



Indian Power Market

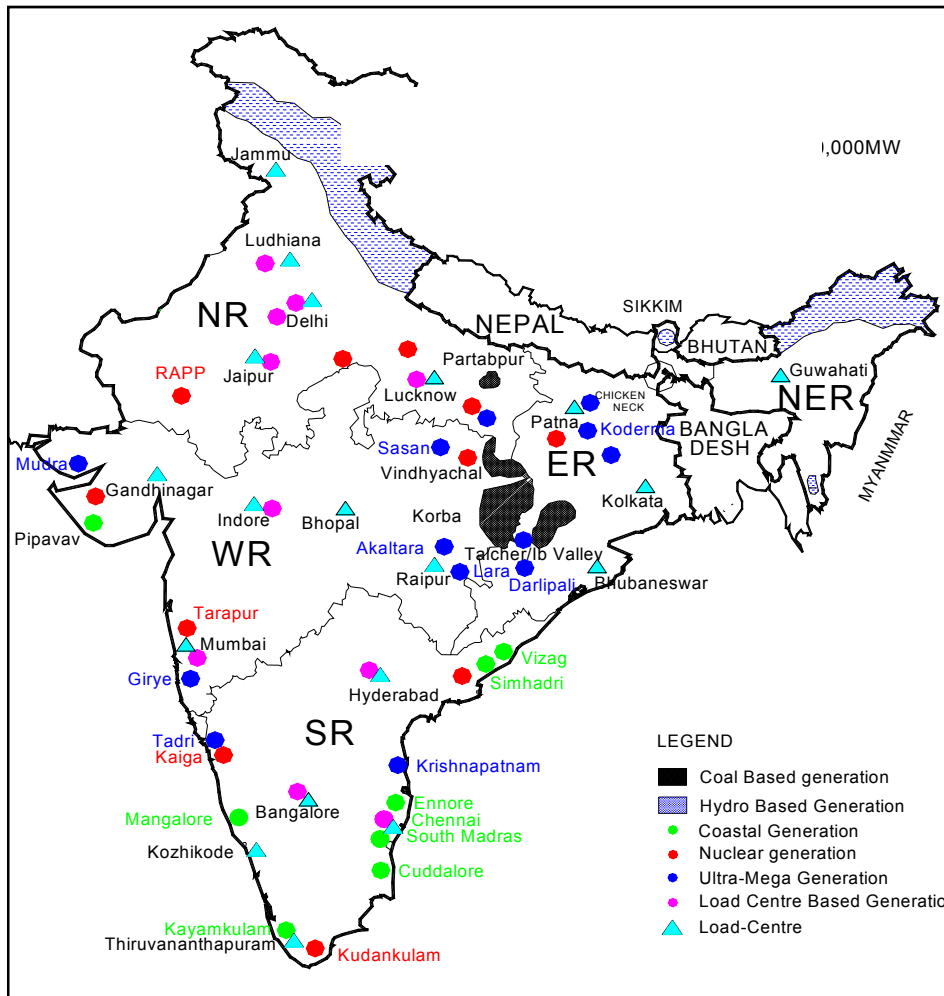
Dr. Rajiv K Mishra

Executive Director

PTC India Limited

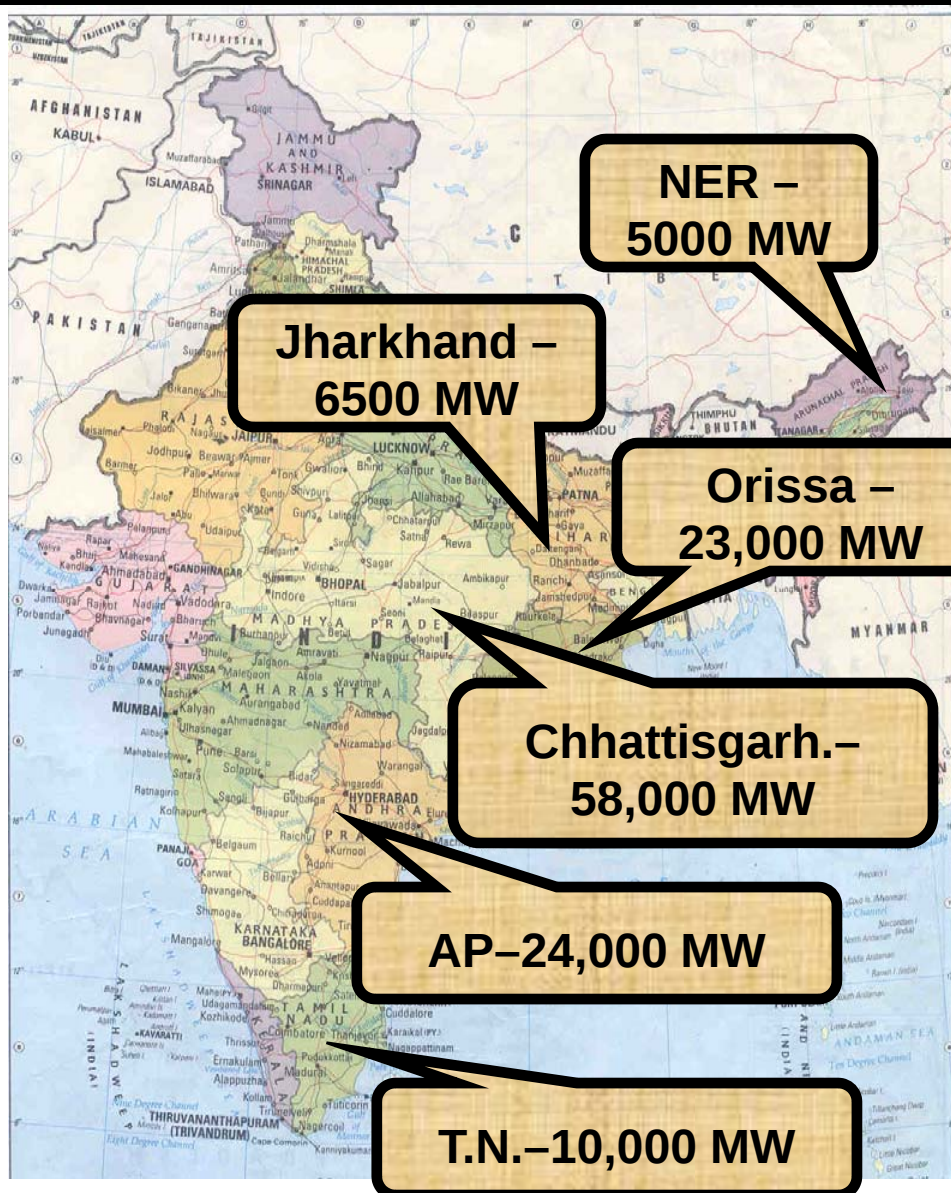


Energy Resources Map

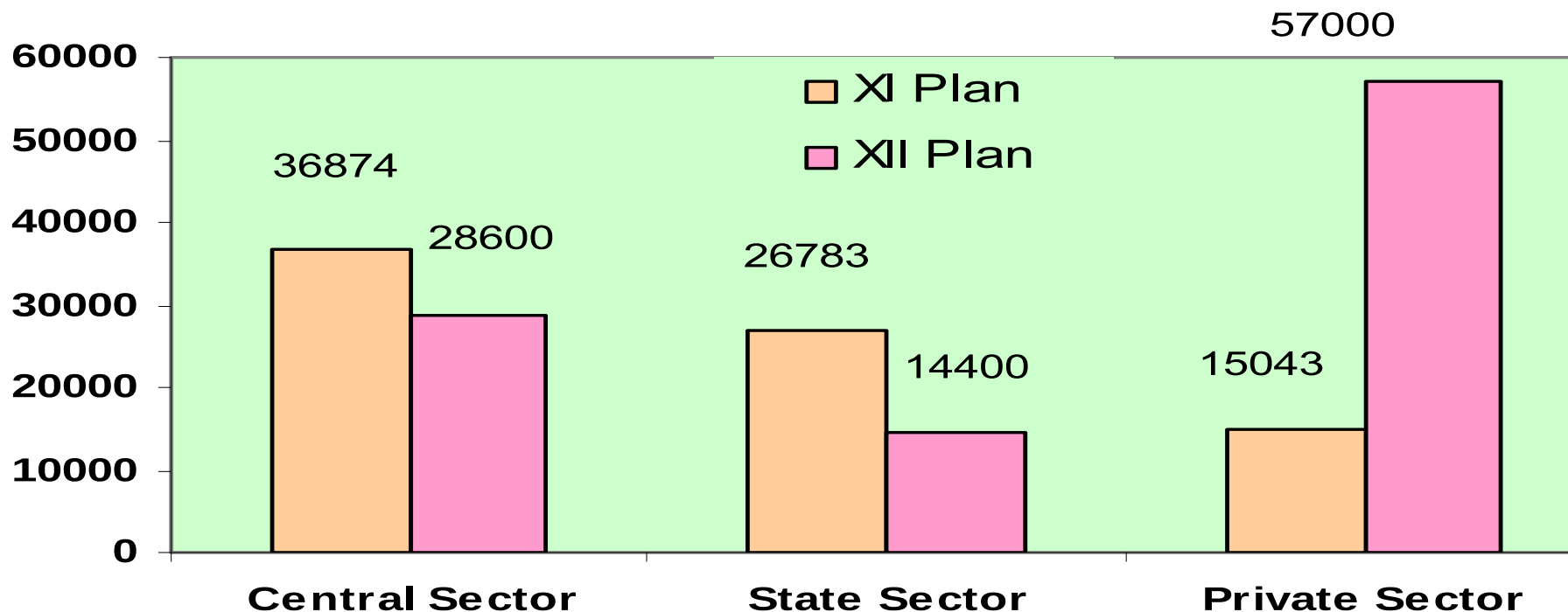


- Coal – In Central India
 - Chhattisgarh : 58000 MW
 - Orissa : 30000 MW
 - Jharkhand : 15000 MW
 - Madhya Pradesh:16000 MW
- Hydro – In North Eastern & Northern Himalayan region
- Coastal based
 - Andhra Pradesh: 24000 MW
 - Tamil Nadu : 10000 MW
 - Gujarat : 11000 MW

