



Functioning of Power Exchange

IX: India's premier technology-led energy marketplace



- ❑ Nation wide, automated and transparent trading platform for physical delivery of electricity, renewables & certificates
- ❑ Commenced operations in 2008; CERC regulated
- ❑ Publicly listed company – 2017 (NSE and BSE)
- ❑ ISO 9001:2015, ISO 27001:2013, ISO 14001:2015
- ❑ **IX is on the Board of Association of Power Exchanges (APEX) where 40 Global exchanges are members**
- ❑ **IX has diversified into Gas Exchange (IGX)**
- ❑ **IX is member of 13 State Regulatory Commission advisory committees**

Robust Ecosystem

7000+

Registered participants

4500+

Commercial & Industries

1500+

RE Generators & Obligated Entities

600+

Generators

55+

Discoms (all)

100+

ESCert Entities

Leading the future of energy with innovation and technology

IEX Over 16 Years – Journey of innovation to meet market needs

- Incorporation of Indian Energy Exchange
- Launched Day Ahead Market.

- Introduced Renewable Energy Certificate (REC) in the market

- Launched round the clock TAM

- Launched RTM & GTAM
- Incorporated Indian Gas Exchange

- GTAM (Hydro)
- LDC
- Redesigned REC



- Introduced Term Ahead Market (TAM)

- Introduced 15 mins contract in DAM
- First solar REC trade
- Signed MOU with PJM Technologies

- Launched Energy Saving Certificate

- Cross Border Trading
- GDAM

- HP-DAM
- Ancillary Services
- HP-TAM
- Incorporated International Carbon Exchange

Supported transformation of Indian power sector through continuous product innovation

Functioning of Exchange

Understanding the Exchange



A Neutral Platform

- Provides necessary **electronic trading platform**
- **Does not influence the price determination process**

Voluntary Participation

- In India, participation in the Power Exchanges is **purely voluntary**

Competition and Transparent platform

- Both sellers & buyers place bids **independent of each other** and compete

Regulatory Oversight

- Under the **Regulatory oversight of CERC**

Risk Mitigation

- **Acts as counterparty in the trade** and absolves the participants of any risk of payment defaults

Standardized Contracts

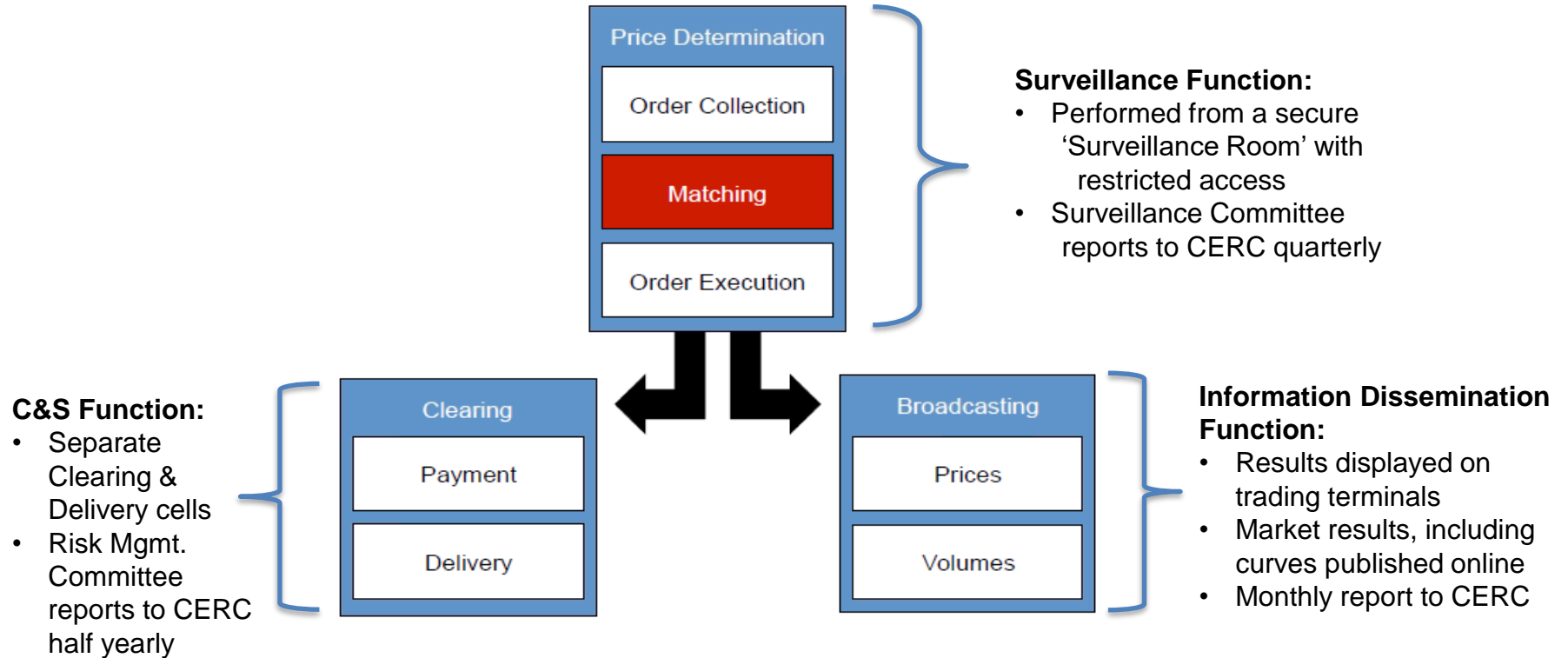
- Contracts traded are standardized contracts, **terms and conditions are well defined**

Power Exchange Characteristics

- **Easy Access**
- **Anonymous**
- **Transparent**
- **Reliable**
- **Secure**



Power Exchange's Key Functions



Existing Products & Auction Mechanism



- Integrated DAM - *Closed double sided auction*
 - **G-DAM**
 - DAM (includes Cross Border Trade)
 - High Price DAM
- Real-Time Market (RTM) - *Closed double sided auction*
- Intraday Market (Conv., HP ITD & **Green**) – *Continuous matching*
- Day Ahead Contingency (Conv., HP DAC & **Green**) – *Continuous matching*
- TAM, HP-TAM & **Green TAM (up to 3 Months)**
 - Daily, Weekly, Monthly – *Uniform price step auction*
 - Any Day Single-Sided Contract (Conv. & **Green**) – *Reverse auction*
- Tertiary Reserve Ancillary Services (TRAS): AS-DAM & AS-RTM
- **Certificates: RECs & ESCerts** – *Closed double sided auction*

Bid types in Day Ahead Market



Single Bid:

- Bids for each 15 min can be entered
- Varying price and quantum pairs
- Allow partial execution

Block Bid:

- Block Bid for any 15 min
- Mother or child bid
- No partial execution

Profile Block Bids: (DAM)

- Flexibility for Renewable generators to model their bidding pattern and also help the Discoms for their demand side management

