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Role of Power Exchanges in India

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- Evolution of power exchange in India
- Factors leading to establishment of power exchanges in India
- Challenges faced in establishing/ promoting the power exchanges
- Regulatory framework for power exchange in India
- Power exchange products
- Price discovery mechanism, clearing, Settlement and risk mitigation in Indian power exchanges
- Contribution of power exchange to Indian power sector such as improvement in Market efficiency, price etc.
- Opportunity in Cross Border Electricity Trade.



Indian Power Market

Pre 2003

- Vertically integrated State Electricity Boards
- Single buyer model
- Only long term contracts – NO MARKET
- Two-part tariff

2003-2008

- **Unbundling of SEBs**-Development of a **multi-buyer-Seller market**
- **Electricity Act, 2003 enacted**

Post 2008

- Competitive markets
- Evolution of power exchanges
- Different products at PXs to manage power portfolios



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Electricity Act - enabler for competition

Intent of the Act was **to promote competition**

- **Promoting OPEN ACCESS - open and non-discriminatory access to transmission and distribution system**
- **Trading recognised as licensed activity**
- **Unbundle Vertically Integrated Utility**
- **Autonomous Regulators at State and Centre**
- **Development of Power Market**
 - Section 66 of the Electricity Act 2003 gives powers to the regulatory commissions to develop the power market including trading



Market Development Phases

	Summary
Pre 2000	<ul style="list-style-type: none"> • No Open Access • All contracts under Long term • Generation Captive supply to Discoms- No Other Option
2003, Enabling Framework	<p>Electricity Act, 2003</p> <ul style="list-style-type: none"> • De-licensing of generation • Development of a multi-buyer-Seller market - Unbundling of SEBs • Trading – licensed activity.
2004, Open Access	<p>CERC OA Regulations , 2004</p> <ul style="list-style-type: none"> • CERC Regulations for Open Access on Transmission Network • Universal Open Access to transmission networks implemented • Trading of bulk power
2008, PX	<p>OA Regulations , 2008</p> <ul style="list-style-type: none"> • Regulations for PX Transactions



Market Development Phases

	Summary
2009 , Consumers Choice	<ul style="list-style-type: none"> • Large Consumers (>1MW) allowed access to buy from generators/PX/traders directly
2010, Power Market Regulations	<p>CERC Power Market Regulations</p> <ul style="list-style-type: none"> • Formal framework for Competitive markets • Norms for setting up and operating power exchanges
2012, Transmission Pricing Rationalised	<p>PoC Regulation,2012</p> <ul style="list-style-type: none"> • Sharing methodology for ISTS charges, based on locational point charging (Rs/MWh)
2002-14 Deviation Settlement Rationalised	<p>DSM Regulation,2014</p> <ul style="list-style-type: none"> • Frequency linked and Volume limits on transaction through UI • Stringent norms and frequency band tightened

