Comments on the Staff Paper on Market Coupling by CERC

Key points on the Background of the Paper

- All Power Exchanges are at National level.
- All Power Exchanges share the same formulation of "Bidding Areas" within the National level. Prices are provided as Single System Market Clearing Price and as "Bidding Area" Prices. However, those prices appear to be the same, most likely caused by no binding transmission constraints between the areas.
- Transmission constraints appear to be formulated as linear Transmission Corridor flow constraints, where each Power Exchange is allotted a proportionate amount of Transmission Corridor transfer capacity. No transmission network power flow model is considered whether in its AC or DC model.
- Trading is only in Electric Energy and no Reserves/Ancillary services are traded. No reserve requirements are considered.
- Power Exchanges differ in some of the "products" they offer. For example, PXIL offers Integrated Day Ahead Spot where both "Green" and "Other" energy bids are cleared, while IEX offers separate DAM and "Green DAM". IEX offers Cross Border Electricity Trade, while others appear not to, etc.
- The Market Clearing and Bid model appear to be influenced by European zonal model, where Market Resources are not modelled separately from economic bids, thus resulting in overcomplicated bid models (i.e., "*Block Bid*", "*Linked Bid*", "*Profile Block Bid*", etc.). European bid models are getting further complicated with participation of new Market Resource types (such as battery energy storage and hybrid resources) and by needs to model Market Resource intertemporal and energy constraints.

General Comments:

The use SCUC and SCED for the simultaneous co-optimization of energy and ancillary service while respecting the network security constraints of the grid has been a proven approach in many wholesale markets around the globe. This not only brings the transparency of the price but incentivizes the market operator to introduce novel services and market participants to bring in newer type of resources. The introduction of the system ramping as a service and growth of storage in the US wholesale energy market and elsewhere in the world is a testament to the success of centralized market clearing with locational based marginal pricing. It also accelerates the next generation zero carbon grid by incentivizing market participation for flexibility services at a granular nodal level. Market coupling initiative is definitely a strong positive step towards it.

Section 4.1 Market Coupling in Global Context

Acknowledge the objectives as stated "Globally, market coupling has been introduced to integrate two or more electricity markets or different geographies. However, in the Indian context, the objectives of market coupling, as stipulated in the Power Market Regulations 2021 ('PMR 2021'), include the discovery of a uniform market clearing price, optimal use of transmission infrastructure, and maximization of economic surplus."

Section 4.2 Key Benefits of Market Coupling

We acknowledge all the benefits listed here. In addition to that the following points are also beneficial.

- Having a single “Market Coupling Operator” allows for uniform Market Clearing software and Market Management System (MMS) to be procured and developed, maintained, and operated, ultimately allowing for less manpower, hardware resources, lower MMS capital, operating and maintenance costs and easier oversight and audit process comparing to three different Power Exchanges performing market clearing functions.
- Implementing any changes to the Market system, whether scaling up existing functionality, or adding new features and Market Products (i.e., new reserve types) is easier when performed within one MCO entity. Reliability and Redundancy standards are easier to be defined, implemented, and monitored. All the communication infrastructure and communication protocols btw single MCO and the Grid Operators (“National Load Dispatch Centre” and those of neighboring countries) are less complex than what would be the case with multiple MCOs / Power Exchanges.
- A central settlement function can be implemented by the MCO as MCO would be in best position to perform such a function, as it would have the market awards (schedules), market prices, as well as energy metering information for actual deliveries.

Section 4.3.1 Diminishing Role of Power Exchanges

yes, the Power Exchanges would lose some functions that are currently overlapping and sub-optimal in contributing to the well-known societal benefits of Wholesale Electricity Markets. We would see that as a natural process of Electricity Markets evolution. However, Power Exchanges can start providing new services to participants, such as market registration and bidding services, market analytics and forecasting, risk monitoring and management, shadow settlements, primary energy (water and fuel) management, billing, and accounting, etc. That landscape of Market Participant services is abundant and well diversified in North America and is becoming more developed in other countries as well.

As the markets develop, the Power Exchange role is not diminishing but changing to new and important roles, such as the role of scheduling coordinator. As the volume grows these scheduling coordinators can submit bids to the market on behalf of many small and medium asset owners. They can also be aggregators for some geographical areas and perform the local balancing.

Section 4.3.2 Dampen Innovation and Technology Investment

The innovation in area of Electricity Markets worldwide comes from many different sources. It starts from the national and regional government entities imposing and stimulating certain policies and regulations. It is aided by research of Academia and the Industry, in particular by partnerships of Market/System operators and MMS vendors worldwide. Those are also driven by activist Market Participants/Stakeholders pursuing better utilization and returns on investments in their Market Resources. Depending on how the MCO entity is incorporated and related to Government Agencies, Power Exchanges, Market Participants, Grid Operators, those factors can add or detract from Market Innovation and Market Technology investment. The Market Policy and Market Tariff ultimately should be draft to be contribute to Technology Investment in Power Sector and complement with Government policies in that Sector.