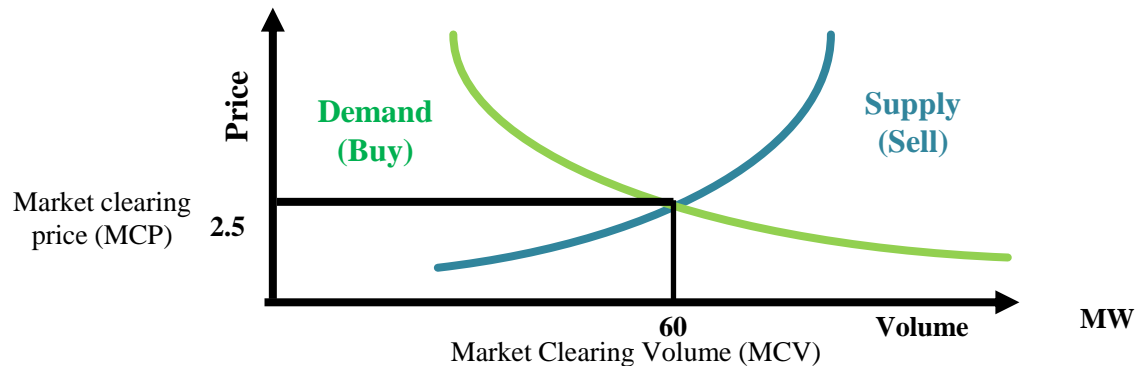
Minimum Quantity Block Bids: (DAM)

- Facility would be provided to define minimum quantity. Balance Quantity will be placed in multiple block bids as a sub-set of the entire bid

Price Calculation Algorithm

Bid Quantum by different portfolios

Price Tick	0	1	1.1	2	2.1	2.5	3	3.1	4	4.1	5	---	---	----	20
Portfolio A, MW	20	20	20	20	20	20	20	10	0	0	0	0	0	0	0
Portfolio B, MW	60	60	60	60	50	40	40	40	40	40	20	20	20	20	20
Portfolio C, MW	40	20	0	0	-40	-60	-80	-81	-120	-120	-120	-120	-120	-120	-120
Total Buy Quantum received, MW	120	100	80	80	70	60	60	50	40	40	20	20	20	20	20
Total Sell Quantum received, MW	0	0	0	0	-40	-60	-80	-81	-120	-120	-120	-120	-120	-120	-120
	120	100	80	80	20	0	-20	-21	-80	-100	-100	-100	-100	-100	-100



Single Bid Concept

Time Block	Bid Volume (MW)	Buy Bid Price	Clearing Price	Result
1	100	Rs 4	Rs 1	Green
2	100	Rs 4	Rs 5	Red
3	100	Rs 4	Rs 3	Green
4	100	Rs 4	Rs 5	Red
Average		Rs 4	Rs 3.5	

Block Bid Concept

Time Block	Bid Volume (MW)	Buy Bid Price	Clearing Price	Result
1	100	Rs 4	Rs 1	
2			Rs 5	
3			Rs 3	
4			Rs 5	
Average				Rs 4

RTM Trading Process

RTM Session For Delivery Period 00:00-00:30

22:45



Auction starts

- Participants place Buy/Sell bids
- Bid Type
- Single Bid
- Block Bid

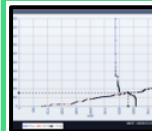
23:00



Auction Ends

- NLDC provides corridor information

23:05



- Matching-Double Sided Closed Auction
- Matching Logic Same as DAM

23:07



Dissemination of result

23:15



Results shared with NLDC & Members

23:30



- NLDC communicates schedule to RLDC
- Comm of Schedules to SLDCs by IEX

By 00:00



LDCs incorporate schedules and updates on their website

Settlement



- Payin T/T+1
- Payout T+1

Similar process is followed for all the sessions

48 auction sessions in a day recurring every 30 mins

- Efficient power demand management at 1-hour notice
- Optimum utilization of generation capacity
- Competitive and transparent power prices
- Renewable energy integration
- Ensuring grid safety and security

Auction

Orders accumulated during order accumulation phase (no matching)

Orders matched after closure of order accumulation period

Orders are used for calculation common price i.e. Equilibrium Price.

All successful orders matched at Equilibrium Price.

Continuous







Price-time priority based continuous matching

The highest Buy order & lowest Sell order gets the priority

If the prices are same then priority is given to the time of the order

TAM / GTAM - Contracts Specification



	INTRADAY	DAC	DAILY	WEEKLY/ MONTHLY
 CONTRACT National /regional	15 Min same day Delivery	15 Min next day Delivery	TAM – Energy traded in MW GTAM - Energy traded in MWh (Profile)	
 TRADING	Continuous trading		Auction	
 TRADING DAYS	Daily		Daily (T+2 to T+90)	Daily (T+2 to W+12)
 TRADE HOURS	00:15 to 19:30	13:00 to 23:30	12:00-17:00	12:00-17:00
 DELIVERY HOURS	04:00 to 24:00	00:00 to 24:00		
 PAY IN/PAY OUT	T+1	D/D+1	D-1/D+1	

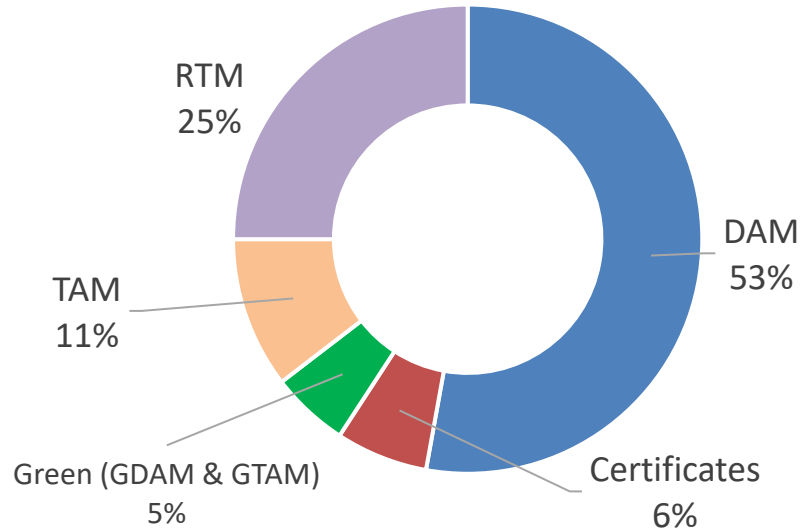
Single Sided Reverse Auction (RA) based contract is also available to for trading of up-to 3 Months

Risk Management in DAM/TAM

	Proprietary/Trading Licensee Members	
Segment	Initial Margin	Basis/Additional Margin
Day-Ahead Market	Margin equal to Last 7 Days Average of Buy turnover	
TAM-Intraday	105% of order	-
TAM-DAC	105% of order Value	-
TAM-Daily / Weekly	5% of order Value	50% of Trade Value
TAM-Weekly	5% of order Value	50% of Trade Value
Reverse Auction	Rs 30,000 / MW	20% / 50% of Trade Value
Certificates	100% of order Value	-

