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REVIEW OF ELECTRICITY MARKET DESIGN CONCEPT

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ACRONYMS

BM	Balancing Market
DAM	Day Ahead Market
DSO	Distribution System Operator
EMDC	Electricity Market Design Concept
EnC	Energy Community
ESCO	Electricity Market Operator
EU	European Union
GNERC	Georgian National Energy and Water Supply Regulatory Commission
GSE	Georgian State Electrosystem
GSP	Grid Supply Point
GWh	Gigawatt Hour
HPP	Hydro Power Plant
HVDC	High Voltage Direct Current
IDM	Intra Day Market
kV	Kilovolt
kWh	Kilowatt Hour
MO	Market Operator
MoU	Memorandum of Understanding
MW	Megawatt
MWh	Megawatt Hour
OTC	Over-The-Counter
PPA	Power Purchase Agreement
PSO	Public Service Obligation
RES	Renewable Energy Source
TPP	Thermal Power Plant
TSO	Transmission System Operator
TWh	Terawatt Hour
USAID	United States Agency for International Development
USS	Universal Service Supplier
VC	Vulnerable Customer
VRE	Variable Renewable Energy
WPSO	Wholesale Public Service Organization

CONTENTS

1. EXECUTIVE SUMMARY

Upon joining the Energy Community (EnC) on July 1st 2017, Georgia committed to a series of transformations in the energy sector to achieve compliance with the relevant European Union (EU) acquis. The future electricity market is based upon the European Union Target Model which is designed to provide an open, transparent environment that supports regional market integration, ensures security of supply and provides electricity to end consumers at fair, cost reflected prices. The wholesale energy market will be bilateral in nature with organized markets to promote the efficiency and transparency of the system, and the retail market will ultimately provide all consumers with the opportunity to choose alternative electricity suppliers.

The government of Georgia is developing a design concept which seeks to identify the transitional steps to the full implementation of the electricity market and describes the institutions and processes required to support the implementation, and the interactions and responsibilities for each of them.

Once fully implemented, the market will have all of the tools to enable the optimization of resources throughout the day, month and year:

- A Balancing Market (BM) to provide a tool for the electricity system operator (TSO) to procure electricity to manage differences between contracted and actual consumption
- A mechanism for the TSO to contract for ancillary services on a competitive basis
- A Day Ahead Market (DAM) to enable participants to modify their bilateral positions to avoid BM risk
- Intraday Market (IDM) to further tune their positions ahead of Gate Closure
- Standardized exchange settled Over the Counter (OTC) contracts
- Forwards market(s) to enable hedging and tuning

The Electricity Market Design Concept (EMDC) document considers some of the specific commercial, political and technical challenges faced by Georgia, which will take time to overcome:

- Georgia is a relatively small market, liquidity will be an issue
- Because of the high proportion of Hydro Power Plants (HPP) in the generation mix, Georgia has surpluses of low cost hydro surpluses in the summer and a high reliance on thermal generation and imports in the winter – marginal pricing will be highly seasonal
- With the exception of Turkey via the High Voltage Direct Current (HVDC) link, it is not currently possible to be simultaneously connected to the neighbouring countries, limiting opportunities for regional electricity exchange
- There is a significant drain on electricity resources in the supply to Abkhazia, which is outside of the electricity market control, but which nevertheless must be catered for
- The are many long term Power Purchase Agreements (PPA) and other contractual arrangements which are incompatible with a liberalized bilateral energy market which also must be accommodated in the design

The introduction of a new and very different electricity trading mechanism is challenging, both in terms of the technologies required to support the necessary systems and processes, and the people in the market who will be operating and trading in the new environment. The Design concept identifies the roles and responsibilities required to manage the electricity market and the transitional steps up to 2026 in which only residential and small commercial businesses remain in the regulated market – the timetable for full implementations is not yet decided.

