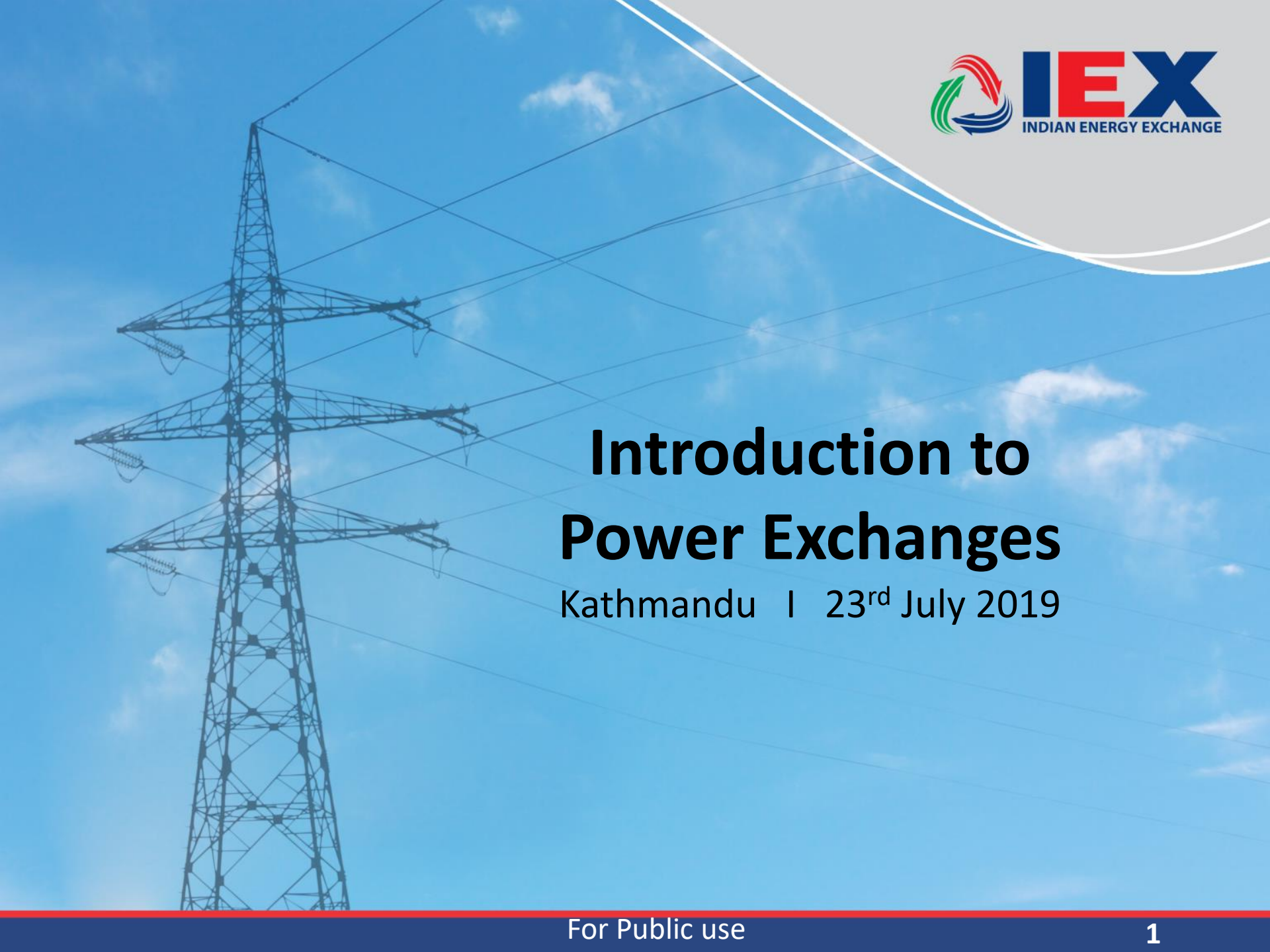


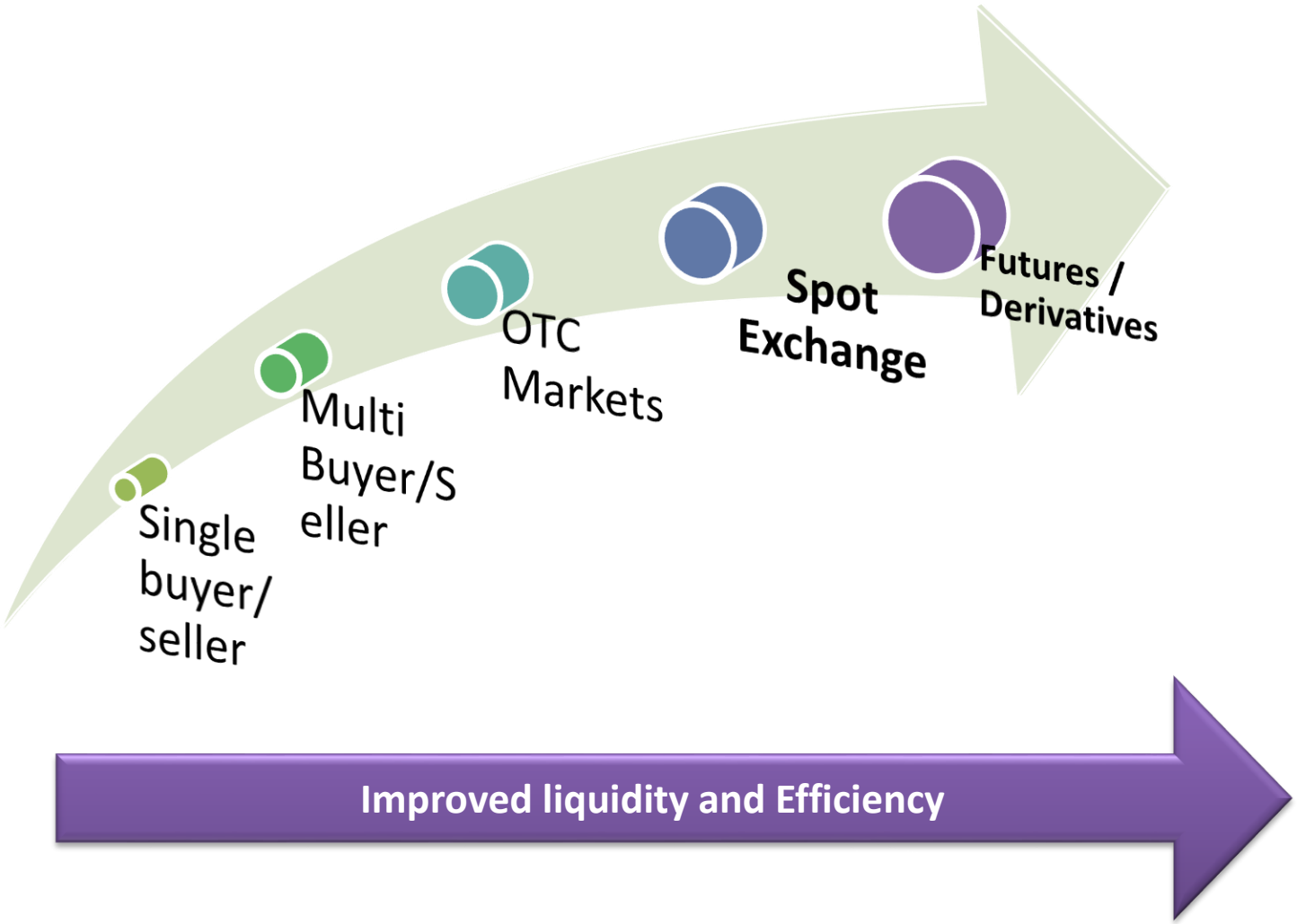
Introduction to Power Exchanges

Kathmandu I 23rd July 2019

In this presentation

- Power Market Overview
- Exchange Snapshot
- Way Forward

Power Market Evolution



Options For Power Trading

Long-term
>7 years

- >7-year PPA -
- Tariff on cost-plus or Competitive bid
- Two-part tariff: Fixed + Variable

Medium Term
1-5 years

- 1 - 5 Years
- Tariff covers : Fixed Cost + Variable Cost
- Competitive bid

Short Term (OTC)
<= 1 year

- Bilateral & PX
- Intraday- 3 Months to be procured through competitive bidding only
- Single part tariff
- Competitive bidding (DEEP Platform) or PX

Power Exchanges

Day-Ahead Market

Term-Ahead Market

Choice of 15-min to whole day
Highly liquid and transparent marketplace
Flexible load management

