Indian Power Markets

&

Open Access

14th Oct,2016

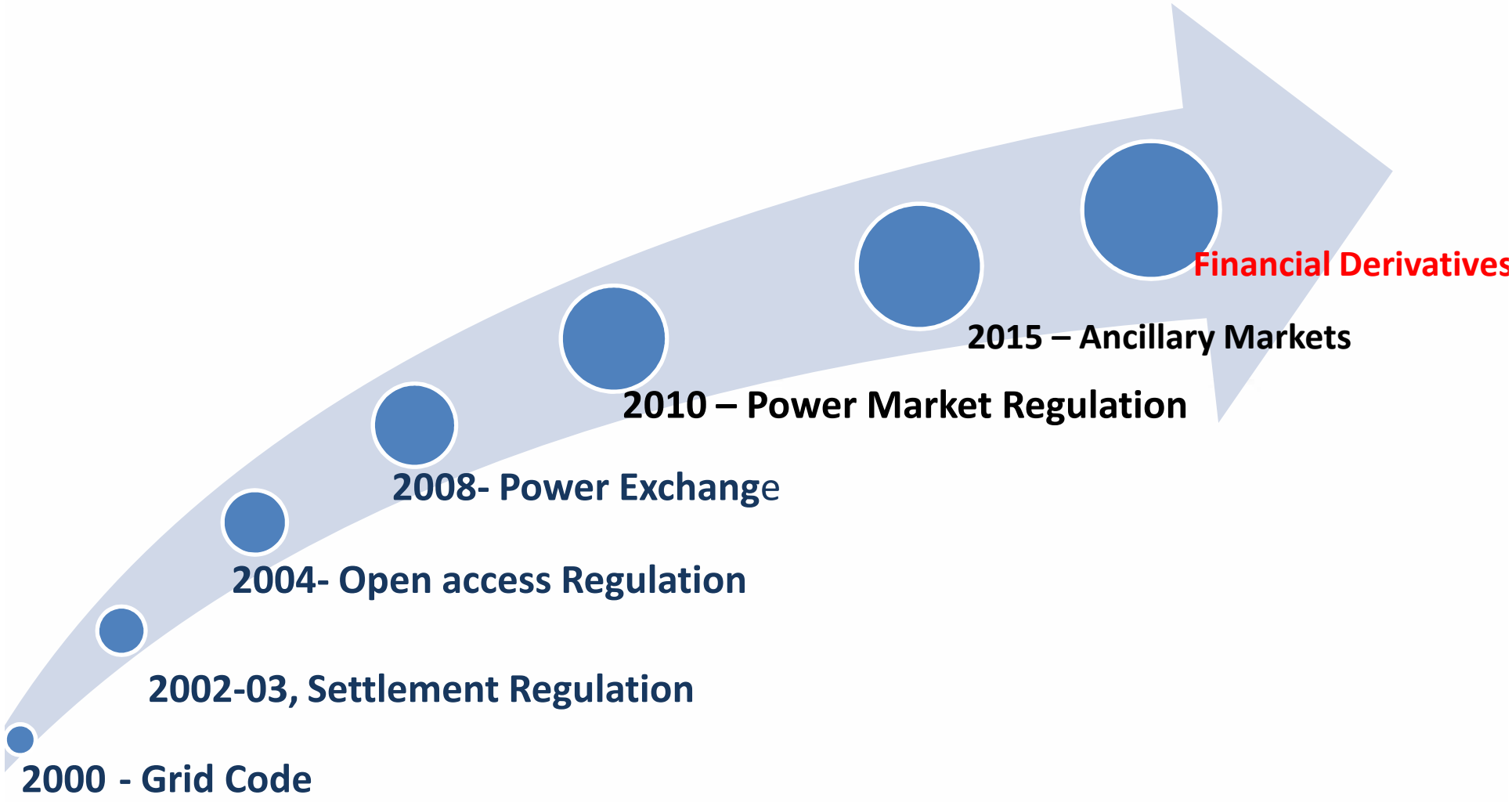
IIT, Kanpur

REGULATORY FRAMEWORK FOR POWER MARKET

Market related legislations

Electricity Act , 2003	• De-licensing of generation • Development of a multi-buyer multi-seller market in power • Trading – licensed activity.
National Electricity Policy , 2005	• Measures to promote competition aimed at consumer benefits • Promote competition through developing markets
Open Access Regulations , 2004 & 2008	• Universal Open Access to transmission networks • Separate procedures for 'Day-Ahead Market(collective transactions) and OTC transactions
National Action Plan on Climate Change, 2008	• Promotion of Renewable energy market through PX • Promotion of energy efficiency market through PX
Power Market Regulations, 2010	• Providing a regulatory framework for Competitive markets • Guidelines and prudential norms for setting up and operating power exchanges

Evolution of Power Market Framework



CERC Power Market Regulations, 2010

Role of PXs defined and norms for setting up and operating PX

- Procedure for application, eligibility criteria, shareholding pattern, Net worth, risk management by PX,

CERC approval for setting up a PX and oversight for contracts offered

Objectives for PX

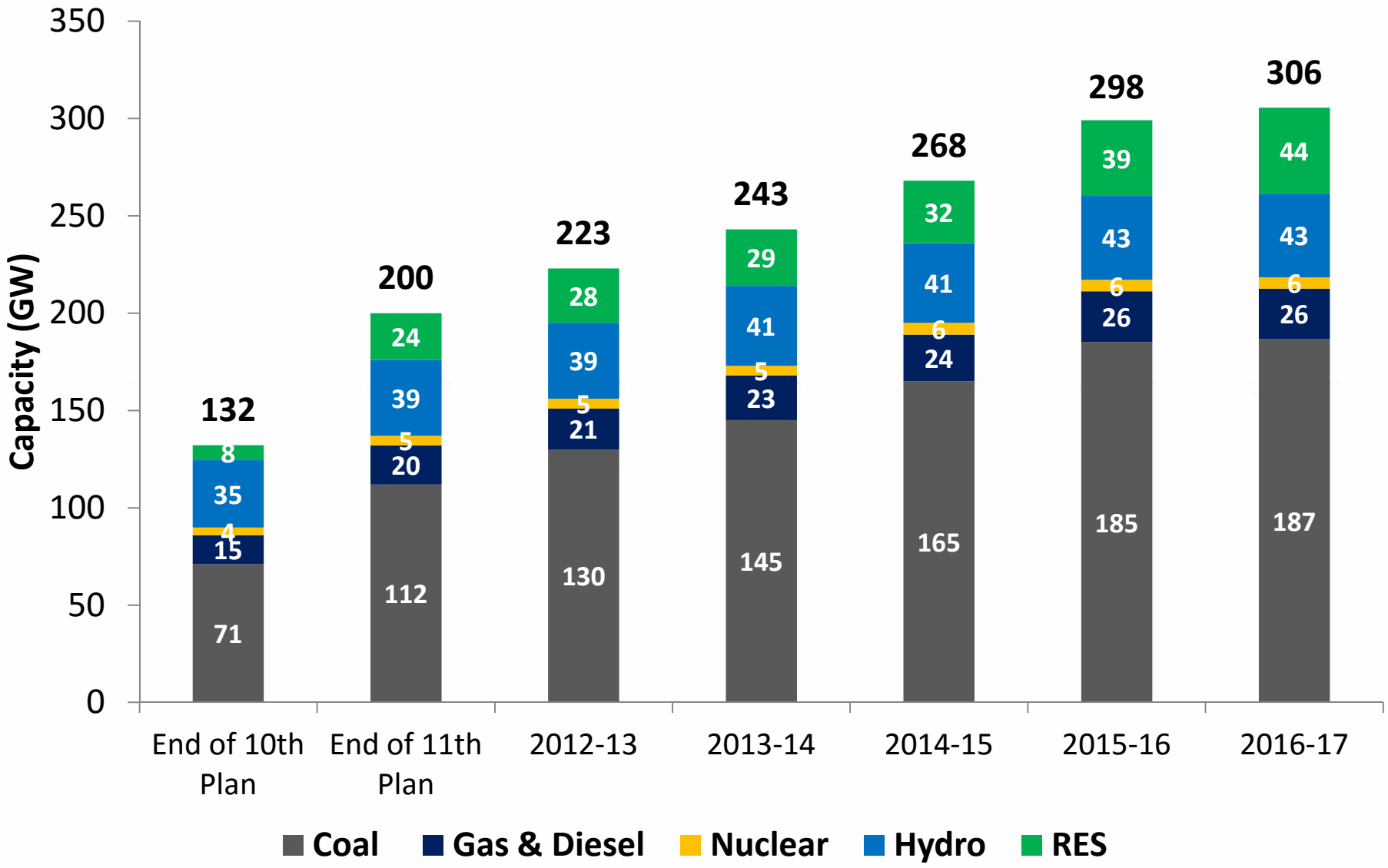
- Ensure fair, neutral, efficient and robust price discovery
- Provide extensive and quick price dissemination
- Design standardised contracts and work towards increasing liquidity in contracts

Defined principle of price discovery for the exchange

- Economic principle of social welfare maximisation
- **Closed double sided bidding, uniform price discovery, market splitting for congestion management**

INDIAN POWER SECTOR

Installed Generation Capacity of India



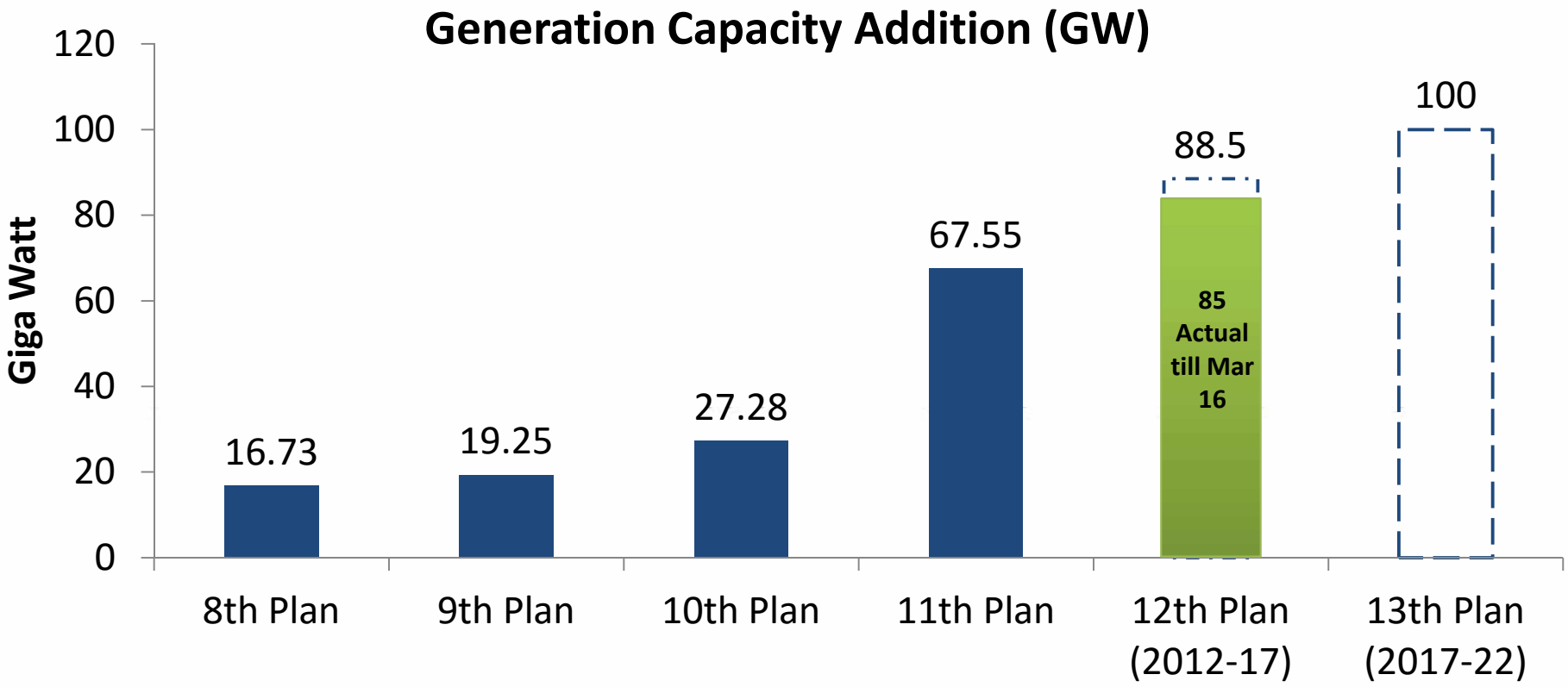
Installed Capacity (31.03.16) & Generation (FY 15-16)

Category	Installed Capacity (MW)	PLF**	Generation (BUs)	Feasible PLF	Possible Generation (BUs)
Coal	185,173	59%^	896	80%	1,298
Gas	24,509	25%^	47	80%	172
Diesel	994	5%	0.4	5%	0.4
Hydro	42,783	33%	121	33%	124
Nuclear	5,780	73%	37	80%	41
RE	38,822	18%	60*	18%	61
Total	**298,060**		**1,161**		**1,695**

Source: Executive Summary of Mar 2016, CEA *including renewable generation till Feb'16

**** Calculated from the Capacity and generation data ^Average capacity taken for the year**

Installed capacity addition in the country



- **In addition, Renewable energy capacity of 175 GW is planned till 2022**

Source: CEA

Power Situation in the Country

Year	Installed Capacity (at the end of FY) (MW)	Peak Met (MW)
2010-11	173,626	110,256
2011-12	199,877	116,191
2012-13	223,344	123,294
2013-14	243,029	129,815
2014-15	267,367	141,160
2015-16	298,060	148,463
2016-17*	**305,554**	**156,058**

- During the last 5 years, **capacity has increased at a CAGR of 11 %** i.e. from 173 GW to 298 GW, **peak demand met increased at a CAGR of only 6.1%**

Power Supply Outlook
India

- Installed capacity of India has reached about 298 GW where as the peak demand is only about 156 GW
- During the last five years, **capacity has increased at a CAGR of 11 %** i.e. from 173 GW to 298 GW, **peak demand met increased at a CAGR of only 6%**
- Coal production increased by 9% in FY 2015-16 from previous year. Import of coal has reduced. With increased coal supply, the energy charge has reduced by 20-30 paise/unit
- Sell quantum available in power market has increased due to higher availability of coal at reasonable prices. Thus, the prices at Exchange also came down
- With good rains, high hydro generation, high coal production and further capacity addition, the prices at Exchange are expected to continue being low.