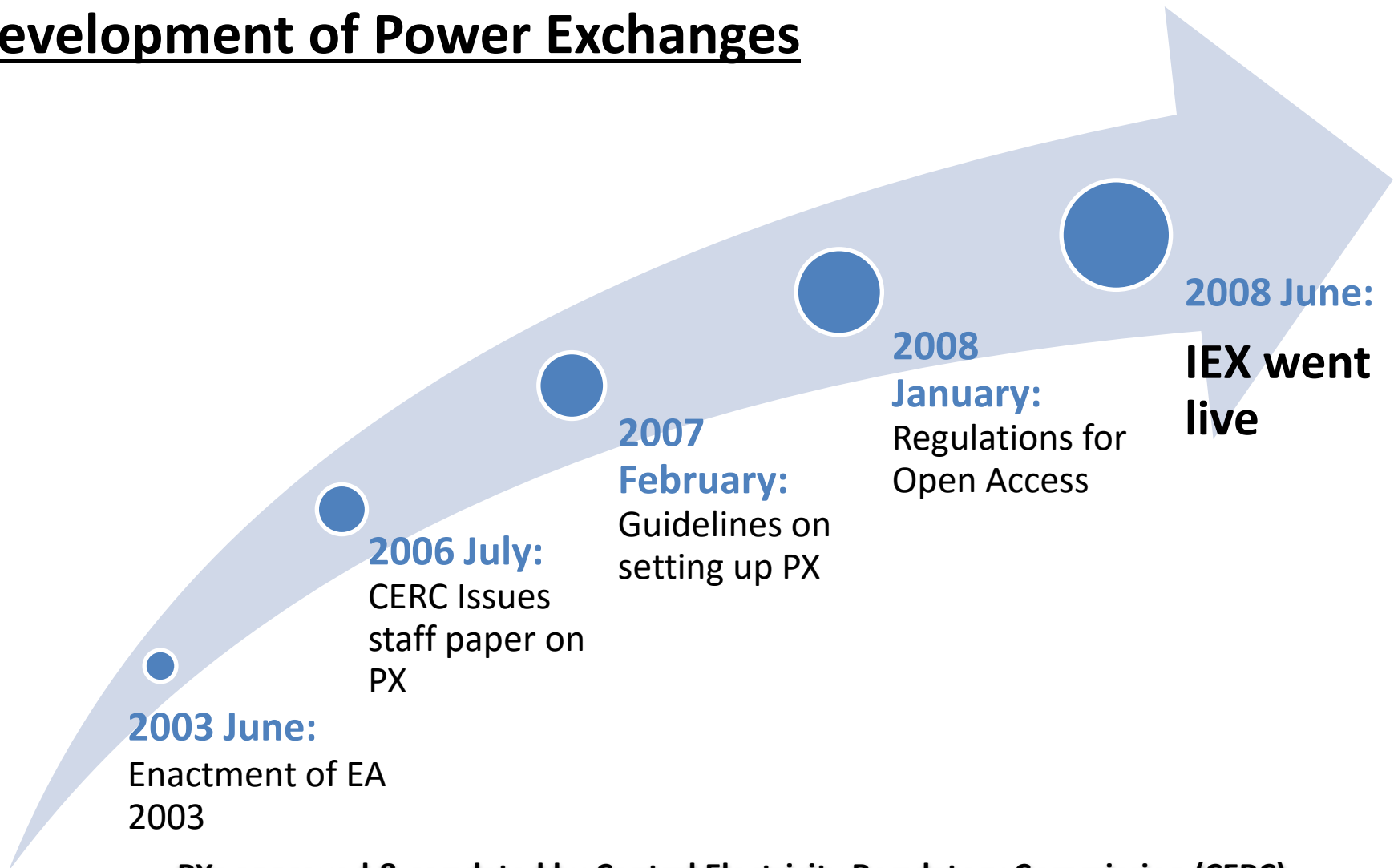


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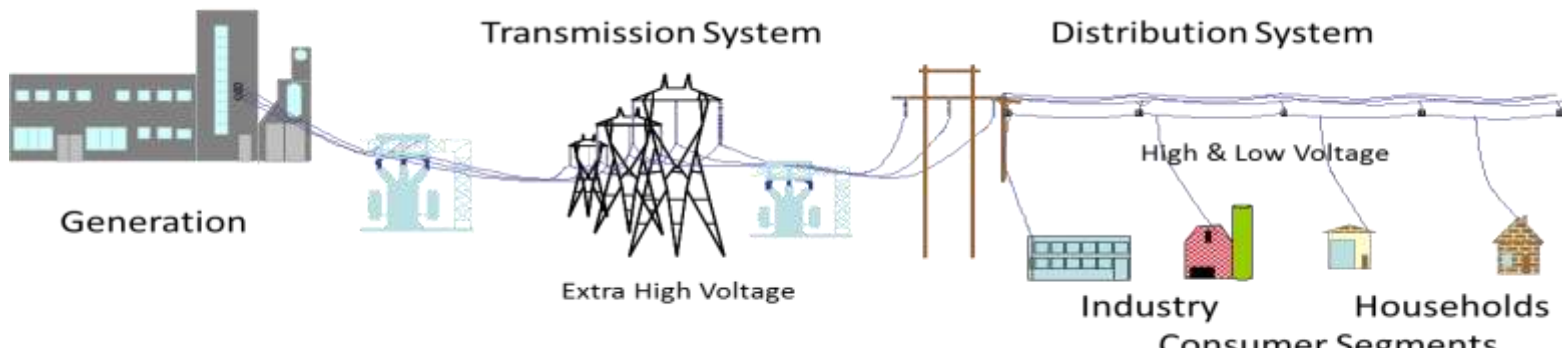
Development of Power Exchanges



PXs approved & regulated by Central Electricity Regulatory Commission (CERC)

Prerequisites present in the sector allowing the launch of Power Exchange

- Scheduling of Power with mechanism to penalize deviations
- Sale and Purchase of electricity allowed
- Merchant plants allowed to sell power apart from long term PPAs.
- Open Access to the networks enabled
- Independent Regulators - CERC & SERCs
- Large Consumers allowed to purchase from third parties





Working of Power Exchanges



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About IEX

- **Inception in June 2008**
- Established under the Regulatory oversight of Central Electricity Regulatory Commission (CERC)
- Transparent market platform that facilitates **delivery based trading**
- **Electronic, on-line bidding**
- **Standardised Contracts**
- **Flexible trading** with separate price discovery for 96 time-blocks of **15 min in a day**
- No Financial products such as Derivatives and Forward contracts
- Worldwide, Power Exchanges (40+) are most common platform to trade power



IEX Market Segments

Delivery-based Contracts

Day-Ahead Market
since June,08

Closed , Double-sided Auction
10-12 am bidding
Each 15-min block , 0.1 MW min NOC required

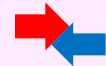
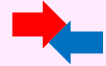


Term-Ahead Market

Round-the-clock Markets since 20th July'15

Day-Ahead Contingency – Another window for Day-Ahead.
Extended Market: Trading window increased to 1500-2300 Hours

Intra-Day –Extended Market: Trading window increased to 0030 – 2000 Hrs for same day delivery, with delivery starting at 0400 Hours
Daily- for rolling seven days (delivery starting after 4 days)
Weekly- for 1 week (Monday-Sunday)



Renewable Energy Certificates
since Feb,11

Green Attributes as Certificates
Sellers : RE generators not under feed in tariffs
Buyers: Obligated entities
1MWh equivalent to 1 REC



Next... Energy Saving Certificates





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Features of Day Ahead Market

- Physical delivery based market (Min 100kW)
- An electronic, closed, uniform, double-sided auction for **each 15-min time block** for the following day
 - Electronic: Bid entry, price discovery etc all done through the electronic platform
 - Closed: Bids entered cannot be seen by other participants
 - Double-sided: Both buyers and sellers enter the price and quantum range they are ready to buy/sell electricity at.
 - Uniform: Each selected bidder receives the same price (as applicable to its bid area) irrespective of the quoted price for every accepted bid.
- **Price Discovery**: Price is discovered for every 15 min after aggregating the buy and sell request posted at the Exchange using advanced algorithm based on the economic principle of demand and supply.
- **Risk Management**: Buyers pay in advance (D-1), sellers paid post delivery



Features of Day Ahead Market

A closed double-sided anonymous auction for **each 15-min time block** for the following day

The intersection between the aggregated sale and purchase curves defines the market clearing price (MCP)

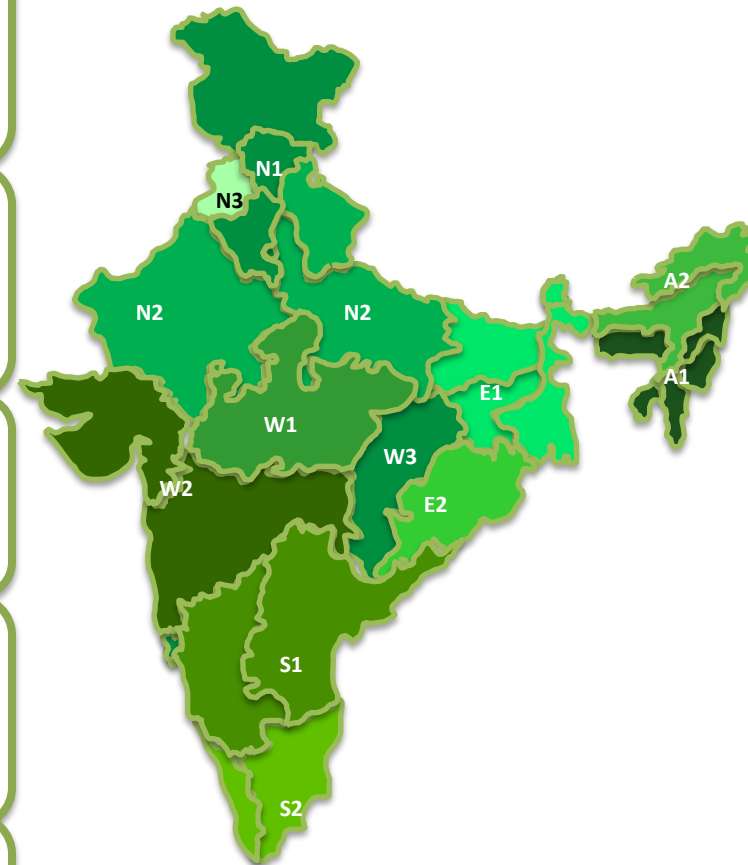
12 Bid area defined

Congestion Management through market splitting and determining Area Clearing Price (ACP) specific to an area