Growing share of Short-term market

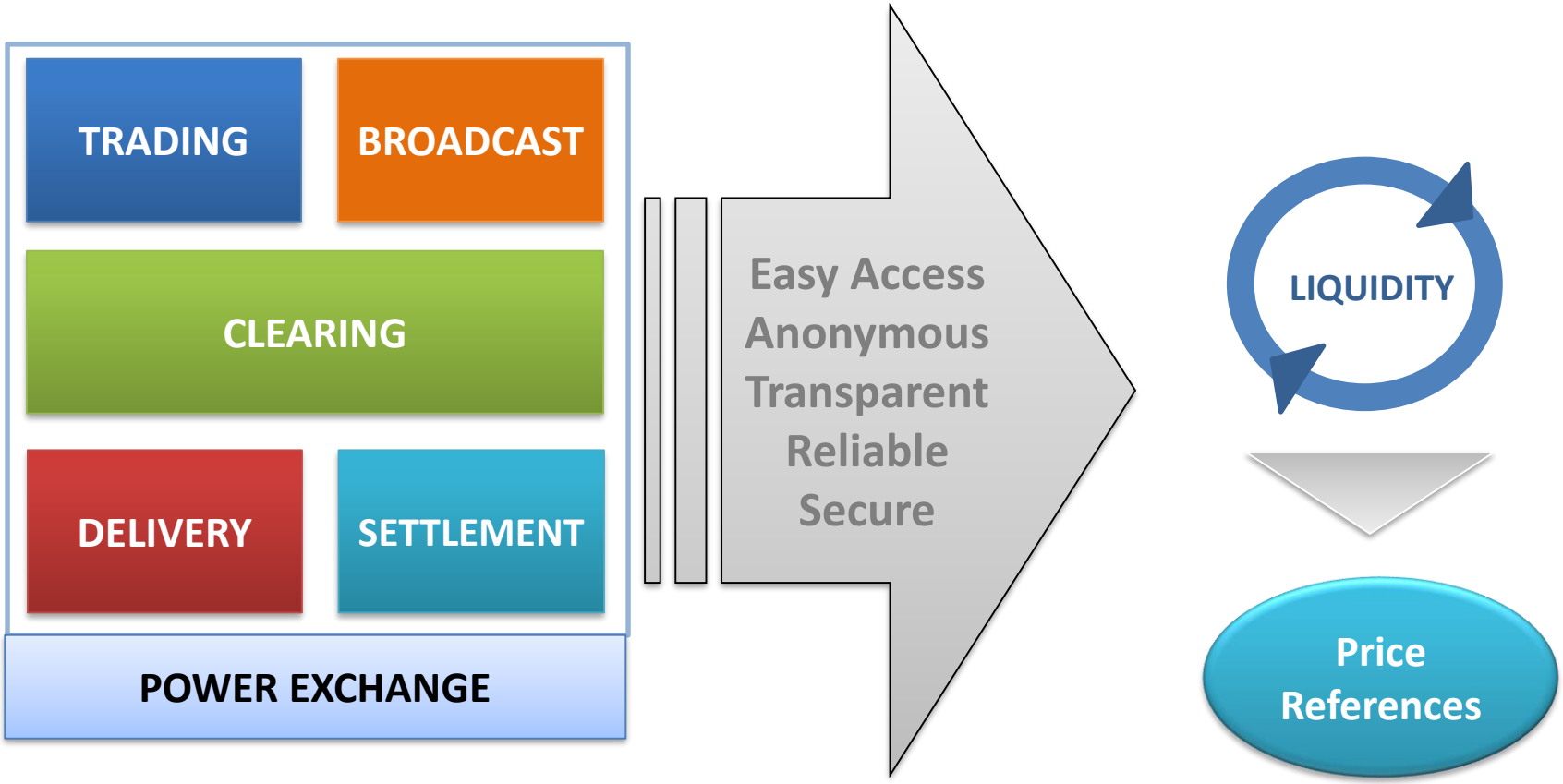
	FY 2009	FY 2019
Long Term		
PPA for over 25 years through long term	93.86%	88.3%
Short-Term	6.1%	11.7%
Exchanges	0.4%	4.0%
Through traders	3.2%	4.1%
Direct Bilateral	0.5%	1.5%
Unscheduled Interchange	2.1%	2.0%

Source: Percentage as per CERC *Report on Short Term Power Market* (Till March '19)

About IEX

- Inception in June 2008
- Established under regulatory oversight of Central Electricity Regulatory Commission (CERC)
- Transparent market platform that facilitates delivery based trading
- Worldwide, Power Exchanges are most commonly used platform to trade power and Day ahead Market (DAM) is more popular
- Financial products such as Derivatives and Forwards EXPECTED

Power Exchange Functions



History and Evolution

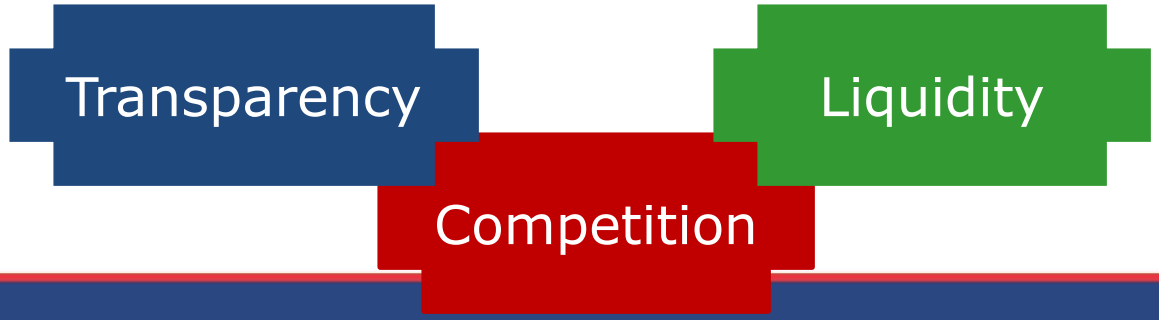
FY18	IEX was listed on the Indian stock exchanges in October 2017 (NSE: IEX, BSE:540750). Started trading ESCerts in September, 2017, traded around 1.3 million ESCerts
FY17	▪ Received certification under ISO 9001:2008, ISO 14001:2004 and ISO 27001:2013 ▪ Daily average cleared volume touches 109 MU/day ▪ Highest cleared volume in a day crossed over 147 MUs ▪ Approval from CERC received for trading of ESCerts
FY16	▪ Highest cleared volume in a day crossed over 136 MUs
FY15	▪ Highest cleared volume in a day crosses over 131 MUs.
FY14	▪ Over 2,900 open access consumers were procuring power through IEX
FY11	▪ Commencement of RECs trading.
FY10	▪ Registered first industrial consumer ▪ Commencement of trading for TAM ▪ Average monthly cleared volume crossed 500 MU.
FY09	▪ Commencement of trading for DAM
FY07	▪ Incorporation of the company as a public limited company

About IEX

- ✓ Market Share: **97%**
- ✓ Average daily trade: **6000 MW+ / 50 Billion kWh /year**
- ✓ High Participation: **4000+ (Electricity Market)**
- ✓ Record Daily Volume : 308 MUs (12,900MW)