POWER MARKET DEVELOPMENT IN INDIA

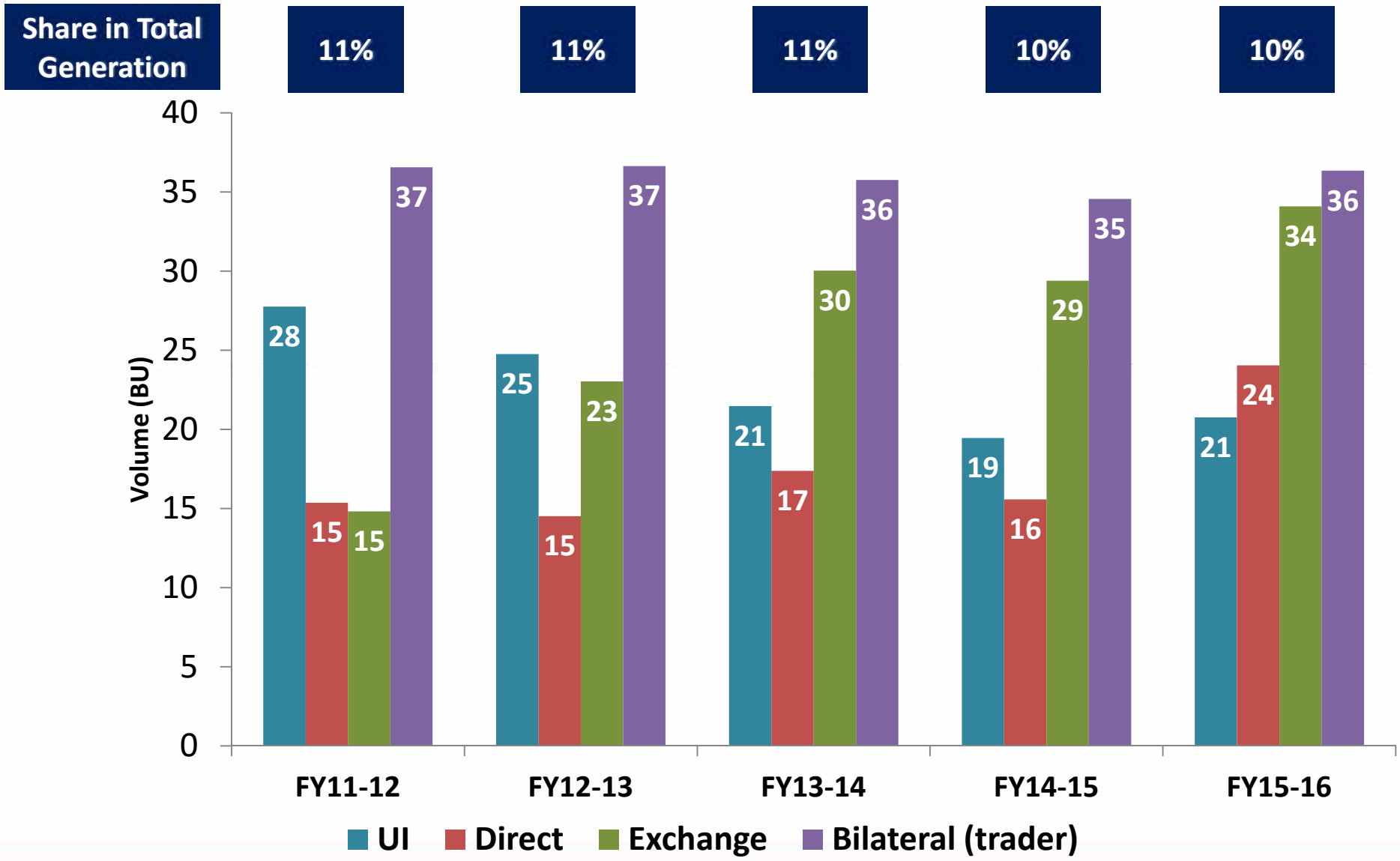
Indian Power Market Snapshot

	FY 2009	FY 2016
Long Term	93.86%	89.6%
PPA for over 25 years through long term		
Short-Term	6.1%	10.4%
Exchanges	0.4%	3.1%
Through traders	3.2%	3.3%
Direct Bilateral	0.5%	2.3%
Unscheduled Interchange	2.1%	1.9%

- Short term market grew at an encouraging rate with a **CAGR of 22%** (FY-09 to FY 16)

Source: Percentage as per CERC *Report on Short Term Power Market*

Share of Short Term Market in Total Gen.



Understanding the Exchange

A Neutral Platform

- Power Exchange is a **neutral platform**, a market place, which provides the necessary electronic trading platform and associated infrastructure to facilitate buying and selling of electricity by the participants. Power Exchange in **no way influences the price determination process**, which is dependent on the offers and bids placed by the market participants i.e., the sellers and buyers

Voluntary Participation

- In India, the participation in any of the markets – bilateral or the Power Exchanges is **purely voluntary**, unlike many countries in the world that have mandated compulsory participation through Power Exchanges. It is the **decision of the market participant to choose** the market place for buying or selling electricity

Anonymity: Trading through the Power

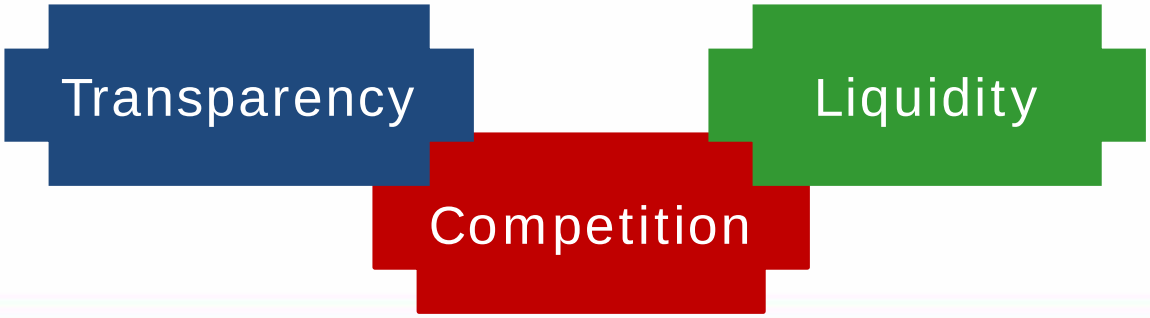
- Exchanges is a **non-cooperative game**. Both the sellers and the buyers place bids on the electronic platform **independent of each other**

Company Snapshot

INDIAN ENERGY EXCHANGE
India's No.1 Power Exchange

- Market Share: **96%**
- Average daily trade: **5000 MW**
- High Participation: **3700+**

3500+ Industries | **50+** Discoms (all) | **350+** Generators



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
since Sep,09

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

Intra-Day **– Round-the-clock Market**

Extended Markets introduced
20th July'15

Daily- *for rolling seven days (delivery starting after 4 days)*

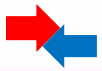
Weekly- *for 1 week (Monday-Sunday)*

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


Auction


Continuous

Features of Day Ahead Market

Physical delivery based market |Min 100kW

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

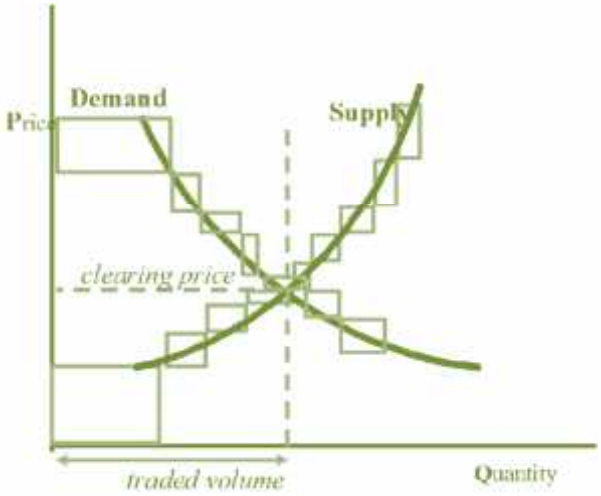
Highly flexible: Bid for any single/combination of time block

Intersection of aggregated sale and purchase curves defines Market Clearing Price (MCP)

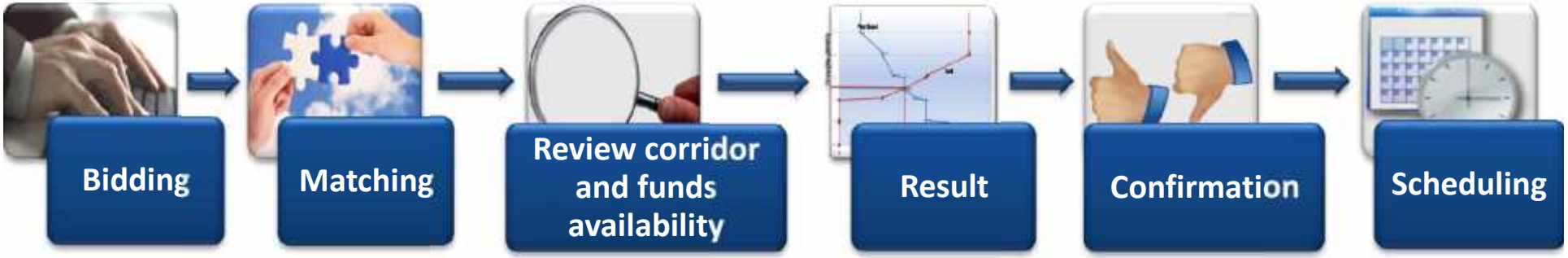
Bid area based on transmission congestion
ATC across bid areas determined by NLDC /RLDCs

Market splitting determines Area Clearing Price (ACP) specific to an area
(available at www.iexindia.com)