2. BACKGROUND

2.1 CURRENT ENVIRONMENT

Generation, transmission and distribution (which includes supply to the end user) functions have been legally unbundled in Georgia for some years. The current market model in Georgia provides for generation following[1] bilateral contracts between generators and distribution companies, many of which are between distribution companies and the power plants that they own or manage; and a small number of large consumers of electricity (5 at the time of writing) designated as Direct Customers who have contracts with specific HPPs. With the exception of small HPP plants (less than 13 MW), generation prices are capped for privately owned generators, and are fully regulated for the state owned Enguri/Vardnili cascade which supplies around 30% of total system generation in a year with average precipitation.

Electricity Generation in Georgia is provided by a mix of hydropower plants and natural gas thermal generation. There is an operating wind farm providing power to the grid and plans for further Variable Renewable Energy (VRE) investment, and a recently constructed coal burning plant. Current installed generation capacity totals 4,050 MW[2] in 2017 and in 2018 total generation was approximately[3] 12.1 TWh, total consumption was 13.1 TWh.

In 2018, the generation mix was made up as follows:

HPP - 71%
Thermal Power Plant (TPP) - 17%
Imports - 12%

Total supply was 12.7 TWh.

The transmission system operator is the Georgian State Electrosystem (GSE), a Joint Stock Company 100% owned by the state through the Partnership Fund. It owns the Transmission lines with voltages below 400 kV, the 400 kV and 500 kV lines are owned by Energotrans which is a subsidiary of GSE, and by Sakrusenergo, a company jointly owned by the State of Georgia and Russian state owned JSC Federal Network Company of the Unified Energy System. GSE is the only dispatch licensee.

The transmission network in Georgia consists of 500 kV, 330 kV, 220 kV, 110 kV and 35 kV voltage lines. A 500 kV transmission line through the Caucasus Mountains and 220 kV through Abkhazia connects Russia to the Georgian grid. There is are 500 kV and a 330 kV connections with Azerbaijan, and with Armenia and Turkey at 220 kV. There are also isolated 110 kV connections with Armenia and Russia. There are plans to upgrade the connections with Russia via a 500 kV connection through the Dariali gorge.

A 500/400 kV HVDC connection to Turkey with a capacity of approximately 700MW was commissioned in 2013. Deregulated small, recently constructed HPP (Renewable Energy Source (RES)) has priority access to the line; spare capacity is sold through an explicit auction managed by GSE.

There are two privately owned distribution companies in Georgia, Telasi and Energo-Pro. Network operations and supply are integrated.

There are five energy intensive users taking electricity directly from the transmission network based on bilateral contracts with generators. Three of the five joined the market in 2018.

Electricity Market Operator (ESCO) has the responsibilities in the current market to manage payments falling due for wholesale electricity supply that is not subject direct contracts in the current market and arrange import/export contracts and is a party to several PPA. ESCO also settles the reserve energy provided by the thermal plants in the winter season.

[1]Generation following meaning all output of the generator is taken by the supplier at the negotiated price. There is no particular volume of energy
[2] Source: GSE Annual Report 2017. Source: GSE
http://www.gse.com.ge/sw/static/file/GSE_ANNUAL_REPORT_2017_ENG_FOR_WEB.pdf
[3] Source: ESCO https://esco.ge/en/energobalansi/by-year-1/2018-energy-balance

- There are several new HPP stations with PPAs that provide for guaranteed sales to ESCO for various periods during the year, and several governmental Memorandum of Understanding (MoUs) for new developments that will result in new PPAs
- All TPPs have guaranteed available capacity payments which are settled through ESCO but with Direct Contracts with distribution companies under regulated tariffs for the energy component of their invoice
- There are some arrangements that permit post-2008 small HPPs which have unrestricted priority access to the HVDC interconnector to Turkey

Although participants are not prevented from directly importing electricity, in practice imports are managed by ESCO. The bulk of the commercial arrangements are through direct contracts between the Distribution System Operators (DSOs) and eligible customers; ESCO sells around 15% of the annual total consumption.