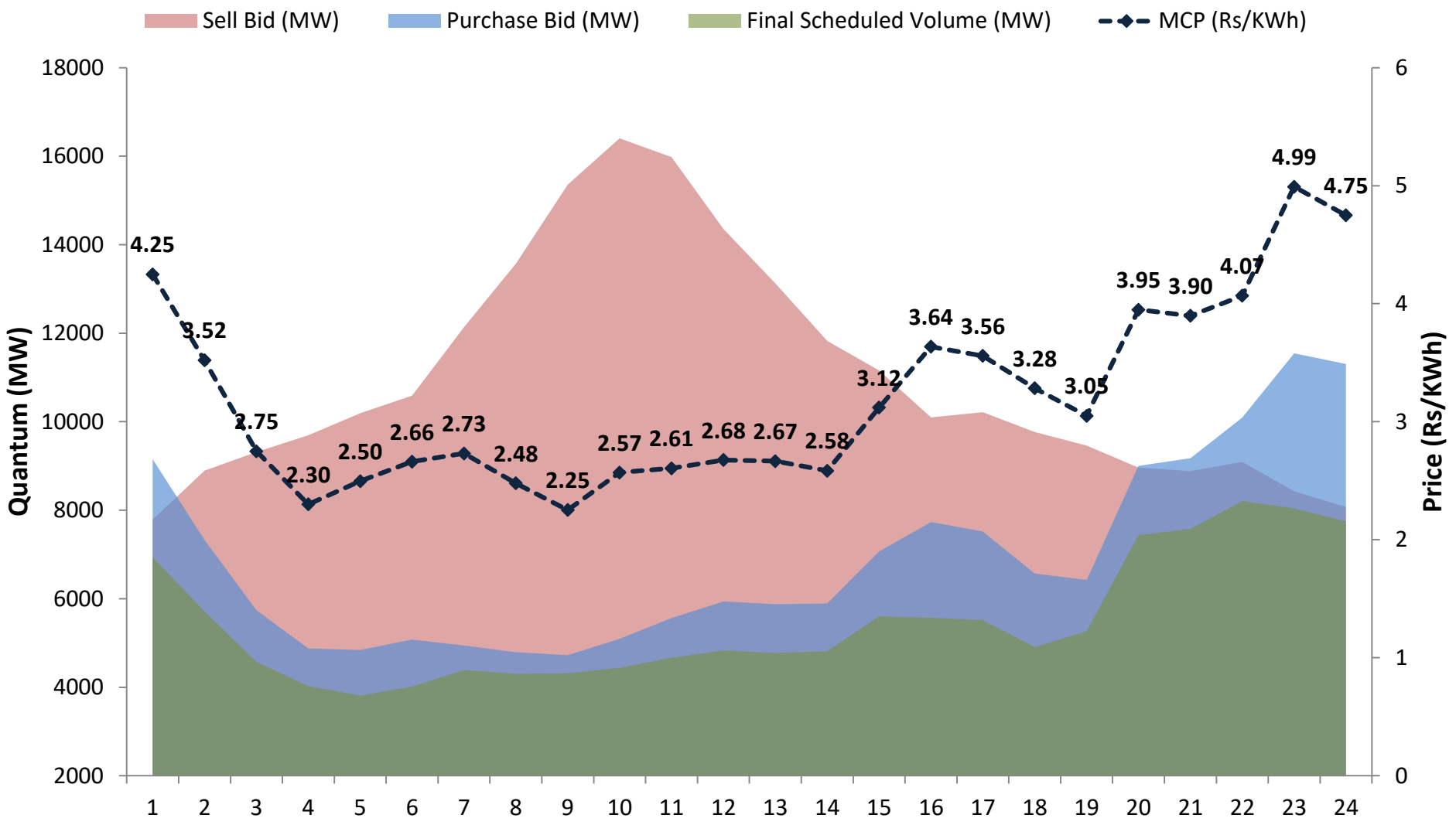
4000+ Industries | **55** Discoms (all) | **100+** ESCert Entities

