statistical analysis. The average balancing electricity price is 5 US cents per kWh, with prices varying between 3 and 6 cents. The trends of balancing electricity prices are stable and characterised by certain seasonality. Calculating a simple correlation coefficient shows that there is a 60% positive correlation between prices and the share of balancing electricity in total supply[16]. Balancing prices are growing with the share of the balancing electricity, while they decrease when the share is low highlighting a seasonal pattern. This seasonality is inherent from the regulations of remunerating local generators for supplying balancing electricity as discussed in the previous section when different regulations apply between May and September and the rest of the year. Furthermore, the share of balancing electricity in total supply has increased substantially over time, with seasonal changes becoming less evident. This might be related to two reasons (i) substantial increase in load, and (ii) increase in the share of energy traded with PPAs that is included in balancing electricity. Although, this is probably due to both factors together.

From the electricity SoS perspective, balancing electricity prices represent a mix of prices for both energy availability and capacity. This is because, it includes balancing electricity from guaranteed capacity providers, regulated HPPs and power plants operating in PPA framework. This mix of prices does not allow the identification of possible challenges either in energy availability or capacity components.

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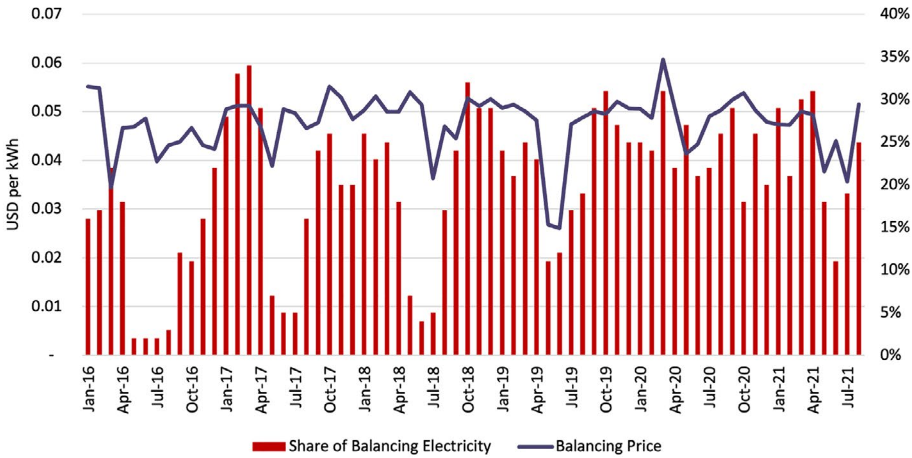
[16] Data on the Figure shows, that share of balancing electricity increased after 2018. Analysis of correlation for two periods of before July 2018 and after shows, that positive correlations are still high 44% and 60% respectively.

Furthermore, the inclusion of fixed prices from regulated HPPs used for balancing purposes creates a downward bias in this indicator.

Figure 2 – Balancing Prices (USD / kWh) and share of balancing electricity in total supply



Source: ESCO

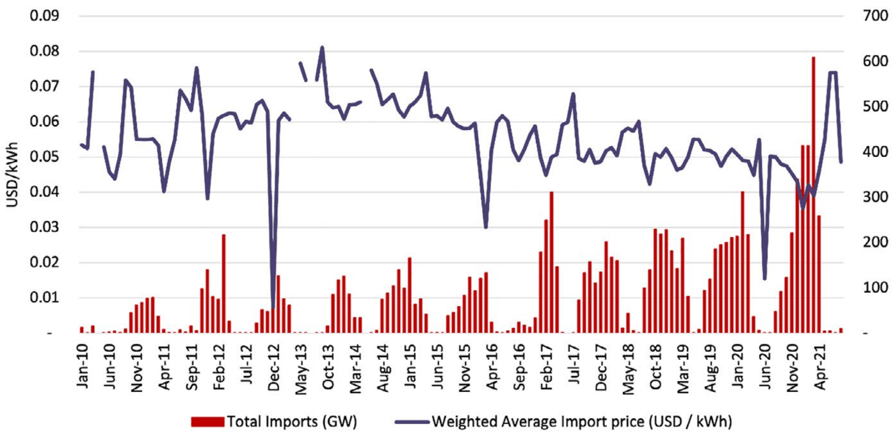
Electricity import prices are one of the important components of balancing electricity. In 2020, 37% of balancing electricity were electricity imports and 70% of imports made in Georgia were through balancing electricity scheme. Import prices in Georgia are not published for reasons of commercial secrecy. However, to gain an insight into import prices, trade data from the Georgian National Statistics Office (Geostat) can be used to calculate a price index that will represent an electricity price for unit imports without transmission and distribution prices and customs[17]. Calculating such monthly price index gives an insight into the scale of those prices and their development tendencies. This can help characterize the tendencies of development in prices for energy availability from imports.

