Ref: HPX/CERC/1611

Date: 16th October 2023

To,

The Secretary,
Central Electricity Regulatory Commission (CERC)
3rd & 4th Floor, Chanderlok Building,
36, Janpath, New Delhi – 110001

Subject: Hindustan Power Exchange Limited (HPX) comments on CERC Staff Paper on "Market Coupling"

Ref: *Public notice ref no Eco-14/1/2023-CERC dated 21.08.2023 inviting comments and suggestions on 'Staff paper on "Market Coupling'*

Dear Sir,

1. Hon'ble Commission issued a Staff Paper on Market Coupling on 21st August'2023 and invited comments from various stakeholders on the same.
2. At the outset, Hindustan Power Exchange Limited (HPX) welcomes this move by the Hon'ble Commission which marks the first step towards the implementation of one of the most important reforms in the Indian power market. Market Coupling has been under discussion for a long time and recommended by subject experts as a solution to issues faced by market participants. The concept was also deliberated at the time of draft CERC (Power Market) Regulations 2020 and the Hon'ble Commission, after a detailed consultation, decided to enact enabling provisions in the CERC (Power Market) Regulations 2021.
3. Our detailed comments on the staff paper are enclosed as **Annexure I** for kind perusal of the Hon'ble Commission. We hope that our submission will be considered favourably towards the early implementation of market coupling. Looking forward to your continued support and cooperation.

Yours sincerely,

(Naveen Godiyal)

Head, Market Operations

Encl: As above

Annexure I

HPX's comments on CERC Staff Paper on Market Coupling

Background

The concept of Market Coupling and the need thereof for the power market has been discussed at various fora in the country since 2010. Para 4.4 and 4.5 of the Staff Paper captures the history of these discussions wherein it is brought out that the Expert Group, comprising of members from CEA, POSOCO, CERC, Power Exchanges and other subject experts from academia, has recommended Market Coupling as the most optimal solution with maximum social welfare maximization irrespective of congestion.

Subsequently, discussion papers on Market Based Economic Dispatch (MBED) by Hon'ble Commission (in 2018) and Ministry of Power (MoP) (in 2021) also underscore the need and importance of Market Coupling among the power exchanges. In recognition of the same the Hon'ble Commission, after detailed deliberation and public consultation, included enabling provisions pertaining to Market Coupling in the PMR 2021.

More recently, report of MoP's group on Development of Electricity Market in India (May 2023) also recommends price coupling by combining the bids and offers in power exchanges across all bidding areas/zones, in order to ensure social welfare maximization.

Against the above backdrop, HPX humbly submits its comments on the various points raised in the Staff Paper, under two distinct chapters -

1. Chapter 1 – Discussion about the various issues being faced by market participants and Market Coupling as a solution to those.
2. Chapter 2 – Comments on the discussion points raised in the Staff Paper.

Chapter 1

1. Competition in the Market

1.1. The preamble to the Electricity Act 2003 ("**Act**") states that it was enacted, inter alia,

"*....for taking measures conducive to development of electricity industry, promoting competition therein, ...*".

1.2. Section 66 of the Act specifically provides for the development of the power market and mandates as follows:

"66. ***Development of Market*** *– The Appropriate Commission shall endeavour to promote the development of a market (including trading) in power in such manner as may be specified and shall be guided by the National Electricity Policy referred to in section 3 in this regard."*

1.3. It is with this intention of developing a vibrant power market in the country, that the Hon'ble Commission allowed a multi-exchange model in the power market at the very genesis of power exchanges in the country. This matter of allowing one or multiple power exchanges in the country was discussed by the Hon'ble Commission in its order dated 18.01.2007 in Suo Motu Petition No. 155/2006 regarding "Development of a common platform for electricity trading".

1.4. This Hon'ble Commission has consistently over the years taken various progressive steps to ensure that there is competition among the market participants to benefit the end consumers and has actively advocated for and facilitated a multi-exchange model. Such steps and interventions by this Hon'ble Commission have shown results as well and have been able to curb any opportunities of undue advantage being taken by a few market participants.

1.5. However, the Expert Group (mentioned in para 4.4 of the Staff Paper) in para 7.6 of its report, distinguished between "competition for the market" and "competition in the market". Relevant part of the report is reproduced below for convenient reference:

"7.6 The Expert Group would like to place on record a word of caution regarding allocation of transmission corridor in case of congestion. ***The core underlying issue is pertaining to "competition for the market" and "competition in the market". From a Regulatory perspective, equity and fairness needs to ensure competition in the market as the current methodology is inclined towards competition for the market****."*

The efforts of the Hon'ble Commission have resulted in a scenario towards ensuring competition for the market and consequently competition in the market has not yet got the requisite attention. The unintended consequence of this has been that though multiple (3) power exchanges have been permitted to operate in the market, there is a near monopoly of one power exchange in the segment of collective transactions.

1.6. The primary reason for such monopoly is different clearing prices on different market platforms which would result in sub-optimal outcomes for either the buyers or the sellers. If the price on a non-dominant power exchange is low, the sellers on that exchange would be at a disadvantage (lower realization) and would like to shift to the dominant exchange. Alternatively, if the prices are high, buyers on the non-dominant exchange would be at a disadvantage (higher procurement cost) and would shift to the dominant exchange, thereby eventually shifting the entire volume to one power exchange as is being witnessed today.

Consider the following example. The table below shows results on two different exchange platforms for a particular hour:

Exchanges	MCP (Rs./MWh)	Discom 1 (Qty Cleared in MWh)	Discom 2 (Qty Cleared in MWh)	Comparative loss to Discom 1	Comparative loss to Discom 2
Exchange X	7000	700	500		
Exchange Y	8000	50	250	-50,000	-250,000

Table 1

Even though the prices discovered on both the platforms are reflective of their own demand-supply situation respectively, from the perspective of market participants (Discom 1 & 2) they incurred a comparative loss on the less liquid platform. It would become difficult for a participant to explain such financial loss to its management or auditors. Thus, the participant will shift to the more liquid exchange, thereby, inadvertently making the collective segments binary in nature. This intrinsic nature suggests that to survive in the collective segments, any new power exchange has to become the new benchmark for price reference. To achieve this, they will have to start with more than 50% market share on Day-1 and consistently clock more than 50% of the market volume for a significant period of time. However, this will still not solve the problem of collective segments being binary by design as the other power exchanges will lose market share and will be eliminated from the segment.

1.7. HPX has faced this design flaw every time market participants have tried to transact in DAM segment on its platform. During the initial couple of days, HPX DAM segment operations ran successfully but due to differences in discovered prices compared to the dominant power exchange, the participants shifted to that power exchange in subsequent sessions.

A brief of the DAM market clearing price and volume on the HPX platform during the initial days of its operation is shown below:

Date	HPX				IEX				PXIL			
	Buy Bid	Sell Bid	MCP	MCV	Buy Bid	Sell Bid	MCP	MCV	Buy Bid	Sell Bid	MCP	MCV
29/07/2022	3.31	2.06	5.65	1.33	248.89	199.19	6.36	145.62	4.68	6.41	6.29	1.53
30/07/2022	3.63	0.1	12	0.1	280.44	191.55	7.01	154.29	4.47	5.96	7.38	0.71
31/07/2022	0.17	0	0	0	185.59	251.43	4.59	130.69	1.2	5.53	5.78	0.6

Table 2 (All fig. is in MUs)

It is clear from the above data that by the third day, the volume on HPX was reduced to zero as the sellers incurred financial losses and buyers moved out due to the perceived risk of unavailability of counter offers and hence limited volume clearance.