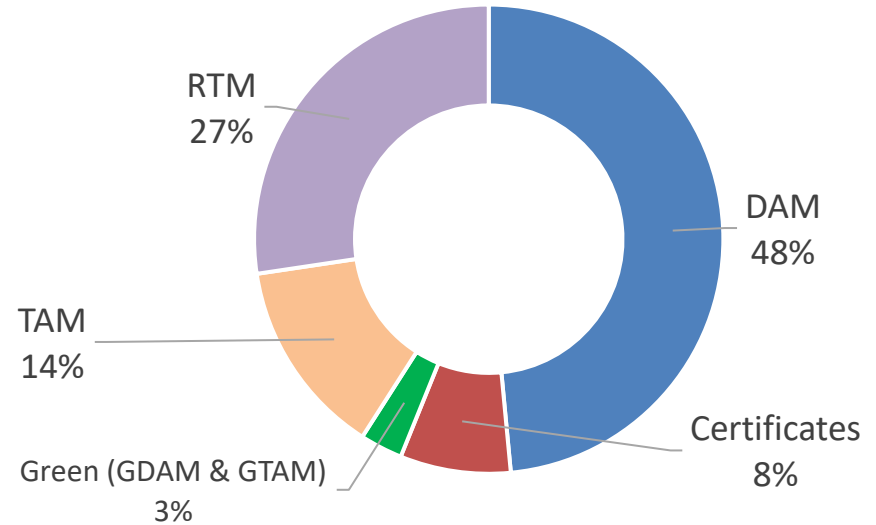
Volumes and Price discovery

Product Mix FY 23



Total Volume: 97 BU

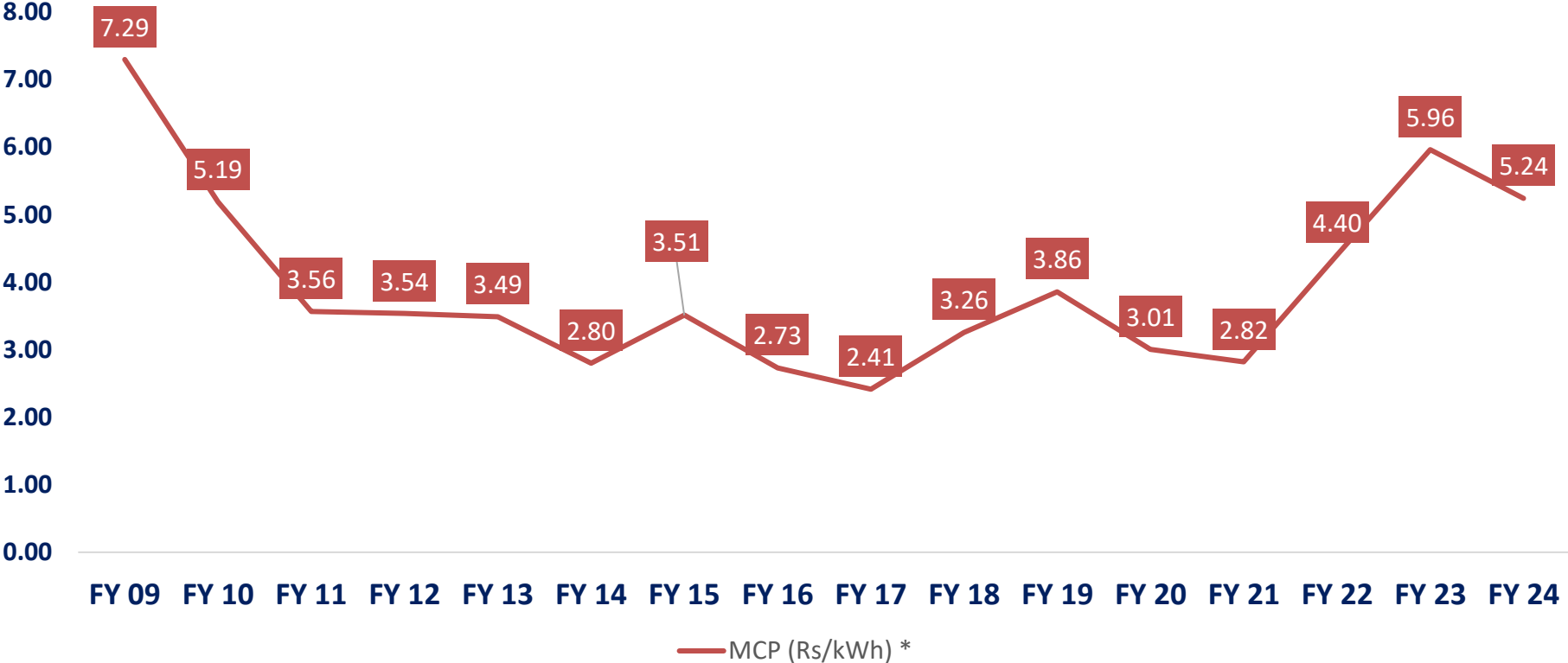
Product Mix FY 24



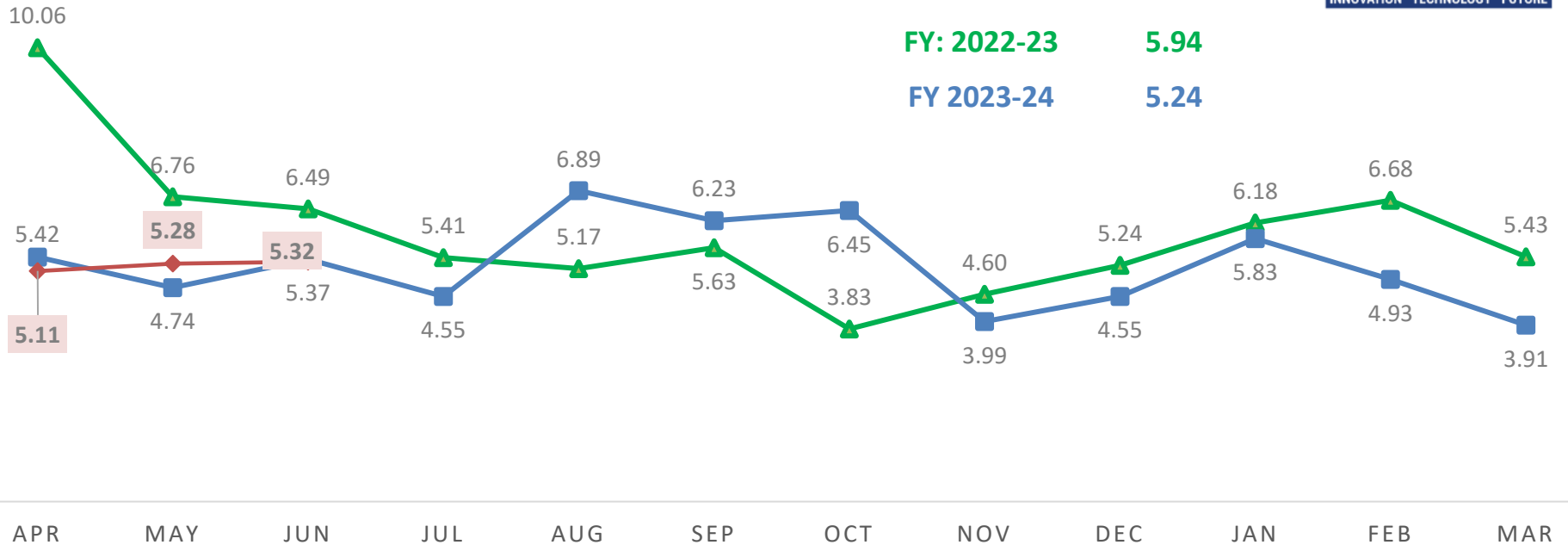
Total Volume: 110 BU

Have effectively introduced products which have gained traction

DAM Price: Exchange has been effectively providing Market Signals



Price Trends (Rs./kWh) at DAM