400+ Generators | **1500+ RE** Generators & Obligated entities



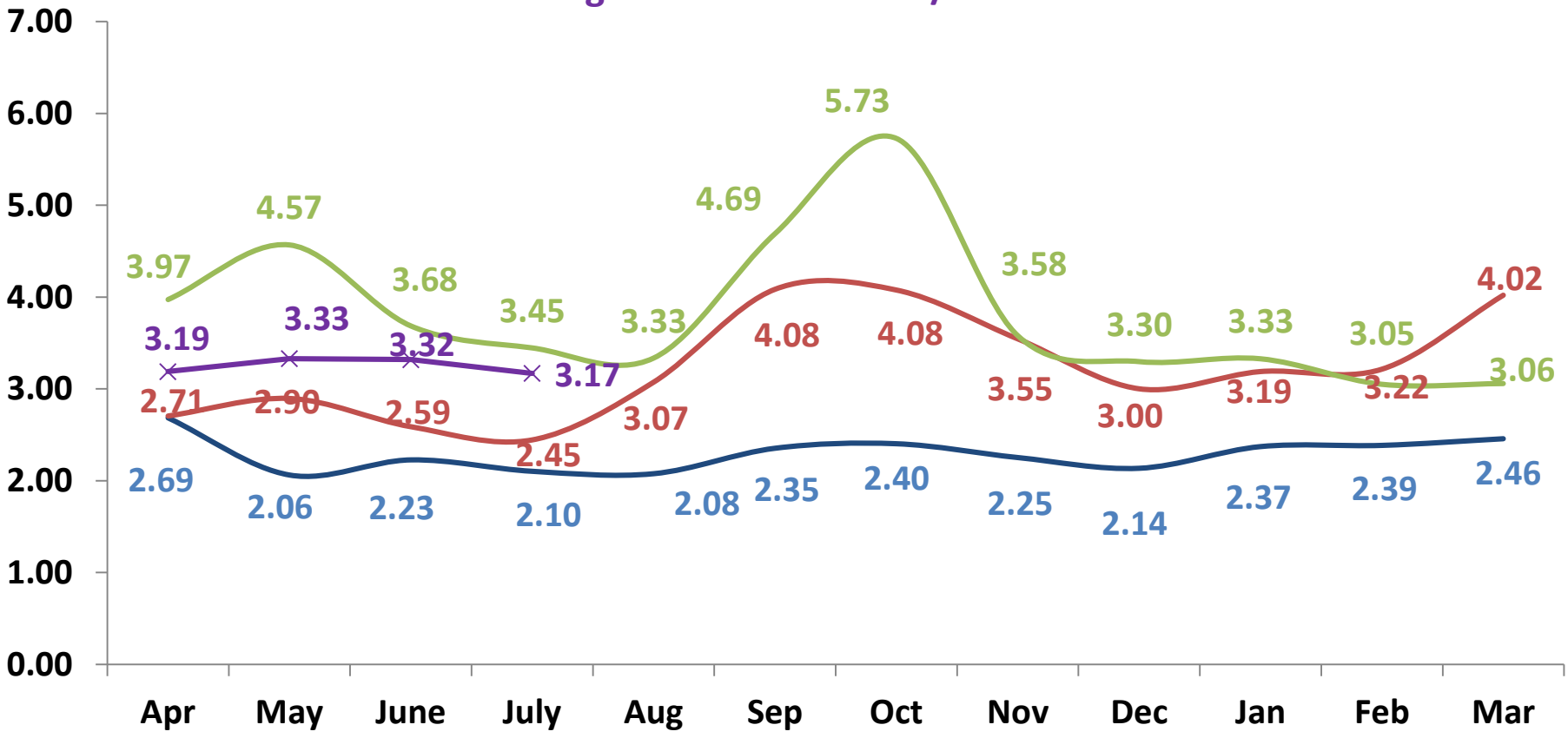
EXCHANGE SNAPSHOT

DAM Market Snapshot
06 June 2019



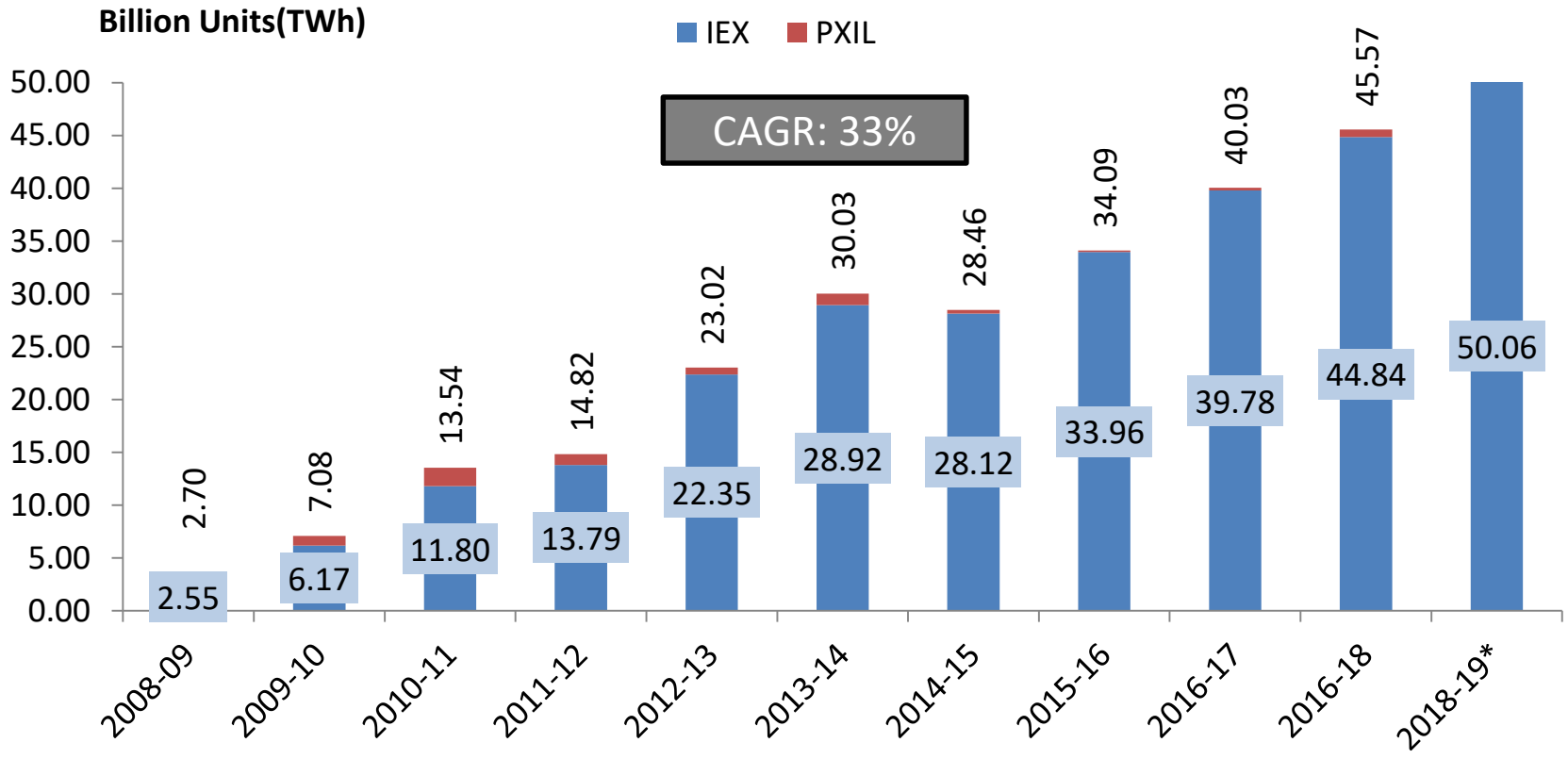
IEX Monthly Avg Price Trend

FY 16-17 Avg. RTC Price: Rs 2.29/kWh
FY 17-18 Avg. RTC Price: Rs 3.24/kWh
FY18-19 Avg. RTC Price: Rs 3.81/kWh
FY19-20 Avg. RTC Price: Rs 3.27/kWh



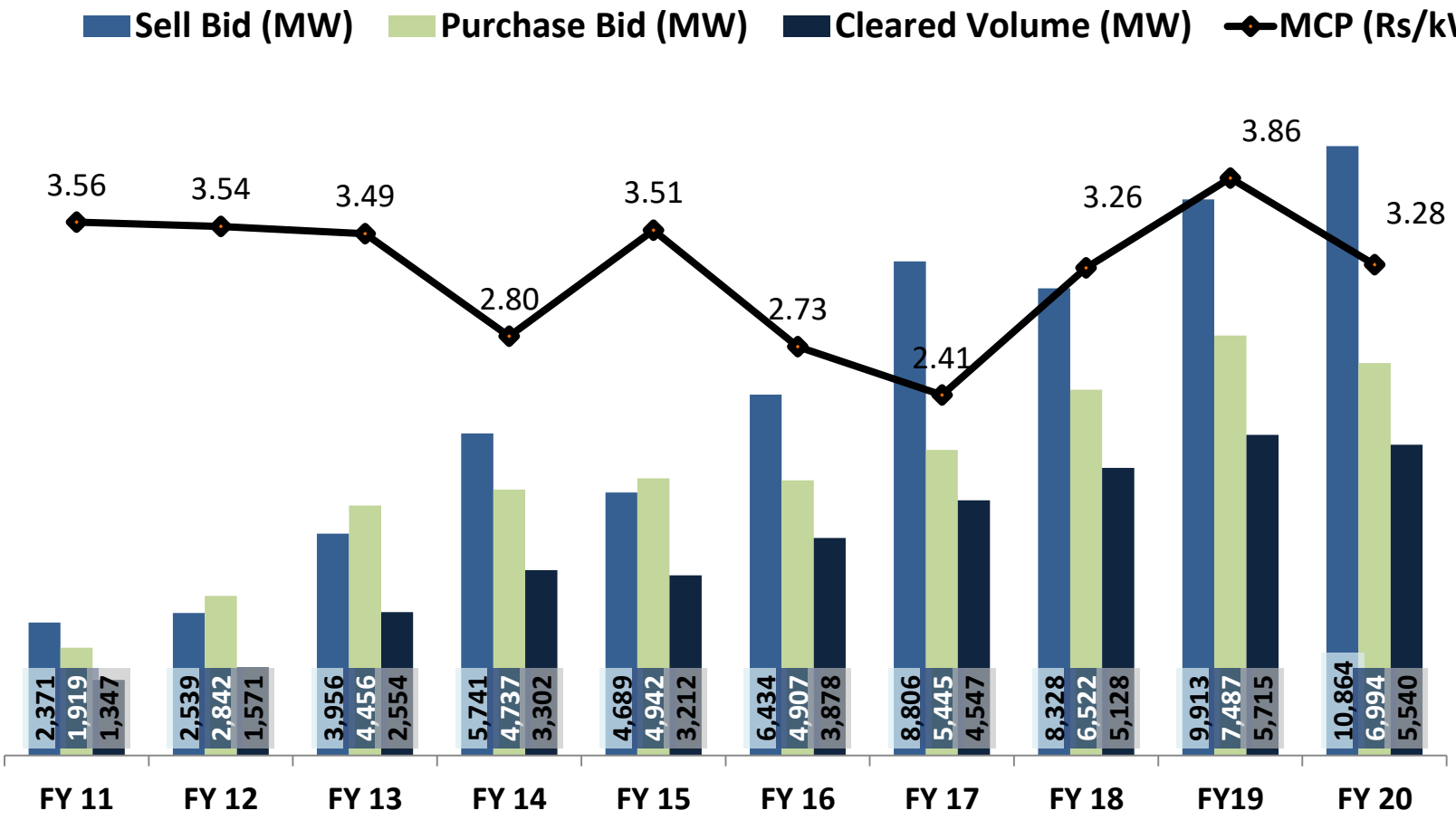
Evolution and growth of Exchanges

- **PXs approved & regulated by Central Electricity Regulatory Commission (CERC)**
- **Two exchanges in India: IEX and PXIL; commenced operations in 2008**



Source: CERC MMC Report (Day-Ahead Market)
**Till March 2019*

Day Ahead Market Volume Trend



Increase in generation capacity pushed the prices down except FY 19 when prices increased primarily due to coal shortage & coal price increase

