**“Global Wholesale Electricity Market Designs | Options | Lessons Learned”**

**Responses to Questions asked During the Webinar**

**Questions on Pakistan’s Electricity Market:**

1. Why a typical “Power Exchange” like in European markets is not introduced in CTBCM (the wholesale competitive power market being established in Pakistan)?

The Pakistani Power Market today is based on Single Buyer Plus Model with an installed generation capacity of 40,000 MW that will cross 50,000 MW mark in next two years. It is important to highlight that Power Sector was de-bundled from a VIU back in 1998, Generation, Transmission and Distribution segments were separated, and independent regulatory Authority (NEPRA) was created. Today, CPPA (the single buyer and market operator) has long terms PPAs with private and government owned power producers on behalf of ten distribution companies.

When the Competitive Trading Bilateral Contract Market (CTBCM) commences in April 2022, only Bulk Power Consumers (1MW and above) will freely choose their suppliers. These consumers are approx.2000 in number (out of 28 million consumers) and represent 16 % of the current power market in terms of sales.

The legacy PPAs that are signed by CPPA on behalf of distribu­tion companies will be commercially allocated to distribution companies; these legacy contracts will be honored and ad­ministered until their expiry. Whereas, with the start of com­petitive wholesale market DISCOs will be allowed sign bilateral contracts, these contracts can be generation following, load following, or fixed quantity supply contracts.

Two products will be offered for trading at start of market: Firm Capacity and Energy. CTBCM will be a cost-based **gross pool** market from dispatch perspective, in which generators will be economically dispatched (security constrained economic dispatch) by the system operator and will have hourly balancing mechanism for energy and annual balancing mechanism for capacity. **Marginal prices** for energy will be discovered ex-post on hourly basis based on real time dispatch results, whereas, marginal prices for capacity will be determined annually by the intersection of demand supply curves.

In order to help the reader, understand the difference in detail, the following **table** compares typical **gross pools / SCED markets** with **typical net pools with Power Exchanges**:

|  |  |  |
| --- | --- | --- |
| **#** | **Gross Pools / SCED Markets** | **Net Pools / Power Exchanges** |
| 1 | Mandatory participation of all generators in the pool, for Security Constrained centralized Economic Dispatch (SCED)  *Under CTBCM it is mandatory for all generators to be subject to centralized SCED* | Generators can, voluntarily, participate in a Power Exchange. Generators are self-dispatched  *Pakistani electricity law mandates all generators to be subject to SCED, no room for voluntary participation* |
| 2 | ISO dispatches generators based on market results (pool). Market can operate either on costs or prices  *Under CTBCM the dispatch will be based on variable costs of all generators and will be discovered from intersection of whole supply and demand, a true representation of demand and supply situation.* | SO or a TSO dispatches generators based on nominations (self-dispatch) and balances the system through balancing market.  Nominations are based on committed volumes of Bilateral Contracts + the results of the Power Exchange |
| 3 | The ISO runs Day ahead and Intraday markets and Real Time Market  *Initially, under CTBCM there will only be real time ex-post marginal prices discovery* | Power Exchange runs Day ahead and intraday market. SO runs Balancing Market |
| 4 | Single, Regional or Nodal Pricing  Implemented mainly in North and South American countries.  *Initially, under CTBCM there will one marginal price across the whole country* | Single (or eventually) Regional based Pricing |
| 5 | Implemented also in several European countries during many years after restructuring | Implemented mainly in Europe nowadays |
| 6 | Financial products (for hedging or coverage) can be traded by the MO/ISO or by separate platforms, depending on the regulation of each particular country | Power Exchange usually offers offer typical financial products |

Therefore, in Pakistan a typical European Power Exchange is not developed.

Moreover, as the Pakistani electricity market has legacy long-term PPA’s, the balancing mechanisms will initially be utilized to do **net-settlements in the pool** i.e., the imbalances only. Several gross pools are established across the globe where 100% settlement is done through the pool (**gross settlements**), whereas in some of the gross pools e.g., Alberta (AESO) is one example where only imbalances are settled. A question has always been raised that why under CTBCM gross settlement is not carried out like in a typical Power Exchange, as it may result in more liquidity in the market.

