

Report on Short-term Power Market in India: 2013-14



Economics Division
Central Electricity Regulatory Commission



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Preface

The power sector has grown significantly since the enactment of the Electricity Act in 2003. However, it still faces the daunting challenge of providing adequate power to meet the growing needs of the economy. The mandate of the Central Electricity Regulatory Commission (CERC) is to promote competition, efficiency and economy in the power markets and improve the quality of supply, which necessitates the development of a healthy short-term power market. A short-term power market can help electricity providers to meet unplanned and fluctuating power requirements, and on the sellers' side, enable power producers as well as procurers to sell their surplus power. In India, the short-term power market, which covers contracts of less than a year through bilateral agreements and power exchanges are well developed, constituting approximately 11 % (about 104 BU) of the total electricity market in 2013-14, though this includes power transactions through unscheduled interchange (UI) as well. Access to information is one of the key elements to ensure efficient markets and faith of the stakeholders in the system. CERC therefore brings out monthly and annual short-term power market reports to keep market participants as well as stakeholders aware and updated on the state of the power market. The annual reports give a snapshot of the short-term power transactions through different mechanisms by various market participants. These reports can be useful to a broader category of audience interested in the power market in India. The annual power market report also contains analysis of RECs transacted through power exchanges. In order to ensure ease of access, the short-term and annual power market reports are available on the CERC website www.cercind.gov.in. As in the past, we are confident that market participants and stakeholders will find the Annual Report for 2013-14 useful.

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Abbreviations

Abbreviation	Expanded Version
ADHPL	Allain Duhangan Hydro Power Limited
ADHPL (GOHP)	Allain Duhangan Hydro Power Limited (GOHP Share)
APCPDCL	Central Power Distribution Company of Andhra Pradesh Ltd
APL	Adani Power Limited
APM	Administered Price Mechanism
APNRL	Adhunik Power and Natural Resources Ltd
APPCC	Andhra Pradesh Power Coordination Committee
Block	15 Minutes Time Block
BRPL	BSES Rajdhani Power Limited
BSEB	Bihar State Electricity Board
BU	Billion Units (Billion kWh)
BUDHIL	Lanco Budhil Hydro Power Private Limited
BYPL	BSES Yamuna Power Limited
CCGT	Combined Cycle Gas Turbine
CERC	Central Electricity Regulatory Commission
CGS	Central Generating Stations
CGSEB	Chhattisgarh State Electricity Board
CPP	Captive Power Producer/Plant
CSPDCL	Chhattisgarh State Power Distribution Company Limited
CSPTCL	Chhattisgarh State Power Trading Company Limited
DAM	Day Ahead Market
DISCOMs	Distribution Companies
DVC	Damodar Valley Corporation
ER	Eastern Region
FGUTPP	Firoz Gandhi Unchahar Thermal Power Project
GOHP/GoHP	Government of Himachal Pradesh
GPS	Gas Power Station
GRIDCO	Grid Corporation of Orissa Limited
GUVNL	Gujarat Urja Vikas Nigam Limited
HEP	Hydro Electric Project
HHI	Herfindahl-Hirschman Index
HPPC	Haryana Power Purchase Centre
HPSEB	Himachal Pradesh State Electricity Board
HSD	High Speed Diesel
IEX	Indian Energy Exchange Limited
ISGS	Inter State Generating Station
J&K	Jammu & Kashmir
JPL	Jindal Power Limited
JSL	Jindal Steel Limited
JSWEL	JSW Energy Limited

Abbreviation	Expanded Version
JVVNL	Jaipur Vidyut Vitaran Nigam Limited
KSEB	Kerala State Electricity Board
kWh	Kilo Watt Hour
KWHEP/S	Karcham Wangtoo Hydro Electric Power Station
KWHEPS (GOHP)	Karcham Wangtoo Hydro Electric Power Station (GOHP Share)
LBHPPL	LANCO Budhil Hydro Power Private Limited
LNG	Liquefied Natural Gas
LOI	Letter of Intent
Ltd	Limited
MALANA2	Malana2 (Everest Power Private Limited)
MCP	Market Clearing Price
MPPMCL	M P Power Management Company Limited
MU	Million Units
MW	Mega Watts
MWh	Mega Watt Hour
NCTP	National Capital Thermal Power Plant (Dadri)
NDMC	New Delhi Municipal Corporation
NEEPCO	North Eastern Electric Power Corporation Limited
NER	North Eastern Region
NEW Grid	Northern, Eastern, Western and North-Eastern Region Grid
NHDC	National Hydro Development Corporation Limited
NHPC	National Hydro-Electric Power Corporation Limited
NLC	Neyveli Lignite Corporation Limited
NLDC	National Load Dispatch Centre
NR	Northern Region
NTPC	National Thermal Power Corporation Limited
OA	Open Access
OAC	Open Access Consumer
OTP	Other than RTC and Peak period
PPA	Power Purchase Agreement
PSPCL	Punjab State Power Corporation Limited
PX/PXs	Power Exchange/Power Exchanges
PXIL	Power Exchange India Limited
RDPPC	Rajasthan Discoms Power Procurement Centre
REC	Renewable Energy Certificates
REL	Reliance Energy Limited
RLNG	Re-gasified Liquefied Natural Gas
ROR	Run of River
RTC	Round The Clock
S1	Southern Region 1
S2	Southern Region 2

Abbreviation	Expanded Version
SEB/SEBs	State Electricity Board
SEL	Sterlite Energy Limited
SJVNL	Sutlej Jal Vidyut Nigam Limited
SR Grid	Southern Region Grid
St	Stage
STPS	Super Thermal Power Station
TAM	Term Ahead Market
TANGEDCO	Tamil Nadu Generation & Distribution Company
THDC	Tehri Hydro Development Corporation Limited
TNEB	Tamil Nadu Electricity Board
TPCL	Tata Power Company Limited
TPDDL	Tata Power Delhi Distribution Limited
TPS	Thermal Power Station
UI	Unscheduled Interchange
UPCL	Uttarakhand Power Corporation Limited
UPPCL	Uttar Pradesh Power Corporation Limited
UT	Union Territory
W1	Western Region 1
W2	Western Region 2
W3	Western Region 3
WBSEDCL	West Bengal State Electricity Distribution Company Ltd
WR	Western Region

Executive Summary

An analysis of short-term transactions of electricity in India has been made in this Report on Short-term Power Market¹ for the year 2013-14. Here, “short-term transactions of electricity” refers to contracts of less than one year period for electricity transacted under bilateral transactions through Inter-State Trading Licensees (only inter-state part) and directly by the Distribution Licensees (also referred as Distribution Companies or DISCOMs), Power Exchanges (Indian Energy Exchange Ltd (IEX) and Power Exchange India Ltd (PXIL)), and Unscheduled Interchange (UI). The analysis includes (i) Yearly/monthly/daily trends in short-term transactions of electricity; (ii) Time of the day variation in volume and price of electricity transacted through traders and power exchanges; (iii) Trading margin charged by trading licensees for bilateral transactions (iv) Analysis of open access consumers on power exchanges; (v) Major sellers and buyers of electricity in the short term market; (vi) Effect of congestion on volume of electricity transacted through power exchanges; (vii) Tariffs of long-term sources of power for various distribution companies; and (viii) Analysis of transactions of Renewable Energy Certificates (RECs) through power exchanges.

Salient features of the report that are discussed in detail in subsequent sections are listed below.

1. Of the total electricity procured in India in 2013-14, the short-term power market comprised 11 per cent. The balance 89 % of generation was procured mainly by distribution companies through long-term contracts and short-term intra-state transactions.
2. In terms of volume, the size of the short-term market in India was 104.64 BU (units) in the year 2013-14. As compared to the volume of electricity transacted through short-

¹ Although unscheduled interchange (UI) is not a market mechanism, electricity transacted under UI is often considered a part of short-term transactions. Also, electricity transacted bilaterally directly between the distribution companies (without involving trading licensees or power exchanges) is also considered a part of short-term market. In the year 2013-14, the volume of UI was about 21.47 BU and that of bilateral transactions between distribution companies was about 17.38 BU.

term market in the year 2012-13 (98.94 BU), this was about 6 % higher. Majority of this growth in volume of 5.70 BU was accounted for by growth in transactions through power exchanges (7.13 BU), followed by direct bilateral transactions between the DISCOMs (2.86 BU). The bilateral transactions through the inter-state trading licensees and the transactions through UI declined by 1.01 BU and 3.29 BU respectively. A *caveat*, however, needs to be added; in case of traders only inter-state transactions have been considered.

3. Excluding UI and direct bilateral sale between the DISCOMs, the volume of electricity transacted was 65.78 BU in 2013-14. This was about 10 % higher than in 2012-13. Volume of electricity transacted through power exchanges witnessed a sharp increase of about 30% over 2012-13 volume. On the other hand, the volume of electricity transacted through inter-state trading licensees witnessed decrease of -2.8%. In monetary terms, the size of this segment of the short-term market was ₹23,952 crore in the year 2013-14², which was 1% less than in the year 2012-13. Of this, ₹8,891 crore was the value of electricity transacted through power exchanges (3% more than in 2012-13), and the balance of ₹15,061 crore was the value of inter-state transaction of electricity through trading licensees (about 4% less than in 2012-13).
4. In absolute terms, the volume of UI in the year 2013-14 decreased by 13% over 2012-13. The share of UI as a percentage of total volume of short-term transaction of electricity continued the downward trend of past years and was about 21% in 2013-14, down from 39%, 34%, 29% and 25% respectively in the years 2009-10, 2010-11, 2011-12 and 2012-13.
5. The share of direct bilateral transactions between DISCOMs as a percentage of total short term transaction volume remains the same at about 15% in the year 2013-14 when compared with the previous year 2012-13. In terms of volume, these direct bilateral transactions between DISCOMs witnessed an increase of about 20% in 2013-14 as compared to 2012-13.

² Excluding transactions pertaining to banking transactions.

6. The weighted average price of electricity transacted through power exchanges was ₹2.90/kWh and through trading licensees it was ₹4.29/kWh in 2013-14. The corresponding values for the year 2012-13 were ₹3.67/kWh and ₹4.33/kWh, respectively. In the year 2013-14, the weighted average price of electricity transacted through Day Ahead Market sub-segment of the power exchanges was ₹2.89/kWh and that through Term Ahead Market sub-segment was ₹3.42/kWh.
7. During the year, about 84% of the volume of electricity transacted through traders was at less than ₹6/kWh. About 51% of the volume was transacted at less than ₹4/kWh.
8. During 2013-14, both power exchanges transacted 97% of the volume of electricity at price less than ₹6/kWh. About 89% of the volume was transacted at less than ₹4/kWh.
9. During 2013-14, only 296 million units of electricity was exclusively bought during peak hours under bilateral transactions from traders (exclusive of banking). This was 1.26% of the total electricity bought under bilateral transaction from traders (excluding banking). A major part of this, 93.51%, was bought on round the clock (RTC) basis, followed by 5.23% exclusively bought in periods other than peak periods (OTP). The per unit price of electricity procured during RTC is high (₹4.30/kWh), when compared with the price during Peak period (₹3.79/kWh) and OTP (₹4.07/kWh).
10. It is observed from the block-wise and region-wise prices of electricity transacted through power exchanges in 2013-14 that the price of electricity in Southern Region (S1 and S2 regions) was high when compared to the price in other regions in both the power exchanges. This was mainly due to high demand for electricity in the Southern Region and due to congestion between NEW grid and SR grid (on December 31, 2013 both the grids were synchronized and thereafter a single integrated transmission network has evolved).
11. Level of competition among the trading licensees is shown for the period from 2004-05 to 2013-14. During the period, number of traders who were undertaking trading increased from 4 to 23 and concentration of market power (HHI based on volume of trade undertaken by the licensees) declined from high concentration (HHI of 0.5512) to

no concentration (HHI of 0.1475). The competition among the trading licensees resulted in increase in volume and decrease in prices in the short-term bilateral market.

12. The weighted average trading margin charged by the trading licensees in 2013-14 was 4 paise/kWh or less, which is in line with the CERC Trading Margin Regulations, 2010.
13. The procurement of power by the industrial consumers through power exchanges began in the year 2009. In both power exchanges, Open Access industrial consumers bought 18.07 BU of electricity, which formed 60.20% of the total day ahead volume transacted in the power exchanges during 2013-14.
14. The weighted average price of electricity bought by open access consumers at IEX was lower (₹2.88/kWh) compared to the weighted average price of total electricity transacted through IEX (₹2.90/kWh). The weighted average price of electricity bought by open access consumers at PXIL was lower (₹2.59/kWh) compared to the weighted average price of total electricity transacted through PXIL (₹2.60/kWh).
15. The year also witnessed constraints on the volume of electricity that could be transacted through power exchanges, mainly due to transmission congestion. During 2013-14, the actual transacted volume was about 16 % less than unconstrained volume. Because of congestion and the splitting of day ahead market at both the power exchanges, the congestion amount collected during the year was ₹392.33 crore.
16. In 2013-14, the number of Solar RECs transacted on IEX and PXIL were 53,056 and 13,624 respectively and the market clearing prices of these RECs were ₹9725/MWh and ₹9666/MWh on IEX and PXIL respectively. During the year, market clearing volume of Non-Solar RECs transacted on IEX and PXIL were 12,71,267 and 14,10,747 respectively and the market clearing price of these RECs was ₹1500/MWh on both IEX and PXIL.

Introduction

A brief analysis of the short-term transactions of electricity in India has been done in this Report on Short-term Power Market³ for the year 2013-14. Here, “short-term transactions of electricity” refers to the contracts less than one year for the following trades:

- (a) Electricity traded under bilateral transactions through Inter-State Trading Licensees (only inter-state trades),
- (b) Electricity traded directly by the Distribution Licensees (also referred as Distribution Companies or DISCOMs),
- (c) Electricity traded through Power Exchanges (Indian Energy Exchange Ltd (IEX) and Power Exchange India Ltd (PXIL)), and
- (d) Unscheduled Interchange (UI).

The analysis includes:

- (i) Yearly/monthly/daily trends in short-term transactions of electricity;
- (ii) Time of the day variation in volume and price of electricity transacted through traders and power exchanges;
- (iii) Trading margin charged by trading licensees for bilateral transactions;
- (iv) Analysis of open access consumers on power exchanges;
- (v) Major sellers and buyers of electricity in the short term market;
- (vi) Effect of congestion on volume of electricity transacted through power exchanges;
- (vii) Tariffs of long-term sources of power for various distribution companies; and
- (viii) Analysis of transactions of Renewable Energy Certificates (RECs) through power exchanges.

³ Although unscheduled interchange (UI) is not a market mechanism, electricity transacted under UI is often considered a part of short-term transaction. Also, electricity transacted bilaterally directly between the distribution companies (without involving trading licensees or power exchanges) is also considered a part of short-term market. In the year 2013-14, the volume of UI was about 21.47 BU and that between distribution companies was about 17.38 BU.

1. Yearly Trends in Short-term Transactions of Electricity (2008-09 to 2013-14)

The analysis on yearly trends in short-term transactions includes the electricity transacted through the following segments:

- trading licensees (inter-state part only) under bilateral transactions or “bilateral trader” segment ,
- power exchange segment with transactions in both Day Ahead and Term Ahead Markets,
- UI segment, and
- direct transactions of electricity between DISCOMs.

Inter-state trading licensees (traders) have been undertaking trading in electricity since 2004 and the power exchanges started operating since 2008. The two power exchanges, IEX and PXIL started their operations in June 2008 and October 2008 respectively. As of March 2014, there were 42 inter-state trading licensees (list is enclosed at Annexure-I) and two power exchanges.

1.1.Total Short-term Transactions of Electricity with respect to Total Electricity Generation

Total volume of short-term transactions of electricity increased from 65.90 BU in 2009-10 to 104.64 BU in 2013-14. The annual growth in volume was 24% from 2009-10 to 2010-11, 16% from 2010-11 to 2011-12, 5% from 2011-12 to 2012-13 and 6% from 2012-13 to 2013-14. Total volume of short-term transactions of electricity as percentage of total electricity generation has increased from 9% in 2009-10 to 11% in 2013-14 (Table-1).

Table-1: Total Volume of Short-term Transactions of Electricity with respect to Total Electricity Generation			
Year	Total Volume of Short-term Transactions of Electricity (BU)	Total Electricity Generation (BU)	Total volume of Short-term Transactions of Electricity as % of Total Electricity Generation
2009-10	65.90	764.03	9%
2010-11	81.56	809.45	10%
2011-12	94.51	874.17	11%
2012-13	98.94	907.49	11%
2013-14	104.64	962.90	11%
<i>Source: NLDC</i>			

The analysis of yearly trends of short-term transactions of electricity for various segments, i.e. electricity transacted through traders and power exchanges, UI, and directly between DISCOMs is included in the sections that follow.