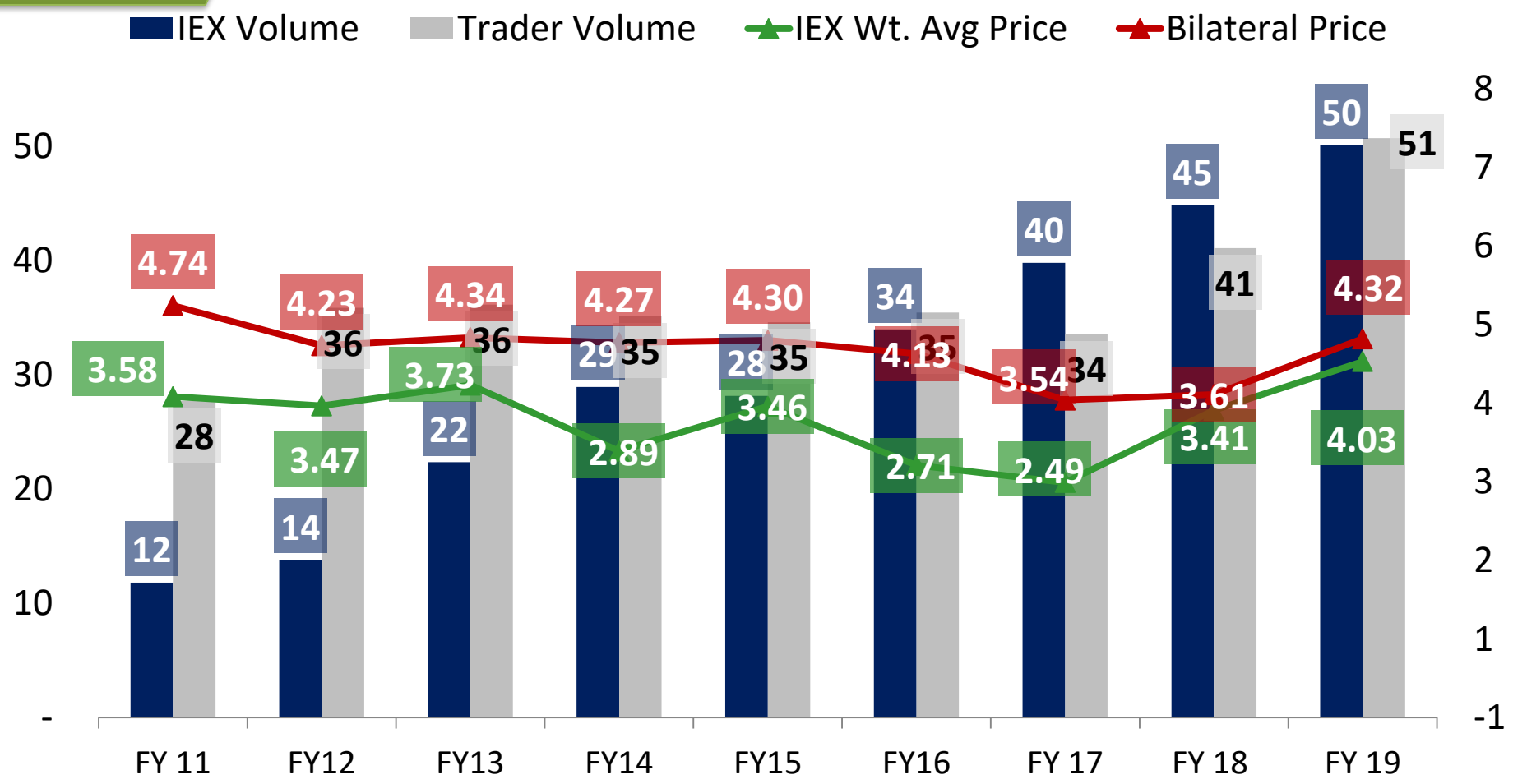
Data till 9th July

Comparison: Volume and Price (Bilateral vs IEX)

Efficient Price Discovery

Efficient Price Discovery has been the biggest growth driver for exchanges in the past

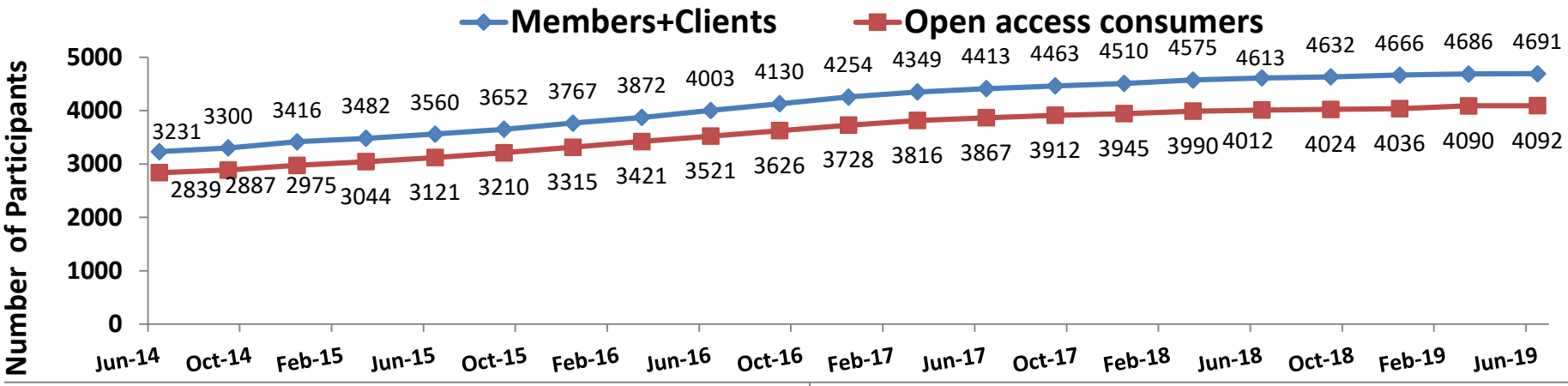
- Discoms can source cheaper power through Exchange to meet shortages
- Prices at Exchange always lower than Bilateral contracts



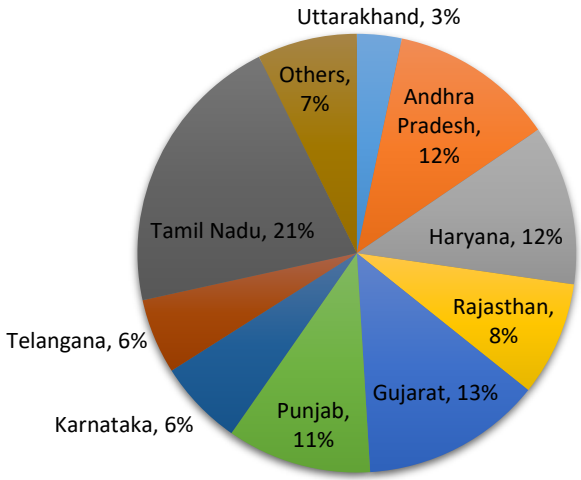
Source: *CERC MMC Reports*

Large participation

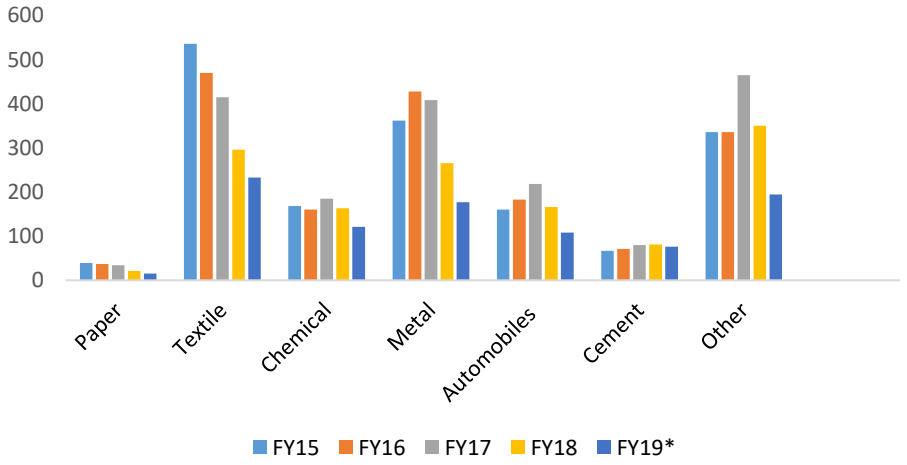
Registered participant base has been growing



Open Access Consumers _ States (As on 31st Dec18)



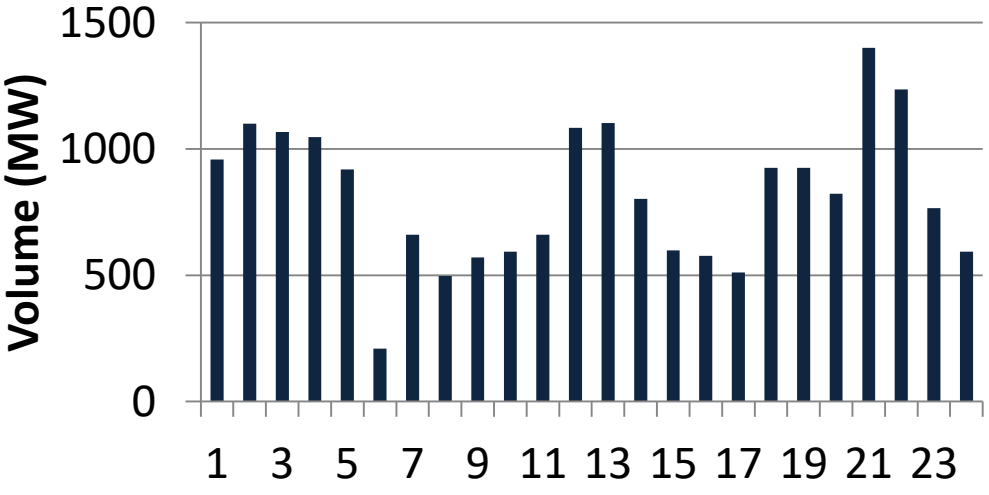
And Spread Across Industries (FY19 - As on 31st Dec,18)