Delivery/ Settlement /All OA Charges thru IEX

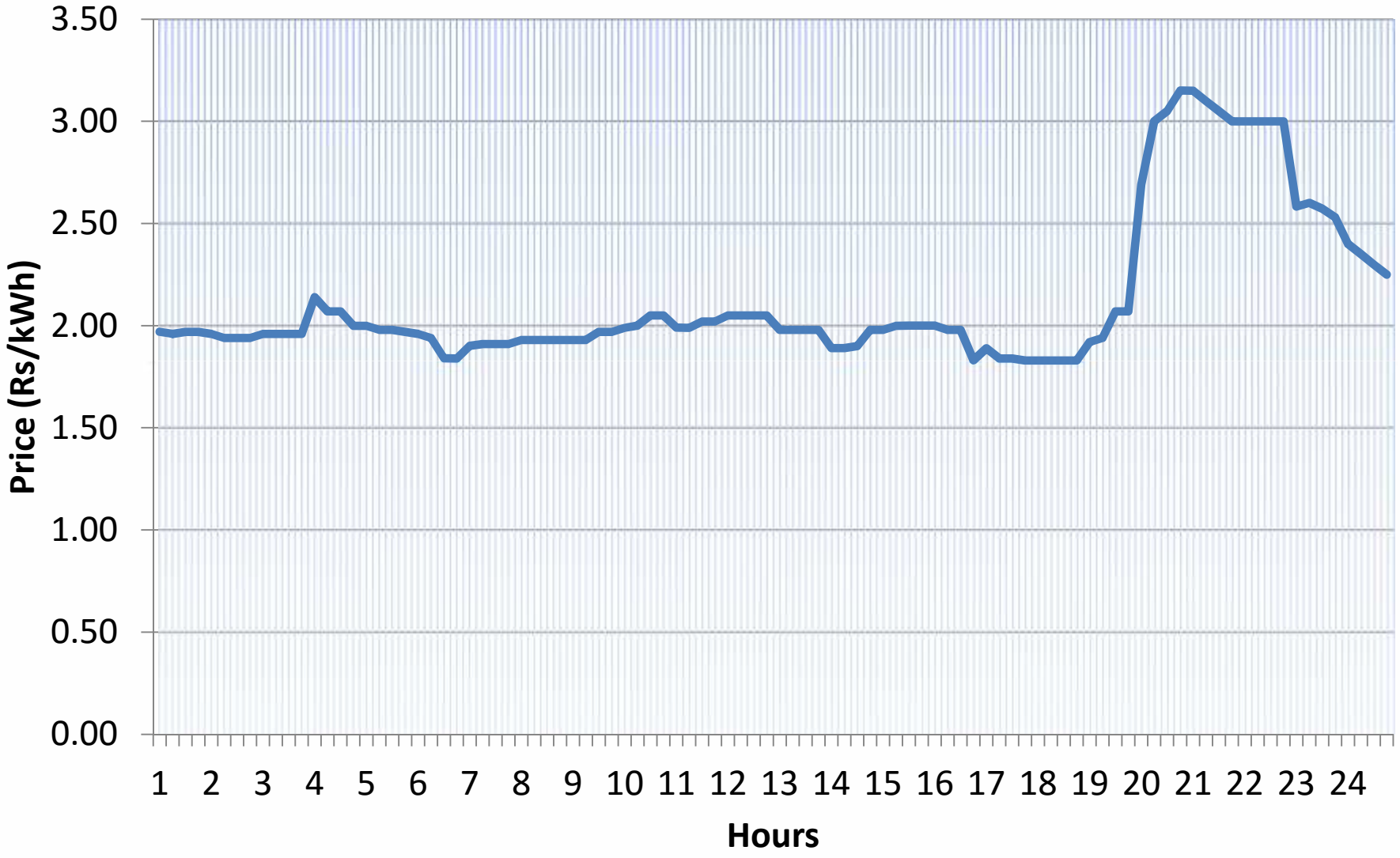


DAM trading process

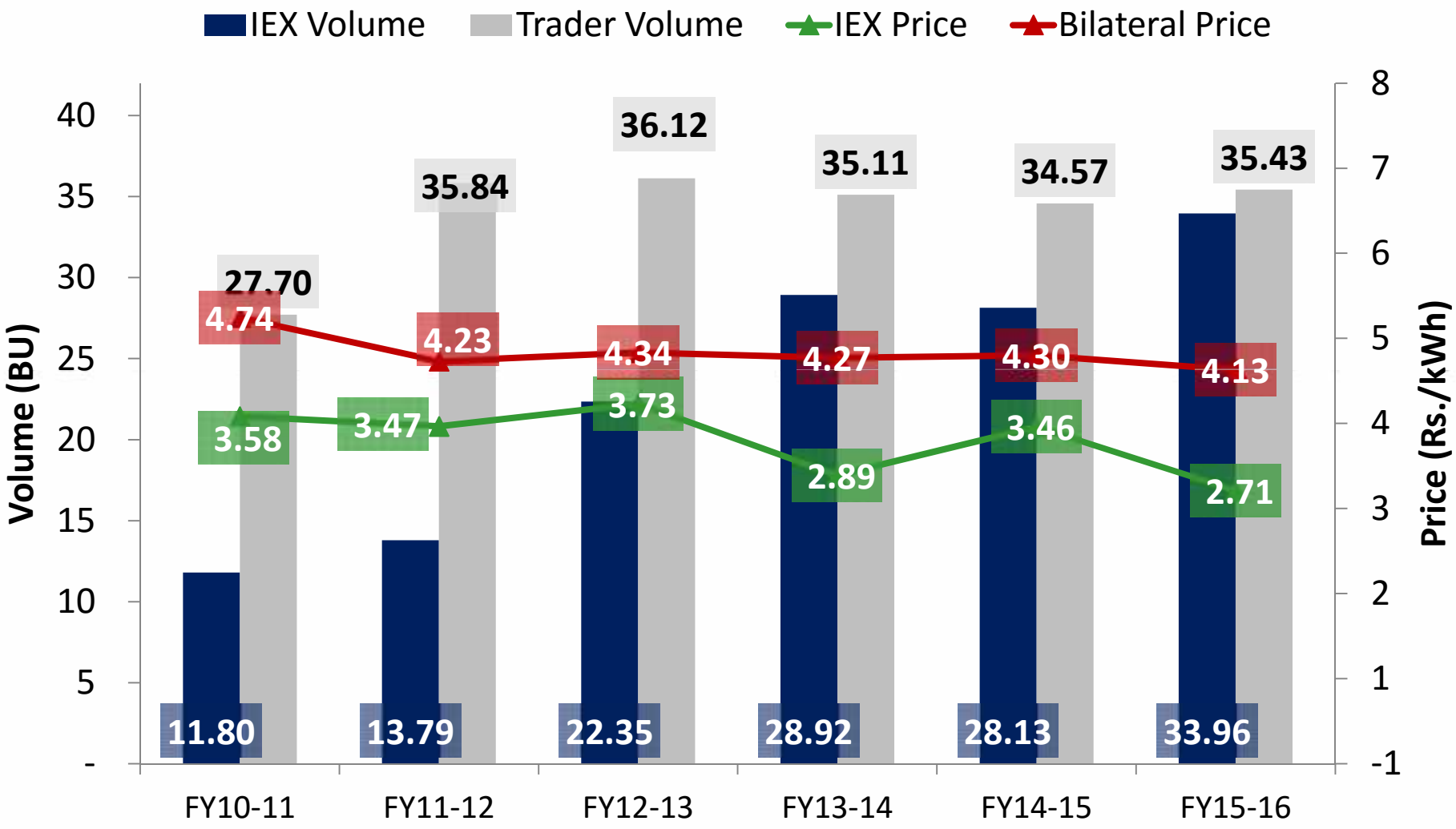


10:00 am to 12:00 pm	12:00 pm to 1:00 pm	1:00 pm to 2:00 pm	3:00 pm	5:30 pm	6:00 pm
Bids for 15-min each or block bids can be placed	MCP & MCV calculated	Corridor availability and funds verified	Final ACV and ACP calculated. Market split if congestion	Collective transaction confirmation by NLDC	Final Schedule sent to RLDC for incorporation

Typical Day Price Trend
(MCP-Aug 31, 2016)



