Market coupling is a concept used in the energy sector, particularly in electricity markets, to improve the efficiency and integration of multiple interconnected markets. While it's not directly related to your user profile, I can provide information on the advantages of market coupling:

1. Price Convergence: Market coupling helps achieve price convergence between different electricity markets. This means that the prices for electricity in different regions become more aligned, reducing price disparities and creating a more consistent pricing structure.

2. Market Efficiency: By coupling markets, it increases the overall efficiency of the energy market. This can lead to better utilization of generation resources, reduced energy losses, and more efficient dispatch of electricity.

3. Increased Liquidity: Market coupling can enhance market liquidity by allowing participants to trade electricity across borders more easily. This can attract more market participants and increase trading volumes.

4. Risk Mitigation: It helps to mitigate risks associated with congestion and price volatility. Cross-border trading can help balance supply and demand, reducing the likelihood of grid congestion and price spikes.

5. Integration of Renewable Energy: Market coupling supports the integration of renewable energy sources by allowing electricity to flow freely across borders. This helps balance intermittent renewable generation with demand in different regions.

6. Enhanced Competition: Market coupling promotes competition by allowing market participants to access a broader market. This can lead to more competitive prices and improved market dynamics.

7. Harmonization of Rules and Regulations: It encourages the harmonization of rules and regulations across different markets. This simplifies the trading process and reduces administrative burdens for market participants.

8. Cross-Border Cooperation: Market coupling fosters cross-border cooperation and collaboration among different electricity market operators and regulators, promoting regional energy security and stability.

9. Consumer Benefits: Ultimately, market coupling can lead to benefits for consumers, including potentially lower electricity prices, improved grid reliability, and access to a wider range of energy sources.

Above shown points are applicable to the scenario where power markets are operating in different reasons and the coupling used to merge those reason into one reason however in Indian scenario it is not the same in Indian context we are trying to merge 3 exchanges who are operating in the same reason and coupling them will not incorporate any another reason into the same.

There are 3 power exchanges are operational in India namely IEX, PXIL and HPX. Out of these 3 exchanges only one exchange is having more than 99.7% share (which is equal to 3 Sigma of normal distribution) of collective market transaction. A 3 Sigma level is confirmation of their confidence in a particular exchange, which may be treated at nodal exchange for coupling.

Talking about other 2 exchanges. They are behaving as outlier as per statistics/ analytics. So, there is a possibility that they are encouraging couple of bidders with small quantities to bid at their exchange. This increases the possibility of non-ethical practices. One of such examples maybe favouring a bidder over another during price discovery by indicative bidding price.

Now, these 2 exchanges are asking the regulator to support them by increasing trading participation in Collective trading market. For achieving this, they are suggesting for market coupling. The same can be achieved by making these 2-exchange participant of IEX.

There were mainly 3 benefits suggested from these coupling is mentioned below. Let us review one by one points.

Discovery of a uniform market clearing price-

Considering 99.7% of result from a single exchange, discovery of uniform market clearing price is already in place. If there is sum other bidding happening it might be adjusted or it could have a outlier effect in the system. There might be some motivation to bidders to go for this kind of bidding with other exchanges. If this is normal then there is no need for market coupling. But if this is not normal then there has to be a review of other exchanges for creating this kind of result into the system. If there are some data points lying beyond the boundaries, they are treated as outliers. When a single exchange is achieving more than 99.7% and other exchanges behaves as outlier. We need think for managing these 0.3% instead of disturbing 99.7% of participation.

Lower price is considered to be better for buyers whereas higher price is considered to be better for seller. If we talk about uniform price it may be good for sailor or it may be good for buyer but 8 doesn't show anything related to the price band.

When market got started in 2008 the price band was up to ₹20,000 whereas after 15 years there is a price limit of ₹10,000. There are 2 kind of extreme scenarios found in the collective market one is known as over supply where lower price band hit and second one is over demand where upper limit of price is hit. Let’s consider current time scenario where we are observing price of ₹10,000 in this case buyers are getting pro-rata based traded volume of their bidded volume. This couldn’t consider as uniform price discovery, as it got disturbed by the price limit itself.