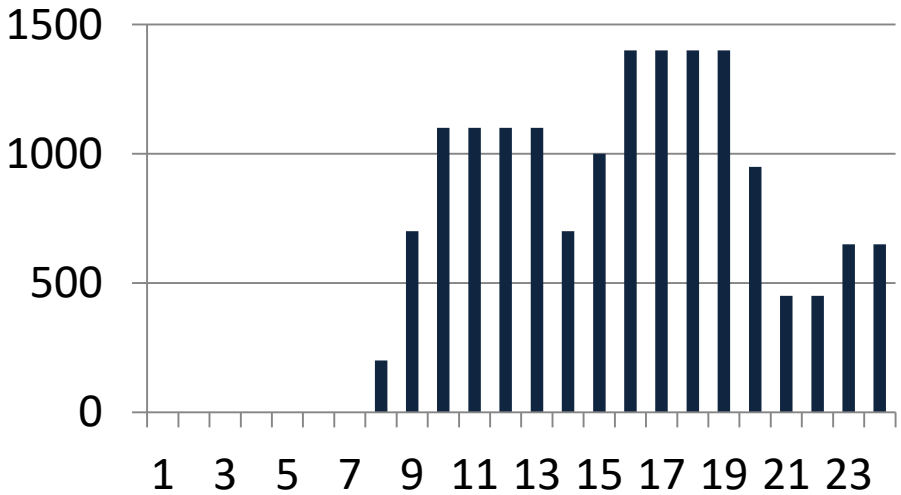
Participation has shown tremendous growth over the years

Average daily participation/day- 600

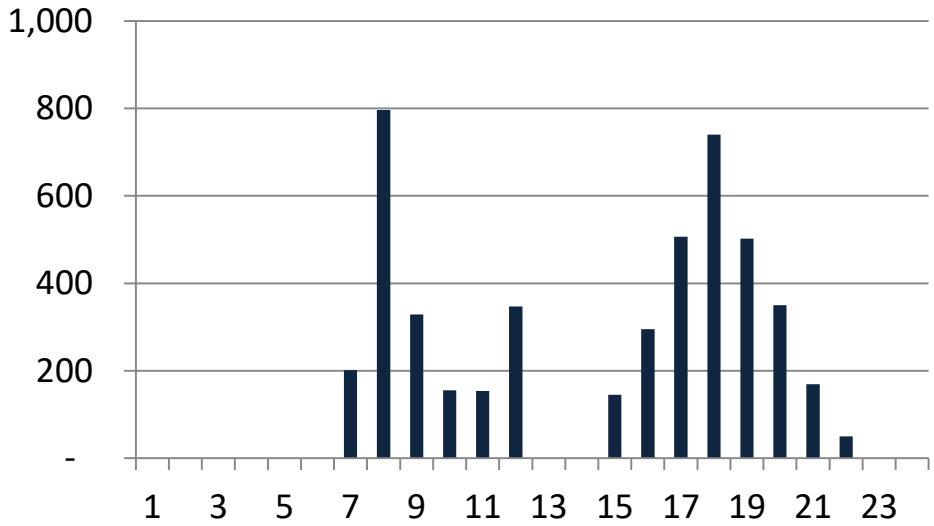
3. Flexibility to utilities to manage portfolio



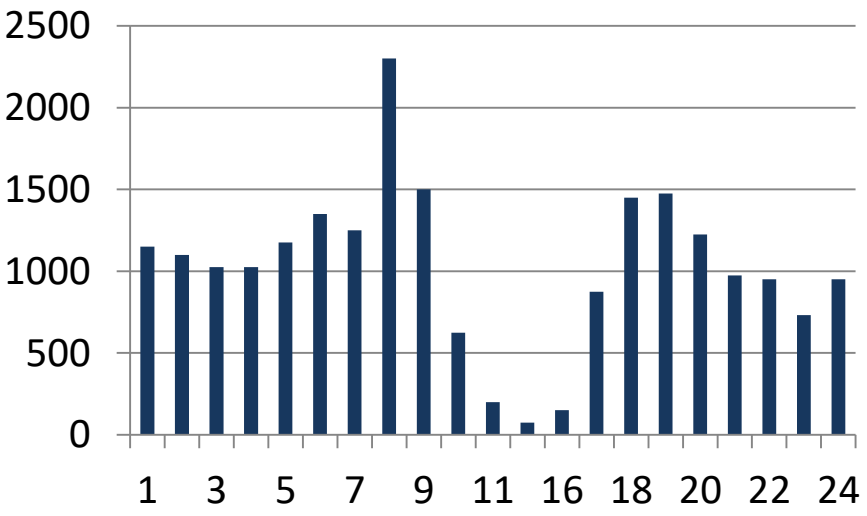
Buy Profile West Bengal-29th Jan '19



Buy Profile – Gujarat-15th Jan '19



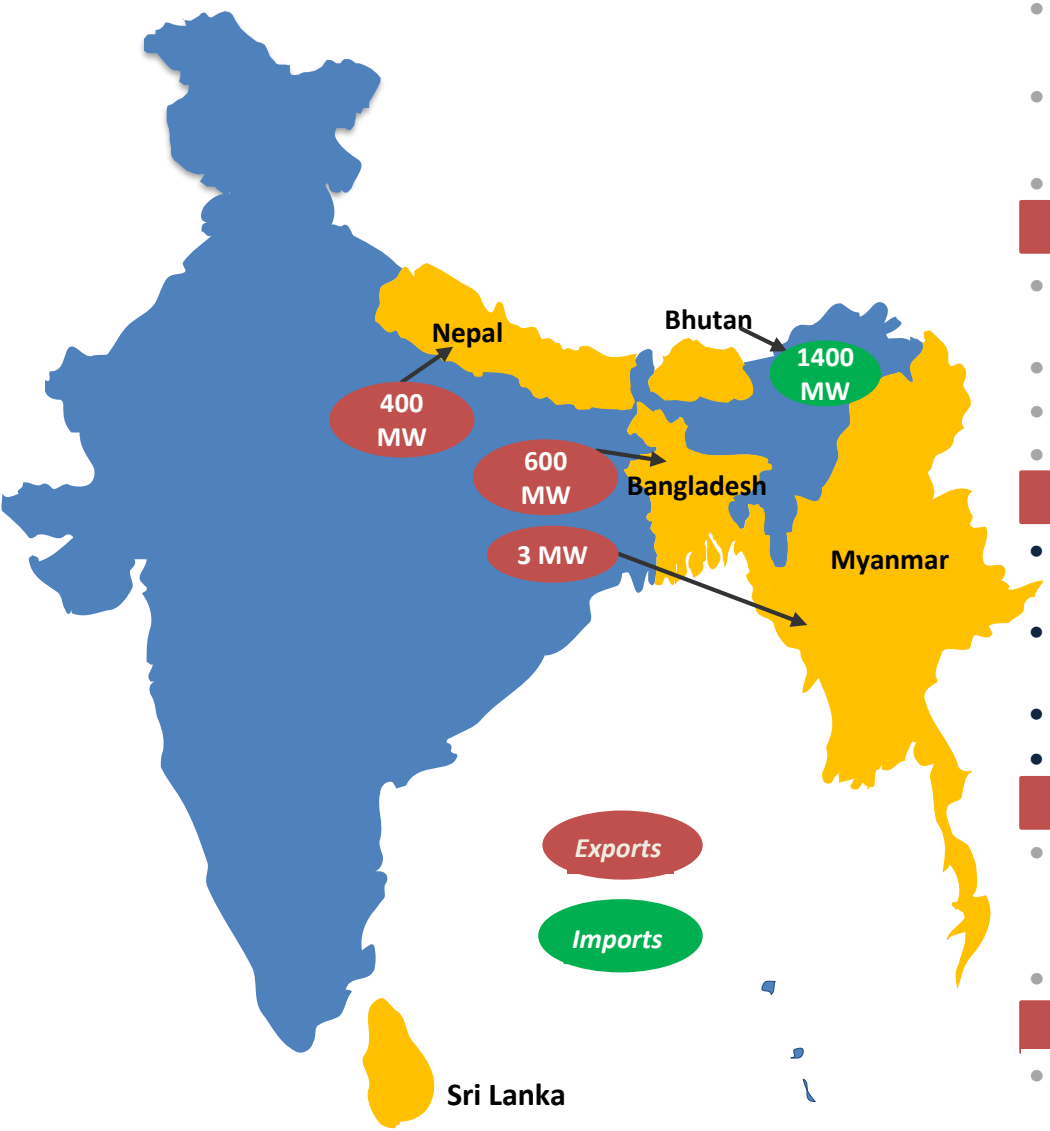
Haryana Sell Profile - 22nd Jan '19



Buy Profile – Telangana - 15th Jan '19

WAY FORWARD

Today: India trades ~2500 MW / ~13BUs with its neighboring countries in S Asia (Nepal, Bangladesh, Bhutan)



Bhutan

- Power surplus: Primarily hydro power; India purchases all surplus as per the **2006 Inter-Governmental Treaty**
- **Total imports of ~1500 MW or 5.6 BUs**; existing **1500 MW transmission capacity**
- **Seasonal generation**, concentrated in **May-Sept.** period