Energy resources (coal, water etc.) are unevenly distributed

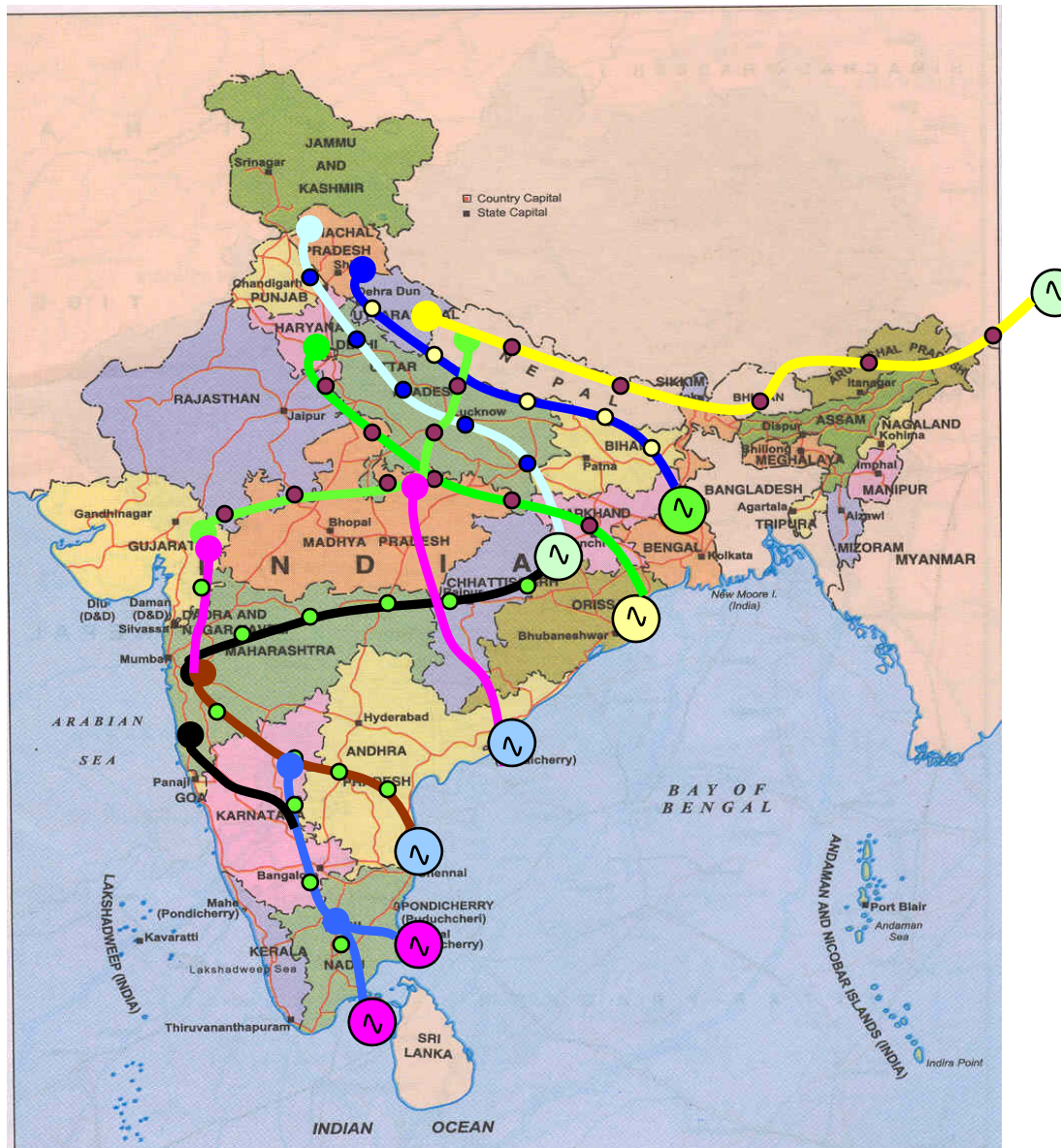


Change in Generation Profile

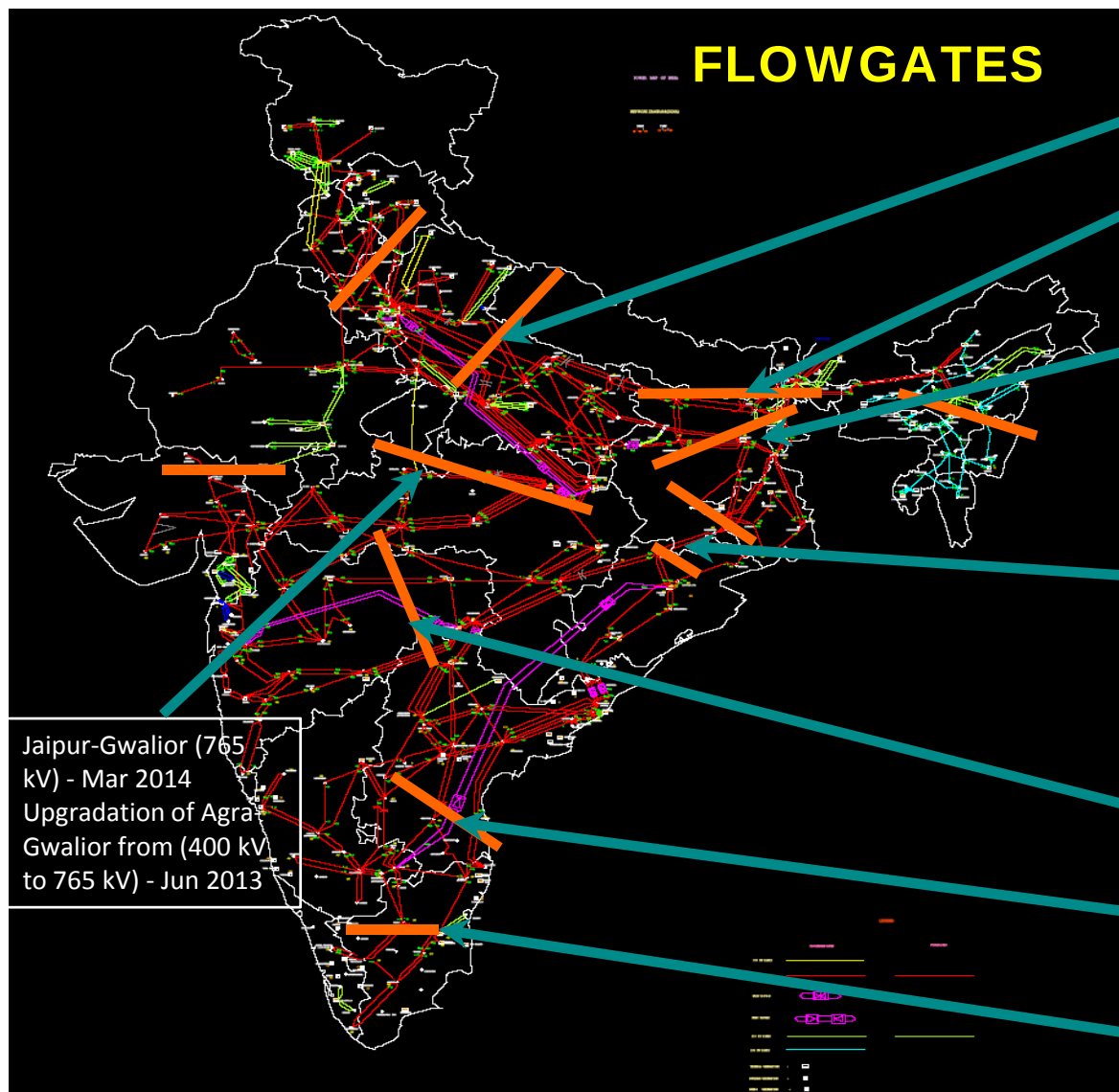


	Central Sector	State Sector	Private Sector	Total
XI	36874 (47%)	26783(34%)	15043(19%)	78700
XII	28600 (28%)	14400(15%)	57000 (57%)	80000

