

Power Procurement Strategy

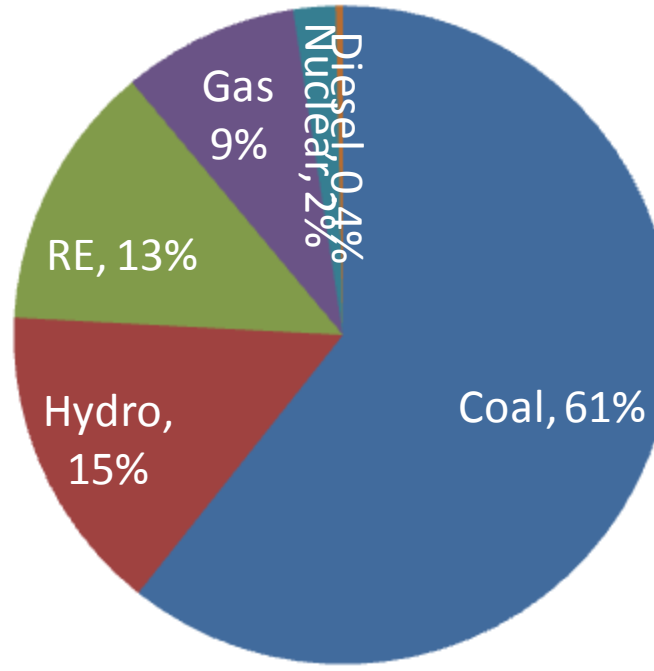
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IIT-Kanpur

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POWER SECTOR OVERVIEW

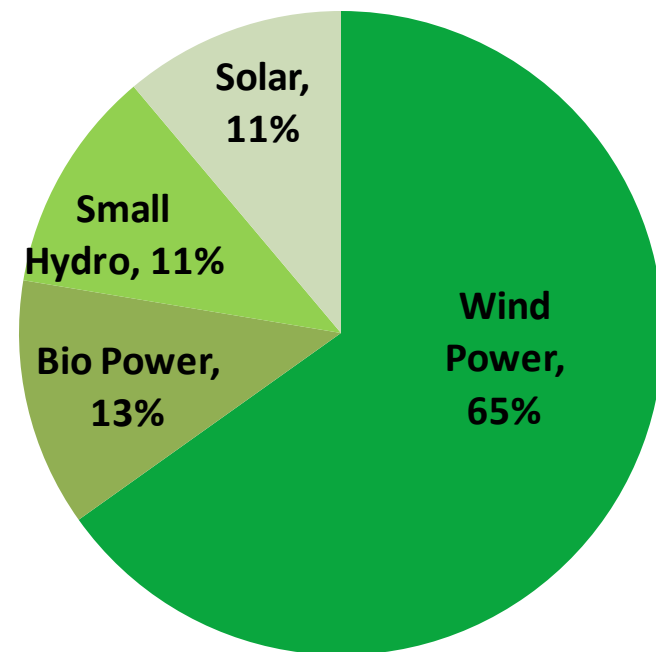
Installed Capacity (All)

Category	Installed Capacity (MW)	Share in Total(%)	Generation (BUs)	Share in Total(%)
Coal	170,138	61%	836	80%
Gas	24,473	9%	41	4%
Diesel	994	0.4%	1.4	0%
Hydro	42,473	15%	129	12%
Nuclear	5,780	2%	36	3%
RE	36,471	13%	-	-
Total	280,328		1042	



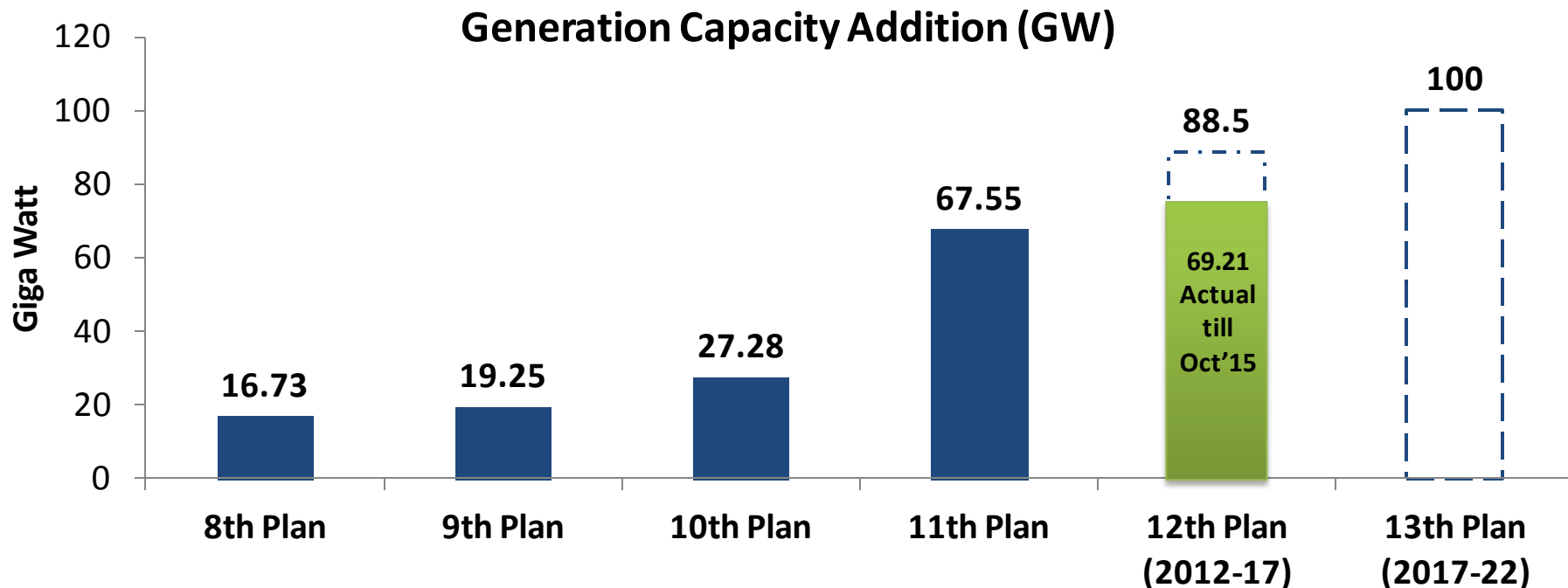
Installed Capacity (Renewable)