However, when the market prices touched the ceiling price (Sep and Oct 2023), it was observed that trades were successfully concluded in other exchanges as the prices were not the determining factor for participation. This is shown in Tables 3a and 3b

September 2023

Date	HPX				PXIL				IEX			
	Buy	Sell	MCV	MCP	Buy	Sell	MCV	MCP	Buy	Sell	MCV	MCP
1/9/2023	2.7	2.7	2.7	10	3.5	0.3	0.3	10	562.2	74.3	74.1	10
2/9/2023	4	3.9	3.9	10	12.4	3.6	3.6	10	573.8	68.1	68.1	10
3/9/2023	8.7	3.9	3.9	10	21.3	3.1	3.1	10	506.1	75.4	75.4	10
4/9/2023	17.7	6.4	6.4	10	19.7	4.3	4.3	10	479	76.3	76.3	10
5/9/2023	3	0.3	0.3	10	4	-	-	-	314.8	136	121	9

Table 3a (All fig. in MUs)

October 2023

Date	HPX				IEX				PXIL			
	Buy	Sell	MCV	MCP	Buy	Sell	MCV	MCP	Buy	Sell	MCV	MCP
6/10/2023	2.0	2.0	2.0	10.0	388.5	228.7	202.9	7.6	2.1	4.9	1.2	10.0
7/10/2023	2.8	2.8	2.8	10.0	395.0	203.4	188.4	8.3	4.8	5.2	0.4	10.0
10/10/2023	6.0	4.8	4.8	10.0	604.9	126.4	126.4	10.0	4.0	0.6	0.2	10.0
11/10/2023	9.7	5.9	5.9	10.0	649.3	120.1	120.1	10.0	26.0	3.1	3.1	10.0
12/10/2023	13.3	6.0	6.0	10.0	620.2	130.5	130.5	10.0	18.5	2.5	2.5	10.0
13/10/2023	13.3	7.7	7.7	10.0	518.9	107.3	107.3	10.0	31.6	6.0	6.0	10.0
14/10/2023	13.7	7.2	7.2	10.0	469.1	125.4	120.8	9.0	15.5	8.2	7.3	10.0
15/10/2023	0.0	0.4	0.0	0.0	252.4	172.7	127.8	7.1	-	0.4	-	10.0
16/10/2023	0.2	0.0	0.0	0.0	356.9	149.3	135.8	8.7	0.2	0.2	0.2	10.0

Table 3b (All fig. is in MUs)

1.8. Implementation of Market Coupling can solve this “core underlying issue” of competition in the market and would create a level playing field among the market platforms. This will result in power exchanges competing on the quality and reliability of services they offer.

2. **Innovation and quality of service**

2.1. It does not need emphasis that competition in a market leads to innovation and betterment of services which ultimately benefits the consumers.

2.2. In the Indian power market, Day Ahead Market (DAM) segment was launched in the year 2008 and one power exchange quickly garnered the predominant share in this market and ultimately became a monopoly. One consequence of such skewed liquidity and negligible competition was that it took the market 12 years to launch the next product in collective transactions i.e., Real Time Market (RTM) in the year 2020.

It was not only the innovation in terms of new products/segments which suffered as a result of monopolistic character of collective transactions but innovation in other aspects of platforms also took a hit. For example, in the last 15 years no or minimal innovation has happened in the DAM segment even though about 95% of exchange-based trade has been executed in this segment alone.

The following examples support this point:

2.2.1. A superior matching technology i.e., Mixed-integer Linear Programming (MILP) was full-fledged implemented in the year 2014 in the European Power Market, however, the same was missing in the Indian Power Sector till 2021.

2.2.2. Many ease-of-doing business-related innovations/facilities such as automated utility for creating bids, automated linked bids with reference numbers etc. which were introduced by HPX could have been provided to market participants much earlier.

2.2.3. The market's inability to handle complex bid structures (e.g. profile bids, flexible block bids etc) in the absence of MILP was not addressed till 2021. Late realization of the need for complex bid structures led to late adoption of mixed integer linear programming (MILP) in the matching algorithm.

2.2.4. Even after the launch of different bid types, the usability of bid types was not advocated nor explained to enlighten the market because of the monopolistic situation

in the market. This is evident from the fact that there is less participation in other types of bids by the market participants (the major portion is of single bid, block bid and link bid).

2.3. On the other hand, the Term Ahead Market (TAM), where competition has been thriving among the power exchanges, has witnessed multiple products like Contingency (Day-Ahead and Intra-day), Daily, Weekly, Monthly, Long Duration Contracts etc.

Months	IEX	HPX	PXIL
22-Jul	582	234	585
22-Aug	840	254	542
22-Sep	1004	104	505
22-Oct	731	86	332
22-Nov	613	168	579
22-Dec	959	251	551
23-Jan	963	422	703
23-Feb	1045	611	604
23-Mar	1184	675	545
23-Apr	963	846	580
23-May	1216	717	564
23-Jun	1224	800	805
23-Jul	1098	96	408
23-Aug	1755	1776	1133
23-Sep	1985	1145	1310

Table 4- TAM Volume (All fig. is in Mus)

2.4. Thus, there is clear and indisputable evidence that competition and balanced liquidity begets innovation and improvement in service standards. This also proves that the skewed share in collective transactions may not be attributed to specific process, people, and technology aspects of a particular exchange. Otherwise, similar market share would have been observed in non-collective segments as well. Rather, the sustained anomalies in distribution of shares in collective segment are rooted in market design issues which need closer scrutiny and redressal.

2.5. The Expert Group cited in the Staff Paper had also concluded that if merging bids are implemented, the power exchanges would compete on services they offer rather than the prices discovered by them in the DAM segment. The relevant excerpt from the report is produced below-

"5.13. The TOR for the Expert Group mentions the core issue that is to be discussed is the allocation of transmission corridors between multiple Power Exchanges in case of congestion. However, the Expert Group opined that the larger issue of implementation of multiple Power Exchanges itself is sub-optimal and is not part of the TOR. Further, ***irrespective of congestion, merging of bids collected through multiple Power Exchanges would result in an overall optimization and maximization of social welfare****."*

2.6. In para 12 of the order dated 18.01.2007 in Petition No. 155/2006, this Hon'ble Commission noted the comments and feedback from market that one power exchange would be a monopoly and would tend to be complacent in the long run and more than one power exchange should be allowed to encourage competition for their sustained performance. Thus, multiple power exchanges were allowed.

2.7. Competition in power exchanges was premised on competition witnessed in the stock and commodity exchanges where the transactions are bilateral (non-collective). The competition in the power exchanges has also worked in the non-collective segments i.e., TAM, GTAM etc. Collective transactions require special dispensation because they are unique in nature and have monopolistic characteristics. Special attributes of collective transactions necessitate Market Coupling.

2.8. Implementation of Market Coupling would help in truly harnessing the objectives envisaged at the genesis of power exchanges while allowing a multi-exchange framework i.e., ensuring competition for sustained performances, eliminating monopoly, and keeping complacency at bay. Market participants would be able to transact on the basis of quality, reliability and cost effectiveness of services offered by power exchanges.

3. **Allocation of Transmission Corridor**

3.1. The concept of Market Coupling was introduced as a solution to the issue of transmission corridor allocation between the power exchanges for collective transactions. It was proposed by NLDC in 2008, then discussed in 14th CAC meeting in 2010 and was proposed as the best solution to transmission allocation by the Expert Group in 2016.

3.2. Presently, all the collective transactions are taking place on one power exchange platform, but the issue of transmission corridor allocation will resurface in case collective transactions start happening at multiple power exchanges without Market Coupling. It will lead to non-clearance of multiple orders/bids on account of insufficient transmission corridor caused by sub-optimal corridor allocation under the present allocation mechanism.

3.3. Merging of bids of all the power exchange platforms (i.e., Market Coupling) offers the best solution to transmission corridor allocation in comparison to other allocation methods, as concluded by the Expert Group after study on "*Simulation of Alternatives Proposed for Allocation of Transmission Corridor between Power Exchanges*".