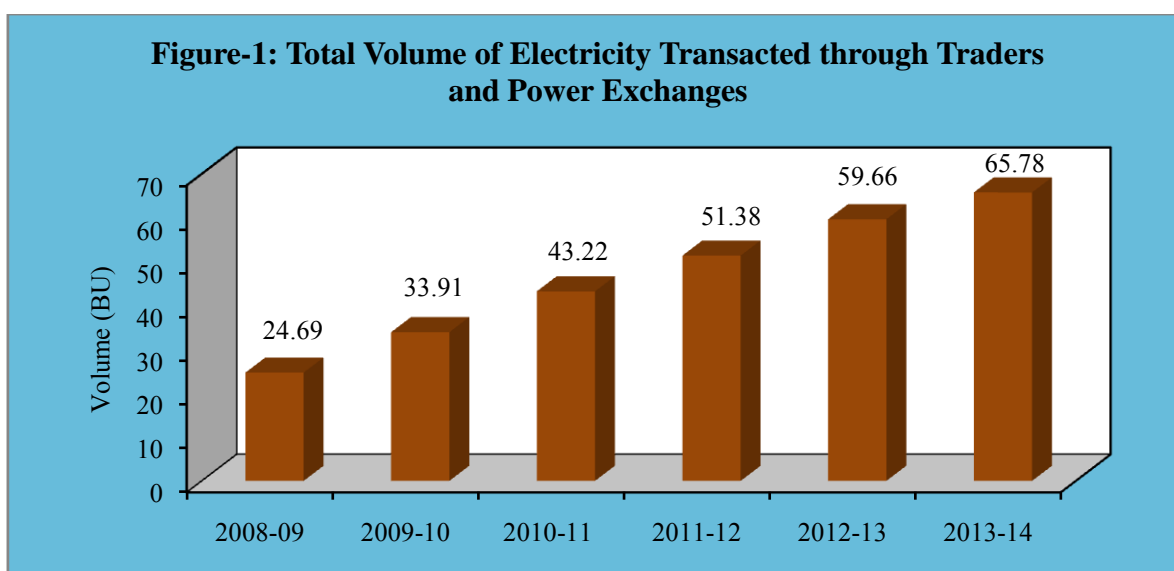
1.1.1 Electricity Transacted through Traders and Power Exchanges

Table-2, Table-3, Figure-1 & Figure-2 show details of volume of electricity transacted through traders under bilateral transactions and through power exchanges for the period from 2008-09 to 2013-14. The volume of electricity transacted through traders and power exchanges increased from 24.69 BU in 2008-09 to 65.78 BU in 2013-14. The share of electricity transacted through traders and power exchanges (in volume terms) as a percentage of total short-term transactions of electricity has increased from 51.45% in 2009-10 to 62.87% in 2013-14. The growth in volume for this segment during the year 2013-14 as compared to 2012-13 was 6.12 BU (10%). The increase in power exchange segment volume was 7.13 BU (30%) whereas bilateral trader segment volume declined by 1.01 BU (-2.79%).

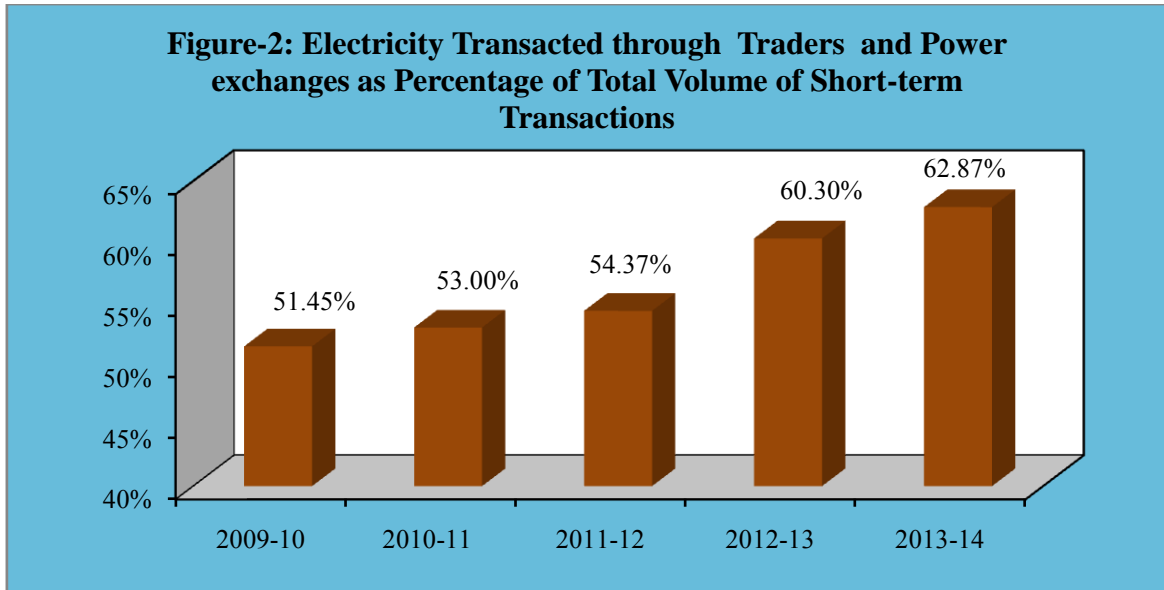
Table-2: Volume of Electricity Transacted through Traders and Power Exchanges

Year	Electricity Transacted through traders (BUs)	Electricity Transacted through IEX (BUs)		Electricity Transacted through PXIL (BUs)		Electricity Transacted through IEX and PXIL (BUs)	Total (BUs)
		Day Ahead Market	Term Ahead Market	Day Ahead Market	Term Ahead Market		
2008-09	21.92	2.62		0.15		2.77	24.69
2009-10	26.72	6.17	0.095	0.92	0.003	7.19	33.91
2010-11	27.70	11.80	0.91	1.74	1.07	15.52	43.22
2011-12	35.84	13.79	0.62	1.03	0.11	15.54	51.38
2012-13	36.12	22.35	0.48	0.68	0.04	23.54	59.66
2013-14	35.11	28.92	0.34	1.11	0.30	30.67	65.78

Note1: The volume of electricity transacted through traders in 2008-09 (April to July 2008) includes cross border trading and intra-state trading volume.

Figure-1: Total Volume of Electricity Transacted through Traders and Power Exchanges**Table-3: Electricity Transacted through Traders and Power Exchanges as percentage of Total Volume of Short-term**

Year	Volume of Electricity Transacted through Traders and Power Exchanges (BUs)	Total Short-term Transactions of Electricity (BUs)	Electricity Transacted through traders and PXs as % of Total Volume of Short-term
2009-10	33.91	65.90	51.45%
2010-11	43.22	81.56	53.00%
2011-12	51.38	94.51	54.37%
2012-13	59.66	98.94	60.30%
2013-14	65.78	104.64	62.87%



The price of electricity transacted through traders and Power Exchanges is shown in Table-4 and Figure-3. The weighted average price of electricity transacted through traders and power exchanges declined from ₹7.29/kWh and ₹7.49/kWh respectively in 2008-09 to ₹4.29/kWh and ₹2.90/kWh respectively in 2013-14.

The decreasing trend in weighted average prices affected the market size of this segment in monetary terms (Table-5). In volume terms (BU terms) the size of this segment increased by about 10 % in the year 2013-14 compared to 2012-13, whereas in monetary terms the growth has declined by about 1%. The power exchange sub-segment registered a high growth of about 30% in volume terms and a low growth of about 3% in monetary terms. The bilateral trader segment registered a negative growth in both volume terms (-3%) and monetary terms (-4%).

Table-4: Price of Electricity Transacted through Traders & Power Exchanges		
Year	Price of Electricity transacted through Traders (₹/kWh)	Price of Electricity transacted through Power Exchanges (DAM+TAM) (₹/kWh)
2008-09	7.29	7.49
2009-10	5.26	4.96
2010-11	4.79	3.47
2011-12	4.18	3.57
2012-13	4.33	3.67
2013-14	4.29	2.90

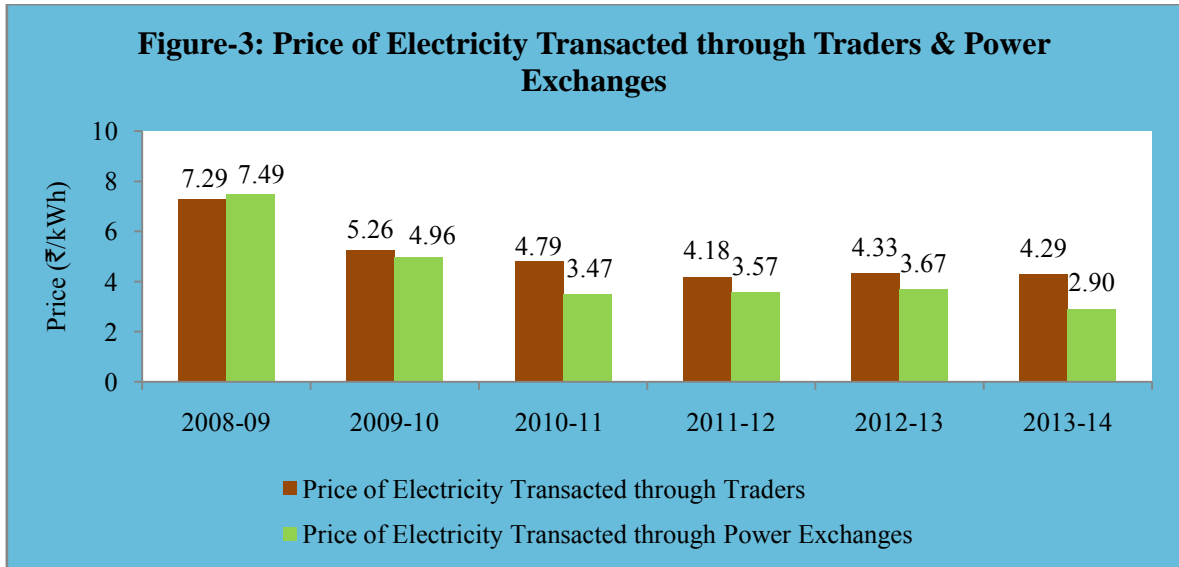


Table-5: Size of the Bilateral Trader and Power Exchange Market in Monetary Terms

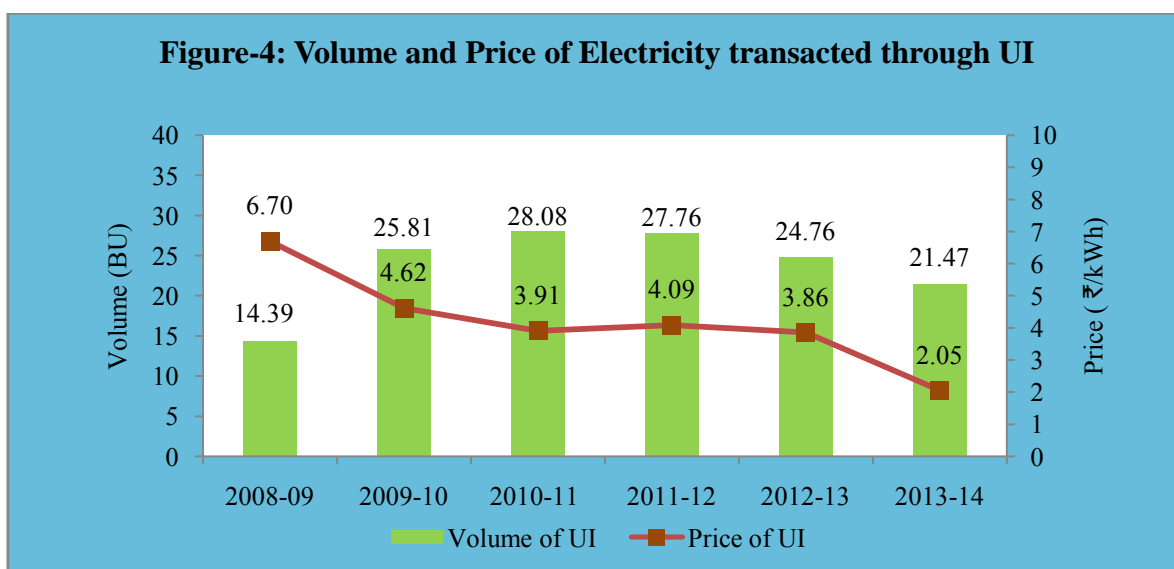
Year	Electricity Transacted through traders (BU)	Price of Electricity Transacted through traders (₹/kWh)	Size of bilateral trader Market (₹ Crore)	Electricity Transacted through Power Exchanges (BU)	Price of Electricity Transacted through Power Exchanges (₹/kWh)	Size of Power Exchange Market (₹ Crore)	Total Size of the bilateral trader + Power Exchange Market (₹ Crore)
2009-10	26.72	5.26	14055	7.19	4.96	3563	17617
2010-11	27.7	4.79	13268	15.52	3.47	5389	18657
2011-12	35.84	4.18	14979	15.54	3.57	5553	20532
2012-13	36.12	4.33	15624	23.54	3.67	8648	24272
2013-14	35.11	4.29	15061	30.67	2.90	8891	23952

1.1.2 Electricity Transacted through UI

The volume and price of electricity transacted through UI is shown in Table-6 and Figure-4. The volume and price of electricity transacted through UI in 2008-09 represents the period from August 2008 to March 2009. It can be observed from Table-6 that the volume of electricity transacted through UI declined from 25.81 BU in 2009-10 to 21.47 BU in 2013-14, and the volume of UI as percentage of total short-term volume declined to 21% in 2013-14 from 39% in 2009-10. It can also be observed from the table that the average price of UI (NEW Grid and SR Grid) declined from ₹4.62/kWh in 2009-10 to ₹2.05/kWh in 2013-14.

Table-6: Volume and Price of Electricity transacted through UI				
Year	Volume of UI (BU)	Total Volume of Short term (BU)	Volume of UI as % of total volume of Short term	Price of UI (₹/kWh)
2008-09	14.39	35.27	41%	6.70
2009-10	25.81	65.90	39%	4.62
2010-11	28.08	81.56	34%	3.91
2011-12	27.76	94.51	29%	4.09
2012-13	24.76	98.94	25%	3.86
2013-14	21.47	104.64	21%	2.05

Note: The data for the year 2008-09, represents the period from August 2008 to March 2009.

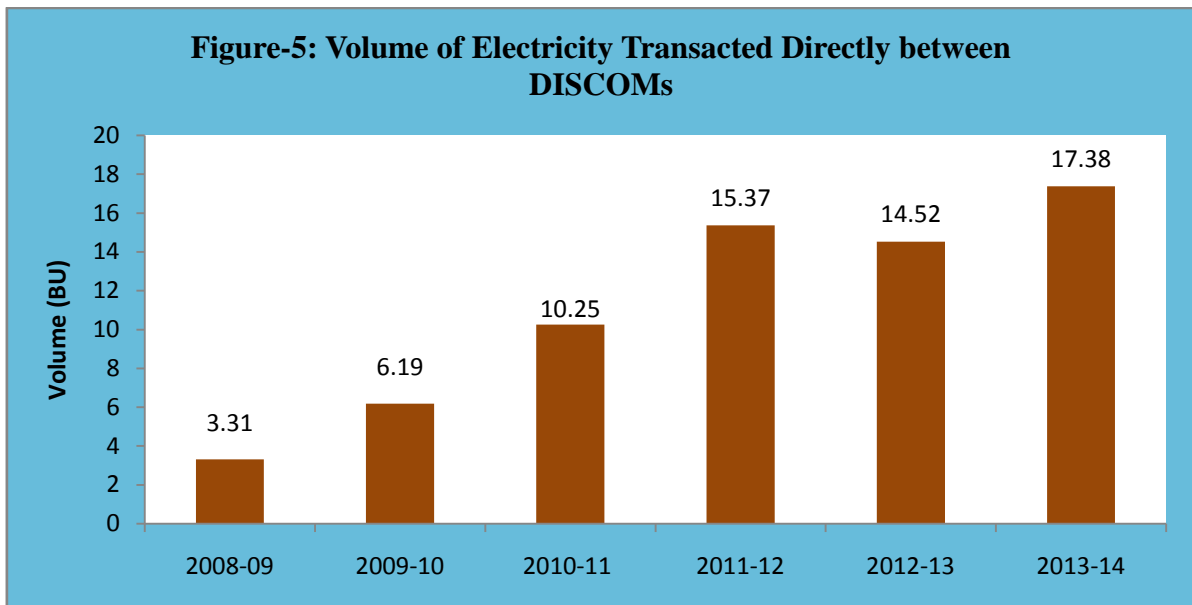


1.1.3 Electricity Transacted Directly Between DISCOMs

The volume of electricity transacted directly between DISCOMs is shown in Table-7 and Figure-5. It can be observed from the table that the volume of electricity transacted directly between DISCOMs increased from 6.19 BU in 2009-10 to 17.38 BU in 2013-14. It can also be observed that, the share of electricity transacted directly between DISCOMs as percentage to total volume of short-term transaction of electricity also increased from 9% to 15% in the same period. However, compared to 2012-13, the volume of electricity transacted directly between DISCOMs increased, whereas the share of electricity transacted directly between DISCOMs as percentage of total volume of short-term transaction of electricity remained the same in 2013-14.