Bangladesh

- Power deficit: Peak demand of ~13 GW and capacity of ~12 GW however, effective capacity of ~9GW (lack of gas)
- **India exports 600 MW or 5.3 BUs**, to meet B'desh's deficit
- **600 MW** transmission capacity**; expected to double** in 5 years
- **Power deficit situation to continue for next 10 years**

Nepal

- Power Deficit: Instances of blackouts during dry seasons; expected to be surplus during monsoon in 5 years
- India financed hydro projects currently stuck owing to land-acquisition challenges
- **India exports 400MW** or 1.8 BUs
- Transmission capacity to be **expanded to 1000 MW** (400 MW now)

Myanmar

- Power surplus: Internal demand is low due to **poor grid connectivity within Myanmar** – only 35% households connected to their main grid
- **India exports 3 MW** or 0.03 BUs; no inter-regional transmission

Sri Lanka

- Power sufficient, though costs are high due to expensive oil imports
- **No power trade currently** given **lack of transmission capacity**;
- 500 MW transmission capacity to come up by ~2030

Enabling Steps for Cross Border Trade through Exchange

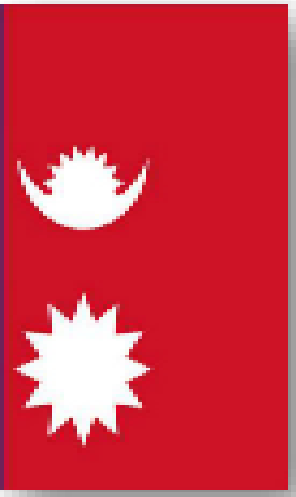
Guidelines issued by Ministry of Power ✓

CERC to notify Regulations for Cross Border Trade ✓

CEA notified draft CBR (Conduct of Business Rules) ✓

IEX to file for changes in contract specs in line with CERC regulations and CEA rules — In process

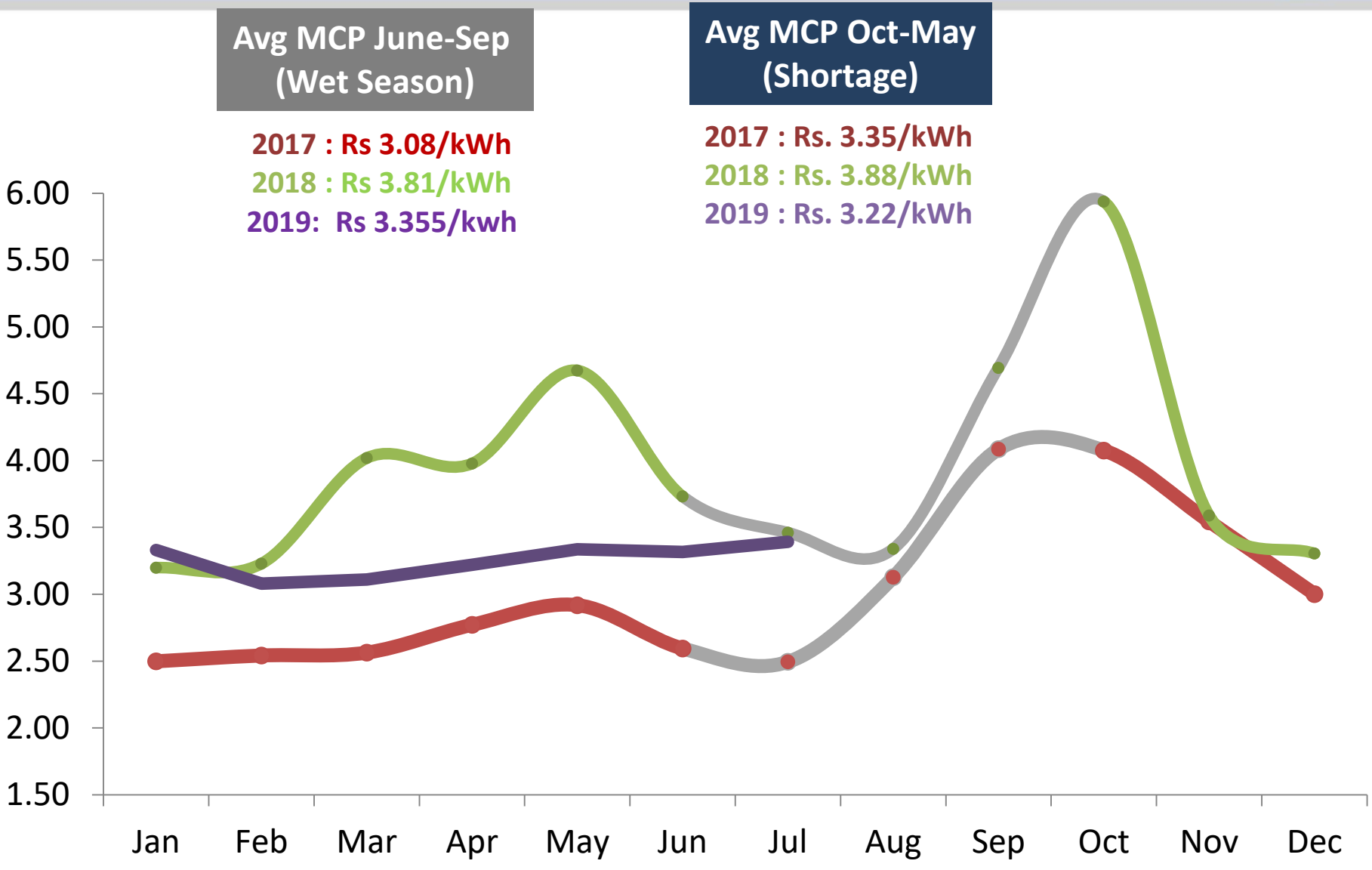
India-Nepal Transactions Potential



- Exports during wet season
- Significant hydro power export possible

- Thermal power support for load following
- Dry season support

IEX Monthly Average Market Clearing Price (Rs./kWh)



Nepal Portfolio Management through Exchange

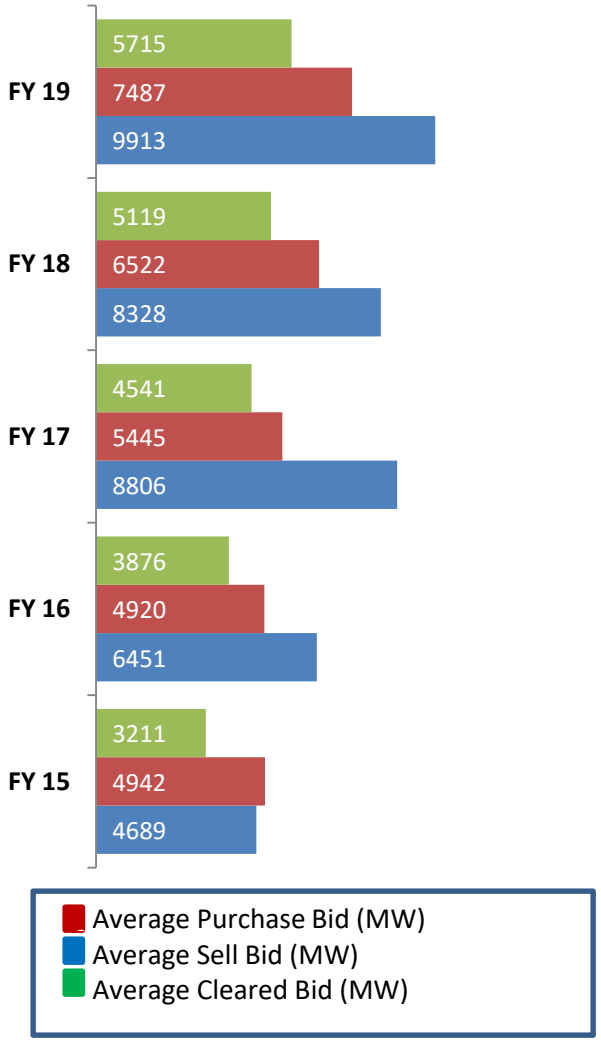
Meeting Shortages

- **Buy Residual Requirement** : when transmission margins are available and demand exits
- **Economise when possible:** Can buy when it's cheaper on IEX and replace costlier power through Bilateral trade to the extent of Contract conditions (~20% in case of 80% take-or-pay contracts)
- **Leverage Value of Stored Water:** Can leverage Storage , similar to Hydro rich state like HP etc., save water for generation in peak hours/ seasons etc.
- **Cheaper Power :** Exchange Prices are lowest during Nepal's peak season (Oct-Feb)