Are we saying this that we will be able to produce different result then IEX producing today, with proposed power market coupling. Otherwise, in practicality the market coupling will only add to complexity level instead off providing better results for the market participants.

**Optimal use of transmission infrastructure**

First of all, we must consider the whole infra require for power transmission is starts from the generators and ends at the actual consumer, where the transmission infra structure is a part. But when we consider only about transmission infrastructure, which is created by selective one agency, this could be considered as biasness for one agency.

For nation the utilization of all infra is very much important whether, it is public or private.

We should aim to harness the maximum available power produced in the system, as we are facing deficit scenario. This could be incorporating additional counterparties for buy and sell. for buyers it will be maximum power procurement addressed and, in case of seller their maximum power must be addressed for selling into the system. this will also facilitate in better utilization of transmission infrastructure.

For an example there are 2 region A and B there is buyer at A region only and there is seller at b region only then transmission infra between A and B will be max utilised. But if there counter parties for possible matches in A and B both regions then there will be less utilization of transmission intra between A and B region. However, the overall infrastructure utilization will be higher. And if you try to use the Max capacity of transmission line it will try to reduce some of the participants at A and B and try to maximise the flow between A and B. This may also create a risk of transmission line failure due to oversupply scenarios. However, we require optimal utilization of installed infrastructure and try to practically reduce the overall infrastructure cost by better utilising power generation and consumption.

**Maximisation of economic surplus**

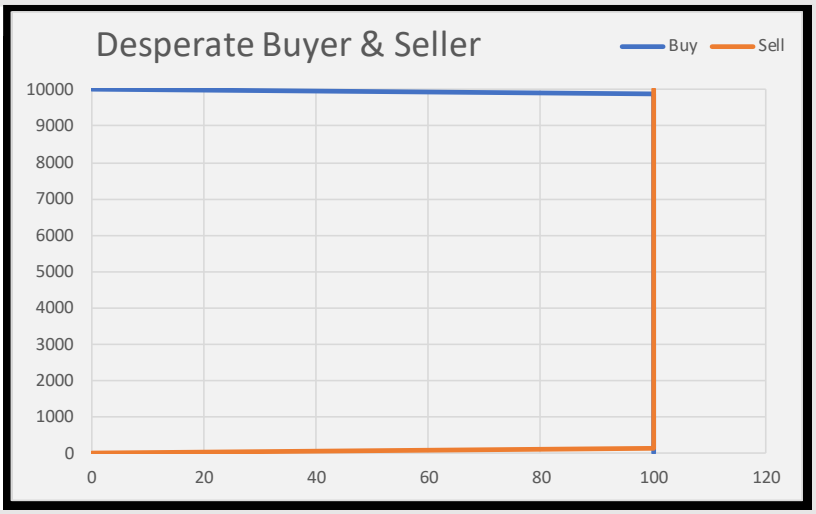
Every logic/ Algorithm has some characteristic, which is identified by different names. In this algorithm a scatter chart of Buy and sell curve is created and the area between selected buy and sell curve is known as Economical surplus. Name is good, but in practicality is value received and saved by privileged buyers and sellers.

The characteristics of this algorithm are.

**Desperate Buyer and Desperate Seller**

Buyers are bidding at a higher rate. Sellers are bidding at a lower rate.
Near about 100% volume cleared in trading. Clearing price may be high or low.
Occurrence possibility is very Low.