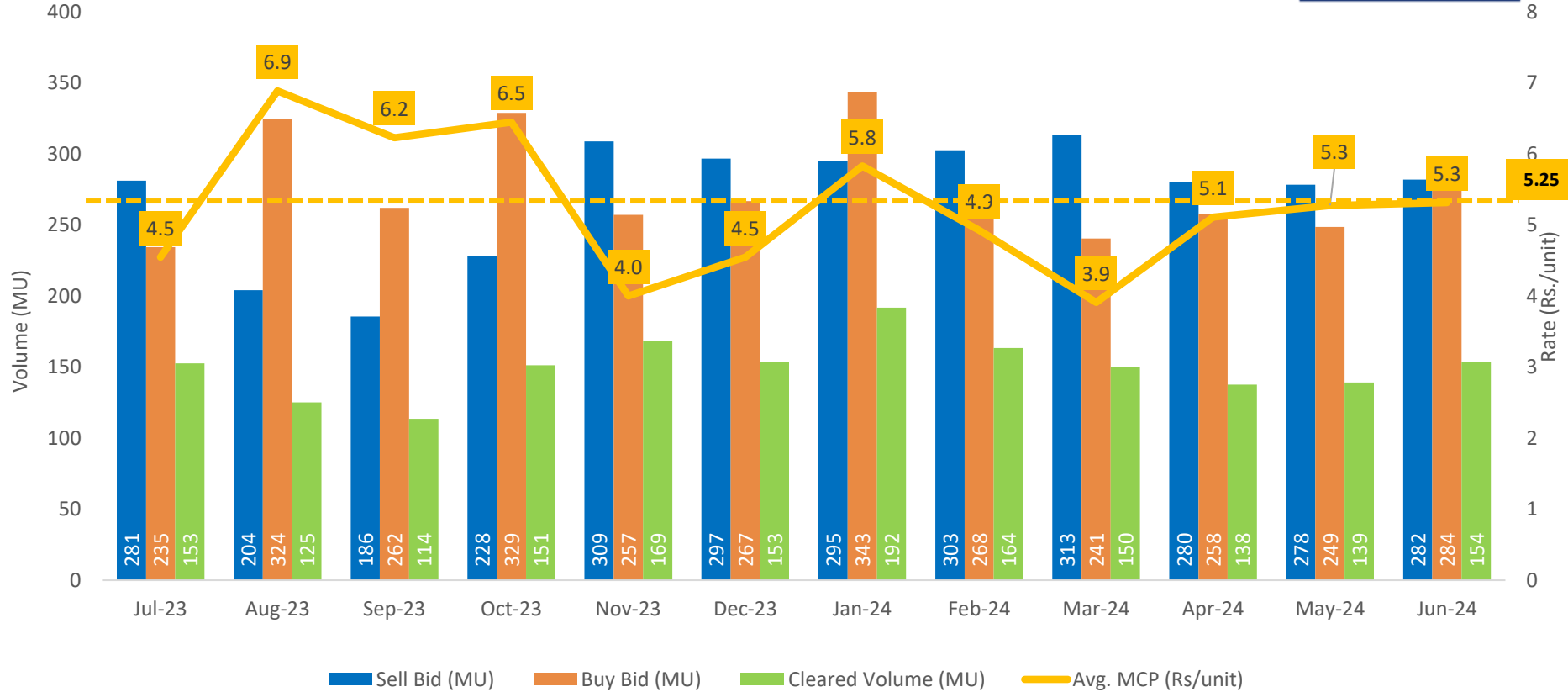


FY: 2022-23 **5.94**
FY 2023-24 **5.24**

- Price cap of Rs. 12/kWh applicable for April 22- March 23
- Price Cap of Rs. 12/kWh revised to Rs. 10/unit from April 2023 onwards
- Data till 18th June-24

Exchange prices have remained range-bound despite unprecedented demand increase, owing to several pro-active measures undertaken by the Govt.

DAM Daily Average Trends (Last 12 Months)