Category	Installed Capacity (MW)	Share in total RE (%)
Wind Power	23,763	65%
Small Hydro	4,102	11%
Bio Power	4,546	12%
Solar	4,061	11%
Total	36,471	



Ambitious targets to capacity addition

Growing impetus on capacity addition



- Investments of **around US\$ 225 billion** planned for the power sector during the 12th Plan.
- **In addition, Renewable energy capacity of 175 GW is planned till 2022.**

Power Situation in the Country

Year	Installed Capacity (at the end of FY) (MW)	Peak Met (MW)
2009-10	1,59,398	1,04,009
2010-11	1,73,626	1,10,256
2011-12	1,99,877	1,16,191
2012-13	2,23,344	1,23,294
2013-14	2,43,029	1,29,815
2014-15	2,67,367	1,41,160
2015-16*	2,843,03	1,48,463

- In last six years, capacity has increased by 1,24,905 MW and demand has increased by 44,454 MW only.
- The country as a whole has witnessed a decline in the deficits.

Financial health of Generators

- Total installed capacity in the Country is **2,80,328 MW**
- Peak demand met : **1,48,005 MW**
- **PLF of coal/lignite plants**
 - **Around 65% in FY 14-15**
 - **Around 62% in FY 15-16 (till Oct)**
 - **FY 07-08 - 78%**
- PLF of gas based plants: **25%** due to shortage of fuel
- Stranded capacity in the country: **A total 50,000 MW stressed**
 - **27,880 MW of coal capacity stranded**
 - **24,000 MW of Gas based Capacity stranded**
- **Key Issues: Lack of fuel, Transmission, Competition, Weak distribution system, Discoms' inability to buy**

Financial Health of Discoms

- Discoms accumulated losses stand at about 3 lakh crores
- Yearly losses of Discoms is about Rs 70,000 crore
- **The gap between average cost of supply of power and average tariff is about 80 paise per unit.**
- Most of the Discoms in the country incurring losses .
- No investment is being made in the Distribution infrastructure and intra-state transmission network resulting in intrastate congestion
- States prefer to do load shedding than buying cheap power from Exchange.

State wise status

	Population (in Cr)	Avg. MW Supply FY 14-15	Per Capita Consum kWh (2011-12)
Punjab	2.8	5,623	1,799
Gujarat	6.0	9,344	1,663
Haryana	2.5	5,978	1,628
Delhi	1.7	3,991	1,587
Chhattisgarh	2.6	3,810	1,320
Himachal Pradesh	0.7	1,287	1,289
Tamil Nadu	7.2	10,517	1,277
Uttarakhand	1.0	1,529	1,232
Maharashtra	11.2	11,507	1,204
Andhra Pradesh	8.5	10,034	1,157
Odisha	4.2	3,099	1,146
Karnataka	6.1	6,803	1,081
Jammu & Kashmir	1.3	1,296	1,015
Rajasthan	6.9	6,529	927
Jharkhand	3.3	844	790
Madhya Pradesh	7.3	7,171	672
Kerala	3.3	1,935	594
West Bengal	9.1	5,319	564
Uttar Pradesh	20.0	9,916	450
Assam	3.1	679	250
Bihar	10.4	1,538	134

Indian Power Market Snapshot

	FY 2009	FY 2015
Long Term	93.86%	90.5%
PPA for over 25 years through long term		
Short-Term	6.1%	9.5%
Exchanges	0.4%	2.73%
Through traders	3.2%	3.4%
Direct Bilateral	0.5%	1.5%
Unscheduled Interchange	2.1%	1.9%

- Short term market grew at an encouraging rate with a **CAGR of 22%** (FY-09 to FY 15).
- Power Exchanges witnessed growth at a **CAGR of 62%** (FY-09 to FY 15).