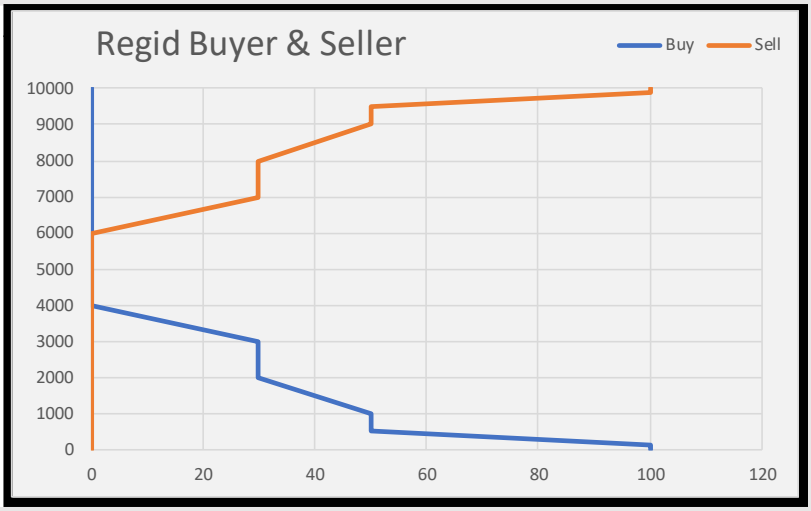
| Price | Buy | Sell |
|---|---|---|
| 0 | 100 | 0 |
| 100 | 100 | 100 |
| 500 | 100 | 100 |
| 1000 | 100 | 100 |
| 2000 | 100 | 100 |
| 3000 | 100 | 100 |
| 4000 | 100 | 100 |
| 5000 | 100 | 100 |
| 6000 | 100 | 100 |
| 7000 | 100 | 100 |
| 8000 | 100 | 100 |
| 9000 | 100 | 100 |
| 9500 | 100 | 100 |
| 9900 | 100 | 100 |
| 10000 | 0 | 100 |



**Rigid buyer and rigid seller**

Buyers are bidding at a lower rate. Sellers are bidding at a higher rate.
Low volume cleared in trading. Clearing price is indicative only.
During initiation period of exchange possibility is very Low.

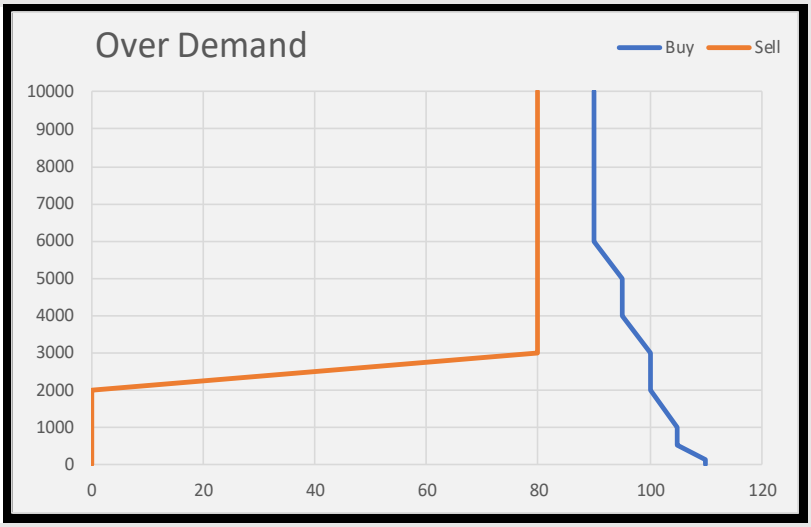
| Price | Buy | Sell |
|---|---|---|
| 0 | 100 | 0 |
| 100 | 100 | 0 |
| 500 | 50 | 0 |
| 1000 | 50 | 0 |
| 2000 | 30 | 0 |
| 3000 | 30 | 0 |
| 4000 | 0 | 0 |
| 5000 | 0 | 0 |
| 6000 | 0 | 0 |
| 7000 | 0 | 30 |
| 8000 | 0 | 30 |
| 9000 | 0 | 50 |
| 9500 | 0 | 50 |
| 9900 | 0 | 100 |
| 10000 | 0 | 100 |




**Over Demand**

Buyers are placing high quantity at a upper limit rate. Sellers are bidding at a normal rate.
All sell volume cleared in trading. Clearing price is upper limit.
During high demand scenario (e.g. election, festival etc.) or low supply (e.g. fuel constraint).