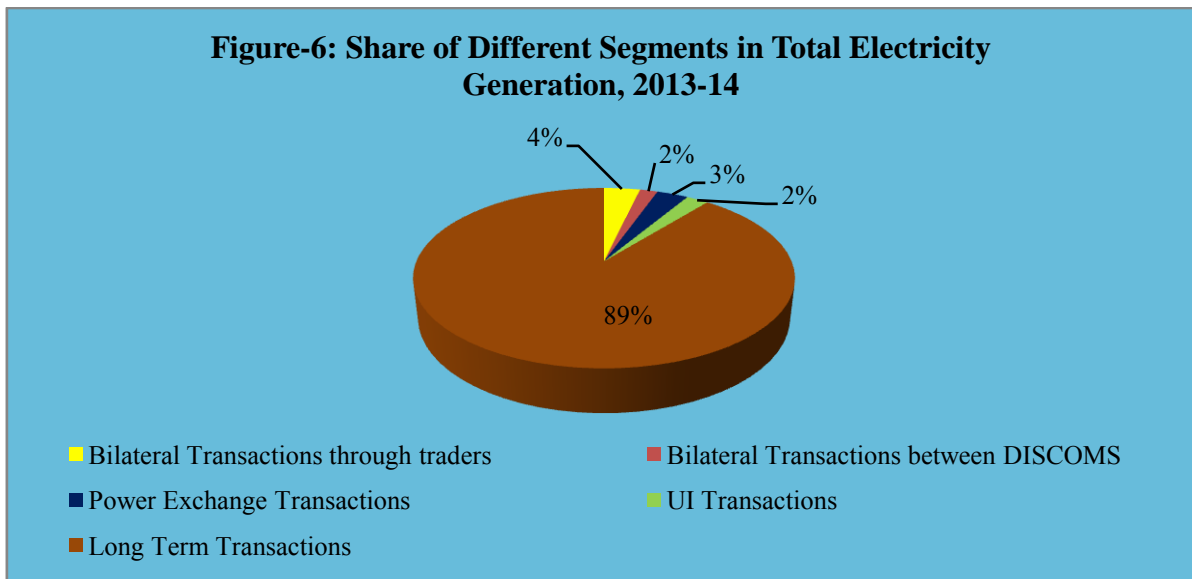
Table-7: Volume of Electricity Transacted Directly between DISCOMs			
Year	Volume of Electricity Transacted Directly between DISCOMs (BU)	Total Volume of Short term (BU)	Volume of Bilateral Direct as % of total volume of Short term
2008-09	3.31	35.27	9%
2009-10	6.19	65.9	9%
2010-11	10.25	81.56	13%
2011-12	15.37	94.51	16%
2012-13	14.52	98.94	15%
2013-14	17.38	104.64	15%

Note: The data for the year 2008-09 is for the period from August 2008 to March 2009.

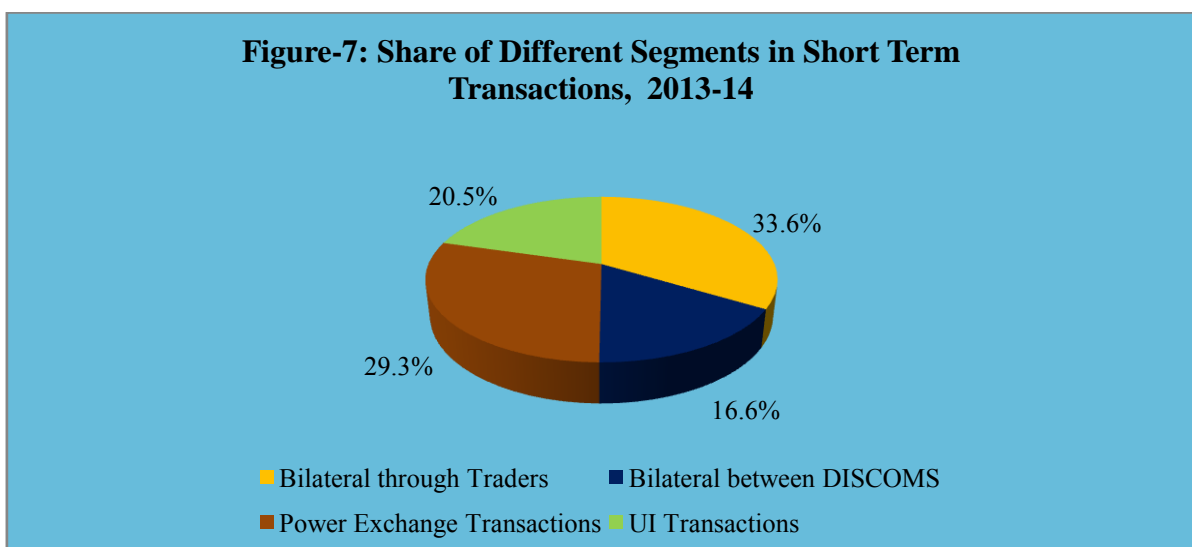


2. Monthly Trends in Short-term Transactions of Electricity (April 2013-March 2014)

During 2013-14, the share of the total short-term transactions in volume terms, including UI as a percentage of total electricity generation in the country was about 11 % (Figure-6 and Table-8).



The share of different segments within the total short-term transaction for the year 2013-14 has been shown in the Figure-7 below.

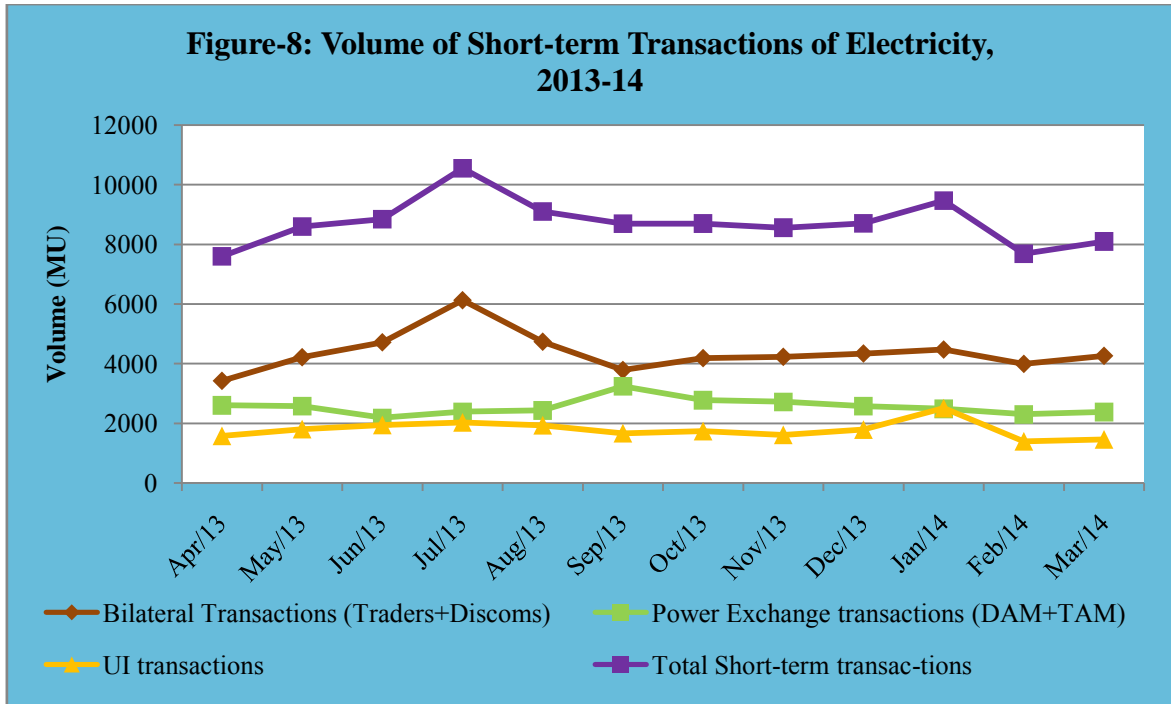


2.1. Volume of Short-term Transactions of Electricity

The volume of short-term transactions of electricity during different months of 2013-14 with break-up for different segments is shown in Table-8 and Figure-8.

Table-8: Volume of Short-term Transactions of Electricity (MUs), 2013-14							
Period	Bilateral through Traders	Bilateral between DISCOMS	Total Bilateral transactions	Power Exchange transactions (DAM+TAM)	UI transactions	Total Short-term transactions	Total Electricity Generation
Apr-13	2669	752	3422	2604	1580	7606	77557
May-13	2945	1271	4216	2578	1806	8599	83943
Jun-13	3258	1459	4717	2184	1944	8845	76108
Jul-13	4079	2053	6132	2388	2030	10550	80522
Aug-13	2870	1867	4737	2436	1935	9107	79481
Sep-13	2319	1468	3787	3242	1669	8698	82614
Oct-13	2514	1671	4185	2778	1739	8702	79431
Nov-13	2001	2228	4229	2719	1613	8561	77305
Dec-13	2624	1717	4341	2576	1789	8707	82235
Jan-14	3100	1374	4473	2488	2506	9468	83123
Feb-14	3116	876	3992	2300	1398	7690	75945
Mar-14	3616	646	4263	2379	1461	8102	84637
Total	35112	17381	52494	30671	21471	104635	962902
% share in total generation	4%	2%	5%	3%	2%	11%	100%
% share in Short-term Volume	33.6%	16.6%	50.2%	29.3%	20.5%	100%	

It is observed from Figure-8 that there is a cyclical trend in the total volume of short-term transactions of electricity. It is also observed from the figure that the volume of all segments of the short-term transactions of electricity does not reflect any trend of increase or decrease.



The volume of short-term transactions of electricity as percentage of total electricity generation varied between 9.57% and 13.10% during the period (Table-9).

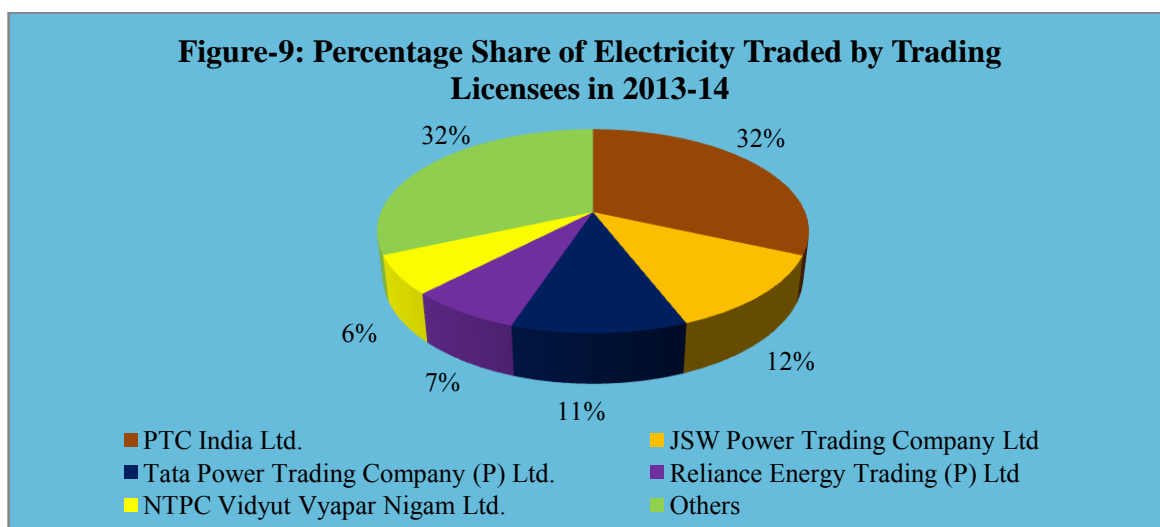
Table-9: Volume of Short-term transactions of electricity as % of total electricity generation	
Period	Short-term transactions as % of total electricity generation
Apr-13	9.81%
May-13	10.24%
Jun-13	11.62%
Jul-13	13.10%
Aug-13	11.46%
Sep-13	10.53%
Oct-13	10.96%
Nov-13	11.07%
Dec-13	10.59%
Jan-14	11.39%
Feb-14	10.13%
Mar-14	9.57%

There were 42 inter-state trading licensees as on 31.3.2014. However, of these, only 23 trading licensees actively traded during the year 2013-14 (Table-10).

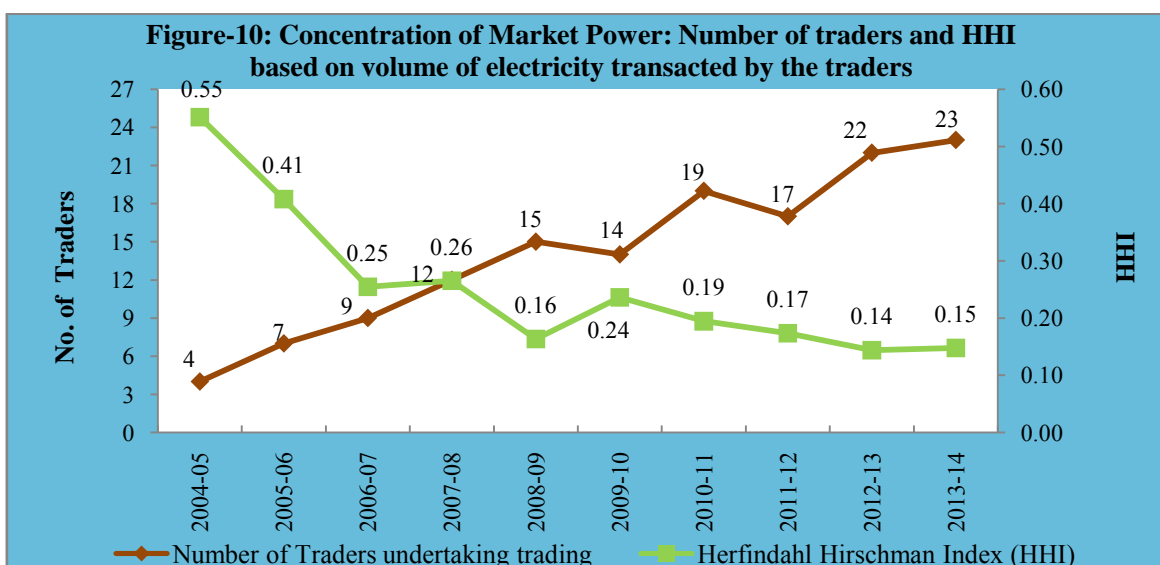
The volume of electricity transacted through traders (traders inter-state bilateral transactions + traders transactions through Power Exchanges) has been analysed using the Herfindahl-Hirschman Index (HHI) for measuring the competition among the traders (Table-10). Increase in the HHI generally indicates a decrease in competition and an increase of market power, whereas decrease indicates the opposite. A HHI value below 0.15 indicates no concentration of market power, the value between 0.15 to 0.25 indicates moderate concentration, the value above 0.25 indicates high concentration of market power. The HHI, based on the volume of electricity transacted through traders during 2013-14 was 0.1449, which indicated non-concentration of market power among the traders.

Table-10: Percentage Share of Electricity Transacted by Traders and HHI, 2013-14			
Sr No	Name of the Trading Licensee	Share of Electricity transacted by traders in 2013-14	Herfindahl Hirschman Index (HHI)
1	PTC India Ltd.	31.68%	0.1004
2	JSW Power Trading Company Ltd	12.40%	0.0154
3	Tata Power Trading Company (P) Ltd.	11.04%	0.0122
4	Reliance Energy Trading (P) Ltd	7.12%	0.0051
5	NTPC Vidyut Vyapar Nigam Ltd.	6.13%	0.0038
6	Adani Enterprises Ltd.	5.02%	0.0025
7	Mittal Processors (P) Ltd.	4.87%	0.0024
8	Shree Cement Ltd.	4.66%	0.0022
9	GMR Energy Trading Ltd.	3.33%	0.0011
10	Knowledge Infrastructure Systems (P) Ltd	2.83%	0.0008
11	Jaiprakash Associates Ltd.	2.80%	0.0008
12	Manikaran Power Ltd.	1.59%	0.0003
13	National Energy Trading & Services Ltd.	1.50%	0.0002
14	Instinct Infra & Power Ltd.	1.21%	0.0001
15	Pune Power Development Pvt. Ltd.	1.20%	0.0001
16	RPG Power Trading Company Ltd.	1.09%	0.0001
17	Essar Electric Power Development Corp. Ltd.	0.88%	0.0001
18	Arunachal Pradesh Power Corporation Pvt. Ltd.	0.37%	0.0000
19	Indrajit Power Technology (P) Ltd.	0.13%	0.0000
20	Customized Energy Solutions India (P) Ltd.	0.10%	0.0000
21	Ambitious Power Trading Company Ltd.	0.04%	0.0000
22	HMM Infra Ltd.	0.03%	0.0000
23	My Home Power Private Ltd.	0.00%	0.0000
Total Volume		100.00%	0.1475
Share of the Top 5 Trading		68.37%	
<i>Note: Percentage share in total volume traded by Licensees in 2013-14 computed based on the volume which includes the volume traded by inter-state trading licensees through bilateral and power exchanges.</i>			
<i>Source: Information submitted by Trading Licensees.</i>			

The percentage share of electricity transacted by major traders in the total volume of electricity transacted by all the traders is shown in Figure-9.



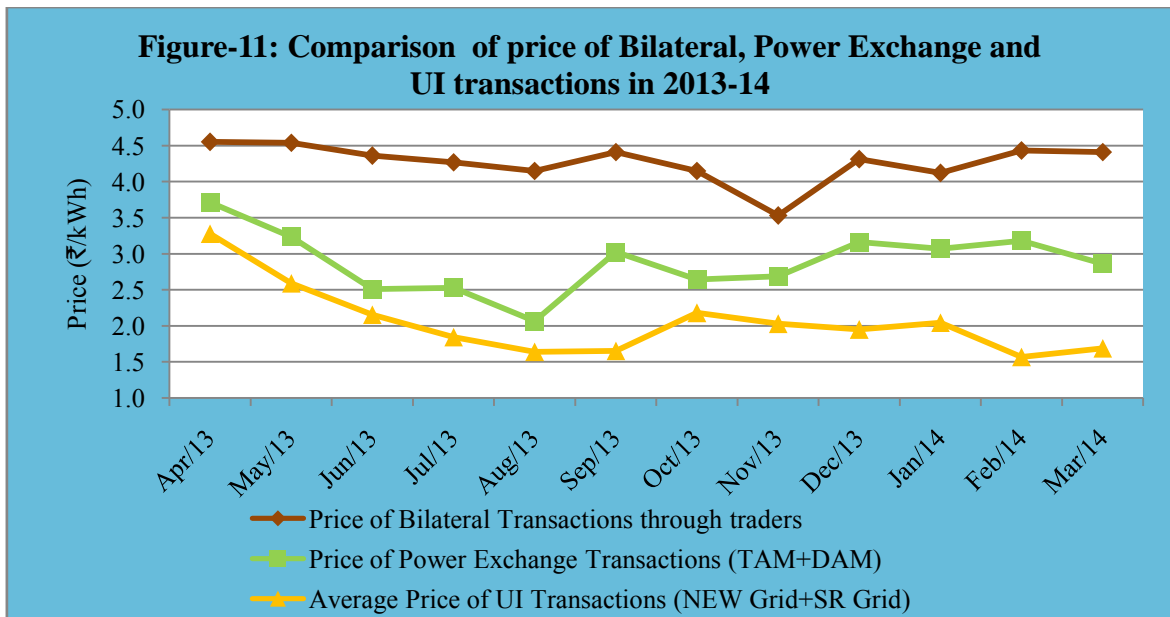
Level of competition among the traders (HHI based on volume of trade undertaken by the traders) is shown in Figure-10 for the period 2004-05 to 2013-14. Number of traders, who were undertaking trading bilaterally or through power exchanges, increased from 4 in 2004-05 to 23 in 2013-14. It can be observed from the figure that there is an inverse relationship between number of traders and the HHI. The concentration of market power declined from high concentration (HHI of 0.55) in 2004-05 to non-concentration (HHI of 0.1475) in 2013-14. The competition among the traders resulted in increase in volume and decrease in prices in the short-term bilateral market (Table-5).