Coal production and supply in the Country

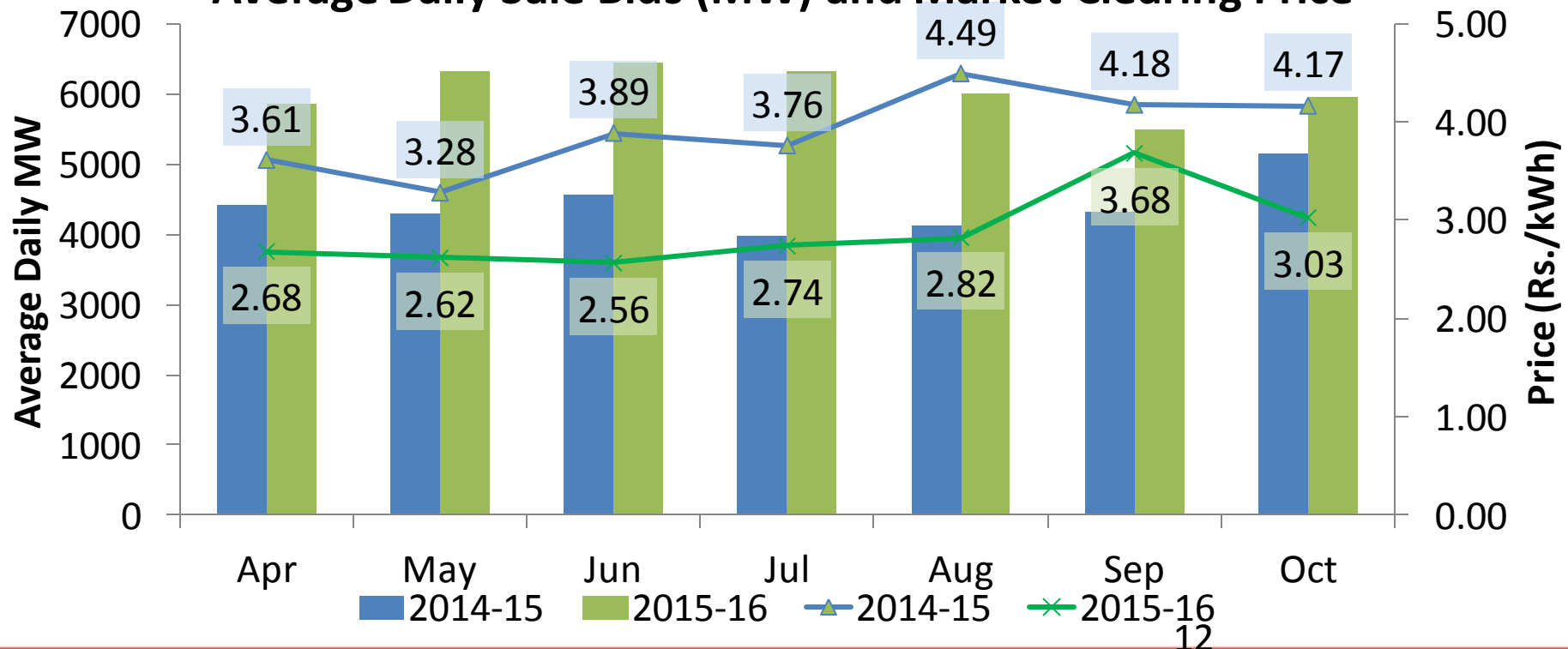
	Total Coal Production (MT)	YoY inc (%)	Import (MT)	YoY inc (%)	Import Cost (Crores INR)
2009-10	532		73		39,180
2010-11	533	0.12%	69	-5.92%	41,550
2011-12	540	1.36%	103	49.24%	78,838
2012-13	556	3.05%	146	41.74%	86,846
2013-14	566	1.68%	167	14.45%	92,329
2014-15	612	8.25%	212	27.12%	1,04,524

- In FY 15, the domestic **coal production increased by 8.5%** to 612 MT.
- The Gol has set a target of increasing domestic coal production to **1.5 billion tonnes (including one bt from CIL) by FY 2021**
- This could create a **surplus situation and reduce import of coal** which in FY 15 was worth Rs.1045 Billion.

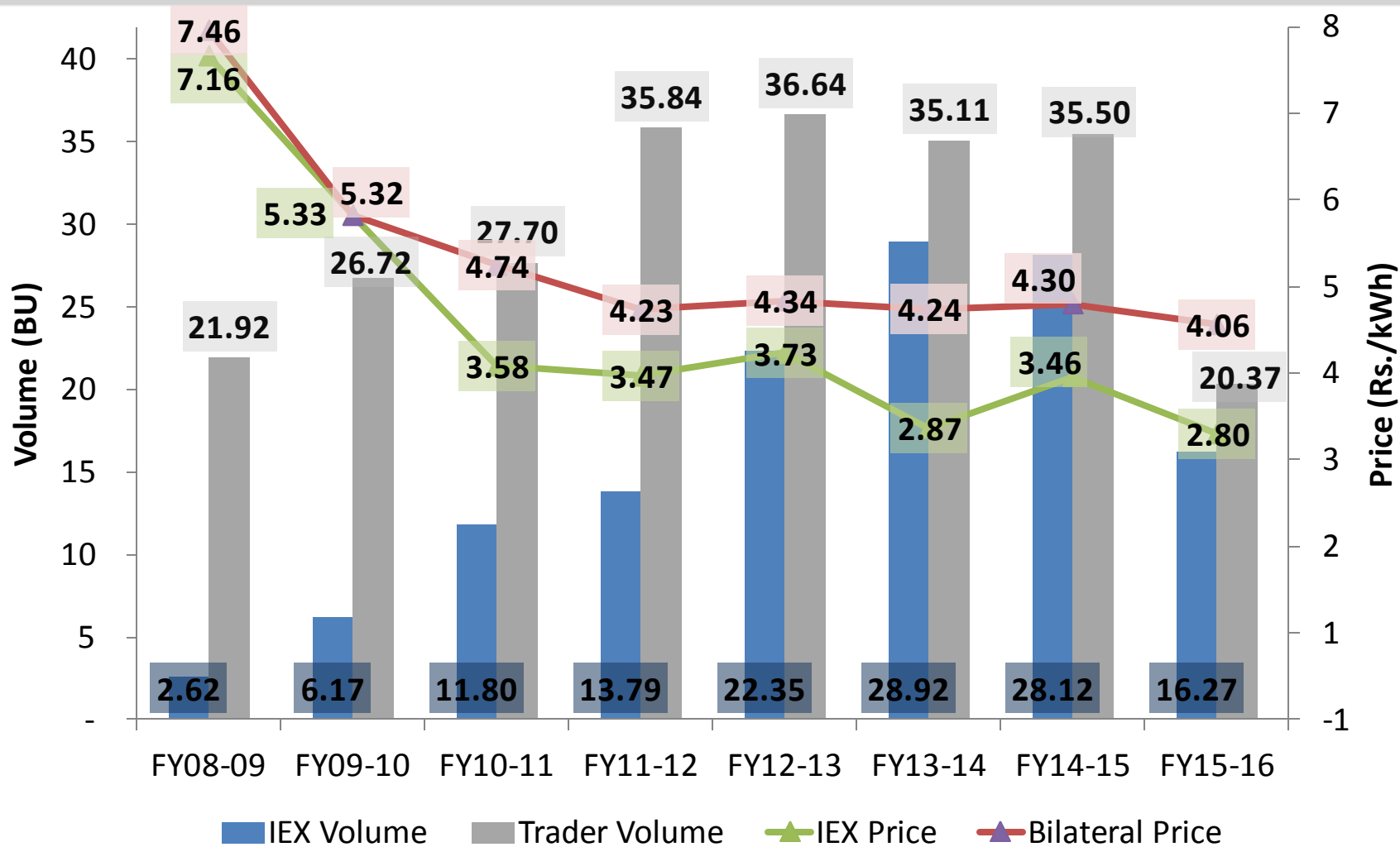
Impact of coal availability on Power Markets

