Report on Short-term Power Market in India: 2011-12

July, 2012

Economics Division
Central Electricity Regulatory Commission
3rd & 4th Floor, Chanderlok Building
36, Janpath, New Delhi-110001.

Foreword

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 95 billion units) of the total electricity market in 2011-12, 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. 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 2011-12 useful.

Dr Pramod Deo
Chairperson
Central Electricity Regulatory Commission

Contents

List of Tables

List of Figures

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 Limited
APPCC	Andhra Pradesh Power Coordination Committee
AVVNL	Ajmer Vidyut Vitaran Nigam Limited
BALCO	Bharat Aluminium Company Limited
BESCOM	Bangalore Electricity Supply Company Limited
BRPL	BSES Rajdhani Power Limited
BSEB	Bihar State Electricity Board
BU	Billion Units (Billion kWh)
BYPL	BSES Yamuna Power Limited
CCGT	Combined Cycle Gas Turbine
CERC	Central Electricity Regulatory Commission
CGS	Central Generating Stations
CPP	Captive Power Producer/Plant
CSPTCL	Chhattisgarh State Power Trading Company Limited
CSPDCL	Chhattisgarh State Power Distribution Company Limited
DAM	Day Ahead Market
DISCOMS	Distribution Companies
FGUTPP	Firoz Gandhi Unchahar Thermal Power Project
GoHP	Government of Himachal Pradesh
GPS	Gas Power Station
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
JKHCL	Jaypee Karcham Hydro Corporation Limited

Abbreviation	Expanded Version
J&K PDD	Jammu & Kashmir Power Development Department
JoVVNL	Jodhpur Vidyut Vitaran Nigam Limited
JPL	Jindal Power Limited
JSL/JSL Ltd.	Jindal Stainless 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
LKPPL	Lanco Kondapalli Power Private Limited
LNG	Liquefied Natural Gas
LOI	Letter of Intent
Ltd	Limited
MPPTCL	Madhya Pradesh Power Trading Company Limited
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MU	Million Units
MW	Mega Watts
NDPL	North Delhi Power Limited
NEEPCO	North Eastern Electric Power Corporation Limited
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
NTPC	National Thermal Power Corporation Limited
OA	Open Access
OAC	Open Access Consumer
PPA	Power Purchase Agreement
PSPCL	Punjab State Power Corporation Limited
PX/PXs	Power Exchange/Power Exchanges
PXIL	Power Exchange India Limited

Abbreviation	Expanded Version
R Infra/R Infra D	Reliance Infrastructure Limited
RLNG	Re-gasified Liquefied Natural Gas
RTC	Round The Clock
SEB/SEBs	State Electricity Board
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
TPS	Thermal Power Station
UI	Unscheduled Interchange
UPPCL	Uttar Pradesh Power Corporation Limited
UT	Union Territory
WBSEDCL	West Bengal State Electricity Distribution Company Limited

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 2011-12. Here, ñshort-term transactions of electricityò 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; and (vii) Tariffs of long-term sources of power for various distribution companies.

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 2011-12, 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 about 94.51 billion kWh (units) in the year 2011-12. As compared to the volume of electricity transacted through short-term market in the year 2010-11 (81.56 billion units), this was about 16 percent higher. Majority of this growth in volume of 12.95 billion units was accounted for by growth in bilateral transactions through the inter-state trading licensees (62.8%), followed by growth in direct bilateral transactions between the DISCOMs (about 39.5%). Transactions through power exchanges accounted for only about 0.2% of this growth. The contribution of UI to this growth of 12.95 billion units was negative; about -2.5%. A *caveat*, however, needs to be added that the transactions through traders considered here are the inter-state transactions.