Proposed 11 nos. High Capacity Transmission Corridors for IPP Projects



Capacity Expansion underway to alleviate congestion



Mainpuri-Hapur (765 kV) - March 2015,
Mainpuri – Greater Noida (765 kV) - July 2015
Bara-Mainpuri (765 kV) – March 2015

Rangpo-Kishanganj 400 kV - Nov 2013

Alipurduar – Salakati (220 kV) - Jan 2015
Alipurduar-Bangaigaon (400 kV) - Jan 2015
Alipurduar-Tala (400 kV) - Jan 2015
Alipurduar-Puntsangchu (Bhutan) (400 kV) - Jan 2015
Alipur Duar – Siliguri (400 kV) - Jan 2015

Gaya-Dumka (400 kV) - Nov 2018
Maithon-Dumka (400 kV) - Oct 2018
Maithon-Durgapur (400 kV)
Gaya-Nabinagar (400 kV) - Nov 2015
Purulia-Ranchi (400 kV), - Dec 2015
Jamshedpur – Chaibasa (400 kV) -Nov 2017
Jamshedpur-Adhunik Power (400 kV) - Mar 2013

Raipur-Wardha (765 kV) - Dec 2013/Jan 2014

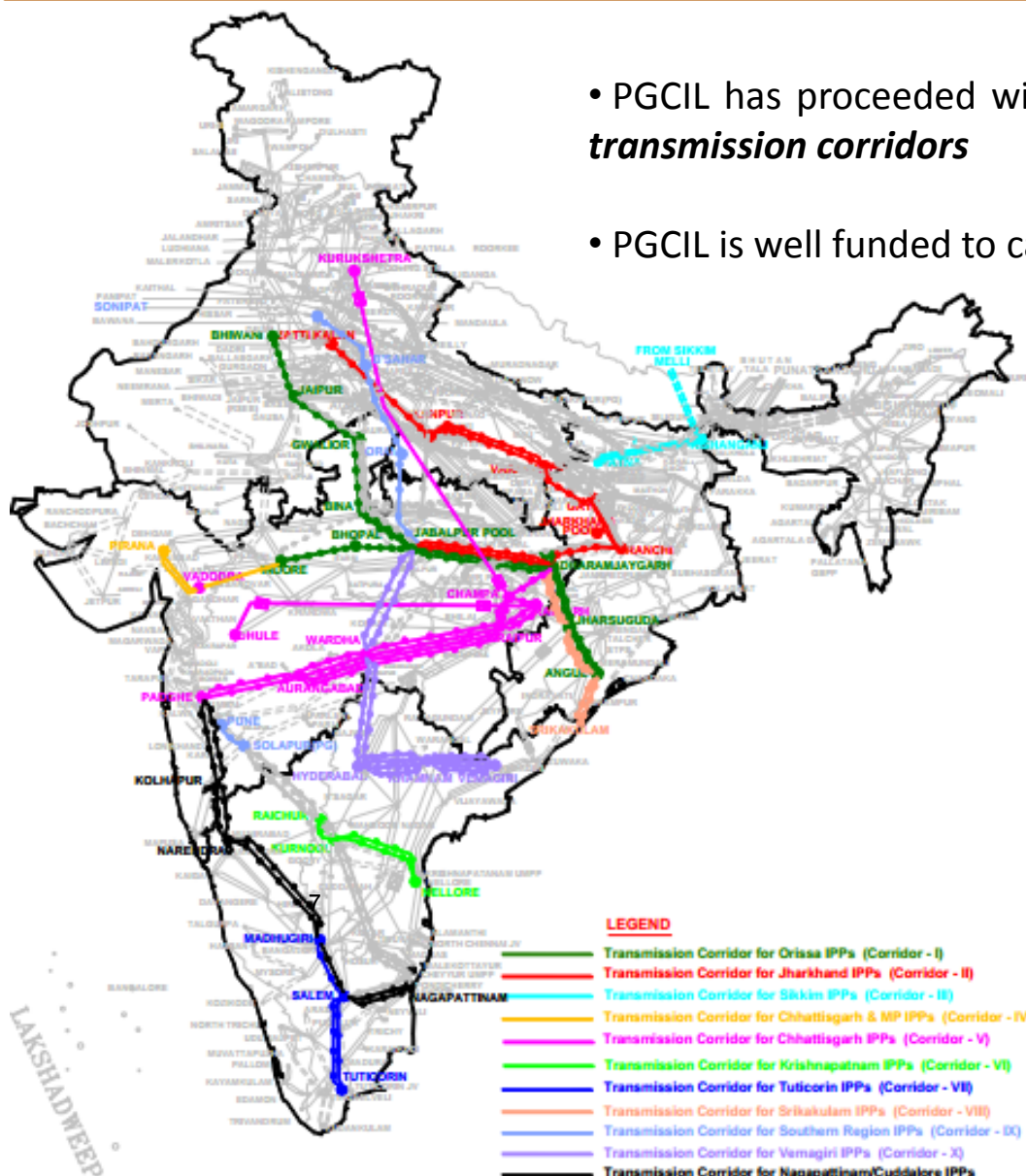
Vijaywada-Nellore (400 kV) - Mar 2014
Nellore-Chennai (400 kV) - Mar 2017

Almaty-Thiruvallam (400 kV) - Oct 2017
~~Almaty-SV Chatram (400 kV) - This year~~
Almaty-Chennai JV (400 kV) - Oct 2014

Capacity expansion underway to alleviate congestion



- PGCIL has proceeded with the execution of **11 high capacity power transmission corridors**
- PGCIL is well funded to carry out its expansion plans



Cluster / Corridor	Transmission Capacity contracted - MW
Orissa	6080
Jharkhand	4084
Sikkim	2358
Bilaspur + MP	4160
Chattisagrh	15185
Krishnapatnam	3072
Tuticorin	2045
Srikakulam	3760
Cuddlore/Nagapattinam	2987
Vemagiri	5150
Total	48881

Source: PGCIL

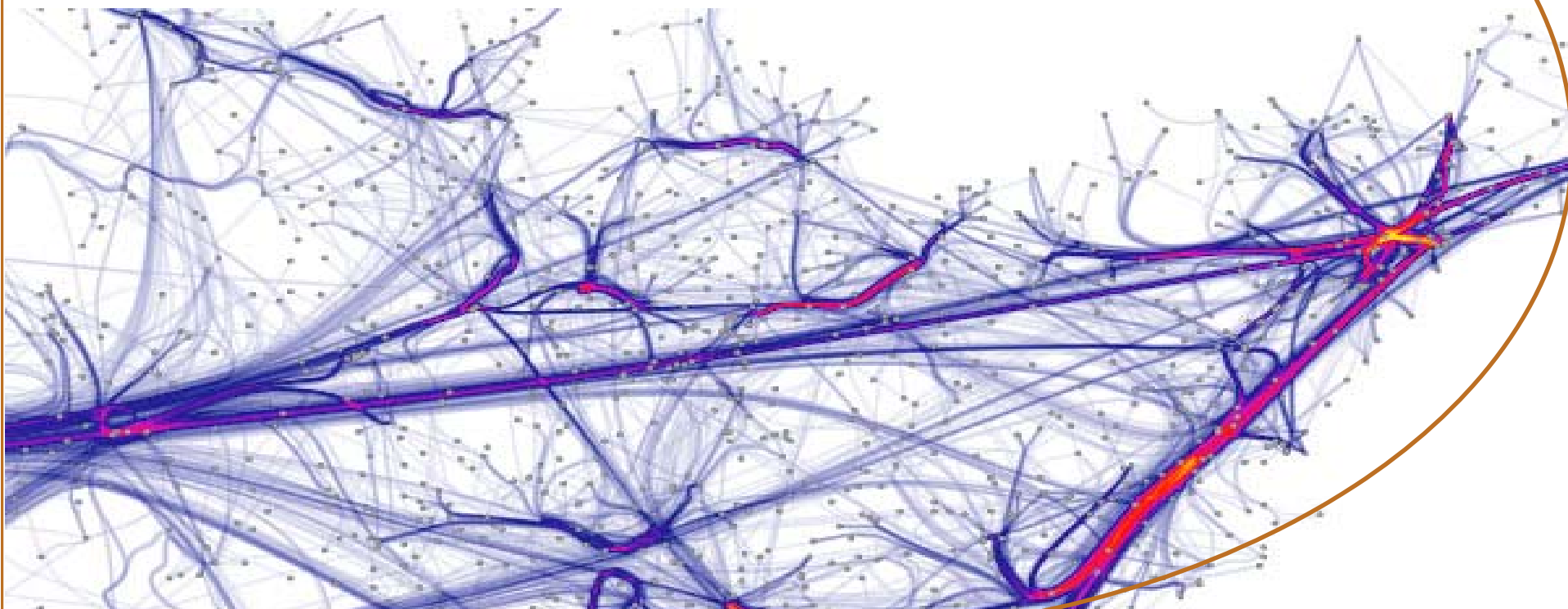
any Fund, including the description of risk invest in such units or shares.