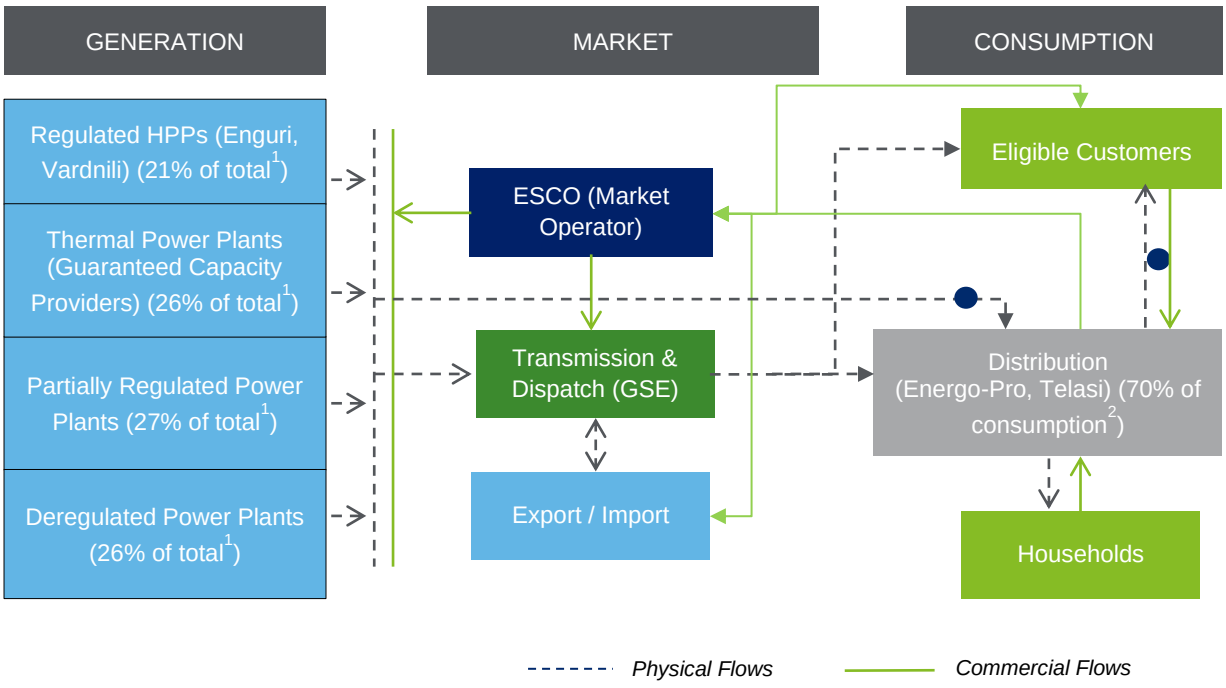
The bulk of electricity imports came from Azerbaijan in 2018, with some supply from Russia and a little from Armenia.

Regarding exports, Turkey was the main market following the commissioning of a 700 MW HVDC link that went into service in 2013. Any generator is permitted to export to Turkey, but as part of an incentive to investors, recent (post-2008) small HPPs have priority access to transmission capacity. However, because of a decrease in prices on the Turkish side of the interconnector, the line is currently under-utilized. In 2018, 383 GWh were exported to Turkey spread over May, June and July. Small volumes were exported to Russia, Azerbaijan and Armenia.

The bilateral contracts exist between distribution companies and generators or 'Direct Customers' (those connected at 35 kV) and generators and are generally for a volume of electricity to be delivered over and agreed time, perhaps weeks or months in duration. They are not firm and are not hourly profiled, so they are not helpful in dispatch planning. There is no process for physical notification of supply.

The figure below shows the current relationships schematically:

Figure 1: Current Structure



In the figure above, the green arrows designate Direct (bilateral) Contracts, the black dashed arrows designate energy flows.

The Direct Contracts specify a price, a delivery period and a tolerance on delivery, for example, a contract may be for 50 GWh +/- 20% for delivery between 1st June and 31st August. The contracts are not profiled and not firm, and there is no obligation to notify the TSO of intended delivery for any

particular hour. GSE dispatches according to recognized operational practice, taking account of demand, reservoir levels, state of TPP plants, import contracts etc.

At the end of each settlement period, ESCO calculates the flows between the contracted parties and notifies them of their payment obligations. Any electricity which has been dispatched outside of contract tolerance is deemed ex-post as balancing electricity and is settled by ESCO.

