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Transforming Power Markets

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Date: January 31, 2019

The Secretary
Central Electricity Regulatory Commission
3rd and 4th floor, Chanderlok Building
36 Janpath, New Delhi - 110001

Sub: Discussion paper on Market Based Economic Dispatch of Electricity: Re-designing of Day-Ahead market (DAM) in India – comments and suggestions from Power Exchange India Limited
Ref: Public Notice No. RA-14026(11)/3/2018-CERC dated 31st December 2018.

Dear Sir,

With regards to the subject mentioned above, **we welcome the initiative by the Hon'ble Commission to revisit and re-design the day ahead market in the country.** The suggestions in the staff paper are indeed encouraging.

We, at PXIL, have prepared our suggestions keeping in view the changes proposed in the Real Time Market, Ancillary Services Market and the Deviation Settlement Mechanism (market linked penalty mechanism for grid discipline) to have a holistic approach towards the changes. Second, our views are to ensure harmonization of the spot market with the forward market and the derivatives market, as and when, they become operational. Accordingly, our suggestions have also included "principles of markets" which need to be defined/ designed.

We have considered "Social Welfare Maximization" of the entire market as the overarching principle, both in letter and spirit, as enshrined in the Power Market Regulations. Our matching algorithm, PIOUS-22, a Multi Integer Linear Program (MILP) developed in collaboration with IIT Mumbai, has stood to Hon'ble CERC's Scrutiny on the same, It can be augmented to include newer aspects as envisaged in the staff paper.

The core of the discussion paper emphasizes implementation of Merit order dispatch (MoD) by the System Operator, which is currently constrained due to self-scheduling of contracts based on Power Purchase Agreements executed by Discoms. The migration from concept of self-scheduling to principles of MoD requires a mechanism to fulfill pay-in/pay-out of market based mechanism and commercial obligation of signed Power Purchase agreement, the discussion paper proposes a mechanism for reconciliation which when routed through the clearing and Settlement system developed by Power exchanges would help in early implementation of the proposed mechanism.

The discussion paper recognizes the adoption of multi power exchange model under provisions of CERC (Power Market) Regulations 2010. However, as the existing power exchanges do not receive same bids from market participants, the discovered prices differ between the exchanges for same

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delivery period and this causes a splitting of the social welfare and is also a cause for creation of a monopoly in the Day Ahead market segment.

The electricity markets in Europe, which has been referred to in the staff paper, have evolved to ensure that Price coupling in day ahead market is undertaken by operating a single price coupling algorithm commonly known as EUPHEMIA (acronym for Pan-European Hybrid Electricity Market Integration Algorithm). Since February-2014, EUPHEMIA is progressively used to calculate energy allocation and electricity prices across Europe, maximizing the overall welfare and increasing the transparency of the computation of prices and flows.

This has also resulted in allowing multiple exchanges to operate simultaneously in the same geography (for example in UK), resulting in increased competition while simultaneously ensuring that a single price benchmark is created thereby serving the overall market by maximizing the social welfare for all participants. In UK market, the Regulator OFGEM approved operation of two Power exchanges APX Group and N2EX by recognizing them as National Electricity Market Operator (NEMO). Currently, the UK market is coupled with EU under the North West Europe (NWE) coupling mechanism, hence in the Day ahead market the bids/offer received by both the Power exchanges when matched under EUPHEMIA algorithm results in a single price being discovered for market participants of UK and EU.

A similar Price coupling approach where the offers & bids received by multiple power exchanges when cleared by a common algorithm will result in single price being discovered for same delivery period and lead to system-wide social welfare maximization and would allow for a multiple exchange model to operate in a competitive environment.

The principle of implementing a Market Based Economic Dispatch (MBED) is step in the right direction to utilize the expertise developed by Power exchanges on matters related to price discovery and clearing & settlement functions over a decade of power exchange operations.

We take this opportunity to reiterate and assure you that Power Exchange India Limited, with its institutional promoters and shareholders, segregation of ownership, Board and management thorough governance structure is suitably equipped to build a trustworthy Market Infrastructure Institution.

We request you to take our comments on record and give us an opportunity to present them during the public hearing or to the staff/Commission at their convenience.