Figure 3 demonstrates the development of these electricity prices since January 2006. These prices and quantities clearly follow a seasonal pattern with amounts being relatively low in summer months compared to winters. It must be noted that compared to the 2010-2015 period, the overall price levels have decreased during the last years. It is also important to note that world energy prices dropped due to the global pandemic and lower demands in 2020. Something that also partly contributed to these tendencies in import prices is the devaluation of the local cur-

[17] The price index for imports is simply a unit price dividing value of imports on quantity imported. Import quantities are available from ESCO's electricity balances. The value of these imports in USD is available from Geostat's trade database, that counts the customs value of the product before internal transmission and distribution in the local network.

rencies in the region, compared to the US dollar since 2014 that could have influenced these price levels.   A substantial increase in imports over the years is an important aspect to monitor from the electricity SoS perspective. Most electricity imports in Georgia happen from Azerbaijan and Russia (88% in 2019). This increases the dependency of Georgia's electricity network on neighbouring power systems and along with lack of capacity could negatively influence overall system resilience[18]. Increasing import amounts represent a challenge for electricity SoS since further increases could lead to the country reaching its transmission capacity limits. Furthermore, substantial import price volatility represents an important risk for commercial viability of the system due to changing circumstances with the trading partners.

Figure 3 – Electricity Import prices and quantities (USD/kWh and GWh)



Source: ESCO

Volatility in time series of import prices and lack of data makes it harder to make a definitive assessment of import price levels. One of the ways to address this data challenge is to observe the distribution of import price indices and identify frequencies of different prices. Observing the data between September 2006 and August 2021, it seems that the most common prices are between 5-6 US cents per kWh. This price level is followed by prices between 6-7 US cents and 4-5 US cents per kWh. Consequently, judging long-term import prices, one could assume that that price level is around 6 US cents. Alternatively, for simulation purposes, these data from trade prices could be used for identifying import price frequency distribution and generating random numbers in ranges of this distribution.

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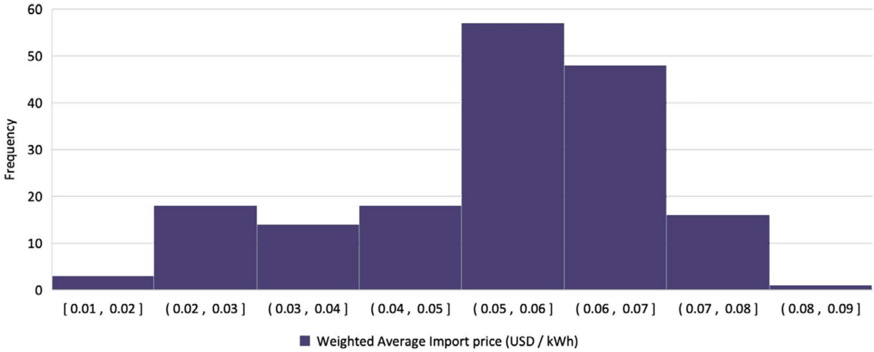
18 Contingency in a neighbouring system could influence the local power supply, both through inability to supply imports, or due to the outage spreading to the local system (Larsen, Osorio and Ackere 2017).