Price and Volume: Bilateral vs. IEX DAM

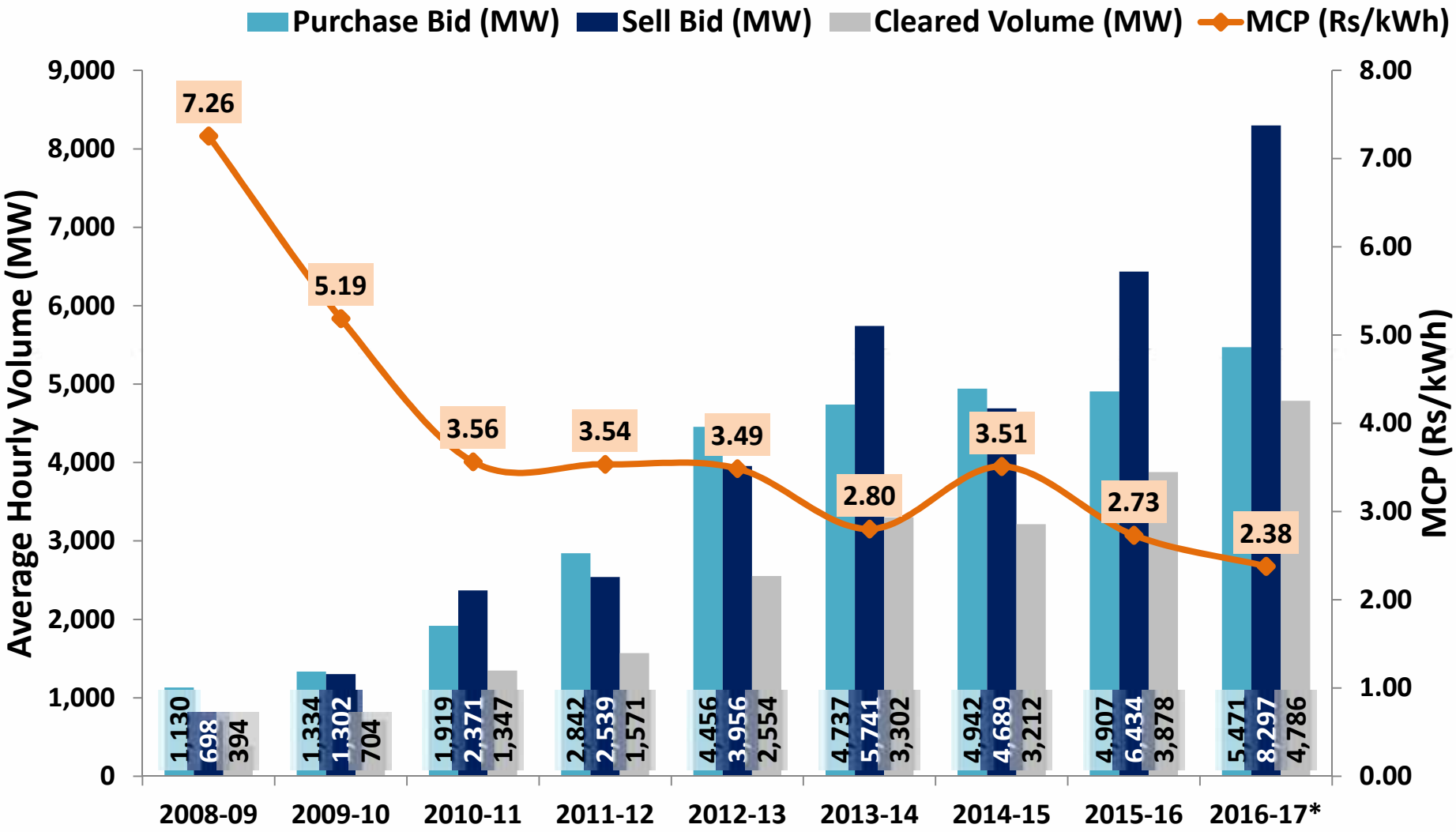


Prices at the Exchange always remained lower than Bilateral Contracts

Source: CERC MMC Reports

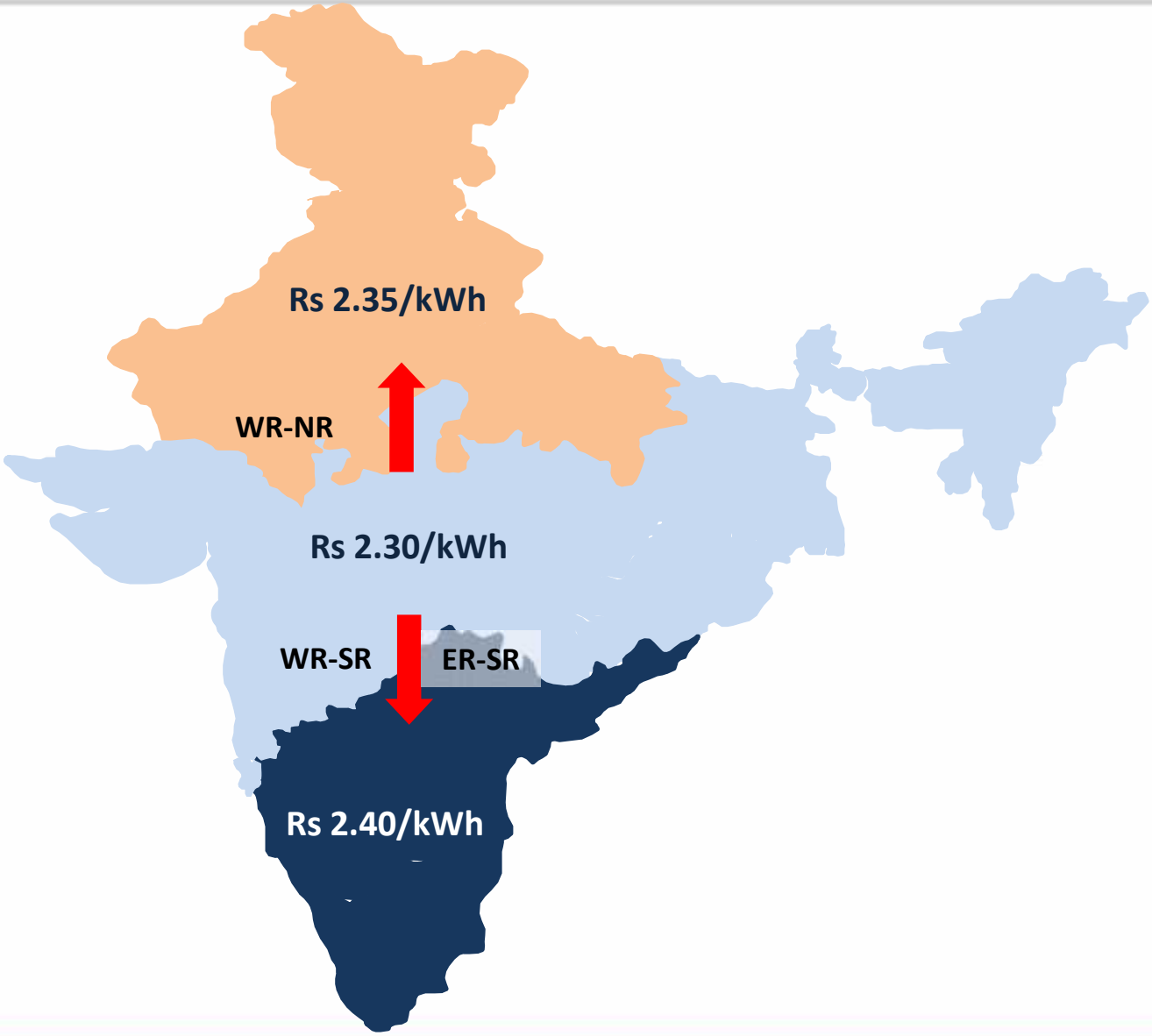
High Liquidity in Volume at IEX

(Average Hourly Volume in MW)



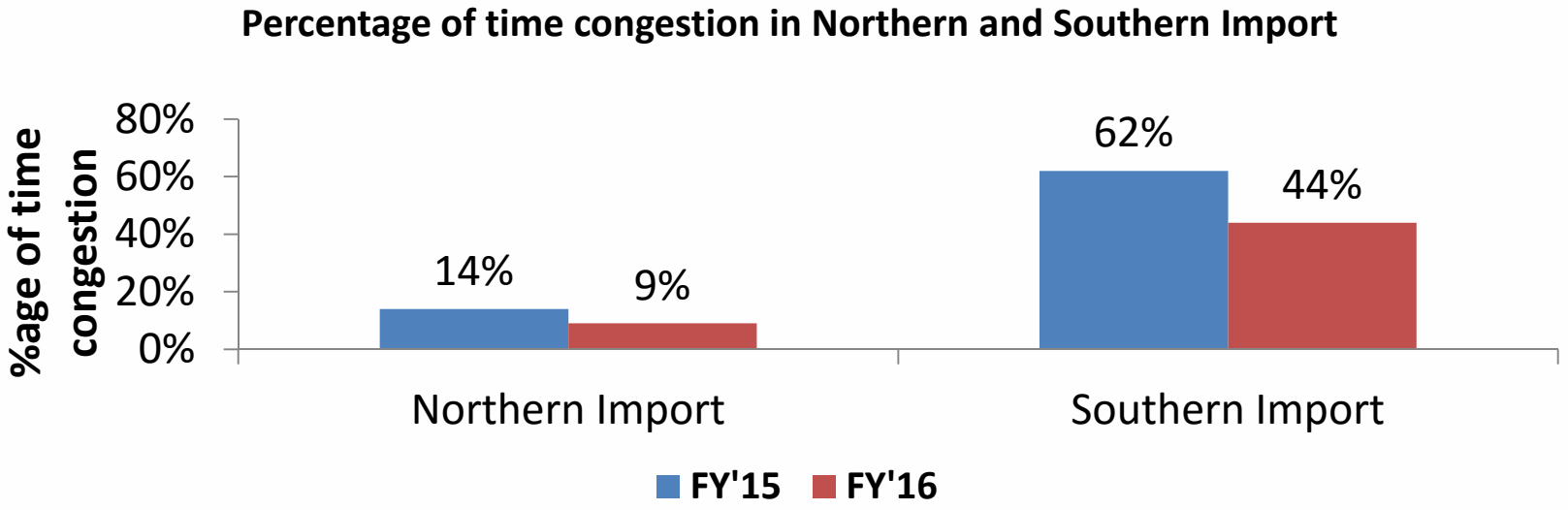
*Up to Sep 30, 2016

Inter-regional Transmission Network
Congested Corridors



Avg Price of April 16 is considered

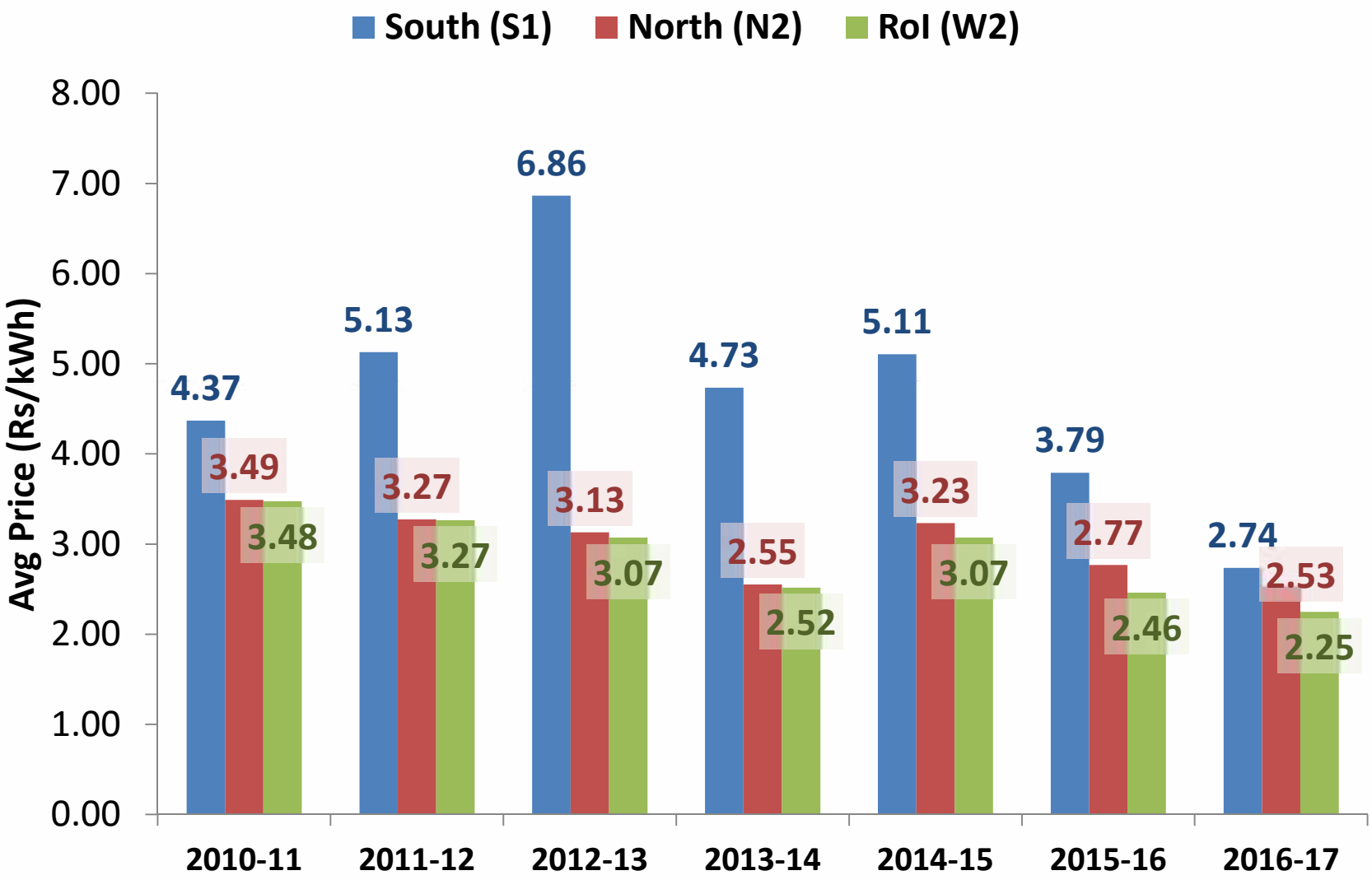
Volume Lost due to Congestion



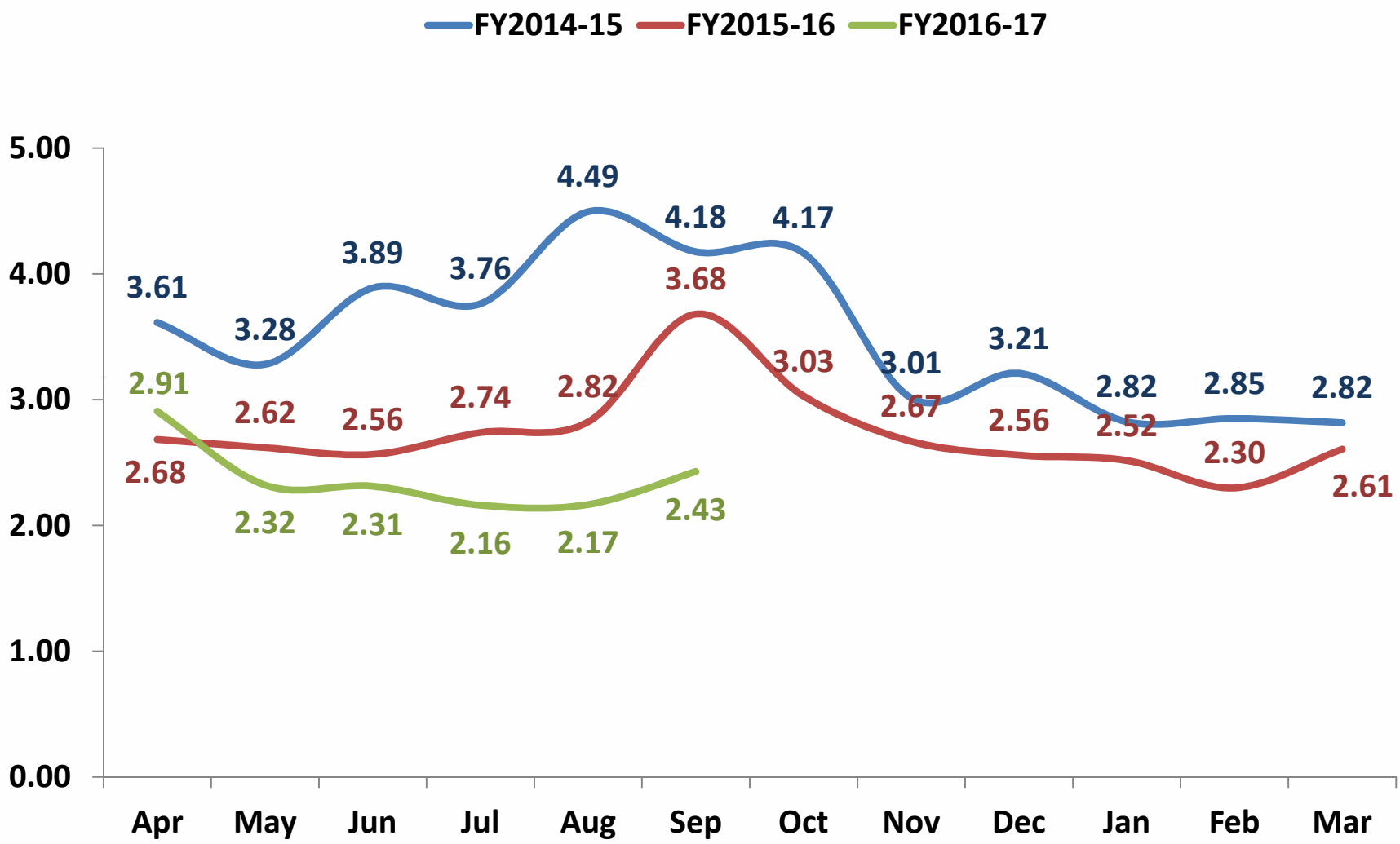
	Market Clearing Volume (MU)	Cleared volume (MU)	Curtailed Volume (MU)	Curtailment (%)
FY11-12	15,561	13,799	1,762	11%
FY12-13	26,143	22,375	3,768	14%
FY13-14	34,230	28,925	5,306	15%
FY14-15	31,227	28,131	3,096	10%
FY15-16	36,210	34,067	2,144	6%