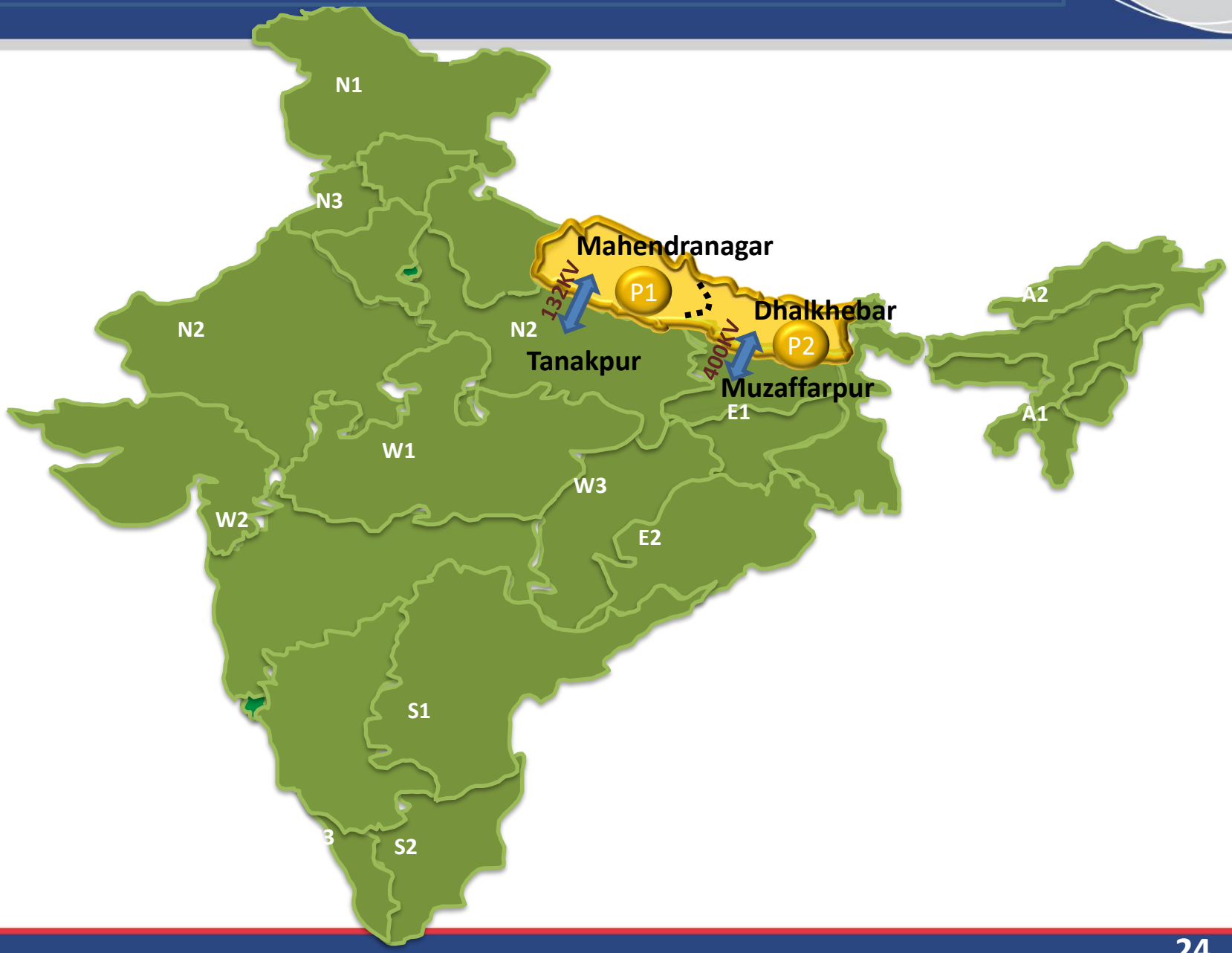
Selling Surplus

- Nepal Going forward will be surplus is wet season
- IEX will offer a very liquid platform to sell the surplus at competitive prices
- Nepal should implement concept of "Value of water" and try to commercially mange manage reservoirs

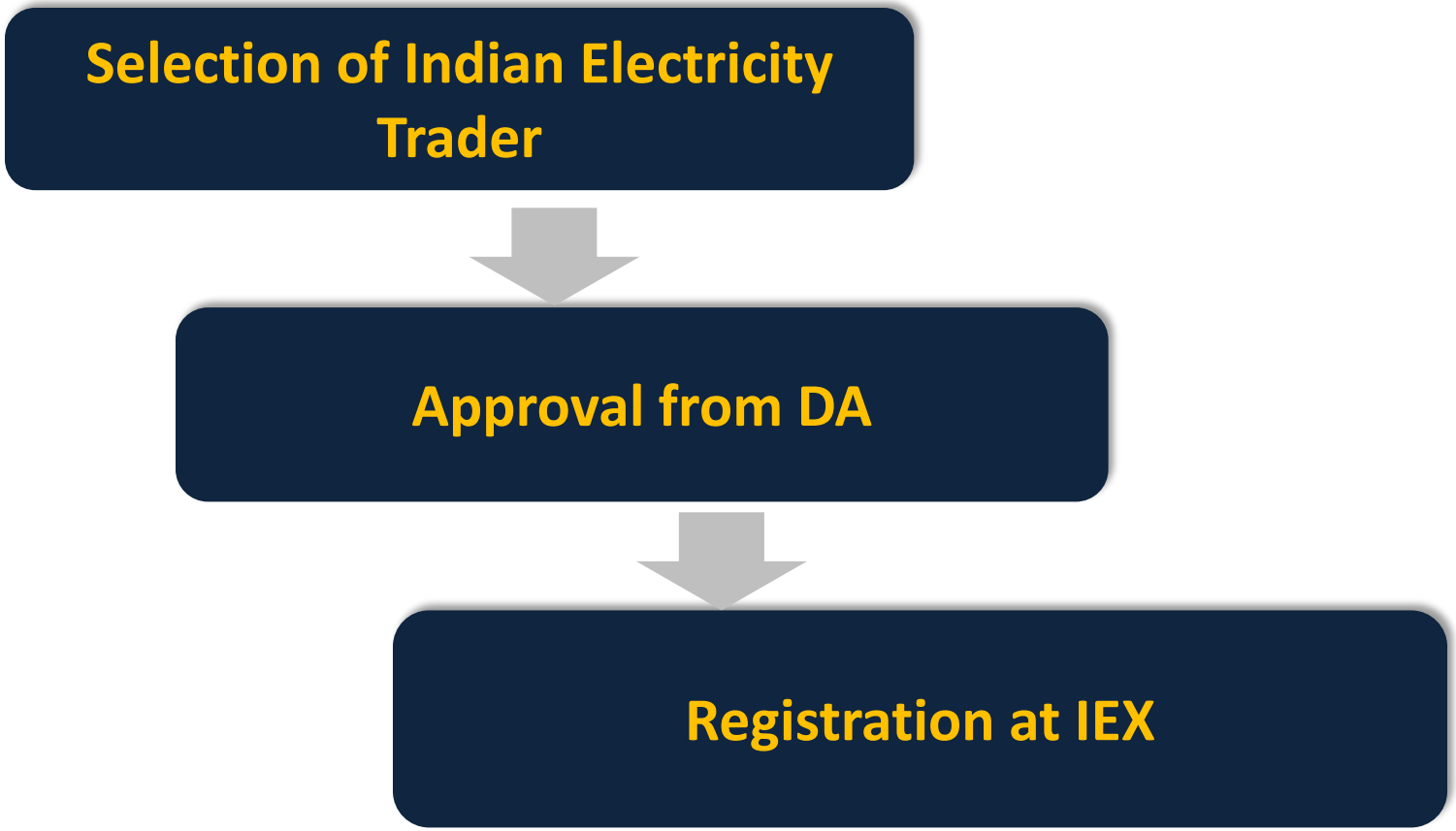
High Liquidity



New Bid Areas & Existing interconnection



Registration Procedure



Thank You

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Load Forecast: Nepal

Fiscal Years	Energy (MU)	Peak Load (MW)
2017-18	7,489	1,644
2018-19	8,391	1,842
2019-20	10,138	2,225
2020-21	12,017	2,638
2021-22	13,952	3,062
2022-23	15,332	3,365
2023-24	16,869	3,703
2024-25	18,579	4,078
2025-26	20,585	4,519
2026-27	22,826	5,011
2027-28	25,332	5,561
2028-29	28,111	6,171
2029-30	31,196	6,848

Source :NEA Annual Report 2017-18