Report on Short-term Power Market in India: 2012-13

July, 2013

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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 procure 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 is well developed, constituting approximately 11 percent (close to 100 billion units) of the total electricity market in 2012-13, though this includes power transactions through unscheduled interchange (UI) as well. Access to information is key to ensuring efficient markets and faith of the stakeholders in the system. The 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, which can also be useful for potential market participants and 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. Hopefully, market participants and stakeholders will find the Annual Report for 2012-13 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
APPCC	Andhra Pradesh Power Coordination Committee
AVVNL	Ajmer Vidyut Vitaran Nigam Limited
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
CPP	Captive Power Producer/Plant
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
HPSEB	Himachal Pradesh State Electricity Board
HSD	High Speed Diesel
IEX	Indian Energy Exchange Limited
ISGS	Inter State Generating Station
J&K	Jammu & Kashmir
J&K PDD	Jammu & Kashmir Power Development Department
JdVVNL	Jodhpur Vidyut Vitaran Nigam Limited

Abbreviation	Expanded Version
JPL	Jindal Power Limited
JSPL	Jindal Steel & Power Limited
JSWEL	JSW Energy Limited
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)
LAPL	Lanco Amarkantak Power Limited
LBHPPL	LANCO Budhil Hydro Power Private Limited
LKPPL/LKPL	Lanco Kondapalli Power Private Limited
LNG	Liquefied Natural Gas
LOI	Letter of Intent
Ltd	Limited
MALANA	Malana Hydro Power Plant
MCP	Market Clearing Price
MPPMCL	M P Power Management Company Limited
MPPTCL	Madhya Pradesh Power Trading Company Limited
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MU	Million Units
MW	Mega Watts
MWh	Mega Watt Hour
NDPL	North Delhi Power Limited
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
PSEB	Punjab State Electricity Board
PSPCL	Punjab State Power Corporation Limited

Abbreviation	Expanded Version
PX/PXs	Power Exchange/Power Exchanges
PXIL	Power Exchange India Limited
RDPPC	Rajasthan Discoms Power Procurement Centre
RECs	Renewable Energy Certificates
REL	Reliance Energy Limited
REL KPDL	Kolte-Patil Developers Limited
RLNG	Re-gasified Liquefied Natural Gas
ROR	Run of River
RTC	Round The Clock
S1	Southern Region 1
S2	Southern Region 2
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
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 Market[1] for the year 2012-13. 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 through licensed traders and power exchanges; (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 Renewable Energy Certificates (RECs) transacted through power exchanges.

Salient features of the report are listed below and are discussed in details in subsequent sections.

1. Of the total electricity procured in India in 2012-13, the short-term power market comprised 11 per cent. The balance 89 percent of generation was procured mainly by distribution companies through long-term contracts and short-term intra-state transactions.

2. In volume terms, the size of the short-term market in India was 98.94 billion kWh (units) in the year 2012-13. As compared to the volume of electricity transacted through short-term market in the year 2011-12 (94.51 billion units), this was about 5 percent higher. Majority of this growth in volume of 4.43 billion units was accounted for by growth in transactions through power exchanges (181%), followed by bilateral transactions through the inter-state trading licensees (6%). The direct bilateral transactions between the DISCOMs and the transactions through UI declined by 19% and 68% 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 59.66 billion units in 2012-13. This was about 16 percent higher than in 2011-12. Volume of electricity transacted through power exchanges witnessed a sharp increase of about 51% over 2011-12 volume. On the other hand, the increase in the volume

[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 2012-13, the volume of UI was about 24.76 billion kWh and that of bilateral transactions between distribution companies was about 14.52 billion kWh.*

of electricity transacted through inter-state trading licensees was very low at 0.8%. In monetary terms, the size of this segment of the short-term market was ₹24272 crore in the year 2012-13[2] , which was 18% more than in the year 2011-12. Of this, ₹ 8646 crore was the value of electricity transacted through power exchanges (56% more than ₹5553 crore done in 2011-12), and the balance of ₹15624 crore was the value of inter-state transaction of electricity through trading licensees (about 4% more than ₹14979 crore done in 2011-12).

4. In absolute terms, the volume of UI in the year 2012-13 decreased by 11% over 2011-12. 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 25% in 2012-13, down from 39%, 34% and 29% respectively in the years 2009-10, 2010-11 and 2011-12.

5. The share of direct bilateral transactions between DISCOMs as a percentage of total short term transaction volume declined to about 15% in the year 2012-13 (as compared to about 16% in the year 2011-12). In terms of volume, these direct bilateral transactions between DISCOMs also witnessed a decline of about 6% in 2012-13 as compared to 2011-12.

6. The weighted average price of electricity transacted through power exchanges was ₹3.67 per kWh and through trading licensees was ₹4.33 per kWh in 2012-13. The corresponding values for the year 2011-12 were ₹3.57 per kWh and ₹4.18 per kWh, respectively. In the year 2012-13, the weighted average price of electricity transacted through Day Ahead Market sub-segment of the power exchanges was ₹3.67/kWh and that through Term Ahead Market sub-segment was ₹3.91/kWh.

7. During the year 2012-13, 89% of the volume of electricity in IEX and 94% of the volume of electricity in PXIL was transacted at less than ₹6/kWh. 70% of the volume in IEX and 73% of the volume in PXIL was transacted at less than ₹4/kWh.

8. During the year, about 97% of the volume of electricity under bilateral transactions through traders was transacted at less than ₹6/kWh. About 45% of the volume was transacted at price less than ₹4/kWh.

9. During 2012-13, only 179 million units of electricity was exclusively bought during peak hours under bilateral transactions from traders (exclusive of banking). This was 0.79% of the total electricity bought under bilateral transaction from traders (excluding banking). A major part of this, 93.24%, was bought on round the clock (RTC) basis, followed by 5.97% exclusively bought in periods other than peak periods. The per unit price of electricity procured on round the clock (RTC) basis was the cheapest (₹4.29/kWh), followed by electricity exclusively procured during non-peak hours (₹4.66/kWh) and electricity exclusively procured during peak hours (₹4.97/kWh).

10. It is observed from the block-wise and region-wise prices of electricity transacted through power exchanges in the year 2012-13 that the price of electricity in Southern Region (S1

[2] *Excluding transactions pertaining to, banking transactions.*

and S2 regions) was high when compared with 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.

11. Level of competition among the trading licensees is shown for the period from 2004-05 to 2012-13. During the period, number of traders who were undertaking trading increased from 4 to 22 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 0.1437). The competition among the trading licensees resulted in increase in volume and decrease in prices in the short-term bilateral market.

12. During the year 2004-05 (when trading started), licensees voluntarily charged 5 paise/kwh or less as the trading margin. However, the trading margin increased in 2005 and weighted average trading margin went up to 10 paise/kwh during April to September 2005. The CERC then decided to regulate this and fixed the trading margin at 4 paise/kwh on 26.1.2006. As a result, the trading margin declined from 9 paise/kwh in 2005-06 to 4 paise/kwh in 2009-10. The weighted average trading margin charged by the trading licensees in 2012-13 was 4 paise/kWh, which is in line with the CERC Trading Margin Regulations, 2010.

13. The procurement of power by the industrial sector consumers through power exchanges began in the year 2009. At IEX, Open Access industrial sector consumers bought 10.41 billion units of electricity, which formed 46.53 % of the total day ahead volume transacted during 2012-13. For PXIL, the respective figures were: 0.26 billion units, and 38.29%.

14. The weighted average price of electricity bought by open access consumers at IEX was lower (₹3.63/kWh) compared to the weighted average price of total electricity transacted through IEX (₹3.67/kWh). The weighted average price of electricity bought by open access consumers at PXIL was higher (₹3.95/kWh) compared to the weighted average price of total electricity transacted through PXIL (₹3.55/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 the year (2012-13), the actual volume transacted could have been about 17 percent higher, had there been no congestion in the system. Because of congestion and the attendant splitting of day ahead market at both the power exchanges, the congestion amount collected during the year was ₹453.30 crore.

16. In 2012-13, the number of Solar RECs transacted on IEX and PXIL were 10443 and 3570 respectively and the market clearing prices of these RECs were ₹12782/MWh and ₹12615/MWh on IEX and PXIL respectively. During the year, market clearing volume of Non-Solar RECs transacted on IEX and PXIL were 1980546 and 595255 respectively and the market clearing prices of these RECs were ₹1731/MWh and ₹1564/MWh on IEX and PXIL respectively.

Report on
Short-term Power Market in India, 2012-13

A brief analysis of the short-term transactions of electricity in India has been done in this Report on Short-term Power Market[3] for the year 2012-13. 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 through licensed traders and power exchanges; (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 Renewable Energy Certificates (RECs) transacted through power exchanges.

1. Yearly Trends in Short-term Transactions of Electricity (2008-09 to 2012-13)

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 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 2013, there were 42 inter-state trading licensees (list is enclosed at Annexure-I) and two 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 2012-13, the volume of UI was about 24.76 billion kWh and that of between distribution companies was about 14.52 billion kWh.*

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 billion kWh (BU) in 2009-10 to 98.94 BU in 2012-13. The annual growth in volume was 24% from 2009-10 to 2010-11, 16% from 2010-11 to 2011-12 and 5% from 2011-12 to 2012-13. Total volume of short-term transactions of electricity as percentage of total electricity generation has increased from 9% in 2009-10 to 11% in 2012-13 (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%

Source: NLDC

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 Trading Licensees and Power Exchanges

Table-2, Table-3, Figure-1 & Figure-2 show details of volume of electricity transacted through trading licensees under bilateral transactions and through power exchanges for the period from 2008-09 to 2012-13. The volume of electricity transacted through inter-state trading licensees and power exchanges increased from 24.69 BU in 2008-09 to 59.66 BU in 2012-13. The share of electricity transacted through trading licensees and power exchanges (in volume terms) as a percentage of total short-term transactions of electricity has shown a moderate rise (from 51.45% in 2009-10 to 60.30% in 2012-13). The growth in volume for this segment during the year 2012-13 as compared to 2011-12 was 8.28 BU in absolute terms and about 16 in percentage terms. Majority of this growth has come from the power exchange segment (8.00 BU). Looking at the individual sub-segment growth between the years 2011-12 and 2012-13, it is observed that the growth was 51% in power exchange segment whereas the growth was 0.78% in bilateral trader segment.

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

Year	Electricity Transacted through trading Licensees (BU)	Electricity Transacted through IEX (BU)		Electricity Transacted through PXIL (BU)		Electricity Transacted through IEX and PXIL (BU)	Total (BU)
		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

Note1: The volume of electricity transacted through trading licensees 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

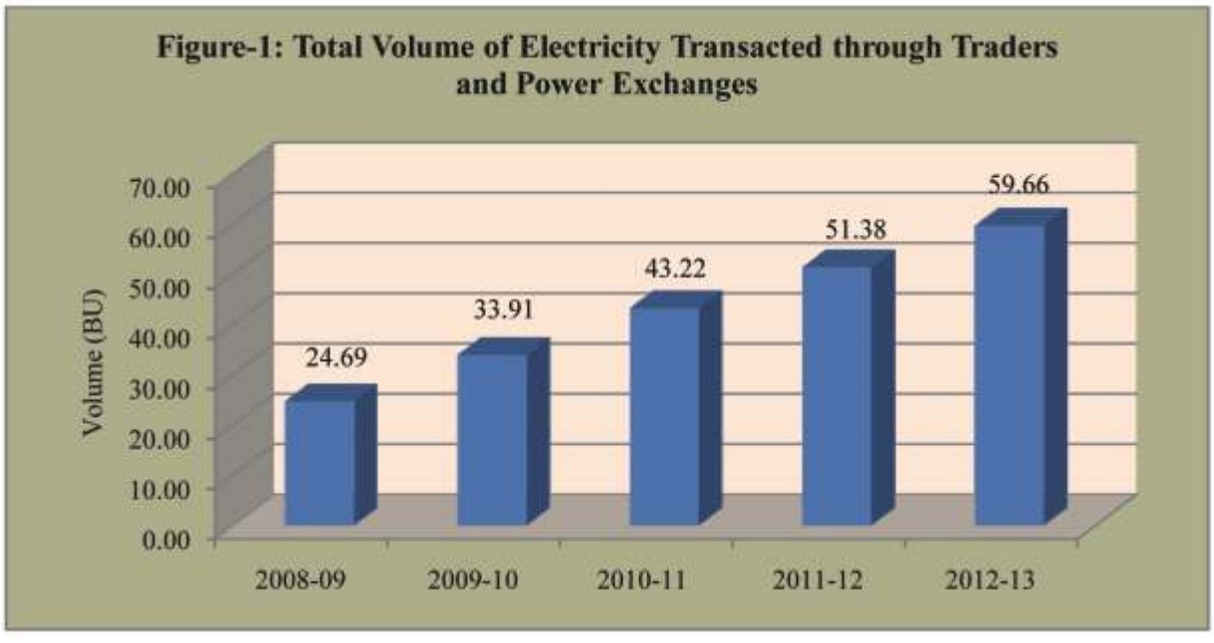
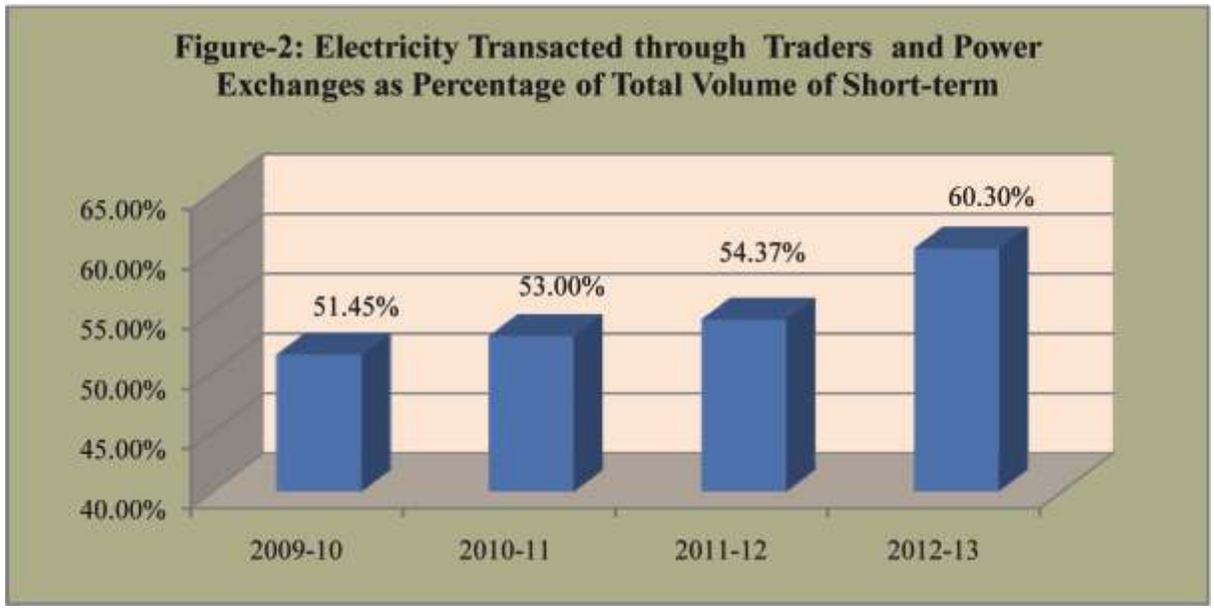


Table-3: Electricity Transacted through Trading Licensees and Power Exchanges as percentage of Total Volume of Short-term

Year	Volume of Electricity Transacted through Traders and Power Exchanges (BU)	Total Short-term Transactions of Electricity (BU)	Electricity Transacted through traders and PXs as % to 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%



The price of electricity transacted through trading licensees and Power Exchanges is shown in Table-4 and Figure-3. The weighted average price of electricity transacted through trading licensees and power exchanges declined from ₹7.29/kWh and ₹7.49/kWh respectively in 2008-09 to ₹4.33/kWh and ₹3.67/kWh respectively in 2012-13.

The decreasing trend in weighted average prices affected the market size of this segment in monetary terms (Table-5). However, there was change in this trend after 2011-12. In physical terms (BU terms) the size of this segment increased by about 16 % in the year 2012-13 compared to 2011-12, whereas in monetary terms the growth has been about 18% (about ₹3740 crore). The power exchange sub-segment registered a low growth of about 51% in physical terms and a high growth of about 56% (or ₹3094 crore) in monetary terms. The bilateral trader segment also registered a low growth of 0.78% in physical terms and a high growth of about 4% in monetary terms (or ₹646 crore).