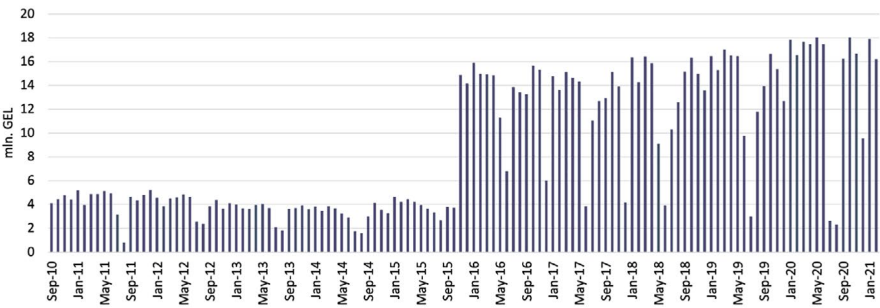
Figure 4 – Frequency Distribution of Electricity Import Prices (USD / kWh)



Source: energy.gov.ge

Guaranteed capacity payments are an important price component on the electricity market as well, that substantially influences electricity SoS. This is because guaranteed capacity payments represent an important part of the sufficiency of capacity from the electricity SoS framework (Figure 1). Observing the data from guaranteed capacity payments in Figure 5, they have substantially increased after building Gardabani CCGT TPP in 2016 that represents both the most flexible generator, but also the largest receiver of monthly guaranteed capacity payments. Unfortunately, data on monthly use of guaranteed capacity by dispatchers is not available. It is, therefore, impossible to calculate unit costs, information that would be vital to understand electricity SoS cost. However, amounts of power used for regulating purposes or as a contingency reserve are not public, therefore, data does not reflect specific costs for different services. Furthermore, some of the ancillary services are provided by HPPs as well (through balancing electricity scheme) that is not reflected in these values. Consequently, to understand tendencies in the provision of capacity-related services, only unit costs for guaranteed capacity will not be sufficient and more detailed research is required on this topic.

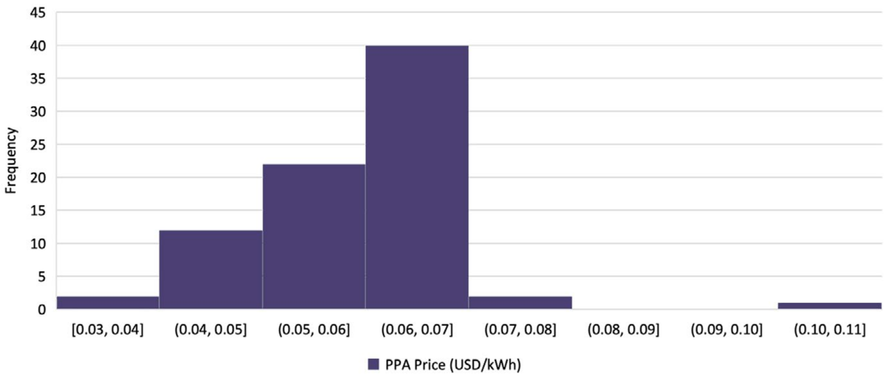
Figure 5 – Guaranteed Capacity Payments (mln. GEL)



Source: ESCO

The previous section underlined the importance of PPA prices for electricity SoS. It is important to understand the existing incentives for the availability of energy and capacity in the Georgian electricity sector. Figure 6 represents the prices of power purchase agreements for the existing projects since 2011 among which some are already commissioned, and others are in different stages of development. As figure 6 demonstrates, most PPA prices vary between 4 and 7 USD cents per kWh. It is noteworthy that import prices are more widely distributed with a larger number of prices reaching levels between 6 and 7 US cents per kWh. Consequently, even compared to import prices from the SoS perspective, as well as in terms of affordability, locally generated power might still provide greater security. Interestingly, data on PPA prices also shows another interesting fact. Its dynamics does not follow any tendency and varies around 6 US cents. This highlights that PPAs prices did not reflect any changing circumstances on the market and needs of electricity SoS.

Figure 6 – Distribution of Prices of Power Purchase Agreements (USD cent per kWh)



Source: energy.gov.ge

Tendencies analysed in this section about electricity prices show several existing drawbacks in approaches of operation on the current electricity market in Georgia and highlight important issues about information transparency. From the electricity SoS perspective, the current approach of accounting balancing electricity prices does not allow differentiation between energy availability and sufficiency of capacity. The only tendency the indicator highlights is the overall seasonal tendency of larger available energy in summer compared to the winter months. Import prices are volatile and lack of transparency about them does not allow estimation of causality between their value, imported electricity quantity or conditions on trading partners' market. The lack of transparency is also an issue for guaranteed capacity payments that do not allow the estimation of unit costs for these values. Since guaranteed capacity payments are not differentiated between different services provided for the needs of electricity SoS, it is also unclear what is a different cost for availability and capacity services. Lastly, a frequency distribution of PPA prices highlights that like import prices their value also varies around 6 US cents. Furthermore, there is no tendency identified through looking at PPA prices by date of signature.