The Illustration below explains in detail that Market Coupling leads to better utilization of transmission capacity:

Step 1 – Receipt of bids

Consider the following bids received on two power exchanges – PX1 and PX2:

PX1 Bids:

PX1 GDAM		0	999	1000	1200	1201	1300	1301	10000
Single Buy1	WR	200	200	200	200	0	0	0	0
Single Buy2	WR	250	250	250	250	250	250	0	0
Single Sell1	SR	0	0	300	300	300	300	300	300

PX1 DAM		0	999	1000	1099	1100	1600	1601	10000
Single Buy1	SR	100	100	100	100	100	100	0	0
Single Sell1	WR	0	0	0	0	70	70	70	70
Single Sell2	WR	0	0	80	80	80	80	80	80

Similarly, bids received on PX2 platform:

PX2 GDAM		0	799	800	849	850	899	900	1000	1001	1100	1101	10000
Single Buy1	SR	70	70	70	70	70	70	70	70	0	0	0	0
Single Buy2	SR	30	30	30	30	30	30	30	30	30	30	0	0
Single Sell1	WR	0	0	100	100	100	100	100	100	100	100	100	100
Single Sell2	WR	0	0	0	0	50	50	50	50	50	50	50	50
Single Sell3	WR	0	0	0	0	0	0	150	150	150	150	150	150

PX2 DAM		0	899	900	999	1000	1200	1201	1400	1401	10000
Single Buy1	WR	140	140	140	140	140	140	140	140	0	0
Single Buy2	WR	60	60	60	60	60	60	0	0	0	0
Single Sell1	SR	0	0	190	190	190	190	190	190	190	190
Single Sell2	SR	0	0	210	210	210	210	210	210	210	210

<u>Step 2</u>: Segment-wise bid accumulation and assessment of required flow

PX1 GDAM Cumulative Bids

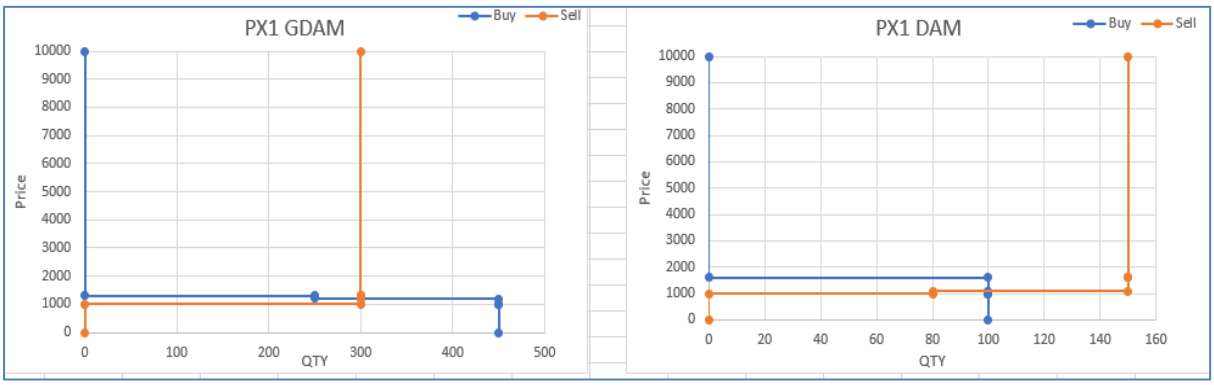
Price	0	999	1000	1200	1201	1300	1301	10000
Buy	450	450	450	450	250	250	0	0
Sell	0	0	300	300	300	300	300	300
Diff	450	450	150	150	-50	-50	-300	-300

Similarly, for PX1 DAM, the cumulative bids are as follows:

Price	0	999	1000	1099	1100	1600	1601	10000
Buy	100	100	100	100	100	100	0	0
Sell	0	0	80	80	150	150	150	150
Diff	100	100	20	20	-50	-50	-150	-150

Step 3: Provisional matching of bids

The aggregated demand-supply curve for both the DAM and GDAM segments would be as follows:



As represented in the curve above, the discovered MCP and MCV are tabulated below –

PX 1	**GDAM**		**DAM**
	MCP	1200.75	1099.29
	MCV	300	100

Based on the above results, the required flow for PX1 GDAM and DAM segments shall be:-

Required Flow:	**SR-WR**	**WR-SR**
	300	100

Step 4: Quantification of Social Welfare

Based on the above result, the total social welfare computed is enumerated below:

PX 1	**GDAM**		**DAM**
	MCP	1200.75	1099.29
	MCV	300	100
	Social Welfare	21329.7	14526.8

Similarly, the above steps for PX2 will be as follows:

<u>Step 2</u>: Segment-wise bid accumulation and assessment of required flow

PX2 GDAM Cumulative bids

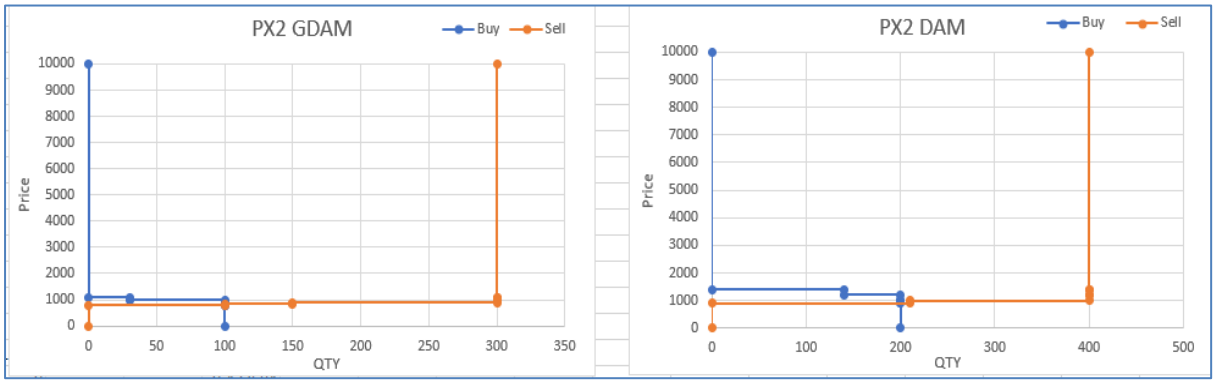
Price	0	799	800	849	850	899	900	1000	1001	1100	1101	10000
Buy	100	100	100	100	100	100	100	100	30	30	0	0
Sell	0	0	100	100	150	150	300	300	300	300	300	300
Diff	100	100	0	0	-50	-50	-200	-200	-270	-270	-300	-300

Similarly, for PX 2 DAM the Cumulative Bids are as follows.

Price	0	899	900	999	1000	1200	1201	1400	1401	10000
Buy	200	200	200	200	200	200	140	140	0	0
Sell	0	0	400	400	400	400	400	400	400	400
Diff	200	200	-200	-200	-200	-200	-260	-260	-400	-400

<u>Step 3</u>: Provisional matching of bids

The aggregated demand-supply curve for both GDAM and DAM segments would be as follows -



PX 2	GDAM		DAM
	MCP	824.5	899.5
	MCV	100	200

Based on the above results, the required flow for PX2 GDAM and DAM segments shall be:-

Required Flow:	WR-SR	SR-WR
	100	200

Step 4: Quantification of Social Welfare

As represented in the curve above, the discovered MCP, MCV and social welfare are tabulated below –

PX 2	GDAM		DAM
	MCP	824.5	899.5
	MCV	100	200
	Social Welfare	5775	22062.5

Step 5: Congestion check

The provisional results and required flows are shared with the nodal agency by both the PXs. The net required flow for both the exchanges is tabulated below –

Cleared Volume	PX1				PX2		
	GDAM	300	1200.75		**GDAM**	100	824.5
	Flow	SR – WR			**Flow**	WR – SR	
	DAM	100	1099.29		**DAM**	200	899.5
	Flow	WR – SR			**Flow**	SR – WR	

The net flow requirement is then shared by the PXs with the nodal agency –

Combined file	200	SR – WR

100	SR – WR

Let's consider that as per NLDC, the available ATC is found to be only 100 MW for both SR to WR and WR to SR:

ATC:	SR-WR	WR-SR
	100 MW	100 MW

Step 6: Corridor allocation by Nodal Agency

As the ATC available is only 100 MW for SR-WR and WR-SR, and the required flow is 300 MW for SR-WR, the nodal agency will allocate 100 MW of ATC on pro – rata basis to both the PXs as shown below -

	PX1			PX2	
NLDC's Allocation	66.67	SR – WR		33.33	SR – WR
	50	WR – SR		50	WR – SR

Step 7: Re-Accumulation of bids

The power exchanges after receiving the available corridors will re-accumulate the bids for both segments.