Let’s consider the following illustration to answer this important question. Consider, if under CTBCM the marginal price is 6000 PKR/MWh at typical one hour and as per the agreed PPA (between and IPP and a retailer) energy price is 8000 PKR/MWh based on pass through variable cost. Consider the following gross settlement for this transaction:

**Figure**: **Case Example**

Graphical user interface, application, Word

Description automatically generated

In the above example the retailer participates in the PX and pays the market clearing price @ PKR 6000/MWH to PX and also the delta of PKR 2000/MWh to the producer separately to balance the price as per PPA. On the other hand if the market price is higher than the PPA price, retailer will pay the market price in PX and generator will pay back the difference of market price and PPA price to retailer, separately. This financial transaction under gross settlement process ends with same results as net-settlement proposed under CTBCM. The latter is more efficient and with less transactions involved for legacy PPAs, considering for initial few years almost 100% of market will be covered with PPAs.

1. How legacy PPAs will be dealt in CTBCM and what are the prospects creating liquidity under the competitive wholesale market in Pakistan?

The legacy PPAs will be allocated to all the Distribution Companies (Distribution Companies) based on the allocation factors. The allocation will be among the Distribution Companies, K-Electric and all other existing distribution licensees (in the role of suppliers) including these small Distribution Companies on the basis of the criterion defined in the detailed design and subsequent methodologies to be developed. Through this allocation, each distribution licensee will be assigned a fixed share (subject to revisions in the future) from the existing contracted capacity so that the individual future needs can be calculated based on their respective demand forecasts.

The following options were evaluated for legacy PPA integration:

1. **Forced Market Integration:** Integration of all legacy contracts into the market through legislation without any regard to contractual terms
2. **Forced Contract Negotiation:** Contracts renegotiated to ensure consistency with the Market Rules
3. **Voluntary Renegotiation:** Contracts renegotiated to ensure maximum integration with some adaptation in Market Rules
4. **Adaptation of Market Rules:** IPPs allowed to complete their contractual terms with modification of the Market Rules
5. **Virtual Generation/Managed Contracts:** All contracts managed by one entity and that entity trade in the Market
6. **Contractual Buy-Outs:** All contracts are bought and full compensation is paid to the IPPs

By carefully evaluating the pros and cons of each option and the risks associated with each one, it was decided that the option 4 i.e. the adaptation of the market rules is the most suitable option for Pakistan.

Another alternative option regarding future procurement is to trust on the actions of the market players and hope that generation will develop on merchant basis. However, this requires major pre-conditions to be met before such market could develop. Some of these pre-conditions are:

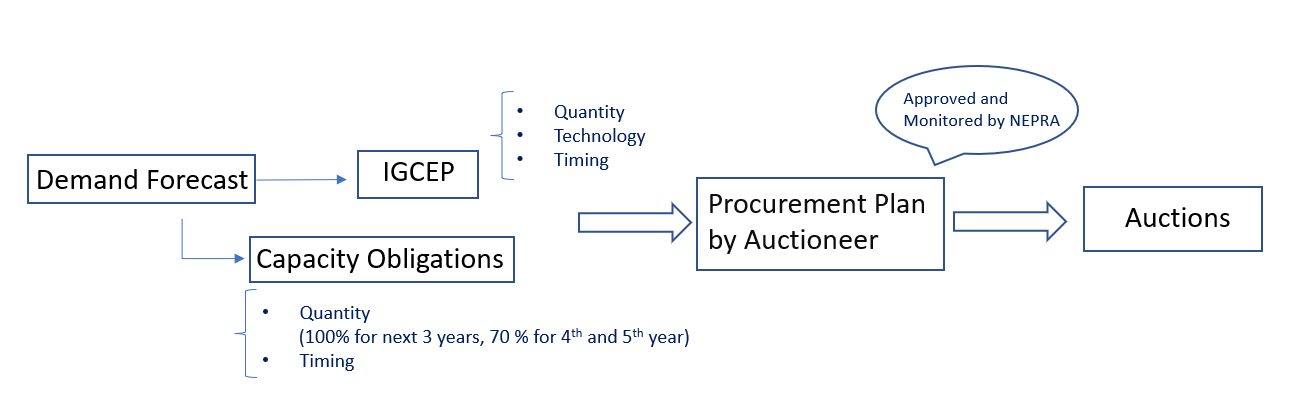
* 100% payments in the market
* Transparency in operations
* Alignment of legal, policy and regulatory framework
* Proactive and competent regulatory body
* Strengthened and matured institutions
* Maturity of Processes
* Efficient operations of the system through SCADA
* Accurate short- and medium-term forecasting
* Enabled ICT to avoid gaming
* Several years of demonstrated performance

Until and unless these pre-conditions are fulfilled to a satisfactory level, a merchant market or short-term market where generators take price and volume risks can’t be developed in true sense.