Therefore, market coupling does not dampen the innovation and technology investment. It also gives the same opportunities to the Power exchanges as they can now invest in tool that maximizes profit for their participants or develop tools for automatic bidding.

Section 4.3.3 Reduce Competition

On the contrary as markets grow in both services, commodities, reliability, new type of resources the technology that is used will grow many fold. It is not one central algorithm that can do everything in the future but many such new algorithms solving diverse problems. Let's take the example of Uncertainty Estimation rising out of the integration of renewable assets. Since this uncertainty directly affects the system ramping capability due to modification of the net load profile the ISO has all the incentive to predict this using AI or other data science technology. An accurate uncertainty estimation incentivizes new product and service like ramp as a product.

Actually, in a power exchange scenario there is chance of large footprint of monopoly by one exchange vs. the other and thus there is higher potential of the exercise of the market power. In case of a coupled market, market power can be effectively detected and mitigated.

Section 4.3.5 No Improvement in Transmission Utilization

the ultimate goal of MCO Market Clearing model would be to model the whole transmission network, akin to the approach in North America and some other regions (i.e., Wholesale Electricity Spot Market in Philippines). Achieving this goal would ultimately accurately model AC power flows while providing secure operation in case of Contingencies, and thus well exceed current simplified Transmission Corridor approach where NLDC provides Transmission Corridor limits day in advance. As much importantly, such approach would accurately model and account for losses in the transmission network.

A SCED performing a Simultaneous Feasibility Study involving both Network Power Flow and Network Contingency Analysis can utilize the transmission better than allocation-based approach. The Power Transfer Distribution Factors (PTDF) model the injection and ejection at each nodes and hence gives more control for the congestion management. In cases of newer resources like batteries, it provides control in both direction from a single point of injection. Features like dynamic transmission limits, preventive corrective mode of operation can be effectively used.

Section 5.1

Acknowledge and Agree

Section 5.2

Acknowledge and Agree

Section 5.2.5

Authors themselves listed them earlier in this text, and they basically reflect many of the "economy of scale" arguments. What I would also see as one of the main benefits of Market Coupling and the MCO is to have them as a steppingstone to the Centralized Operations Planning (DAM) and Centralized Dispatch (RTM) of Market Resources. In other words, in the future, the role of MCO would not only be to clear submitted Buy and Sell bids and provide uniform Clearing Price, but to consider all the Power transactions, accurately model the Transmission Grid and Power Flows, and so to schedule and dispatch all the resources enabling secure operation of Power System, taking that role from NLDC. In other words, for MCO to assume the role of Independent System Operators in North America.

Section 5.3

"*Which argument fits better in the Indian context*" I find that the second argument (mis-labeled 5.3.1.) fits better for the long term.

Section 5.5

"Which Algorithm should be adopted for a coupled market", we would strongly advise development of an algorithm that would have use of more detailed transmission model and also model physical resources as Market Resources. Besides the main goal of uniform pricing, such model should provide for central Dispatch and Operations Planning capability of the kind we see in North America ISOs and Wholesale Market Operators in some other countries (Australia, Philippines). EUPHEMIA model does not model physical resources but rather tries to encapsulate resource capabilities and constraints into different bid formats, yielding to more and more complicated bid forms, and yet lagging modelling capabilities where physical resources are directly represented. Models that involve presentation of physical resources are more accurate and also have less complex bid structures as resource constraints and capabilities are decoupled form the bid model that is more focused on economic parameters. The close-to-physical modelling also helps integration of the large-scale renewables and new type of resources such as storages.

Regarding the algorithm development, note that in almost all of the cases around the world, the market clearing algorithms and MMS software are developed by dedicated Software vendors, often in cooperation with Market/System Operators and not exclusively by the Power Exchanges or Market/System Operators.

Section 5.6 & 5.7

"*How will the clearing & settlement be carried out and changes in settlement process."* We would advise a centralized clearing& settlement process, to be conducted by MCO. Market Participants can interface directly with MCO, for bid submission, for market clearing results and for settlement & billing, or contract Power Exchanges to perform those functions for them. MCO will be monitoring risk exposure and providing for sufficient credit (prudential requirements) of individual market participants. MCO will be performing dispute resolution, as well as price corrections.

Section 5.8

"In which market segment should the coupling be introduced first? – Simultaneous introduction in DAM and RTM