Most of the wholesale electricity generation is sold to distribution companies and large industrial consumers through bilateral contracts at fixed or capped regulated tariffs. The remainder is defined as balancing energy, managed by ESCO and priced depending on the generation mix used to supply the electricity. The balancing electricity covers the difference between contracted and consumed electricity and is priced at the average weighted price from the tariffs.

3. MARKET DESIGN CONCEPT

The design objective is to create the systems, procedures, institutions and capabilities that will enable the managed migration from the current sector structure to a model that fully implements the target model of the EU acquis in a manner that permits the risks to be controlled for participants in terms of trading, and for retail customers in terms of impact on tariffs. The design must be capable of full compatibility with the provisions of the EU Acquis in the long term and must be capable of delivering protection to non-eligible customers in the short to medium term:

- Strong Regulatory oversight:
  - Market rules to ensure a transparency and fairness in the market
  - Transparent tariffs for natural monopolies
  - Robust systems and processes to monitor market activities.
- All market participants require unimpeded access to their counterparties:
  - the design provides for commercially unrestricted Third-Party access to transmission network for market participants
  - Distribution and supply must be legally unbundled to allow unimpeded Third Party Access to the distribution network;
  - Access to organized markets for properly qualified participants.
- Market Prices:
  - Day ahead, Intra-day, and balancing prices should be established through organized markets
  - Transparent tariff setting for natural monopolies
  - Stringent monitoring to avoid abuse of market power
  - All consumers must be able to choose suppliers.
- Unbundling:
  - The Transmission System Operator should be legally unbundled from any supply or generation companies; the two Distribution System operators must be fully internally separated from supply activities.

The Market Concept Design seeks to manage the risks inherent in a transformational process by gradually opening the market to large consumers by giving increasing access to de-regulated generations companies until the whole market operates on a commercial basis.

3.1 TARGET MODEL

The draft Design Concept identifies the actors in the new electricity market:

- Market Operator
- Transmission System Operator
- Distribution System Operator
- Electricity Generator
- Trader
- Supplier
- Qualified (eligible) Customer
- Public Service Provider

It also describes the various markets required to facilitate trade:

- Day Ahead Market
- Intraday Market
- Bilateral Contracts Market
- Balancing Market

A draft implementation schedule is included in the Design Concept which identifies the progressive roll out of eligible consumers of electricity, reproduced below:

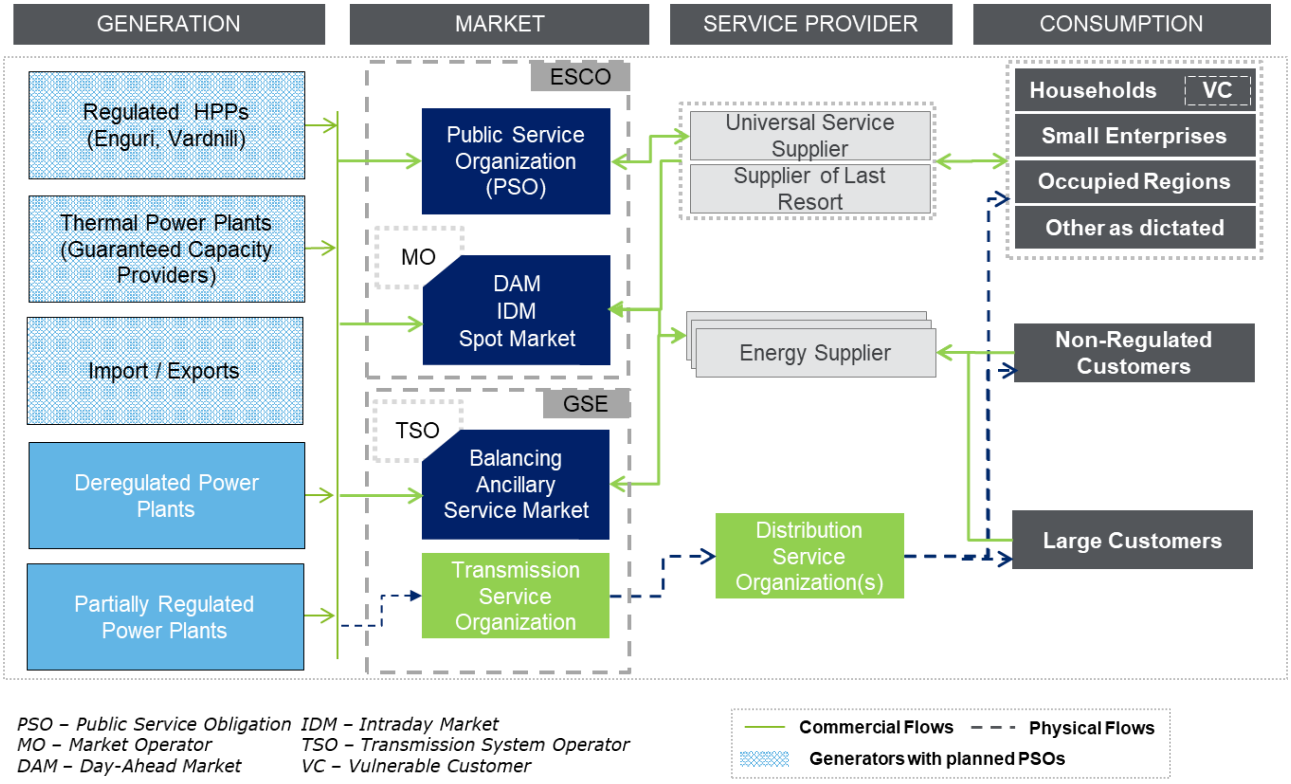
Table 1: Market implementation Schedule

Year	Implementation of Market Segments	Generation Deregulation	Moving out Customers to the wholesale market
2019-2020	2019: Simulations and risk evaluation 2020: - Testing of Day-Ahead and Balancing Markets (hourly) - Finalization of Day-Ahead market implementation and operation launch (power exchange)		Existing criteria (35/110 kV grid supply not less than 5 million kWh electricity consumption etc.) in total 3.2 TWh
From 2021	Finalization of Balancing Market establishment and its launch		All 35/110 KV network supply not less that 0.4 million kWh consumption – in total 3.7 TWh
From 2022	Establishment of intraday market		All 6/10 and 35/11 KV network supply not less than 1 million kWh consumption – in total 4.3 TWh
From 2026			All customers except for households and small enterprises

The market design concept does not at this stage establish a target date for full implementation of the market.

The schematic below represents the transactions and interactions in the penultimate incarnation of the electricity market.

Figure 2: Revised Market Design



3.2 DESIGN PRINCIPLES

The objectives are achieved through a phased implementation strategy comprising of stages.

- Stage 1 from 2021 moves some specific large consumers into the first incarnation of the organized market, with the introduction of the Day Ahead and Balancing markets. Most of the large consumers have been buying electricity directly from generation companies for many years, but this first incarnation requires them to contract by the hour and accept

imbalance costs. Similarly, the deregulated generation companies must also notify the TSO of their hourly dispatch schedule and accept imbalance charging. To facilitate this, selected generation must be made available exclusively to the market sector, and a balancing market established to provide a mechanism for participants to procure balancing electricity and to establish a price for that electricity. Approximately 3.7 TWh or around 30% of consumption will be taken out of the regulated market

- Stage 2 opens the market to a wider selection of commercial consumers, mandating that organizations connected to 6/10 kV and 11/35 kV consuming more than 1 GWh per annum leaves the regulated sector, 4.3 TWh (35% of consumption) is now deregulated. The Intraday market is opened at the stage
- Stage 3 is the roll out to all other consumers in Georgia, excluding the residential/small commercial sector. 50% of consumption?
- The 3 stages progressively re-organizes the existing structure into a hybrid pool/bilateral form to allow for the co-existence of the deregulated and regulated sectors during the transition. The timetable for Stage 4, the roll out to all consumers, is not mentioned in the Electricity Market Design Concept, but it presumably entail the deregulation of all generation, the ability for residential and small businesses to choose their supplier, and the enactment of laws protecting customers from malpractice from suppliers.