2.2. Price of Short-term Transactions of Electricity

The monthly trends in price of short-term transactions of electricity are shown in Table-11 and Figure-11 & 12. The price analysis is mainly based on the average price of UI and the weighted average price of other short-term transactions of electricity. The price of bilateral trader transactions represents the price of electricity transacted through traders. The trends in price of electricity transacted through traders (bilateral trader transactions) were studied separately for total transactions as well as for the transactions undertaken Round the Clock (RTC), during Peak, and during Off-peak periods.

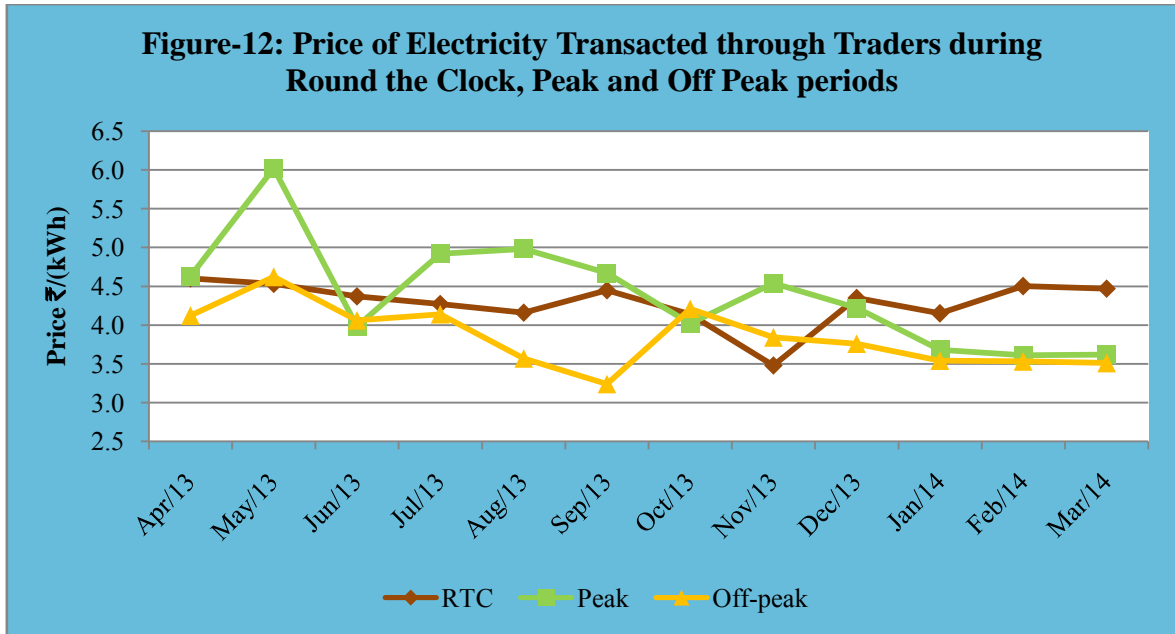
Table-11: Price of Short-term Transactions of Electricity (₹/kWh)								
Period	Bilateral through Traders				Power Exchange		UI	
	RTC	Peak	Off-peak	Total	IEX	PXIL	NEW Grid	SR Grid
Apr-13	4.60	4.63	4.12	4.55	3.74	2.71	2.27	4.29
May-13	4.53	6.02	4.62	4.54	3.26	2.44	1.73	3.45
Jun-13	4.37	3.98	4.06	4.36	2.52	2.15	1.64	2.67
Jul-13	4.27	4.92	4.14	4.27	2.54	2.11	1.43	2.26
Aug-13	4.16	4.98	3.57	4.15	2.07	1.89	1.30	1.98
Sep-13	4.45	4.67	3.24	4.41	2.98	2.82	1.62	1.69
Oct-13	4.14	4.02	4.21	4.15	2.65	2.41	1.76	2.60
Nov-13	3.48	4.54	3.84	3.53	2.69	2.59	2.04	2.02
Dec-13	4.35	4.22	3.76	4.31	3.16	3.05	2.09	1.81
Jan-14	4.15	3.68	3.54	4.12	3.05	3.02	1.87	2.22
Feb-14	4.50	3.61	3.53	4.43	3.17	2.94	1.55	1.59
Mar-14	4.47	3.62	3.51	4.41	2.86	2.76	1.69	1.69



It can be observed from the above figure that the price of electricity transacted through traders was relatively high when compared with the price of electricity transacted through power exchanges and UI during all the months in 2013-14.⁴

The trends in price of electricity transacted by traders during RTC, Peak and Off-peak periods are shown in Table-11 & Figure-12. It can be observed from the figure that the price of electricity during peak period is higher in most of the months from April to November 2013 when compared with the price during RTC and off peak periods. The price of electricity during RTC is high from December 2013 to March 2014 when compared with the price during peak and off peak periods.

⁴ The comparison between the price of power exchanges and the price of bilateral transactions should also be seen in the light that the delivery point for transactions of power exchanges is the periphery of regional transmission system in which the grid connected entity is located whereas the delivery point for bilateral transactions may vary from transaction to transaction. The delivery point may be state or regional periphery or any other point as per the contract executed.

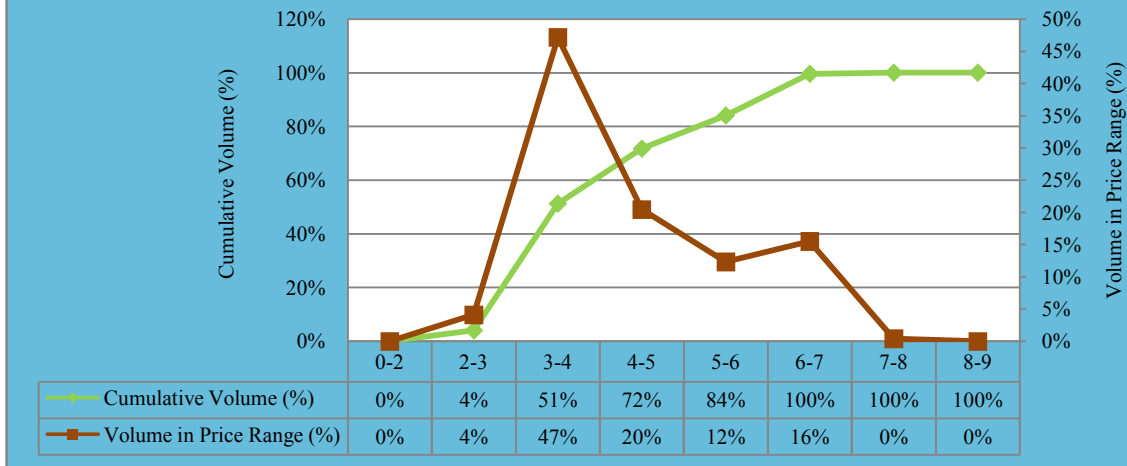


2.3 Volume of Electricity Transacted in Various Price Slabs

Volume of electricity transacted in various price slabs is shown for bilateral trader segment and power exchange segment separately. In the case of power exchanges, it is the Day Ahead Market sub-segment that has been considered.

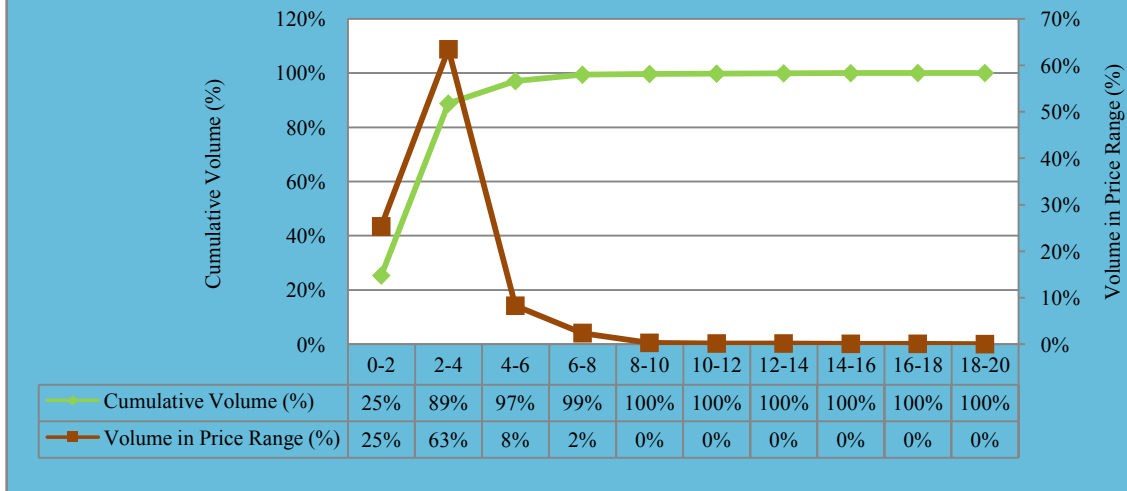
Volume of bilateral transactions at different price slabs in 2013-14 is depicted in Figure -13. The figure shows that 51% of the volume of electricity was transacted through traders at less than ₹4/kWh and 84% of the volume was transacted through traders at less than ₹6/kWh.

Figure-13: Volume of Bilateral Transactions at different Price Slabs, 2013-14



Volume of transactions in power exchanges at different price slabs in 2013-14 is depicted in Figure -14. The figure shows that 89% of the volume of electricity was transacted through power exchanges at less than ₹4/kWh and 97% of the volume was transacted through power exchanges at less than ₹6/kWh.

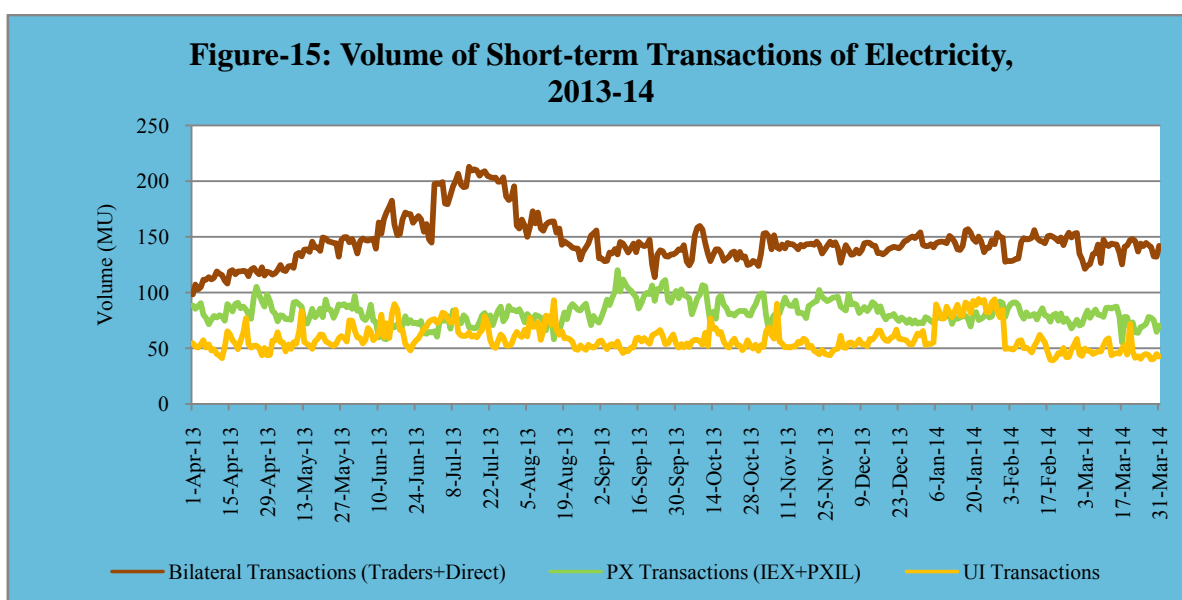
Figure-14: Volume of Transactions in Power Exchanges at different Price Slabs, 2013-14



3. Daily Trends in Short-term Transactions of Electricity (1st April 2013 to 31st March 2014)

3.1 Volume of Short-term Transactions of Electricity

Trends in daily volume of short-term transactions are shown in Figure-15. It can be observed from the figure that there was an increasing trend in the volume of electricity transacted through bilateral transactions from April to July 2013 and then a declining trend from July to September 2013. It can also be observed that there is low volatility in the volume of electricity transacted through power exchanges and through UI during the year.



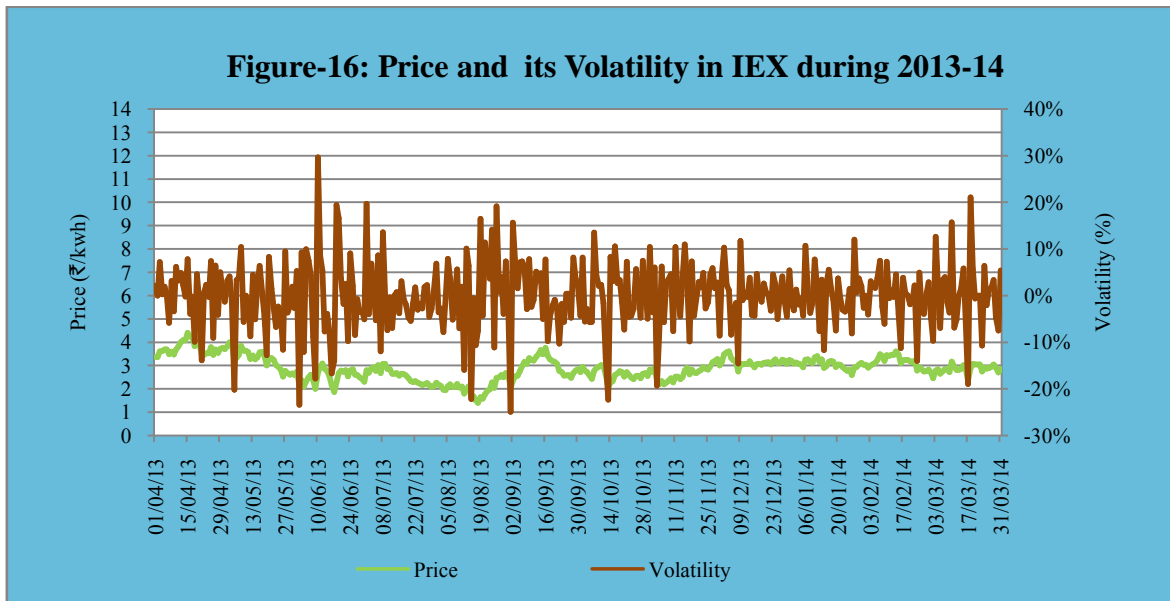
3.2 Price of Short-term Transactions of Electricity

Trends in daily price of short-term transactions have been illustrated in this section for power exchanges and UI.

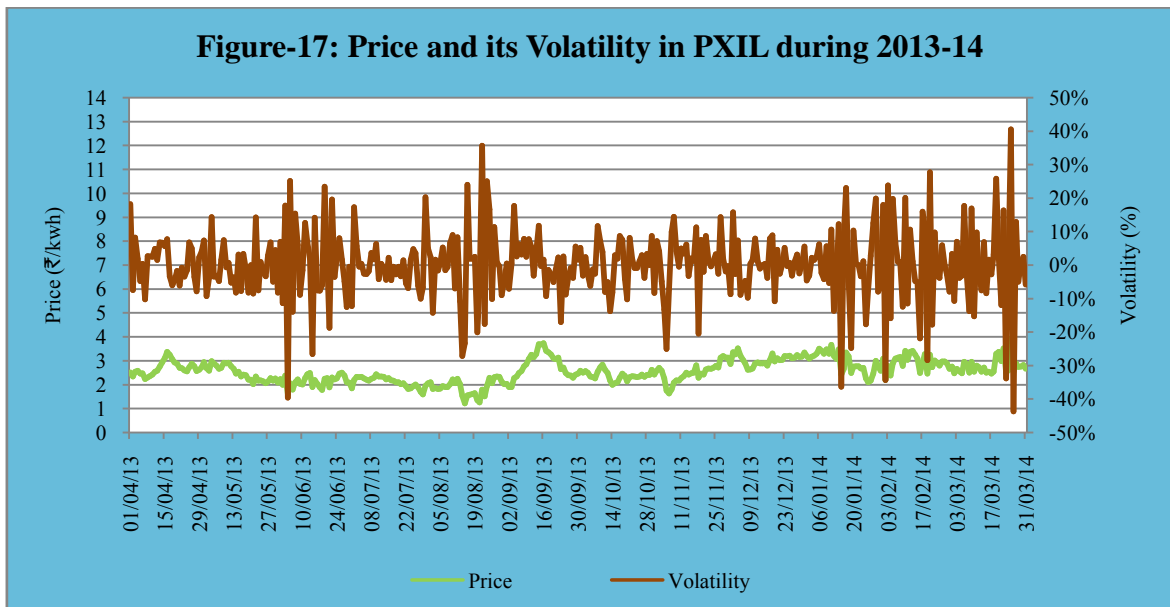
3.2.1 Trends in Price of Electricity Transacted through Power Exchanges

The weighted average price of electricity transacted through IEX and its volatility is shown in Figure-16. Volatility in the Price of electricity transacted through IEX has been

computed using daily data for 2013-14 and it works out to 7.16%. (See Annexure-II for historic volatility formula).