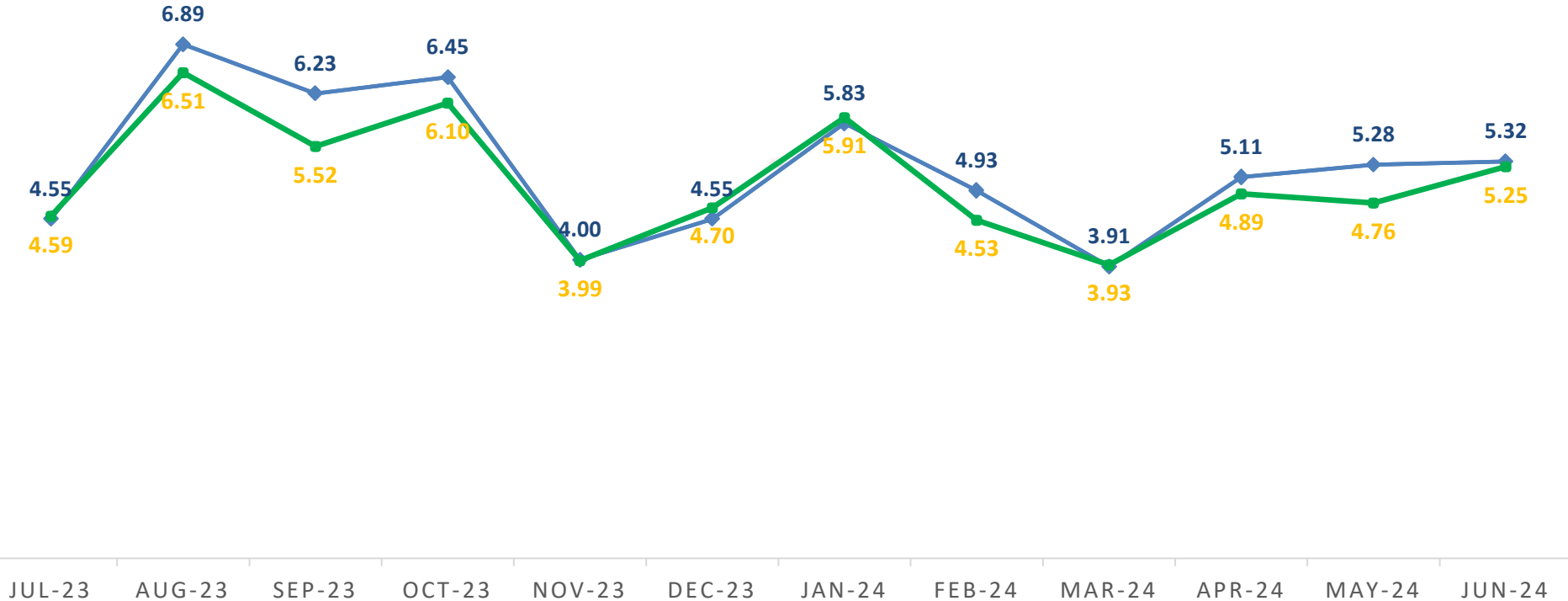


Price Trends (Rs./kWh) DAM & RTM (Last 12 Months)



DAM Avg MCP: 5.25 Rs./unit

RTM Avg MCP: 5.06 Rs./unit



Power Sector overview: Growing demand



✓ All India Power Demand – FY 24

- Last 3 years (FY21 to FY24) Peak demand has grown at CAGR ~8.1% & Energy demand has grown at CAGR of ~8.4%
- Peak demand inc. by 16% YoY in FY 24; clocked all time high of 240 GW (Sep'23) [Recently touched 250 GW (May'24)]
- State with maximum % demand increase in FY24 are Karnataka (24.5%), Jharkhand (13%), AP (12%), WB (12%), KL (12%) & MAH (11%)
- RE generation share w.r.t total generation
 - Wind & Solar Generation contributed 11%
 - Wind, Solar & Hydro Generation contributed 19%

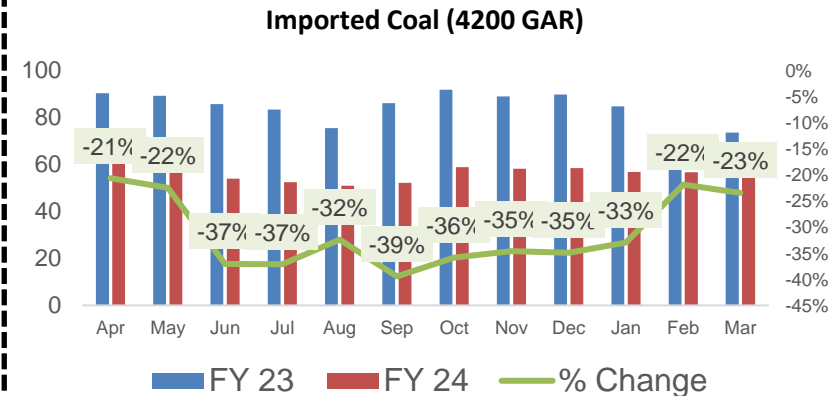
✓ Domestic Coal

- Coal production inc. by 11.7% YoY [893 MT (FY'23) to 997 MT (FY'24)]
- Quantity offered through e-auction has increased by 53%; E-Auction premium reduced from ~ 140% to ~20%

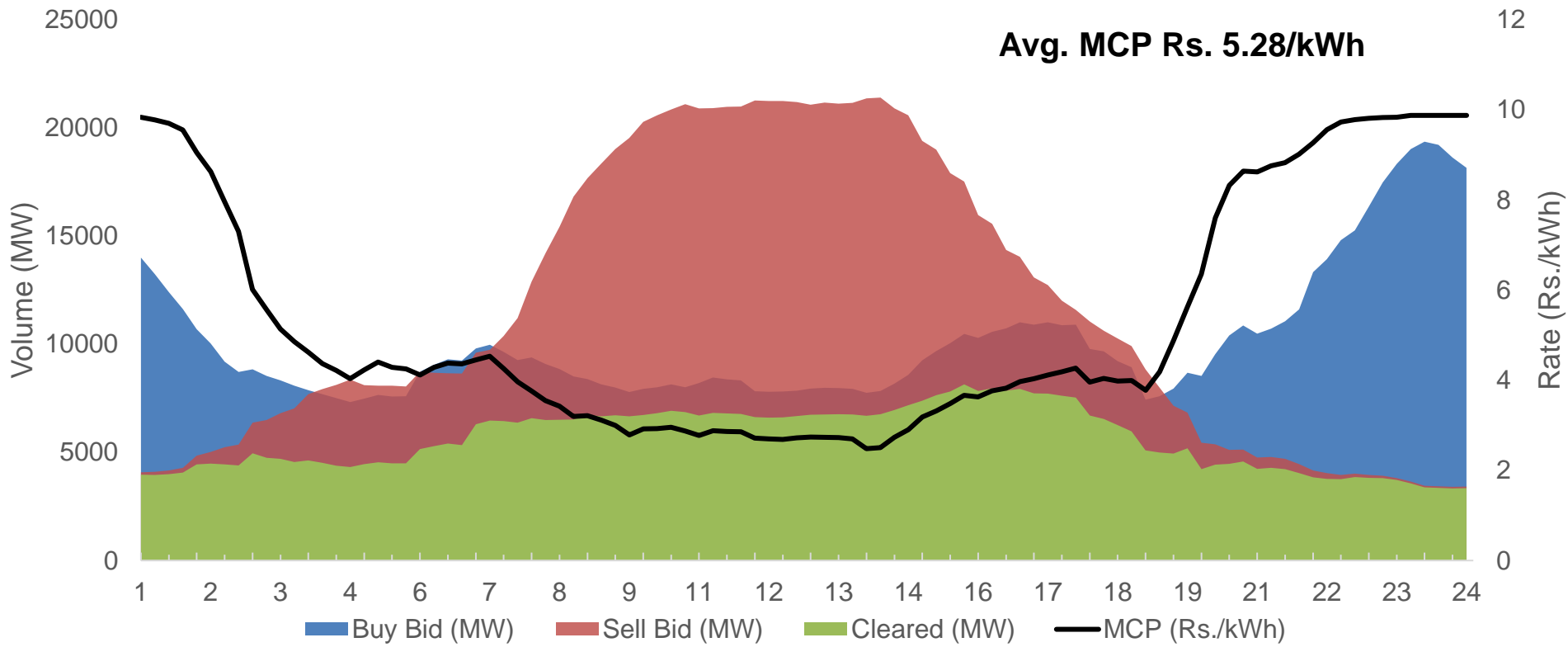
✓ Imported Coal Prices:

- Prices of Imported Coal (4200 GAR) have come down by 31% from 84 \$/ton in FY 23 to 58 \$/ton in FY 24
- Improvement in Coal stock (~17 Days), Reduction in Gas prices has increased liquidity on IEX