Table-4: Price of Electricity Transacted through Traders & Power Exchanges

Year	Price of Electricity transacted through Trading Licensees (₹/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

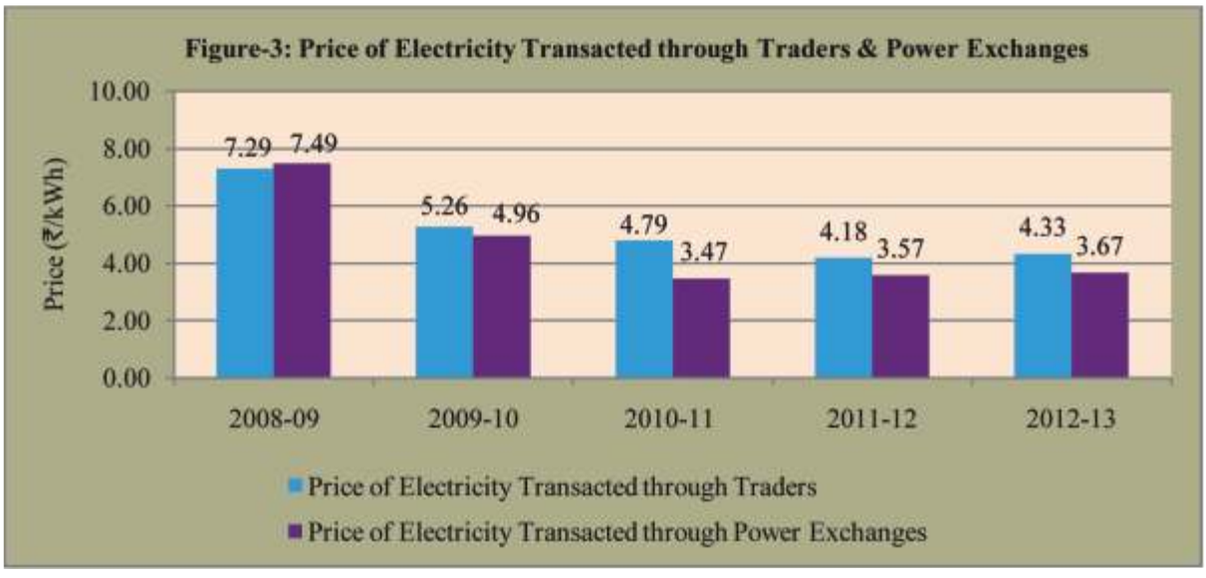


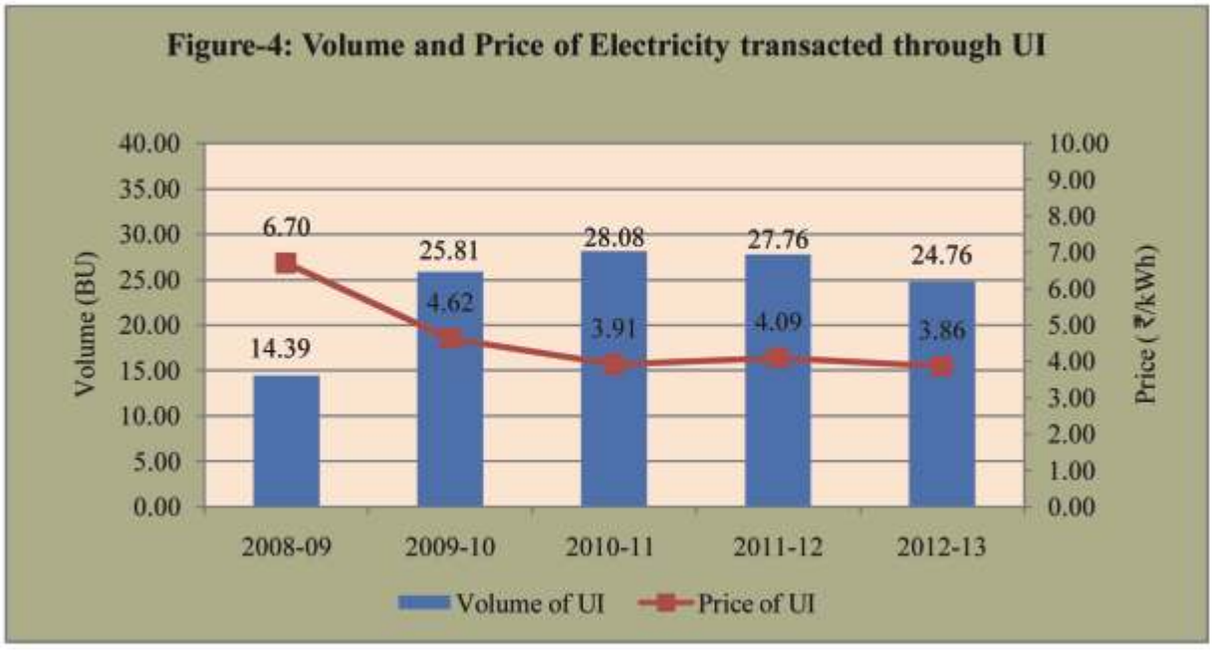
Table-5: Size of the Bilateral Trader and Power Exchange Market in Monetary Terms

Year	Electricity Transacted through trading Licensees (BU)	Price of Electricity Transacted through Trading licensees (₹/kWh)	Size of bilateral trader Market in ₹ Crore	Electricity Transacted through Power Exchanges (BU)	Price of Electricity Transacted through Power Exchanges (₹/kWh)	Size of Power Exchange Market in ₹ 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

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 that the volume of electricity transacted through UI declined from 25.81 BU in 2009-10 to 24.76 BU in 2012-13, and the volume of UI as percentage of total short-term volume has declined to 25% in 2012-13 as compared to 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 ₹3.86/kWh in 2012-13.

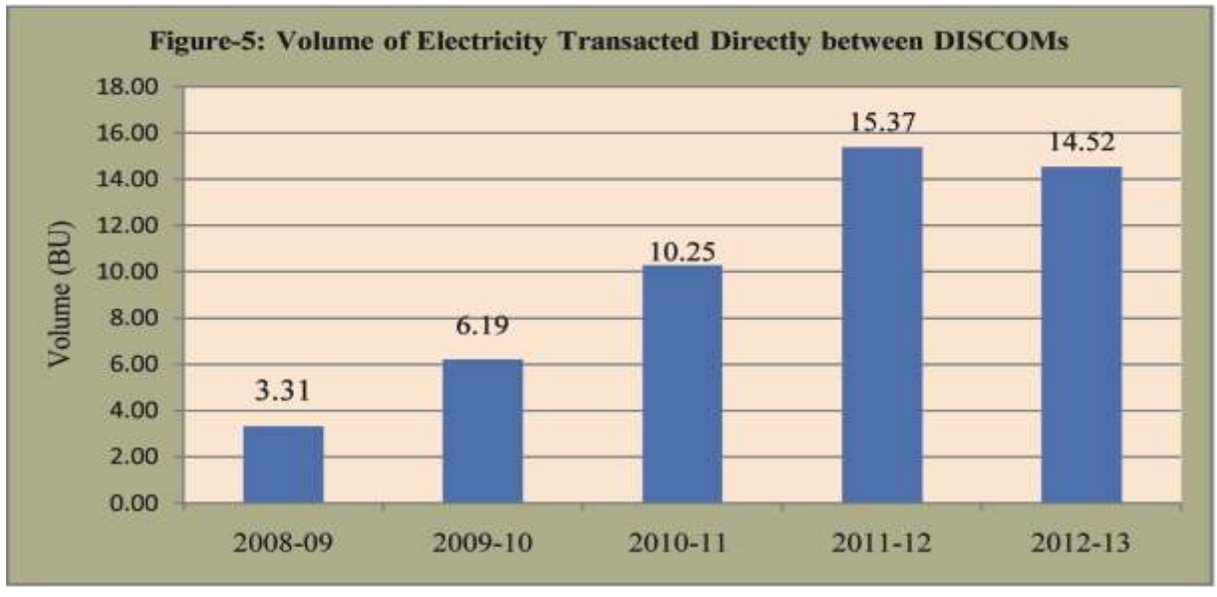
Table-6: Volume and Price of Electricity transacted through UI				
Year	**Volume of UI (BU)**	**Total Volume of Short term (BU)**	**Volume of UI as % of total volume of Short term**	**Price of UI (₹/kWh)**
2008-09	14.39	35.27	41%	6.70
2009-10	25.81	65.90	39%	4.62
2010-11	28.08	81.56	34%	3.91
2011-12	27.76	94.51	29%	4.09
2012-13	24.76	98.94	25%	3.86
Note: The data for the year 2008-09 is for the period from August 2008 to March 2009.				



1.1.3 Electricity Transacted Directly Between DISCOMs

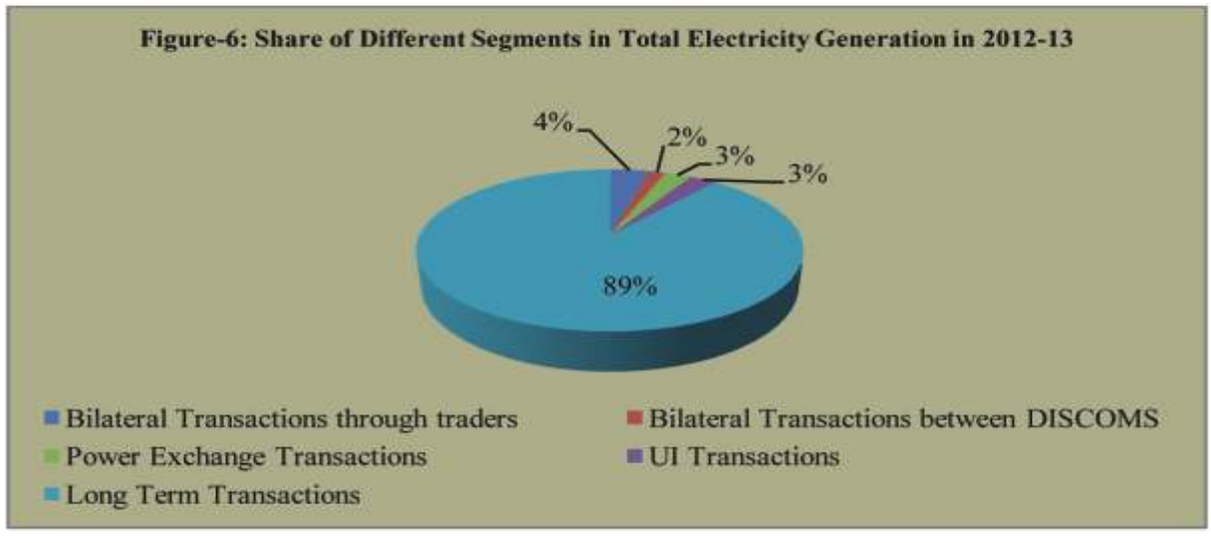
The volume of electricity transacted directly between DISCOMs is shown in Table-7 and Figure-5. It can be observed from the table that the volume of electricity transacted directly between DISCOMs increased significantly from 6.19 BU in 2009-10 to 14.52 BU in 2012-13. It can also be observed that, the share of electricity transacted directly between DISCOMs as percentage to total volume of short-term transaction of electricity has also increased from 9% to 15% in the same period. However, compared to previous year (2011-12), both volume of electricity transacted directly between DISCOMs and the share of electricity transacted directly between DISCOMs as percentage to total volume of short-term transaction of electricity slightly declined in 2012-13.

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

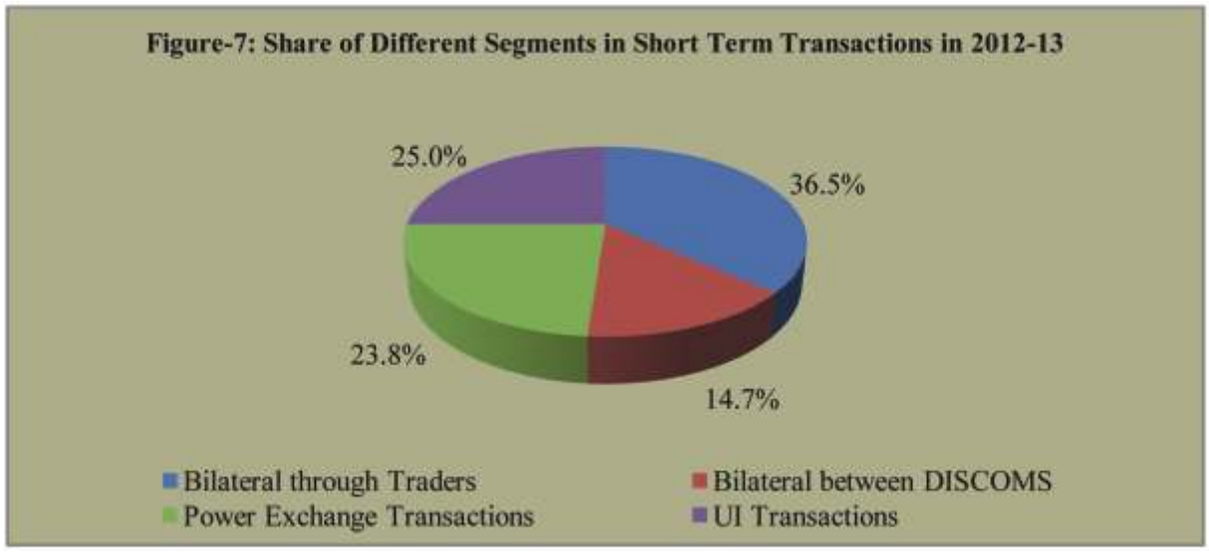


2. Monthly Trends in Short-term Transactions of Electricity (April 2012-March 2013)

During 2012-13, 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 percent (Figure-6 and Table-8).



The share of different segments within the total short-term transaction for the year 2012-13 has been shown in the Figure-7 below.



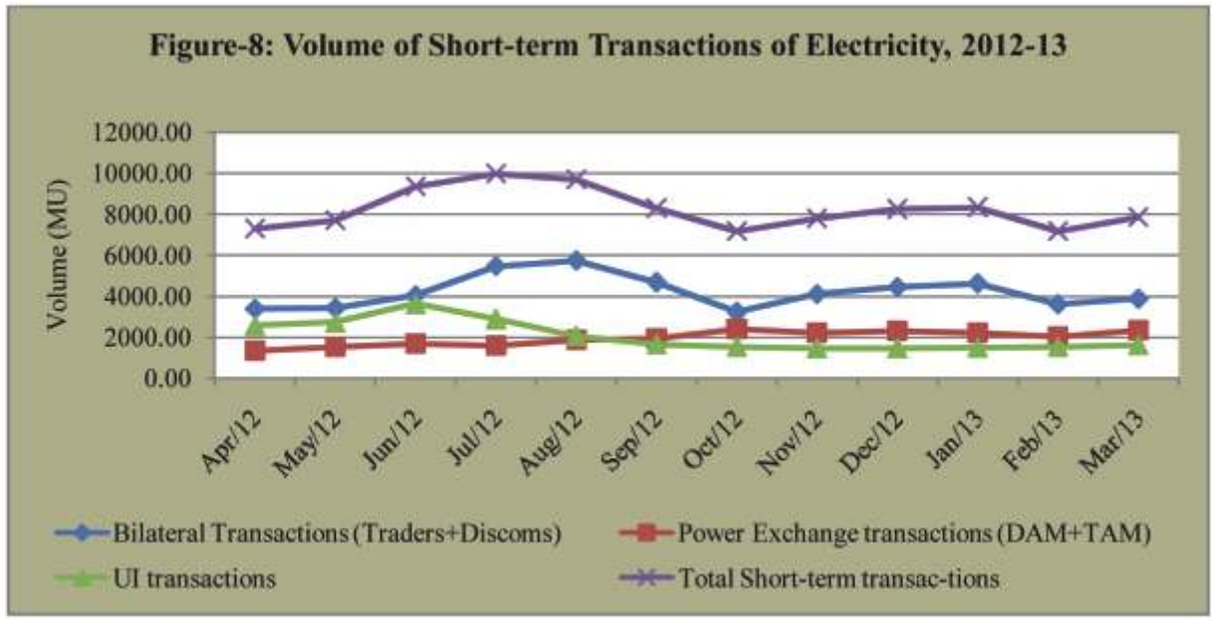
2.1. Volume of Short-term Transactions of Electricity

The volume of short-term transactions of electricity during different months of the year 2012-13 with break-up for different segments is shown in Table-8 and Figure-8.

Table-8: Volume of Short-term Transactions of Electricity (MUs), 2012-13

Period	Bilateral through Traders	Bilateral between DISCOMS	Total Bilateral transac-tions	Power Exchange transac-tions (DAM+TAM)	UI transac-tions	Total Short-term transac-tions	Total Electricity Generation
Apr-12	2376.06	1010.98	3387.04	1345.83	2576.07	7308.94	74725.25
May-12	2358.44	1068.25	3426.69	1536.21	2736.64	7699.54	78786.00
Jun-12	2891.17	1148.43	4039.60	1684.82	3638.02	9362.44	76305.68
Jul-12	3733.82	1737.69	5471.51	1604.86	2900.29	9976.66	76091.19
Aug-12	3828.00	1910.69	5738.69	1887.96	2076.03	9702.68	74262.66
Sep-12	3031.99	1655.61	4687.60	1949.77	1661.62	8298.99	73074.53
Oct-12	2327.02	901.70	3228.72	2407.35	1541.99	7178.06	78311.13
Nov-12	3172.01	931.50	4103.51	2219.47	1474.50	7797.48	72601.61
Dec-12	3360.16	1086.27	4446.43	2323.97	1480.16	8250.56	76495.84
Jan-13	3428.10	1192.76	4620.86	2217.82	1502.50	8341.18	78403.87
Feb-13	2660.25	949.90	3610.15	2032.69	1534.05	7176.89	68458.78
Mar-13	2953.50	924.81	3878.31	2331.45	1637.26	7847.02	79973.89
Total	**36120.52**	**14518.59**	**50639.11**	**23542.20**	**24759.13**	**98940.44**	**907490.43**
% share in total genera-tion	**4%**	**2%**	**6%**	**3%**	**3%**	**11%**	**100%**
% share in Short-term Volume	**36.5%**	**14.7%**	**51.2%**	**23.8%**	**25.0%**	**100%**	

It can be observed from Figure-8 that there is a cyclical trend in the total volume of short-term transactions of electricity. It can also be observed from the figure that there is no constant increase/decrease in the volume of all segments of the short-term transactions of electricity. This trend may have emerged due to change in demand and supply of electricity from season to season.



The volume of short-term transactions of electricity as percentage of total electricity generation varied between 9.17% and 13.11% 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-12	9.78%
May-12	9.77%
Jun-12	12.27%
Jul-12	13.11%
Aug-12	13.07%
Sep-12	11.36%
Oct-12	9.17%
Nov-12	10.74%
Dec-12	10.79%
Jan-13	10.64%
Feb-13	10.48%
Mar-13	9.81%

There were 42 inter-state trading licensees as on 31.3.2013. However, of these, only 22 trading licensees actively traded during the year 2012-13 (Table-10).

The volume of electricity transacted through trading licensees (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 trading licensees (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 trading licensees during 2012-13 was 0.1437, which indicated non-concentration of market power among the trading licensees.