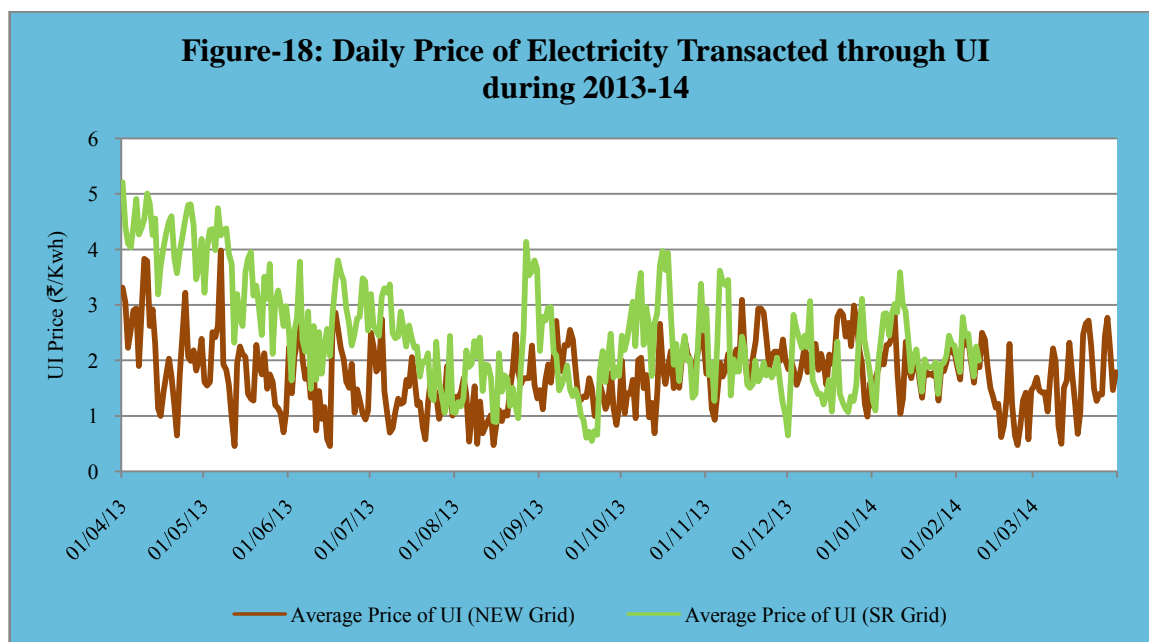
The weighted average price of electricity transacted through PXIL and its volatility is shown in Figure-17. Volatility in the Price of electricity transacted through PXIL has been computed using daily data for 2013-14 and it works out to 10.46%.



3.2.2 Trends in Price of Electricity Transacted through UI

Trends in daily price of electricity transacted through UI, both in the NEW Grid and SR Grid, are shown in Figure-18.

Till December 2013, there were two separate transmission networks (NEW Grid and SR Grid) in India which had separate frequency profiles, therefore, there were two UI prices. On December 31 2013, both NEW Grid and SR Grid were synchronized and thereafter a single integrated transmission network has been evolved. A single UI price can be seen after synchronization.



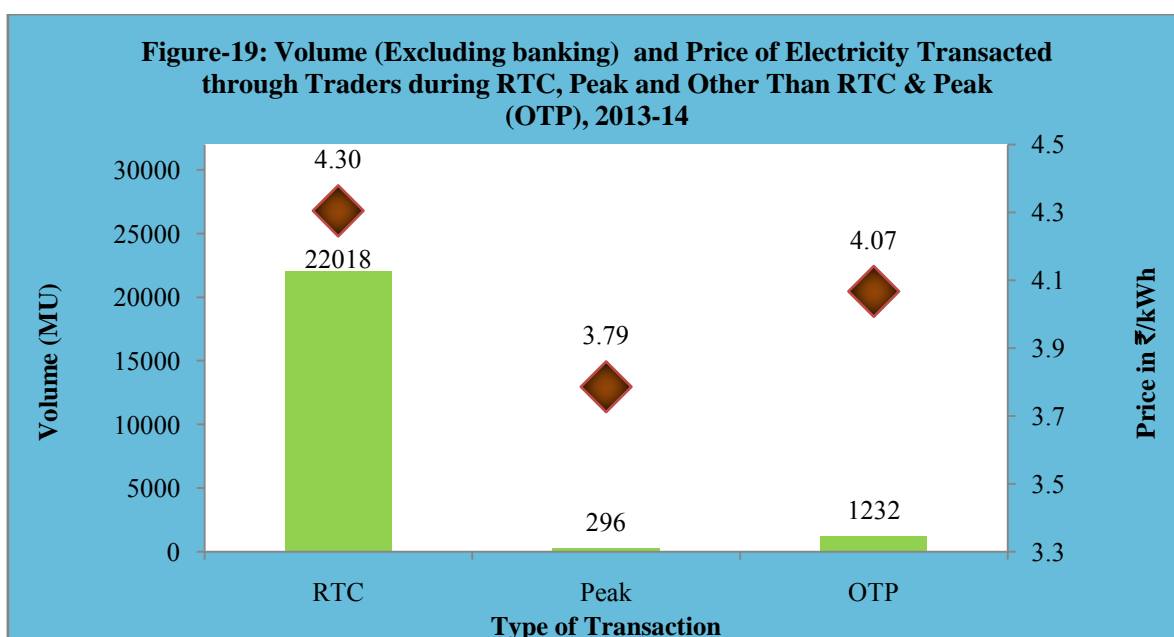
It can be observed from the above figure that there was divergence in the price of UI in the NEW Grid and SR Grid from April to September 2013 (prices in SR Grid higher than prices in NEW Grid), while there was convergence in the price of UI in the rest of the months. The divergence was due to higher demand in the two Southern states of Tamil Nadu and Kerala. It can also be observed from the above figure that there was single UI price after synchronization of both NEW Grid and SR Grid in December 2013.

4. Time of the Day Variation in Volume and Price of Electricity Transacted through Traders and Power Exchanges

In this section, time of the day variation in volume and price of electricity transacted through traders has been illustrated for RTC (Round the Clock), Peak period and other than RTC & Peak period. Time of the day variation in volume and price of electricity transacted through power exchanges is shown block-wise. Price of electricity transacted through power exchanges is also shown region-wise and block-wise.

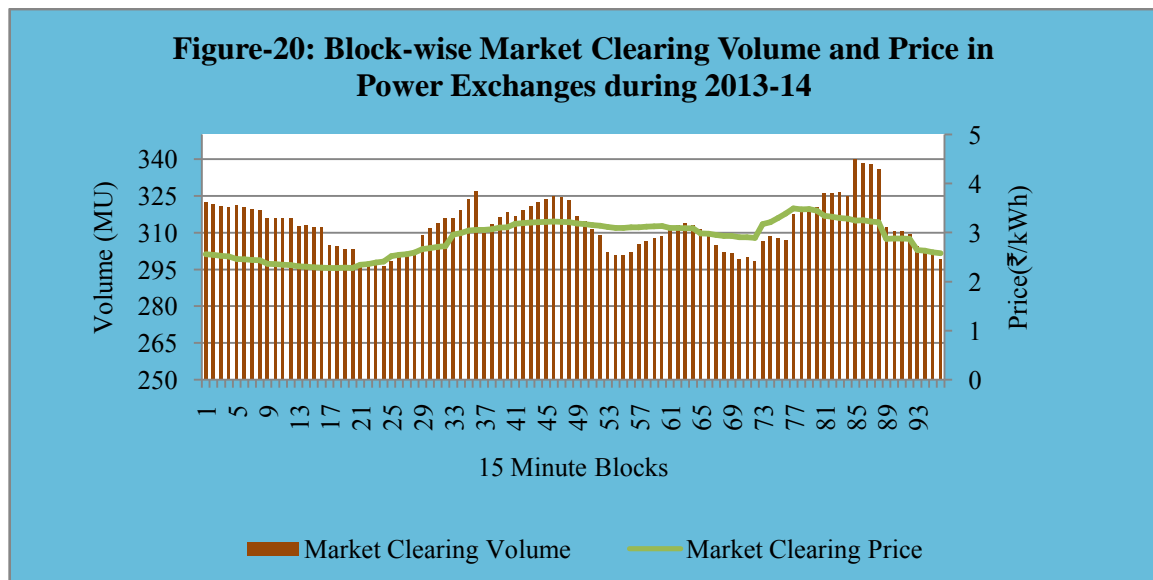
4.1 Time of the Day Variation in Volume and Price of Electricity Transacted through Traders

Time of the day variation in volume and price of electricity transacted through bilateral trader transactions is shown in Figure-19. The volume of the traders represents inter-state transaction volume i.e. excluding banking transaction volume. Time of the day variation in volume is shown during RTC (Round the Clock), Peak period and OTP (other than RTC & Peak period). Of the total volume, 93.50% was transacted during RTC followed by 5.20% during OTP, and 1.30% during peak period. It can be observed from the figure that there is hardly any volume transacted during peak period. It can also be observed that the weighted average price during RTC is high (₹4.30/kWh), when compared with the price during Peak period (₹3.79/kWh) and OTP (₹4.07/kWh).



4.2 Time of the Day Variation in Volume and Price of Electricity Transacted through Power Exchanges

Time of the day variation in volume and price of electricity transacted through power exchanges (Day ahead market) are shown block-wise in Figure-20. It can be observed from the figure that during peak period (between hours 18:00 to 23:00), the weighted average price of power exchanges was higher when compared to the weighted average price in rest of the hours. It can also be observed that volume of electricity transacted during peak period was higher when compared to the volume of electricity transacted in rest of the hours, indicating that there is more demand during peak period.



Region-wise and hour-wise prices of electricity transacted through power exchanges are shown in Figure-21 and Figure-22. It can be observed from the figures that during the entire 2013-14, the price of electricity in Southern region (S1 and S2 regions) was high when compared with the price in other regions in both the power exchanges. It can also be observed that in the evening peak period the price in the southern region was even much higher when compared with other regions. This is mainly due to high demand for electricity in the southern region. The prices were high due to congestion between NEW Grid and SR Grid, accompanied by market splitting on the power exchanges.

Figure-21: Region-wise and Block-wise Price of Electricity Transacted through IEX, 2013-14

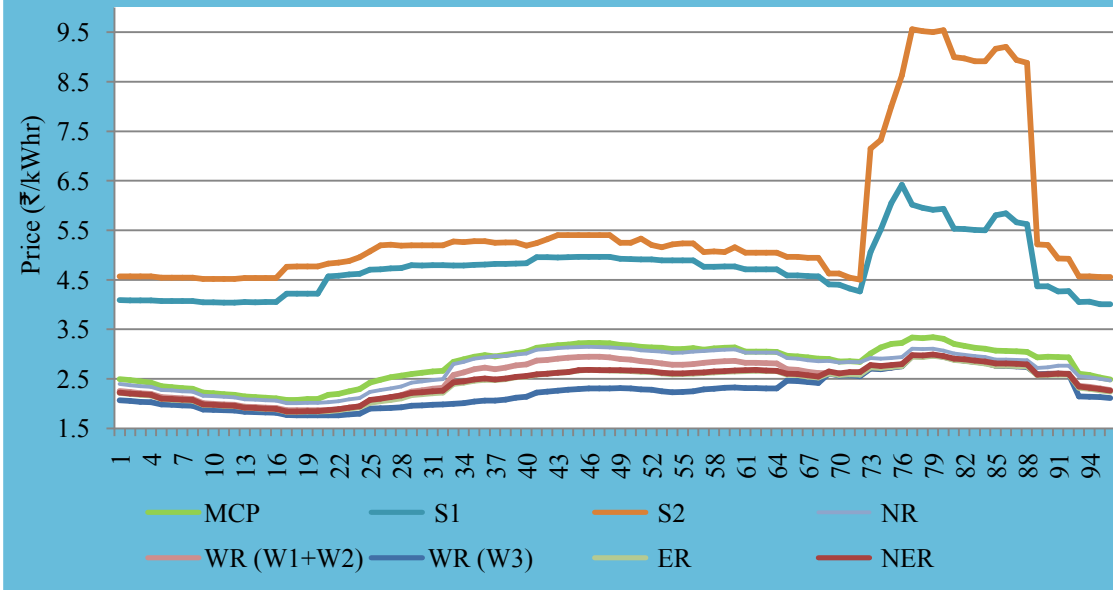
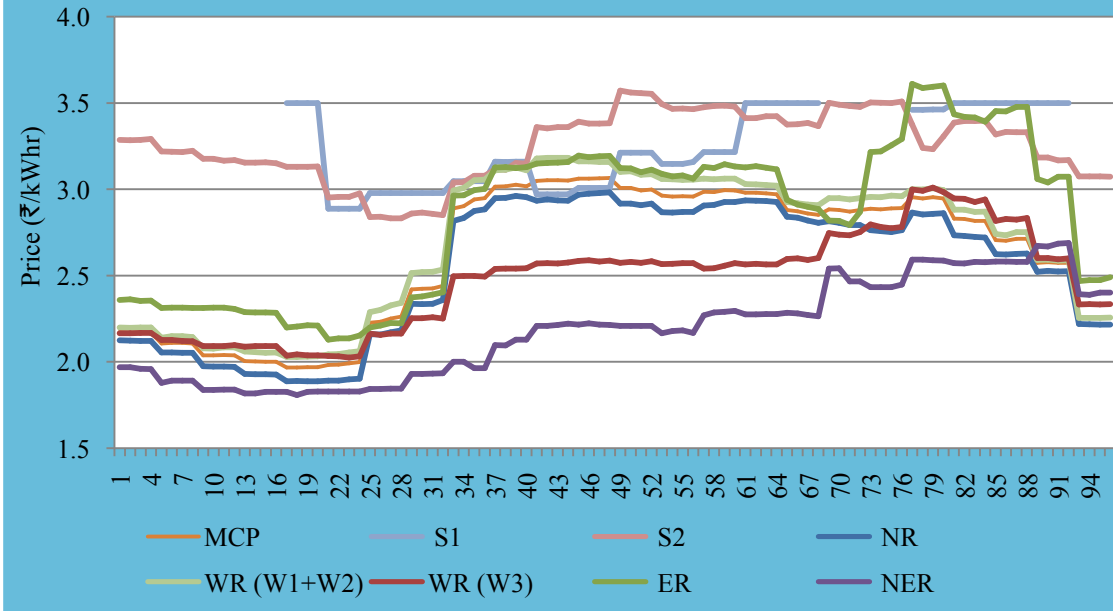


Figure-22: Region-wise and Block-wise Price of Electricity Transacted through PXIL, 2013-14

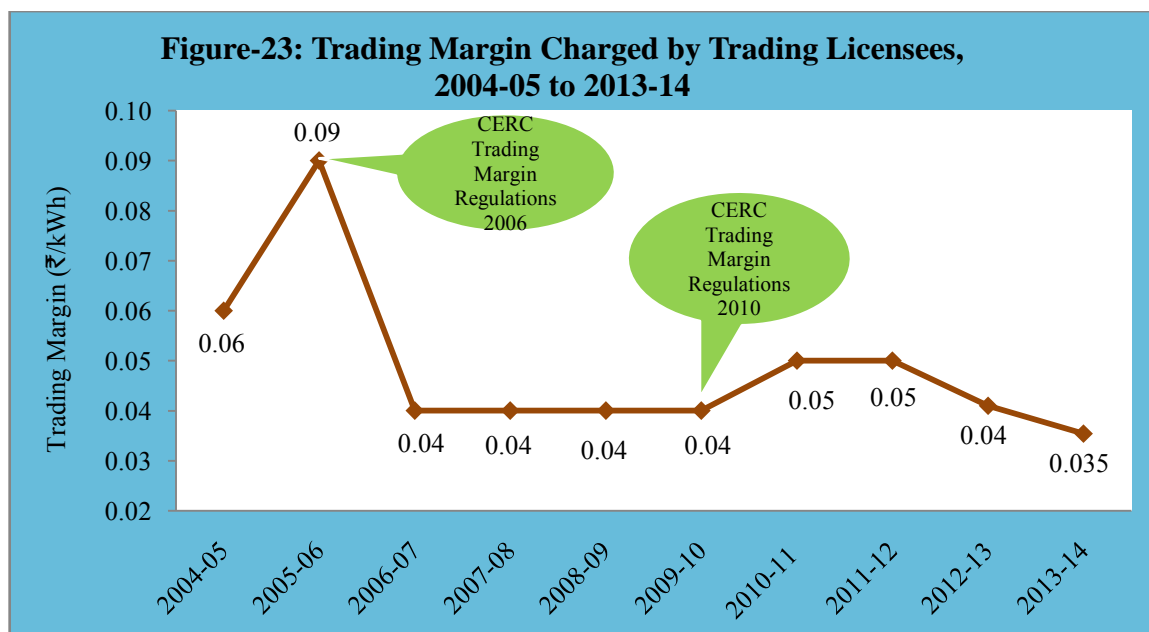


5. Trading Margin Charged by Trading Licensees for Bilateral Transactions

During the year 2004-05 (when trading started), the licensees voluntarily charged 5 paise/kWh or less as the trading margin. However, trading margin increased in 2005 and the weighted average trading margin charged by the licensees went up to 10 paise/kWh during April to September 2005 period. The Commission then decided to regulate the margin and fixed the trading margin at 4 paise/kWh vide "CERC (Fixation of Trading Margin) Regulations" notification dated 26.1.2006. As a result of these trading margin regulations, the licensees charged trading margin of 4 paise or less from 26.1.2006 onwards until revised Trading Margin Regulations, 2010 on 11.1.2010 (see Table-12, Table-13 & Figure-23) were issued.