3. Excluding UI and direct bilateral sale between the DISCOMs, the volume of electricity transacted was about 51.38 billion units in 2011-12. This was about 19 percent higher than in 2010-11. Volume of electricity traded under bilateral transactions through inter-state trading licensees witnessed a sharp increase of about 29% over 2010-11 volume. On

[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 2011-12, the volume of UI was about 27.76 billion kWh and that of bilateral transactions between distribution companies was about 15.37 billion kWh.*

the other hand, the increase in the volume of electricity transacted through power exchanges was very low at 0.2%. In monetary terms, the size of this segment of the short-term market was about ₹20532 crore in the year 2011-12[2], which was 10% more than in the year 2010-11. About ₹5553 crore of this was the value of electricity transacted through power exchanges (3% more than ₹5389 crore done in 2010-11), and the balance of about ₹14979 crore was the value of inter-state transaction of electricity through trading licensees (about 13% more than ₹13268 crore done in 2010-11).

4. In absolute terms, the volume of UI in the year 2011-12 decreased by 1% over 2010-11. 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 29% in 2011-12, down from 39% and 34% respectively in the years 2009-10 and 2010-11.

5. The share of direct bilateral transactions between DISCOMs as a percentage of total short term transaction volume increased to about 16% in the year 2011-12 (as compared to about 13% in the year 2010-11). In terms of volume, these direct bilateral transactions between DISCOMs witnessed a steep rise of about 50% in 2011-12 as compared to 2010-11.

6. The weighted average price of electricity transacted through power exchanges was ₹3.57 per kWh and through trading licensees was ₹4.18 per kWh in 2011-12. The corresponding values for the year 2010-11 were ₹3.47 per kWh and ₹4.79 per kWh, respectively. In the year 2011-12, the weighted average price of electricity transacted through Day Ahead Market sub-segment of the power exchanges was ₹3.48/kWh and that through Term Ahead Market sub-segment was ₹5.48/kWh.

7. The weighted average price of weekly contracts under the Term Ahead Market sub-segment was ₹5.51/kWh; which was higher than the weighted average price of ₹4.18/kWh for electricity transacted through bilateral contracts involving traders.

8. During the year 2011-12, 94% of the volume of electricity in the two power exchanges was transacted at less than ₹6/kWh. 73% of the volume in IEX and 74% volume in PXIL was transacted at less than ₹4/kWh.

9. During the year, about 99% of the volume of electricity under bilateral transactions through traders was transacted at less than ₹6/kWh. About 55% of the volume was transacted at prices between ₹4 and ₹5 per kWh.

10. During 2011-12, only about 171 million units of electricity was exclusively bought during peak hours under bilateral transactions from traders (exclusive of banking). This was about 0.73% of the total electricity bought under bilateral transaction from traders (excluding banking). A major part of this, about 94.64%, was bought on round the clock (RTC) basis, followed by 4.63% exclusively bought in periods other than peak periods. The per unit price of electricity procured on round the clock (RTC) basis was the cheapest

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

(₹4.14/kWh), followed by electricity exclusively procured during non-peak hours (₹4.45/kWh) and electricity exclusively procured during peak hours (₹5.39/kWh).

11. It is observed from the hour-wise and region-wise prices of electricity transacted through power exchanges in the year 2011-12 that 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. This was mainly due to high demand for electricity in the Southern Region and due to congestion between NEW Grid and SR Grid.

12. Level of competition among the trading licensees is shown for the period from 2004-05 to 2011-12. During the period, number of traders who were undertaking trading increased from 4 to 17 and concentration of market power (HHI based on volume of trade undertaken by the licensees) declined from high concentration (HHI of 0.5512) to moderate concentration (HHI of 0.1732). The competition among the trading licensees resulted in increase in volume and decrease in prices in the short-term bilateral market.

13. It was a voluntary practice during the year 2004-05 (when trading started) that licensees charged 5 paise/kwh or less as the trading margin. However, the weighted average trading margin went up to 10 paise/kwh during April to September 2005. Considering this increase, CERC 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 2010-11 and 2011-12 was 5 paise/kWh, which is in line with the CERC Trading Margin Regulations, 2010.

14. The procurement of power by the industrial sector consumers through power exchanges that began in the year 2009 continued during the years 2010-11 and 2011-12. At IEX, Open Access industrial sector consumers bought about 6.275 billion units of electricity, which formed about 45.48 % of the total day ahead volume transacted during 2011-12. For PXIL, the respective figures were: 0.307 billion units, and 14.90%.