5. PRICE FACTORS IN GEORGIA'S ELECTRICITY SOS

Price incentives are an important tool for ensuring supply-side security of the electricity market. Georgia has been going through a lengthy electricity market reform since 2016, toward the introduction of the day-ahead and intra-day electricity market that has been postponed multiple times and is expected to start its operations from the beginning of 2022. The introduction of electricity exchange is important for competition between producers to provide different electricity SoS services, as well as greater price transparency. This is expected to have a positive impact on energy availability. It is also expected to decrease the need for balancing electricity since the intra-day market will enable more short-term agreements between sellers and buyers. This will also ensure better remuneration for those power plants that can provide the needed capacity and store energy over time. However, its impact on the sufficiency of capacity will be limited. This role lies on the market for ancillary services that are still going to be provided with the current schemes: balancing electricity and guaranteed capacity payments. As shown in the previous sections of this paper, the guaranteed capacity payments scheme lacks transparency and does not incentivize power plants other than TPPs for providing ancillary services.

The Government decree 246 of 21st April 2020, introduced the conceptual model of the electricity market that includes the market for ancillary services. However, a conceptual framework for this ancillary service market is not identified in the decree. Thus, the market structure, its operations and the type of services that will be traded on this market are not clear. Considering all these changes, after which some of the electricity SoS related challenges will be better reflected in prices, we list the issues that are not expected to be resolved with the introduction of the intraday and day-ahead electricity market.

The previous section has shown some transparency challenges on import prices and guaranteed capacity payments that hinder the identification of ongoing tendencies in SoS. Furthermore, the current practices of PPAs also lack incentives for the provision of electricity SoS related services. These challenges are grouped in four categories below:

i. lack of clear vision on the development of the market on ancillary services and role of different players in its development;

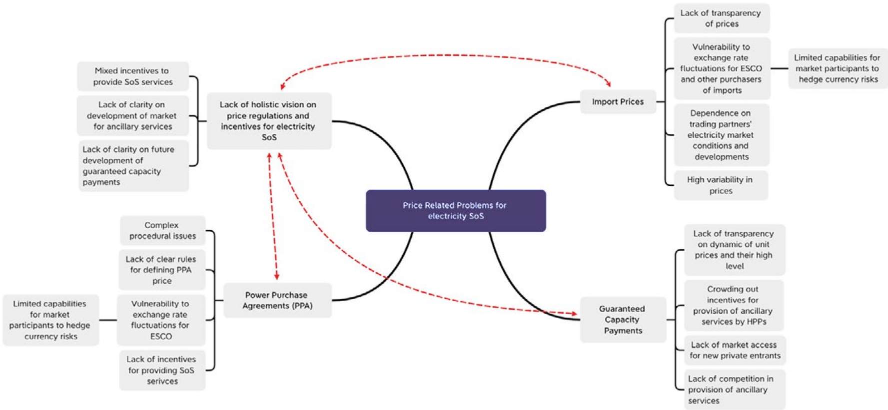
ii. problems with guaranteed capacity payments;

iii. issues with electricity import prices;

iv. use of power purchase agreements for higher electricity SoS.

These issues are summarised in Figure 7 and discussed in greater detail below:

Figure 7 – Problem mapping for price related issues in Georgia's electricity SoS



Source: Developed by author

The development of an ancillary services market with proper remuneration is vital for incentive-based electricity SoS. This will ensure, that ongoing developments on the market are reflected in a relevant way, the system operates minimizing costs and is sustainable in the long term. Currently, there are mixed incentives for providing Electricity SoS services in Georgia. Guaranteed capacity payments ensure financial stability to the generators that provide this service. However, due to regulatory constraints, they are only available for TPPs and are not available for HPPs, especially ones that are newly built. PPAs include a condition for selling electricity over specific periods (during those months, when there is a lack of energy availability) to link the payments with electricity SoS. However, there are no specific tools for incentivising capacity availability during peak demands for hydropower plants operating under the framework of PPAs. Also, it has to be noted that inability to provide needed capacity services through PPAs could also jeopardize the integration of variable renewable energy sources in the system.