Based on feedback and experience with 2006 regulations and considering various risks associated with the electricity trading business, CERC revised the trading margin in 2010. As per the CERC (Fixation of Trading Margin) Regulations, 2010, the trading licensees are allowed to charge trading margin up to 7 paise/kWh in case the sale price exceeds ₹3/kWh, and 4 paise/kWh where the sale price is less than or equal to ₹3/kWh. The trading licensees have been charging the trading margin accordingly, and weighted average trading margin for bilateral transactions during 2004-05 to 2013-14 is given in Table-12 and Figure-23.

Table -12: Weighted Average Trading Margin Charged by Trading Licensees, 2004-05 to 2013-14	
Period	Trading Margin (₹/kWh)
2004-05	0.06
2005-06	0.09
2006-07	0.04
2007-08	0.04
2008-09	0.04
2009-10	0.04
2010-11	0.05
2011-12	0.05
2012-13	0.04
2013-14	0.035
<i>Note 1: Weighted Average Trading Margin is computed based on all Inter-state Trading Transactions excluding Banking Transactions</i>	



Weighted average trading margin charged by the trading licensees for bilateral transactions for different sale price ranges during 2013-14 is provided in Table-13 below.

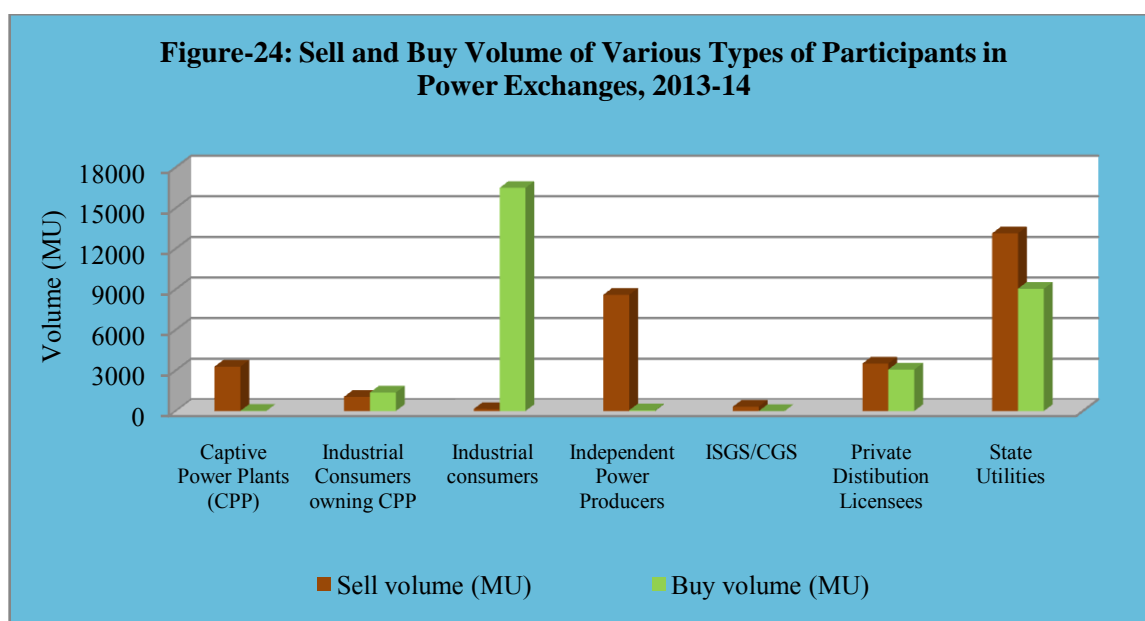
Table -13: Weighted Average Trading Margin Charged by Trading Licensees during 2013-14	
Sale Price of Electricity Transacted by Trading Licensees(₹/kWh)	Weighted Average Trading Margin Charged by Trading Licensees(₹/kWh)
When Sale Price is less than or Equal to ₹3/kWh	0.02
When Sale Price is greater than ₹3/kWh	0.04
<i>Note 1: Weighted Average Trading Margin is computed based on all Inter-state Trading Transactions excluding Banking Transactions</i>	

6. Analysis of Open Access Consumers on Power Exchanges

This section contains analysis of various types of participants and analysis of open access consumers in day ahead market of power exchanges.

6.1 Analysis of Various Types of Participants in Power Exchanges

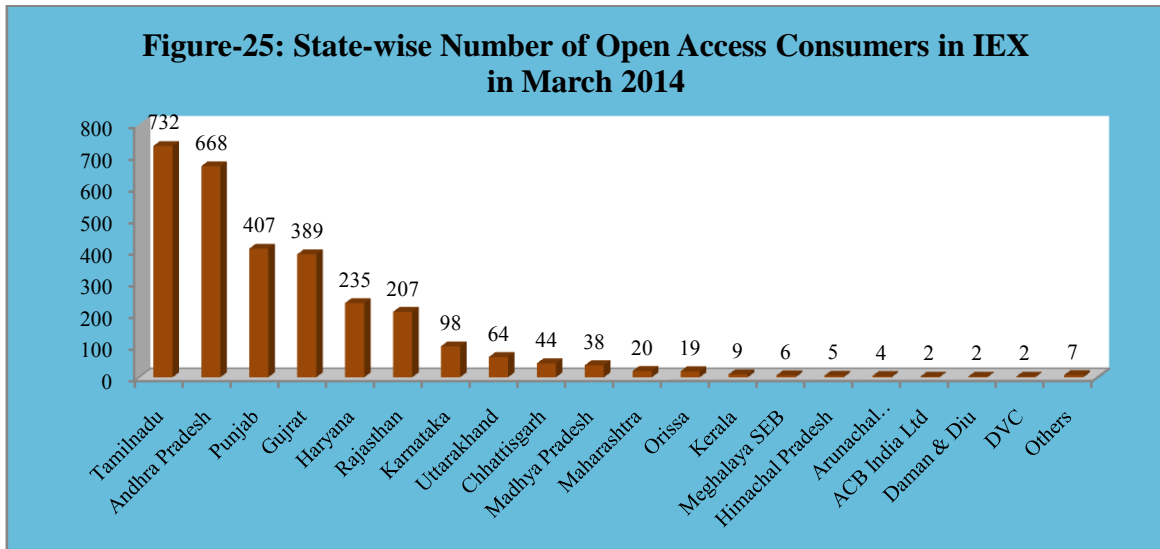
There are seven types of participants in both the power exchanges, as shown in Figure-24. It can be observed from the figures that major sellers of electricity through power exchanges were state utilities followed by independent private producers, private distribution licensees and captive power plants. It can also be observed that major buyers of electricity through power exchanges were industrial consumers, state utilities and private distribution licensees.



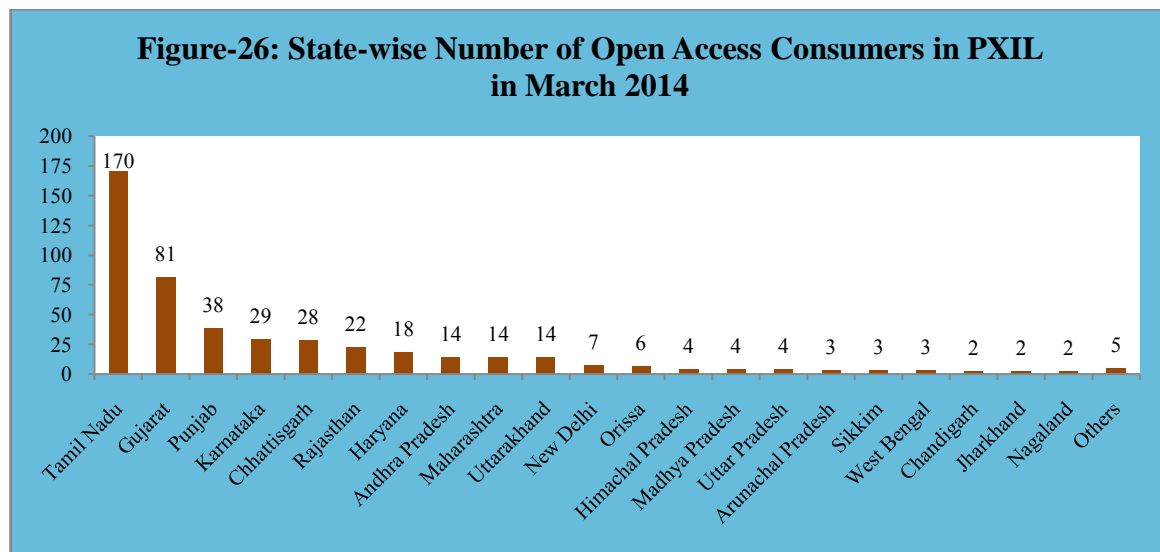
6.2 Analysis of Open Access Consumers in Power Exchanges

The year 2010-11 witnessed collective open access transactions, a significant development in procurement of power by the industrial consumers through power exchanges. It can be observed that 2958 Open Access (OA) Consumers were procuring part of their power requirements through IEX at the end of March 2014. These consumers were mostly located in Tamil Nadu, Andhra Pradesh, Punjab and Gujarat (Figure-25).

During the year, these OA consumers procured a total of 17575 MU of electricity through IEX. In 2013-14, the weighted average price of electricity bought by OA consumers at IEX was lower (₹2.88/kWh) when compared to the weighted average price of total electricity transacted through IEX (₹2.90/kWh).

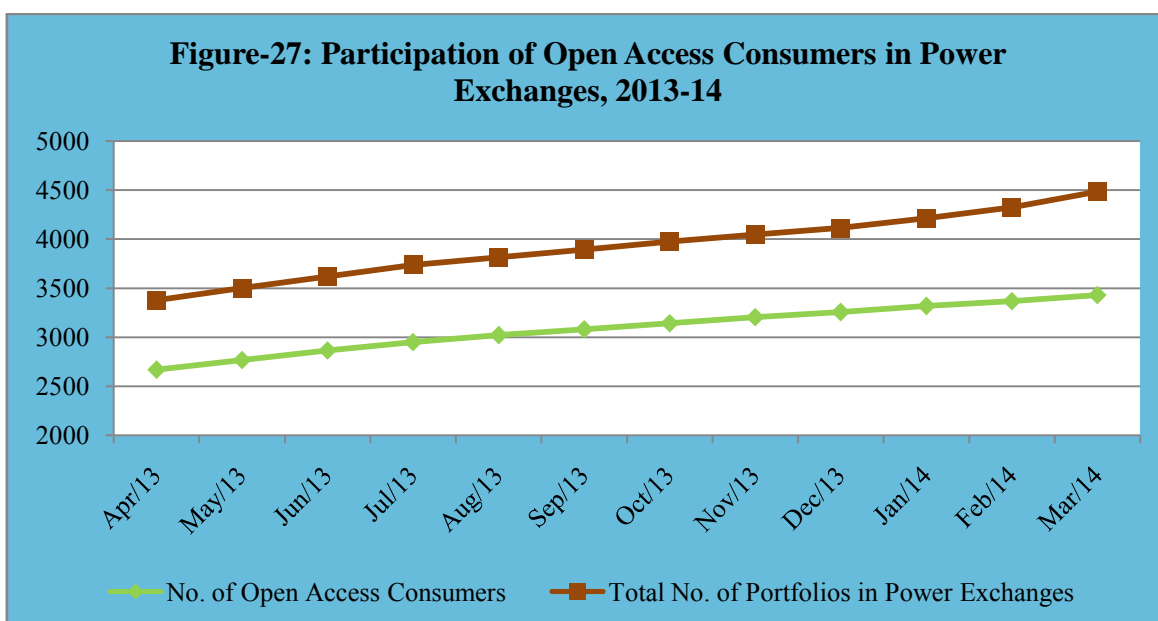


About 473 OA consumers procured a part of their power requirements through PXIL. These consumers were mostly located in Tamil Nadu, Gujarat and Punjab (Figure-26). During the year, these OA consumers procured a total of about 503 MU of electricity through PXIL. In 2013-14, the weighted average price of electricity bought by open access consumers at PXIL was lower (₹2.59/kWh) when compared to the weighted average price of total electricity transacted through PXIL (₹2.60/kWh).



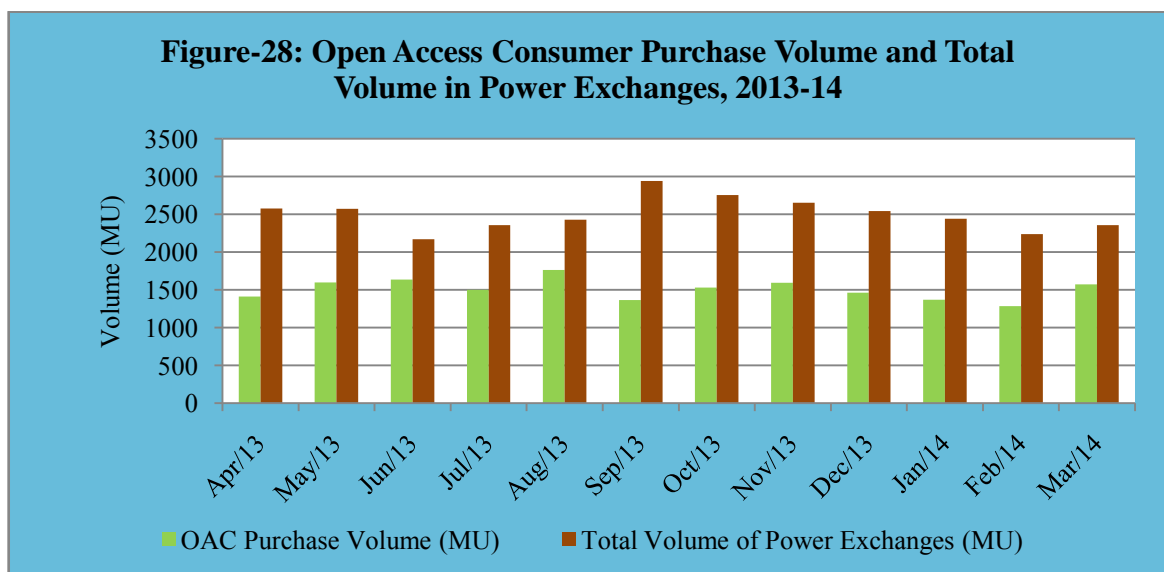
In Table-14 & Figure-27, a month-wise comparison is made between the number of OA consumer participants and the total number of portfolios in Power Exchanges. It can be seen that the number of OA consumers as a percentage of total number of portfolios in Power Exchanges was varying between 76.66% and 79.26% during 2013-14. It can be observed from the figure that there is an increasing trend in the number of OA consumers and total number of portfolios in both power exchanges.

Table-14: Number of Open Access Consumers in Power Exchanges, 2013-14			
Month	No. of Open Access Consumers	Total No. of Portfolios in Power Exchanges	% of Open Access Consumers
Apr-13	2668	3378	78.98%
May-13	2768	3501	79.06%
Jun-13	2866	3619	79.19%
Jul-13	2951	3736	78.99%
Aug-13	3021	3815	79.19%
Sep-13	3081	3894	79.12%
Oct-13	3144	3976	79.07%
Nov-13	3206	4045	79.26%
Dec-13	3256	4114	79.14%
Jan-14	3318	4211	78.79%
Feb-14	3369	4324	77.91%
Mar-14	3431	4482	76.55%



In Table-15 & Figure-28, a month-wise comparison is shown between purchase volume of OA consumers and total volume of Power Exchanges. During 2013-14, volume of electricity procured by OA consumers as a percentage of total volume transacted in Power Exchanges was varying between 46.37% and 75.41%. For the year as a whole, the volume procured by OA consumers as a percentage of total volume transacted in Power Exchanges was 60.20%.

Table-15: Participation by Volume of Open Access Consumers in Day Ahead Market of Power Exchanges, 2013-14			
Month	OAC Purchase Volume (MU)	Power Exchanges Total Volume (MU)	% OAC Purchase Participation
Apr-13	1411.82	2576.54	54.80%
May-13	1595.75	2572.52	62.03%
Jun-13	1634.74	2167.76	75.41%
Jul-13	1500.07	2357.72	63.62%
Aug-13	1762.30	2429.77	72.53%
Sep-13	1363.28	2939.84	46.37%
Oct-13	1529.93	2754.64	55.54%
Nov-13	1593.39	2653.75	60.04%
Dec-13	1462.01	2543.14	57.49%
Jan-14	1370.08	2441.82	56.11%
Feb-14	1284.77	2236.98	57.43%
Mar-14	1570.06	2356.78	66.62%
Total	18078.20	30031.26	60.20%



7. Major Sellers and Buyers of Electricity in the Short term market

Table-16 and Table-17 show top 10 sellers and buyers of electricity through traders (bilateral trader segment transactions). The same data for IEX is shown in Table-18 and Table-19 and for PXIL in Table-20 and Table-21. It can be seen that the dominant sellers, both at the power exchanges and traders, are a mixed group comprising of independent power producers, distribution companies, state government agencies, and captive power plants. The major buyers from traders and at power exchanges are mostly state distribution companies.