- Increased availability of coal for the power sector has had a positive impact.
- Generation has increased by 6% and many stranded plants have started operating
- Sale of power on IEX has increased

Average Daily Sale Bids (MW) and Market Clearing Price



Price and Volume: Bilateral vs. IEX DAM



*Data up to Sep 2015, Source: CERC MMC Reports

Prices at the Exchange have always been lower than Bilateral Prices

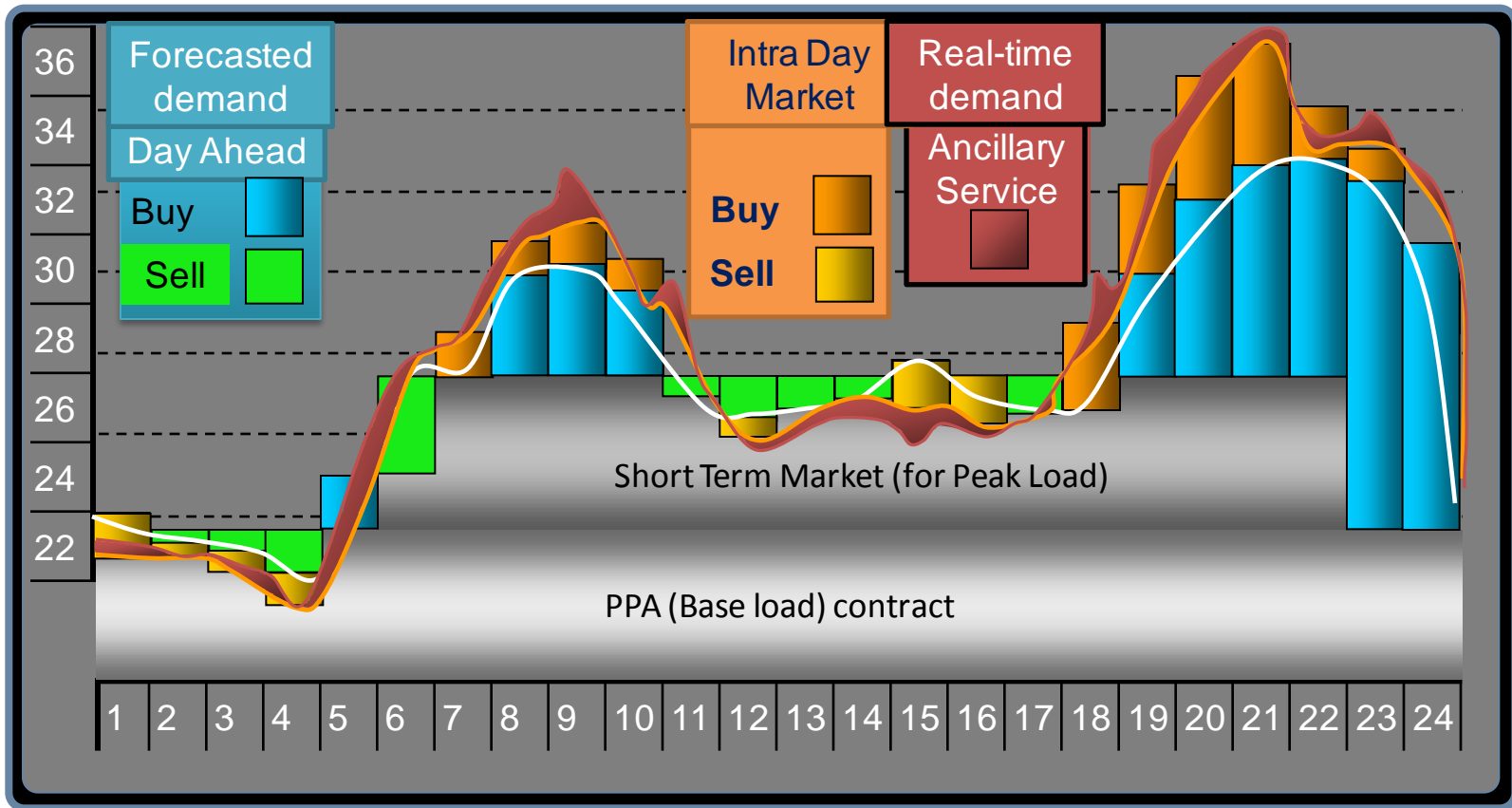
Opportunities for DISCOMS

- **PPA for base load only**
 - i. Discoms should tie-up PPA only to manage their base demand
 - ii. Many Discoms have tied PPAs to meet their peak demand as well. The Discoms have to pay the capacity charge for this quantum even in the off peak time example Gujarat, Haryana, Delhi, Punjab
 - iii. So for optimum utilisation, Long Term PPA should be only for base demand and seasonal variations should be bought through other available market options