After commissioning of Sholapur-Raichur line and associated transmission lines congestion in SR has reduced

Region-Wise Price Trend



Monthly Price Trend



Data as on 30 Sept 2016

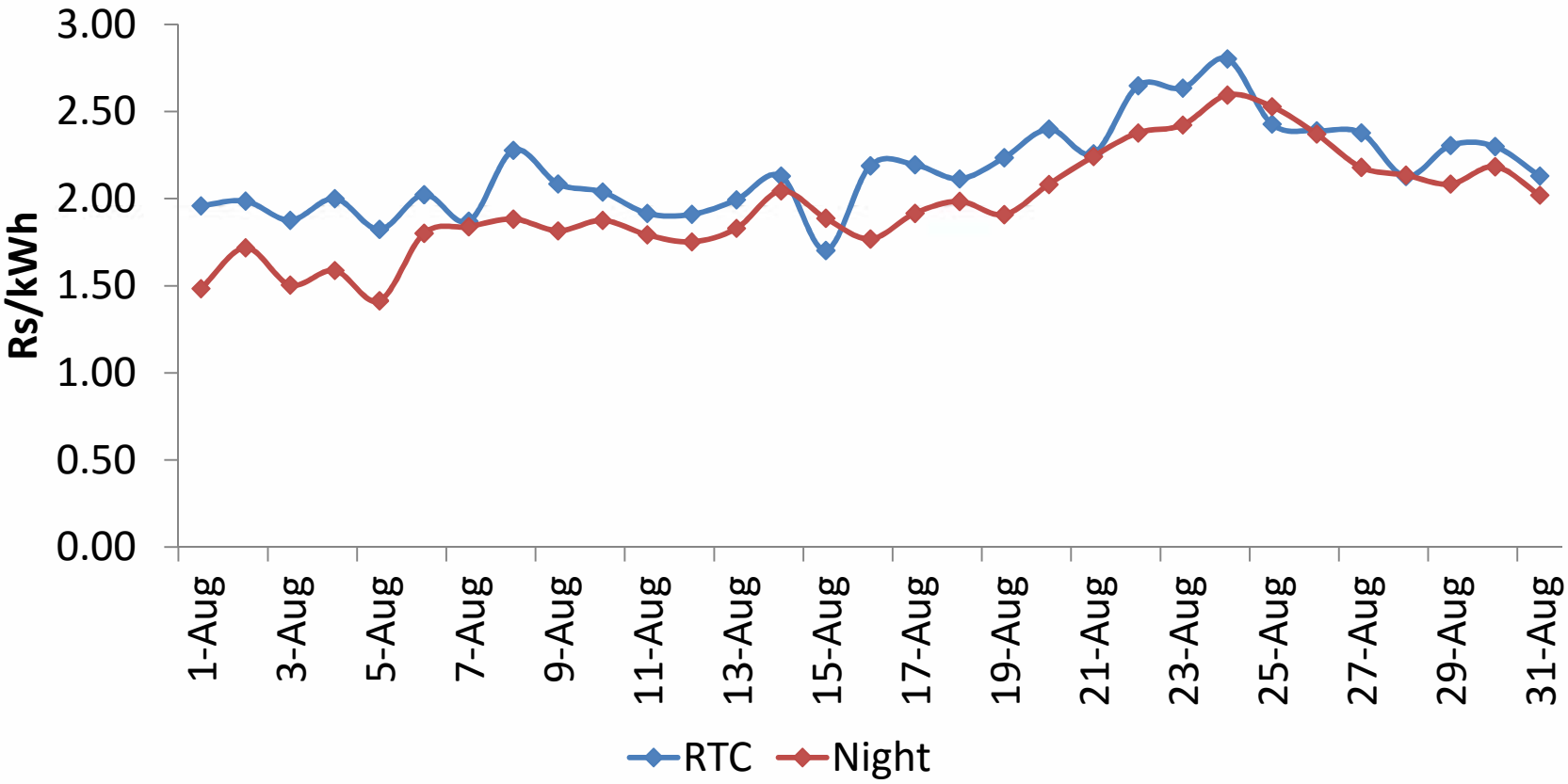
IEX Daily Avg Volume and Price

Aug 2016

Avg Daily Volume: 111 MU

Avg MCP (RTC): 2.17 Rs/kWh

Avg MCP (Night): 1.97 Rs/kWh)



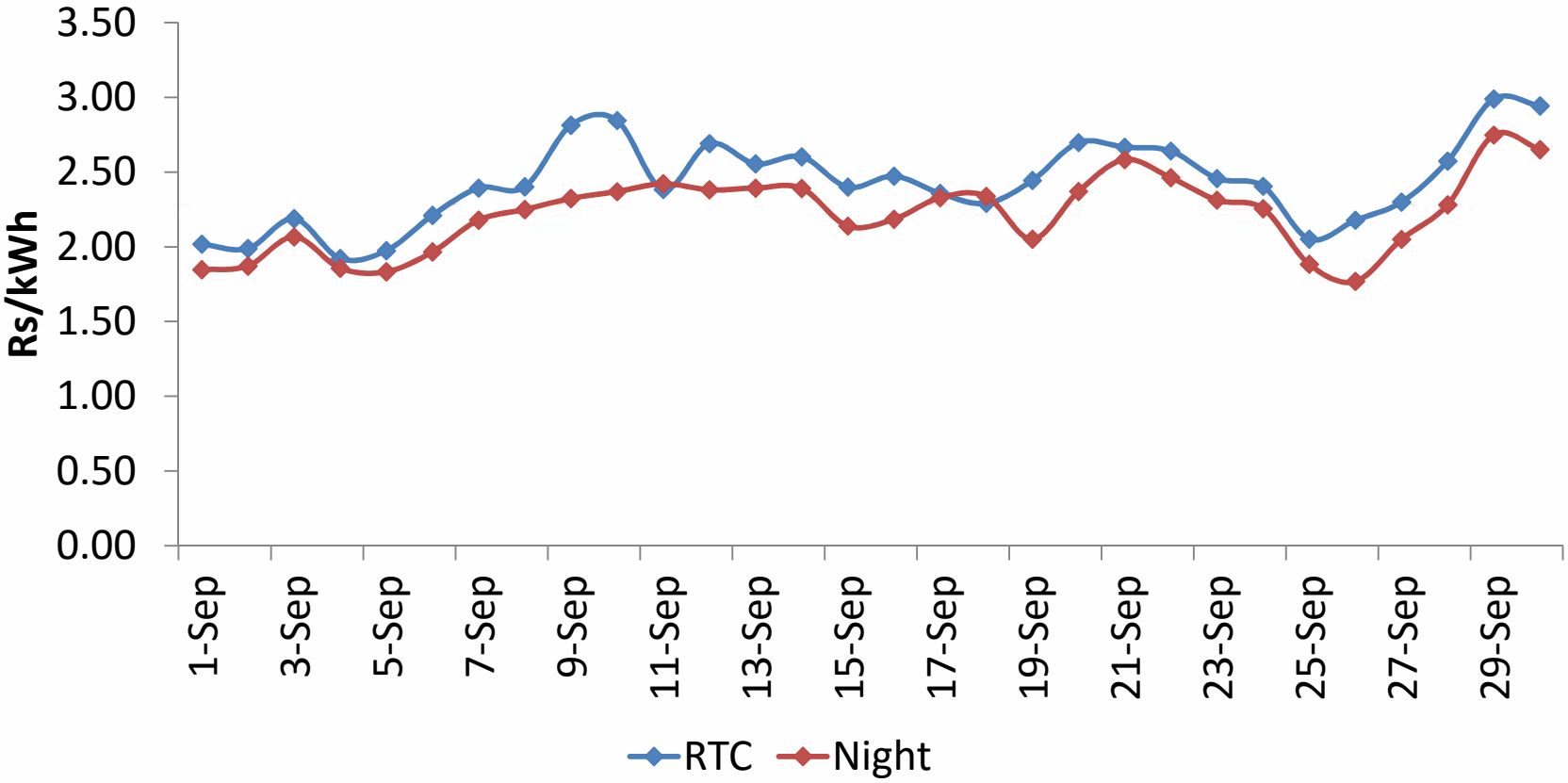
IEX Daily Avg Volume and Price

Sep 2016

Avg Daily Volume: 121 MU

Avg MCP (RTC): 2.43 Rs/kWh

Avg MCP (Night): 2.22 Rs/kWh



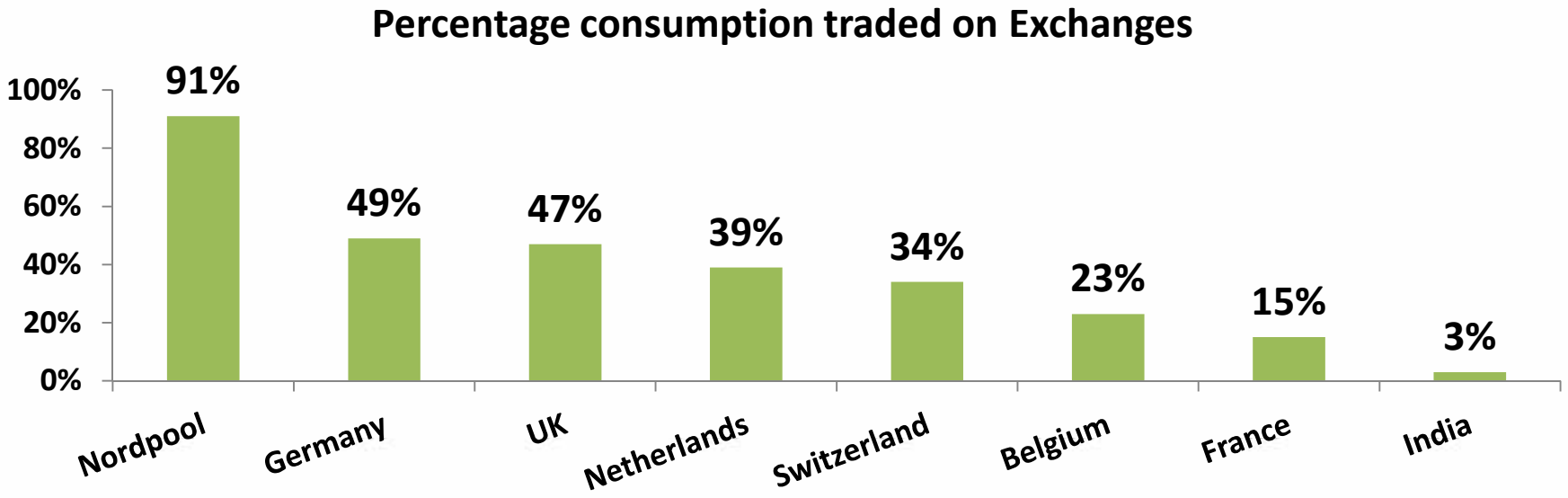
How Discom/industry prepares to buy/sell on exchange?

1. Get Standing Clearance from SLDC
   - Check Open Access Regulations of State
   - Get Clearance from Discom
     - Install ABT meters and apply to Discom
2. Become exchange Member/Client
   - Client registration … with Annual fees
   - Membership… for larger industries (of say >20MW)
3. Check historical prices vis-à-vis your costs etc. and place bids (price/quantity)
   - Exchange handles Delivery and Financial Settlements and all charges payable to statutory bodies

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, participant bid at marginal cost
- **Enormous cost savings for industries and Discoms, as competition promotes efficiency and lower price**
- 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.