PX1 GDAM Cumulative Bids:

Price	0	999	1000	1200	1201	1300	1301	10000
Buy	450	450	450	450	250	250	0	0
Sell	0	0	166.67	166.67	166.67	166.67	166.67	166.67
Diff	450	450	283.3	283.3	83.3	83.3	-166.67	-166.67

The final flow will be **166.67 MW** from **SR to WR**.

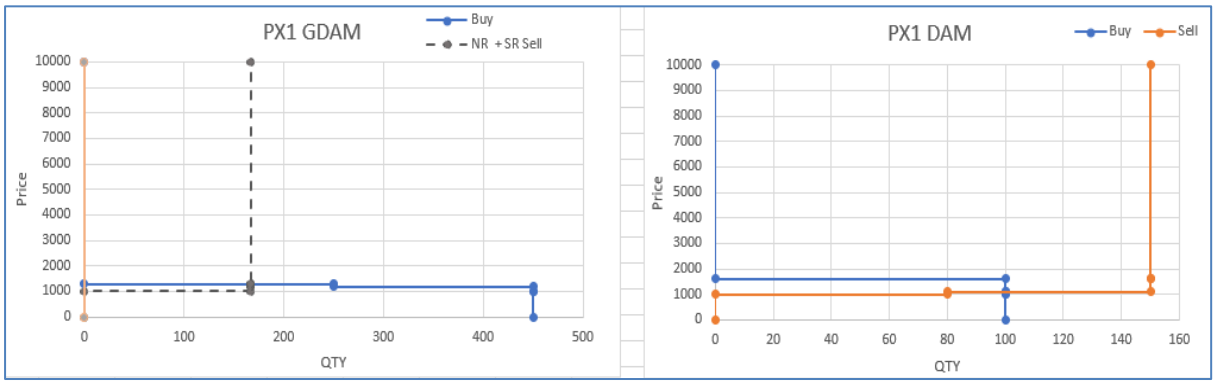
PX1 DAM Cumulative Bids:

Price	0	999	1000	1099	1100	1600	1601	10000
Buy	100	100	100	100	100	100	0	0
Sell	0	0	80	80	150	150	150	150
Diff	100	100	20	20	-50	-50	-150	-150

The final flow will be **100 MW** from **WR to SR-**

Step 8: Final Matching of bids

After re-accumulation, PX1 will re-create the demand-supply curve considering the curtailed volumes to arrive at ACP, ACV and Social Welfare for the market –



Step 9: Publishing of result

The final result for the market from PX1 for its respective segments would be –

		GDAM	DAM
PX 1	ACP	1300.33	1099.29
	ACV	166.67	100
	Social Welfare	12560.4	14526.8

A similar process will be followed by PX2 for determination of MCP.

Step 7: Re-accumulation of bids

For GDAM on PX2, no congestion was observed. Hence, there is no requirement of re-accumulation of bids.

Price	0	799	800	849	850	899	900	1000	1001	1100	1101	10000
Buy	100	100	100	100	100	100	100	100	30	30	0	0
Sell	0	0	100	100	150	150	300	300	300	300	300	300
Diff	100	100	0	0	-50	-50	-200	-200	-270	-270	-300	-300

The final flow will be **100 MW** from **WR to SR**.

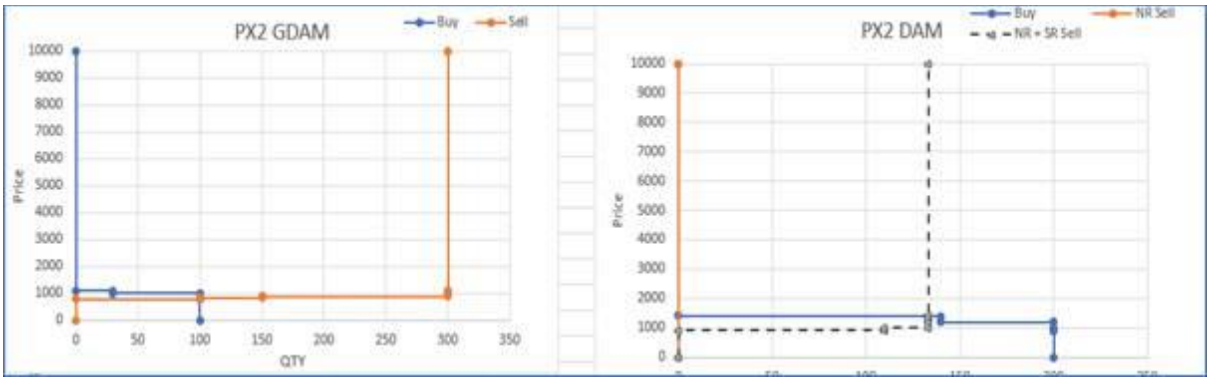
PX2 DAM accumulation of bids –

Price	0	899	900	999	1000	1200	1201	1400	1401	10000
Buy	200	200	200	200	200	200	140	140	0	0
Sell	0	0	133.33	133.33	133.33	133.33	133.33	133.33	133.33	133.33
Diff	200	200	66.67	66.67	66.67	66.67	6.67	6.67	-133.33	-133.33

The final flow will be **133.33 MW** from **SR to WR**.

Step 8: Final Matching of bids

The final curve for demand-supply for both DAM and GDAM segments will be plotted by PX2 to determine the final market results.



Step 9: Publishing of result

The market result for PX2 in both DAM and GDAM segments comprising of ACP, ACV and social welfare for the market is as tabulated below -

	GDAM		DAM
PX 2	ACP	824.5	1400.05
	ACV	100	133.33
	Social Welfare	5775	16711.4875

The final market results for respective PXs and respective segments along with the curtailed volume in an uncoupled market are shown below:

	PX1				PX2		
Clearance	**GDAM**	**166.67**	**1300.33**		**GDAM**	**100**	**824.5**
	DAM	**100**	**1099.29**		**DAM**	**133.33**	**1400.05**
	Curtailment	**133.33**			**Curtailment**	**66.67**	

Post Market Coupling Scenario

Now, let us repeat the above steps considering Market Coupling for the power exchanges.

Step 2: Segment wise Bids Accumulation and assessment of required flow

Cumulative GDAM Bids:

Price	0	799	800	849	850	899	900	999	1000	1001	1100	1101	1200	1201	1300	1301	10000
Buy	550	550	550	550	550	550	550	550	550	480	480	450	450	250	250	0	0
Sell	0	0	100	100	150	150	300	300	600	600	600	600	600	600	600	600	600
Diff	550	550	450	450	400	400	250	250	-50	-120	-120	-150	-150	-350	-350	-600	-600

The required flow will be **200 MW** from **WR to SR**.

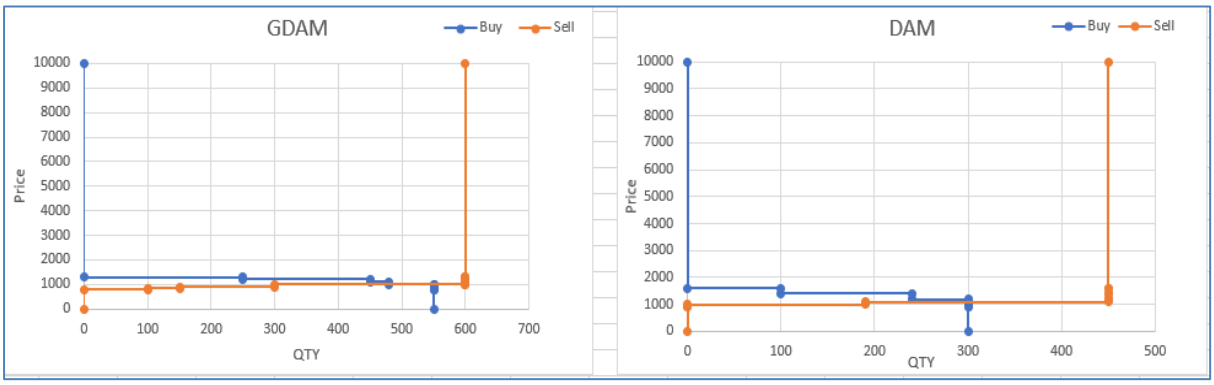
Cumulative DAM Bids:

Price	0	899	900	999	1000	1099	1100	1200	1201	1400	1401	1600	1601	10000
Buy	300	300	300	300	300	300	300	300	240	240	100	100	0	0
Sell	0	0	400	400	400	400	450	450	450	450	450	450	450	450
Diff	300	300	-100	-100	-100	-100	-150	-150	-210	-210	-350	-350	-450	-450

The required flow will be **100 MW** from **SR to WR**.