Table-16: Major Sellers of Electricity through Traders, 2013-14					
S.No	Seller	State	Volume (MU)	Approximate percentage of total volume transacted through traders	Weighted Average Sale Price in ₹/kWh
1	JSWEL	Karnataka	3744.02	15.90%	6.06
2	GOHP(ADHPL+Malana2+KWHEPS+Budhil)	Himachal Pradesh	2529.38	10.74%	3.52
3	APL	Gujarat	2327.53	9.88%	3.99
4	SEL	Orissa	2306.17	9.79%	3.96
5	KWHEPS	Himachal Pradesh	1748.81	7.43%	3.79
6	JPL	Chhattisgarh	1548.03	6.57%	3.42
7	APNRL	Jharkhand	987.76	4.19%	3.58
8	GRIDCO	Orissa	864.60	3.67%	5.56
9	CSPTC+CSPDC + Chhattisgarh	Chhattisgarh	767.57	3.26%	4.07
10	MEL	Orissa	763.22	3.24%	5.78

Note: Volume sold by major sellers and total volume transacted through traders does not include the volume through banking arrangement.

Table-17: Major Buyers of Electricity through Traders, 2013-14					
S.No	Buyer	State	Volume (MU)	Approximate percentage of total volume transacted through traders	Weighted Average Purchase Price in ₹/kWh
1	APPCC+ APCPDCL	Andhra Pradesh	5723.07	24.31%	5.64
2	PSPCL	Punjab	2451.51	10.41%	3.89
3	KSEB	Kerala	2424.30	10.30%	5.27
4	RDPPC+ JVVNL	Rajasthan	2180.09	9.26%	3.32
5	WBSEDCL	West Bengal	1907.33	8.10%	3.60
6	UPPCL	Uttar Pradesh	1304.81	5.54%	3.45
7	BSEB	Bihar	1159.13	4.92%	4.65
8	TNEB+ TANGEDCO	Tamil Nadu	1112.54	4.72%	4.62
9	HPSEB	Himachal Pradesh	1011.83	4.30%	3.22
10	UPCL	Uttarakhand	705.42	3.00%	3.47
<i>Note: Volume bought by major buyers and total volume transacted through traders does not include the volume through banking arrangement.</i>					

From Table-17 it can be seen that weighted average purchase prices of electricity of major buyers such as APPCC, KSEB BSEB and TNEB from traders (bilateral transactions) were higher than the weighted average price for the entire bilateral trader segment (₹4.29/kWh).

Table-18: Major Sellers of Electricity in the Day Ahead Market of IEX, 2013-14					
S.No	Name of Seller	State	Sell Volume (MU)	Percentage of the Total Volume Transacted in IEX	Weighted Average Sell Price (₹/kWh)
1	GUVNL	Gujarat	3501.52	12.11%	2.83
2	MPPMCL	Madhya Pradesh	2595.84	8.97%	2.58
3	KWHEP	Himachal Pradesh	1783.36	6.17%	2.32
4	JPL	Jindal Power	1261.03	4.36%	2.29

S.No	Name of Seller	State	Sell Volume (MU)	Percentage of the Total Volume Transacted in IEX	Weighted Average Sell Price (₹/kWh)
5	HPPC	Haryana	1169.08	4.04%	2.73
6	TPDDL	Delhi	1092.51	3.78%	2.57
7	BRPL	Delhi	992.48	3.43%	2.07
8	GOHP(ADHPL+ KWHEPS+ LBHPPL)	Himachal Pradesh	945.31	3.27%	2.34
9	WBSEDCL	West Bengal	773.54	2.67%	2.58
10	CGSEB	Chhattisgarh	687.02	2.38%	2.32

Note: Total Volume transacted through Day Ahead Market of IEX was about 28925 MU

Table-19: Major Buyers of Electricity in the Day Ahead Market of IEX, 2013-14					
S.No	Name of Buyer	State	Buy Volume (MU)	Percentage of the Total Volume Transacted in IEX	Weighted Average Buy Price (₹/kWh)
1	UPPCL	UP	1821.96	6.30%	2.65
2	Essar Steel Ltd	Gujarat	1480.10	5.12%	2.53
3	APCPDCL	Andhra Pradesh	1123.70	3.88%	4.74
4	TPCL	Maharashtra	860.74	2.98%	2.48
5	JVVNL	Rajasthan	852.14	2.95%	3.38
6	Torrent Power Ltd	Gujarat	832.23	2.88%	2.87
7	UPCL	Uttarakhand	789.61	2.73%	2.68
8	PSPCL	PUNJAB	717.79	2.48%	2.82
9	REL	Maharashtra	714.73	2.47%	2.96
10	JSL	Haryana	655.94	2.27%	2.55

Note: Total Volume transacted through Day Ahead Market of IEX was about 28925 MU.

From Table-19 it can be seen that weighted average prices of electricity for major buyers such as APCPDCL, JVVNL and REL in the day ahead market IEX were higher than the weighted average price for the entire day ahead market of IEX (₹2.90/kWh).

Table-20: Major Sellers of Electricity in the Day Ahead Market of PXIL, 2013-14					
S. No	Name of the Seller	State	Sell Volume (MU)	Percentage of the Total Volume Transacted in PXIL	Weighted Average Sell Price (₹/kWh)
1	GUVNL	Gujarat	384.35	34.75%	2.82
2	NDMC	Delhi	143.34	12.96%	2.59
3	GRIDCO	Orissa	87.00	7.87%	3.08
4	Sterlite Energy Ltd	Orissa	83.31	7.53%	2.52
5	Rajasthan	Rajasthan	66.70	6.03%	2.28
6	BRPL	Delhi	64.37	5.82%	2.08
7	BYPL	Delhi	55.67	5.03%	2.07
8	WBSEDCL	West Bengal	48.80	4.41%	2.62
9	KWHEPS	Uttar Pradesh	41.68	3.77%	2.17
10	Emco Energy Ltd	Maharashtra	37.97	3.43%	2.26

Note: Total Volume transacted in the Day Ahead Market of PXIL was about 1106 MU.

Table-21: Major Buyers of Electricity in the Day Ahead Market of PXIL, 2013-14					
S. No	Name of the Seller	State	Sell Volume (MU)	% of the Total Volume Transacted in PXIL	Weighted Average Sell Price (₹/kWh)
1	UPPCL	Uttar Pradesh	147.39	13.33%	2.37
2	UPCL	Uttarakhand	129.77	11.73%	2.78
3	Sumeet Industries Ltd	Gujarat	62.74	5.67%	2.51
4	JVVNL	Rajasthan	58.43	5.28%	3.24
5	PSPCL	Punjab	52.61	4.76%	2.98
6	Essar Steel India Ltd	Gujarat	49.92	4.51%	2.89
7	Binani Cement Ltd, Sirohi	Rajasthan	48.21	4.36%	2.14
8	Well_Known Polyesters Ltd	Daman and Diu	31.78	2.87%	2.95
9	Binani Cement Ltd, Neem ka Thana	Rajasthan	26.85	2.43%	2.37
10	Jay Chemical Industries Ltd	Gujarat	23.35	2.11%	2.54

Note: Total Volume transacted in the Day Ahead Market of PXIL was about 1106 MU.

From Table-21 it can be seen that weighted average prices of electricity for major buyers such as UPCL, JVVNL, PSPCL Essar Steel Ltd and Well Known Polyesters Ltd in the PXIL Day Ahead Market were higher than the weighted average price for the entire day ahead market in the PXIL (₹2.60/kWh).

8. Effect of Congestion on Volume of Electricity Transacted through Power Exchanges

The volume of electricity transacted/sold through power exchanges is sometimes constrained due to transmission congestion. The details of congestion in both the power exchanges are shown in Table-22 and Table-23.

Annual details of congestion in power exchanges are shown in Table-22. It can be observed from the table that there is an increasing trend in the unconstrained cleared volume and actual volume transacted. Unconstrained cleared volume and actual volume transacted increased from 8.10 BU and 7.09 BU respectively in 2008-09 to 35.62 BU and 30.03 BU respectively in 2013-14. Volume of electricity that could not be cleared (i.e. the difference of unconstrained cleared volume and actual volume transacted) as % to unconstrained cleared volume declined from 12% in 2009-10 to 5% in 2010-11 and then increased to 16% in 2013-14.

Table-22: Annual Details of Congestion in Power Exchanges				
Year	Unconstrained Cleared Volume* (MU)	Actual Cleared Volume and hence scheduled (MU)	Volume of electricity that could not be cleared due to congestion (MU)	Volume of electricity that could not be cleared as % to Unconstrained Cleared Volume
1	2	3	4 (2-3)	5 (4/2)
2009-10	8098.74	7087.10	1011.65	12%
2010-11	14263.45	13540.75	722.70	5%
2011-12	17084.28	14827.68	2256.61	13%
2012-13	27672.30	23024.41	4647.89	17%
2013-14	35621.04	30029.62	5591.42	16%
<i>* This power would have been scheduled had there been no congestion.</i>				
Source: IEX, PXIL & NLDC				

During 2013-14, in the IEX, the unconstrained cleared volume and the actual volume transacted were 34.23 BU and 28.92 BU respectively (Table-23). The actual transacted volume was 15.50% less than unconstrained volume. During the same year, in PXIL, the unconstrained cleared volume and the actual volume transacted were 1.39 BU

and 1.11 BU respectively. The actual transacted volume was 20.44% lesser than unconstrained volume.

Table-23: Power Exchange wise Details of Congestion, 2013-14			
	Details of Congestion	IEX	PXIL
A	Unconstrained Cleared Volume* (MU)	34230.41	1390.62
B	Actual Cleared Volume and hence scheduled (MU)	28923.23	1106.39
C	Volume of electricity that could not be cleared and hence not scheduled because of congestion (MU) (A-B)	5307.18	284.24
D	Volume of electricity that could not be cleared as % to Unconstrained Cleared Volume	15.50%	20.44%
<i>* This power would have been scheduled had there been no congestion.</i>			
Source: IEX, PXIL & NLDC			

Congestion, consequent market splitting, and the resultant difference in market prices in different regions give rise to congestion charges. The congestion amount collected during the year 2013-14 was ₹392.33 crore.

9. Tariff of Long-term Sources of Power for Various Distribution Companies

It can be seen that short-term market, which includes UI, power transacted through traders (inter-state part), bilateral power transactions directly between DISCOMs, and power transacted through power exchanges, met about 11 % of the power requirement of the distribution companies in the year 2013-14. The balance 89 % power requirement of the distribution companies was met from power procured under long-term contracts with state and central government owned power generating companies and independent power producers, and also intra-state power purchases from traders under bilateral transactions.

The details on tariff of central government power generating companies, tariff (levelised tariff) of power projects under Case-1 bidding, and the details on average cost of supply and average revenue of state power utilities have been provided below.

9.1 Tariff of Central Government power generating companies

The central government power generating companies in 2013-14, accounted for about 31 percent of the total power generation in the country.

The prices paid by distribution companies to procure power from central government owned generating companies in 2013-14 (under long-term Power Purchase Agreements) are shown in Table-24 and 25. It can be seen that, on an average, the distribution companies paid between ₹1.47 and ₹5.29 per kWh for procuring power from coal and lignite based stations, between ₹3.36 and ₹12.88 per kWh from gas/RLNG based power stations, between ₹8.46 and ₹13.67 per kWh from liquid fuel based power stations (Table-24), and between ₹0.79 per kWh and ₹5.91 per kWh from hydro stations (Table-25).

Table-24: Tariff of Central Thermal Power Stations, 2013-14					
Sl. No.	Name of the Generating Station	Installed Capacity (MW), March 2014	Fixed charges (Paise/kWh)	Energy Charges (Paise/kWh), March 2014	Total Tariff (Paise/kWh)
I: Coal Based thermal generating Stations of NTPC					
A.	Pit head Generating Stations				
1	Rihand STPS (St-I)	1000	83	150	233
2	Rihand STPS (St-II)	1000	93	147	241
3	Rihand STPS (St-III)	1000	179	143	322
4	Singrauli STPS	2000	54	121	175
5	Vindhyachal STPS (St-I)	1260	65	138	203
6	Vindhyachal STPS (St-II)	1000	65	130	195
7	Vindhyachal STPS (St-III)	1000	113	130	243
8	Vindhyachal STPS (St-IV)	1000	152	130	282
9	Korba STPS (St-I & II)	2100	56	92	147
10	Ramagundam STPS (St-I&II)	2100	60	221	281
11	Ramagundam STPS (St-III)	500	97	288	385
12	Talcher TPS	460	73	121	194
13	Talcher STPS (St-I)	1000	83	170	252
14	Talcher STPS (St-II)	2000	87	170	257
15	Sipat STPS (St-I)	1980	141	153	294
16	Sipat STPS (St-II)	1000	124	158	282
17	Korba STPS (St-III)	500	162	91	252
	Sub-Total (A)	20900			
B.	Non-Pit head Generating Stations				
18	FGUTPP TPS (St-I)	420	88	324	412
19	FGUTPP (St-II)	420	91	328	419
20	FGUTPP (St-III)	210	139	329	468
21	NCTP Dadri (St-I)	840	90	339	429
22	NCTP Dadri (St-II)	980	159	335	494
23	Farrakka STPS (St-I&II)	1600	81	299	380
24	Farrakka STPS (St-III)	500	152	296	448
25	Tanda TPS	440	111	388	498
26	Badarpur TPS	705	90	439	529
27	Kahalgaon STPS (St-I)	840	96	312	408
28	Kahalgaon STPS (St-II)	1500	116	295	410
29	Simhadri (St-I)	1000	104	271	375
30	Simhadri (St-II)	1000	169	273	441
31	Mauda-I	1000	187	308	495
	Sub-Total (B)	11455			
	Total Coal (A+B)	32355			

Sl. No.	Name of the Generating Station	Installed Capacity (MW), March 2014	Fixed charges (Paise/kWh)	Energy Charges (Paise/kWh), March 2014	Total Tariff (Paise/kWh)
II: Natural Gas (APM & Non-APM)/LNG/Liquid Fuel based generating stations of NTPC					
A: Using Natural Gas(APM) as Fuel					
1	Dadri CCGT	830	54	345	399
2	Faridabad	431	79	266	345
3	Anta CCGT	419	70	290	360
4	Auraiya GPS	663	53	332	385
5	Gandhar GPS	657	100	246	346
6	Kawas GPS	656	79	257	336
	Total APM Gas	3657			
B: Using Natural Gas(Non-APM) as Fuel					
1	Gandhar GPS	657	100	339	439
2	Kawas Gas	656	79	344	423
	Total Non-APM Gas	1314			
C: Using LNG as Fuel					
1	Dadri CCGT	830	54	1057	1111
2	Anta CCGT	419	70	879	949
3	Auraiya GPS	663	53	1067	1120
4	Faridabad	431	79	841	920
5	Gandhar GPS	657	100	1172	1272
6	Kawas Gas	656	79	1209	1288
	Total LNG	3657			
D: Using Liquid Fuel (Naphtha/HSD) as Fuel					
1	Dadri CCGT	830	54	793	847
2	Faridabad	431	79	767	846
3	Anta CCGT	419	70	815	885
4	Auraiya GPS	663	53	1038	1091
5	Kayamkulam CCGT	360	87	1280	1367
6	Kawas Gas	656	79	886	965
	Total Naphtha/HSD	3359			
III: Lignite Based thermal generating Stations of NLC					
1	TPS-I	600	88	257	345
2	TPS-II Stage-I	630	63	217	279
3	TPS-II Stage-II	840	64	217	281
4	TPS-I (Expansion)	420	124	203	327
5	Barsingsar	250	291	110	401
	Total NLC	2740			
IV: Gas/Liquid Fuel based generating Stations of NEEPCO					
1	Agartala GPS	84	125	259	383
2	Assam GPS	291	147	198	345
	Total NEEPCO	375			

Table-25: Composite Tariff of Central Hydro Power Stations, 2013-14					
Name of Generating Company	Name of the Generating Station	Type	Installed Capacity (MW)	Annual Fixed Charges (₹/Lakhs)	Composite Tariff (₹/kWh)
NHPC					
1	Baira siul	Pondage	180	10292.94	1.51
2	Loktak	Storage	105	10695.13	2.73
3	Salal	ROR	690	24669.15	0.92
4	Tanakpur	ROR	123	8837.69	2.24
5	Chamera-I	Pondage	540	27669.56	1.91
6	Uri-I	ROR	480	33853.30	1.50
7	Rangit	Pondage	60	8134.24	2.76
8	Chamera-II	Pondage	300	33603.01	2.58
9	Dhauliganga-I	Pondage	280	27569.10	2.79
10	Dulhasti	ROR	390	95214.01	5.74
11	Teesta-V	Pondage	510	49709.79	2.22
12	Sewa-II	Pondage	120	18790.14	4.05
13	Chamera-III*	Pondage	231	33375.42	3.53
14	Chutak*	ROR	44	10378.95	5.61
15	Uri-II*	ROR	240	32772.26	3.35
16	Nimoo Bazgo*	Pondage	45	12326.06	5.91
	Total		4338		
NHDC					
1	Indira Sagar	Storage	1000	50756.03	2.59
2	Omkareshwar	Storage	520	39699.92	4.76
	Total		1520		
THDC					
1	Tehri Stage-I*	Storage	1000	110842.71	4.60
2	Koteshwar*		400	38316.27	3.81
			1400		
SJVNL					
1	Naptha Jhakri	RoR	1500	155755.70	2.59
NEEPCO					
1	Khandong	Storage	50	3251.75	1.34
2	Kopili Stage-I	Storage	200	8170.63	0.79
3	Doyang	Storage	75	8041.32	4.06
4	Ranganadi	Pondage	420	29535.47	1.81
5	Kopili Stage-II	Storage	25	1322.83	1.76
	Total		770		
<i>* Provisional Tariff</i>					

9.2 Levelised tariff of power projects under Case-I Bidding

Table-26 indicates long-term levelised tariff for power available from power projects bid in the year 2012-13 under Case-I. The price of the power projects under Case-I for long-term varied in the range of ₹4.48 per kWh to ₹5.84 per kWh.