Bid types: Portfolio Orders or Block Orders

Minimum bid=Re.1 for 0.1MWh

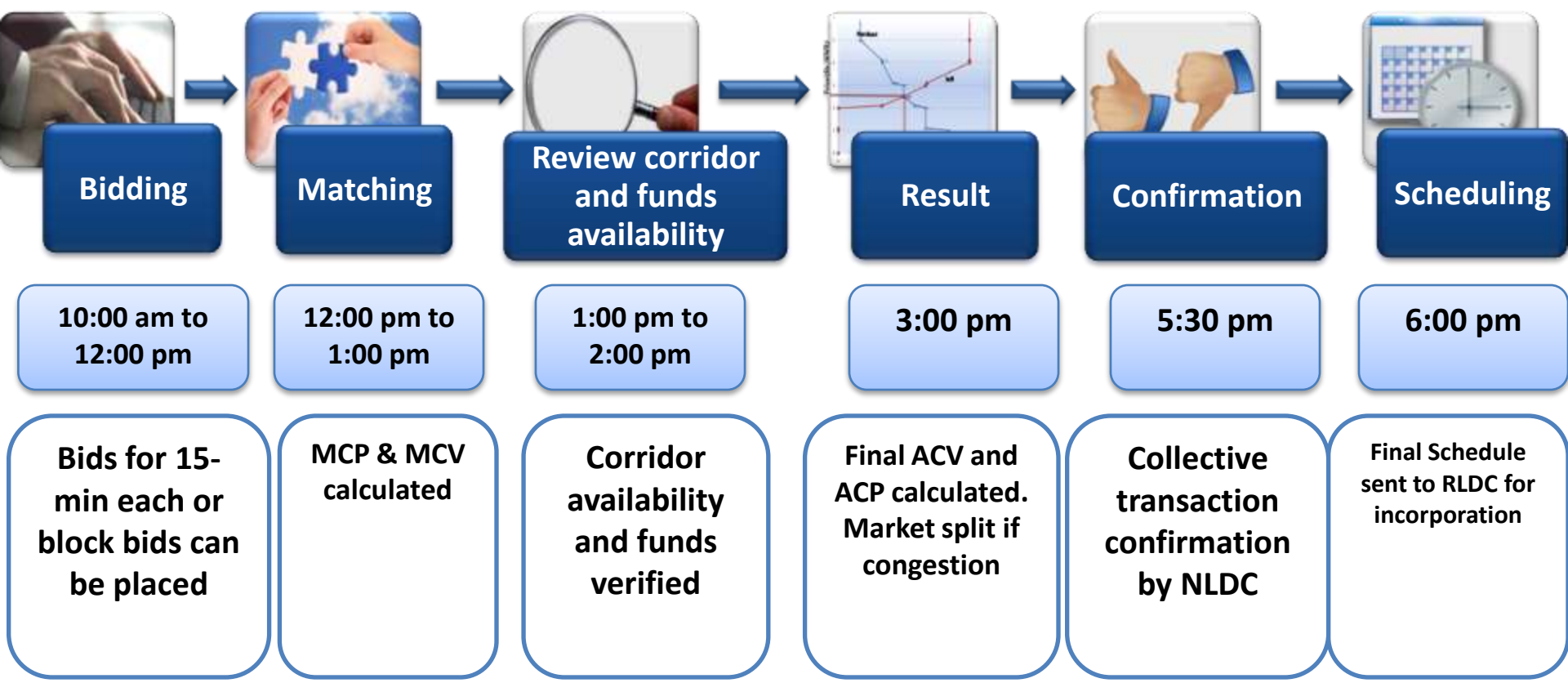
Minimum Price & Volume Step = 0.1p * 0.1 MWh



12 Bid Areas



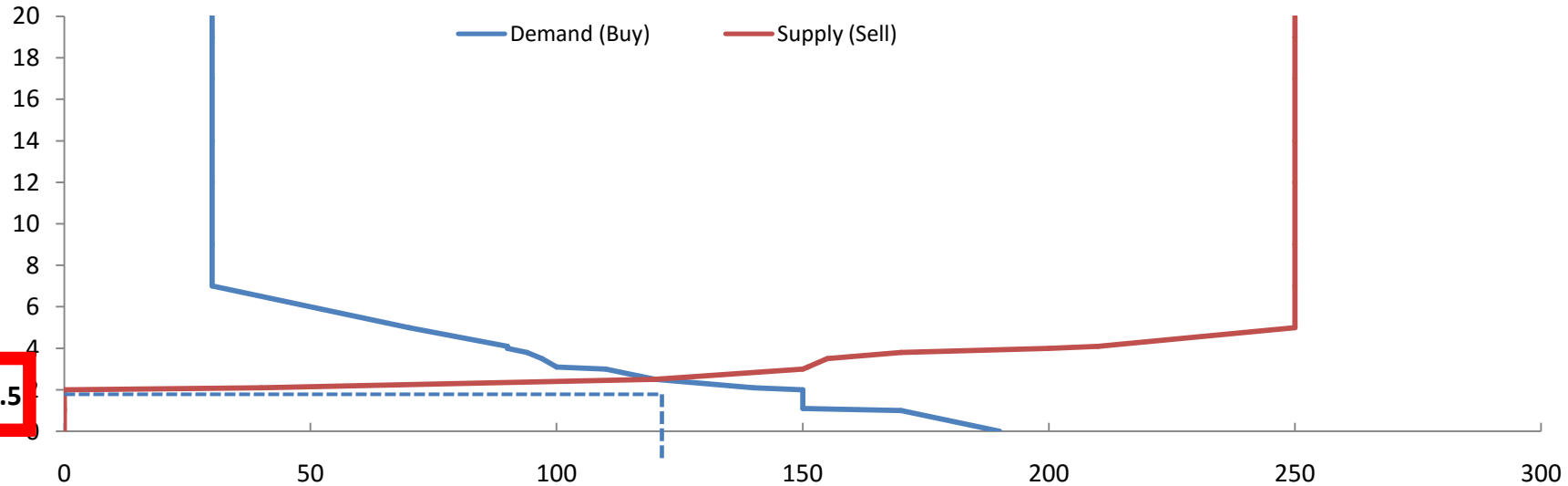
DAM trading process



Matching: Model Price Calculation algorithm (Example for a sample 15-min)