<u>Step 3</u>: Provisional Matching of bids

The aggregated demand-supply curve for the above scenario for both DAM and GDAM segments would be -



Provisional results for the market considering the demand-supply curve is as mentioned below-

		GDAM	DAM
Post Coupling	**MCP**	999.83	899.75
	MCV	550	300
	Social Welfare	40267.71	39584.38

Post Market Coupling, the provisional cleared volume with flow requirements is shown below -

Cleared Volume and prices	**GDAM**	550	999.83
	Flow	200	WR-SR
	DAM	300	899.75
	Flow	100	SR – WR

Step 4: Congestion check

The net required flow for the market is from WR to SR of 100 MW, which will be shared with the nodal agency for corridor allocation -

Combined file	100	WR-SR

The available corridor for the market is same as considered in the pre-Market Coupling scenario:

ATC	SR - WR	WR – SR
	100 MW	100 MW

Step 5: Corridor allocation by Nodal agency

The nodal agency provides the corridor allocation considering the cleared volumes and the available ATC -

NLDC's Allocation	100	WR-SR

Step 7: Final matching of bids

No curtailment, provisional result shall be considered as final result.

Step 8: Publishing of Result

The final market clearing volumes are -

Clearance	**GDAM**	550
	DAM	300
	Curtailment	0

The above illustration clearly demonstrates that market coupling results in volume maximization and optimized corridor allocation. Quantification of these benefits in the above scenario is tabulated below:

Market Benefit				
Segments	Pre-Market Coupling		Post Market Coupling	
	Volume	Social Welfare	Volume	Social Welfare
DAM	233.33	31238.27	300	39584.38
GDAM	266.67	18335.38	550	40267.71
Curtailment	200	-	-	-

Coupling of collective segments resulted in 22% more clareance in DAM and 52% more in GDAM as compared to uncoupled market. Further, market coupling also leads to optimized transmission corridor allocation and enhanced social welfare for the market.

4. **System Efficiency and Social Welfare Maximization**

4.1. Market Coupling leads to increased depth and breadth of the market by integrating bids of market participants who may choose to participate on multiple platforms thereby allowing them to avail benefits of a multi-exchange model but with the discovery of a single and uniform price based on the entire bid-ask of the overall market.

4.2. The discussion papers issued by both this Hon'ble Commission as well as MoP on MBED acknowledge that merging bids from multiple power exchanges and arriving at a common market clearing price (i.e., Price Coupling or Market Coupling) would lead to better system efficiency and higher social welfare as compared to different prices on different power exchanges.

The illustration below shows how market coupling leads to social welfare maximization

Step 1 – Receipt of bids

Consider the following bids received on two power exchanges – PX1 and PX2:

PX1 Bids:

PX1 GDAM	0	1800	1801	1900	1901	1999	2000	10000
Single Buy1	200	200	200	200	0	0	0	0
Single Buy2	100	100	100	100	0	0	0	0
Single Sell1	0	0	0	0	0	0	700	700

PX1 DAM	0	1499	1500	1599	1600	2400	2401	10000
Single Buy1	400	400	400	400	400	400	0	0
Single Sell1	0	0	70	70	70	70	70	70
Single Sell2	0	0	0	0	30	30	30	30

PX2 GDAM Bids:

Price	0	1399	1400	1499	1500	1599	1600	2000	2001	2100	2101	2200	2201	10000
Single Buy1	600	600	600	600	600	600	600	600	0	0	0	0	0	0
Single Buy2	200	200	200	200	200	200	200	200	200	200	0	0	0	0
Single Buy3	200	200	200	200	200	200	200	200	200	200	200	200	0	0
Single Sell1	0	0	0	0	0	0	350	350	350	350	350	350	350	350
Single Sell2	0	0	0	0	450	450	450	450	450	450	450	450	450	450
Single Sell3	0	0	400	400	400	400	400	400	400	400	400	400	400	400

PX 2 DAM Bids:

Price	0	1399	1400	1499	1500	2400	2401	2500	2501	10000
Single Buy1	250	250	250	250	250	250	250	250	0	0
Single Buy2	350	350	350	350	350	350	0	0	0	0
Single Sell1	0	0	0	0	600	600	600	600	600	600
Single Sell2	0	0	400	400	400	400	400	400	400	400

<u>Step 2</u>: Segment-wise bid accumulation and assessment of required flow

PX1 Cumulative Bids DAM

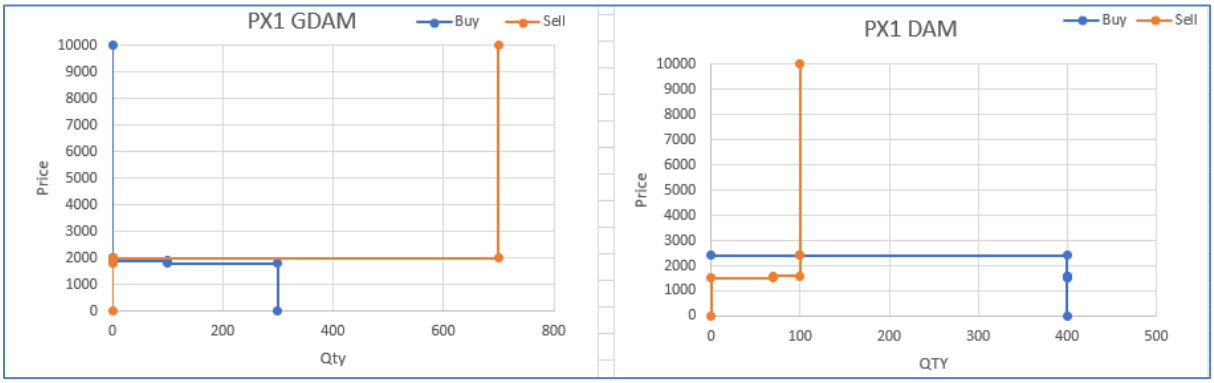
Price	0	1800	1801	1900	1901	1999	2000	10000
Buy	300	300	100	100	0	0	0	0
Sell	0	0	0	0	0	0	700	700
Diff	300	300	100	100	0	0	-700	-700

PX1 Cumulative Bids GDAM

0	1499	1500	1599	1600	2400	2401	10000
400	400	400	400	400	400	0	0
0	0	70	70	100	100	100	100
400	400	330	330	300	300	-100	-100

<u>Step 3:</u> Provisional matching of bids

The aggregated demand-supply curve for both DAM and GDAM segments would be as follows:



As represented in the curve above, the discovered MCP, MCV and social welfare are tabulated below -

PX 1	GDAM		DAM
	MCP	0	2400.75
	MCV	0	100
	Social Welfare	0	21784.375

Similarly, the above steps for PX2 will be as follows:

<u>Step 2 :</u> Segment wise bid accumulation

GDAM

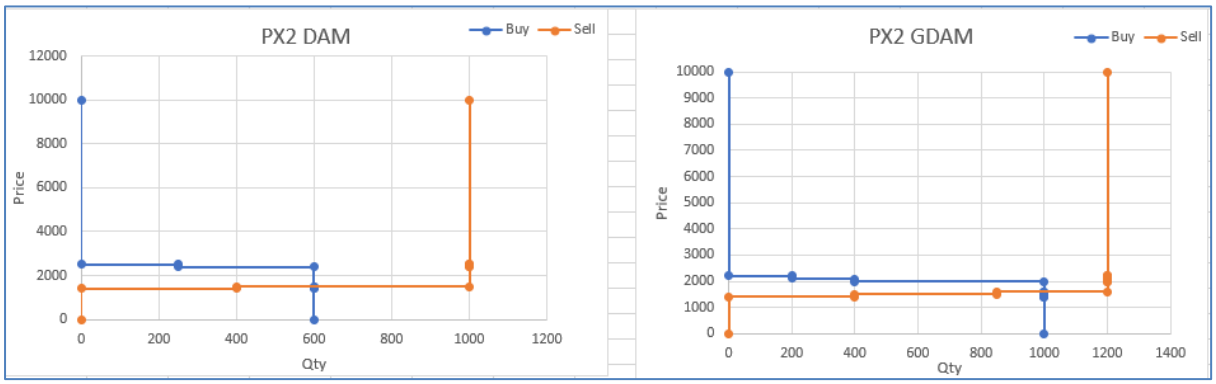
Price	0	1399	1400	1499	1500	1599	1600	2000	2001	2100	2101	2200	2201	10000
Buy	1000	1000	1000	1000	1000	1000	1000	1000	400	400	200	200	0	0
Sell	0	0	400	400	850	850	1200	1200	1200	1200	1200	1200	1200	1200
Diff	1000	1000	600	600	150	150	-200	-200	-800	-800	-1000	-1000	-1200	-1200

DAM

Price	0	1399	1400	1499	1500	2400	2401	2500	2501	10000
Buy	600	600	600	600	600	600	250	250	0	0
Sell	0	0	400	400	1000	1000	1000	1000	1000	1000
Diff	600	600	200	200	-400	-400	-750	-750	-1000	-1000

Step 3: Matching of bids

The aggregated demand-supply curve for the above scenario for both DAM and GDAM segments would be -



The table below shows the discovered MCP, MCV and social welfare for the curve represented in the graph -

	GDAM		DAM
PX2	MCP	1599.43	1499.33
	MCV	1000	600
	Social Welfare	146510.72	151416.67

Post Market Coupling Scenario

Now, let us repeat the above steps considering Market Coupling for the power exchanges -

Step 2: Segment wise Bids Accumulation

Cumulative GDAM Bids:

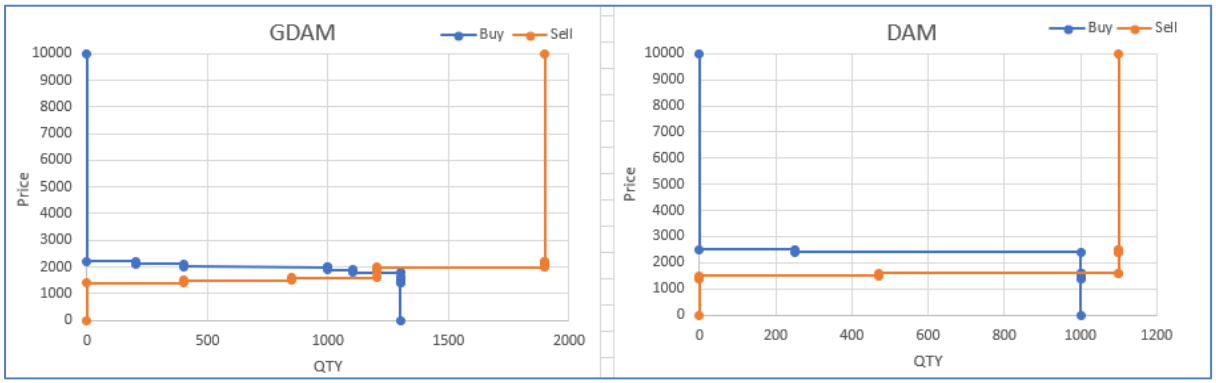
Price	0	1399	1400	1499	1500	1599	1600	1800	1801	1900	1901	1999	2000	2001	2100	2101	2200	2201	10000
Buy	1300	1300	1300	1300	1300	1300	1300	1300	1100	1100	1000	1000	1000	400	400	200	200	0	0
Sell	0	0	400	400	850	850	1200	1200	1200	1200	1200	1200	1900	1900	1900	1900	1900	1900	1900
Diff	1300	1300	900	900	450	450	100	100	-100	-100	-200	-200	-900	-1500	-1500	-1700	-1700	-1900	-1900

Cumulative DAM Bids:

Price	0	1399	1400	1499	1500	1599	1600	1601	2400	2401	2500	2501	10000
Buy	1000	1000	1000	1000	1000	1000	1000	1000	1000	250	250	0	0
Sell	0	0	0	0	470	470	1100	1100	1100	1100	1100	1100	1100
Diff	1000	1000	1000	1000	530	530	-100	-100	-100	-850	-850	-1100	-1100

Step 3: Matching of bids

The curve for demand-supply for both DAM and GDAM segments will be as follows:



Publishing of result

The market result in both DAM and GDAM segments comprising of MCP, MCV and social welfare for the market is tabulated below -

		GDAM	DAM
Post Coupling	**MCP**	1800.5	1599.84
	MCV	1200	1000
	Welfare	159056.25	218260.52

The above illustration clearly demonstrates that Market Coupling results in higher clearing volume and enhanced social welfare:

Market Benefit				
Segment	**Pre-Market Coupling**		**Post Market Coupling**	
	Cleared Volume	**Social Welfare**	**Cleared Volume**	**Social Welfare**
DAM	700	173201.04	1000	218260.52
GDAM	1000	146510.7	1200	159056.3

5. **Paving the way for various reforms**

5.1. Both the Hon'ble Commission and MoP discussion papers on MBED consider uniform market clearing price across exchanges as one of the requirements for implementation of MBED.

5.2. The Explanatory Memorandum to the draft Power Market Regulations 2020 mentions in clause 3.5.2 that financial products in electricity market would require uniform price discovery in the Day Ahead and Real Time markets. And this has been cited as one of the reasons to include enabling provisions on Market Coupling in the draft PMR 2020 and PMR 2021. Relevant section is produced below -

> *"..the Commission expects that financial products in the electricity market (which are under the process of being approved by the competent authority) would require uniform price discovery in the Day Ahead and Real-time markets."*

5.3. Comments received from stakeholders by the Honorable Commission on the subject of Market Coupling as proposed in the draft PMR 2020 state that Market Coupling would pave the way for MBED, market based ancillary services and for integration of power markets from neighboring countries.

5.4. As the discussions on these reforms – MBED, Ancillary Services market, Cross-border spot market – are also underway, it is essential that Market Coupling be implemented to enable deepening of the power market and market-wide social welfare maximization.

6. **Benefits for Market Participants and Consumers**

6.1. Uniform market clearing price will also lead to better portfolio management for market participants. In a truly liquid market, after Market Coupling, the participants will be able to participate purely based on their portfolio requirements rather than based on a segment offering most liquidity on a specific exchange.

6.2. Post implementation of Market Coupling, the issue of trading on the only exchange where the collateral has been deposited may be addressed and wider avenues will be available to the market participants for trading.

6.3. Market Coupling will also help in increasing the depth of the power market through availability of new derivative products which necessarily require a uniform benchmark price.

6.4. As is clear from the aforesaid, the benefits of Market Coupling have not been disputed by the policymakers and stakeholders. These include:

6.4.1. Uniform clearing price across the market leading to One Nation One Market.

6.4.2. Harnessing true potential of the multi-exchange framework by increased competition.

6.4.3. Deepening of markets by paving way for various reforms like MBED, Electricity Derivatives, Ancillary Services etc.

6.4.4. Increased liquidity, efficiency, and social welfare.

6.4.5. Optimal use of transmission network.

6.4.6. Promoting innovation and improving service quality.

6.4.7. Better portfolio optimization and management for the market participants.

6.4.8. Facilitation of market-based cross-border trade.

6.4.9. Catering to future energy needs of the country when high merchant capacity and Renewable Energy (RE) will require increased liquidity in the market.