Congestion in Southern Grid too will ease out



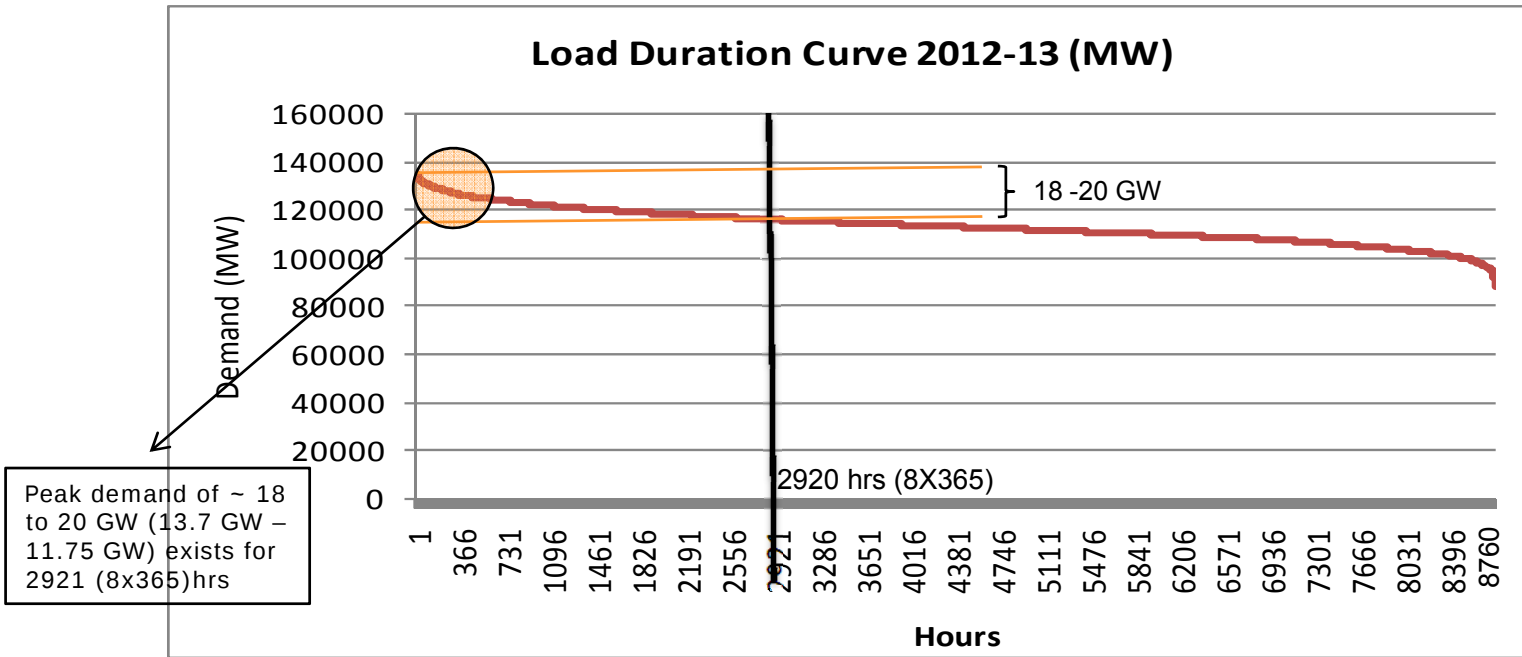
Capacity flow: North East West (NEW)-SR Grid

	2012-13	2013-14	2014-15	2015-16	2016-17
Capacity flow from NEW to SR	1900	1900	3400	3900	Occasional Congestion



Annual Load Duration Curve of India – 2012-13

Strictly Private & Confidential



Source: NLDC

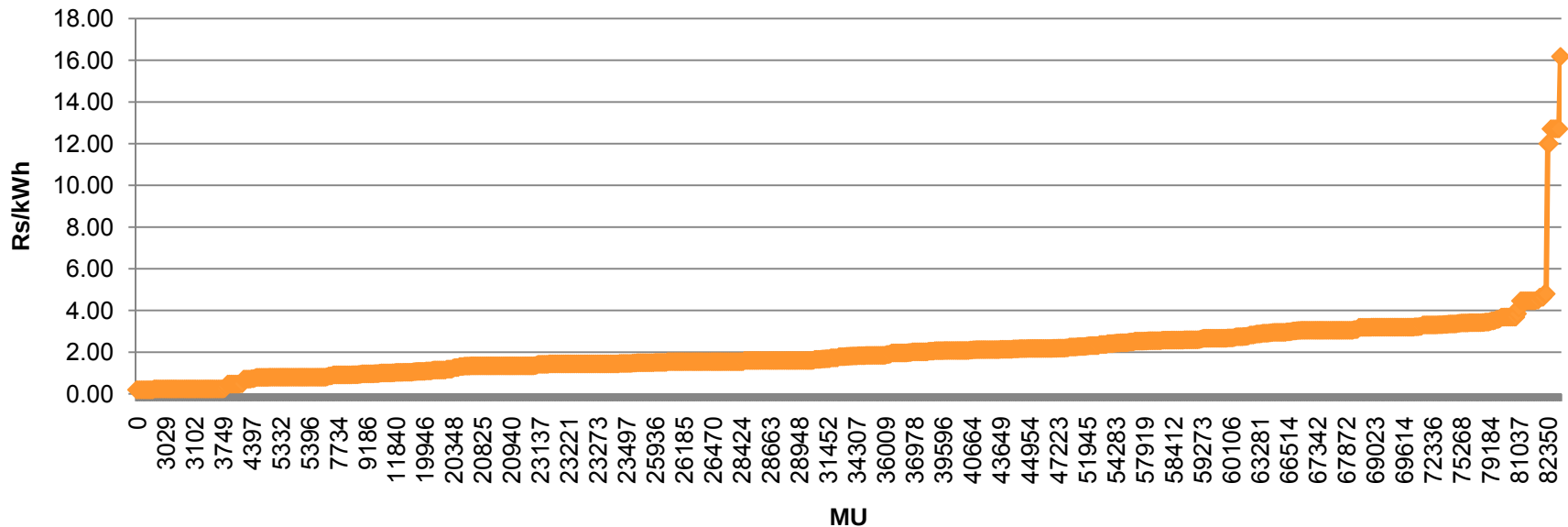
The stated official demand is an understated demand as it does not include the regular load shedding.

- National load duration curve is relatively flat, with the demand varying in a relatively narrow range between 85 GW and 138 GW.
- Even considering an 8 hour average peaking requirement (which was done by CERC in framing draft regulations on peaking power), the overall peaking requirement is of the order of 18 to 20 GW.
- 223 GW of installed capacity caters to peak demand of nearly 138 GW and base load of ~ 120GW thereby low PLF of power plants due to fuel shortage, lower PLF from renewable sources and also load shaving.

Typical Supply Curve

ST Prices:

Hourly Supply Curve - April (00:00 hrs to 01:00 hrs)



- ❑ The above shows a typical supply curve for variable cost.
- ❑ Short Term tariff is discovered where the demand cuts the above supply curve. The tariff of that marginal plant is considered as Market Clearing Price in short run (SRMC)

Government Initiatives



- Private Sector Allowed
 - 100% FDI
 - Distribution Privatization in Odisha
 - Mega Power Policy
 - PTC formation
 - Competitive bidding
- 1991 1992-97 1995-96 1997 1998-99 2003 2006

- Projects given fast clearances
- Foreign Investors invited aggressively

- CEA clearance exempted for thermal projects upto 1000 MW

- Electricity Act – 2003
- Generation Delicensed
- Open Access

2006

2007

2008

2010

2011

- Concept of Ultra Mega Power introduced

- Distribution Franchisee Concept introduced

- R-APDRP

- Shunglu committee Report on Distribution Reforms

- APTEL Judgement on Suo-moto determination of tariffs by SERCs

R-APDRP: Restructured Accelerated Power Development & Reform Program, APTEL: Appellate Tribunal for Electricity, SERC: State Electricity Regulatory Commission