15. The weighted average price of electricity bought by open access consumers at IEX was lower (₹3.06/kWh) compared to the weighted average price of total electricity transacted through IEX (₹3.47/kWh). The weighted average price of electricity bought by open access consumers at PXIL was higher (₹3.64/kWh) compared to the weighted average price of total electricity transacted through PXIL (₹3.56/kWh).

16. 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 (2011-12), the actual volume transacted could have been about 15 percent higher, had there been no congestion prevalent in the system. Because of congestion and the attendant splitting of day ahead market at both the power exchanges, the congestion amount during the year was ₹484.76 crore.

Report on
Short-term Power Market in India, 2011-12

An 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 2011-12. Here, ñshort-term transactions of electricityò 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; and (vii) Tariffs of long-term sources of power for various distribution companies.

1. Yearly Trends in Short-term Transactions of Electricity (2008-09 to 2011-12)

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 ñbilateral traderò segment ,
- power exchange segment with transactions in both, Day Ahead and Term Ahead Markets,
- UI segment and
- direct transactions of electricity between DISCOMs.

[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 2011-12, the volume of UI was about 27.76 billion kWh and that of between distribution companies was about 15.37 billion kWh.*

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 2012, there were 41 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 billion kWh (BU) in 2009-10 to 94.51 BU in 2011-12. The annual growth in volume was 24% from 2009-10 to 2010-11 and 16% from 2010-11 to 2011-12. Total volume of short-term transactions of electricity as percentage of total electricity generation has increased from 9% in 2009-10 to 11% in 2011-12 (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%

Source: NLDC

The analysis of yearly trends in different segments of short-term transactions of electricity i.e. electricity transacted through traders and power exchanges, UI, directly between DISCOMs is dealt in the following sections.

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 2011-12. The volume of electricity transacted through inter-state trading licensees and power exchanges increased from 24.69 BU in 2008-09 to 51.38 BU in

2011-12. 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 54.37% in 2011-12). The growth in volume for this segment during the year 2011-12 as compared to 2010-11 was 8.16 BU in absolute terms and about 19 in percentage terms. Majority of this growth has come from the bilateral trader segment (8.14 BU). Looking at the individual sub-segment growth between the years 2010-11 and 2011-12, it is observed that the growth was 29% in bilateral trader segment whereas the growth was 0.15% in power exchange 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