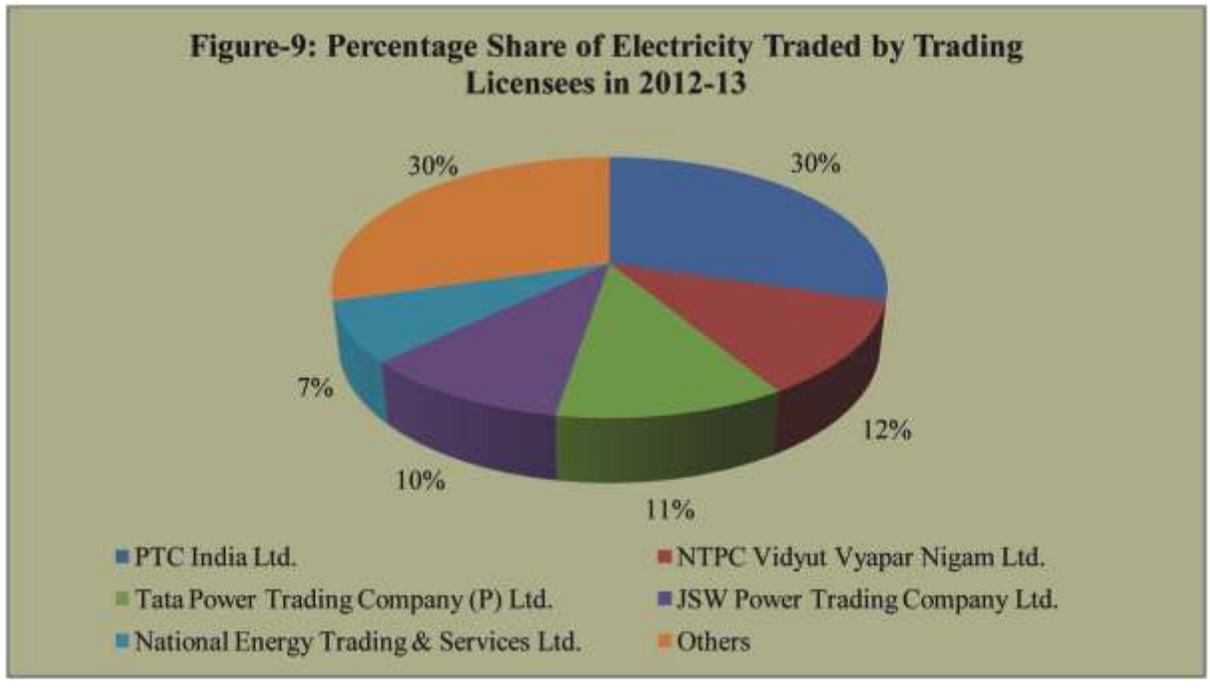
Table-10: Percentage Share of Electricity Traded by Trading Licensees and HHI in 2012-13

Sr No	Name of the Trading Licensee	Share of Electricity traded in 2012-13	Herfindahl Herschman Index (HHI)
1	PTC India Ltd.	29.64%	0.0879
2	NTPC Vidyut Vyapar Nigam Ltd.	11.67%	0.0136
3	Tata Power Trading Company (P) Ltd.	11.29%	0.0128
4	JSW Power Trading Company Ltd.	10.38%	0.0108
5	National Energy Trading & Services Ltd.	7.44%	0.0055
6	Adani Enterprises Ltd.	6.91%	0.0048
7	Reliance Energy Trading (P) Ltd	6.85%	0.0047
8	Knowledge Infrastructure Systems (P) Ltd.	4.74%	0.0023
9	Mittal Processors (P) Ltd.	1.98%	0.0004
10	Shree Cement Ltd.	1.89%	0.0004
11	Jaiprakash Associates Ltd.	1.38%	0.0002
12	GMR Energy Trading Ltd.	1.28%	0.0002
13	Instinct Infra & Power Ltd.	1.07%	0.0001
14	Essar Electric Power Development Corp. Ltd.	0.92%	0.0001
15	Global Energy (P) Ltd.	0.86%	0.0001
16	RPG Power Trading Company Ltd.	0.76%	0.0001
17	Manikaran Power Ltd.	0.40%	0.0000
18	Arunachal Pradesh Power Corporation (P) Ltd	0.23%	0.0000
19	Indrajit Power Technology (P) Ltd.	0.13%	0.0000
20	Ambitious Power Trading Company Ltd.	0.08%	0.0000
21	Pune Power Development Pvt. Ltd.	0.07%	0.0000
22	Customized Energy Solutions India (P) Ltd.	0.04%	0.0000
Total Volume		**100.00%**	**0.1437**
Share of the Top 5 Trading		**70.41%**	

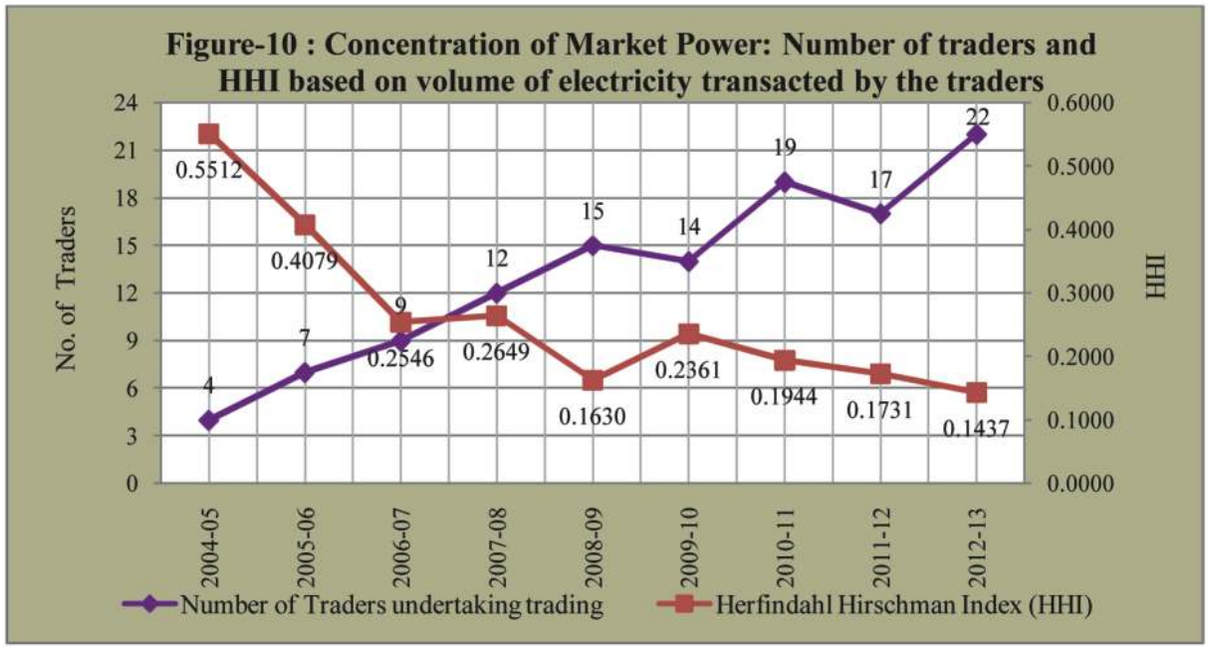
Note: Percentage share in total volume traded by Licensees in 2012 -13 computed based on the volume which includes the volume traded by inter-state trading licensees through bilateral and power exchanges. From October 2012 to March 2013, the volume includes cross border trading volume and intra-state trading volume.

Source: Information submitted by Trading Licensees.

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



Level of competition among the trading licensees (HHI based on volume of trade undertaken by the licensees) is shown in Figure-10 for the period 2004-05 to 2012-13. Number of inter-state trading licensees, who were undertaking trading bilaterally or through power exchanges, increased from 4 in 2004-05 to 12 in 2012-13. It can be observed from the figure that there is an inverse relationship between number of trading licensees and the HHI. The concentration of market power declined from high concentration (HHI of 0.5512) in 2004-05 to non-concentration (HHI of 0.1437) in 2012-13. The competition among the trading licensees resulted in increase in volume and decrease in prices in the short-term bilateral market (Table-5).

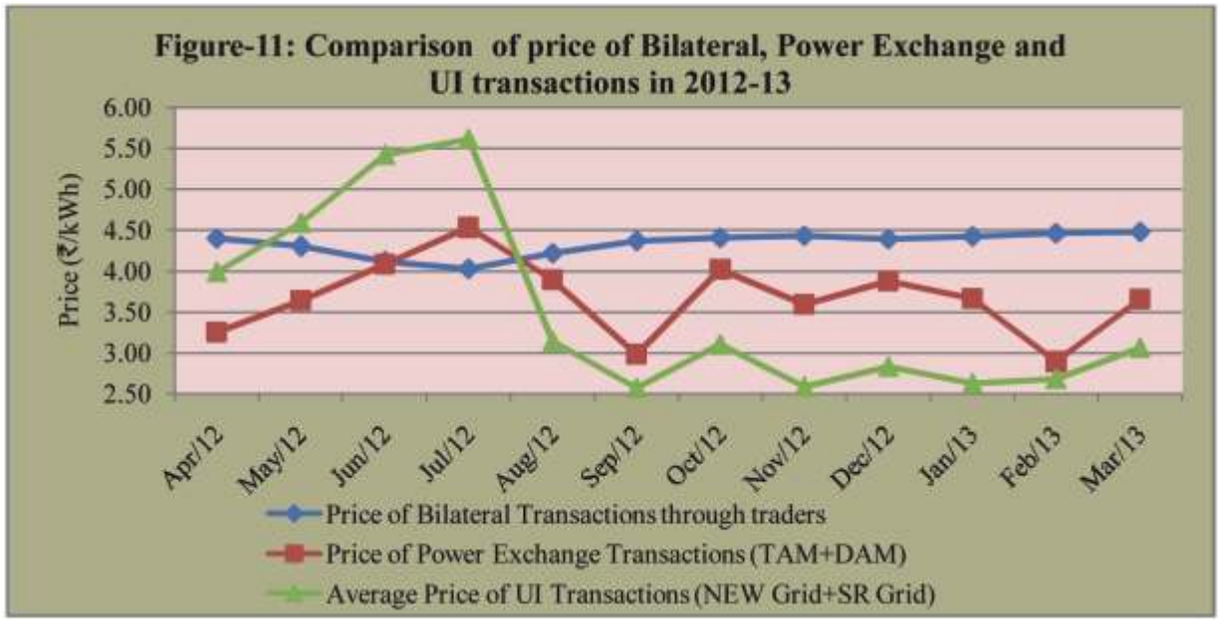


2.2. Price of Short-term Transactions of Electricity

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 trading licensees. The trends in price of electricity transacted through trading licensees (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.

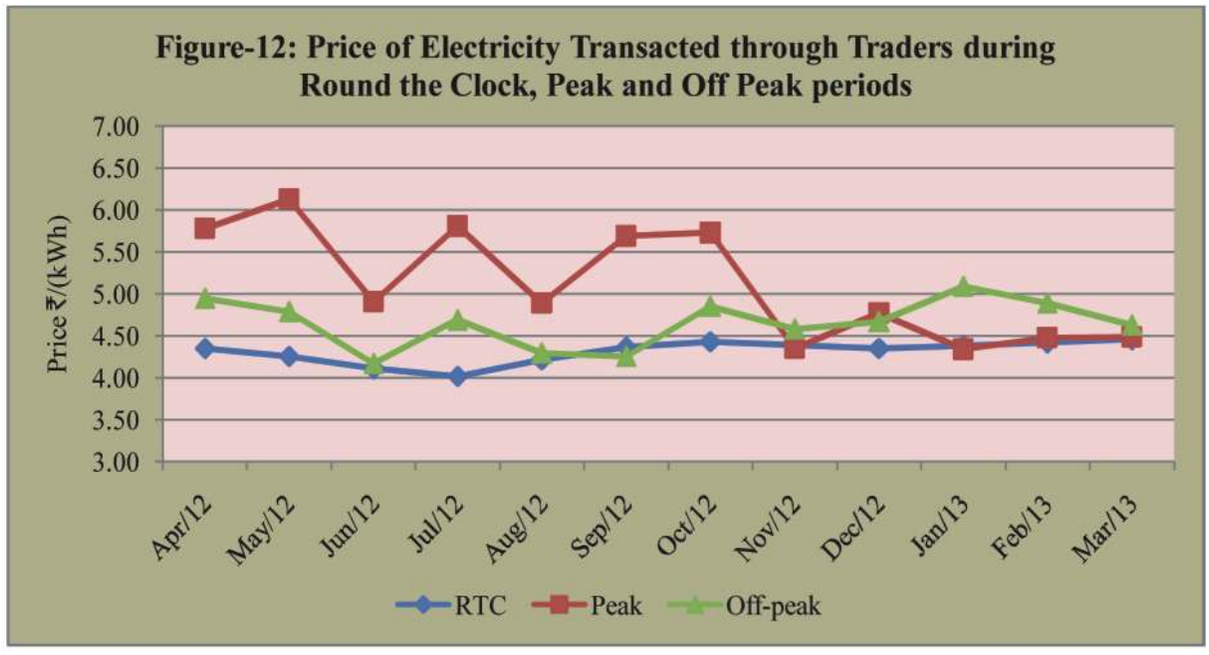
Table-11: Price of Short-term Transactions of Electricity (₹/KWh), 2012-13

Period	Bilateral through Traders				Power Exchange		UI	
	RTC	Peak	Off-peak	Total	IEX	PXIL	NEW Grid	SR Grid
Apr-12	4.35	5.78	4.95	4.40	3.19	4.71	2.81	5.16
May-12	4.26	6.13	4.79	4.30	3.60	3.89	4.26	4.92
Jun-12	4.11	4.91	4.17	4.11	4.11	4.10	5.55	5.29
Jul-12	4.02	5.81	4.69	4.03	4.51	4.54	6.13	5.09
Aug-12	4.22	4.89	4.30	4.22	3.89	3.53	2.16	4.12
Sep-12	4.37	5.69	4.26	4.37	2.98	2.34	1.45	3.69
Oct-12	4.43	5.73	4.85	4.41	4.03	3.76	2.29	3.91
Nov-12	4.39	4.35	4.58	4.43	3.62	2.89	1.87	3.30
Dec-12	4.35	4.77	4.67	4.39	3.90	3.08	2.33	3.33
Jan-13	4.38	4.34	5.09	4.42	3.65	3.66	2.31	2.94
Feb-13	4.42	4.48	4.89	4.46	2.90	2.42	1.53	3.83
Mar-13	4.46	4.49	4.63	4.48	3.68	2.76	1.79	4.33



It can be observed from the above figure that the price of electricity transacted through trading licensees was relatively high when compared with the price of electricity transacted through power exchanges and UI during the period August 2012 to March 2013.

The trends in price of electricity transacted by trading licensees during RTC, Peak and Off-peak periods are shown in Figure-12. It can be observed from the figure that the price of electricity during peak period is high in all the months from April to November 2012 when compared with the price during RTC and off peak periods.

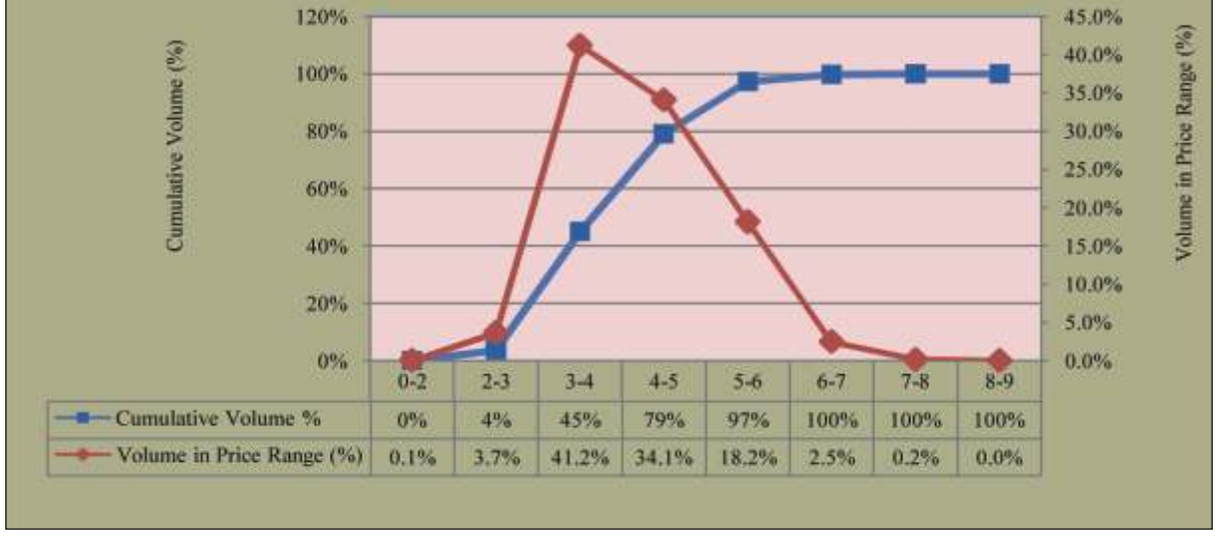


2.3 Volume of Electricity Transacted in Various Price Slabs

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

Cumulative volume and price of bilateral trader segment transactions in 2012-13 is depicted in Figure -13. The figure shows that only 45% of the volume of electricity through traders has been transacted at less than ₹4/kWh. It can be observed from the figure that 97% of the volume has been transacted at less than ₹6/kWh.