Unfortunately, despite active work on electricity market liberalisation reform and establishment of day-ahead and intraday electricity markets (that is expected to become operational from 2022), the future perspective of the ancillary service market is unclear. It is important to develop a clear vision on how the ancillary service market will be operated.

Normally, two types of services are traded on the ancillary market: (i) regulating reserves and (ii) contingency reserves. The first type of reserves is used for covering daily imbalances, such as sudden peaks or decreases in supply due to generation variability in renewable sources. The second type is used to cover any possible deficit due to contingency, such as outage from component failures in the electricity system. The creation of this type of market and splitting of these services separately means more dynamic and transparent development of prices. Furthermore, it also supplements better conditions for the integration of more variable renewable energy sources into the system and their secure operations. This will make price incentives more powerful as well as support electricity SoS. Furthermore, the establishment of the ancillary service market means decreased need or abolishment of guaranteed capacity payments, as well as other types of balancing services currently traded through ESCO. Thus, important questions that need to be answered are:

- How guaranteed capacity payments will be substituted for TPPs and what will be the mechanism for their remuneration?
- How to integrate PPAs into the ancillary service market and ensure sufficient incentives for newly built power plants to plan and provide for these services?

The guaranteed capacity payments currently provide incentives for TPPs to provide capacity services and not sell those set levels through direct contracts. This is demonstrated well in Table 1 which presents that unit prices in case of full utilization of guaranteed capacity are close to another power plant. Consequently, during different operational circumstances based on utilisation of guaranteed capacity, the unit costs could potentially be even higher. These strong incentives should attract investments in the provision of services related to electricity SoS, however, an entry on this market is limited and highly regulated. As a result, somewhat paradoxically, guaranteed capacity payments crowd out the incentives for the system operators to use HPPs (specifically, newly built HPPs) for providing ancillary services. This is because to minimise system costs, the operator tries to utilize guaranteed capacity payments as much as possible – bringing the unit costs of that energy as low as possible. This structure crowds out the provision of ancillary services by HPPs that could potentially do it for lower costs. Furthermore, since some of the buyers of guaranteed capacity are electricity exporters, this represents an important additional cost and disincentive for selling electricity cross-border during the off-peak periods. In addition, there is a substantial lack of transparency in the provision of guaranteed capacity services. Firstly, it is not clear what are the regulating and contingency reserves within the provided guaranteed capacity and there is no information on how these costs are split. Second, the utilization levels of guaranteed capacity are not public which does not allow the calculation of the unit costs for these ancillary services.

PPAs are another important aspect of electricity SoS in Georgia since they are the main mechanism for attracting investments in new power plants. There are several challenges related to their use. As mentioned earlier, the current schemes for acquiring PPA before project realisation are complex and lack transparency. Furthermore, recent experiences (with Namakhvani HPP, Khadori 3 HPP) have shown that PPAs do not represent a guarantee that the project will be realised as planned on the feasibility study stage. Furthermore, there are no clear rules for defining the

PPA price. Earlier regulation intended to create the environment where different investors could have a bidding procedure for acquiring a specific PPA. However, this process was not successful, since in most cases there was only one candidate. As a result, PPA prices are still defined through negotiations between an investor and the government, without any pre-defined methodology or limit. In addition, exchange rate fluctuation is an important risk for the ESCO that is the counterpart for all PPAs. This is an important commercial vulnerability for electricity SoS that has very limited currency hedging capabilities in the Georgian context.

From the perspective of electricity SoS, probably the most important challenge is that PPAs do not include any incentives for providing ancillary services. Technically, the PPA period is the only constraint that obliges power plants during the annual peak load seasons to supply electricity to the local grid. Otherwise, PPAs do not provide any incentives for power plants to optimize their generation schedules around providing additional capacity during peak periods.