Comparison of Percentage consumption traded on Exchanges



Country	DAM (BU)	Intraday (BU)	Total traded (BU)	Net electricity consumption (BU)	% consumption traded on Exchange
Nordic & Baltic	361.0	4.9	365.9	400	**91%**
Germany	264.4	24.9	289.3	585	**49%**
UK	147.1	14.5	161.7	347	**47%**
Netherlands	44.5	1.0	45.5	116	**39%**
Switzerland	20.5	1.1	21.6	63	**34%**
Belgium	19.8	0.8	20.6	89	**23%**
France	66.1	5.0	71.1	482	**15%**
India	28.5	0.9	29.4	940	**3%**

OPEN ACCESS FRAMEWORK

Electricity Act enabled competition

Intent of the Act was to promote competition by "freeing" all possible avenues of procurement and sale of power:

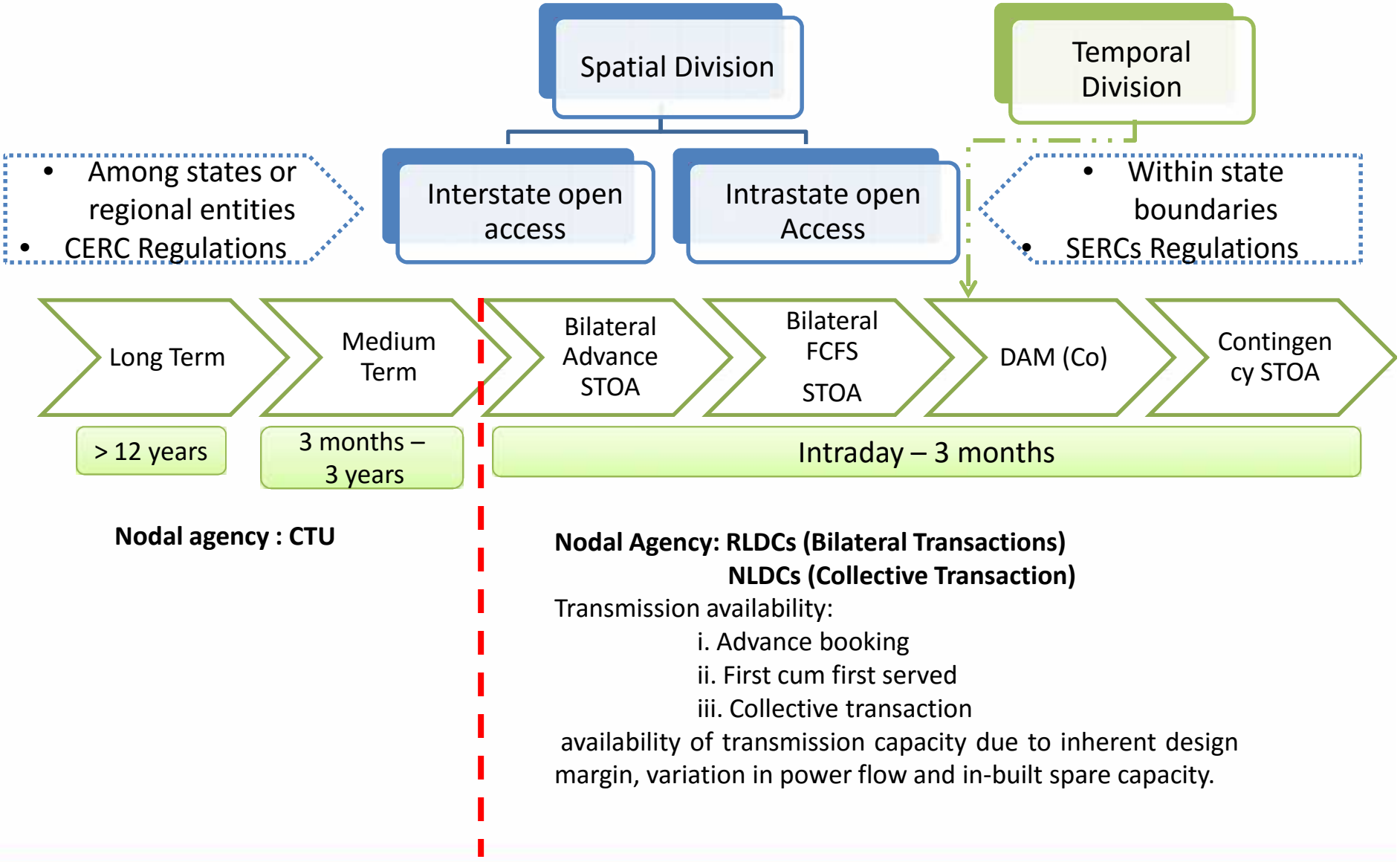
- **Delicensing of generation**
- **Promoting Captive Generation**
- **Promoting open and non-discriminatory access to transmission and distribution system (OPEN ACCESS)**
- **Development of Power Market**
  - Section 66 of the Electricity Act 2003 gives powers to the regulatory commissions to develop the power market including trading
  - **Amendment proposed by MoP** in the Sec 66 of the Act also gives power to the commissions to **promote development of spot as well as forward market including trading**

Open Access - Background

- Electricity Act, 2003

  Open Access means *"The non discriminatory provision for the use of transmission lines or distribution system by any licensee or consumer or a person engaged in generation in accordance with the regulations specified by the appropriate commission"*

Open Access Segregation



Inter-State Open Access Regulatory Framework

CERC (Open Access Regulations) 2008 Last Amendment: 2013	• Specifies roles of different agencies system operators, CTU & Transmission licensees and others • Specifies Timelines • Provide for congestion management- Setting relative priorities • Separate procedures for 'Day-Ahead Market (collective transactions) and OTC transactions on inherent margins
CERC (Grant of connectivity, Long Term Access and Medium Term Open Access) in inter state transmission Regulation, 2009 Last Amendment: 2013	• Nodal agency for grant of Long and Medium access: **CTU** • Defines criteria for grant of access and application procedure for medium and long term access
Procedure for Scheduling STOA in Interstate Transmission (Collective Transaction) (Bilateral Transaction)	• **Collective Transaction:** Application procedure, treatment of losses, congestion management at PXs • **Bilateral Transaction:** • Procedure for Advance Scheduling/FCFS/Day-Ahead Bilateral/Contingency Transaction

Intra-State Open Access Regulations

- Each SERC defines the Terms and Conditions for intra-state open access regulations

- Typically the regulations define :
  - Connectivity and Technical Requirements for open access
  - Application Procedure and approvals for long term, medium and short term access for intra-state open access
  - Open Access charges applicable on the entities availing open access

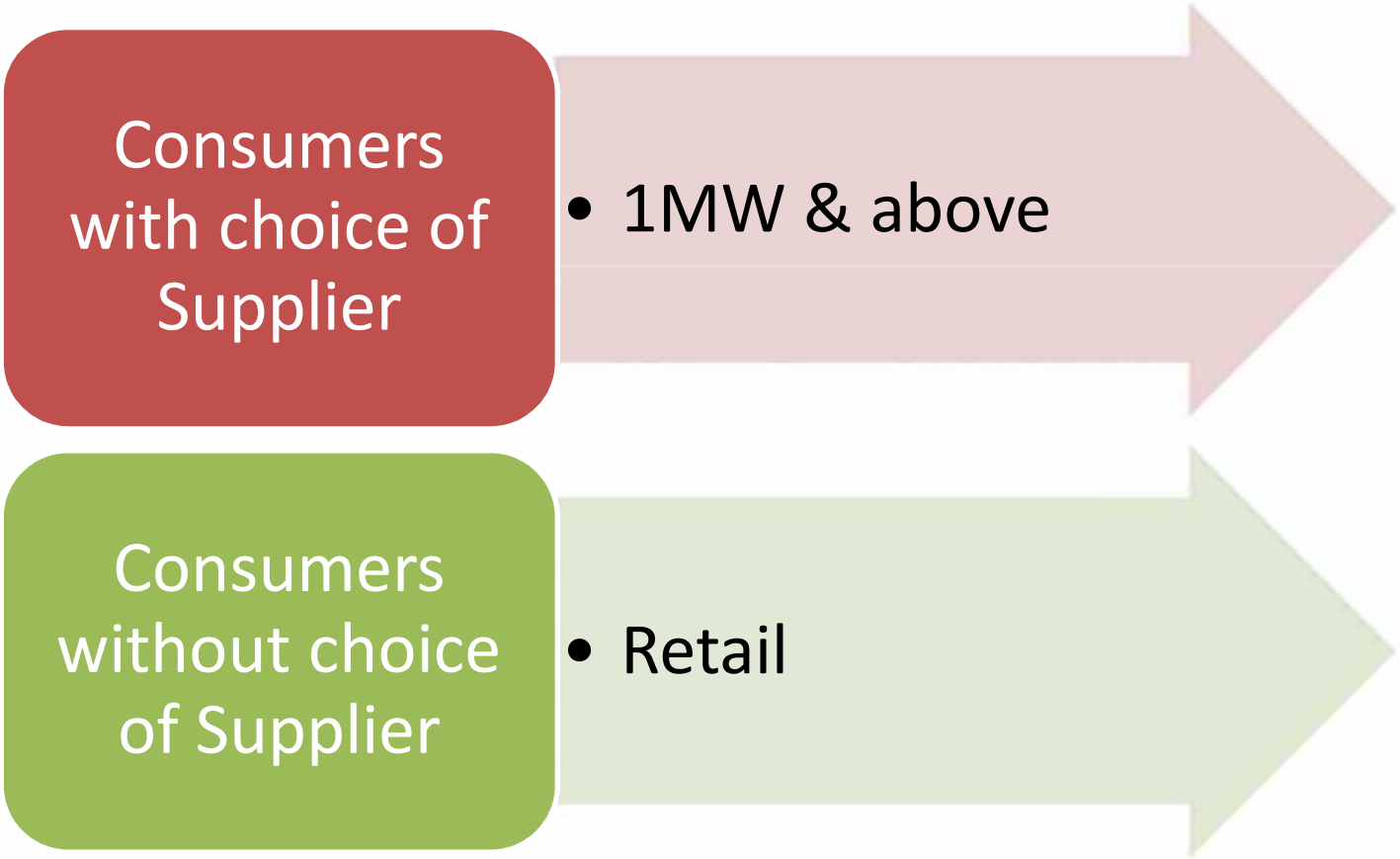
Intra-State Open Access Regulations..SERCs

Basic features

- Eligibility Criteria:
  - Connectivity
    - Voltage
    - Feeder- Mixed or Express
  - Connected Load/ capacity
- State Transmission Losses & Charges
- Wheeling/Distribution losses & charges
- Cross-Subsidy Surcharge
- Additional Surcharge, if any
- Other special conditions (BG's, Imbalance Settlement, DISCOM Undertaking etc.)
- Standard procedure for grant of Open Access
  - SLDC to publish procedures

Open Access for Consumers

Secton 42 (ii) - 2 Types of Consumers:



Status of Open Access for Large Consumers

- Electricity Act, 2003 envisages States to implement open access for 1MW+ customers by Jan, 2009
- First retail open access through IEX, first transaction in Aug, 2009
- Several operational and regulatory impediments have led consumers to choose **partial** open access and **not full** open access
- Consumer maintains its supply agreement with local distribution company and **leverages market for economical and contingency power.**

Enablers for facilitating implementation of Open Access

Open Access Charges | Legislative | Operational

- **Sec 42 (2)** :"….Provided also that such surcharge and cross subsidies shall be progressively reduced in the manner as may be specified by the State Commission…"
- **Tariff Policy 8.3.2**: SERC may bring tariff to be +/-20% of cost of supply
- **NEP, 2005 Sec 5.8.3:** "…..the amount of surcharge and additional surcharge levied from consumers who are permitted open access should not become so onerous that it eliminates competition……."

Implement existing statutes in EA 2003 and NTP 2016

Enablers for facilitating implementation of Open Access

Open Access Charges | **Legislative** | Operational

- **Strengthen Sec 11, 37, 108** to remove ambiguity and facilitate OA
  - **Sec 11:** OA to generators restricted by state government by citing extraordinary circumstances
  - **Sec 37:** State governments can direct LDC to restrict power sale outside state in lieu of maintaining smooth and stable supply
  - **Sec 108:** Directions of state government will prevail where public interest is involved
- **Sec 42(4) :** Define uniform methodology of determination of additional surcharge

Strengthen EA 2003 by expanding, restricting and/or clarifying scope under certain statues concerning OA

Enablers for facilitating implementation of Open Access

Open Access Charges | Legislative | **Operational**

- **Equip SLDCs**
  - Use revenue accrued to SLDC from OA consumers for Infrastructure development, automation, capacity and capability building. 100 OA consumers imply a yearly revenue of appx Rs 9 crores to SLDC
  - Leverage technology solutions and automate processes for NOC issuance, energy scheduling and energy settlement
  - IEX has introduced SLDC interface to help manage NOCs of customers in the state of Punjab and Tamil Nadu. The same can be adopted for other states
- **Open Access Registry (OAR)**
  - **OAR** will bring in transparency and facilitate faster transactions using automatic rule-based open access clearance while removing manual discretions

Amendments in NTP, 2016

Open Access – *Cross-subsidy Surcharge, Additional Surcharge and Standby Charges*

Cross subsidy and additional surcharge shouldn't be barrier to competition

- **Cross Subsidy Surcharge**
  - New Formula to calculate CSS: **S= T – [C/ (1-L/100) + D+ R]**
    - *T: tariff payable by consumer including RPO*
    - *C: per unit weighted average cost of power purchase by the Licensee, including RPO*
    - *D: aggregate of transmission, distribution and wheeling charge*
    - *L: aggregate of transmission, distribution and commercial loss*
    - *R: per unit cost of carrying regulatory assets (if applicable)*
  - **CS Surcharge capped at 20% of tariff**

- **Additional Surcharge**
  - Applicable only if it is conclusively demonstrated that the obligation of a licensee, in terms of existing power purchase commitments, has been and continues to be stranded, or there is an unavoidable obligation and incidence to bear fixed costs consequent to such a contract.