MERGING OF MARKETS

Five Regional Grids
Two Frequencies

August 2006
North synchronized
With Central Grid

March 2003
West synchronized
With East & Northeast

October 1991
East and Northeast
synchronized

NEW Grid

South
Grid

Central Grid

North

East

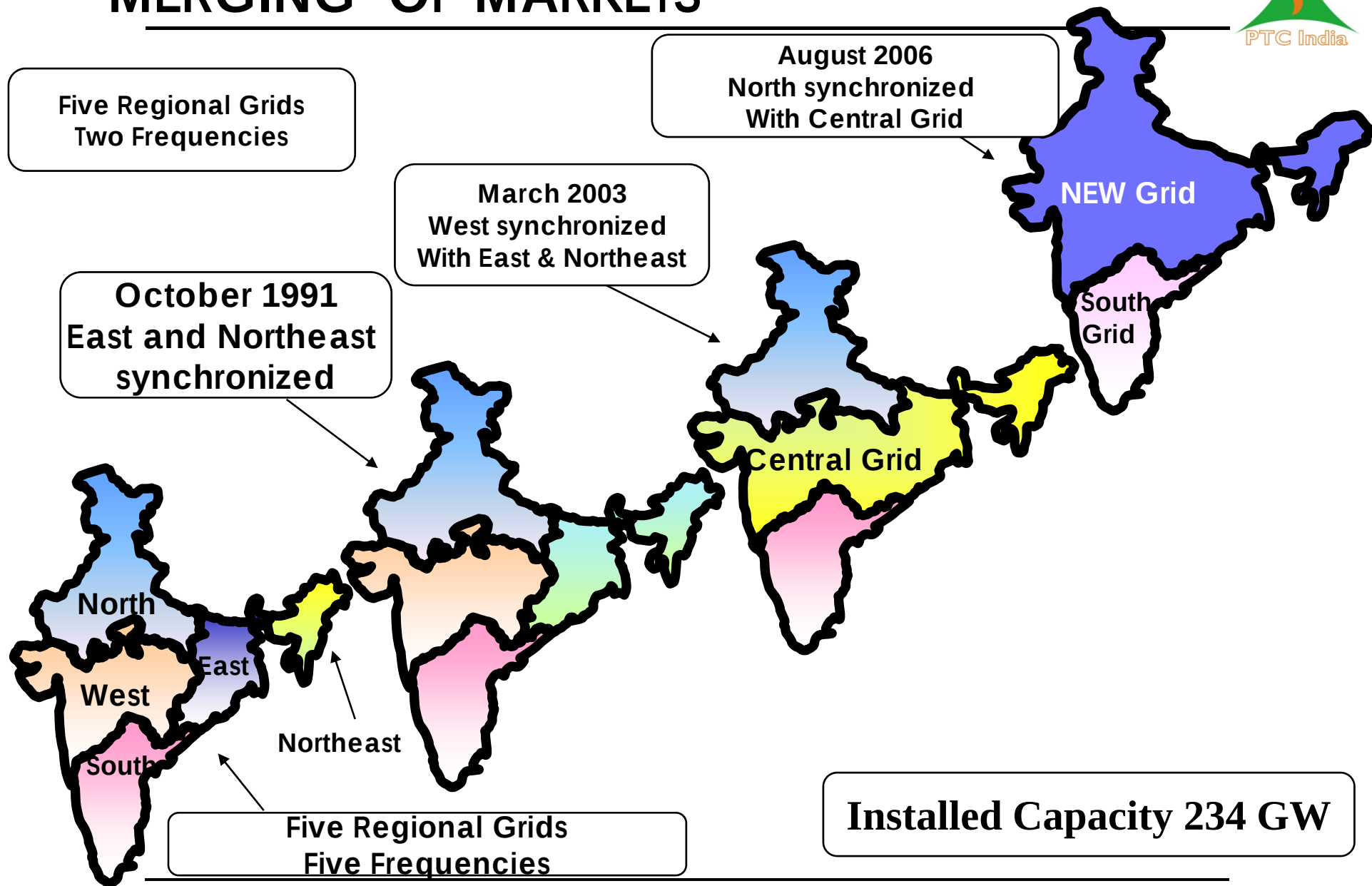
West

South

Northeast

Five Regional Grids
Five Frequencies

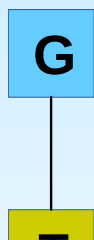
Installed Capacity 234 GW



Evolving Power Industry Structure

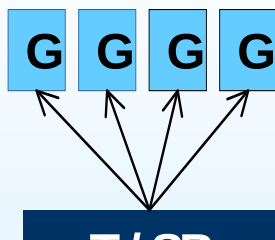
No Competition

- No choice
- Government makes decision



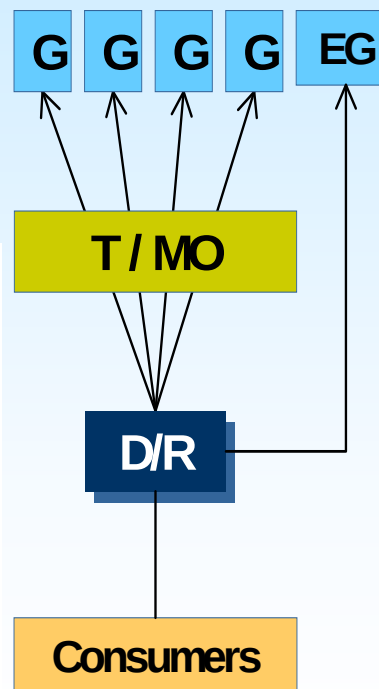
Generation Competition

- Single buyer has choice



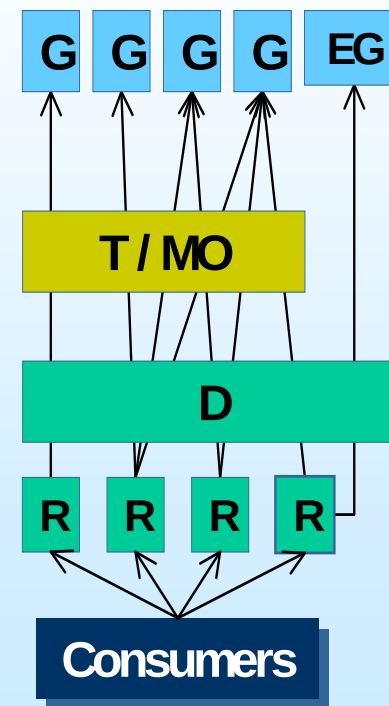
Wholesale Competition

- Distribution/retail companies have choice



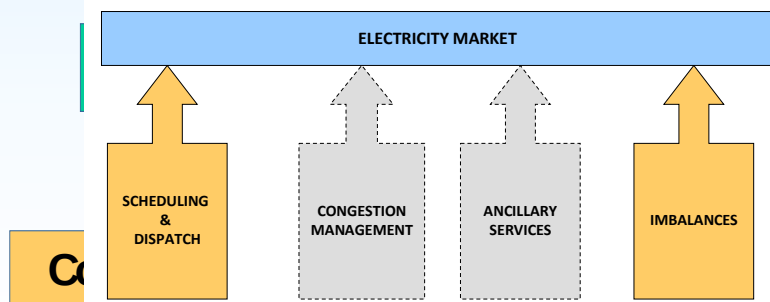
Retail Competition

- Consumers have choice



Market Design

Four Pillars of Market Design



"Making Competition Work in Electricity",
Sally Hunt

MO = Market Operator
EG = Embedded Generator

Indian market is here

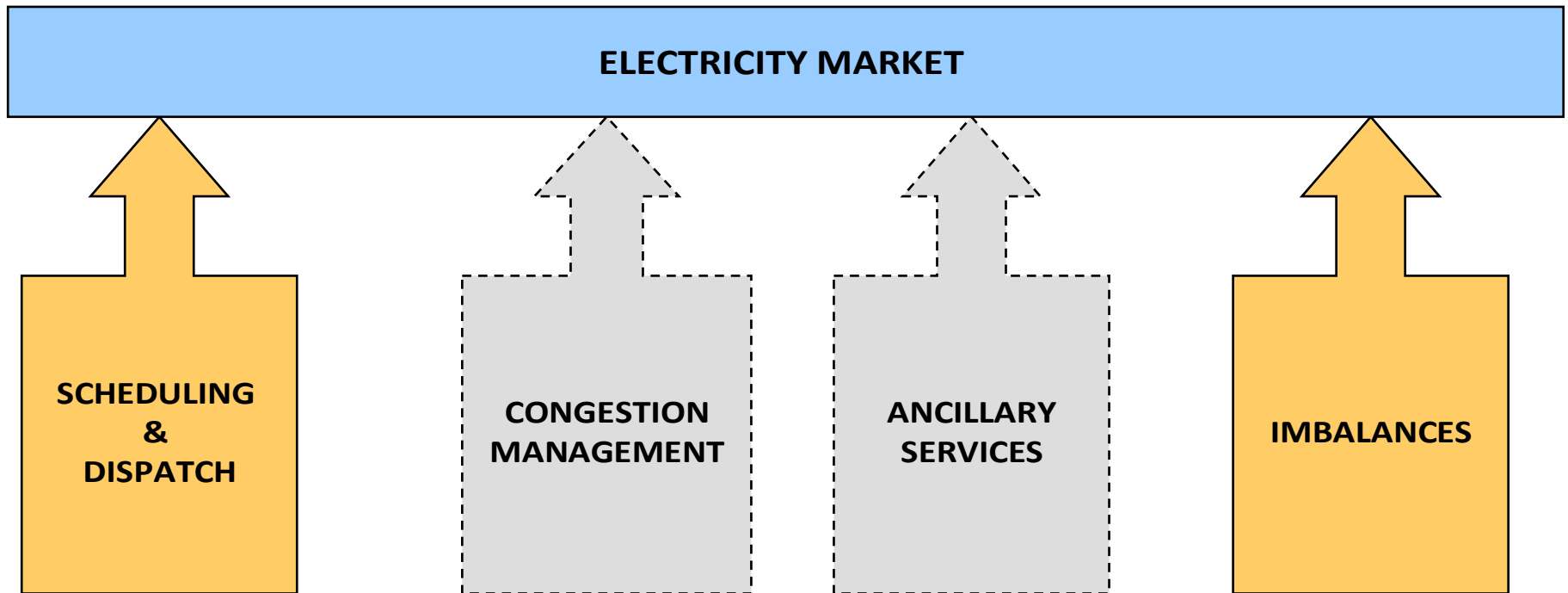
- Total volume traded in short term market in 2012-13 was >99 BUs (including UI), an increase of 24 % YOY
- Weighted average price of electricity on exchanges was lower than bilateral market which shows that users are ready to pay premium for delivery certainty
- Size of the bilateral traders' market in monetary terms –
Rs. 18,000 crore