Thanking You,
Yours faithfully,
For **Power Exchange India Limited**

Prabhajit Kumar Sarkar
Managing Director & CEO

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PXIL COMMENTS, SUGGESTIONS ON STAFF PAPER ON MARKET BASED ECONOMIC DISPATCH: RE-DESIGNING THE DAY AHEAD MARKET

The international experience, referred to in the staff paper, brings out the following aspects on design and operationalization of the markets:

(i) **Objectives of the spot market**: least cost grid operations with reliability. In other words harmonization of market operation and system operations.
(ii) **Integration of the Spot, RTM and balancing markets**.
(iii) **Development of a number of contracts** to facilitate participation.
(iv) **Price coupling in only the SPOT market** to maximize system-wide social welfare and ensure viable competition in the Day-ahead markets

The multi exchange model adopted in our country, will have to follow the above design principles, but will also have to keep into consideration, our adopted market structure and few of the unique aspects which have served us well during the last decade, such as:

(a) **A multi exchange model with minimalist approach to Regulations as the model is expected to be self-correcting.** The need for innovation and space for at least two exchanges to ensure effective competition in the market. **The need to have multiplicity in product offering can only be ensured through competition.**
(b) **Price coupling as the need and the instrument for ensuring Maximization of Social Welfare Mechanism in the SPOT market** by economic dispatch and technical dispatch both being integrated through an iterative solution. A single price indicator for the entire market to ensure markets at or closer to real-time have a singular price benchmark for effective operations.
(c) **Segregation of market operation and system operation** in all of the above aspects has already been covered in the staff paper. They are discussed in greater details in the forth-coming sections.

It is pertinent to mention here that across the electricity markets of Europe, the European Commission has notified Regulation EU 2015/1222 dt. 24 July 2015 regarding guidelines on capacity allocation and congestion management with one of the objectives being ***respecting the need for a fair and orderly market and fair and orderly price formation***. The Regulation provides for National Electricity Market Operator (NEMO) to be designated by Designating authority / Electricity Regulator of the country, nominating a Market Coupling Operator (MCO) for matching orders for day-ahead and intraday market for different bidding zones.

The electricity markets in Europe have thus evolved to ensure that ***Price coupling in day ahead market is undertaken by operating a single price coupling algorithm commonly known as EUPHEMIA*** (acronym for Pan-European Hybrid Electricity Market Integration Algorithm). Since February-2014, EUPHEMIA is progressively used to calculate energy allocation and electricity prices across Europe, maximizing the overall welfare and increasing the transparency of the computation of prices and flows.

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This has also resulted in allowing multiple exchanges to operate simultaneously in the same geography (for example in UK), resulting in increased competition while simultaneously ensuring that a single price benchmark is created thereby serving the overall market by maximizing the social welfare for all participants.

In UK market, the Regulator OFGEM approved operation of two Power exchanges APX Group and N2EX by recognizing them as National Electricity Market Operator (NEMO). Currently, the UK market is coupled with EU under the North West Europe (NWE) coupling mechanism, hence in the Day ahead market the bids/offer received by both the Power exchanges when matched under EUPHEMIA algorithm results in a single price being discovered for market participants of UK and EU.

In India as well, the Hon'ble Commission had constituted an Expert committee for Transmission capacity allocation to Power exchanges in FY 2014-15 vide order no 158/MP/2013 dt. 30.04.2015. While the scope of the Expert committee was to evaluate the current practice of allocation of Transmission capacity for collective transaction on day ahead basis. It also considered and recommended that the merging the bids of the two Power exchanges for a common price discovery would give optimum solution as outlined in the Minutes of meeting of the 4th meeting of Expert group vide ref no 158/MP/2013/2015 dated 26.06.2015. The relevant extracts of page 4/5 of MoM is reproduced as follows:

> *"(d) The solution of merging of bids of the two Power exchanges would give the optimum solution thereby giving maximum Social welfare. Upon implementation, the exchanges would mainly compete on services, frontend (user interface), clearing mechanism, reports, etc. However, merging of bids methodology, would require designing of a suitable mechanism around it, e.g. Algorithm for merging, same bid structures, etc. Thus it is advisable to constitute a separate committee to facilitate its implementation.*
> *(e) It was also discussed that any solution other than merging of bids may be ultimately sub-optimal for transmission corridor allocation..."*

Dr. Nicholas Ryan, Assistant Professor of Economics, Yale University who specializes in Indian Energy Sector presented his views in the expert group meeting endorsing the concept of Price coupling as most viable alternative to maximize Social welfare along with Optimal corridor utilization.