- **Standby Charges**
  - In case of outages of generator supplying to a consumer on open access, **standby arrangements** should be provided by the licensee on the payment of tariff for temporary connection to that consumer category as specified by the Appropriate Commission.
  - *Standby charges shall not be more than 125% normal tariff*

States blocking Open Access

- Earlier CSS was calculated as the difference between the industrial tariff and cost of top 5% power purchase but as per the new formula, the CSS is being calculated as the difference between the tariff and the weighted average cost of power.
- As a result, Many States such as Daman & Diu, Dadra & Nagar Haveli, Gujarat, Maharashtra, Haryana, Himachal Pradesh, Chhattisgarh, Karnataka and West Bengal increased CSS
- States such as Tamil Nadu, WB, Andhra Pradesh, where CSS is over 20% of the tariff have still not re-determined CSS

States blocking Open Access (cont.)

- **High Additional Surcharge**
  - States such as Delhi, Rajasthan, Haryana, Punjab and Gujarat have high additional surcharge of about Rs 1/unit that reduces OA viability
- **With these tariff barriers, even though the average power purchase cost is Rs. 3.50/kWh, the viability for open access consumer is only when he can get power at Rs. 2.50/kWh**

Non-Tariff Barriers

Certain states imposes restrictive conditions on OA consumers to purchase power from other sources.

- State does not give NoC to consumer citing transmission constraints
- Even in the states where OA is allowed, SLDC is not giving clearances (WB and Maharashtra) on flimsy grounds
- Many states require SCADA for consumers

Open Access Charges including CSS, AC, wheeling and transmission charge shouldn't exceed the difference between retail tariff and average power purchase cost

Open Access Charges

Cross Subsidy Surcharge (Rs/kWh)			
State	**FY2015**	**FY2016**	**%Change**
West Bengal	2.20	2.87	30%
Meghalaya	1.47	1.90	29%
Haryana	0.93	1.57	69%
Gujarat	0.59	1.45	146%
Orissa	1.29	1.41	10%
Chattisgarh	0.89	1.21	36%
Karnataka	0.63	0.86	37%
Bihar	0.13	0.78	500%
Uttar Pradesh	0.23	0.63	174%
Uttarakhand	0.42	0.47	12%
DND	0.00	0.42	Introduced
Himachal Pradesh	0.14	0.41	193%
DNH	0.03	0.22	633%
Additional Surcharge (Rs/kWh)			
Delhi	0.00	1.67	Introduced
Punjab	0.00	1.13	Introduced
Haryana	0.84	0.87	4%
Rajasthan	0.00	0.80	Introduced
Himachal Pradesh	0.00	0.78	Introduced

Open Access framework v/s Discom tariff

- The Open Access framework has been designed to compensate Discoms against all charges (cross subsidy, transmission, stranded assets etc) except for Energy Cost.

- Therefore, a comparison of the charges payable by Open Access consumers (after including APPC) should be equivalent to their industrial tariff.

- However, as per details in the ARR, it is found that in many states, the sum total of OA charges and APPC is higher that the industrial tariff.

- This highlights that Open Access charges are being set higher to restrict Open Access in the States.

APPC v/s IEX Break Even Price

State	Average Power Purchase cost	IEX Break Even Price
Gujarat	3.29	2.57
Madhya Pradesh	2.82	2.16
West Bengal	3.42	2.65
Tamil Nadu	3.35	2.35
Andhra Pradesh	4.08	2.76
Haryana	3.91	4.17
Rajasthan	3.41	4.20

Calculation Sheet

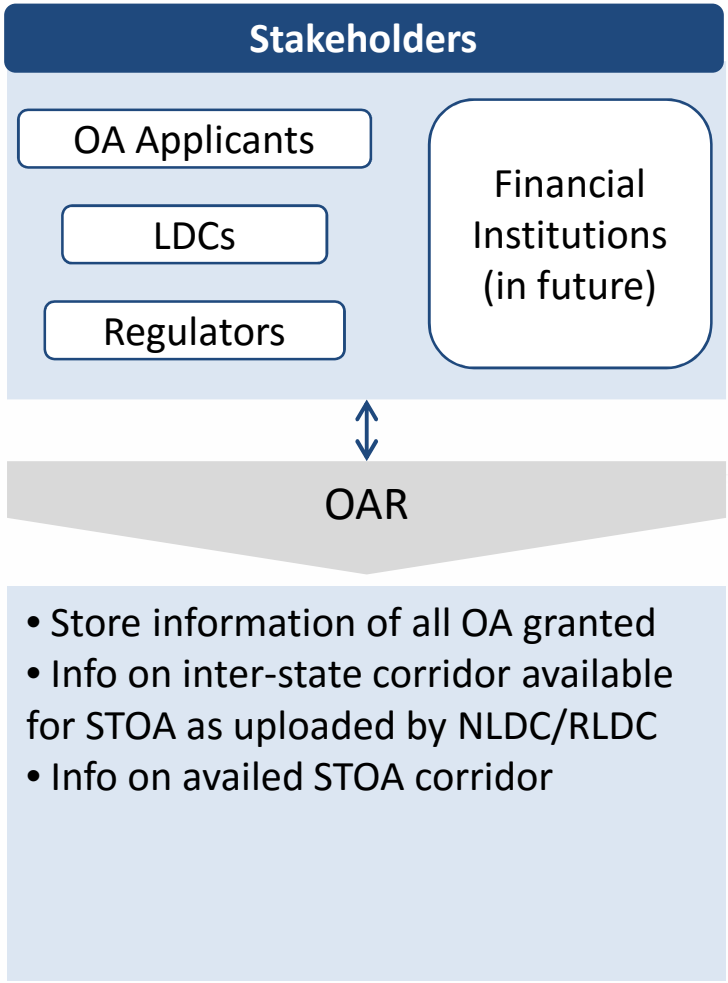
Madhya Pradesh			
	Rs./unit		Rs./unit
APPC (Average Pooled Cost of Power Purchase)	**2.82**	**HT Tariff**	6.10
State losses	2.59%	**Rebates/Discounts**	
Wheeling Losses	5.83%		
Transmission Charges	0.06	Load Factor above 50%	1.00
Wheeling Charges	0.23	Power Factor >99% (7% on Bill Value)	0.427
Cross Subsidy Surcharge	1.67	Timely Payment	
Total APPC and other charges	**5.03**	**Total Tariff Payable**	**4.67**

Open Acces – Way forward

- Open Access has been implemented in the country for last 10 years
- **Full Open Access is viable**: Industries should be allowed open access without contract demand, that is, no payment of demand charges and additional surcharge
- **Aggregation:** Further, there are many industries with contract demand of <1 MW. Even these industries can be provided open access by combining 2-3 industries and one of the industry acting as leading consumer. Haryana is one such example where group of 2 or more consumer with combined contract demand of 1 MW or above can collectively apply for open access

Open Access Registry Framework
Proposal for implementation

- This will bring in transparency and facilitate faster transactions using automatic rule-based open access clearance while removing manual discretions
- Integrated IT based system
- All OA approvals automated
- Function as an interacting medium between the OA Participants, Trade Intermediaries/PXs and National/Regional and State LDCs.
- Record of Information will be available to CERC, System Operators, OA Customers, Traders and PXs



SUGGESTIONS FOR DISCOMS

1. **Power Procurement Optimization by Discoms**

2. **Long-term PPA for only Base Load of Discoms**

Distribution
NTP, 2016 mandates

SERCs to prepare road-map for 24-hour supply by '22

Performance Standards

- SERC to notify standards of performance with respect to quality, continuity and reliability of service for all consumers.
- Penalties may be imposed on licensees in accordance with section 57 of the Act for failure to meet the standards.

Merit order Dispatch purchases are allowed

- All power purchase costs need to be considered legitimate unless it is established that the MoD principle has been violated or power has been purchased at unreasonable rates.

Regulatory Asset

- Provision of RA to be only as a very rare exception in case of natural calamity or force majeure conditions
- Recovery to be time bound and in <7 years

Power Procurement by Discoms (6)

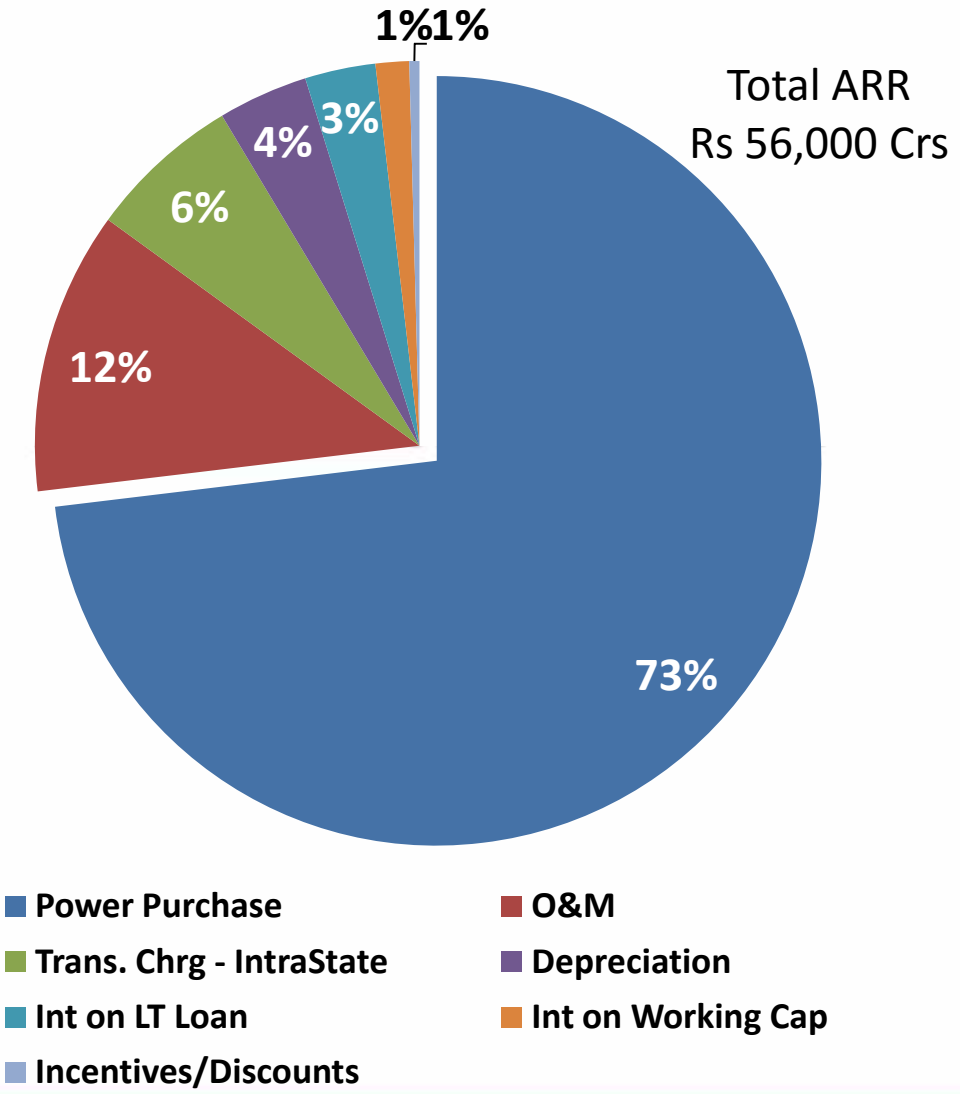
- 24-Hour notice for URS capacity for allowing Gen to sell
- Benefits over VC to be shared 50:50, if not already provided in the PPA.
- Change of Law allowed to be pass-through