Table-26: Capacity Contracted under Case-I Bidding Route during 2012-13								
Sr. No.	State	Name of the Developer/ Plant	Name of the Procurer	Capacity (MW)	Fuel Type	Levelized Tariff (₹/ kWh)	Date of Bidding Deadline	Medium / Long-Term
1	Uttar Pradesh	Navyuga Power, Krishnapatnam, A.P	UPPCL	800	Imported Coal	5.84	Sep-12	Long-Term
2	Uttar Pradesh	NSL Power, Odisha	UPPCL	300	Blended Coal	4.48	Sep-12	

Source: Forum of Regulators

9.3 Average Cost of Supply and Average Revenue of State Power Utilities

The data on average cost of supply to state power utilities (SEBs, Power Deptts., DISCOMs) and average revenue (revenue from sale of power by state power utilities) without subsidy has been taken from "Performance Report of State Power Utilities" published by Power Finance Corporation (Table-27).

Table-27: Average Cost of Supply and Average Revenue (without subsidy) of State Power Utilities		
	Average Cost of Supply	Average Revenue (without subsidy)
2008 - 09	3.40	2.63
2009 - 10	3.55	2.68
2010 - 11	3.97	3.03
2011 - 12	4.39	3.31

Source: PFC, "The Performance of State Power Utilities for the years, 2008-09 to 2010-11 and 2009-10 to 2011-12.

The average cost of supply increased from ₹3.40/kWh in 2008-09 to ₹4.39/kWh in 2011-12. The average revenue (without considering subsidy booked) increased from ₹2.63/kWh in 2008-09 to ₹3.31/kWh in 2011-12.

10. Analysis of transactions of Renewable Energy Certificates (RECs) through power exchanges.

The concept of Renewable Energy Certificates (RECs) seeks to address mismatch between geographical availability of renewable energy sources and the requirement of the obligated entities to meet their renewable purchase obligation by purchasing green attributes of renewable energy. The REC mechanism is a market based instrument, to promote renewable sources of energy and development of market in electricity.

One REC is equivalent to 1 MWh of electricity injected into the grid from renewable energy sources. The REC is exchanged only in the power exchanges approved by CERC within the band of a floor price and forbearance (ceiling) price as notified by CERC from time to time. The forbearance price and floor price notified by CERC for the period from 1st April 2012 is as under:

Forbearance and Floor Price w.e.f 1st April 2012		
Type of REC	Floor Price (₹/MWh)	Forbearance Price (₹/MWh)
Solar	9300.00	13400.00
Non-Solar	1500.00	3300.00

The first REC trading session was held on power exchanges in March 2011. The details of REC transactions are shown in Table-28 and Table-29. The market clearing volume of Solar RECs transacted in 2013-14 on IEX and PXIL were 53056 and 13624 respectively and the weighted average of market clearing price of these RECs were ₹9725/MWh and ₹9666/MWh on IEX and PXIL respectively. Market clearing volume of Non-Solar RECs transacted in 2013-14 on IEX and PXIL were 1271267 and 1410747 respectively and the weighted average of market clearing price of these RECs was ₹1500/MWh on both IEX and PXIL.

The gap between the volume of buy and sell bids of RECs placed through power exchanges shows that there was less demand for both Solar RECs and Non-Solar RECs. For Solar RECs, the ratio of buy and sell bids was 0.09 and 0.10 in IEX and PXIL respectively. For Non-Solar RECs, the ratio of buy and sell bids was 0.05 and 0.08 in IEX and PXIL respectively.

Table-28 : Annual details of Renewable Energy Certificates transacted through Power Exchanges					
Sr.No.	Details of REC Transactions	IEX		PXIL	
	Type of REC	Solar	Non-Solar	Solar	Non-Solar
	Year	2013-14		2013-14	
A	Volume of Buy Bid	54238	1271267	14043	1410747
B	Volume of Sell Bid	585976	25165246	135000	17233135
C	Ratio of Buy Bid to Sell Bid Volume	0.09	0.05	0.10	0.08
D	Market Clearing Volume (MWh)	53056	1271267	13624	1410747
E	Market Clearing Price (₹/MWh)	9725	1500	9666	1500

Month-wise volume and price of RECs transacted through power exchanges are shown in the following table (Table-29).

Table-29 : Volume and Price of Renewable Energy Certificates Transacted through Power Exchanges, 2013-14				
Month	IEX		PXIL	
	Volume of REC Transactions (MWh)	Weighted Average Price of REC Transactions (₹/MWh)	Volume of REC Transactions (MWh)	Weighted Average Price of REC Transactions (₹/MWh)
Solar				
Apr-13	1005	12206	1212	12000
May-13	669	11490	1034	10990
Jun-13	797	9300	682	9300
Jul-13	1983	9300	46	9300
Aug-13	1754	9300	605	9300
Sep-13	5880	9300	832	9300
Oct-13	6548	9300	2709	9300
Nov-13	6983	9300	371	9300
Dec-13	6893	9300	989	9300
Jan-14	5517	9300	844	9300
Feb-14	7816	9300	492	9300
Mar-14	7211	9300	3808	9300

Month	IEX	PXIL	Month	IEX
	Volume of REC Transactions (MWh)	Weighted Average Price of REC Transactions (₹/MWh)		Volume of REC Transactions (MWh)
Non-Solar				
Apr-13	10670	1500	33789	1500
May-13	18543	1500	34425	1500
Jun-13	36147	1500	36339	1500
Jul-13	72321	1500	89081	1500
Aug-13	31101	1500	9788	1500
Sep-13	38195	1500	11636	1500
Oct-13	98921	1500	51719	1500
Nov-13	97743	1500	211185	1500
Dec-13	250722	1500	153140	1500
Jan-14	78955	1500	280042	1500
Feb-14	176107	1500	202718	1500
Mar-14	361842	1500	296885	1500

List of Trading Licensees as on 31.3.2014					
Sr. No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
1	Adani Enterprises Ltd	I	Adani House, Plot No 83, Sector 32, Institutional Area, Gurgaon - 122001, Haryana	9711733252	praveen.tamak@adani.in
2	Adhunik Alloys & Power Ltd	IV	701, 7th Floor, World Trade Tower, Barakhamba Lane, Connaught Place, New Delhi -110001	91-11-49304009; 09958338886	vksarawagi@adhunikgroup.co.in; powertrading@adhunikgroup.co.in
3	Ambitious Power Trading Company Ltd	IV	6th Floor, 8, MTNL Building, Bhikaji Cama Place, New Delhi	918826604442; 918800318686	rajesh.maurya@jindalsteel.com, Shalabh.tandon@jindalsteel.com
4	Arunachal Pradesh Power Corp. (P) Ltd	III	A-Sector, Legi Complex, Naharlagun, Itanagar, AP- 791110	9873355292	Karan@appcpl.com
5	BS Trans Comm Ltd	III	Survey No 82-83,92-95 & 107, NH 7, Athvelly Village, Medchal Mandal, RR Distt., Andhra Pradesh	040-44558888; 040-66666204/205	info@bsgroup.in
6	Customized Energy Solutions India (P) Ltd	IV	A 501, GO Square, Aundh-Hinjewadi Link Road, Wakad, Pune - 411057, Maharashtra	020-32407682	indiatradingteam@ces-ltd.com
7	DLF Energy (P) Ltd	III	10th Floor, Gateway Tower, DLF City, Ph-3, Gurgaon, Haryana 122002	9871134531; 9958512576	g-ajay@dlf.in , sharan-sidharath@dlf.in
8	Essar Electric Power Development Corp. Ltd	III	Essar House, 11, KK Marg, Mahalaxmi, Mumbai – 400 034	9930134960	ashok.singh3@essar.com

Sr. No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
9	Gemac Engineering Services (P) Ltd	IV	3rd Floor, Wescare Towers, No. 16, Cenotaph Road, Teynompeta, Chennai - 600018	044-24343753	admin@gemacengineering.com
10	Global Energy (P) Ltd	I	1st Floor, Shangri La's Eros Corporate Plaza, 19 Ashoka Road, Connaught Place, New Delhi-11001	011-47334444	globalenergy@gmail.com
11	GMR Energy Trading Ltd	1	GMR Energy Trading Limited, New Udaan Bhawan, Terminal-3, Opp. ATS Complex, International Terminal, Indira Gandhi International Airport, New Delhi- 110037	91-11-46084156; 91-8527190252; Fax:91-11-46084180	POWER-TRADINGBD@gmrgroup.in
12	Green Fields Power Services (P) Ltd	IV	101, Sri Guru Krupa, 7-1-54/2/c, D.K. Road, Ameerpet, Hyderabad – 500 016	91-40-23731823; 9160619000	info@greenfieldspower.com
13	Greenko Energies (P) Ltd	IV	#1366, Road No. 45, Jubilee Hills, Hyderabad - 500033, India	91-040-40301000, 32915858	info@greenkogroup.com
14	HMM Infra Ltd	III	#2350/3, Mariwala Town, Manimajra, Chandigarh-160101	0184-2261212; 09996136454	info@hmmpower.com
15	Indiabulls Power Trading Ltd	IV	"Indiabulls House" 448-451, Udyog Vihar, Phase-V, Gurgaon-122016	9650338839	ajit.panda@indiabulls.com
16	Indrajit Power Technology (P) Ltd	III	Trade world 'C' Wing 16th floor, Kamala City, Senapati Bapat marg, Lower Parel, Mumbai.-400013.	022-30418146; 9960053675	scrathod@lloyds.in

Sr. No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
17	Instinct Infra & Power Ltd	III	C-201, Naraina Industrial Area, Phase - 1, New Delhi - 110028	9910555026	salil@instincttrade.com
18	Jaiprakash Associates Ltd	I	Sector 128 Noida 201304	9654891985; 9910968663; 9717150984	sarabjeet.dhingra@jalindia.co.in, awnish.pandey@jalindia.co.in, ashish4.gupta@jalindia.co.in
19	JSW Power Trading Company Ltd	I	Upper Ground Floor, NBCC Tower, 15 Bhikaji Cama Place, New Delhi-110066	011-26192275; 26767020; 09873352917	hiralal.choudhary@jsw.in,
20	Karam Chand Thapar & Bros (CS) Ltd	I	KCT Block, 85-A, Panchkuian Road, New Delhi-110001	011-23366590; 23747629; 9810434862; 9310434862	cskhirbat@kctcoales.com, kctdelhi@kctcoales.com
21	Knowledge Infrastructure Systems (P) Ltd	I	G 2, Salcon Aurum, 4 Commercial Centre, Jasola, N Delhi 25	011-46067070; 9810518133; Fax: 011-46027217	contact@knowledgegroup.in, rmahajan@knowledgegroup.in
22	Manikaran Power Ltd	II	3/A, Aastha, 460, E.M. Bye Pass, Kolkata - 700107	91-33-40610165; 24433994	nsk@manikaranpowerltd.in
23	Mittal Processors (P) Ltd	II	Corporate office: #1004, Antriksh Bhawan, 10th Floor, Connaught Place, 22 KG Marg, New Delhi-110001	91-11-66666999; 8588865346; 8950003381	info@mittalsgroup.com, controlroom@mittalsgroup.com
24	MY Home Power (P) Ltd	III	3rd,Block, 5th Floor, My Home Hub, Hitec City, Madhapur, Hyderabad-500 081	040-66222700; 9010262683	sureshkumar@mhp.csl.in

Sr. No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
25	National Energy Trading And Services Ltd	I	Lanco House, Plot No. 397, Udyog Vihar, Phase III, Gurgaon - 122 016, Haryana	0124-4741000/1358	navneet.gupta@lancogroup.com
26	Newfields Advertising (P) Ltd	IV	3/4 – A, Asaf Ali Road, New Delhi - 110002	9312573322	ramangupta@newfields.co.in
27	NTPC Vidyut Vyapar Nigam Ltd	I	Core-3, 7th Floor, Scope Complex, Lodhi Road , New Delhi - 110003	011-24387055	anuraggupta@ntpc.co.in
28	Pan India Network Infravest Ltd	I	135, Continental Building, Dr. Annie Besant Road, Worli, Mumbai 400 018	011-41040090	mohit.jain@infra.esselgroup.com, Powertrading.pini@Infra.esselgroup.com
29	PCM Power Trading Corp. Ltd	III	Dabriwala House, 10-C Middleton Row, 4th Floor, Block-C, Kolkata-700071, West Bengal	0353-2777028/029	INFO@PCMPOWERTRADING.CO.IN
30	PTC India Ltd	1	2nd Floor, NBCC Towers, 15 Bhikaji Cama Place, New Delhi - 110066	011-46026724	hde@ptcindia.com
31	Pune Power Development (P) Ltd	IV	C/o.Kalyani Steel Ltd, Corporate Office, Mundhawa, Pune411036.	020-25810094; 9922940309	punepower.power@gmail.com ; tarit30@yahoo.co.in
32	Reliance Energy Trading Ltd	I	2/22A, Shanti Niketan, New Delhi-110021	011-30323444; 30324444; 30325444	Shiftincharge.Operation@relainceada.com
33	RPG Power Trading Company Ltd	II	6, Church Lane, 1st Floor, Kolkata-700001	033-66252010; Fax:033-66252004	rpgpowertrading@rps-g.in; suman.ghosh@rps-g.in

Sr. No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
34	Shree Cement Ltd	I	Room No.114, Hans Bhawan, 1 Bhadurshah Zafar marg, Delhi-110002	011-23370320; Ext-365	shreepowertrading@gmail.com; powertrading@shreecementltd.com
35	Shyam Indus Power Solutions (P) Ltd	IV	129,Transport Centre, Rohtak Road, Punjabi Bagh New Delhi-35	011-45764444	pdgoyal@shyamindus.com, shyamindus@vsnl.net
36	SN Power Markets (P) Ltd	I	4th Floor, MGF Metropolitan Mall, Saket District Center, New Delhi-110017	011-60050116; 9654309003	pratyush.thakur@statkraft.com, maneesh.bhartia@statkraft.com
37	Subhash Kabini Power Corp. Ltd	IV	Mfar Silverline Techpark, 2nd Floor,Plot No. - 180, EPIP Zone - 2nd Phase, Whitefield, Bangalore - 560066	080-41229491	Prem.bhatia@spml.co.in
38	Suryachakar Power (P) Corp. Ltd.	IV	Suryachakra Power Corporation Limited, Plot no: 304-L-III, Road No.78, Film Nagar, Jubilee Hills, Hyderabad – 500096	91-40-30823000; 91-40-23550597/98	admin@suryachakra.com
39	Tata Power Trading Company (P) Ltd	I	Tata Power Trading Company Ltd., C - 43, Sector 62, Noida 201307, Uttar Pradesh, India	91-120-6663000	power@tatapowertading.com
40	Vandana Vidhyut Ltd	IV	Vandana Bhawan;M. G.Road,Raipur-492001,Chhattisgarh	0771-4006000	vvl@vandanavidhyut.com
41	Vedprakash Power Private Ltd	IV	Vedprakash Power Private Limited, Ground Floor, Ismail Building, D.N Road, Flora Fountain, Mumbai-400001	9711344115	mukul@vedprakashpower.com
42	VISA Power Trading Company Ltd	IV	VISA House, 8/10, Alipore Road, Kolkata - 700027	91-33-30119000	alok.kumar@visapower.net

Historic Volatility Calculation

Volatility = Standard deviation of daily prices returns.

Historical Volatility Formula:

$$\sigma = \sqrt{\frac{1}{(n-1)} \sum_{y=1}^n \left(\ln \frac{y_i}{y_{i-1}} - \mu \right)^2}$$

where

$$\mu = \frac{1}{n} \sum_{y=1}^n \left(\ln \frac{y_i}{y_{i-1}} \right)$$

1. Daily prices returns = $\ln (y_i / y_{i-1})$.
2. y_i is price today; y_{i-1} is price on previous day.
3. \ln is natural logarithm
4. n is the number of observations
5. μ is the average daily returns

Herfindahl-Hirschman Index (HHI) Calculation

Formula for computing the HHI is as under:

$$\mathbf{HHI} = \sum_{i=1}^N \mathbf{s}_i^2$$

where s_i is the market share of firm i in the market, and N is the number of firms.

The Herfindahl-Hirschman Index (*HHI*) ranges from $1 / N$ to one, where N is the number of firms in the market. Equivalently, if percents are used as whole numbers, as in 75 instead of 0.75, the index can range up to 100^2 or 10,000.

- A HHI index below 0.01 (or 100) indicates a highly competitive index.
- A HHI index below 0.15 (or 1,500) indicates an unconcentrated index.
- A HHI index between 0.15 to 0.25 (or 1,500 to 2,500) indicates moderate concentration.
- A HHI index above 0.25 (above 2,500) indicates high concentration.

There is also a normalised Herfindahl index. Whereas the Herfindahl index ranges from $1/N$ to one, the normalized Herfindahl index ranges from 0 to 1.