Price Tick	0	1	1.1	2	2.1	2.5	3	3.1	3.5	3.8	4	4.1	5	7	9	12	14	17	19	20
Portfolio A	20	20	20	20	20	20	20	10	7	4	0	0	0	0	0	0	0	0	0	0
Portfolio B	60	60	60	60	50	40	40	40	40	40	40	40	20	20	20	20	20	20	20	20
Portfolio C	70	70	70	70	70	60	50	50	50	50	50	50	50	10	10	10	10	10	10	10
Portfolio D	40	20	0	0	-40	-60	-80	-81	-85	-100	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120
Portfolio E	0	0	0	0	0	-40	-50	-50	-50	-50	-60	-60	-90	-90	-90	-90	-90	-90	-90	-90
Portfolio F	0	0	0	0	0	-20	-20	-20	-20	-20	-20	-30	-40	-40	-40	-40	-40	-40	-40	-40

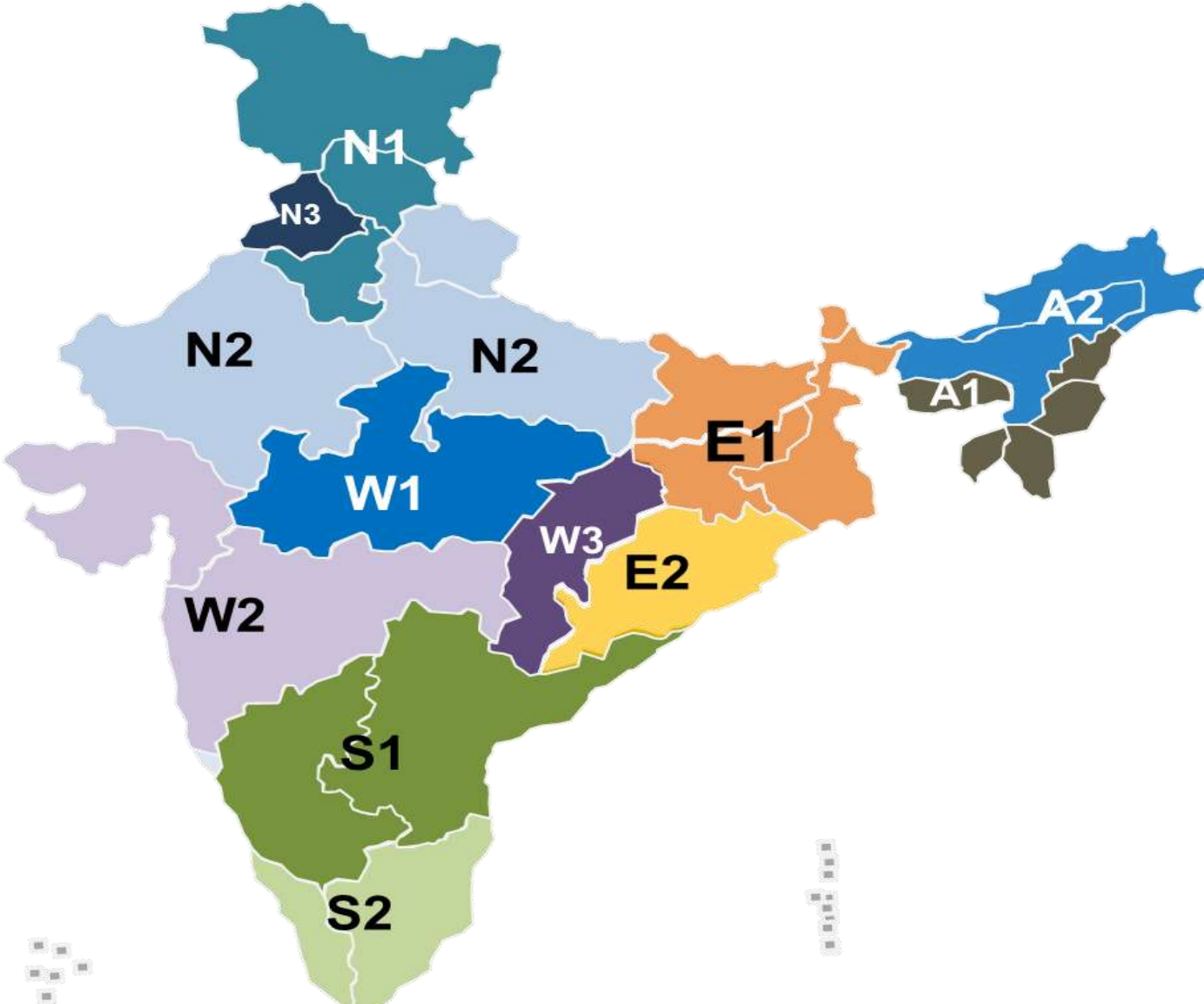
Total Buy, MW	190	170	150	150	140	120	110	100	97	94	90	90	70	30	30	30	30	30	30	30
Total Sell, MW	0	0	0	0	-40	-120	150	-151	-155	-170	-200	-210	-250	-250	-250	-250	-250	-250	-250	-250
Net Transaction, MW	190	170	150	150	100	0	-40	-51	-58	-76	-110	-120	-180	-220	-220	-220	-220	-220	-220	-220



MCP: Rs 2.5

MCV: 120 MW

Bid Areas at IEX





Performance of Power Exchange markets



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Company Snapshot



- Market Share: **96%**
- Average daily trade: **4000 MW**
- High Participation: **3700+**