Merit Order Purchase by Discoms

- **Under long term PPA two component**
  - Capacity charges (commitment charges): paid irrespective of whether discom purchase power from these plants or not
  - Energy charges : Paid corresponding to the number of units of power purchased from that particular plant
- **Discoms can replace costlier long term power by procurement from IEX, if,**
  - Energy charge of power under long term PPA is greater than IEX rates
  - During night hours prices at IEX are further low and savings can be enhanced
- **Discoms can continue paying fixed charge to Long Term PPAs and substitute where energy charge is higher than IEX price**
- There is enough liquidity available in the market and merchant capacity of about 20,000 MW is available. **With improved supply, better transmission system and low prices in market, most optimum power procurement strategy must be formed by Discom**
- West Bengal, Rajasthan & Bihar have adopted optimization strategy and have achieved significant savings. Other States like Karnataka and J&K keen to implement
- **Regulations may stipulate inclusion of Exchange Price in merit order to enable Discoms to optimize procure power through Exchange in a cost effective manner**

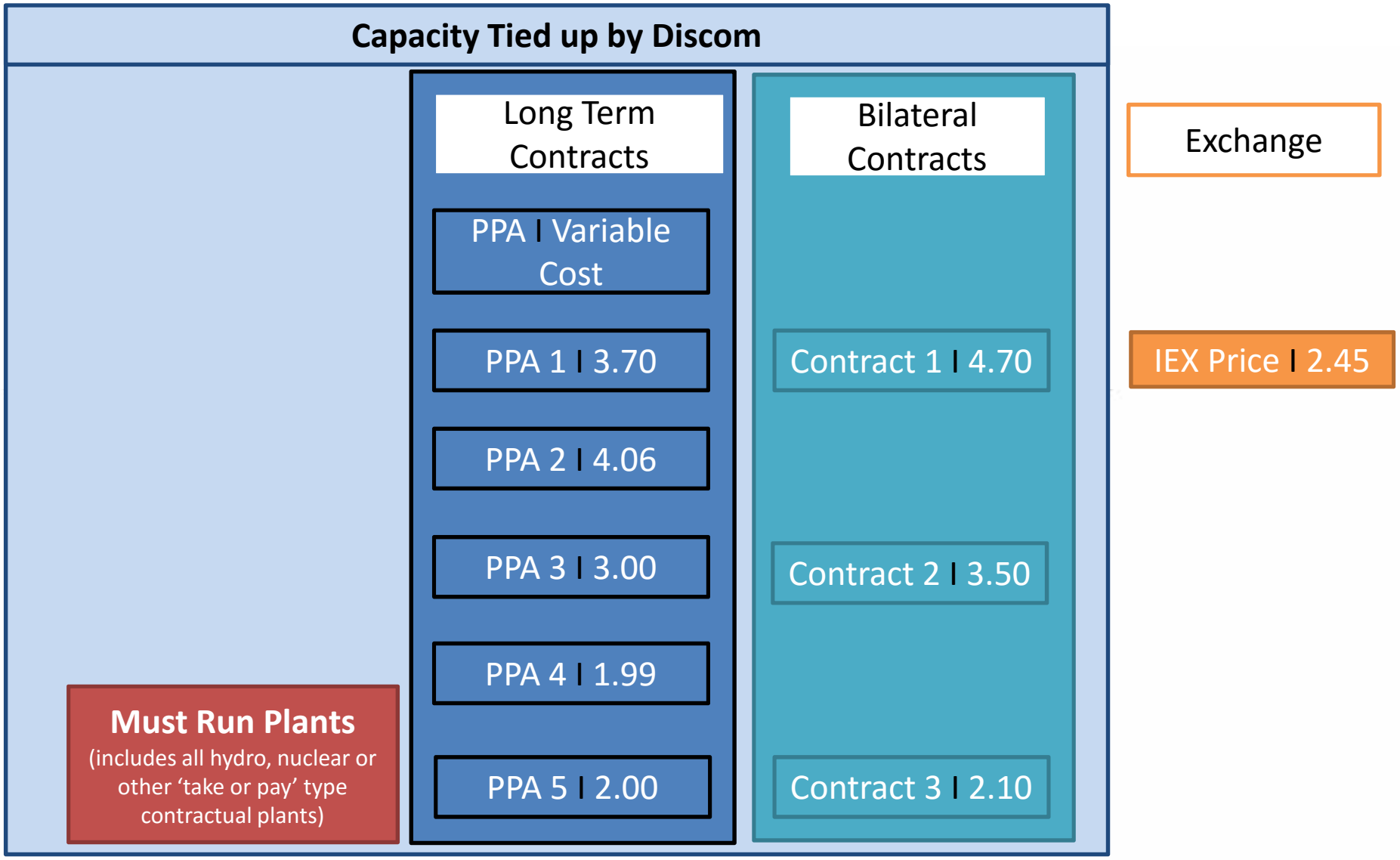
Power Purchase Expense for Discom

- Power purchase accounts for 70-80% of the total revenue requirement for Discoms
- SMART BUYING can save at least 10% (Rs 4124Cr.)



Expenditure for Maharashtra Discoms for FY 2015-16

Merit order dispatch schedule to be prepared based on Variable cost and considering Exchange Prices



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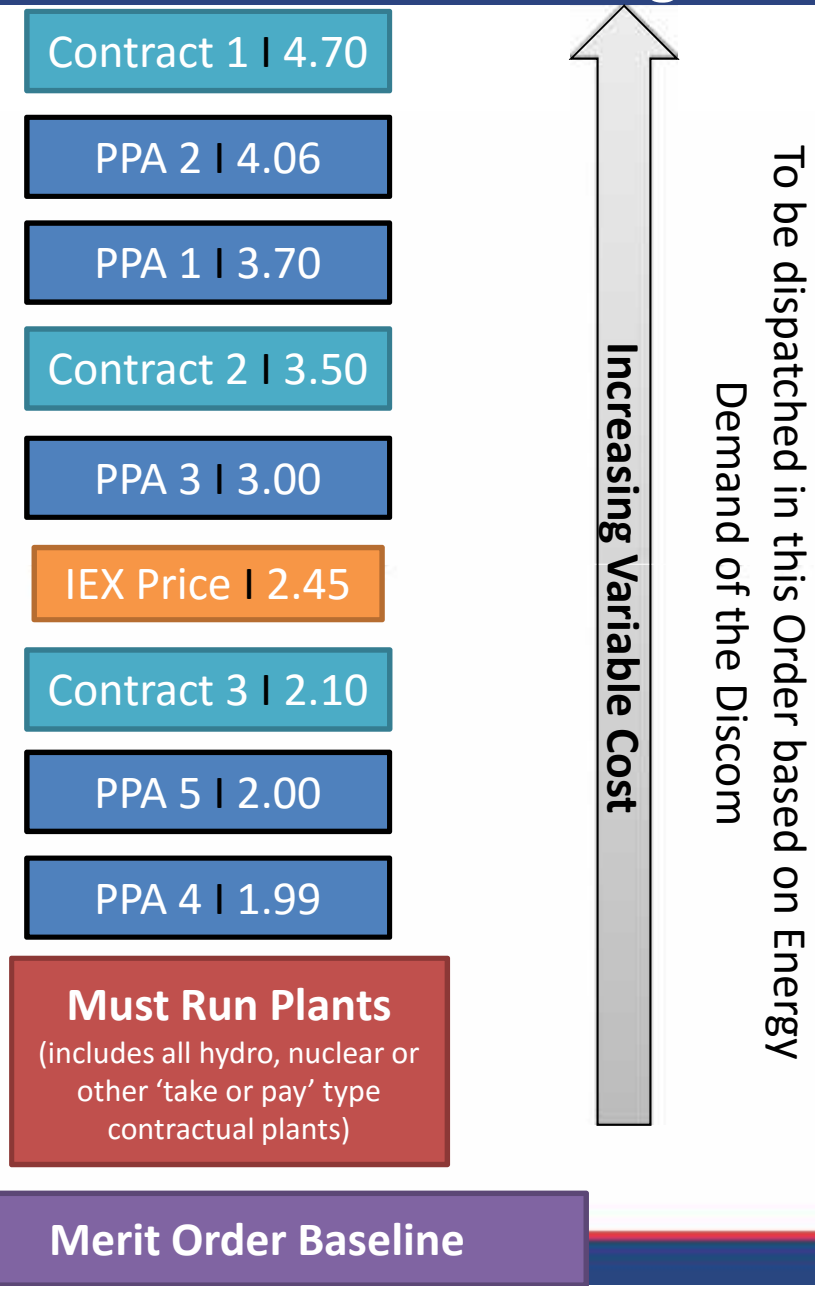


2. Long Term PPA only for Base Load

- Many Discoms (example Gujarat, Haryana, Delhi, Punjab) have tied PPAs to meet their peak demand. As a result, Discom is paying fixed charge for 12 months while the peak demand is only for 5-6 months. Due to this, power procurement cost for Discoms increases.

  In Delhi, consumers are paying about Rs. 1/unit extra only on this account.

- There is enough liquidity available in the market and merchant capacity of about 40,000 MW is available.

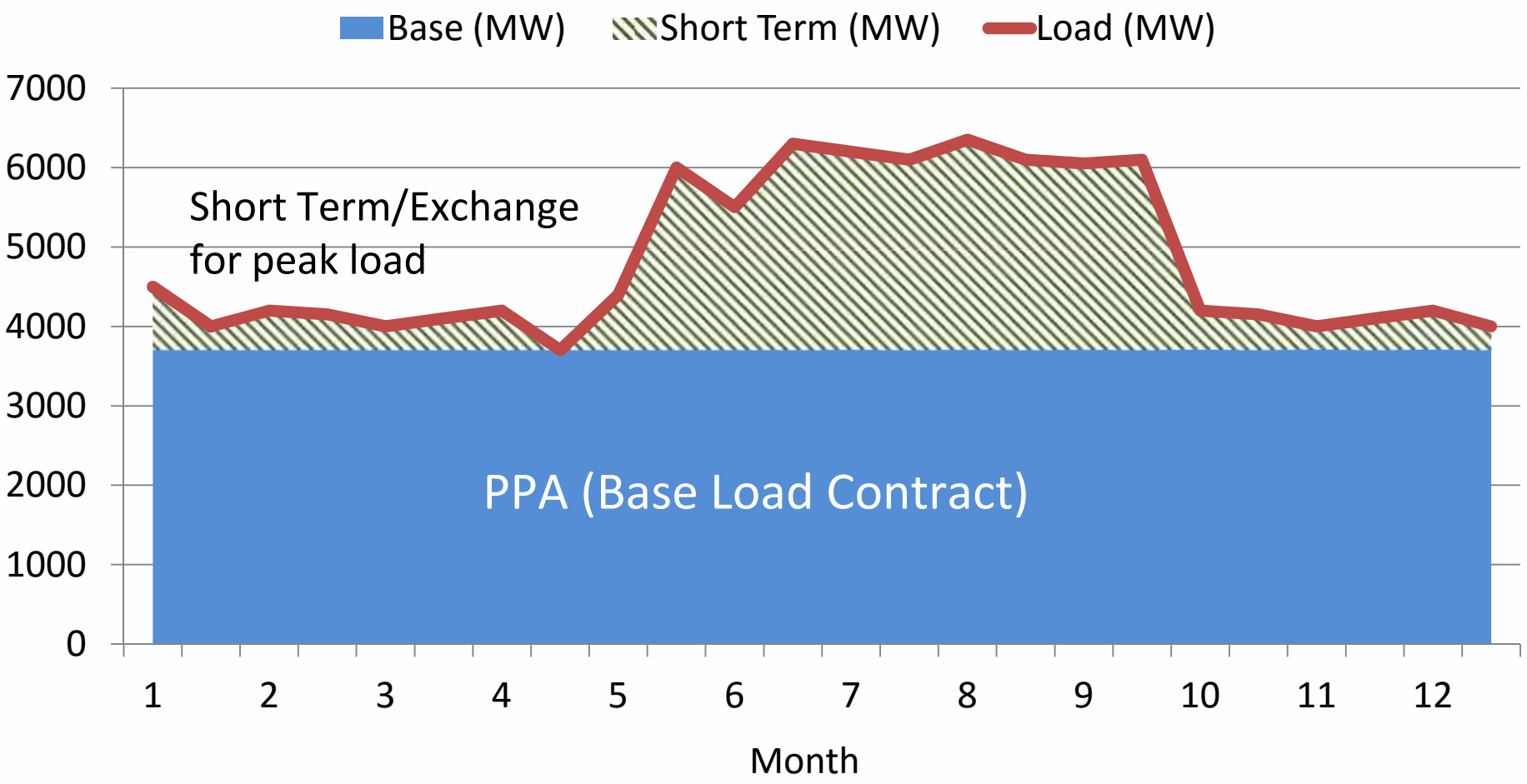
- On the basis of this, most **optimum power procurement strategy must be formed by Discom**

- Discom should contract capacities on long term basis only for meeting base demand and should manage seasonal variations through short term market

Meeting Shortages/Surplus through Short Term Market

Maximizing efficiency – Ideal Scenario

➔ **Surpluses/Deficits** - Balance physical supply and demand



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