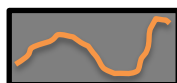
Meeting Shortages/Surplus through STM

Maximizing efficiency – Ideal Scenario

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



Forecasted Demand Curve of the Discom



Actual Demand



Real time variations



Cost Optimization through Exchange

Replacement of high variable cost power by Exchange power

• Replacement of high variable cost power by Exchange power

I. 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

II. Discoms can replace costlier long term power by procurement from IEX, if,

- Energy charge of power plant is greater than IEX rates
- During night hours prices at IEX are further low and savings can be enhanced

III. Discoms can continue paying fixed charge to Long Term PPAs and substitute where energy charge is higher than IEX price

IV. IEX prices are around 25%-30% lower than the Bilateral Prices

Cost Optimisation by Discoms

- Discoms can devise least cost option to meet demand in the state by tracking prices at IEX
 - Energy charge greater than prevailing ACP can be substituted with power from IEX
 - During off-peak hours, when prices at IEX are low, savings can be enhanced replacing power from LT to PX Transactions

Merit Order for Dispatch in State

	Type	Dispatch Mode	Capacity (MW)	Energy Charge (INR/kWh)	
Plant A	Hydro	Must Run	100	0.00	<div style="border: 2px solid green; padding: 5px; text-align: center;"> ACP= INR 3.45/kWh </div>
Plant B	Hydro	Must Run	150	0.00	
Plant C	Nuclear	Must Run	500	2.80	
Plant D	Coal	Merit	120	3.00	<div style="border: 2px solid purple; padding: 5px; text-align: center;"> Substituted with power @ INR 2.50 during off peak hours from IEX </div>
Plant E	Coal	Merit	120	3.20	
Plant F	Coal	Merit	100	3.50	<div style="border: 2px solid red; padding: 5px; text-align: center;"> Substituted with power @ INR 3.45 from IEX </div>
Plant G	Coal	Merit	90	3.80	
Plant H	Coal	Merit	90	4.00	
Merit Based Capacity (MW)			520		

Potential Savings: INR 50 Crore a month

Optimization of Power Procurement Cost

Discoms exhaust long term and medium term contracts first despite availability of power at cheaper prices at PXs