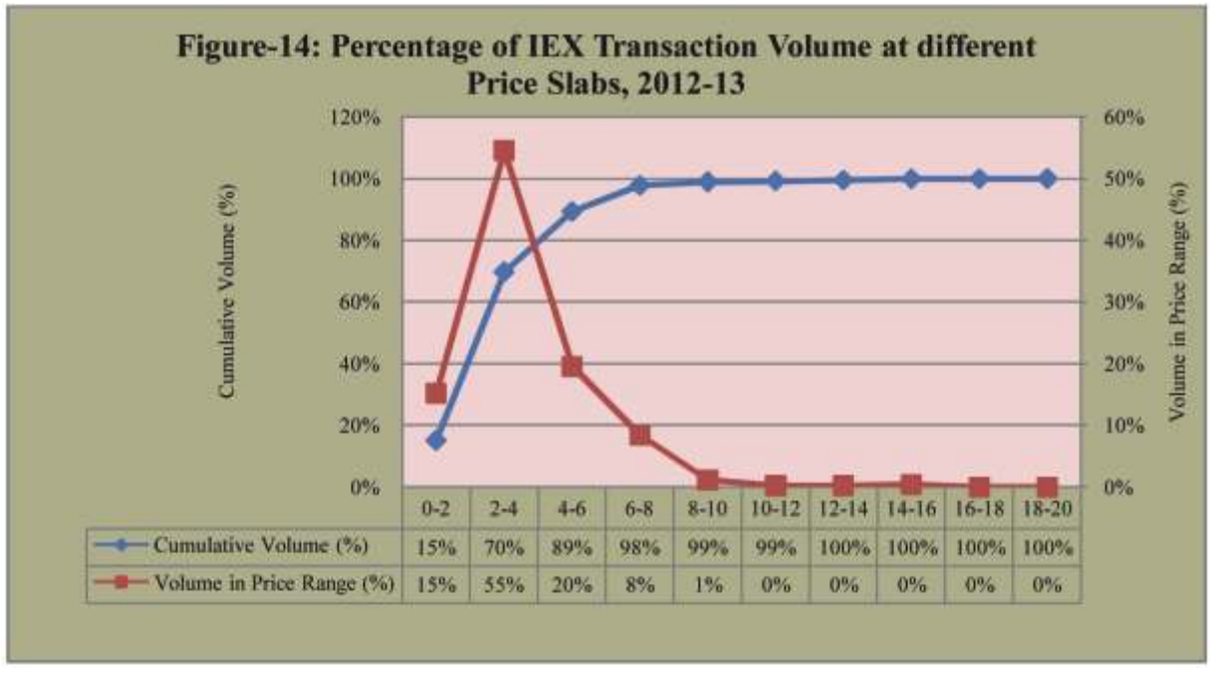
Figure-13: Percentage of Bilateral Transaction Volume at different Price Slabs, 2012-13



	0-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9
Cumulative Volume %	0%	4%	45%	79%	97%	100%	100%	100%
Volume in Price Range (%)	0.1%	3.7%	41.2%	34.1%	18.2%	2.5%	0.2%	0.0%

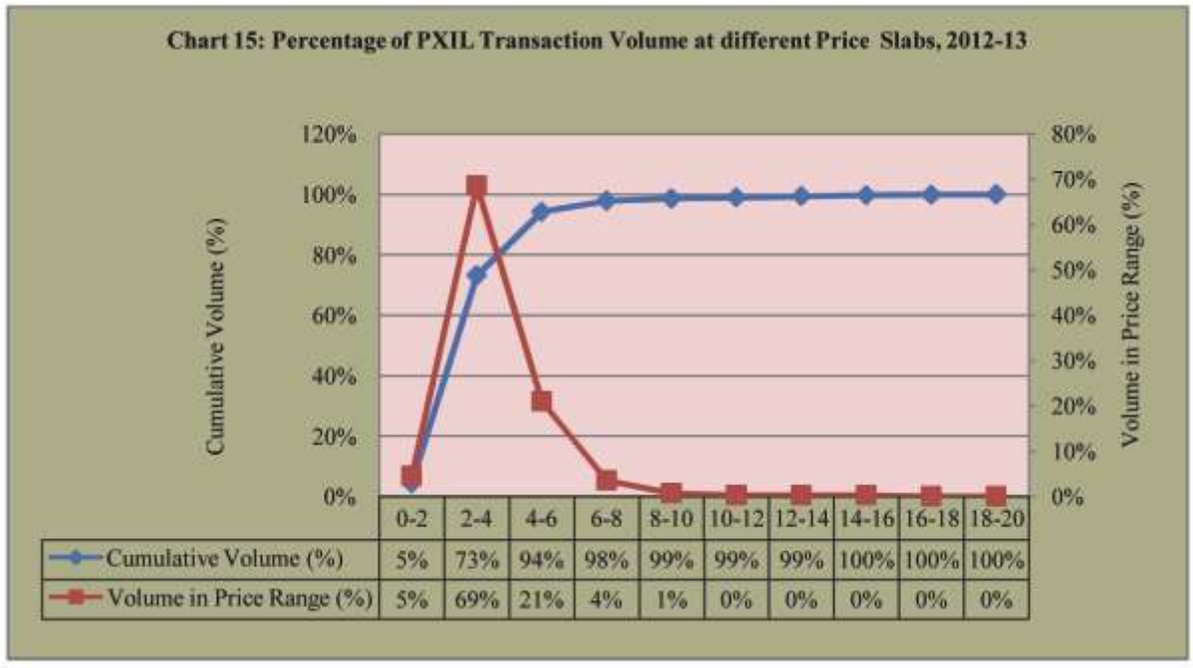
Cumulative volume and price of IEX Transactions in 2012-13 is depicted in Figure -14. The figure shows that 70% of the volume of electricity in IEX has been transacted at less than ₹4/kWh. It can be observed from the figure that 89% of the volume has been transacted at less than ₹6/kWh.

Figure-14: Percentage of IEX Transaction Volume at different Price Slabs, 2012-13



	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20
Cumulative Volume (%)	15%	70%	89%	98%	99%	99%	100%	100%	100%	100%
Volume in Price Range (%)	15%	55%	20%	8%	1%	0%	0%	0%	0%	0%

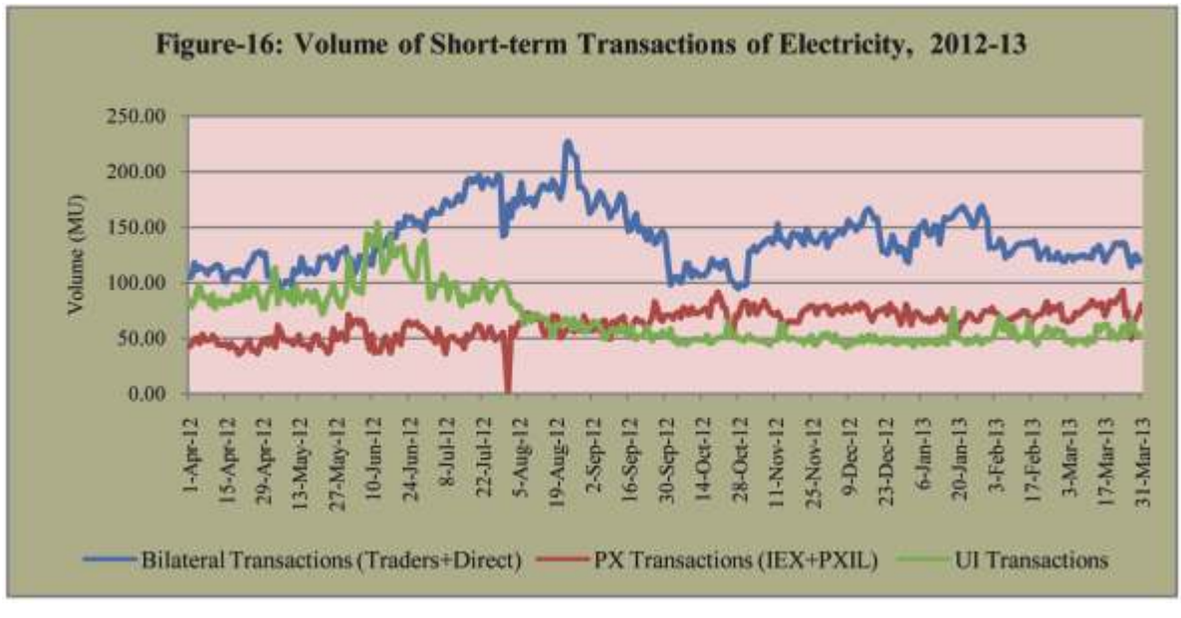
Cumulative volume and price of PXIL Transactions in 2012-13 is depicted in Figure -15. The figure shows that 73% of the volume of electricity in PXIL has been transacted at less than ₹4/kWh. It can be observed from the figure that 94% of the volume has been transacted at less than ₹6/kWh.



3. Daily Trends in Short-term Transactions of Electricity (1st April 2012 to 31st March 2013)

3.1 Volume of Short-term Transactions of Electricity

Trends in daily volume of short-term transactions are shown in Figure-16. It can be observed from the figure that there is cyclical trend in the volume of electricity transacted through bilaterals during the year 2012-13. It can also be observed that there is an increasing trend in the volume of electricity transacted through power exchanges whereas there is a declining trend in the volume of electricity transacted through UI during the year.

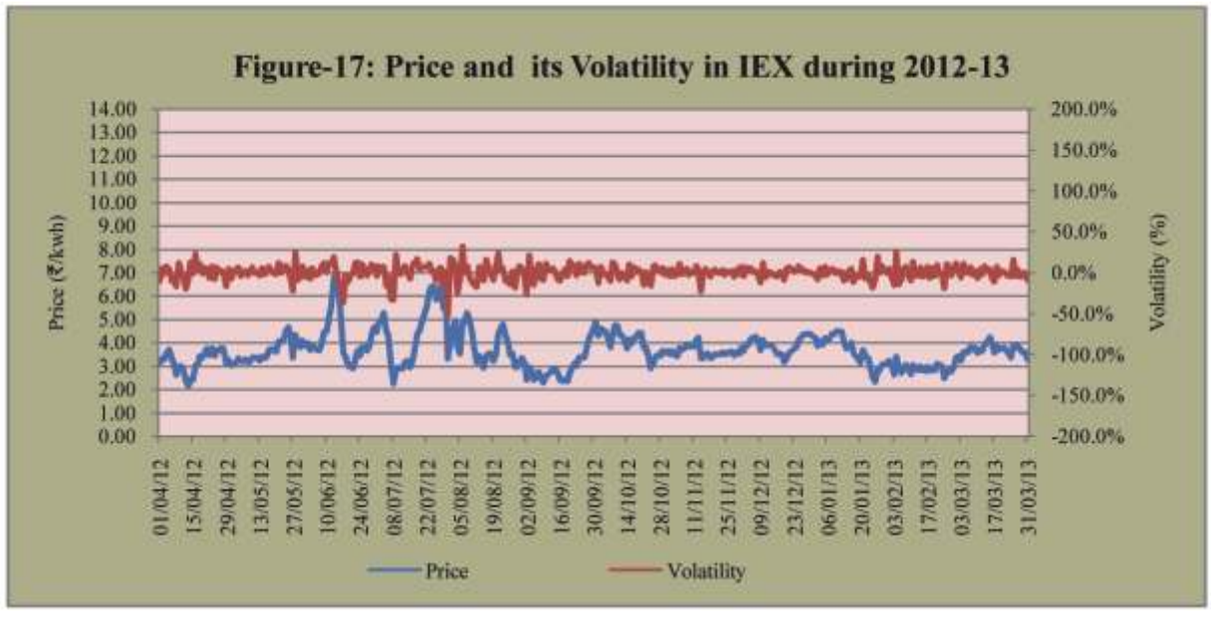


3.2 Price of Short-term Transactions of Electricity

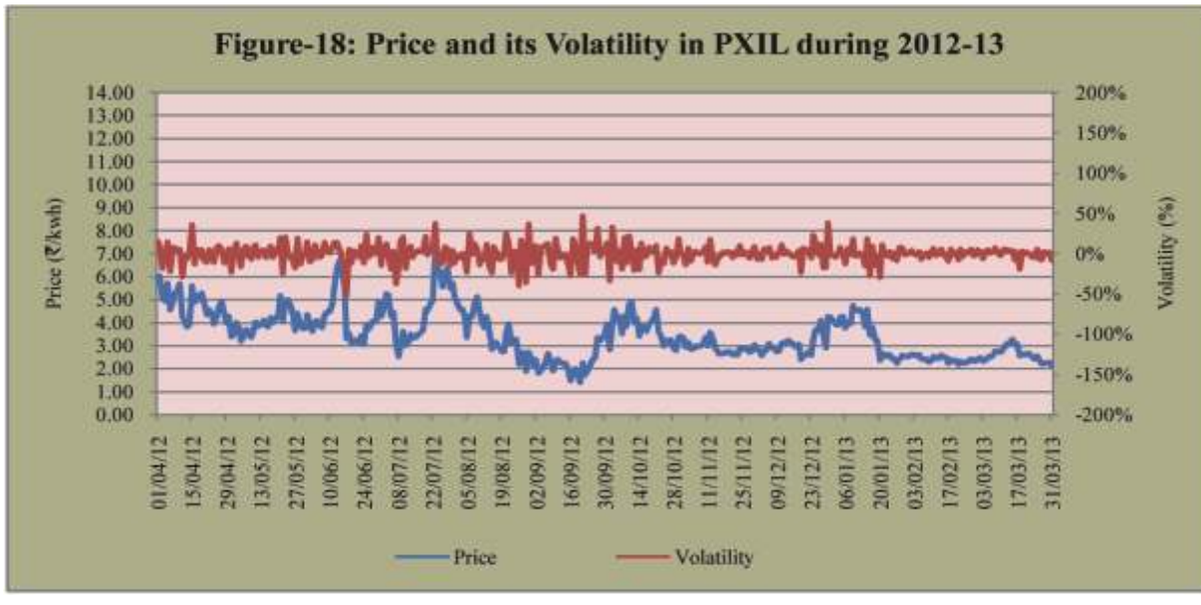
Trends in daily price of short-term transactions have been illustrated in this section for power exchanges and UI transactions.

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-17. Volatility in the Price of electricity transacted through IEX has been computed using daily data for the year 2012-13 and it works out to 9.30%. (See Annexure-II for historic volatility formula).

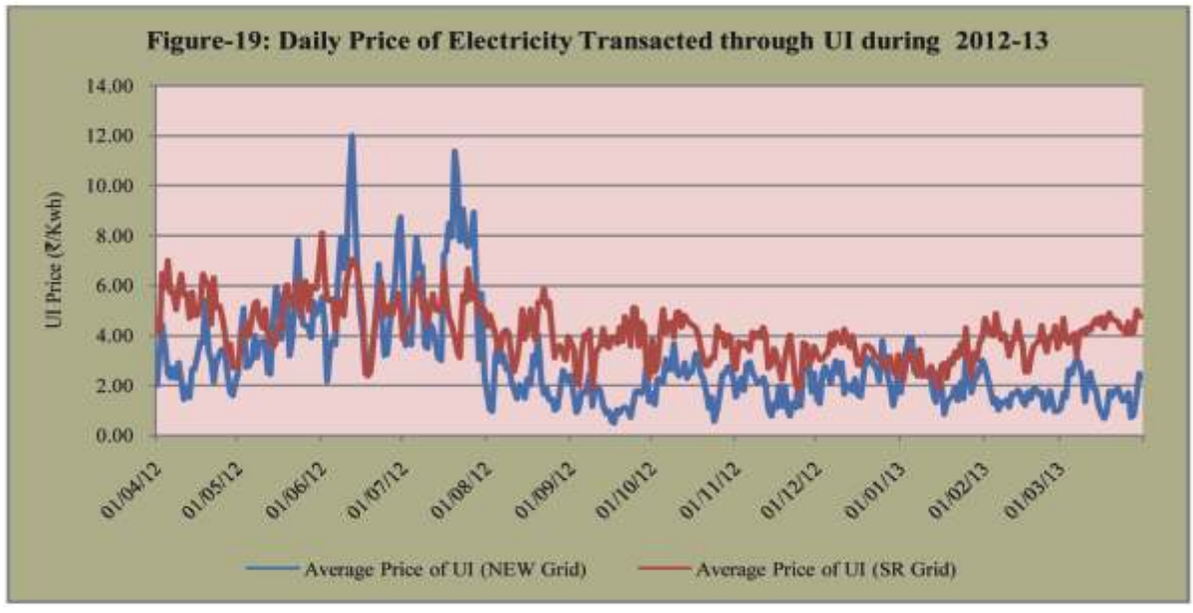


The weighted average price of electricity transacted through PXIL and its volatility is shown in Figure-18. Volatility in the Price of electricity transacted through PXIL has been computed using daily data for the year 2012-13 and it works out to 12.08%.



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-19.



It can be observed from the above figure that there was divergence in the price of UI in the NEW Grid and SR Grid in the month of April, August and October 2012 and in February and March 2013 (with prices in SR Grid registering higher levels than price in the 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 the UI price in the NEW Grid was high for a few days in June and July 2012, when compared with the UI price in SR Grid.