1. How future procurement for regulated consumers (less than 1 MW who don’t have choice) will be done in CTBCM?

Power procurement of new contracts for Distribution Companies will be through competitive processes, initially administered centrally by the Independent Auction Administrator (IAA) and/or, at a later stage, through direct competitive contracting by each DISCO, when this possibility be authorized by Regulator following applicable regulations and guidelines. Future procurement for regulated consumers will be done through competitive auctions conducted by IAA, against the forecasted incremental demand of Distribution Companies, and Indicative Generation Capacity Expansion Plan (IGCEP). The following diagram captures the procurement process:

**Figure**: **Procurement Process for Consumers who don’t have choice**



Regarding centralized auction, an alternative option is to allow DISCOs to individually conduct competitive auctions and procure capacity to meet their obligations. In such scenario, considering the current situation of power sector, the low-performing DISCOs will be unable to find any sellers or may be charged very higher price because of high nonpayment risk. In order to cover this risk until the performance of these DISCOs is improved, a centralized procurement mechanism for all DISCOs has been proposed to neutralize the individual counter party risk for the low performing DISCOs.

Moreover, as global experience shows that a major trustworthy auctioneer can obtain better price by auctioning large quantiles and attracting large players. Therefore, a decentralized procurement process by individual DISCOs for regulated consumers can result in higher cost compared to centralized single auction.

1. Can you share what are the biggest challenges that your jurisdiction faced during the marketdesign implementation? And how were you able to address them?

There were multiple challenges that we are facing during the implementation phase of CTBCM, some of them are listed below:

* Free riding issue
* Stranded cost
* Cross-Subsidy
* Market Implementation Monitoring and Coordination

These issues are discussed hereunder:

**Free Riding Issue:**

During the Design Phase of the Wholesale Market, a transition issue was identified that needed due consideration.

Recent capacity additions (via PPA) in the system have changed the cost structure of power sector into a high fixed cost but comparatively low operating costs/variable costs. Therefore, the marginal cost of electricity generation in the country is expected to remain very low in the coming years. Moreover, there is a surplus generation available in the system for the few years.

The issue relates with the trading / participation of old generation plants whose fixed cost is very low and variable cost is far above the average marginal price in the system for next 5 to 6 years. As per simulation these power plant does not get dispatch for the coming years, as the marginal prices are far below their variable cost of generation.

If these plants are allowed to trade in the CTBCM by contracting with Bulk Power Consumers (BPCs), there is a certain chance that:

* these old plants will be enjoying high profits on the cost of regulated consumers who have paid for long-term contracts “Free riding” (buying at low Marginal prices, having very low fixed costs and not being dispatched in a cost-based pool). The DISCOs supplied consumers will pay for high generation costs and BPCs can manipulate the market by procuring at very low marginal prices for a long period of time.
* the tariff for regulated consumers may rise, as the exiting consumer is not further contributing in high fixed costs

This issue will be resolved by applying appropriate stranded assets costs to the consumers leaving the regulated market. The stranded cost will be calculated by the Regulator and applied all consumers in such a manner that it will remove the incentive of free riding and only those generators will come into the market whose variable cost of generation is lower the average marginal price.

**Cross-Subsidy Surcharge (CSS):**

Under the current tariff structure in Pakistan, large consumers normally pay higher tariffs than their true cost of service to cross-subsidize the small consumers (this is an interclass subsidy which is determined by the regulator at tariff determination stage). The cross-subsidization is a policy/regulatory decision and is applicable to all consumers irrespective of purchasing electricity from DISCO or having bilateral contract with alternative Suppliers.