Long Term

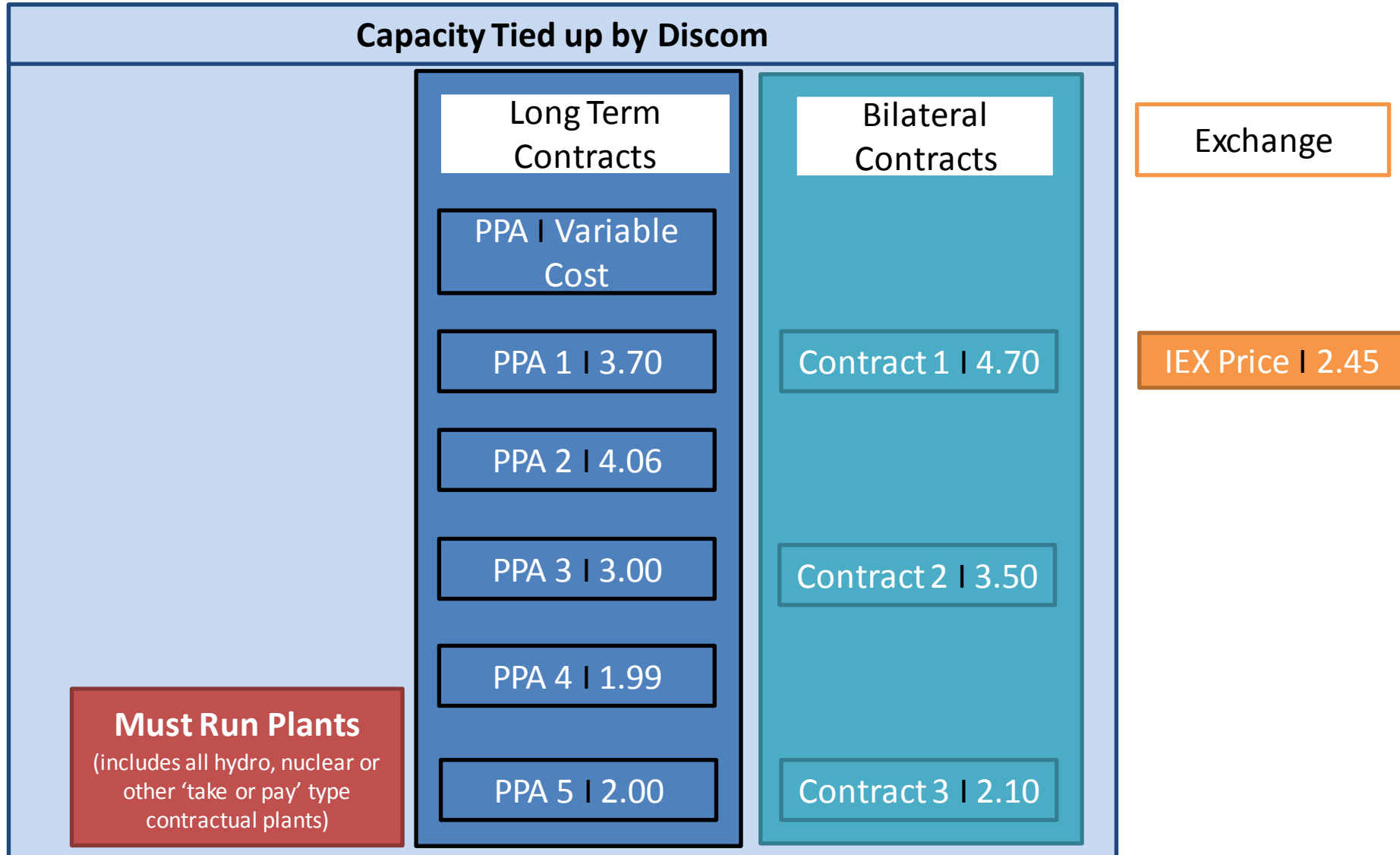
Medium Term

Short Term

Purchase on economic principle of Merit Order

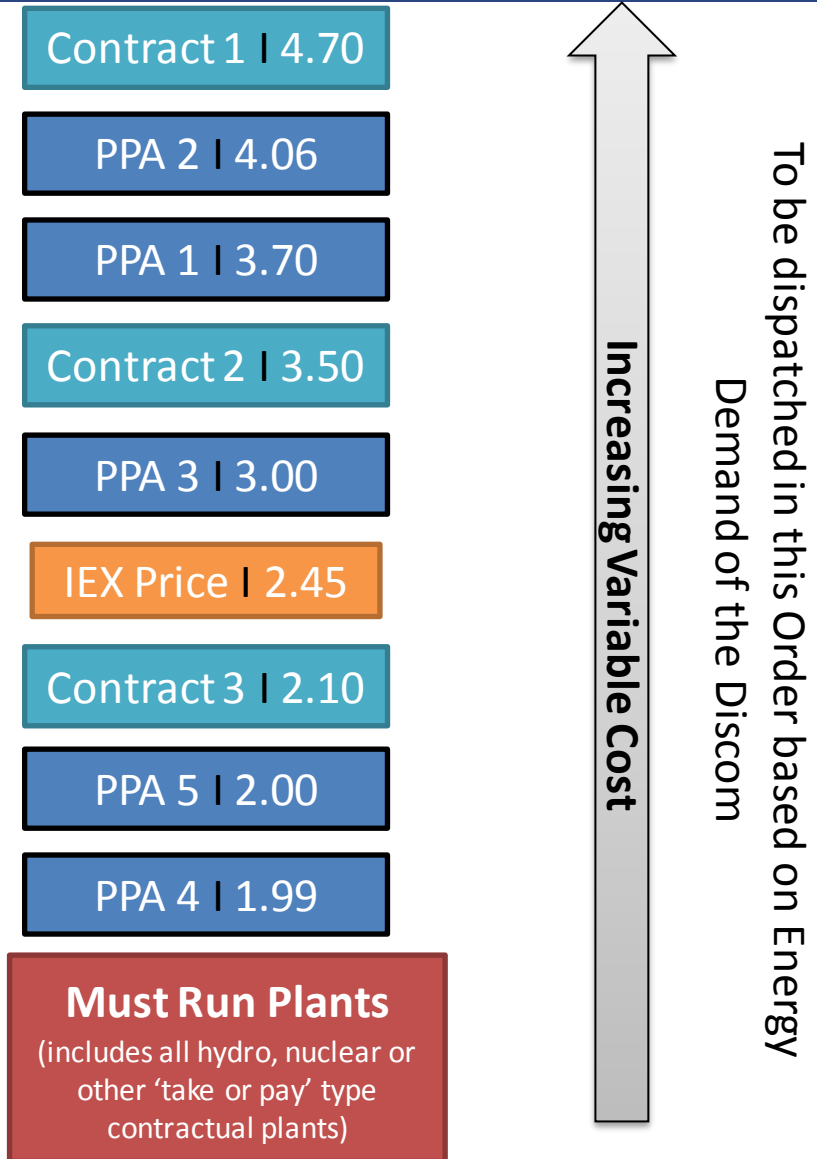
Merit order dispatch schedule to be prepared based on Variable cost and considering Exchange Prices

Capacity Tied up by Discom



Merit Order Baseline

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



Merit Order Baseline

Replacement Potential:

Region wise plants with high variable cost as compared to IEX prices

Region	Station	Capacity (MW)	Energy Charge (Rs/kWh)	IEX Price in the Region* (Rs./kWh)
East	Barh	660	4.06	2.22
	Farakka-I, II & III	2100	2.78 - 2.8	
	Kahalgaon-I & II	2340	2.42 - 2.57	
North	Badarpur TPS	705	5.09	3.18
	Auraiya-Wtd	663	4.36	
	Dadri-Wtd	830	4.27	
	NCTPP Dadri I & II	1820	3.81 - 4.18	
	Tanda	440	3.63	
	Anta-Wtd	419	3.55	
	Faridabad-Wtd	431	3.35	
	Unchahar-I, II & III	1050	2.89	
South	Simhadri-I & II	2000	2.74	2.99
	Ramagundam I, II & III	2600	2.54 - 2.71	
West	Mouda	1000	3.89	2.18
	Kawas-Wtd	656	3.36	
	Gandhar-Wtd	657	3.28	

*IEX Average area prices for the month of June'15

Cost Optimisation Potential in Bihar Annual: Plant-wise

S. No	Power Plant	Allocated Capacity (MW)	Variable Cost-FY15 (Rs./kWh)	Replaceable Volume (MU)	Annual Volume (MU)	Potential Savings (Cr)
1	KBUNL Stage 1 U-1	220	4.06	700	700	112
2	BARH STPS II	430	4.06	1,290	1,290	174
3	Adani-Gujarat	300	3.17	515	1,612	20
4	Barauni TPS	220	3.00	359	836	9
5	Farakka STPS I & II	379	2.80	1,189	3,429	18
6	Farakka STPS III	55	2.78	203	714	2
7	KhSTPS I	293	2.57	223	2,220	0
8	KhSTPS II	78	2.42	0	515	0
9	Talcher STPS I	344	1.47	0	2,855	0
10	GMR	200	1.46	0	870	0
	Total	2,419		4,476	15,041	335

Source:

- Variable Cost taken from ARR of NBPDCL & SBPDCL
- Variable Cost of Rs. 4.06 is considered as 4.06 for April 15 as per ARR of FY 2015-16
- Source for Volume:
 - Volume of CGS taken from ERPC
 - Volume of SGS taken from ARR

Cost Optimization by Bihar

- Bihar has initiated the process of Cost Optimization
- The costlier power from Barh & Dadri stations is replaced by the cheaper power from IEX.
- The Energy Charges of these power plants are greater than the IEX rates.
- **Bihar has made a saving of over 11 crores in 21 days**

Due to low prices at the Exchange there is further potential to increase savings

Utility Software created by IEX for Bid Optimization

- IEX has created a **utility software for Discoms** and is providing it free of cost
- The **software is customised for each Discom** to take into account its existing PPAs along with their variable cost and status of must run plants etc.
- Based on the inputs fed into the software, it provides with the optimisation bid which should be put into the IEX bidding platform along with details of backing down if the Bid is selected
- Benefits:
 - Discoms need not be bothered about Exchange prices for bidding
 - The software will create bid as per the Discoms merit order and other constraints fed to it
 - On acceptance of the Bid, the Discom can backdown the plants

Banking Transactions

- Banking transactions takes place directly between Discoms, the transactions are cashless in nature, where one Discom banks power to other for utilising it later.
- Commercial considerations required for Banking transactions with the reference price available.

Case Study: Banking @ 500 MW quantum

MONTH	DRAWAL by Discom-1 (MUs)	IEX PRICE (Rs/KWh)	DRAWAL by Discom-2 (MUs)	IEX PRICE (Rs/KWh)
Nov'14	365	2.63		
Dec'14	372	2.96		
Jan'15	372	2.70		
Feb'15	320	2.60		
Jun'15			350	3.18
Jul'15			362	3.2
Aug'15			362	2.64
Sept'15			372	3.43
Weighted Avg (as per data available)	1429	2.72	1446	3.11
TOTAL	1429	2.72	1446	3.11
Profit/Loss to Discom-1 Rs Crore			(60)	

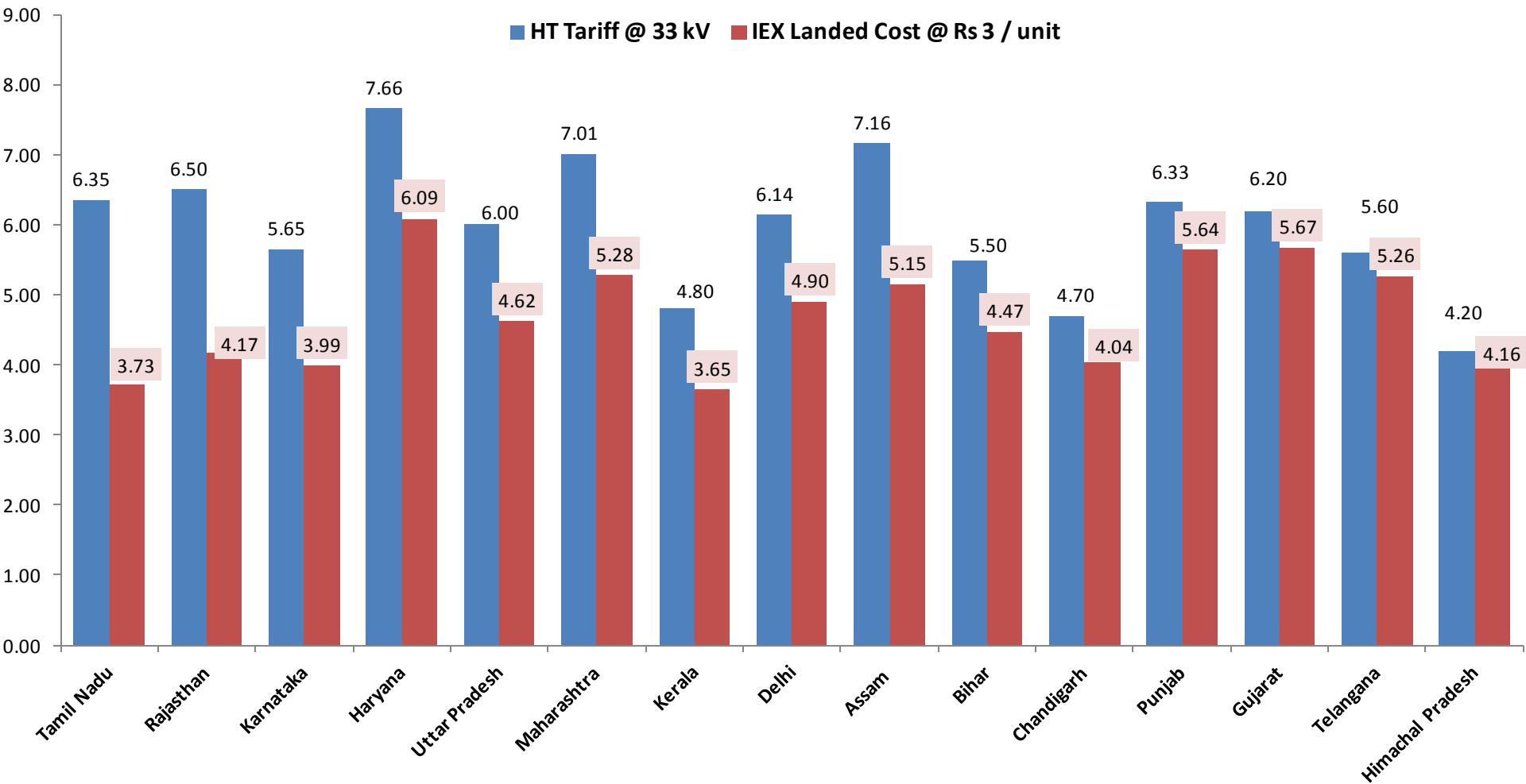
Cost Benefit Analysis for Open Access Consumer