	Demand Met (BU)		% Change
	FY23	FY24	YoY
Q1	400	410	2.5%
Q2	386	435	12.7%
Q3	348	377	8.3%
Q4	372	400	7.4%
FY	1506	1622	7.7%



DAM Snapshot for Month of May-24 (Average)



Surplus availability during solar hour and deficit during non-solar hours

Green Market: Realization

Price (Rs/
kWh)



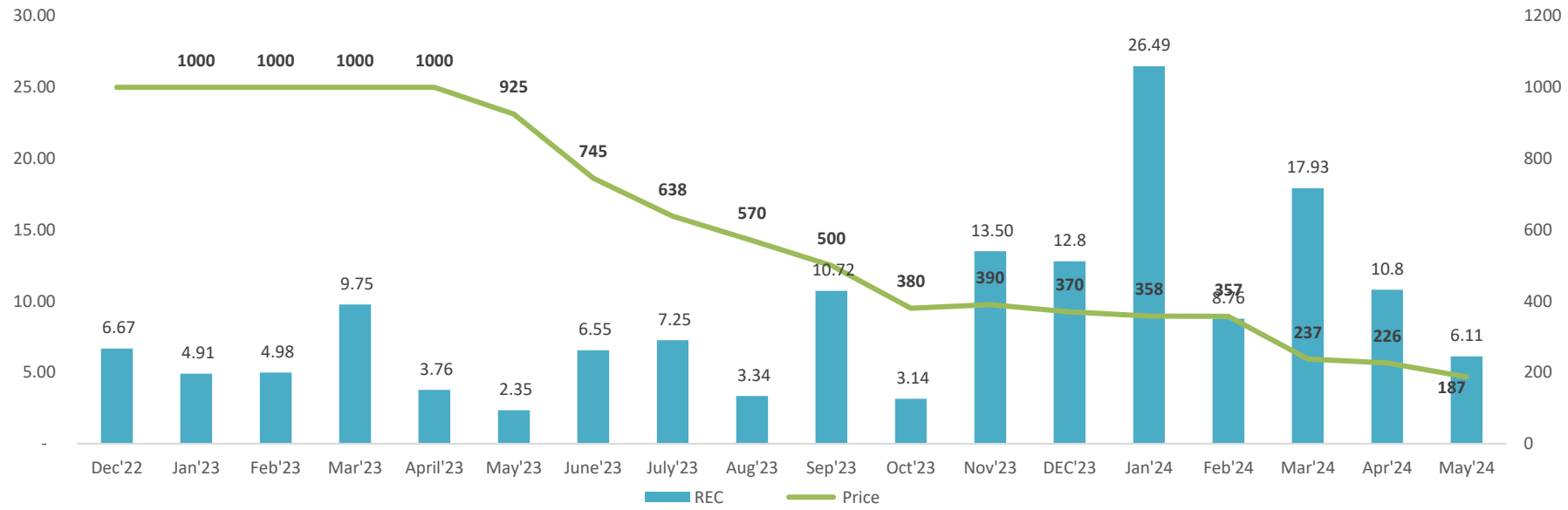
FY 22	
GDAM Avg. (RTC)	5.29 [premium of Rs 0.89 / kWh]
DAM Avg.	4.40
FY 23	
GDAM Avg.	6.48 [premium of Rs 0.54 / kWh]
DAM Avg.	5.94
FY 24	
GDAM Avg.	5.81 [premium of Rs 0.57 / kWh]
DAM Avg.	5.24

GDAM has helped RE capacities to achieve better realization thereby aiding green capacity addition in the country

Renewable Energy Certificates (REC): Market Snapshot



REC Cleared Volume (in Lakhs) Vs Avg Price (in Rs/REC)



- REC inventory is 3.7+ crores; Price discovered during the last session was Rs 150 / REC (i.e. effectively Rs 0.15 / kWh)
- Good opportunity for the obligated entities to meet their RPO
- Also provides good opportunity for voluntary participants



Cross Border Electricity Trade

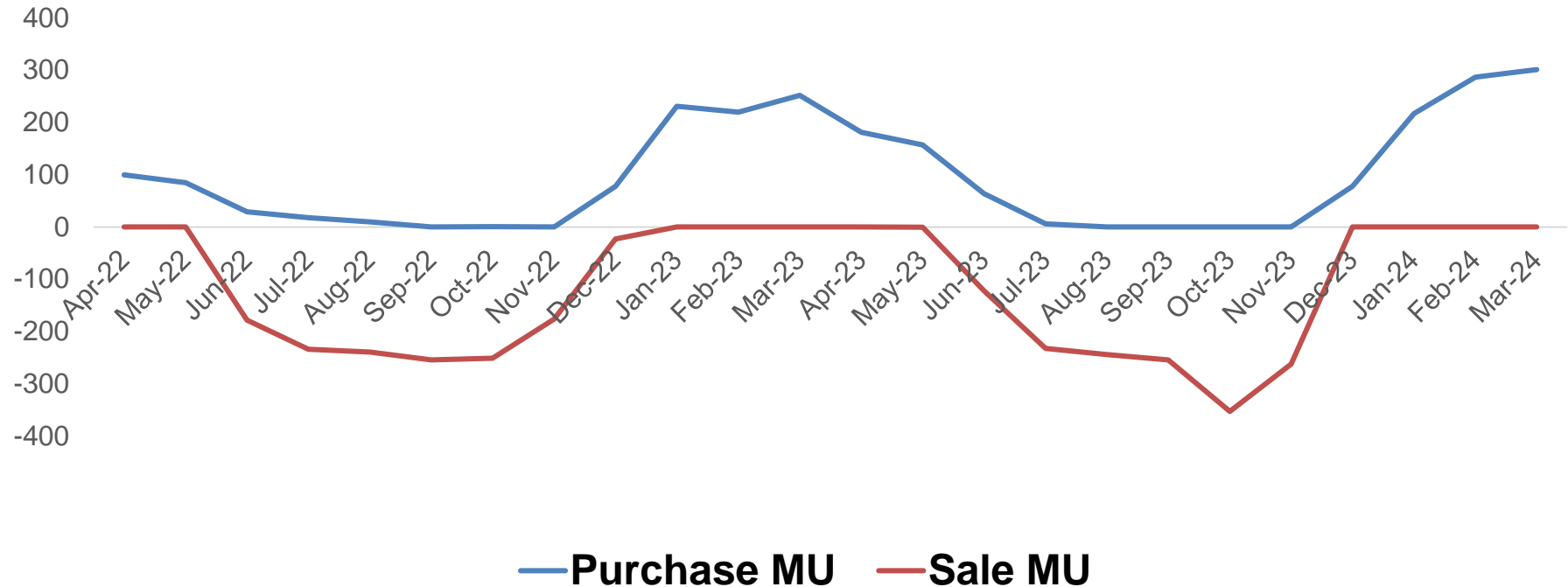
Leveraging of Cross Border Trade through Power Market