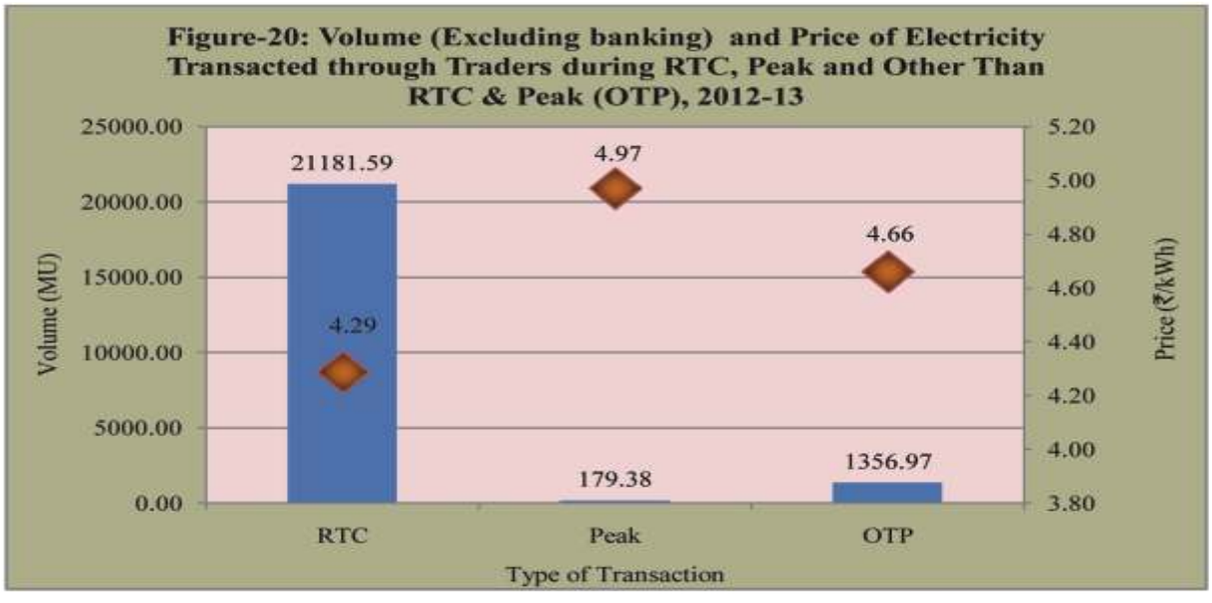
4. Time of the Day Variation in Volume and Price of Electricity Transacted through Traders and Power Exchanges (Day Ahead Market Sub-Segment)

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

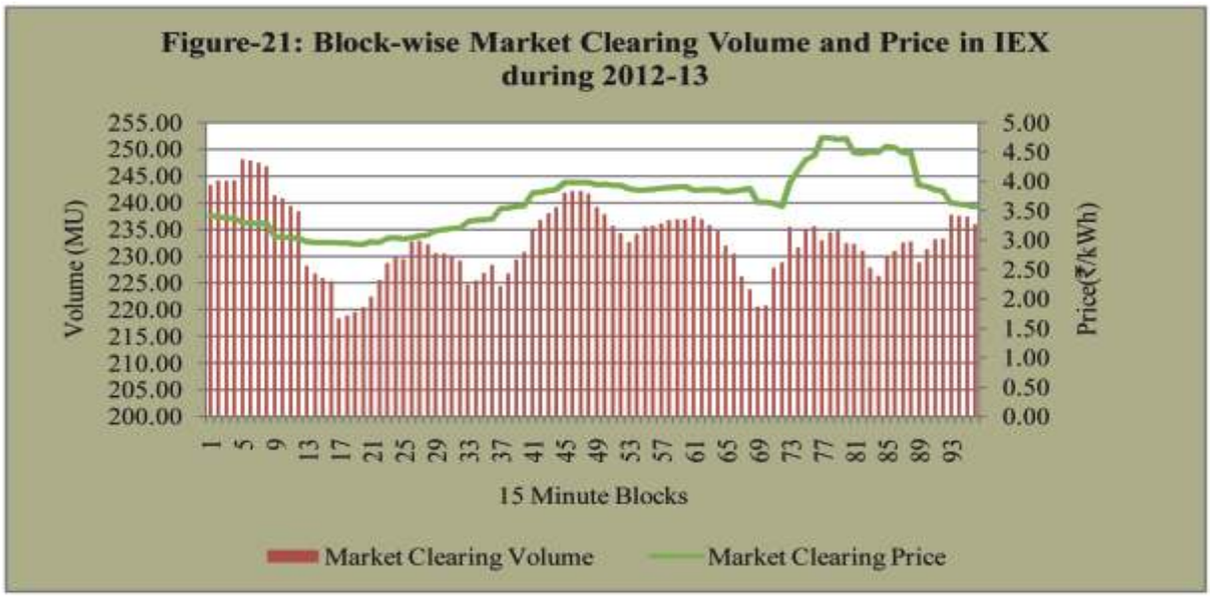
Time of the day variation in volume and price of electricity transacted through bilateral trader transactions is shown in Figure-20. The volume of the traders represents inter-state transaction volume i.e. excluding banking transaction volume. Time of the day variation in volume is shown during RTC (Round the Clock), Peak period and OTP (other than RTC & Peak period). Of the total volume, 93.24% was transacted during RTC followed by 5.97% during OTP,

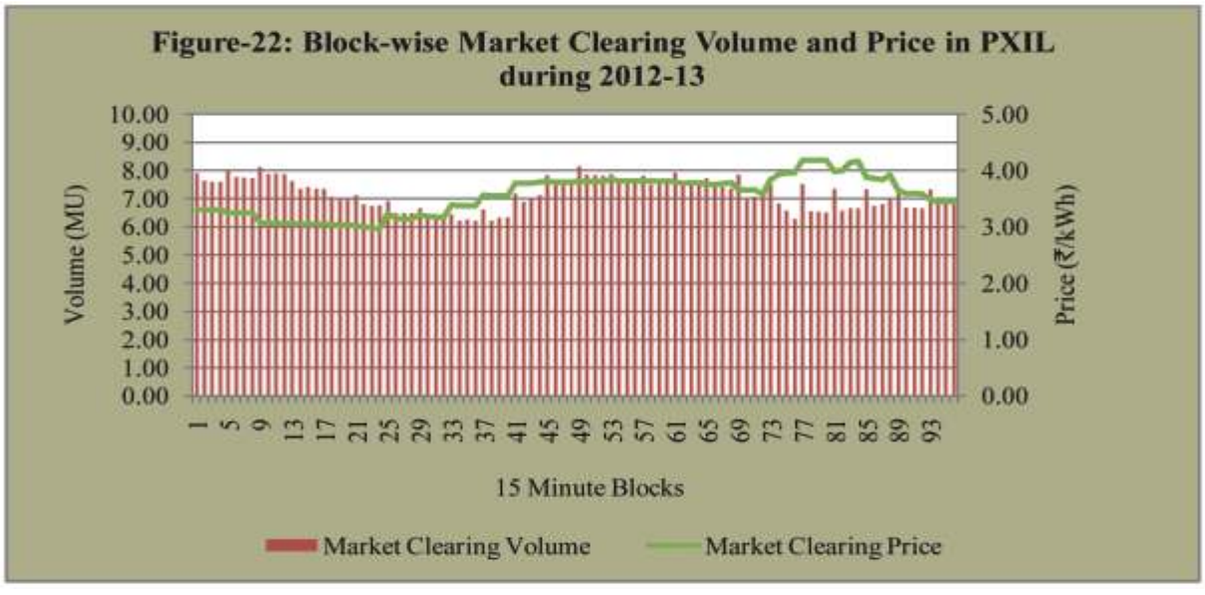
and 0.79% during peak period. It can be observed from the figure that there is hardly any volume transacted during peak period. It can also be observed that the price during peak period is high (₹4.97/kWh), as expected, when compared with the price during RTC and OTP.



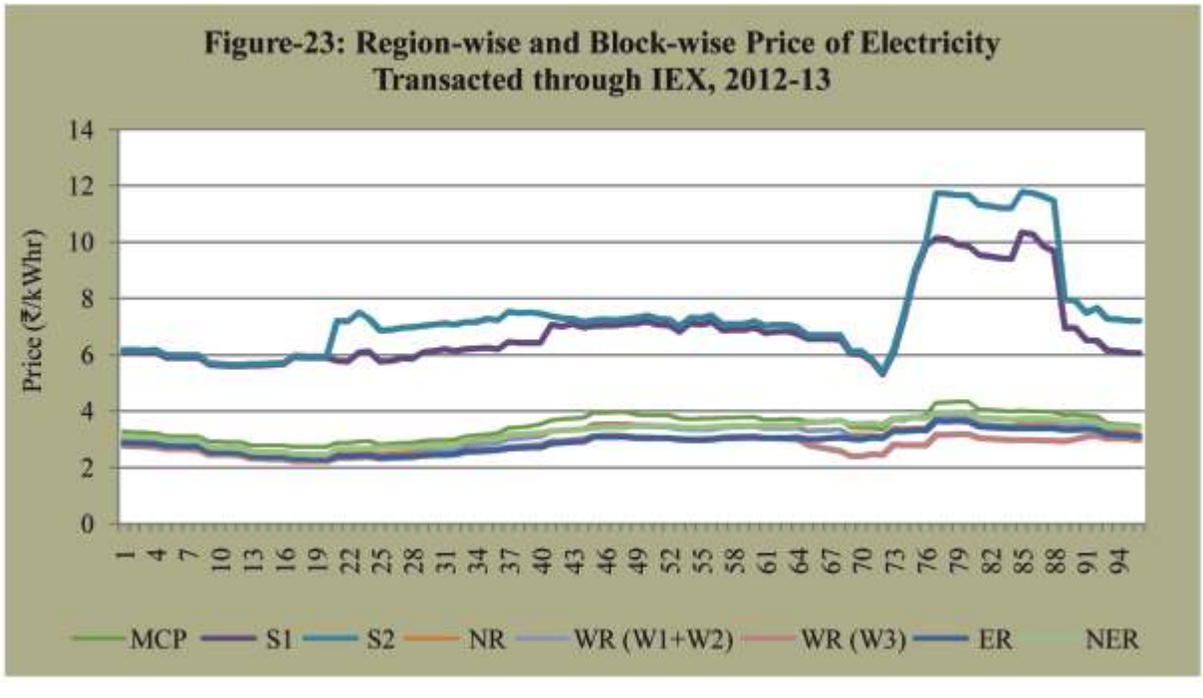
4.2 Time of the Day Variation in Volume and Price of Electricity Transacted through Power Exchanges (Day Ahead Market Sub-Segment)

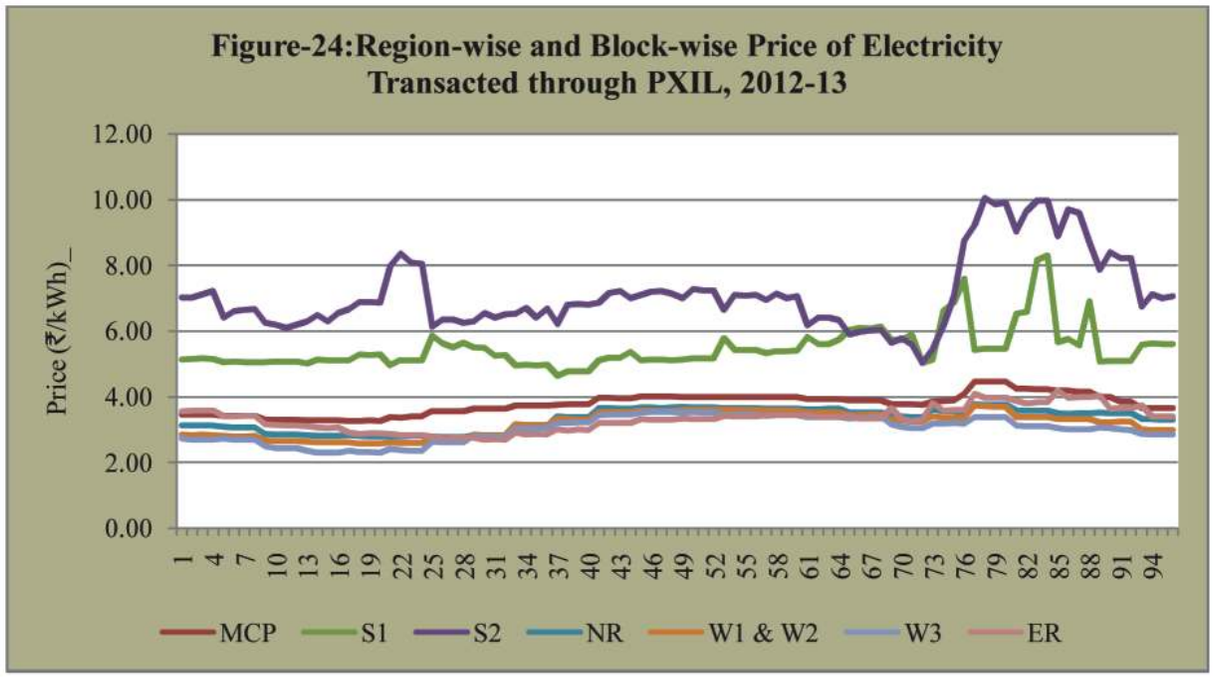
Time of the day variation in volume and price of electricity transacted through IEX and PXIL is shown in Figure-21 & Figure-22. Time of the day variation in volume and price of electricity transacted through power exchanges are shown block-wise. It can be observed from the figures that during peak period (between hours 18:00 to 23:00), the prices in both the exchanges were high when compared with the rest of the hours. It can also be observed that volume of electricity transacted in IEX and PXIL during peak period is low when compared with the rest of the hours, indicating that there is less demand during peak period.





Region-wise and hour-wise prices of electricity transacted through power exchanges are shown in Figure-23 and Figure-24. It can be observed from the figures that during the entire 2012-13, 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 in the power exchanges.



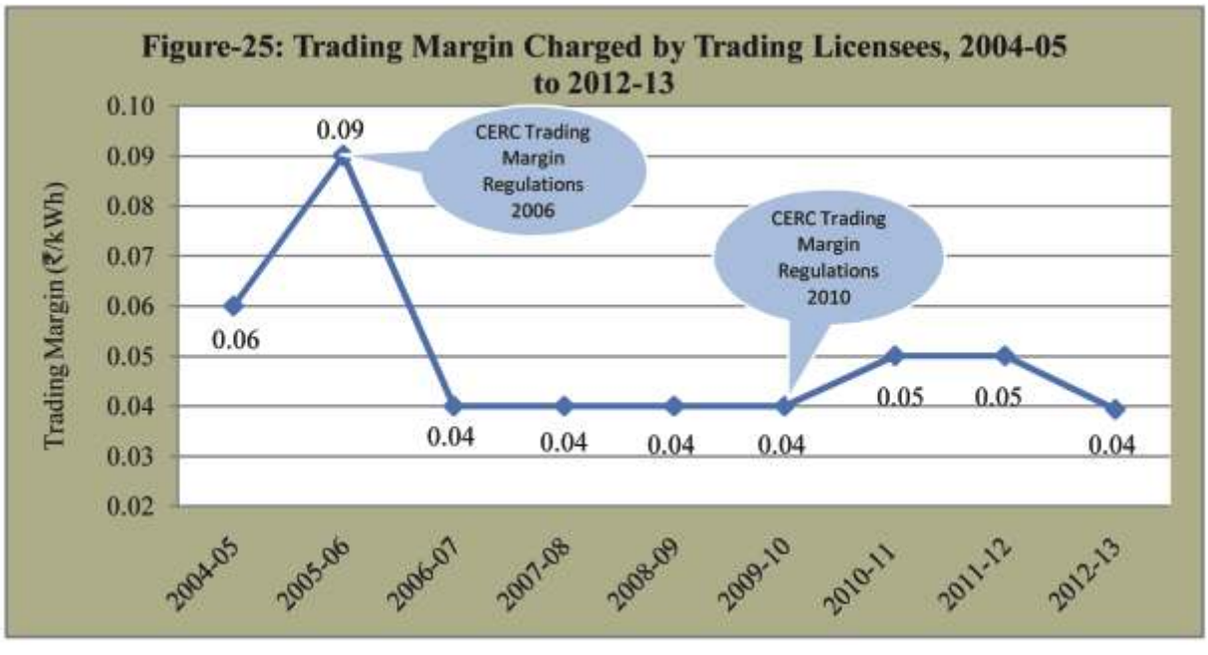


5. Trading Margin Charged by Trading Licensees for Bilateral Transactions

During the year 2004-05 (when trading started), the licensees voluntarily charged 5 paise/kwh or less as the trading margin. However, it 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-25) 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 margins for bilateral transactions during 2004-05 to 2012-13 is given in Table-12 and Figure-25.

Table-12: Weighted Average Trading Margin Charged by Trading Licensees, 2004-05 to 2012-13	
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
Note 1: Weighted Average Trading Margin is computed based on all Inter -state Trading Transactions excluding Banking Transactions	



Weighted average trading margin charged by the trading licensees for bilateral transactions for different sale price ranges during 2012-13 is provided in Table-13 below.

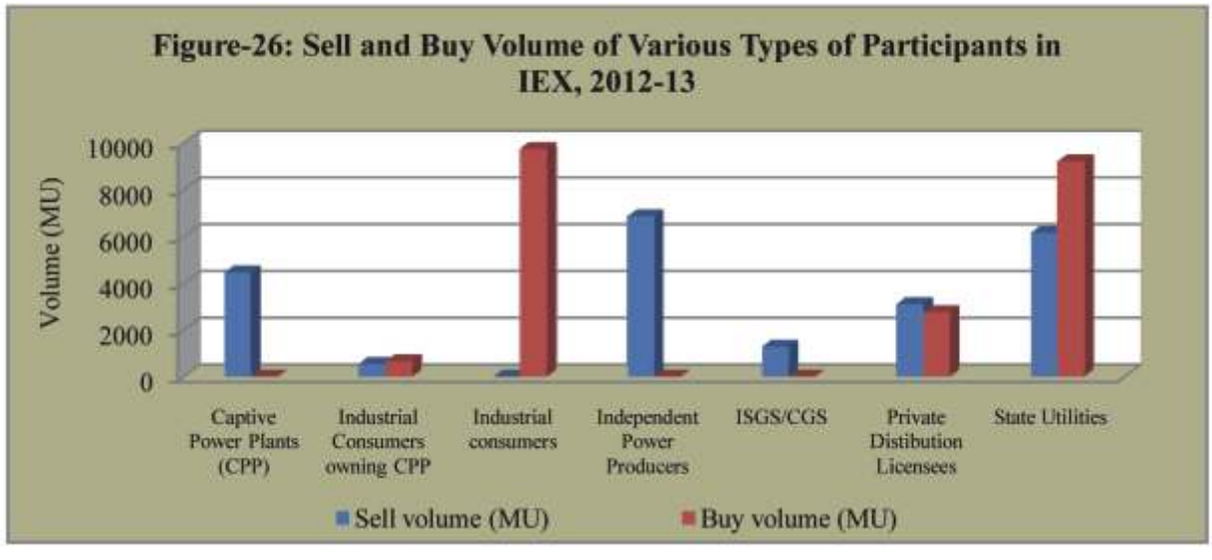
Table -13: Weighted Average Trading Margin Charged by Trading Licensees during 2012-13	
Sale Price of Electricity Transacted by Trading Licensees(₹/kWh)	**Weighted Average Trading Margin Charged by Trading Licensees(₹/kWh)**
When Sale Price is less than or Equal to ₹3/kWh	0.001
When Sale Price is greater than ₹3/kWh	0.04
₹3-4/kWh	0.04
₹4-5/kWh	0.05
₹5-6/kWh	0.03
₹6-7/kWh	0.02
₹7-8/kWh	0.06
₹8-9/kWh	0.04
Note 1: Weighted Average Trading Margin is computed based on all Inter -state Trading Transactions excluding Banking Transactions	