The substantial increase in electricity imports in Georgia over the past couple of years has highlighted the potential importance of import prices for the country's electricity SoS. These prices have an increasingly large impact on the wholesale electricity market and end-user tariffs in the long-term. As shown in Figure 3, they are characterised with substantial variability, not only across the season but over the years. This clearly demonstrates that increasing imports means higher dependence on developments in neighbouring electricity markets, especially those of Azerbaijan and Russia. These developments are reflected in electricity import prices creating a potential commercial risk for the Georgian wholesale electricity market. Large imports from Azerbaijan make Georgian electricity markets more dependent on international natural gas prices as well that influence local power production costs in Azerbaijan and can influence import prices to Georgia as well. The current transmission capacity limits with Russia are 650 MW in Winter and 570 MW in Summer, while with Azerbaijan it's 950 in Winter and 840 in summer. The Ten-Year Network Development of the GSE plan entails increasing these limits to 1600 MW with Russia and 1400 with Azerbaijan irrespective of the season. Despite this increase in import capabilities, these limits underline that imports cannot be increased indefinitely with any of the trade partners. After reaching this capacity limit, the trading partners might decide to control amounts of imports through an increase in prices as well. Exchange rate risks and the limited capability to hedge these fluctuations is an important challenge both for ESCO and other importers. This represents an important challenge for electricity SoS that could potentially affect the solvency of important players on the wholesale electricity market[19].

19 Since around 80% (electricity balance 2019) of prices for final customers are regulated by GENERC short-term increase in electricity prices could have a negative impact on solvency of utilities or ESCO until prices for final customers are adjusted to reflect growth in import prices.

Lastly, to better understand import patterns greater transparency in import prices is needed. This could potentially support research to understand causalities between import prices and electricity market developments in Georgia and among trading partners. Making these prices public could help local electricity market stakeholders (such as civil society organizations and think-tanks) to have a more positive role in the development of the future energy policy oriented towards ensuring electricity SoS.

To summarize this discussion, earlier sections have demonstrated that a comprehensive analysis of electricity SoS in the short and long-term is impossible without a review of price incentives on different layers of the wholesale electricity market. The current conditions on the Georgian electricity market do not allow conducting such a holistic analysis. This is both due to transparency issues as well as the structure of the electricity market that does not allow identification of different vital services provided within the wholesale electricity market. The price regulations, investment support mechanisms and remuneration for the provision of ancillary services should be such that encourages actions towards more security of supply. These could be done with greater flexibility of price incentives over periods. The establishment of a market for ancillary services along with day-ahead and intra-day markets is vital to encourage market participants to supply SoS related services, such as regulating and contingency reserves. To keep costs of ancillary services down it is important to ensure competition on the respective market. All this requires clear planning and answering the question on several important fronts:

- How should the guaranteed capacity mechanism be transformed to integrate TPPs on the market of ancillary services, while keeping them financially sustainable?
- How should the PPAs be integrated in the market for ancillary services to encourage generation planning using outcomes of both energy exchange (intra-day and day-ahead market) and market for ancillary service?
- How should the power plants in the government ownership and regulated price (Enguri and Vardnili) participate in the trade of electricity SoS related services?
- How should the private power plants with price ceiling participate on the market for ancillary services?
- What are the rules for electricity importers to trade on market for ancillary services?

6. CONCLUSIONS AND RECOMMENDATIONS

In this policy work, we used prices on Georgia's power market to explore electricity SoS related challenges. Initially, practices available in international academic and policy research for assessing security of supply were explored. We concentrated on understanding the role of prices in assessing electricity SoS. Afterwards, we reviewed the current typology of prices on the Georgian electricity market, analysed their current regulation and potential role in SoS. Furthermore, the existing tendencies and development of these prices on the wholesale electricity market were reviewed. Lastly, we identified the existing problems this price system creates to electricity security. Based on earlier findings in this section, we develop several policy recommendations to address these issues.