Chapter 2

1. **Point 5.2 of the Staff Paper: Does the current Indian Power Market scenario form a compelling case for market coupling?**

1.1 As mentioned in the staff paper it needs to be noted that the transaction volume on exchanges is approx. 7% only. However, it has been projected that the market will grow multifold in the coming years. This is primarily due to increase in RE generation and upcoming merchant capacity addition in the country. It is estimated that the Indian power sector will grow at more than 6% per annum for next five years. The Trade Promotion Council of India, in its report "*How are Power Exchanges Transforming India's Energy Sector?*", highlights the importance of power exchanges in such scenario:

> *"Power exchanges would be crucial in facilitating efficient integration of the projected RE capacity into the grid. Exchanges will be instrumental in managing the intermittencies of renewable energy, reducing the cost of integration, and providing price signals for further capacity additions. Globally, power exchanges have played a key role in reducing the cost of renewable energy integration and providing efficient price signals for newer capacity addition. Taking cognisance, the Government aims to increase the share of power exchanges to 25 percent by 2030."*

If we are envisaging 25% of the country's generation to be traded on power exchanges, the choice of the exchange platform becomes crucial for the market participants. Thus, Market Coupling is required on an urgent basis.

1.2 The benefits of Market Coupling in India have been emphasized at various forums and need not be explained again.

1.3 The only point of discussion is the timing for its implementation. The Staff Paper mentions that the majority of collective transactions happen on one exchange platform and that coupling may not result in significant change in price discovery. However, we need to

analyze the reason for one-sided market share in collective transactions and whether such a system provides the best possible marketplace for the participants.

1.4 The reasons for one sided market share in collective transactions are discussed in detail in Topic 1 of Chapter 1. It can be inferred from Topic 1 that collective transactions required special dispensation because they are unique in nature and have monopolistic characteristics. The skewed share cannot be attribute to any specific process, people or technology aspects of a particular exchange but is a design flaw in the market and requires correction at the earliest.

1.5 Whether the present system provides the best possible platform for market participants?

1.5.1 Allowing multiple power exchanges in the sector was a well-thought-out decision of the Hon'ble Commission given the benefits of competition. Thus, near monopoly of one power exchange in the segment of collective transactions cannot be the intended consequence of the multi-exchange model.

1.5.2 Point 2 of chapter 1 highlights how the present market was and is still deprived of several groundbreaking innovation (like superior matching technology, new bid types etc.) in the platforms due to monopoly situation in collective transaction. Thus, the participants are definitely not getting benefit of the best possible platform and associated innovations and services.

1.5.3 It is pertinent to highlight that monopoly of one power exchange in one market segment has the tendency to stifle competition in other market segments as well due to limitations of operational ease. If a member holds collateral in the dominant exchange for collective transactions, it would be reluctant to initiate trades in other segments on other platforms as it would mean submitting additional collateral on those exchanges. It would find it operationally cumbersome to transfer or park funds in other power exchanges in case it is required to trade in any other market segment say the Term Ahead Market (TAM). It would find operational

convenience to trade on the same power exchange in other market segments as well.

1.5.4 Thus, even if a customer is getting better services, technology etc. on non-dominant exchange (s), it will transact on dominant platform due to operational convenience. In other words, despite some of the other power exchanges possessing superior technology and superior service, the present market design favors monopoly, which has primarily led to the volumes being concentrated on the dominant power exchange. The customer is devoid of choice of platform – the basic premise of competition.

1.6 Therefore, from the point of view of competition and providing customers with the choice of marketplace for their transactions, the existing decoupled system is fundamentally flawed. It needs to be understood that by not having Market Coupling presently, there is a loss of social welfare, skewed participation on exchanges and distortion in price signals. And distorted price signals (multiple prices) are the reason why competition between the exchanges doesn't and cannot manifest in the current market design.

1.7 It is true that the market has been, somehow, functioning in the distorted system of multiple exchanges without coupling. But we need to decide how long we would like to devoid the market participants of the benefits of market coupling and giving them the choice of transacting on the best exchange platform. If Market Coupling is delayed further, we need to assess the long-term systemic risks of having only one dominant exchange, even at the current volume level.

1.8 Reference price in the market

1.8.1 DAM segment prices are considered to be the reference price of the power market. However, multiple prices (2/3 exchanges) are a market distortion where all the prices are seemingly wrong. Multiple prices in the collective segment would effectively mean two/three price signals for the same commodity to be delivered to

the same geography and at the same time. Which of them are to be considered as a reliable reference price and more importantly can any of those prices be trusted?

1.8.2 It has been argued against market coupling that the prices in DAM/GDAM/RTM would converge when the volumes on all the exchanges are comparable. This is a fallacious argument with utopian assumptions. It may be possible in theory, but it is impractical in reality because of the sub-optimal outcome for one set of market participants (buyers or sellers).

1.8.3 Single reference price in the market also acts as an important signal for overall development and planning in the sector including generation and transmission. It will also pave the way for future reforms like cross-border trading, derivatives in electricity, MBED etc.

1.8.4 Thus, the Importance of DAM as the benchmark/reference market and attributes of collective transactions in conjunction compound the requirement of implementing Market Coupling on urgent basis.

1.9 To summarize, HPX believes there is an urgent need to implement Market Coupling among the power exchange. It will lead to maximization of social welfare, choice to market participants to transact on best and most efficient platform, single reference price for the market and smooth transition towards future market reforms.

2. **Point 5.3 of the Staff Paper: Effect of Coupling on technological innovation and competition.**

2.1 It needs no emphasis that healthy market competition is fundamental to a well-functioning economy. Basic economic theory demonstrates that when companies/service providers compete for customers, it leads to lower prices, higher quality goods and services, greater variety, and more innovation. Thus, the argument that Market Coupling would result in less incentive for product innovation (para 5.3.1 of the Staff Paper), has no merits. The best services and innovation are derived from the competitiveness of the market and since the collective market has become unintentionally monopolistic towards one exchange due to the reasons discussed above, it has also hampered innovation in the power markets.

This has been discussed in detail in point no. 2 of Chapter 1.

2.2 Thus, the argument in para 5.3.1 is flawed. In fact, after implementation of Market Coupling, the competition would be bolstered owing to the fact that the exchanges will have to compete based on the credibility of the services offered. Services can include various value-added services that can aid market players in decision-making. The Expert Group (para 4.4 of the Staff Paper) had also concluded that in case merging of bids is implemented, the power exchanges would compete on services they offer rather than the prices discovered by them in the DAM segment.

2.3 Moreover, three power exchanges working together are likely to provide more innovative bid types (profile bid, linked bid, min quantity profile bid etc.) and improved matching algorithm to the market participants. The power exchanges may jointly form an innovation cell under regulatory supervision for this purpose which could help the centralized algorithm innovate and accommodate complex bid structures.

2.4 Similarly, ease of transaction, technology solutions, information dissemination, advanced analytics, high quality services etc. will be better in a coupled market rather than in the present scenario.

3. Point 5.4 of the Staff Paper: Who shall be the Market Coupling Operator?

3.1 The Staff Paper has discussed three options for Market Coupling Operator (MCO) – Power Exchanges as MCO on rotational basis, System Operator (SO) as MCO or an explicitly formed entity as MCO.

3.2 An entity other than power exchanges as MCO – be it SO or a newly formed entity for this purpose – may offer advantages such as neutrality and independence. However, it will be associated with following disadvantages:

3.2.1 **Initial costs and investment** – Establishing a new entity involves significant initial costs, such as the costs of setting up infrastructure, hiring staff, and developing systems. Even if the system operator is designated as MCO, it will have to make substantial investment to procure technology platform and matching engine.

3.2.2 **Lack of experience and expertise** – Power Exchanges have been operational in the country for the last 15 years and are sufficiently experienced in their operations. A new entity or system operator lacks the expertise to handle day to day power exchange operations. Both entities may face operational challenges during the initial phases of operation, as it gains experience and builds a track record.