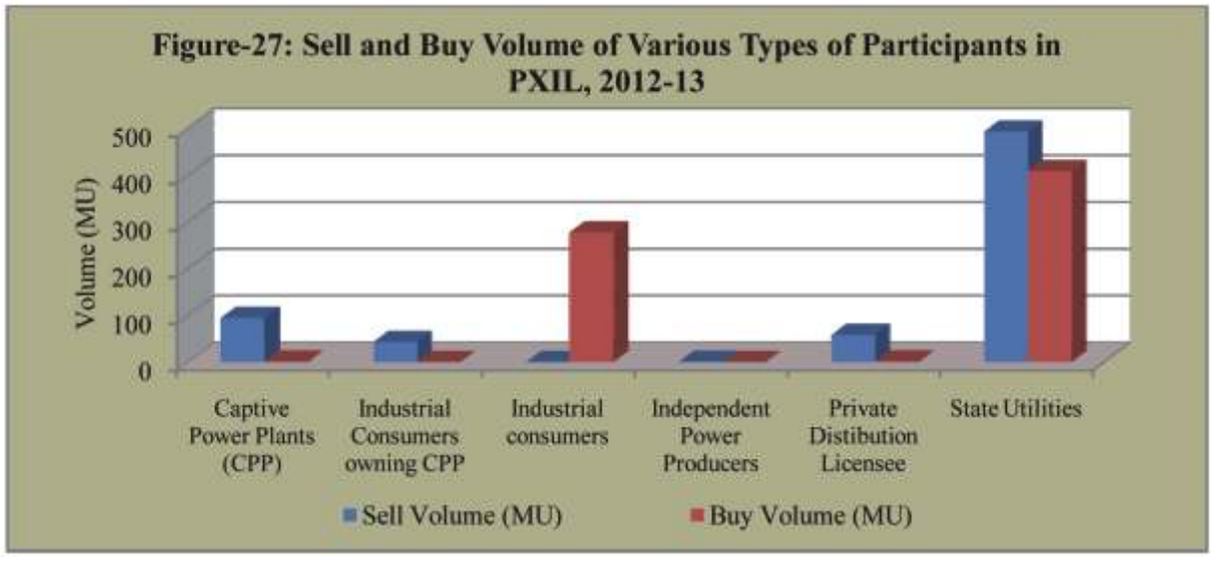
6. Analysis of Open Access Consumers on Power Exchanges (Day Ahead Market Sub-Segment)

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

6.1 Analysis of Various Types of Participants in Power Exchanges

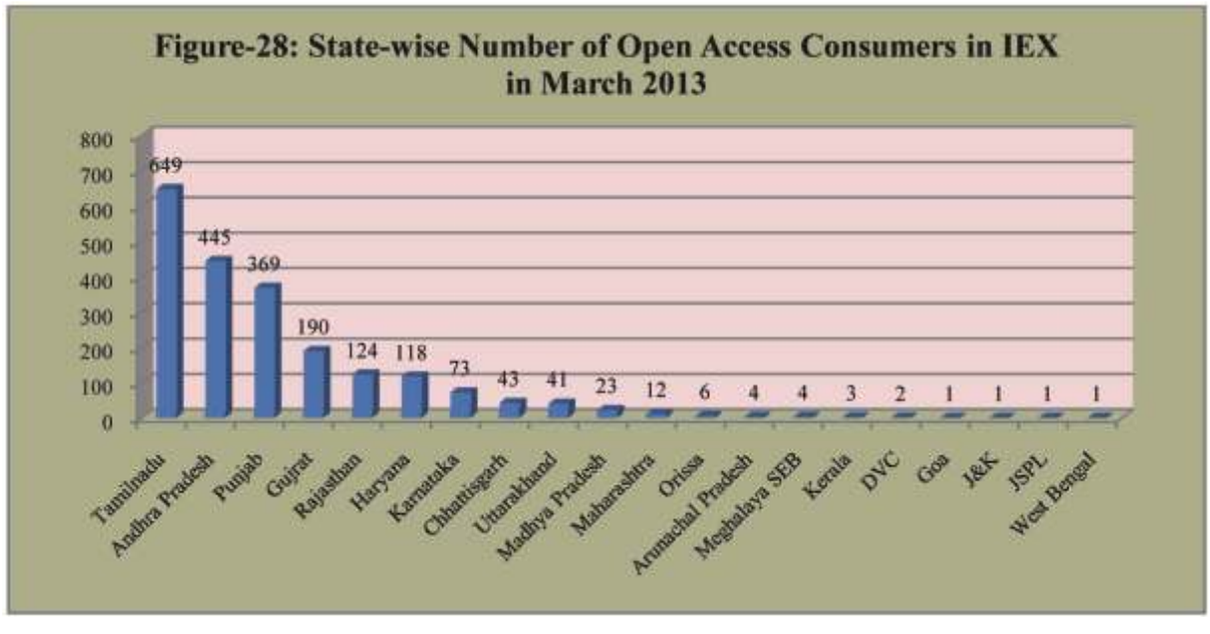
There are seven types of participants in both the power exchanges, as shown in Figure-26 and Figure-27. It can be observed from the figures that major sellers of electricity through power exchanges were independent private producers followed by state utilities, captive power plants and private distribution licensees. It can also be observed that major buyers of electricity through power exchanges were state utilities, industrial consumers and private distribution licensees.





6.2 Analysis of Open Access Consumers at 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 2110 Open Access (OA) Consumers were procuring part of their power requirements through IEX at the end of March 2013. These consumers were mostly located in Tamil Nadu, Andhra Pradesh and Punjab (Figure-28). During the year, these OA consumers procured a total of 10410 MU of electricity through IEX. In 2012-13, the weighted average price of electricity bought by open access consumers at IEX was lower (₹3.63/kWh) compared to the weighted average price of total electricity transacted through IEX (₹3.67/kWh).



In Table-14 & Figure-29, a month-wise comparison is made between number of open access consumer participants and total number of portfolios in IEX. In Table-15 & Figure-30, a month-wise comparison is shown between purchase volume of open access consumers and total volume of IEX. It can be seen that the number of OA consumers as a percentage of total number of portfolios in IEX has steadily gone up from 93.32% at the beginning of the year in April 2012 to 94.75% at the end of the year in March 2013. From April 2012 to March 2013, the volume procured by OA consumers as a percentage of total volume transacted in IEX, varied from 28.08% to 67.58%. For the year as a whole, volume procured by OA consumers as a percentage of total volume transacted in IEX was 46.53%.

Table-14: Number of Open Access Consumers in IEX, 2012-13

Month	No. of Open Access Consumers	Total No. of Portfolios in IEX	% of Open Access Consumers
Apr-12	1314	1408	93.32%
May-12	1363	1460	93.36%
Jun-12	1406	1507	93.30%
Jul-12	1445	1547	93.41%
Aug-12	1489	1591	93.59%
Sep-12	1540	1645	93.62%
Oct-12	1644	1752	93.84%
Nov-12	1721	1831	93.99%
Dec-12	1812	1925	94.13%
Jan-13	1898	2012	94.33%
Feb-13	1997	2111	94.60%
Mar-13	2110	2227	94.75%

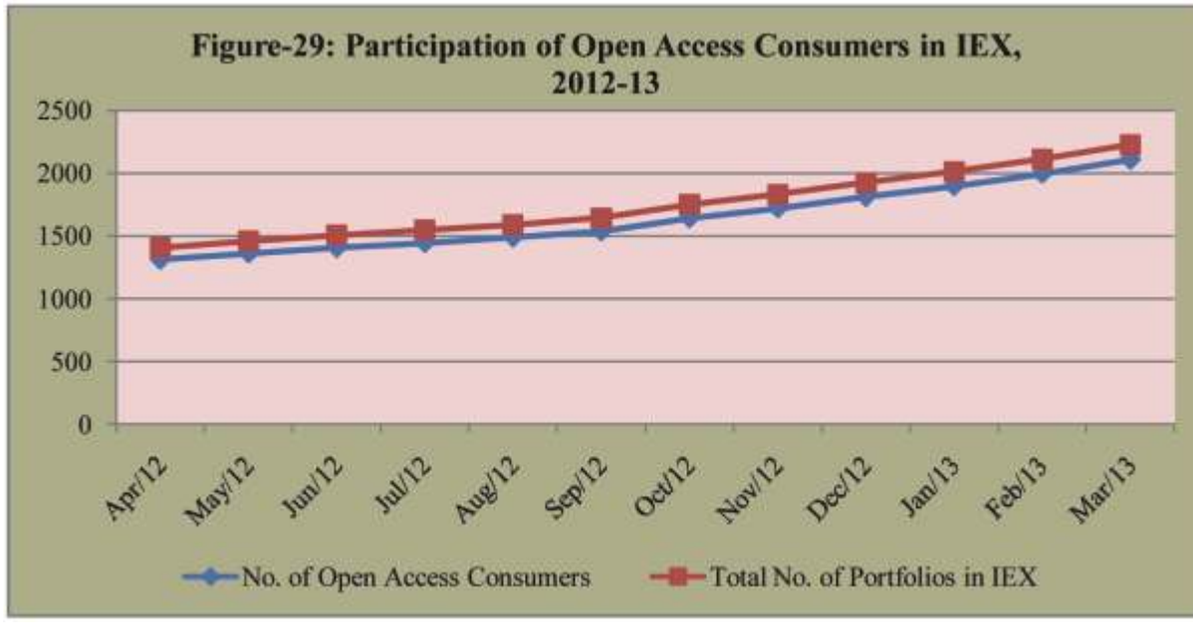
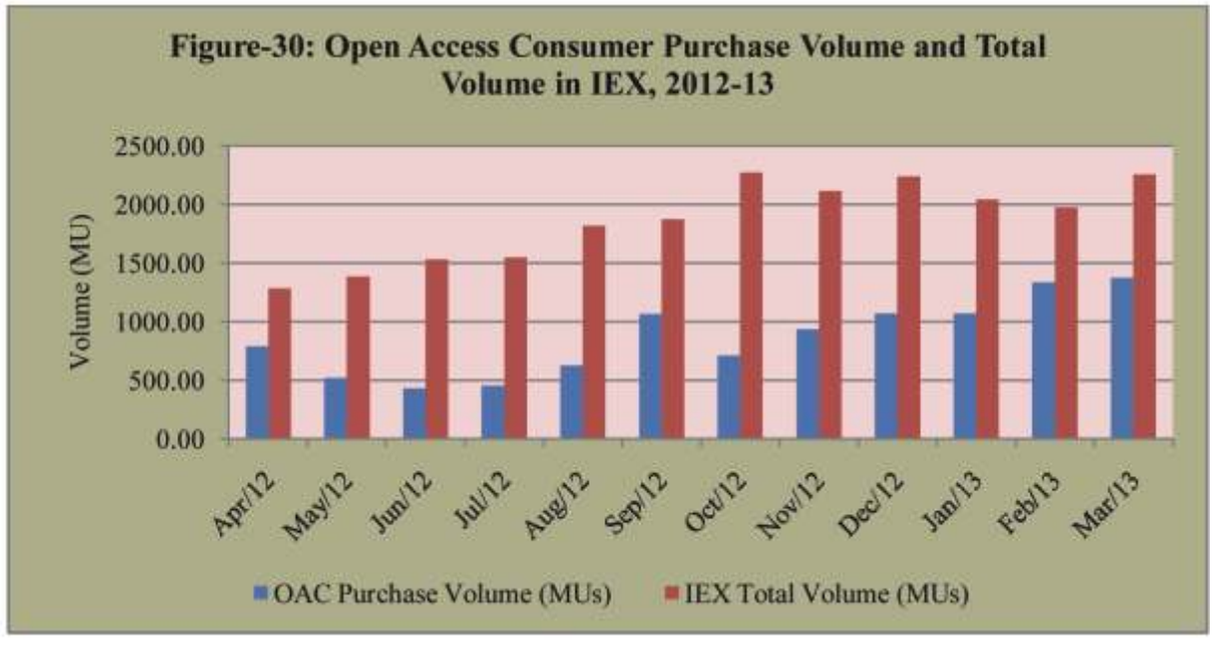
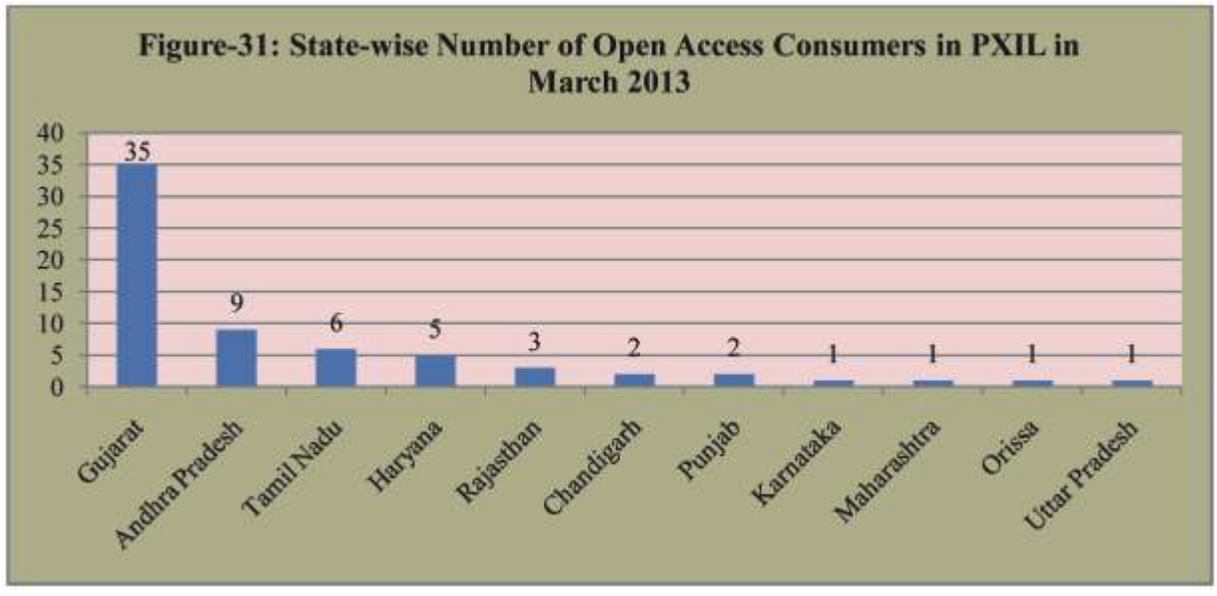


Table-15: Volume Participation of Open Access Consumers in IEX Day Ahead Market in 2012-13			
Month	**OAC Purchase Volume (MU)**	**IEX Total Volume (MU)**	**% OAC Purchase Participation**
Apr-12	793.75	1283.86	61.83%
May-12	524.25	1388.39	37.76%
Jun-12	431.19	1535.34	28.08%
Jul-12	452.64	1547.90	29.24%
Aug-12	626.69	1821.02	34.41%
Sep-12	1065.34	1878.69	56.71%
Oct-12	715.97	2277.60	31.44%
Nov-12	940.88	2119.01	44.40%
Dec-12	1074.45	2242.51	47.91%
Jan-13	1070.98	2045.40	52.36%
Feb-13	1334.98	1975.42	67.58%
Mar-13	1379.00	2259.65	61.03%
Total	**10410.13**	**22374.78**	**46.53%**



336 Open Access Consumers procured a part of their power requirements through PXIL. These consumers were mostly located in Gujarat, Andhra Pradesh and Tamil Nadu (Figure-31). During the year, these OA consumers procured a total of about 263 MU of electricity through PXIL. In 2012-13, the weighted average price of electricity bought by open access consumers at PXIL was higher (₹3.95/kWh) when compared with the weighted average price of total electricity transacted through PXIL (₹3.55/kWh).



In Table-16 & Figure-32, a month-wise comparison is made between number of open access consumers and total number of portfolios in PXIL. In Table-17 & Figure-33, a month-wise comparison is shown between purchase volume of open access consumers and total volume of PXIL. It can be seen that the number of OA consumers as a percentage of total number of portfolios in PXIL increased from 86.83% at the beginning of the year in April 2012 to 88.65% at the end of the year in March 2013. From April 2012 to March 2013, the volume procured by OA consumers as a percentage of total volume transacted in PXIL, varied from 13.12% to 75.70%. For the year as a whole, volume procured by OA consumers as a percentage of total volume transacted in PXIL was 38.29 %.