Further, in MBED based mechanism when all power is to scheduled on day ahead basis, discovery of different prices would be sub-optimal for achieving system wide social welfare. **The alternatives as proposed in the staff paper need to be implemented to avoid suboptimal utilization of generation assets.**

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MULTI EXCHANGE MODEL

1) The system operator and the market operator are envisaged to remain separate in the proposed flame work.

2) The alternative mechanism proposed in section 7.12, are

(i) Market clearing engine could be operated by one of the power exchange by rotation:-"
We are the opinion that this is most elegant way of having the best of both the worlds i.e. Convergence in prices and continuation of a multi exchange model. Over a period of time the market forces would ensure that similar/same processes are adopted even through subtle differences could remain. Also with periodic scrutiny and audit of the matching algorithm of the exchanges, the findings can be used to ensure evolution of the matching engine along with the markets and market participants.

Lastly, with multiple exchanges operating their respective matching engines will have to integrate with only one system operator which augurs well with the structure of the market wherein dispatches are built over the transmission infrastructure but will also ensure that social welfare has both the components integrated viz. economic welfare and welfare on account of efficient transmission allocation. Moreover, the transmission would remain implicit as is the case in current market.

(ii) "Market clearing engine can be operated by an independent entity:-"
We are of the view that the keyword is **'independent"**. Other than the market operator(s) and system operator, if there is any other entity we reserve our comments on the same, as in absence of regulatory status of the entity, qualification requirements, periodicity of review etc. it will not be prudent for us to have a view formed on the same.

In case it is the system operator, we run the risks identified when the Hon'ble Commission decided in favour of the multi exchange model. System Operator running the matching engine will eliminate competition and the system operator may not have the incentive to periodically upgrade their matching engine.

Lack of competition will stifle all innovations in the market. **While it will achieve the objective of price convergence but will be at a very high cost. It is worth our while to mention that during the last ten years of exchange operations, the market operators and the system operator have worked to provide checks and balances to each other on market aspects whether it is creation of a new zone, identification of congestion, transmission allocation, introduction of new products, new features etc. which will be lost should the market operator and the system operator roles be played by one entity.**

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In case it is the market operator(s) who are to run the matching engine, it is important to ensure that there is no monopoly, and equal opportunity is extended to the exchange(s) and therefore alternative (i) is the best option.

3) An alternative way could be to distribute the geographies/regions to exchange(s) for the bid solicitation. From the view point of the participants; they would be interacting with only one exchange at any given point in time. From the view point of the regulations, equal opportunity is offered to exchanges. In order to administer the exchange towards innovation so that competition is ensured the allocation of geographies be on rotation every quarter so that there is no frequent change leading to confusion. This would also ensure that any new exchange which comes up is also accommodated in the cycle and the process is in the spirit of the multi exchange model.

It is worthwhile to mention that while bid solicitation can be entrusted to all the operating exchanges, the matching algorithm be offered to the exchange whose software has been audited and not found wanting on principles in the PMR and also been operational in the market for least two years.

The rotation in the Price Discovery among the exchange can be on a monthly basis.

PRICE CONVERGANCE IN DAY AHEAD MARKET ONLY

Electricity cannot be differentiated on quality and the only attributes left are place of delivery and time of delivery. The current market structure of two prices for the same commodity, at the same location and the same time of delivery, in a voluntary market, are not in sync with the commodity's characteristics. The value of electricity changes on the temporal scale also, which is also absent in the current day ahead market structure when bids are solicited at the same time, delivery is at the same time etc. Therefore, the prices should converge in both the markets and as has been mentioned above in terms of experiences in the European markets, this would lead to promotion of competition and would allow multiple exchanges to become viable without any one exchange becoming a monopoly. **It is pertinent to mention here that with the price markers/takers remaining the same on a given day/period, there should be one price of electricity in the spot market.**

A singularity of prices in the Day-ahead market would also be essential for the development of markets closer to real time as well as for development of electricity derivatives. Such markets would take price cues from the Day ahead spot market for settlement of the contracts and multiple prices in the DAM would distort and disrupt the entire development of the power markets.