3.3 MARKET SEGMENTS

The ECDM specifies two distinct segments prior to the transition to full competition, consisting of the competitive sector encompassing and the regulated sector containing the captive consumers and the centrally dispatched generation fleet at tariffs specified by Georgian National Energy and Water Supply Regulatory Commission (GNERC).

The competitive sector includes:

- a Day Ahead Market
- an Intraday Market
- a Bilateral Contracts Market (effectively a Forwards market)
- a Balancing market
- deregulated (i.e. not subject to regulated tariffs or central dispatch) generation
- suppliers (purchase from the competitive market and resell to eligible customers)
- eligible customers (contracting directly through contracts or procuring through suppliers)

The DAM, IDM and Bilateral markets will be organized by the new MO.

The regulated sector includes:

- a Wholesale Public Service Organization (WPSO), responsible for purchasing all regulated generation and imports
- Universal Service Supplier(s) (USS) who will be regionally based and will purchase electricity from the WPSO and re-sell it to all consumers in the regulated segment at regulated tariff; and may purchase from the competitive market if there is insufficient supply from the WPSO
- the regulated Generation fleet, designated as ‘Electric Generator proving a Public Service’

4. ISSUES AND CHALLENGES

4.1 BALANCING IN A 'MIXED' MARKET

As noted above, the concept calls for two different scheduling regimes to serve the regulated and competitive sectors, i.e. central dispatch controlled by the TSO predicated on a least cost basis, and self-dispatch with generation owners dispatching their plant according to the contracts they have established in the various markets.

In a competitive market, the buyers must inform the TSO of their expected offtake for each and every hour (or half hour, depending on the regime) in the day for each meter point in the day, and similarly the generation companies must notify their generation unit commitment for each time period. From there, the TSO will use their accumulated knowledge to establish whether the market is long (more generation greater than predicted consumption) or short (consumption greater than expected generation). The TSO will then take bids and offers through the balancing market until the imbalance for the time period is filled and the price for balancing electricity for the period is established.

In the regulated market, the TSO is constantly reviewing the stability of the system and re-dispatching generation to keep the system within tolerance at least cost.

It is difficult to envisage how the two regimes may co-exist since there will always be a leakage for one sector to the other, for example:

Competitive Contracts = 0.2 GWh in an hour
Competitive Supply = 0.15 GWh

The regulated market has supplied 0.05 GWh. At what price? In every hour there will be an imbalance, and since the regulated generation does not take part in the balancing market to either buy or sell there will be no mechanism to establish the balancing price.

A possible solution is that the first phase of the market includes the Public Service Supplier and the Universal Supply companies in the balancing mechanism. The two organizations would prepare hourly forecasts of supply and demand, entering into bids and offers into the balancing market. This would provide valuable experience in operating and tuning the market rules. Initially, since the BM is a volatile environment, bids and offers should be capped and collared.

4.2 LEGACY CONTRACTS

The TPP power plants in Georgia benefit from Guaranteed Capacity Payments, which are incompatible with an electrical energy market. It is unlikely that the owners and investors the assets would agree to dissolve the agreements; they must therefore be accommodated in the model. There are also some PPAs for small HPP plant to provide electricity to ESCO in the winter. ESCO is also the importer of electricity from Russia, Azerbaijan, Armenia and Turkey.

In the short to medium term, Georgia will need imports and thermal plants to manage the winter season. Currently, ESCO assumes the role of importer and counterparty to the TPPs, recovering their cost from the distribution company tariffs. These commitments must be integrated into the EMDC in a manner that apportions the costs fairly and transparently. However, at the moment there is no mechanism to recover the cost associated with Guaranteed Capacity an Imports in the competitive market.

Clearly, as the competitive market grows and the regulated market shrinks, the burden of expensive electricity will shift increasingly to the regulated segment, which is unacceptable.