**Total size of Power market:
~Rs. 35,500 Crores**

Market Design

Four Pillars of Market Design



*"Making Competition Work in Electricity",
Sally Hunt*

Evolution of Power Market in India

**Financial
Derivatives**

**Capacity
Market**

**Ancillary
Market**

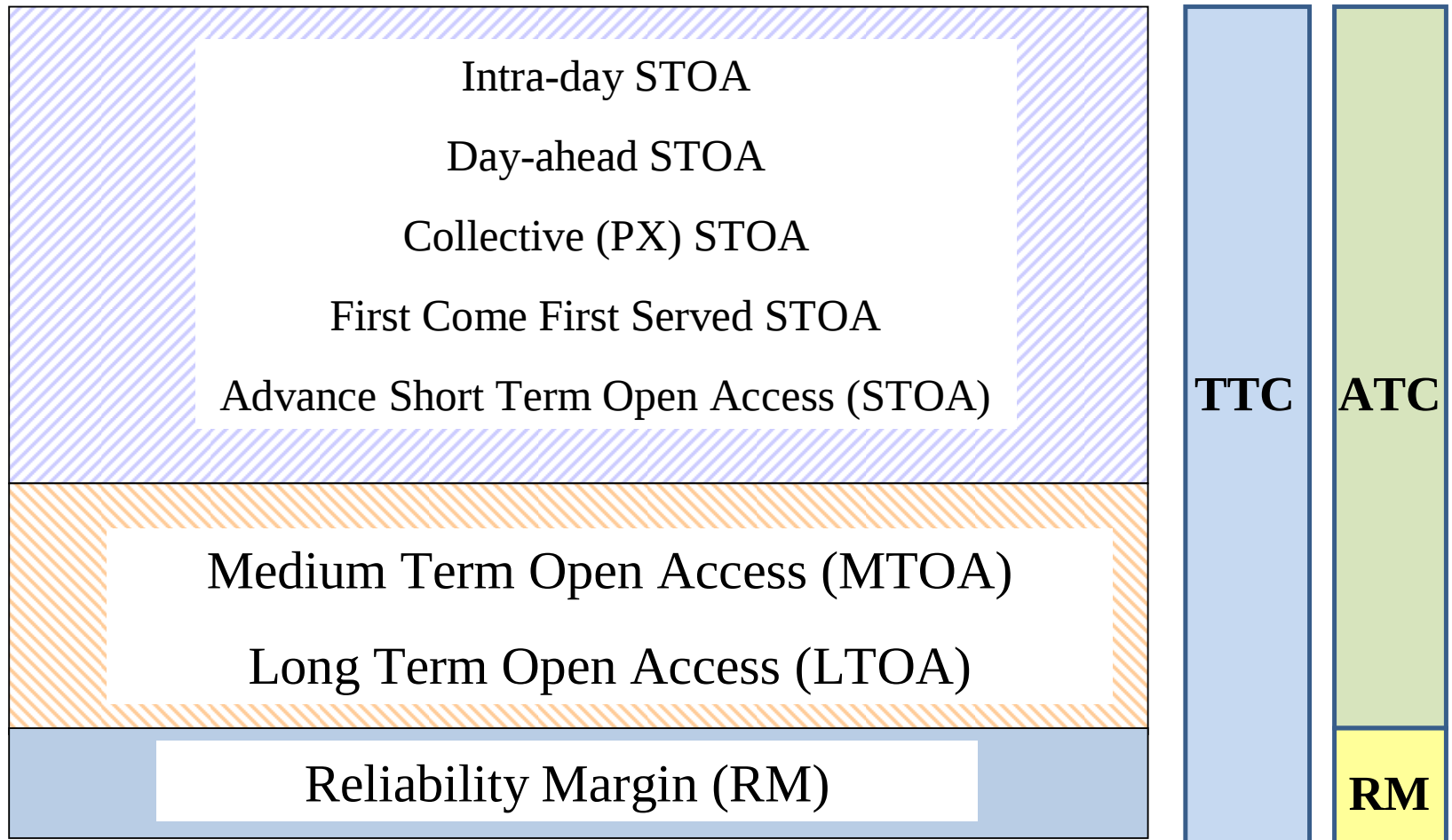
Power Exchange
2008

Open Access
2004

Settlement System
2002-03

Grid Code
Feb.'2000

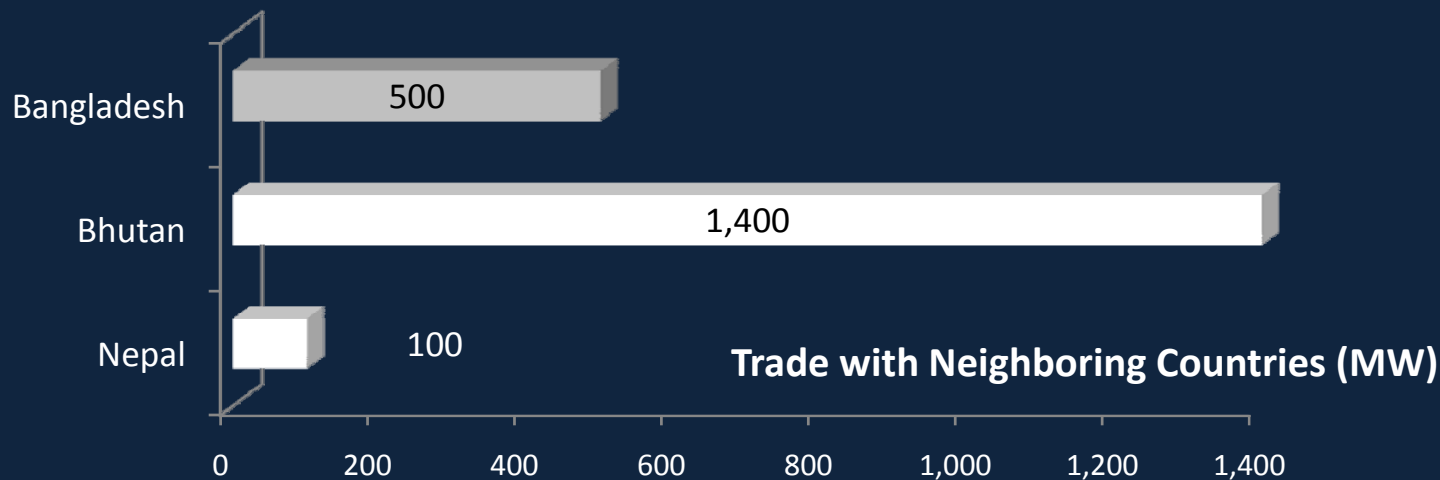
Total & Available Transfer Capability



- First National level PX Indian Energy Exchange (IEX) : promoted by PTC Group, commenced operation in 2008
- Another exchange PXIL followed, third exchange is on anvil
- IEX: ~ 95 % market share
- Growing Portfolio: more than 2000 participants
- Trade:
 - Day Ahead Market (DAM) – 30% of short-term market
 - Term Ahead Market (TAM) – 4% of short-term market
- Size of the power exchange in monetary terms – more than Rs. 5000 Crores
- PX begun trade of Renewable Energy Certificates (RECs)



Cross Border Trade



- Currently with Bhutan and Nepal through PTC India Ltd.
- Bangladesh trade expected to start in Nov'13 – 250 MW export by NTPC and 250 MW through PTC
- India-Bhutan 10,000 MW Plan by 2020
- Sri Lanka Transmission System proving too expensive to be commercially viable
- Import of electricity not under restricted category presently

Upcoming Cross Border Transmission Links



Nepal

- 132 KV Kataiya – Duhabi (Nepal) line: 50 MW to Nepal through Bihar under bilateral arrangement
- 132 KV Ramnagar – Balmikinagar - Gandak (Nepal) line: 15-20 MW
- 132 KV Tanakpur – Mahendranagar(Nepal) line: 20 MW by PTC during dry season
- 400KV D/C Muzzafarpur – Dhalkebar

Bhutan

- Chukha: 220 kV Chhukha-Birpara and Chukha-Singhigaon-Birpara feeders with capacity of ~350 MW
- Tala: 400 kV Tala-Siliguri and Tala-Malabase-Siliguri feeders with capacity of 2500-2700 MW (current utilization – 1100-1200 MW)
- Kurichhu: 132 kV Salakti-Gelephu and Deothang-Rangia lines