3300+ Industries | **50+** Discoms (all) | **350+** Generators

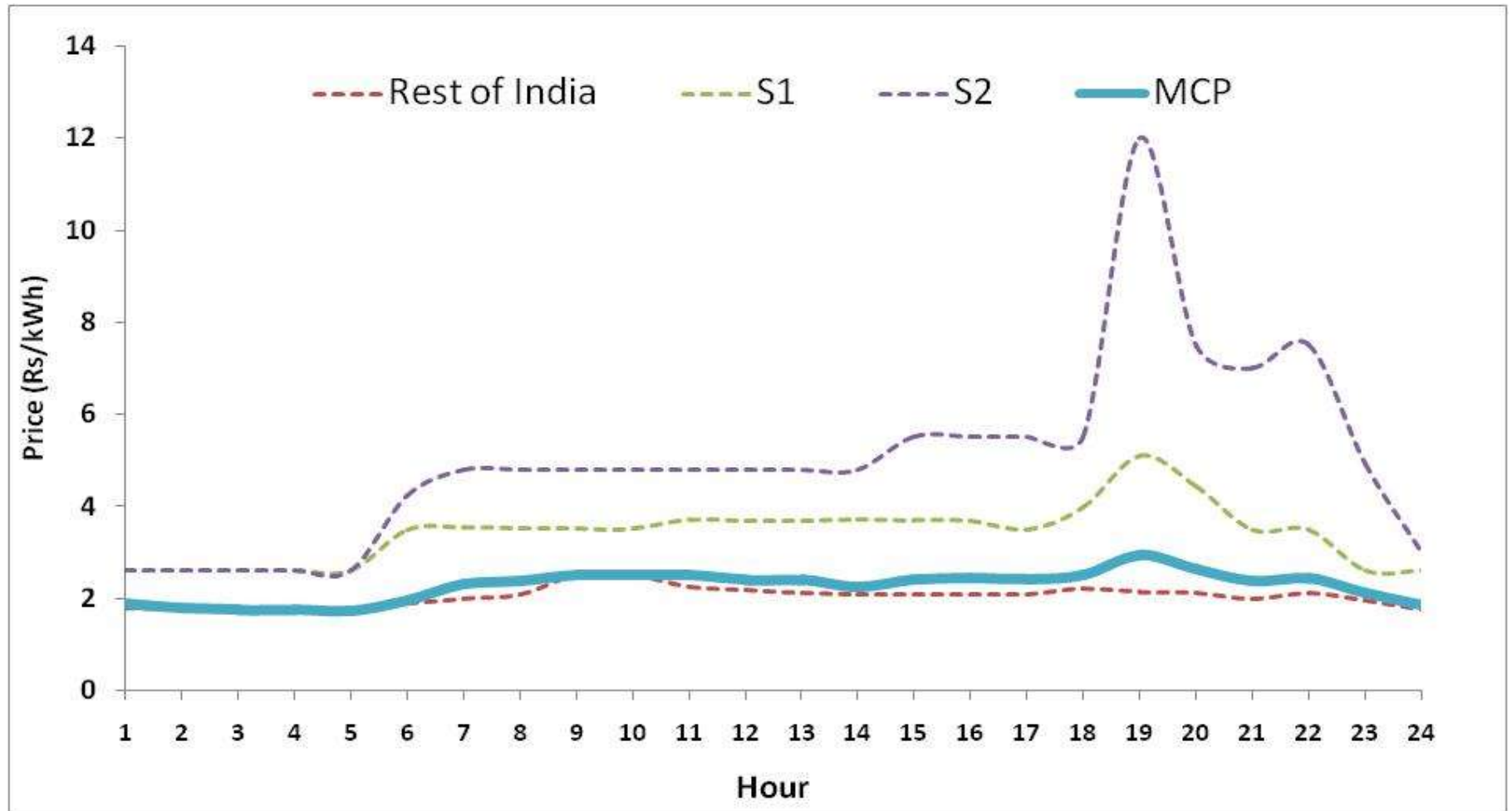
Transparency

Liquidity

Competition

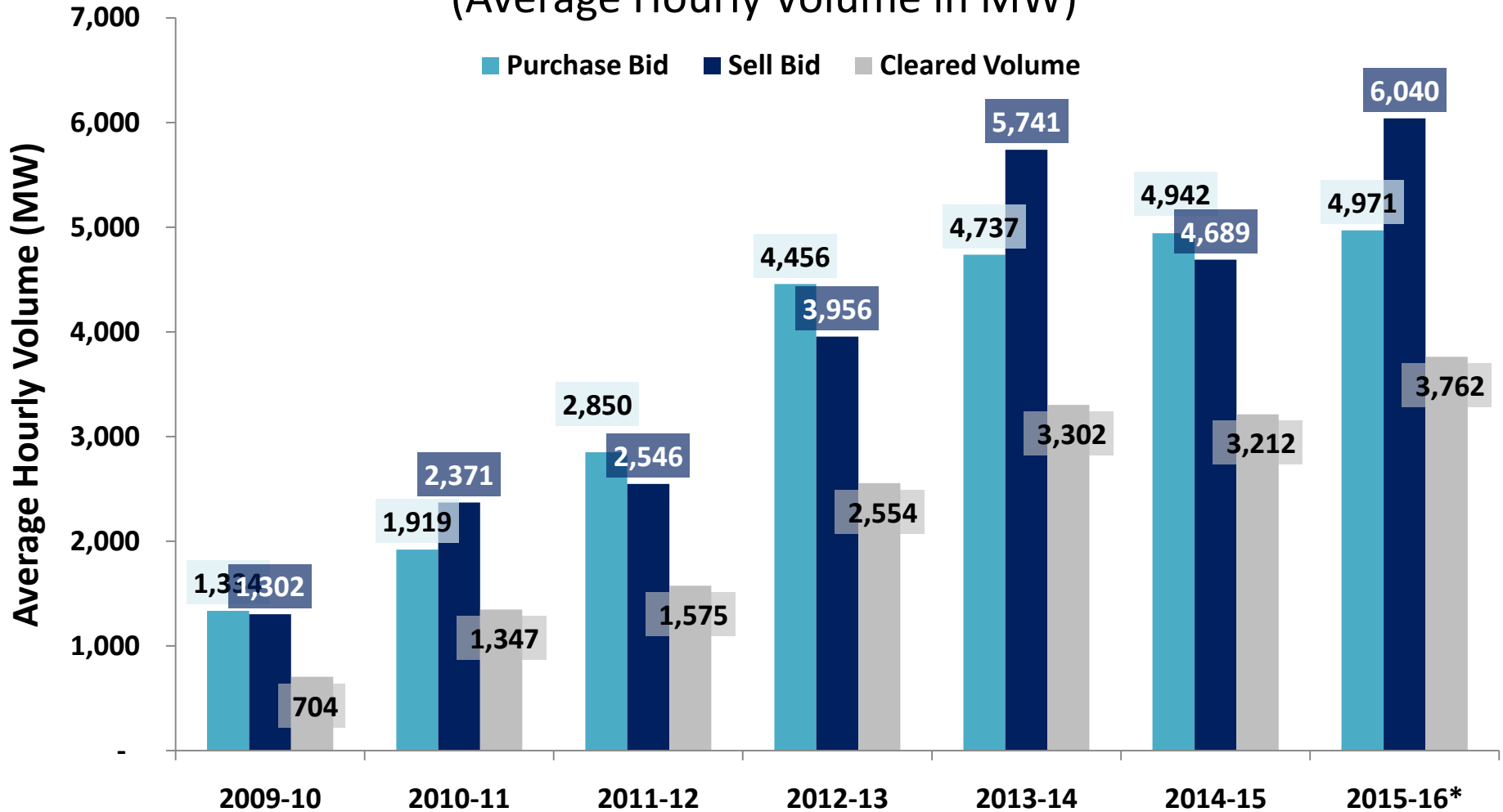
Typical price trend

(Area Clearing Prices for each 15min)