Table-16: Number of Open Access Consumers in PXIL, 2012-13

Month	No. of Open Access Consumers	Total No. of Portfolios in PXIL	% of Open Access Consumers
Apr-12	277	319	86.83%
May-12	279	321	86.92%
Jun-12	280	322	86.96%
Jul-12	283	325	87.08%
Aug-12	286	328	87.20%
Sep-12	295	338	87.28%
Oct-12	304	347	87.61%
Nov-12	315	358	87.99%
Dec-12	321	364	88.19%
Jan-13	325	368	88.32%
Feb-13	328	371	88.41%
Mar-13	336	379	88.65%

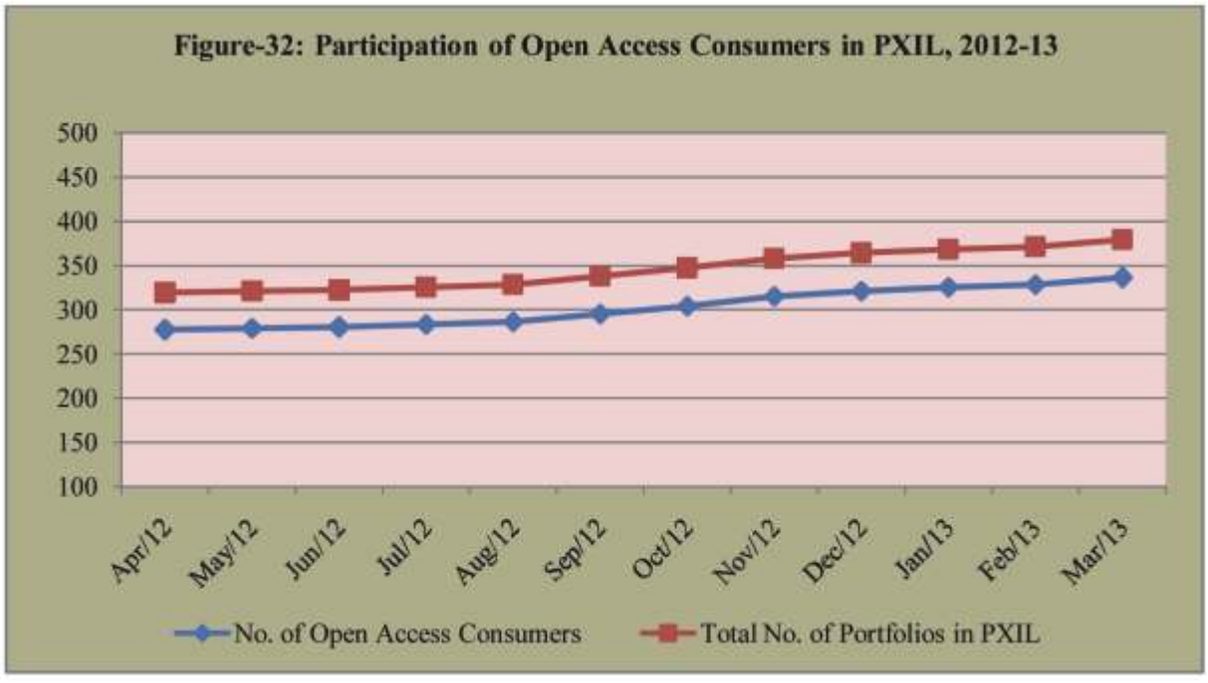
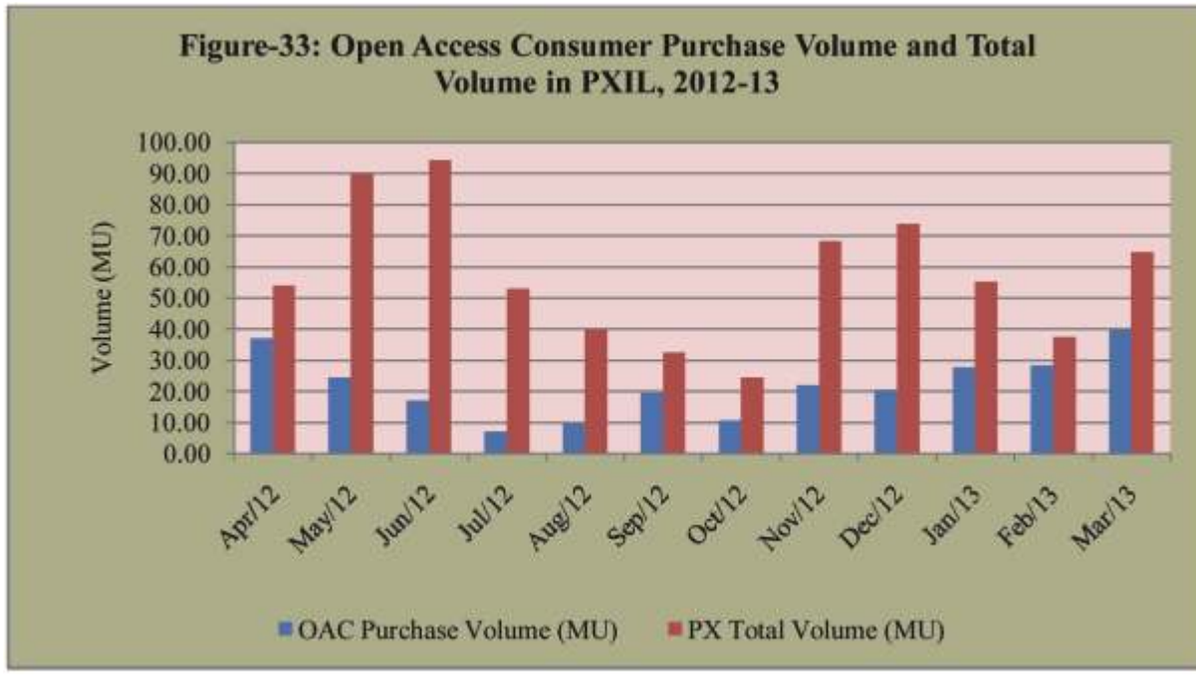


Table-17: Volume Participation of Open Access Consumers in Day Ahead Market of PXIL in 2012-13

Month	OAC Purchase Volume (MU)	PX Total Volume (MU)	% OAC Purchase Participation
Apr-12	36.99	54.05	68.43%
May-12	24.51	89.98	27.24%
Jun-12	16.97	94.48	17.96%
Jul-12	6.94	52.93	13.12%
Aug-12	9.42	39.93	23.59%
Sep-12	19.49	32.49	60.00%
Oct-12	10.58	24.39	43.38%
Nov-12	21.87	68.28	32.03%
Dec-12	20.60	73.89	27.87%
Jan-13	27.69	55.32	50.05%
Feb-13	28.32	37.41	75.70%
Mar-13	40.03	64.82	61.76%
Total	**263.41**	**687.96**	**38.29%**



7. Major Sellers and Buyers of Electricity through Licensed Traders and Power Exchanges

Table-18 and Table-19 show top 10 sellers and buyers of electricity among trading licensees (bilateral trader segment transactions). The same data for IEX is shown in Table-20 and Table-21 and for PXIL in Table-22 and Table-23. It can be seen that the dominant sellers, both at the power exchanges and among licensed traders, are a mixed group comprising of independent power producers, distribution companies, state government agencies, and captive power plants. The major buyers from trading licensees and at power exchanges are mostly state distribution companies.

Table-18: Major Sellers of Electricity through Bilateral Trader Segment (Trading Licensees) in 2012-13

S.No	Seller	State	Volume (MU)	Approximate percentage of total volume transacted through traders	Weighted Average Sale Price in ₹/kWh
1	SEL	Orissa	3494.82	15.38%	4.12
2	JPL	Chhattisgarh	2694.36	11.85%	3.97
3	APL3+APL (Mundra)	Gujarat	2626.09	11.55%	3.96
4	JSWEL	Karnataka	2585.34	11.37%	5.66
5	KWHEPS +JKWHEP	Himachal Pradesh	1873.78	8.24%	3.91

6	GOHP (ADHPL+BUDHIL+KWHEPS+MALANA2	Himachal Pradesh	1384.20	6.09%	3.27
7	WBSEDCL	West Bengal	845.95	3.72%	3.95
8	NDPL (TPDDL)	Delhi	790.15	3.48%	3.90
9	GRIDCO	Odisha	777.15	3.42%	5.20
10	LKPL	Andhra Pradesh	629.14	2.77%	5.37
Note: Volume sold by major sellers and total volume transacted through trading licensees does not include the volume through banking arrangement.					

Table-19: Major Buyers of Electricity through Bilateral Trader Segment (Trading Licensees) in 2012-13

Sr. No	Buyer	State	Volume (MU)	Approximate percentage of total volume transacted through traders	Weighted Average Purchase Price in ₹/kWh
1	APCPDCL+APPCC	Andhra Pradesh	4514.50	19.86%	5.31
2	PSPCL	Punjab	3087.94	13.59%	3.68
3	BSEB	Bihar	1977.23	8.70%	4.19
4	TNEB+TANGEDCO	Tamilnadu	1594.00	7.01%	4.34
5	KSEB	Kerala	1582.86	6.96%	5.16
6	MSEDCL	Maharashtra	1365.88	6.01%	4.07
7	UPCL	Uttarakhand	1233.54	5.43%	3.87
8	RDPPC+JVVNL +JdVVNL+AVVNL	Rajasthan	1157.30	5.09%	3.87
9	WBSEDCL	West Bengal	838.43	3.69%	4.27
10	HPSEB	Himachal Pradesh	809.86	3.56%	2.91
Note: Volume bought by major buyers and total volume transacted through trading licensees does not include the volume through banking arrangement.					

From Table-19 it can be seen that weighted average purchase prices of electricity of major buyers such as APPCC, KSEB and TNEB from traders (bilateral transactions) were higher than the weighted average price for the entire bilateral trader segment (₹4.33/kWh).

Table-20: Major Sellers of Electricity in the Day Ahead Market in IEX, 2012-13					
S.No.	**Name of Seller**	**State**	**Sell Volume (MU)**	**Percentage of the Total Volume Transacted in IEX**	**Weighted Average Sell Price (₹/KWh)**
1	GOHP+ADHPL(GOHP)+KWHEPS (GOHP)+LBHPPL (GOHP)	Himachal Pradesh	1876.27	8.39%	3.18
2	JPL	Chhattisgarh	1808.86	8.08%	2.46
3	GUVNL	Gujarat	1405.96	6.28%	3.33
4	MPPMCL	Madhya Pradesh	1289.20	5.76%	2.78
5	TPDDL	Delhi	1181.26	5.28%	2.73
6	KWHEP	Himachal Pradesh	757.64	3.39%	3.29
7	Adani Power Ltd	Gujarat	748.03	3.34%	3.30
8	BRPL	Delhi	627.23	2.80%	2.84
9	LAPL	Andhra Pradesh	620.26	2.77%	3.14
10	Sterlite Energy Ltd	Orissa	561.52	2.51%	3.13
Note: Total Volume transacted through Day Ahead Market in IEX was 22346 MU.					

Table-21: Major Buyers of Electricity in the Day Ahead Market in IEX, 2012-13					
S.No.	**Name of Buyer**	**State**	**Buy Volume (MU)**	**Percentage of the Total Volume Transacted in IEX**	**Weighted Average Buy Price (₹/kWh)**
1	JVVNL	Rajasthan	2623.86	11.73%	3.47
2	Torrent Power (Ahmedabad+Surat)	Gujarat	1865.57	8.34%	3.50
3	UPPCL	U.P.	1423.35	6.36%	3.89
4	KSEB	Kerala	1271.20	5.68%	6.67
5	MSEDCL	Maharashtra	1060.25	4.74%	3.01
6	PSEB	PUNJAB	898.87	4.02%	3.65
7	Essar Steel India Ltd	Gujarat	882.18	3.94%	2.89
8	Jindal Stainless Ltd	Haryana	513.08	2.29%	2.77
9	REL_KPDL	Maharashtra	431.53	1.93%	3.43
10	TAMILNADU	Tamilnadu	346.79	1.55%	5.84
Note: Total Volume transacted throu gh Day Ahead Market in IEX was 22346 MU.					

From Table-21 it can be seen that weighted average prices of electricity for major buyers such as KSEB, Tamil Nadu and UPPCL in the IEX day ahead market were higher than the weighted average price for the entire day ahead market segment in the IEX (₹3.67/kWh).

Table-22: Major Sellers of Electricity in the Day Ahead Market in PXIL, 2012-13					
Sr. 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	360.26	52.37%	3.36
2	WBSEDCL	West Bengal	48.78	7.09%	2.98
3	Jindal Steel & Power Ltd.	Chhattisgarh	43.20	6.28%	3.07
4	UT Chandigarh	Chandigarh	41.44	6.02%	3.12
5	GoHP	Himachal Pradesh	35.33	5.14%	3.49
6	Sterlite Energy Ltd	Orissa	29.65	4.31%	2.76
7	ACB (India) Ltd	Chhattisgarh	27.02	3.93%	3.22
8	BRPL	Delhi	26.25	3.82%	2.83
9	BYPL	Delhi	24.75	3.60%	2.30
10	APCPDCL/APPCC	Andhra Pradesh	11.63	1.69%	6.35
Note: Total Volume transacted in the Day Ahead Market in PXIL was 67 8.21 MU.					

Table-23: Major Buyers of Electricity in Day Ahead Market in PXIL, 2012-13					
Sr. No	**Name of the Buyer**	**State**	**Buy Volume (MU)**	**Percentage of the Total Volume Transacted**	**Weighted Average Buy Price (₹/kWh)**
1	Rajasthan	Rajasthan	129.12	18.77%	3.55
2	UPPCL	Uttar Pradesh	72.38	10.52%	3.57
3	PSPCL	Punjab	59.98	8.72%	3.78
4	Binani Cement Ltd	Rajasthan	40.58	5.90%	2.48
5	MSEDCL	Maharashtra	36.63	5.32%	3.07
6	WBSEDCL	West Bengal	29.92	4.35%	3.82
7	APCPDCL/APPCC	Andhra Pradesh	23.04	3.35%	5.04
8	KSEB	Kerala	21.15	3.07%	5.72
9	Dishman Pharmaceutical and Chemicals Ltd	Gujarat	19.66	2.86%	2.91
10	MPPTCL	Madhya Pradesh	17.80	2.59%	2.87
Note: Total Volume transacted in the Day Ahead Market in PXIL was 678.21 MU.					

From Table-23 it can be seen that weighted average prices of electricity for major buyers such as KSEB, APPCC, WBSEDCL, PSPCL and UPPCL in the PXIL Day Ahead Market were higher than the weighted average price for the entire day ahead market in the PXIL (₹3.55/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-24.

During 2012-13, in the IEX, the unconstrained cleared volume and the actual volume transacted were 26.14 billion kWh and 22.35 billion kWh respectively. This indicates that the actual transacted volume could have been 14.52 percent higher if there was no congestion in the system. During the same year, in PXIL, the unconstrained cleared volume and the actual volume transacted were 1.53 billion kWh and 0.68 billion kWh respectively. This indicates that the actual transacted volume could have been 55.65 percent higher, if there was no congestion in the system.

Congestion, consequent market splitting, and the resultant difference in market prices in different regions give rise to congestion charges. The congestion charges are being deposited in the Power System Development Fund, which was created pursuant to CERC (Power System Development Fund) Regulations, 2010. Congestion in power exchanges, besides affecting the volume, also resulted in formation and accumulation of money in the fund. The congestion amount collected during the year 2012-13 was ₹453.30 crore.

Table-24: Details of Congestion in Power Exchanges, 2012-13

	Details of Congestion	IEX	PXIL
A	Unconstrained Cleared Volume* (MU)	26143.18	1529.12
B	Actual Cleared Volume and hence scheduled (MU)	22346.20	678.21
C	Volume of electricity that could not be cleared and hence not scheduled because of congestion (MU) (A-B)	3796.98	850.91
D	Volume of electricity that could not be cleared as % to Unconstrained Cleared Volume	14.52%	55.65%

** This power would have been scheduled had there been no congestion.*

Source: IEX, PXIL & NLDC

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

It can be seen that short-term market, which includes UI, power transacted through licensed traders (inter-state part), bilateral power transactions directly between DISCOMs, and power transacted through power exchanges, met about 11 percent of the power requirement of the distribution companies in the year 2012-13. The balance 89 percent 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 central government power generating companies in 2012-13, accounted for about 41 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 2012-13 (under long-term Power Purchase Agreements) are shown in Table-25 and 26. It can be seen that, on an average, the distribution companies paid between ₹1.27 and ₹4.09 per kWh for procuring power from coal and lignite based stations, between ₹3.15 and ₹11.60 per kWh from gas/RLNG based power stations, between ₹8.46 and ₹12.68 per kWh from liquid fuel based power stations (Table-25), and between ₹0.79 per kWh and ₹5.83 per kWh from hydro stations (Table-26).

Table-27 and 28 indicate medium term and long-term levelised tariff for power available from power projects bid in the year 2010-11 and 2011-12 under Case-I and Case-II (State specific) respectively. The price of the power projects under Case-I for long-term varied in the range of ₹2.345 per kWh to ₹3.324 per kWh and for medium term varied in the range of ₹4.10 per kWh to ₹4.85 per kWh. The price of the power projects under Case-II (State specific) for long-term varied in the range of ₹2.89 per kWh to ₹3.223 per kWh. The price in the medium term was relatively high when compared with the price in the long-term.

Table-25: Tariff of Central Thermal Power Stations, 2012-13

Sl. No.	Name of the Generating Station	Installed Capacity (MW), March 2013	Fixed charges (Paise/ kWh)	Energy Charges (Paise/kWh), March 2013	Total Tariff (Paise/ kWh)
I: Coal Based thermal generating Stations of NTPC					
A.	**Pit head Generating Stations**				
1	Rihand STPS (St-I)	1000	81	93	174
2	Rihand STPS (St-II)	1000	95	97	191
3	Rihand STPS (St-III)*	500	174	92	266
4	Singrauli STPS	2000	50	77	127
5	Vindhyachal STPS (St-I)	1260	64	105	168
6	Vindhyachal STPS (St-II)	1000	75	99	174
7	Vindhyachal STPS (St-III)	1000	114	99	213
8	Vindhyachal STPS (St-IV)*	500	152	100	252
9	Korba STPS (St-I & II)	2100	54	81	135
10	Ramagundam STPS (St-I&II)	2100	58	207	265
11	Ramagundam STPS (St-III)	500	97	251	348
12	Talcher TPS*	460	NA	68	NA
13	Talcher STPS (St-I)	1000	83	91	174
14	Talcher STPS (St-II)	2000	80	91	171
15	Sipat STPS (St-I)	1980	120	111	231
16	Sipat STPS (St-II)*	1000	125	110	235
17	Korba STPS (St-III)	500	158	80	238
	Sub-Total (A)	**19900**			
B.	**Non-Pit head Generating Stations**				
18	FGUTPP TPS (St-I)#	420	87	228	314
19	FGUTPP (St-II)	420	103	202	304
20	FGUTPP (St-III)	210	141	202	342
21	NCTP Dadri (St-I)	840	89	236	325
22	NCTP Dadri (St-II)	980	160	226	386
23	Farrakka STPS (St-I&II)	1600	80	196	276
24	Farrakka STPS (St-III)*	500	133	195	327
25	Tanda TPS	440	110	180	290

Sl. No.	Name of the Generating Station	Installed Capacity (MW), March 2013	Fixed charges (Paise/ kWh)	Energy Charges (Paise/kWh), March 2013	Total Tariff (Paise/ kWh)
26	Badarpur TPS	705	84	316	400
27	Kahalgaon STPS (St-I)	840	97	201	298
28	Kahalgaon STPS (St-II)	1500	119	190	309
29	Simhadri (St-I)	1000	103	222	324
30	Simhadri (St-II)	1000	164	222	385
31	Mauda*	500	94	299	392
	Sub-Total (B)	**10955**			
	Total Coal (A+B)	**30855**			
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	60	283	343
2	Faridabad	431	79	239	318
3	Anta CCGT	419	69	262	331
4	Auraiya GPS	663	53	268	321
5	Gandhar GPS	657	110	227	337
6	Kawas GPS	656	90	225	315
	Total APM Gas	**3657**			
B: Using Natural Gas(Non-APM) as Fuel					
1	Gandhar GPS	657	110	299	409
2	Kawas Gas	656	90	304	394
	Total Non-APM Gas	**1314**			
C: Using LNG as Fuel					
1	Dadri CCGT	830	60	841	902
2	Anta CCGT	419	69	608	678
3	Auraiya GPS	663	53	856	909
4	Faridabad	431	79	670	749
5	Gandhar GPS	657	110	1050	1160
6	Kawas Gas	656	90	730	820
	Total LNG	**3657**			