However, the BPCs who opt for open access can avoid themselves from these cross-subsidy payments. If this matter is not properly addressed, it will increase the tariff for the remaining regulated consumers and will create a perverse incentive for other BPCs as well to leave Distribution Companies and sign bilateral contracts with alternative suppliers just to avoid the cross-subsidy. This will have detrimental impacts on the financial position of Distribution Companies and will cause a death spiral for them. This incentive is also against the principles of markets that incentivize efficiency. In such a case, the BPCs or competitive suppliers have the advantage over the Distribution Companies not because they are efficient, but because they are exempted from certain charges.

To resolve above issue, it was recommended that CSS should be applied on all consumers, whether it be a regulated consumer or free one. It will give a level playing field to all suppliers.

The following diagram depicts the costs per unit or KWh to a typical large consumer in the current regime:

**Figure**: **B4 (large industrial consumer costs/KWh including cross subsidy)**

Timeline, bar chart

Description automatically generated

**Stranded Assets Costs:**

The BPCs leaving their incumbent Distribution Companies to get power from alternative Suppliers would result in stranded costs for their respective Distribution Companies as Capacity has already been procured under the take or pay arrangements pursuant to the applicable policies while considering the demand of such BPCs in the demand forecasts of Distribution Companies for next few years. This will result in the payments by Distribution Companies in terms of fixed capacity charges for the generation being procured.

The Distribution Companies recover the power purchase price from the consumers in a volumetric manner (costs are charged to consumers on per unit of energy consumed). Due to this tariff structure, any reduction in sales of Distribution Companies due to BPCs opting to procure electricity from alternative suppliers during this commitment period, will result in non-recovery of capacity charges being committed while this demand was being considered. This phenomenon is called the stranded assets costs where the Distribution Companies are unable to recover certain legitimate costs being incurred on behalf of the consumers.

As discussed above under the issue of free ridding, the stranded costs will be calculated by the Regulator and applied all consumers in such a manner that it will remove the incentive of free riding and only those generators will come into the market whose variable cost of generation is lower the average marginal price.

**Figure**: **Stranded Costs /KWh**

Chart

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**Market Implementation, Monitoring and Coordination**

Close monitoring and coordination of the implementation roadmap will be needed at multiple hierarchies to successfully implement market reforms. It was a challenge because in developing countries the institutions do not share information and collaborate with each other. It was envisaged that there should be a forum at government level for monitoring the market implementation, progress of all entities and a collective decision making.

In the approved market model, it was proposed that for the monitoring of the CTBCM Implementation Roadmap and provide guidance and support at the strategic level, a Market Implementation Monitoring Group (MIMG), with representatives of all involved stakeholders shall be formed.

MIMG is responsible for monitoring the implementation of the roadmap based on reports from its members. It also has the role of proposing corrective action to address the causes of delays and difficulties identified in implementing the roadmap.

The MIMG have the following functions:

* Provide guidance and support to all stakeholders with specific roles in the CTBCM implementation
* Seek the involvement of different authorities to authorize or take the appropriate decisions, as and when required, for implementation of CTBCM actions
* Provide for measures to mitigate the effects of delays, if any
* Propose solutions whenever implementation problems arise
* Coordinate with stakeholders, when implementation requires interaction at the interface among them
* Facilitate the provision of resources for implementing these reforms
* Prepare and disseminate information on appropriate level about the progress in the CTBCM implementation

Ministry of Energy Power Division, being the owner of involved power sector entities lead the MIMG and provides supervision, guidance, and leadership to its subsidiaries. Similarly, NEPRA being the Regulator of the power sector monitors the progress of its licensees and provide necessary directions wherever required.

**Figure**: **Structure of MIMG**

Graphical user interface

Description automatically generated with medium confidence

CPPA-G as the central coordinator facilitates the entities during the implementation of the roadmap and carries out the necessary capacity building of the stakeholders in terms of market development. CPPA-G also keeps track of the group of actions under the implementation roadmap and raises red flags for the consideration and necessary action of the Ministry and Regulator in case any incompliance is observed which may cause a delay.

**Question on Argentinian Electricity Market:**

1. What is the reason and objective of shifting from cost-based pool to the bid-based pool with acap (Fuel Price + 5%) in 2008?

The market is still cost-based, and the way to declare those costs is a little complex but is based on costs. Please see below a transcript of the market procedures (available on CAMMESA)

website:

<https://microfe.cammesa.com/static-content/CammesaWeb/download-manager-files/Los%20Procedimientos/Los%20Procedimientos%20XXVIII.pdf> ).