Cross Border Transmission Links



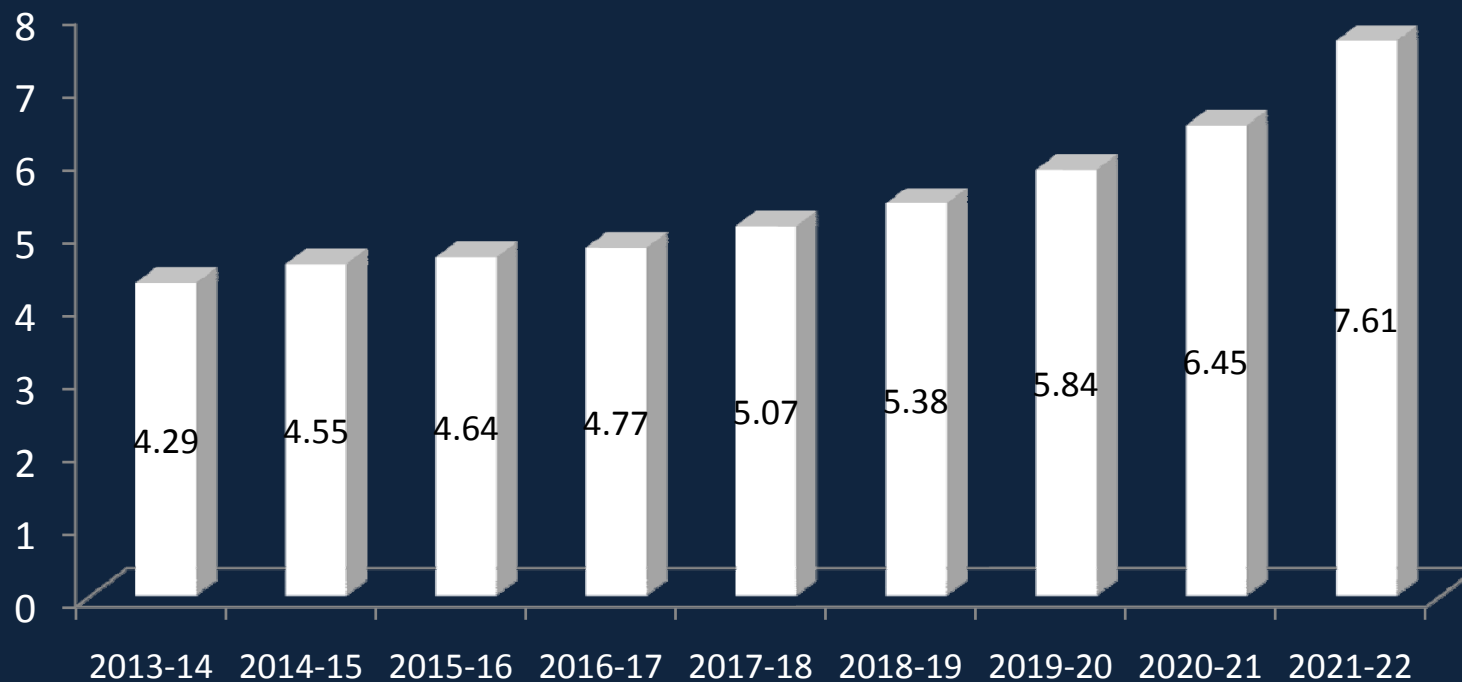
Upcoming Transmission Links

- Bangladesh – HVDC back to back at 400 kV line with initial capacity 500 MW, can be ramped up to 1000 MW
- Nepal – Existing trade through 132 kV, 33 kV, 11 kV level
 - New 400 kV by Dec'14: Initially to run at 220kV (350-400 MW)
- Bhutan – Through 400 kV, 220 kV, 132 kV lines
 - Total transmission capacity around 2500 MW
 - National Transmission Grid Master Plan for Bhutan corresponding to 2020 & 2030

All India Price Forecasts

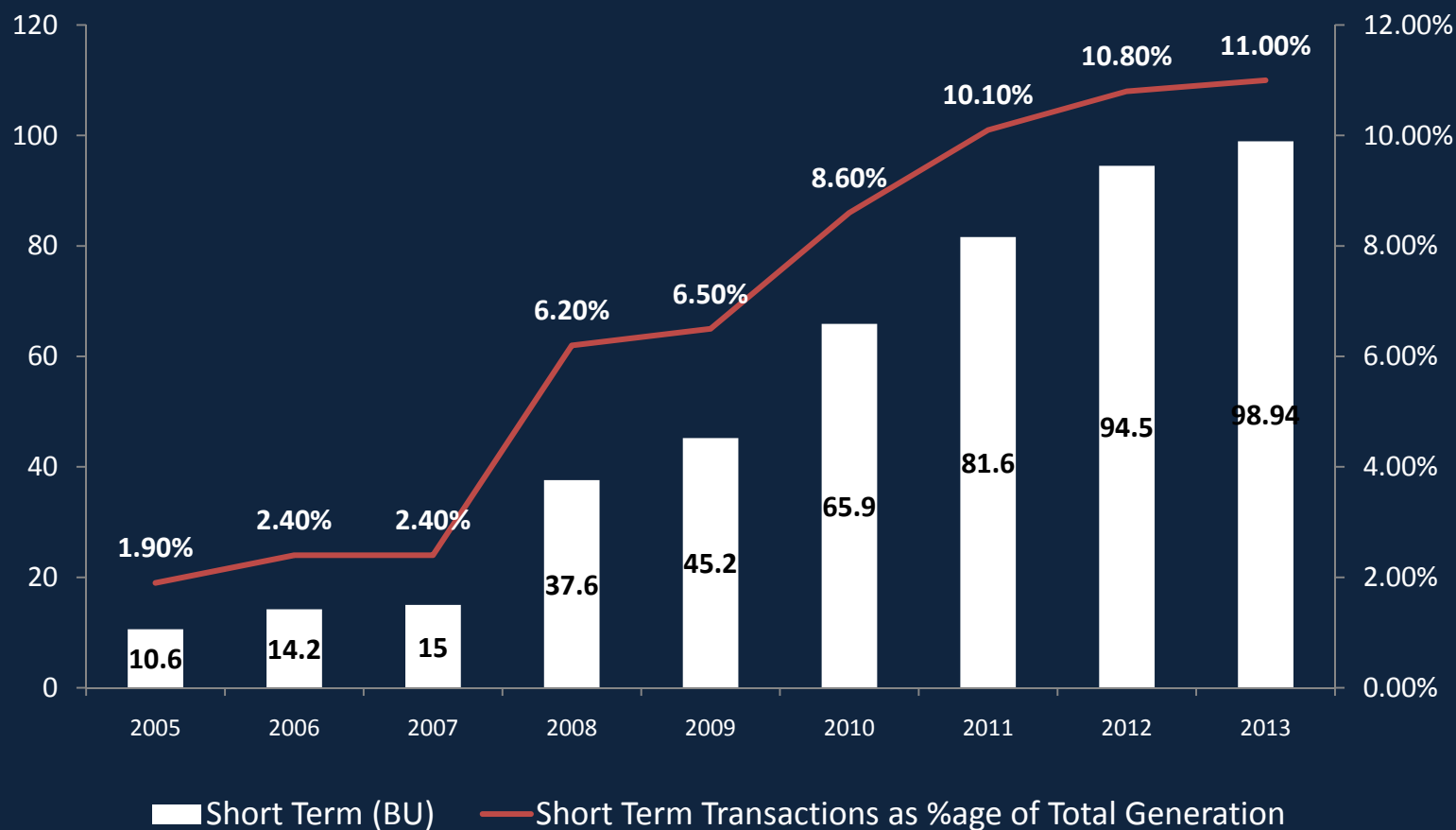


All India Average ST Price Forecasts (INR/kWh)



Price forecasts on All India basis projected by a reputed consultant for an independent study carried out for PTC.

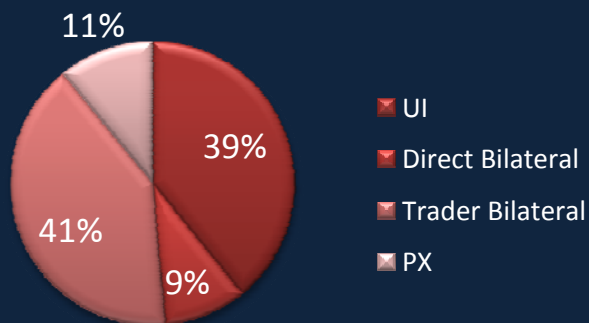
Short Term Trading Market



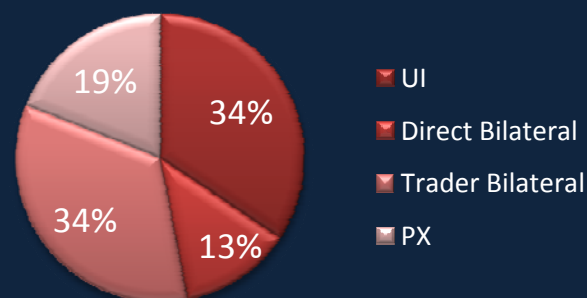
Short Term Market Composition (BUs)