3.2.3 **Resource constraints** – The new entity or SO may face resource constraints, such as financial constraints and limited access to experienced staff, as compared to established entities.

3.2.4 **Market acceptance** – It may take time for the new MCO to build trust and acceptance among market participants.

3.2.5 **Regulatory approvals** – Establishing a new entity as the MCO would require regulatory approvals and compliance with market regulations. This may be a time-consuming process and might delay implementation of Market Coupling.

3.3 On the other hand, power exchanges as MCO by rotation (Round Robin model or RR model) may offer the following advantages:

3.3.1 **Robust and proven technology** – HPX, the newest power exchange, offers the most advanced and state of the art technology solution with matching engine based on MILP. Other exchanges have also recently upgraded their technology to MILP. The market participants have tried and tested the technology of power exchanges.

3.3.2 **Experience and expertise** – The existing power exchanges have subject matter experts with vast experience of handling exchange operations.

3.3.3 **Learning and best practices** – The RR model allows exchanges to learn from each other's experiences and share best practices. This can help to improve the overall performance of the market coupling mechanism.

3.3.4 **Market integration** – the RR model will lead to enhanced collaboration and understanding among exchanges, which will further result in a more integrated and efficient market.

3.3.5 **Risk mitigation** – This model reduces the risk of market disruptions by involving multiple exchanges. If one exchange experiences problems, another exchange can take over as the MCO.

3.3.6 **Avoid wastage of resources** – All the three power exchanges have invested in developing a fair, neutral, efficient, and robust matching algorithm for price discovery, developing an IT based exchange platform for enabling transactions electronically and facilitate extensive, quick, and efficient price discovery for

transactions executed in different contracts. The technology and systems being used by power exchanges should not be allowed to go waste by appointing a new entity or SO as MCO.

3.3.7 **Fairness and equity** – All exchanges have an equal opportunity to be the MCO, which can help to build trust and cooperation among market participants.

3.4 The only disadvantage of RR model could be coordination for MCO role transition every four (4) months. But this is likely to be smoothened after initial few cycles of transition.

3.5 In view of the above, power exchanges as MCO by rotation, seems to be the most suitable option, as exchanges have gained a good understanding of the complexities involved with the matching engines and integration of new bid structures, over the years. The nominated power exchange would be responsible for bid collection and price discovery, while the other power exchanges may also run the price discovery algorithm, share the results with the nominated power exchange, and help in fine-tuning the algorithm. During the interim period, the other power exchanges (who are not MCO) should focus on developing new bid structures to meet the evolving requirements of market participants, and undertaking adequate tests and preparations to ensure a smooth transition when it is their turn to perform the role of MCO.

4. Point 5.5 of the Staff Paper: Which Algorithm should be adopted for a coupled market?

4.1 The most widely used bid types in IEX, HPX and PXIL are Normal Bids and Block Bids. IEX and HPX have further received approval for the introduction of 'Minimum Quantity Block Bid', 'Profile Block Bid' and 'Linked Bid'.

4.2 It shall be noted that most of the design and operating aspects for Collective transactions i.e., double sided closed bid auction with uniform market clearing price, operating timelines for the markets, allocation of transmission capacities and congestion management, scheduling and dispatch rules etc. are all defined through the various provisions of PMR 2021, other CERC regulations and Procedures notified in this regard.

4.3 Since all the major design features and operational procedures for Collective transactions are tightly controlled and notified in Regulations and approved Procedures, the creation of MCO will not stifle innovation in these segments. The three power exchanges will continue to compete on the same fronts as they have been under the extant regulations.

4.4 At the beginning of Market Coupling, the bid types in DAM & RTM across the exchanges may be standardized/harmonized. In the coupled market, new bid types can be collectively developed basis the market demands. As mentioned above, the non-MCO power exchanges may focus on these things.

4.5 It is also recommended that double-closed bid uniform pricing mechanism based on the MILP model should be adopted as a pricing discovery model. It offers several benefits as compared to other models:

4.5.1 **Accuracy** – MILP-based price discovery algorithms have been able to find the most optimal solution to the market clearing problem, which ensures that the resulting prices are accurate and fair.

4.5.2 **Transparency** – MILP algorithms are transparent, which means that market participants can understand how the prices are calculated. This helps to build trust and confidence in the market.

4.5.3 **Efficiency** – MILP algorithms can calculate the prices quickly and accurately, even for large and complex markets.

4.5.4 **Flexibility** – MILP algorithms offer greater flexibility in accommodating complex bid structures and can be adapted to meet the specific needs of different power exchanges and markets.

4.6 In addition to the above general benefits for the market, MILP based price discovery can also offer benefits for power exchanges such as:

4.6.1 **Reduced costs** – By improving the accuracy and efficiency of price discovery, MILP can help power exchanges to reduce their operational costs.

4.6.2 **Increased liquidity** – MILP can help to increase liquidity in the power market by making it easier for market participants to trade.

4.6.3 **Improved market integration** – MILP can help with market integration in coupled markets by allowing power exchanges to couple their markets together.

5. Point 5.6 of the Staff Paper: How will the clearing & settlement be carried out?

5.1 The power exchanges have implemented a robust and tested clearing and settlement procedure for performing the clearing and settlement, on behalf of the market participants. The operation of clearing and settlement is performed in accordance with the guidelines of the PMR 2021 and is periodically audited by the Hon'ble Commission.

5.2 In the coupled market, power exchanges can continue handling the clearing and settlement as per PMR 2021. Some specific procedures and norms may have to be framed to provide flexibility to execute transactions in any power exchange.

The power exchange acting as MCO, shall communicate to the other power exchanges about their cleared portfolios and simultaneously the payin/payout needs to be made in between the exchanges. The exchanges will generate pay-in, and pay-out files based on the outcome of the bidding process and accordingly, inter-exchange fund transfers will be made to maintain a balance between surplus and deficit funds for pay-in and pay-out. Subsequently, the exchanges will share obligations with the respective members involved in the trades, and clearing banks facilitate fund transfers between members and exchanges.

5.3 As MCO is proposed to be one of the power exchanges (by rotation), there will be no requirement to increase the transaction fee or charging additional transaction fee for inter-exchange communication or settlement.

5.4 For grievance handling, the power exchange can continue functioning as per the existing dispute resolution mechanisms.

6. Point 5.7 of the Staff Paper: Changes in the settlement process.

6.1 The Staff Paper poses the question of whether traders should be allowed to submit their bids directly to MCO to reduce cost of power for trader clients.

6.2 It is humbly submitted that even if traders are allowed to submit bids directly to MCO (power exchanges by rotation), we do not envisage substantial financial benefits for the trader clients. Thus, it is suggested that traders and all market participants should be given the choice to submit their bids on any power exchange based on their comfort and services offered by the power exchanges.

7. **Point 5.8 of the Staff Paper: In which market segment should the coupling be introduced first?**

7.1 The transaction figures used in para 5.8 of the Staff Paper don't highlight the ratio of the uncleared volume that could have been cleared if the market coupling was in place.

7.2 In the collective market segment, market coupling is required to ensure system-wide social welfare maximization. Accordingly, the necessary and sufficient requirements for price convergence are:

7.2.1 Uniform price discovery and market clearing at one price.

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

7.3 The envisaged implementation of the Market Based Economic Dispatch (MBED) and mandatory participation in the Indian Day-Ahead Market (IDAM) as proposed in the Ministry of Power (MOP) report on the 'Development of Electricity Market in India' further strengthens the need for price convergence or one price in the spot markets. This need for price convergence should be in all such markets/products where a uniform price auction mechanism is being implemented.

7.4 As the reference price of market is considered to be what is discovered in the spot market (DAM), and the volumes are extremely skewed, this indicates that market coupling is required to be introduced in spot market (DAM) first. If a phase-wise implementation is envisaged, then market coupling in the Real-Time Market (RTM) can be taken up in the second phase.

7.5 It is also important to note that transmission network optimization will be done under MBED in the future and not with any other contract. Hence, other bilateral contracts operating on the power exchange platform should be best left to power exchanges to design, develop, and offer to the market.