**Variable Costs of Production:**

The Generators must inform the Agency in-charge of Dispatch (OED) of the modifications to their declaration of variable costs of production, with the same characteristics and methodology as that defined below the procedures for the declarations of the seasonal period.

**Variable Costs of Production of a Thermal Plant:**

Variable cost of production of a thermal power plant, conventional or nuclear, is the variable cost foreseen by the generator to produce electrical energy over a period, and includes the cost of fuels, the cost associated with the own consumption of the machines, the cost of variable inputs other than fuels, the costs associated with start-stop cycles for semi-base and state-of-the-art machines, and any other variable costs required.

This cost is expressed by type of machine installed in the plant, establishing four possible types (steam turbine, gas turbine or engines, combined cycle and nuclear), and for each type of fuel that the machine can consume, considering as type of fuel those established for the definition of fuel reference prices.

The values that define the variable cost of production are expressed in equivalent units of the fuel to be consumed to produce electrical energy ($/ unit of fuel). The number of values that define the variable cost of production of a thermal power plant depends accordingly on the number of types of machines installed in the plant and the number of different types of fuels they can consume.

1. What is the impact of distributed generation on the wholesale market of Argentina at present and in near future?

Distributed generation embedded in the distribution network, is a matter of the Distribution Companies. Same as net metering. For the time being transactions of consumers beyond the boundaries of the Distribution Companies are not foreseen.

1. Can you share what are the biggest challenges that your jurisdiction faced during the market design implementation? And how were you able to address them?

As indicated in the presentation, the high-level main challenges could be summarized as follows:

* General Crisis
* Loadshedding (up to 20%)
* High generation unavailability
* Increasing circular debt
* High deficit in the sector
* Very high losses
* Governance
* Lost control of the companies
* Tariffs
* Highly politicized
* Inefficient Investments

The introduction of competition and the private sector in a transparent and predictable market, brought in strong incentives to the companies participating in the market to become efficient. Also, the obligations associated with the concessions, or the market procedures brought in discipline in an aggressive competitive environment

At the distribution level, new operators (strategic investors) manage to reduce losses and increase collection in a relatively short period, after having been a few years with limited or no profits.

The regulated tariffs (adjustment formulas by the regulator) become transparent and predictable, significantly reducing the political interference

Most of the new investments were taken out of the government responsibility and transferred to the market, not only financing but also decision. The open access and free entry for generation out in the market the investment decisions, driven by the balance between offer and demand and the consequent marginal spot price. Transmission expansion was decided by the market based on benefits for the users of them. Distribution Companies owners decided distribution network expansions and other services, based on their return on investment compared with the penalties incurred otherwise.

1. Security of supply is critic-regulations and new models sometimes have pressure on it, good operating market should generate correct impulses with reference prices

Not necessarily. The case of Argentina shows that with a proper market design, the signals to ensure long term security of supply works, balancing investors interests with the interests of the consumers. Excess of investment, lead to lower return on investments, a deficit of investment leads to loss of profits due to penalties (the intersection point between the investment costs vs penalties shall be consistent with the targeted quality of service, including the security of supply)

1. During market reform did Argentina faced any issues of transition to competition cost/stranded assets cost? And how this issue was resolved?

One of the reasons for combining market reform and privatization, allowed to settle some inadequacies existing in the market and some arising from the reform.  For example:

* In the generation segment, investors offered prices discounting inefficiencies of the to be privatized according to the actually expected revenues
* In the transmission segment, investors discounted the cost of investment producing low benefits in the market
* In summary, what could be called stranded costs, were mostly absolved by the Government by reducing the proceeds of the privatization, which allow the market with a reasonable balance since its inception

**Questions on Turkish Electricity Market:**

1. Can you share what are the biggest challenges that your jurisdiction faced during the market design implementation? And how were you able to address them?

The biggest challenges were the metering data gathering and financial settlement part. But digitalization played an important role and helped in overcoming these issues.

1. What is the status of retail Electricity Market in Turkey?

Now almost all the consumer has right to choose her supplier and get some benefit comparing with the tariff. Generation side also can reflect the costs directly to the market.

1. How is transmission planning done in turkey?

Transmission company prepare and update the plans for the grid. They send for evaluation to the Regulator and Ministry. It’s a detailed procedure and detailed calculation issue. Regulatory bodies approve and publish it.