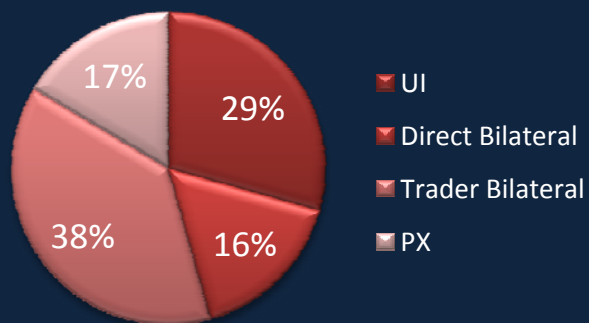
(FY 2010)



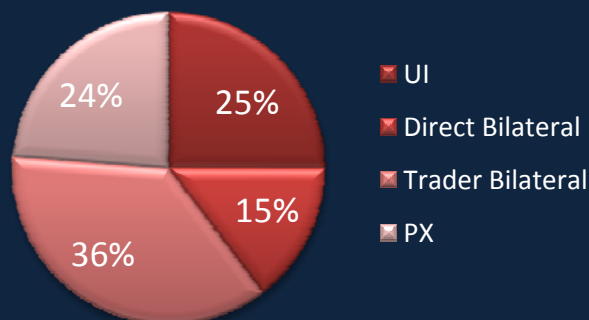
(FY 2011)



(FY 2012)



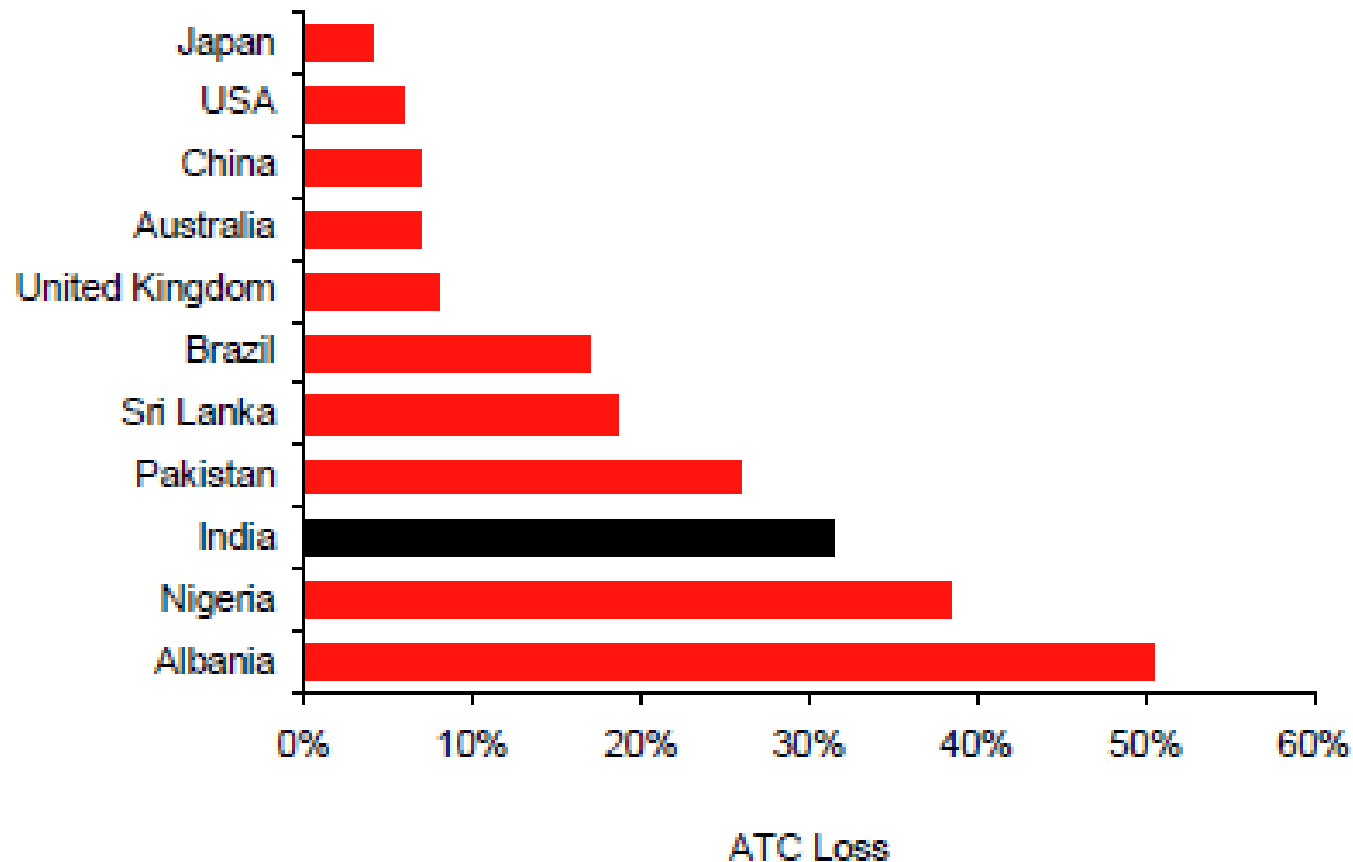
(FY 2013)



Huge Potential For Improvement



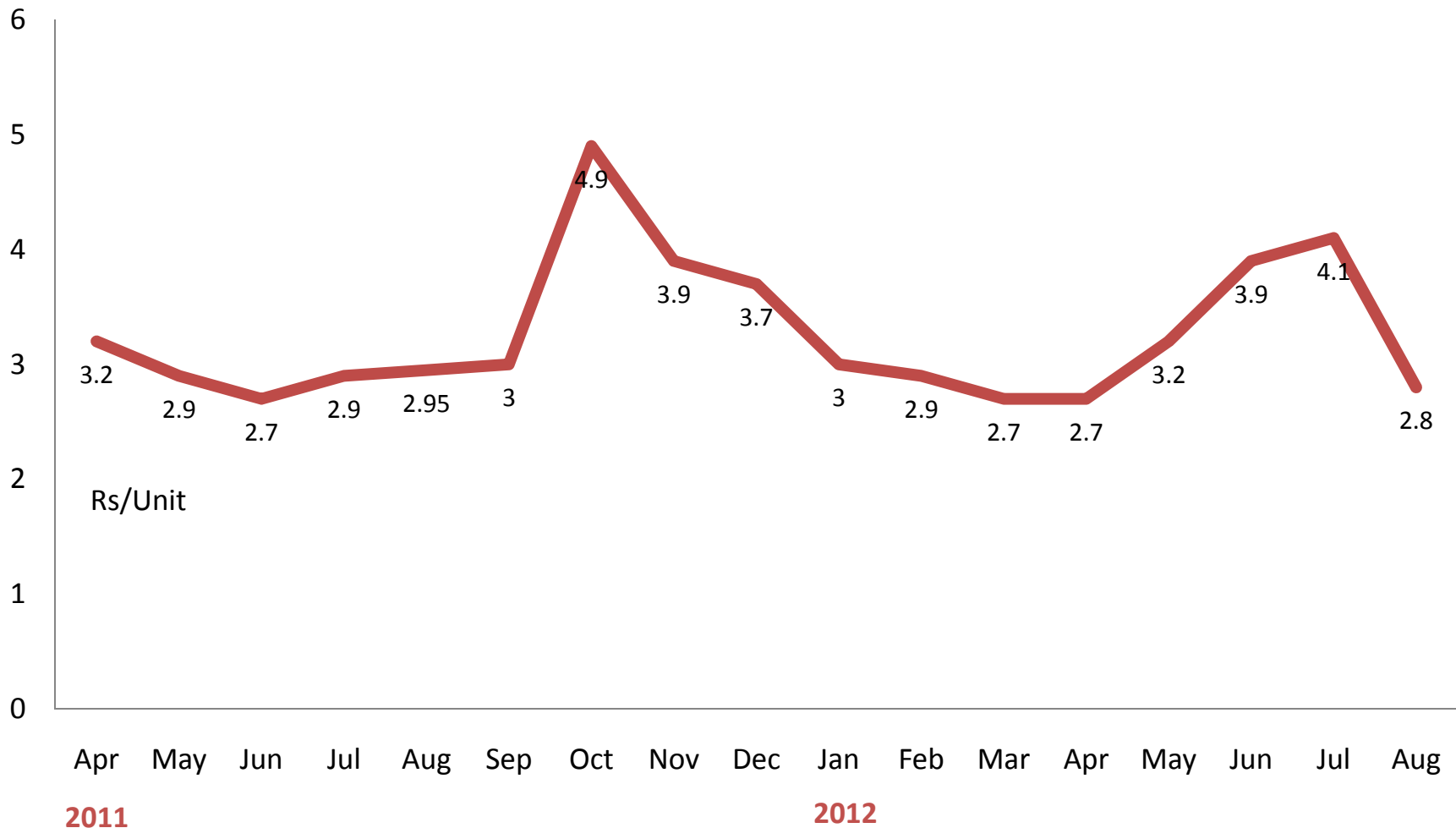
Losses on global scale – India among the worst



Market Scenario (Average Prices)



Average Monthly Prices IEX (April 2011 – August 2012)



Thank You