High Liquidity in Volume at IEX

(Average Hourly Volume in MW)

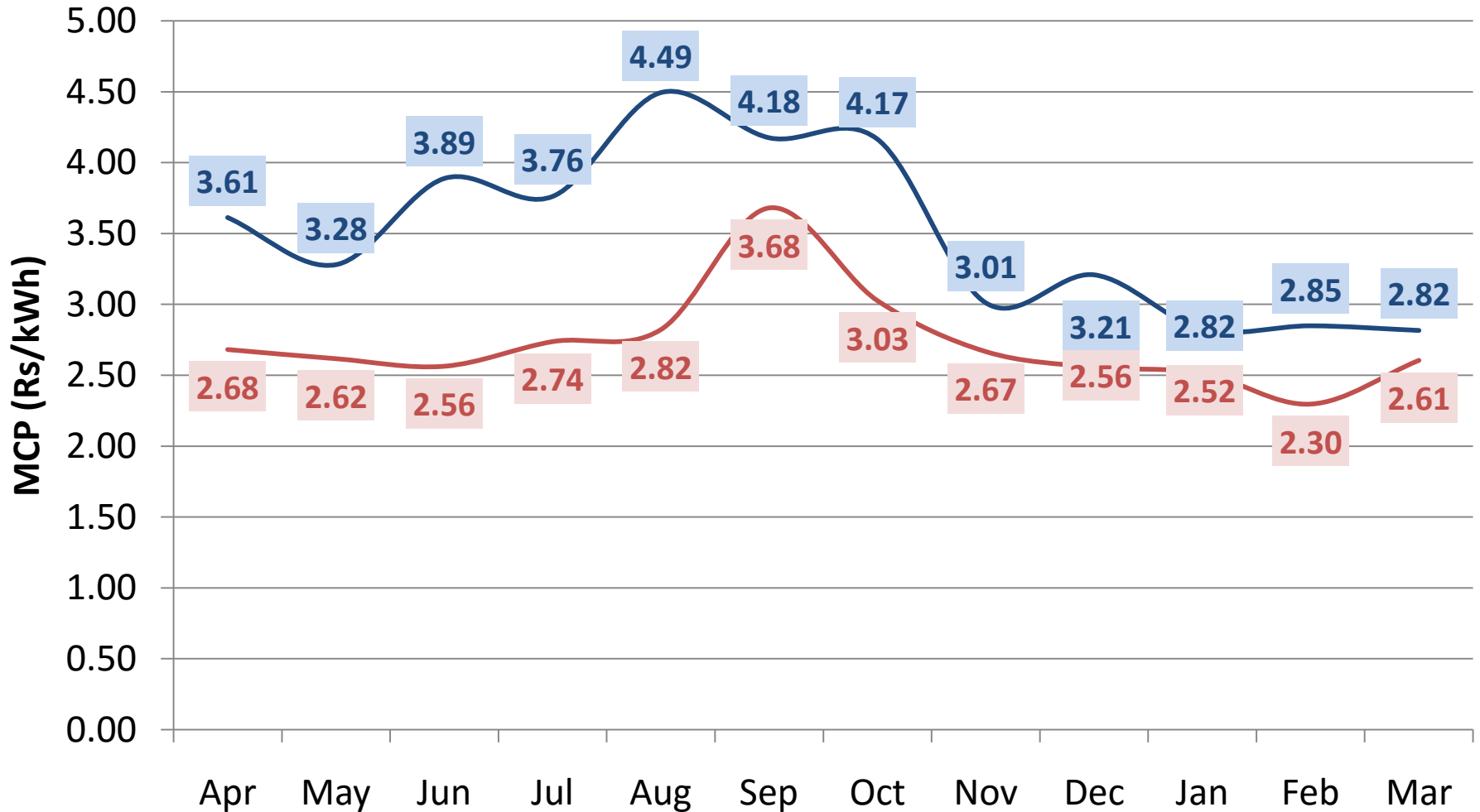


* Up to Dec 15, 2015

Monthly Average Clearing Prices

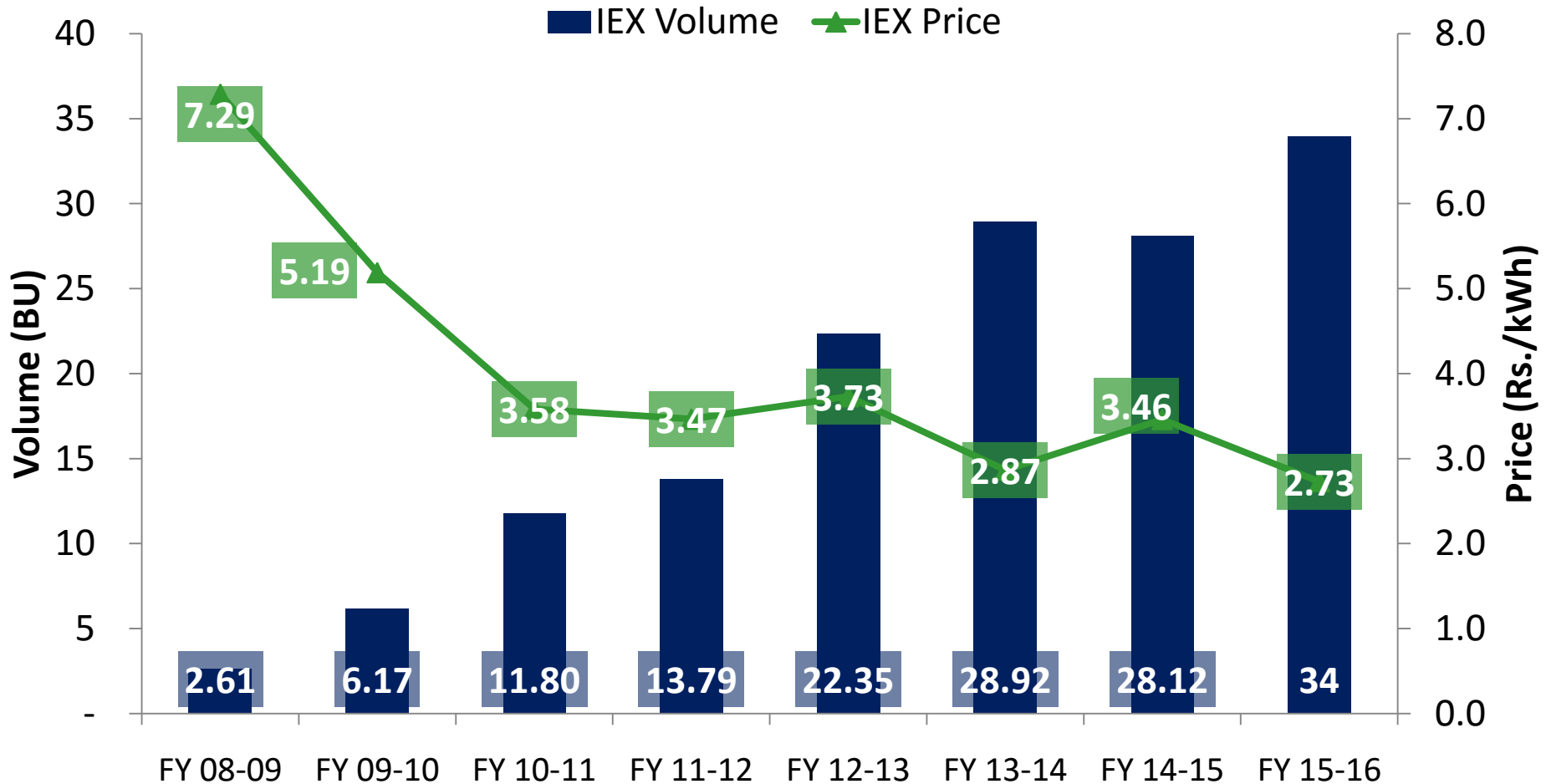
— FY 2014-15 (Avg MCP: Rs 3.51/kWh)

— FY 2015-16 (Avg MCP: Rs 2.73/kWh)





Price and Volume trend at IEX Day Ahead Market





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Power Exchange benefits to the Country

- Scarce resource allocated to demands which values the commodity most
 - Operates on economic principles of demand-supply
 - Buyer ready to pay more gets priority
- Transparent price discovery, Uniform Market Clearing price – true price discovery