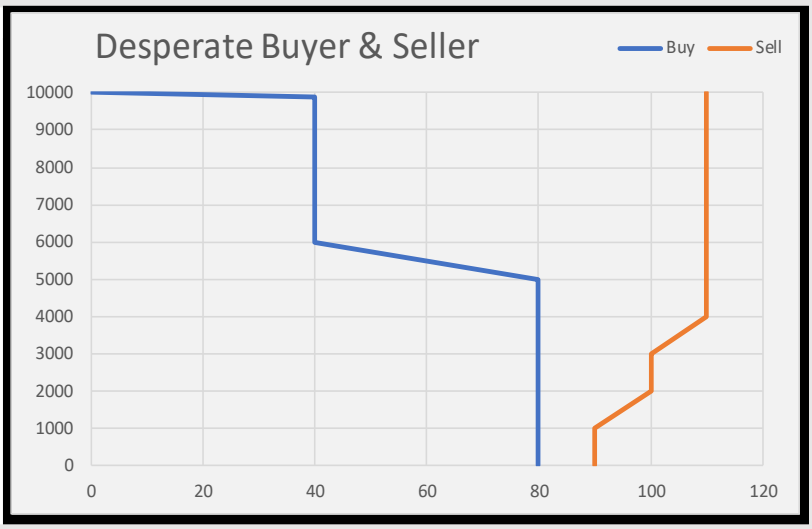
| Price | Buy | Sell |
|---|---|---|
| 0 | 110 | 0 |
| 100 | 110 | 0 |
| 500 | 105 | 0 |
| 1000 | 105 | 0 |
| 2000 | 100 | 0 |
| 3000 | 100 | 80 |
| 4000 | 95 | 80 |
| 5000 | 95 | 80 |
| 6000 | 90 | 80 |
| 7000 | 90 | 80 |
| 8000 | 90 | 80 |
| 9000 | 90 | 80 |
| 9500 | 90 | 80 |
| 9900 | 90 | 80 |
| 10000 | 90 | 80 |




**Over Supply**

Buyers are bidding at normal rate. Sellers are bidding at a lower limit rate.
All buy volume cleared in trading. Clearing price is lower limit.
During very low demand scenario (e.g. heavy rainy season) and must run plant quantity surpass the demand.

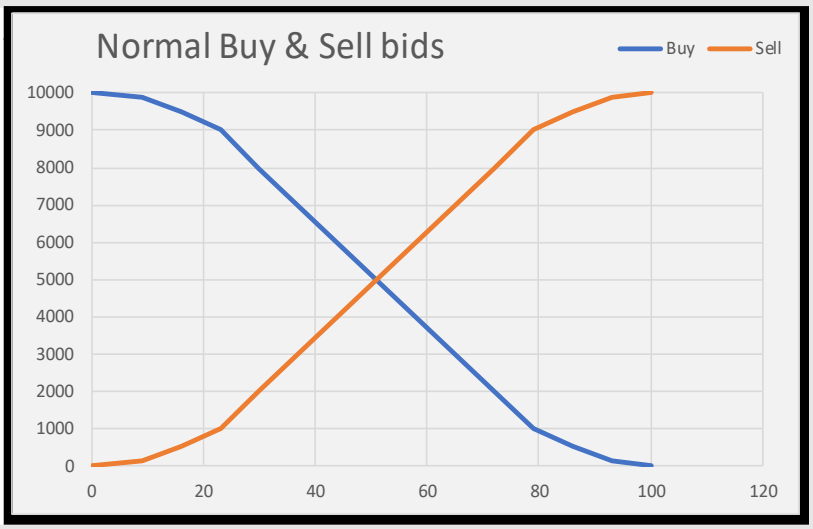
| Price | Buy | Sell |
|---|---|---|
| 0 | 80 | 90 |
| 100 | 80 | 90 |
| 500 | 80 | 90 |
| 1000 | 80 | 90 |
| 2000 | 80 | 100 |
| 3000 | 80 | 100 |
| 4000 | 80 | 110 |
| 5000 | 80 | 110 |
| 6000 | 40 | 110 |
| 7000 | 40 | 110 |
| 8000 | 40 | 110 |
| 9000 | 40 | 110 |
| 9500 | 40 | 110 |
| 9900 | 40 | 110 |
| 10000 | 0 | 110 |




**Normal bidding Scenario**

Buyers are bidding at normal rate. Sellers are bidding at normal rate.
Nearabout 50% volume cleared in trading. Clearing price is dependent on market base participation.
General scenario found in throughout life cycle of exchange.