Voltage Level	33 kV	132 kV
Volume Traded in MW	10	10
Hours Traded	24	24
Total Volume in MWh (at Regional Periphery)	240	240
IEX Rate at Regional Periphery (in INR per unit)	3.00	3.00
Losses		
Assam Withdrawal POC Loss	2.05%	2.05%
State Loss	3.64%	3.64%
Wheeling Losses	17.60%	0.00%
Cost After Losses (in INR per unit)	3.73	3.17
Charges		
State Transmission Charges (in Rs/unit)	0.42	0.42
Assam Withdrawal POC Charges (in Rs/unit)	0.17	0.17
Wheeling Charges (in Rs/unit)	0.22	0.00
NLDC Operating Charges+ NLDC Application Charges + SLDC Charges*	0.03	0.03
IEX Transaction Charges @ Rs 20 per MW (in INR/unit)	0.02	0.02
Professional Fees (If transacted through Member)* *	0.02	0.02
Cross Subsidy Charges (in INR/unit)	0.54	0.54
IEX Rate @ ex ABT Meter (in INR/unit)	5.15	4.37
Energy Charges (in INR/unit)	7.16	7.16
Savings Per Unit (in INR/unit)	2.01	2.79

*Assumption: Buy Quantity is 10 MW for 24 hours and 1000 Portfolios are selected everyday

Cost saving potential for Industries

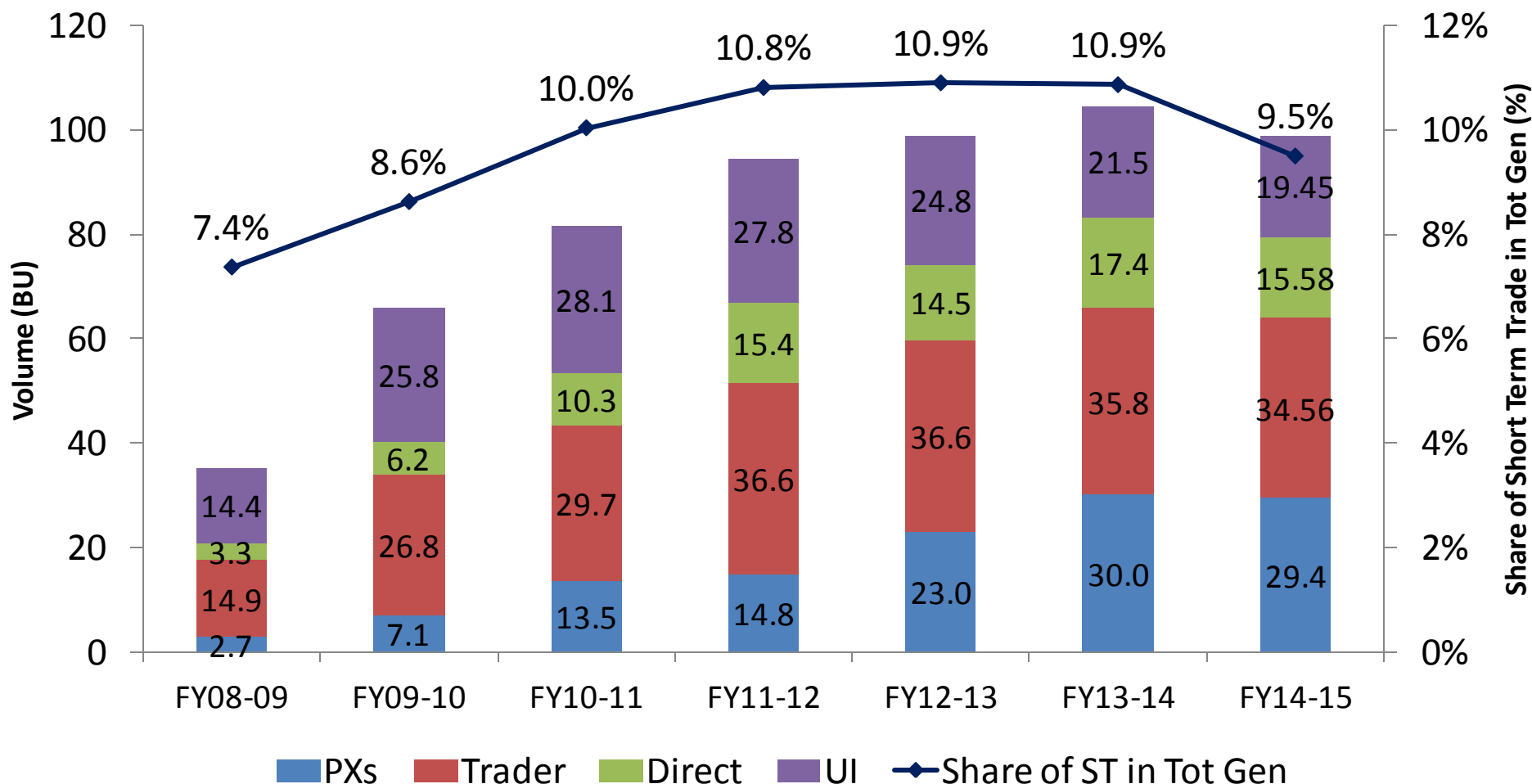
Comparison with State tariff



**IEX Landed cost calculated at Rs 3 per unit, the actual price on most days is lower than this*

Thank You

Growing Share of Short Term Market in Total Gen.



- Short term market growing at an encouraging rate with a **CAGR of 22%** in the past six years.
- **Power Exchanges** witnessing growth at a **CAGR of 62%** (last six years).