Possible solutions are:

- WPSO (or some successor organization) takes responsibility for re-selling imported electricity through the bi-lateral and day ahead markets. Under this regime, prices would float up in the winter when there is a paucity of hydro resource and would be lower in the summer season. This is normal in any market; the offering that Universal Suppliers would have to accommodate all of the cost in their tariff offering.
- Guaranteed Capacity charges for the TPPs were a feature of the original single buyer model and is very difficult to accommodate into and energy market. In this case, perhaps the best solution would be for the regulator to introduce a levy which would be collected from all consumers through a specific tariff element in the bills. Some communication

would be helpful to sell the concept to the general public, but they have always paid this levy, albeit opaquely.

4.3 LIQUIDITY

If a marketplace has a high volume of trade, then the ask price (offer to sell) should be close to the bid price (offer to buy) – stocks should be easy to sell and resell.

There are some barriers to trading that may adversely affect trading in electricity in Georgia:

- Georgia has around 1.7 million households and with an annual consumption of 12.5 TWh in 2018, which is a small market
- It has no access little or no access to neighbouring liquid markets – transactions are generally negotiated bi-laterally
- There is no history of electricity trading in the Georgian generation or supply companies – the focus of such companies is traditionally asset management
- For a uniform commodity – a MWh of electricity - the cost of electricity in Georgia has great variation in cost depending on the season and the weather within the season
- There is no familiarity with the products in the market – winter peakload, summer baseload etc.

There is a risk with illiquid markets that prices will behave chaotically – especially in new markets. In the EU when the balancing markets were introduced, prices were chaotic.

Some possible initiatives are:

- Ensure that staff who will be responsible for trading are fully trained, by classroom and study tour, in the methods and risks in trading electricity
- Ensure that the systems and processes are robust and well understood
- Create a simulated environment for training, populated by real data
- Insist that large companies become market makers by trading at least 50% of volume though the trading platforms rather than OTC – even when trading between commonly owned companies
- Encourage wholesale traders to enter the market to buy and resell electricity.

4.4 METERING

As the market opens to smaller customers, many of the meters will not be hourly meters at the boundaries of the transmission system.

In Georgia, the majority of non-hourly meters are read every month thus avoiding many of the issues caused by timing differences (in many jurisdictions meters may not be read for many months to save back office costs), and so reasonably accurate estimates of total consumption per Grid Supply Point (GSP) per supplier should be available. However, there will be no record of the hourly consumption, which is the proposed unit for balancing.

To address this issue, it will be necessary to define a series of classes of customers who have a similar profile of consumption. Some research will be necessary to identify the divisions between the classes, but typically they will represent different types of industrial and commercial enterprise, educational establishments etc., and one or two classifications of household customer. For example:

- Households unrestricted
- Commerce unrestricted
- Commerce with a load factor between 20% and 30%
- Commerce with a load factor between 30% and 40%
- Commerce with a load factor greater than 40%

Each of these classes are assigned a load profile which typifies their consumption pattern. Then, by knowing the total consumption for each class on a GSP from the Suppliers records, the load profile for each class is applied to establish the hourly load for each Supplier connected to the GSP. For each Supplier, the load from their interval metered customers for each GSP is added and the final hourly load is calculated.

From there, the contracted amounts are compared with the actuals and imbalances calculated.

5. ABKHAZIA

The way that Abkhazia consumption is treated has a material impact on tariffs which will reflect on the EMDC. There is no payment to Abkhazia for electricity, and Abkhazia represents a large proportion of demand, in the order of 20%. Currently, the consumption of Abkhazia is deemed to be fulfilled by the output of Enguri and Vardnili, but when the costs are analyzed on an hourly basis it becomes clear that in the winter Enguri does not cover Abkhazia consumption. It is also the case that by withholding Enguri generation from the mix the average cost of generation is increased. In addition, the absence of Enguri from the organized markets will have a detrimental effect on electricity.

With the advent of the competitive market, losses of electricity into Abkhazia will have to be catered for explicitly. Clearly, Abkhazia will not be establishing a bilateral contract with a supplier or registering as a balance responsible party. Initially, WPSO procures electricity for Abkhazia at the price of balancing electricity and is reimbursed by the state. As the market opens and becomes more liquid, a successor organization is created and funded by the state to procure Abkhazia electricity through market mechanisms.

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