- Optimum Utilization of resources
- Fostering Economic Growth and Regional Integration
- Making use of seasonal demand and supply
- Harnessing Renewable Energy
- Facilitating access to electricity and quality supply to all

Month Wise Power Trade with Nepal [effectively helping both the countries]



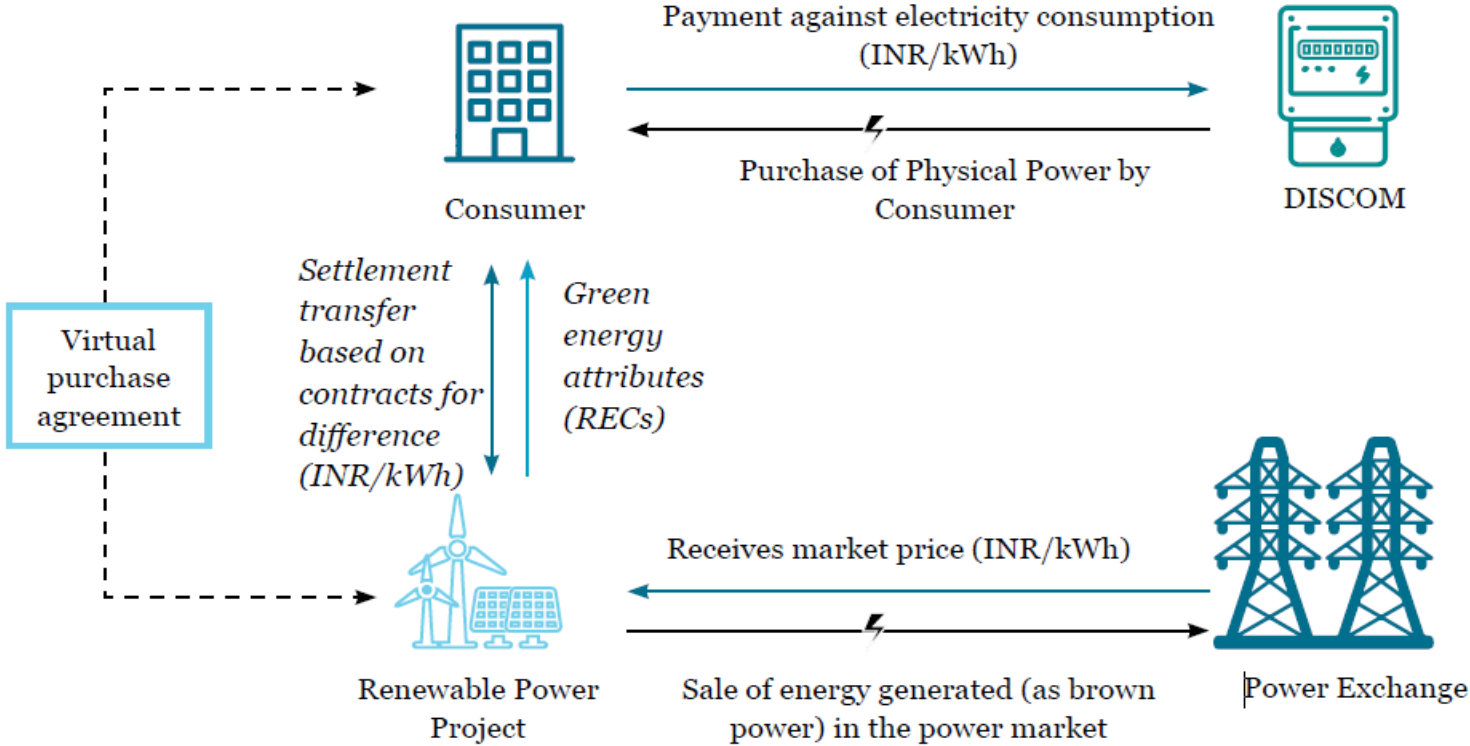
Month wise Trade with Nepal (MU)-FY 23 & FY 24



Exchange is supporting Emerging RE Market models

- I. **VPPA**
- II. **Firm & Dispatchable RE (FDRE) tenders**

VPPA model - Market-based model for Corporate's climate goals



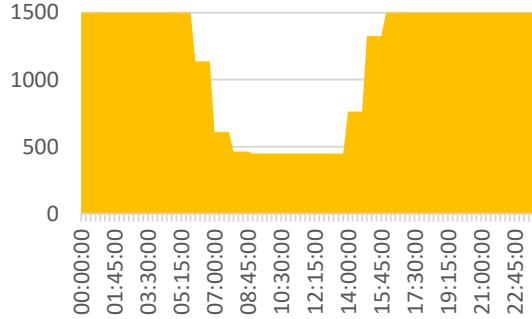
SECI Tender : 1500 MW RTC power from grid-connected RE project with storage

S.No.	Parameters	Specifications
1	PPA Capacity	1500 MW (Likely scrapped)
2	Annual Availability Factor	<ul style="list-style-type: none"> ➤ 100% off-take as per the demand specified by Procurer ➤ Monthly demand fulfilment Ratio (DRF) – 90%
3	End Procurer	<ul style="list-style-type: none"> ▪ PSPCL (Punjab) – April to Sept ▪ MPPCL – Oct to March
4	Penalty for Shortfall	1.5 x the applicable tariff
5	Mode of dispatch	Scheduling of Power by Buying entity – Dispatchable RE
6	Supply from Market	5% of the annual supply quantum can be supplied from Green Markets

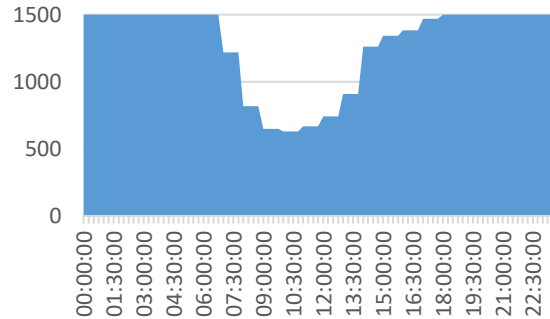
SECI Tender - FDRE-2 (Punjab)