- **Enormous cost savings for industries and Discoms, as competition increases, promotes efficiency and as a result prices decreased**
- Sets reference price for other transactions, bilateral prices also decreased after Exchange operation
- Physical delivery-based market – not susceptible to manipulation
- Low transaction cost, Low Overheads, standardized contracts lead to decreased ambiguity
- Payment Security ensured by the Exchange, giving confidence to merchant generators.



Cross Border Trade through Exchange



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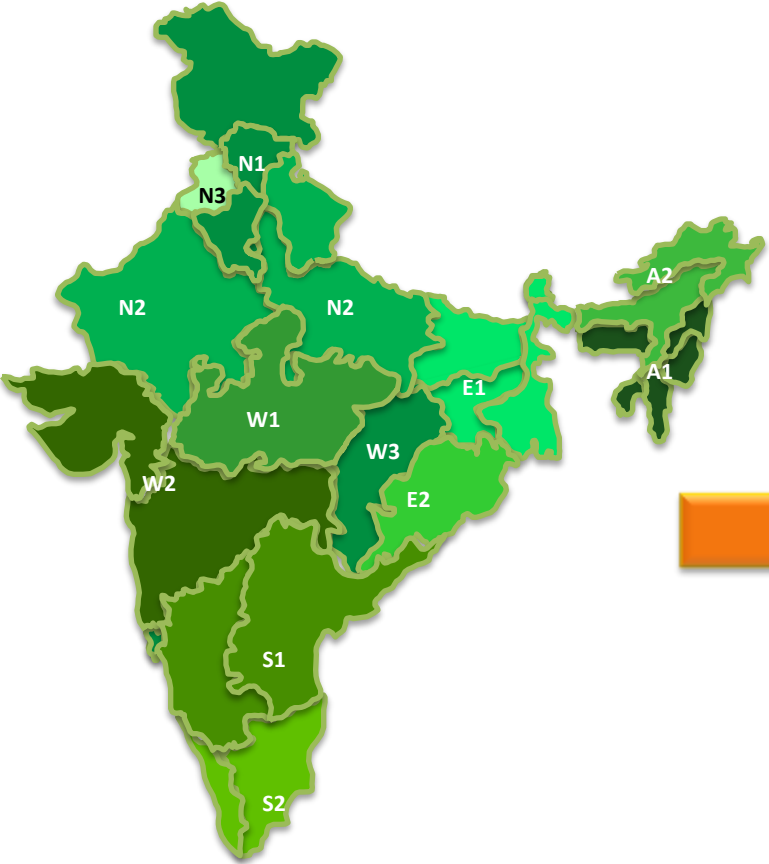
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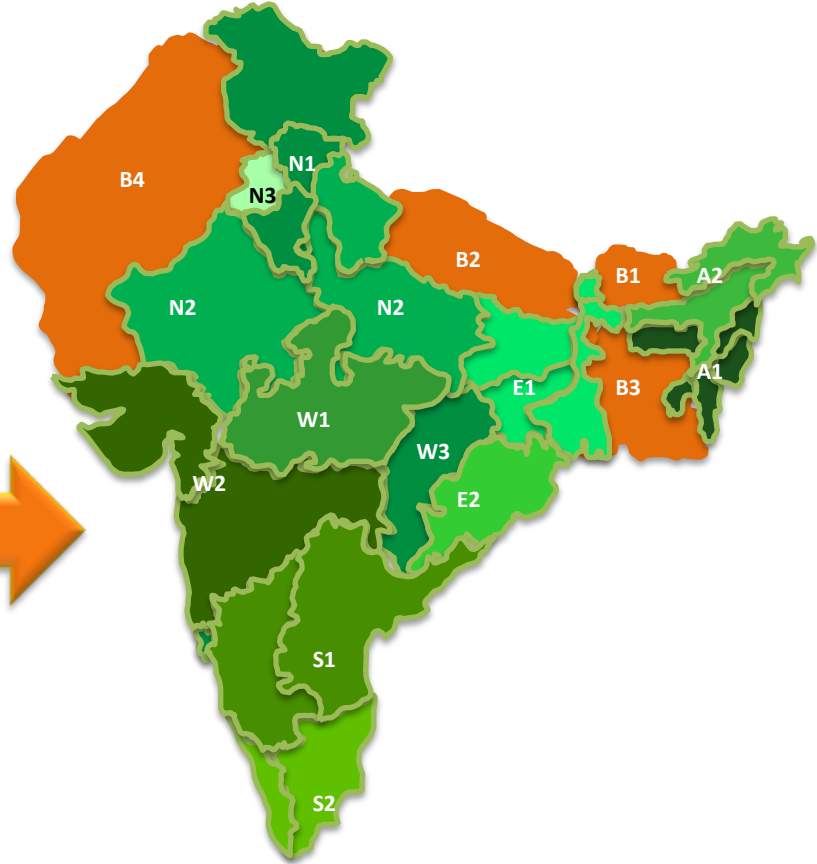
Why harness the Power Exchange markets for regional trade?