Therefore, a price coupling in the Day-ahead markets is necessary to ensure system-wide social welfare maximization. Accordingly, the necessary and sufficient requirements for price convergence are:

(i) Uniform price discovery and market clearing at one price.

(ii) Social welfare maximization, both on economic basis and welfare on transmission optimization to maximize the volumes without compromising on reliability.

The proposed market structure espouses mandatory participation in the day ahead market which furthers the need for price convergence or one price in the spot markets. **This need of price convergence should be in all such markets / products where uniform price auction mechanism is being implemented.** Whatever left un-cleared will warrant contracts which are specific to few participants due to either their different needs or are contingent requirements. Therefore, these contracts will be bilateral in nature. Also, the SWM principle can be applied to the largest segment of the market rather than an instrument for other transactions. **It is worthwhile to keep in mind that transmission network optimization will be done alongside the MBED dispatch and not with any other product;** hence, the other products are best left for the market operators to design, develop and offer to the market.

MULTIPLE SETTLEMENT MARKETS:

The markets segment (Day ahead spot, Intra Day, Day ahead, contingency Real Time Markets and the balancing markets) will have to be designed in such fashion that not only are they on a temporal continuum but are also integrated. **The only integrating factor in the markets can be the price.** It is therefore necessary to revise the inter-linking mechanism of the current day ahead market to DSM Price Vector to the MBED discovered price in such a way that the DSM price vector is a disciplinary tool referenced to the Day ahead market price, wherein the penalty to be paid beyond the gate closure and over the market price creates sufficient deterrent to nudge participants towards RTM, ID/DAC. **It will be best left on to exchange to devise products to these segments as, post gate closure, everything will have to be settled at the DSM price vector.**

COMMENTS, SUGGESTIONS AND CHALLENGES IN THE PROPOSED FRAMEWORK.

1) The proposed frame work proposes to utilize the uniform price discovery on social welfare maximization, at the exchange(s), to be widened and have the Aggregate Demand and Supply Curves be created at the national level, on a day ahead basis. There is no denying on the fact this will lead to most optimum dispatch of the resources.

2) The frame work also proposes to utilize the settlement and risk management system developed at the exchange to be used for the settlement of the contracts.

3) The framework expects the generators to bid based on their variable marginal costs. During the last ten years of exchange operations the sellers and the buyers in a uniform price dispatch tend to submit overtly competitive bids. Therefore, the exchange will have to define newer bid structure to capture the data points. The block bids, iceberg bids, parent

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child bid etc. will have to be re-defined as these are the bids which add constraints in the clearing/price discovery as compared to the normal bid which is the most competitive bid.

4) The fixed price component of the visiting PPA will have to be settled separately, Also the differential in the PPA price and the DA prices will be settled outside the exchange. As the generators are assured of their prices, the propensity to bid the true prices in the market is higher. The prompt payment system is likely to bring down the variable cost of generation which will lead to savings for the utility.

5) Section 4.7: As has been rightly captured in the section, the "transaction" in our Day ahead Market is an after activity. Both the price of bid and the quantity are not the transaction but contribute in the transaction. Two, once the transaction is done, the participants or the bidders do not have any control over it. The MBED will have transactions which have to be necessarily done i.e. which are not part of the price discovery process and others which will be part of the transaction. **Accordingly the clearing and settlement process/procedure, risk management system will have to evolve on an ongoing basis. It will have to capture the willingness to pay by the buyers so that it doesn't become cost prohibitive but also ensures capital efficiency at the members end.**

6) Additionally, Variable Costs of generators would have to be captured appropriately to aid the BCS reconciliation. In most of the cases now, as the variable costs are dependent on coal costs, truing up of variable costs occur after the transaction. Therefore a single format for determining variable costs for power stations across the country needs to be implemented for the the BCS process to be implemented seamlessly.

7) *Market monitoring section 7.10* mentions "...price interventions to controls market power and reduce market concentration. The section further mentions that effective completion is necessary condition for well-functioning markets (emphasis added).
In the above context it is reiterated that clause 7.12 (i) where in the market clearing engine is operated by one of the power exchanges by rotation is necessary and sufficient to ensure "Effective Competition".

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