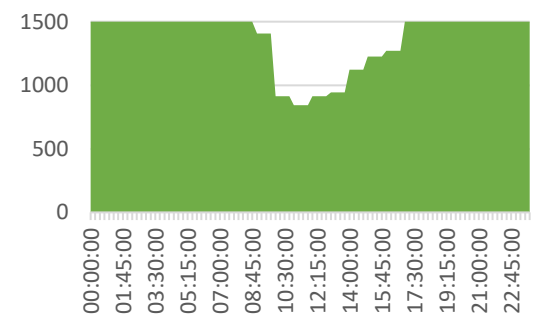
April



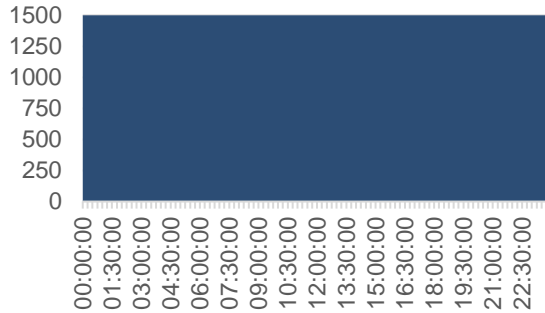
May



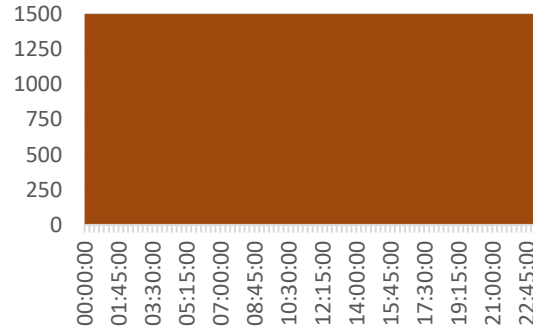
June



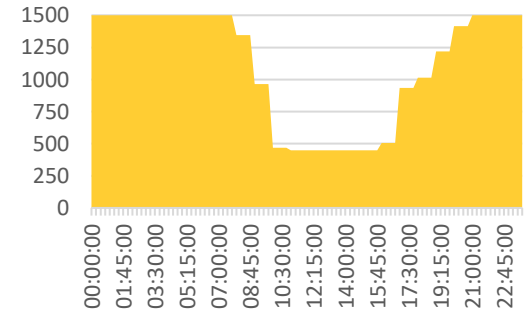
July



August



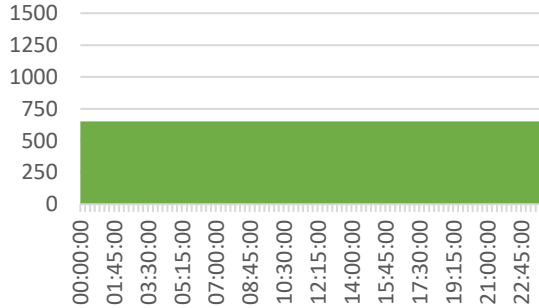
September



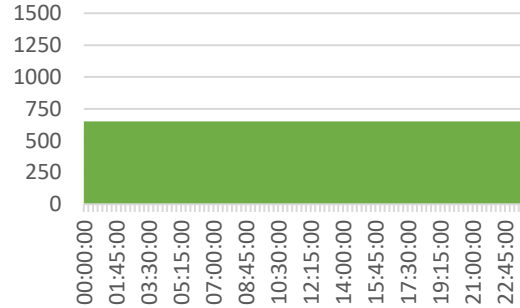
SECI Tender - FDRE-2 (MP)



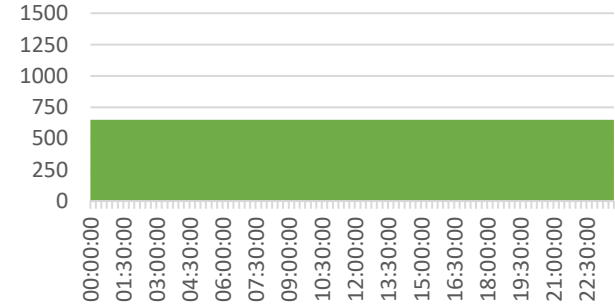
Oct



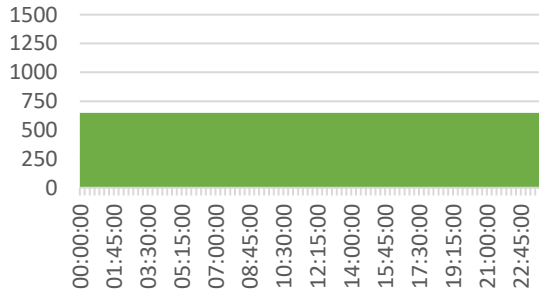
Nov



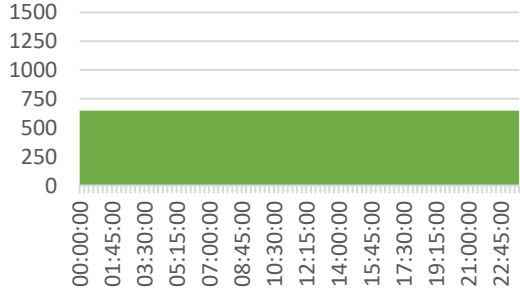
Dec



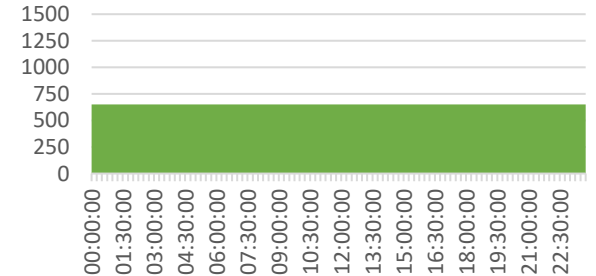
Jan



Feb



March



Power Exchange is expected to play a crucial role in supporting FDRE & RTC Tenders

- ✓ Excess RE supply (due to Project over-sizing) will create surplus generation w.r.t PPA profile
- ✓ The Excess generation can be sold in GDAM/DAM/RTM which has decent liquidity of Buy & Sell
- ✓ As per FDRE guideline, 5% of the annual PPA obligation can be met through GDAM
- ✓ **Thus, Exchange acts as a Pool for selling excess and meeting deficit through Green Market**

Future opportunities & cap. Building initiative

New Products

- IEX planning to introduce TAM Contracts up-to 11 months, petition has been file in Nov'23
- Capacity Market
- RE capacity through exchanges; Contract for Differences; Deepen Ancillary Market
- Launch of Derivatives will provide price hedging opportunity and lead to lower volatility in prices thereby increasing liquidity in the spot market

P2P Trading

- P2P trading of electricity is emerging in different parts of the world due to increasing number of Prosumers
- IEX through its MoU Partners has been jointly exploring P2P opportunities in various states.
- The Guidelines have been issued in UP and draft guideline has been issued by DERC.

Launch of IEX Academy (Capacity building); Price Index - PowerX

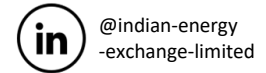



- ✓ Launched in June to create pool of skilled professionals for capacity building in the power market
- ✓ Customized certification courses to develop skills and expertise in Electricity Markets across topics such as power sector policies, regulatory frameworks, and power exchange operations
- ✓ Courses designed based on in-house experience of IEX, and in collaboration with academic institutions and think tanks.





- ✓ Launched IEX Power Price Index – ‘PowerX’ – India’s first Electricity Price Index.
- ✓ Provides competitive benchmark signals and enable market participants to make more effective decisions.
- ✓ Calculated based on weighted average price of Day-Ahead Market and Real-Time Market.

Thank you



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