- **Better resource optimization**
 - Can use the inherent margins in transmission to transact power
- **Management of daily demand variations**
 - Daily demand variations and Peak requirements can be managed optimally through Day-Ahead Transactions.
- **Competitive, transparent and neutral market**
- **Liquid, diversified market**
- **Standardized contracts, competitive prices** through market determined prices (no need for negotiations)

Additional bid areas



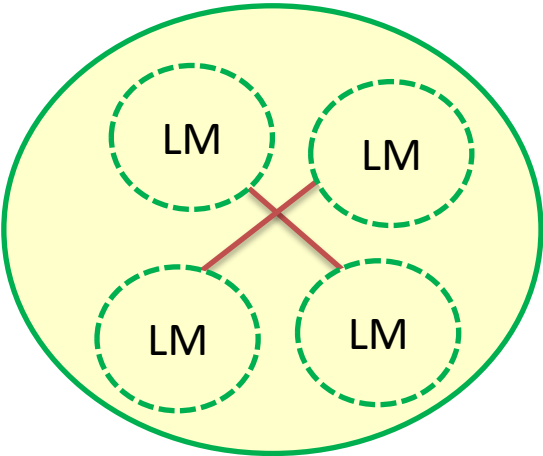
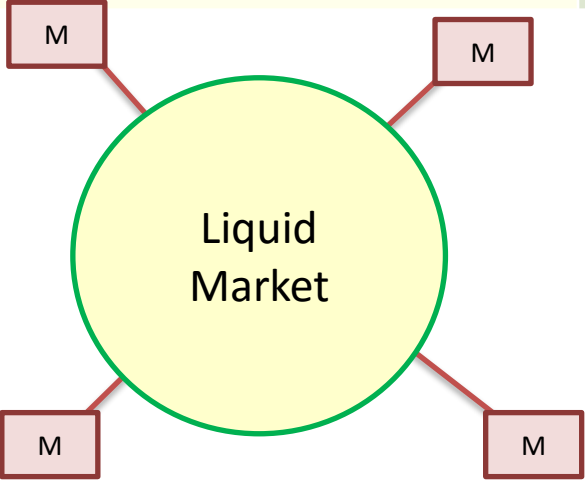
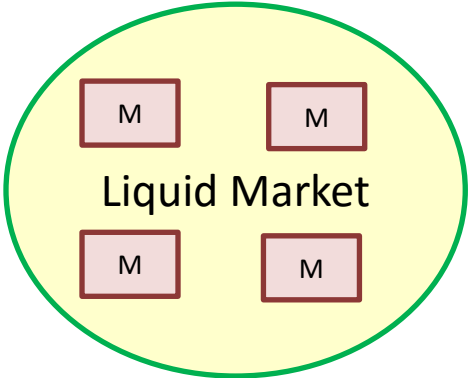
12 Bid Areas



Additional bid area could be added for each country

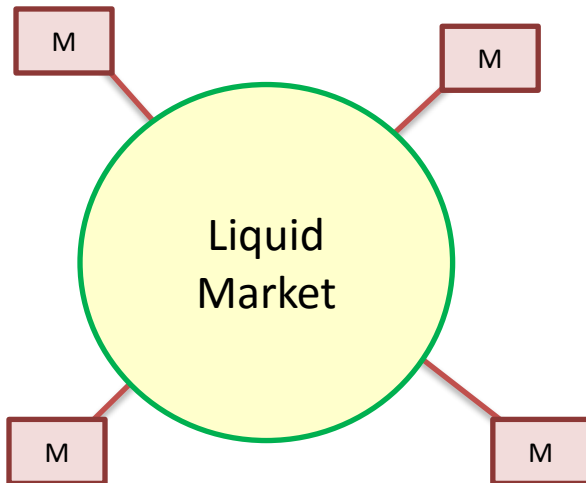
Power Exchange Market models

AFRICAN MODEL	NORDPOOL MODEL	EUROPEAN COUPLING MODEL
Individual Countries come together to form a single PX	Individual Countries join already existent single liquid PX	Two or more PXs join/couple to form larger integrated market
Example: SAPP, WAPP	Denmark, Finland & Baltic countries joined Nordpool	North West Europe Coupling (7 Power Exchanges coupled)
Suitable where not single market is liquid on its own	Suitable where at least one liquid market is present	Suitable where all markets are liquid by themselves



Preferred Model for South Asia

Proposed market for SAARC Region



- ✓ Presence of Liquid markets in India
- ✓ Exchanges in India offers standardised contracts and competitive platform and allow market based price discovery
- ✓ Governing regulations and policy development are still at nascent stage in many countries, this will allow other countries to align the relevant rules for development of a harmonized market.

Thank You

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Individual market

- Characterized by
 - single buyer model
 - Long-term tie-ups with IPPs
 - Few utilities either generating own power or buying from IPPs
 - Net surplus/deficit transacted by Utility
 - Few or No merchant capacities
 - Large consumer not participating in market
 - Few or no retailers

LM

**Liquid
Competitive
market**

- Characterized by
 - Presence of liquid market
 - Efficient market based price discovery
 - Competition achieved through a range of markets: Spot/day-ahead/Intraday
 - Prices reflective of demand/supply
 - Adequate trade volumes among participants
 - Adequate level of HHI
 - Adequate resilience in buy/sell

The target of each country/region is to move towards liquid and competitive markets