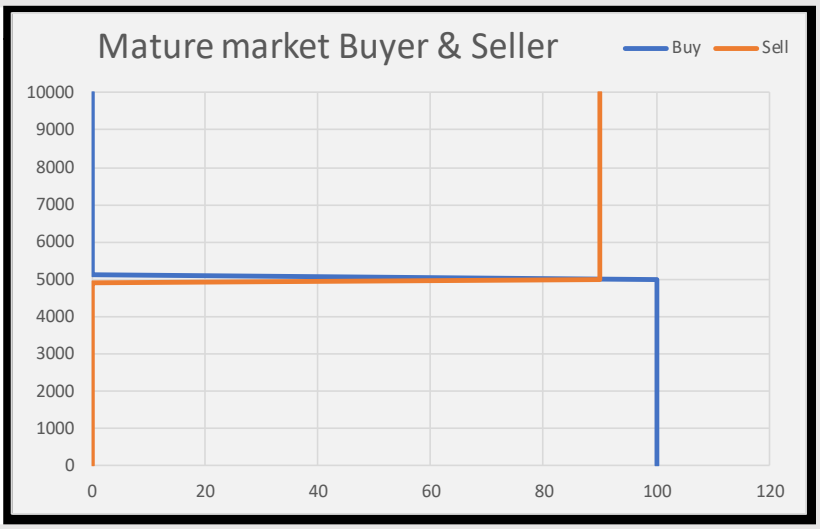
| Price | Buy | Sell |
|---|---|---|
| 0 | 100 | 0 |
| 100 | 93 | 9 |
| 500 | 86 | 16 |
| 1000 | 79 | 23 |
| 2000 | 72 | 30 |
| 3000 | 65 | 37 |
| 4000 | 58 | 44 |
| 5000 | 51 | 51 |
| 6000 | 44 | 58 |
| 7000 | 37 | 65 |
| 8000 | 30 | 72 |
| 9000 | 23 | 79 |
| 9500 | 16 | 86 |
| 9900 | 9 | 93 |
| 10000 | 0 | 100 |




**Mature market Scenario**

Buyers are bidding nearer to clearing price. Sellers are bidding nearer to clearing price.
Nearabout 100% volume cleared in trading. Clearing price is depended on market base participation.
General scenario found in throughout life cycle of exchange.

| Price | Buy | Sell |
|---|---|---|
| 0 | 100 | 0 |
| 100 | 100 | 0 |
| 500 | 100 | 0 |
| 1000 | 100 | 0 |
| 2000 | 100 | 0 |
| 3000 | 100 | 0 |
| 4900 | 100 | 0 |
| 5000 | 100 | 90 |
| 5110 | 0 | 90 |
| 7000 | 0 | 90 |
| 8000 | 0 | 90 |
| 9000 | 0 | 90 |
| 9500 | 0 | 90 |
| 9900 | 0 | 90 |
| 10000 | 0 | 90 |




However, there are scenarios where we may prefer lower social welfare and give preference to the higher volume clearance. This scenario is caused during Block bid selection.

Based on the above illustration, it becomes evident that the intended outcomes of market coupling can be realized under the following conditions:

1. Reduction of Entry Barriers: The achievement of market coupling would likely require a substantial reduction in entry barriers for new power exchanges as stipulated in the Power Market Regulation 2020. This reduction could encompass criteria such as net worth requirements and shareholding patterns. By lowering these barriers, it becomes more feasible for new exchanges to enter the market.

2. Emergence of Multiple Exchanges and Aggregators: A consequence of reduced entry barriers would be the emergence of multiple power exchanges and aggregators. These entities could introduce new products tailored for specialized power producers and buyers, including those involved in hydrogen production, pump storage, and battery technologies.

3. Cost Optimization: The introduction of new exchanges into the power market could lead to increased competition, which, in turn, might optimize costs for market participants. As competition fosters efficiency, participants can expect to benefit from improved pricing and potentially reduced operational expenses.

In summary, for market coupling to achieve its desired results, it is imperative to address entry barriers, encourage the entry of new exchanges, and create an environment that promotes competition and cost optimization in the power market.

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