Sl. No.	Name of the Generating Station	Installed Capacity (MW), March 2013	Fixed charges (Paise/ kWh)	Energy Charges (Paise/kWh), March 2013	Total Tariff (Paise/ kWh)
D: Using Liquid Fuel (Naphtha/HSD) as Fuel					
1	Dadri CCGT	830	60	793	853
2	Faridabad	431	79	767	846
3	Anta CCGT	419	69	815	885
4	Auraiya GPS	663	53	1038	1092
5	Kayamkulam CCGT	360	85	1183	1268
6	Kawas Gas	656	90	949	1039
	Total Naphtha/HSD	**3359**			
III: Lignite Based thermal generating Stations of NLC					
1	TPS-I	600	86	239	325
2	TPS-II Stage-I	630	62	198	259
3	TPS-II Stage-II	840	61	198	259
4	TPS-I (Expansion)	420	123	175	298
5	Barsingsar	250	301	109	409
	Total NLC	**2740**			
IV: Gas/Liquid Fuel based generating Stations of NEEPCO					
1	Agartala GPS	84	119	228	347
2	Assam GPS	291	144	175	320
	Total NEEPCO	**375**			
** Provisional Tariff*					
# Energy Charges as on April 2013					

Table-26: Composite Tariff of Central Hydro Power Stations, 2012-13					
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	9811.71	1.44
2	Loktak	Storage	105	10223.05	2.61
3	Salal	ROR	690	24417.35	0.91
4	Tanakpur	ROR	123	8522.70	2.16
5	Chamera -I	Pondage	540	26191.85	1.81
6	Uri-I	ROR	480	33449.26	1.49
7	Rangit	Pondage	60	7750.87	2.63
8	Chamera-II	Pondage	300	34237.74	2.63
9	Dhauliganga-I	Pondage	280	27047.18	2.74
10	Dulhasti	ROR	390	96695.54	5.83
11	Teesta-V *	Pondage	510	46829.82	2.09
12	Sewa-II	ROR	120	19180.77	4.13
13	Chamera-III*	ROR	231	23062.70	2.44
14	Chutak*	ROR	44	3177.92	1.72
	Total		**4053**		
NHDC					
1	Indira Sagar	Storage	1000	51309.31	2.62
2	Omkareshwar	Storage	520	39527.62	4.74
	Total		**1520**		
THDC					
1	Tehri stage-I#	Storage	1000		
SJVNL					
1	Nathpa Jhakri#	ROR	1500		
NEEPCO					
1	Khandong	Storage	50	4477.31	1.85
2	Kopili Stg.I	Storage	200	8129.78	0.79
3	Doyang	Storage	75	10228.94	5.17
4	Ranganadi	Pondage	420	29139.41	1.78
5	Kopili Stage-II	Storage	25	1338.56	1.78
	Total		**770**		
* Provisional Tariff					
# Tariff is yet to be finalised.					

Table-27: Capacity Contracted under Case-I Bidding Route during 2010-11 & 2011-12								
Sr. No.	**State**	**Name of the Developer/Plant**	**Name of the Procurer**	**Capacity (MW)**	**Fuel Type**	**Levelized Tariff (₹/kWh)**	**PPA Date/LOI Date/Tariff Adoption Date**	**Medium/ Long-term**
1	Uttar Pradesh	M/s Athena Chhattisgarh Power Pvt Ltd	UPPCL	300	Domestic Coal	3.324	LOI issued dated 5.3.2011	Long-term
2	Gujarat	M/s Wardha Power Company (KSK Mahanadi Power Co. Ltd.)	GUVNL	1010	Domestic Coal	2.345	PPA dated 3.6.2010	
3	Gujarat	M/s Shahpurji Pullonji & Co. Ltd.	GUVNL	800	Imported Coal	2.8	PPA dated 15.5.2010	
4	Gujarat	M/s Essar Power Gujarat Ltd.	GUVNL	800	Imported Coal	2.8	PPA dated 15.5.2010	
5	Maharashtra	M/s. Indiabulls Power Ltd, at Nandgaonpeth, Dist. Amaravati	MSEDCL	1200	Domestic Coal	3.26	LOI issued dated 31.5.2010	
6	Maharashtra	M/s Adani Power Maharashtra	MSEDCL	1200	Domestic Coal	3.280	Tariff adopted dated 28-12-2010	
7	Maharashtra	M/s Emco Energy Ltd.	MSEDCL	200	Domestic Coal	2.879	Tariff adopted dated 28-12-2010	
8	Maharashtra	M/s Adani Power Maharashtra Ltd.	MSEDCL	125	Domestic Coal	3.280	Tariff adopted dated 19-05-2011	
9	Maharashtra	M/s KSK Wardha Power Ltd.	Rinfra-D	260	Domestic Coal	4.850	Tariff adopted dated 01-07-2011	Medium Term (1-7 yrs)
10	Maharashtra	M/s Vidharbha Industries Power Ltd.	Rinfra-D	134	Domestic Coal	4.240	Tariff adopted dated 31-05-2011	
11	Maharashtra	M/s Abhijeet	Rinfra-D	55	Domestic Coal	4.800	Tariff adopted dated 01-07-2011	
12	Maharashtra	M/s Adani Power Maharashtra Ltd.	MSEDCL	800	-	4.100	Tariff adopted dated 19-05-2011	
13	Maharashtra	M/s JSWE (R) Ltd.	MSEDCL	200	-	4.100	Tariff adopted dated 19-05-2011	

Source: Forum of Regulators

Table-28: Capacity Contracted under Case-II (State Specific) Bidding Route during 2010-11 & 2011-12								
Sr. No.	**State**	**Name of the Developer/Plant**	**Name of the Procurer**	**Capacity (MW)**	**Fuel Type**	**Levelized Tariff (₹/kWh)**	**PPA Date/LOI Date/Tariff Adoption Date**	**Medium/ Long-term**
1	Punjab	Rajpura Thermal Power Plant (RTPP)	PSPCL	1320	Domestic Coal	2.89	Tariff adopted dated 14.07.2010	Long-term
2	Uttar Pradesh	Prayagraj Thermal Power Project (Bara)	UPPCL	1980	Domestic Coal	3.02	Tariff adopted dated 27.8.2010	
3	Uttar Pradesh	Sangam Thermal Power Project (Karcchana)	UPPCL	1320	Domestic Coal	2.97	Tariff adopted dated 27.8.2010	
4	Rajasthan	Gurha Thermal power Project	JVVNL, JoVVNL & AVVNL	70	Domestic Coal (Lignite)	3.223	LOI issued dated 15.12.2011	

Source: Forum of Regulators

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

The concept of Renewable Energy Certificates (RECs) seeks to address mismatch between 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 remotely located in the form of RECs. 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-29 and Table-30. The market clearing volume of Solar RECs transacted in 2012-13 on IEX and PXIL were 10443 and 3570 respectively and the market clearing price of these RECs were ₹12782/MWh and ₹12615/MWh on IEX and PXIL respectively. Market clearing volume of Non-Solar RECs transacted in 2012-13 on IEX and

PXIL were 1980546 and 595255 respectively and the market clearing price of these RECs were ₹1731/MWh and ₹1564/MWh on IEX and PXIL respectively. It can be observed from Table-29 that there was an increase in non-solar RECs of about 108% in IEX and 826% in PXIL during the year 2012-13 when compared with the year 2011-12.

The gap between the volume of buy and sell bids of RECs placed through power exchanges shows that there was more demand for Solar RECs and less demand for Non-Solar RECs. For Solar RECs, the ratio of buy and sell bids was 5.49 and 2.65 in IEX and PXIL respectively. For Non-Solar RECs, the ratio of buy and sell bids was 0.27 and 0.26 in IEX and PXIL respectively.

Table-29 : Annual details of Renewable Energy Certificates transacted through Power Exchanges

Sr.No.	Details of REC Transactions	IEX			PXIL		
	Type of REC	Non-Solar	Solar	Non-Solar	Non-Solar	Solar	Non-Solar
	Year	2011-12	2012-13		2011-12	2012-13	
A	Volume of Buy Bid	2279406	77277	2435188	272597	12173	655146
B	Volume of Sell Bid	1284434	14076	9184800	116963	4592	2489921
C	Ratio of Buy Bid to Sell Bid Volume	1.77	5.49	0.27	2.33	2.65	0.26
D	Market Clearing Volume (MWh)	951008	10443	1980546	64266	3570	595255
E	Market Clearing Price (₹/MWh)	2829	12782	1731	2676	12615	1564

Month-wise volume and price of RECs transacted through power exchanges are shown in the following table (Table-30).

Table-30 : Volume and Price of Renewable Energy Certificates Transacted through Power Exchanges, 2012-13

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-12	0	-	0	0
May-12	5	13000	5	13000
Jun-12	336	12750	6	12506

Jul-12	93	12800	86	12800
Aug-12	129	12850	250	12850
Sep-12	735	12500	425	12900
Oct-12	820	12680	971	12500
Nov-12	733	12720	486	12100
Dec-12	931	12620	277	12100
Jan-13	2105	12500	203	12500
Feb-13	1924	12500	310	13000
Mar-13	2632	13400	551	13000
Non-Solar				
Apr-12	62277	2201	8949	2201
May-12	153125	2402	15550	2150
Jun-12	223164	2402	13321	2460
Jul-12	147369	2000	10851	2202
Aug-12	248168	1500	25725	1555
Sep-12	239364	1500	25082	1500
Oct-12	132231	1500	90469	1500
Nov-12	54976	1500	77376	1500
Dec-12	173644	1500	100000	1500
Jan-13	190875	1500	2462	1500
Feb-13	48093	1500	104859	1500
Mar-13	307260	1500	120611	1500

Annexure-I

List of Trading Licensees as on 31.3.2013					
Sr.No	**Name of Licensee**	**Present Category of License**	**Address**	**Contact Number**	**Email-ID**
1	Tata Power Trading Company (P) Ltd.	I	4th Floor, C-43, Sector-62, Noida-201307	022-67172863; 8097089124	power@tatapowertrading.com
2	Adani Enterprises Ltd.	I	Adani House, Plot No 83, Sector 32,Institutional Area,Gurgaon-122001	0124-2555332; 0124-2555555	rahul.sharma@adani.com
3	PTC India Ltd.	I	2nd Floor ,NBCC Towers, 15 Bhikaji Cama Place, New Delhi-110066	011-41659154; 011-41659500	pvarshney@ptcindia.com
4	Reliance Energy Trading (P) Ltd.	I	Reliance Energy Trading Limited,2/22A, Shanti Niketan, New Delhi-110021	011-30323444	Mahendrakumar.Garg@relianceada.com
5	NTPC Vidyut Vyapar Nigam Ltd.	I	NTPC Bhawan, Core 7, Scope Complex, 7 Institutional Area, Lodhi Road, New Delhi-110003.	011-24387741; 011-24364775	anuraggupta@ntpc.co.in
6	National Energy Trading & Services Ltd.	I	Lanco House, Plot # 397, Udyog Vihar, Phase III, Gurgaon - 122 016	0124-4741000	navneet.gupta@lancogroup.com
7	Karam Chand Thapar & Bros Ltd.	I	Thapar House, 25 Brabourne Road, Kolkata, West Bengal-700001	011-23366590; 8800098097	aarora@kctcoalsales.com
8	JSW Power Trading Company Ltd.	I	NBCC Tower, UGF,15, Bhikaji Cama Place, New Delhi-110066	011-26767000	hiralal.chaudhary@jsw.in

Sr.No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
9	GMR Energy Trading Ltd	I	IBC-Knowledge Park, Phase 2, 9th Floor, Tower-D, 4/1, Bannerghatta Road, Near Dairy Circle, Bangalore-560029	080-40432000; 080-40432744; 080-40533061	Madhusmita.Mahapatra@gmrgroup.in
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	Knowledge Infrastructure Systems (P) Ltd.	I	G-02, Salcon Aurum Complex,4, Commercial Centre, Jasola, New Delhi-110076	011-46067070	arustagi@knowledgegroup.in
12	Shree Cement Ltd.	I	101, Hans Bhawan, Bahadur Shah Zafar Marg, New Delhi-2	011-23370320	powertrading@shreecementltd.com
13	Jai Prakash Associates Ltd	I	JA House, 63 Basant Lok, Basant Vihar, New Delhi-110057	011-26141540, 011-26147411	sarabjeet.dhingra@jalindia.co.in
14	SN Power Markets Private Limited	I	C-1,Sector2, Noida-201301, NCR-Delhi	120-4605100,120-4605103	somendra.rout@snpower.com
15	RPG Power Trading Company Ltd.	II	6, Church Lane, 1st Floor, Kolkata-700001	033-66252012; 033-66252010	suman.ghosh@rp-sg.in
16	Mittal Processors (P) Ltd.	II	GF-71,Vardman Apartment, Abhay Khand-III, Indira Puram, Ghaziabad-201010, U.P.	0180-6612531/532	rdjain@mittalsgroup.com

Sr.No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
17	Instinct Infra & Power Ltd.	III	C-201, Naraina Ind. Area ,Phase-1, New Delhi-110028	011-25893495; 011-41410259	salil@instinct trade.com
18	Essar Electric Power Development Corporation Ltd	III	Essar House, 11, Keshavrao Khadye Marg, Mahalaxmi, Mumbai-400034	022-66601100	Anil.Sharma2 @essar.com
19	Indrajit Power Technology (P) Ltd.	III	1, Pearl Mansion (N), 91,M. Karve Road, Mumbai-400 020.	022-22006969	rmalegavi@in drainfra.in
20	Jay Polychem(In dia) Ltd	III	D-143,Defence Colony, New Delhi 110024	011-4279100	info@jaypoly chem.com
21	My Home Power Ltd.	III	3rd Block, 5th Floor, My Home Hub, Madhapur, Hyderabad 500081	040-66139240	projects@my homepower.in
22	PCM Power Trading Corporation Ltd.	III	PCM Tower, Sevoke Road, Siliguri -734001, West Bengal.	0353-2777028/29/40	infopcmpowe rtrading.co.in
23	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
24	DLF Energy Private Limited, Gurgaon	III	10th Floor, Gateway Tower, DLF City,, Phase III, Gurgaon, Haryana-122002	0124-4778748, 0124-4568900	daheriya-sneh@dlf.in
25	Arunachal Pradesh Power Corporation (P) Ltd, Itanagar	III	A-Sector, Legi Complex,Naharlagun, Itanagar,Arunachal Pradesh – 7911 10	011-45111969/8902243310	http://www.ap pcpl.com/cont actus.html

Sr.No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
26	Manikaran Power limited, Kolkata	III	3A,"AASTHA", 460, EM Bypass, Kolkata.West Bengal, India, Pin-700107	033-24431994	contactus@manikaranpowerltd.in
27	Suryachakra Power Corporation (P) Ltd.	IV	725,1st floor, Street No.11, Himayathnagar, Hyderabad-500029	040-23550597	admin@suryachakra.com
28	Visa Power Ltd.	IV	9, Shakespeare Sarani, Kolkata- 700071	033-30119000	r.bose@visapower.net.in
29	Pune Power Development Pvt. Ltd	IV	Anmol, 25, Yashwant Nagar, Range Hill Corner, Pune – 411007	020-25560186	punepower.power@gmail.com
30	Greenko Energies (P) Ltd.	IV	#1071, Road No. 44, Jubilee Hills, Hyderabad-500033	040-40301000 040-32915858	surya.pery@greenkogroup.com,
31	Vandana Vidyut Ltd.	IV	Vandana Bhawan;M. G.Road,Raipur-492001,Chhattisgarh	0771-4006000	vvl@vandanavidyut.com
32	Subhash Kabini Power Corporation Ltd.	IV	Mfar Silverline Techpark, 2nd Floor,Plot No. - 180, EPIP Zone - 2nd Phase, Whitefield, Bangalore - 560066	080-41229491	Prem.bhatia@spml.co.in
33	Adhunik Alloys & Power Ltd.	IV	Lansdowne, Towers,2/1A Sarat Bose Road, Kolkatta-700020	033-30915300; 033-30915344	vksarawagi@adhunikgroup.co.in
34	Indiabulls Power Trading Ltd.	IV	Indiabulls House, 448-451,Udyog Vihar, Phase - V, Gurgaon -122001	0124-6682101; 011-30252900	manish.s14@indiabulls.com

Sr.No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
35	Ambitious Power Trading Company Ltd.	IV	Jindal Power Limited,Jindal Centre,12, Bhikaiji Cama Place,New Delhi 110 066	011 2618 8340	info@jindalpower.com
36	Shyam Indus Power Solutions India (P) Ltd.	IV	129,Transport Centre, Rohtak Road, Punjabi Bagh New Delhi-35	011-45764400	pdgoyal@shyamindus.com, shyamindus@vsnl.net
37	Abellon Clean Energy Ltd.	IV	Sangeeta Complex, Near Parimal Crossing, Ellisbridge, Ahmedabad-380006	079-66309332	mandavi.singh@abellonpower
38	Customised Energy Solutions India (P) Ltd.	IV	A 501,GO Square, Waquad, Hinjewadi link Road, Pune-411057	0997 1174089	abhatnagar@ces-ltd.com
39	Gemac Engineering Services (P) Ltd.	IV	3rd Floor, Wescare Towers, No. 16, Cenotaph Road, Teynompet, Chennai - 600018	044-24343753	http://gemac.asia/power-index.html
40	Greta Power Trading Limited	IV	No.-42A, 2nd Floor,Bheemanna Mudali Garden Road,Abhirampuram, Alwarpet,Chennai – 600018	044-24662993	
41	Green Fields Power Services (P) Ltd	IV	101, Sri Guru Krupa,7-1-54/2/c, D.K. Road, Ameerpet, Hyderabad – 500 016	040-23731823	info@greenfieldspower.com
42	HMM Infra Limited	IV	308, World Trade Center, Babar Road , New Delhi-110001	011-49534400	info@hmminfra.com

Historic Volatility Calculation

Volatility = Standard deviation of daily prices returns.

Historical Volatility Formula:

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

where

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

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. In 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:

$$HHI = \sum_{i=1}^{N} s_i^2$$

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.

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