This analysis identified several groups of the challenges that electricity SoS has with the current structure and accessibility of prices on the electricity market. Firstly, the lack of transparency related to prices on the electricity market do not allow an in-depth review and identification of tendencies. In a transparent and well-functioning setting, price should reflect changing circumstances in terms of energy availability and the sufficiency of power capacity. Second, the provision of ancillary services is not remunerated in a way that incentivises generation patterns and investment to provide these services. Third, the existing mechanism of PPAs is very simplistic and does not incentivise the provision of different types of electricity SoS related services. These issues and recommendations are briefly summarised below:

TRANSPARENCY – ensuring transparency is important for security of supply for multiple reasons. It allows international investors to keep track of ongoing market development, identify potential needs of the market and develop investment projects in generation accordingly. Furthermore, greater transparency is vital for identifying problematic developments and challenges to security of supply. Three transparency issues were identified in the current practice. First, ESCO publishes data on the amount of guaranteed capacity, however, total amounts are not informative for understanding unit costs for the provision of these ancillary services. Second, ESCO publishes import quantities and their grouping by a mechanism of these imports (i.e., through direct contracts, or balancing electricity), however, this also does not allow the identification of price levels for imports, unless an indirect and imprecise approach of calculating import prices is applied. Third, balancing electricity represents a mix of services both energy availability and capacity related. Consequently, changing balancing prices don't represent changing circumstances on the market. For these reasons, the first recommendation is to improve transparency in guaranteed capacity payments, import prices and balancing electricity.

Recommendation 1: To allow an analysis of costs for the provision of guaranteed capacity, ESCO must publish utilisation rates for this mechanism. Furthermore, to bring more transparency, while keeping component of commercial secrecy in electricity import prices, ESCO and GSE can create an import price database that will include every import transaction, with respective quantities, prices, and country of origin. Each transaction should be coded so that parties of the import are not identifiable. This kind of data along with GSE's hourly electricity balances can allow building import price forecasting and substantially improve the existing quality of models, both for analytical purposes locally and for international investors. Furthermore, balancing electricity prices represent a mix of both availability and capacity services. Thus, for a better understanding of different tendencies on the respective electricity SoS dimension, it is preferable to split balancing prices based on services that are provided within the mechanism.

INCENTIVES FOR ANCILLARY SERVICES – as identified earlier, the structure for the provision of ancillary services on the Georgian electricity market provides incentives for closed market of TPPs, HPPs do not have the incentive for planning their generation in a way that supports greater electricity SoS. Resolution of the Government of Georgia #246 of April 16th, 2020, sets the concept for a new electricity market model, including the creation of balancing and ancillary service market. This resolution does not show future structure for ancillary services.

Recommendation 2: To enhance clarity in future developments of the electricity market and allow new investors to plan considering the electricity SoS needs GoG and market operators must provide a clear structure of the market for balancing and ancillary services. This must include a mechanism for ensuring competition between all electricity market participants for providing electricity SoS related services. Opening the ancillary service market to the HPPs will contribute to the greater ability of the system to integrate variable renewable energy sources. More VRES itself will contribute to greater energy availability in the system. Furthermore, this should bring clarity on how the current mechanism of guaranteed capacity payments will be phased out after the introduction of a market for ancillary services.

INCENTIVES FOR NEW INVESTORS – the current structure of signing PPAs is bureaucratically complex, while the only government incentive for greater electricity SoS is to mandate power plants to sell electricity exclusively on the local market for a pre-defined number of months. This simplistic approach does not encourage investors for planning their projects for electricity SoS, thus, they concentrate merely on energy availability. A more complex contracting mechanism of providing power for different services (i. e. availability vs capacity) could create incentives for better investment planning. All these aspects limit the investment potential on the Georgian electricity market, both for conventional energy sources, as well as VRES.

Recommendation 3: The Government of Georgia must revise its approach to attract investments in the electricity sector. Specifically, the mechanism of a public-private partnership must be revised to lessen the bureaucratic procedures. Furthermore, the procedure of negotiating PPA prices also needs to be revised creating a methodological approach to guide government decisions and allowing the inclusion of additional mechanisms for adequate compensation for electricity supply security-related services. This will also contribute to greater transparency and informing the public on PPAs, forming an explicit understanding of reasons for different types of compensations. Lastly, the current PPA pricing mechanism must be revised to reflect demands for different electricity SoS services. Multiple prices within PPA can be applied for the provision of different services such as energy availability and power capacity.

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