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

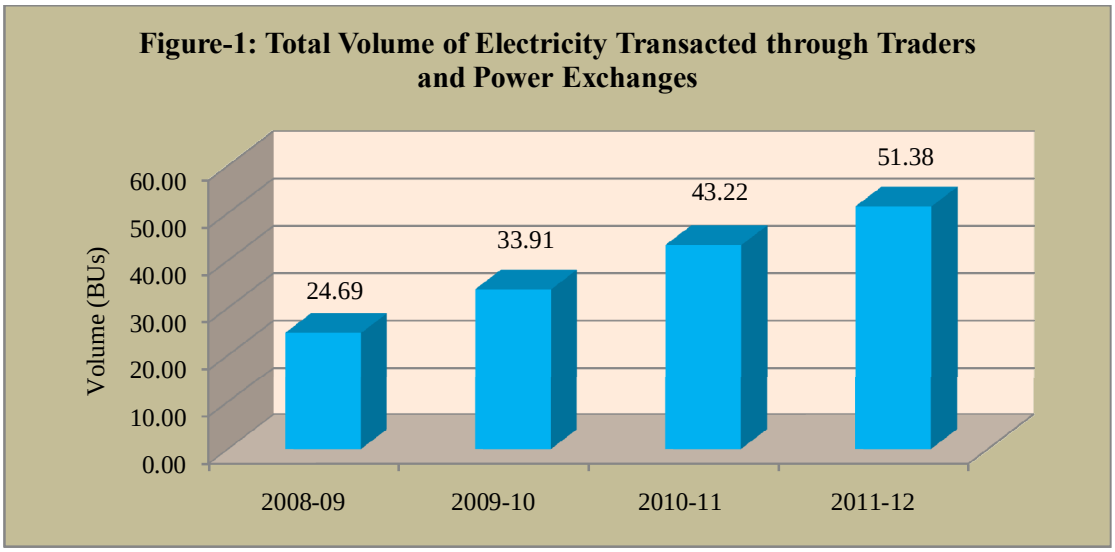
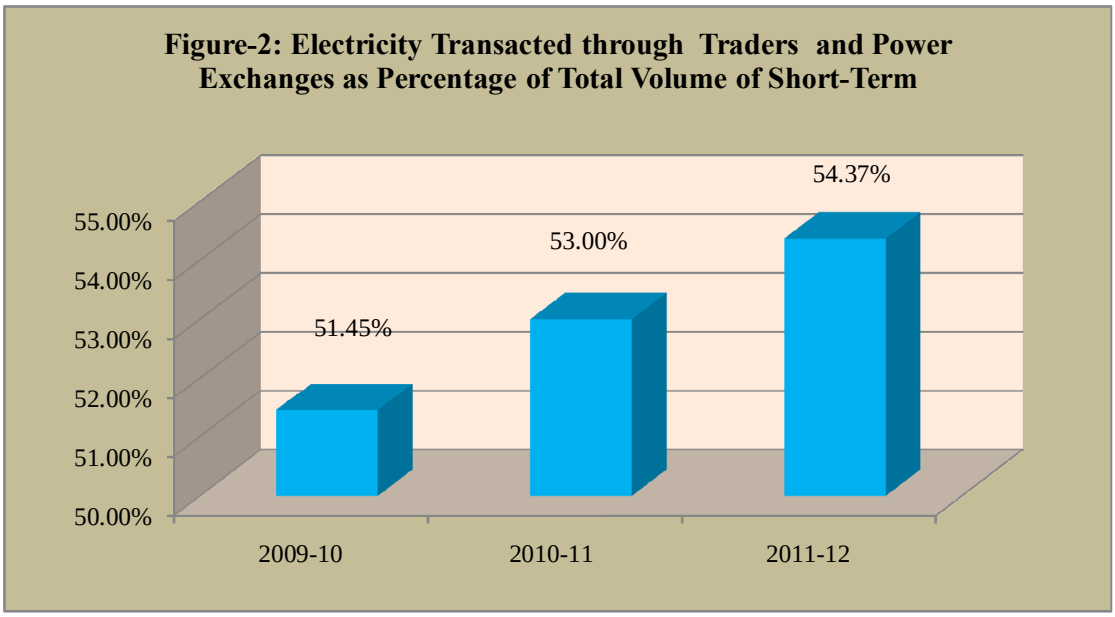


Table-3: Electricity Transacted through Trading Licensees and Power Exchanges as Percentage of Total Volume of Short-term			
Year	Volume of Electricity Transacted through Traders and Power Exchanges (BU)	Total Short-term Transactions of Electricity (BU)	Electricity Transacted through traders and PXs 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%



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 ₹4.18/kWh and ₹3.57/kWh respectively in 2011-12. It is thus seen that the price of electricity in the short-term market in the year 2011-12 was on the lower side as compared to price prevalent in the previous three years.

The decreasing trend in weighted average prices has had its effect on the market size of this segment in monetary terms (Table-5). Thus, although in physical terms (BU terms) the size of this segment increased by about 19 % in the year 2011-12 compared to 2010-11, in monetary terms the growth has only been about 10% (or about ₹1875 crore). In fact, the bilateral trader sub-segment, though registering a high growth of about 29 % in physical

terms, registered low growth of only about 13 % (or about ₹1711 crore) in monetary terms. The power exchange segment, though registered low growth of 0.15% in physical terms, registered high growth of about 3% in monetary terms (or about ₹164 crore).

Table-4: Price of Electricity Transacted through Traders and 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

Figure-3: Price of Electricity Transacted through Traders and Power Exchanges

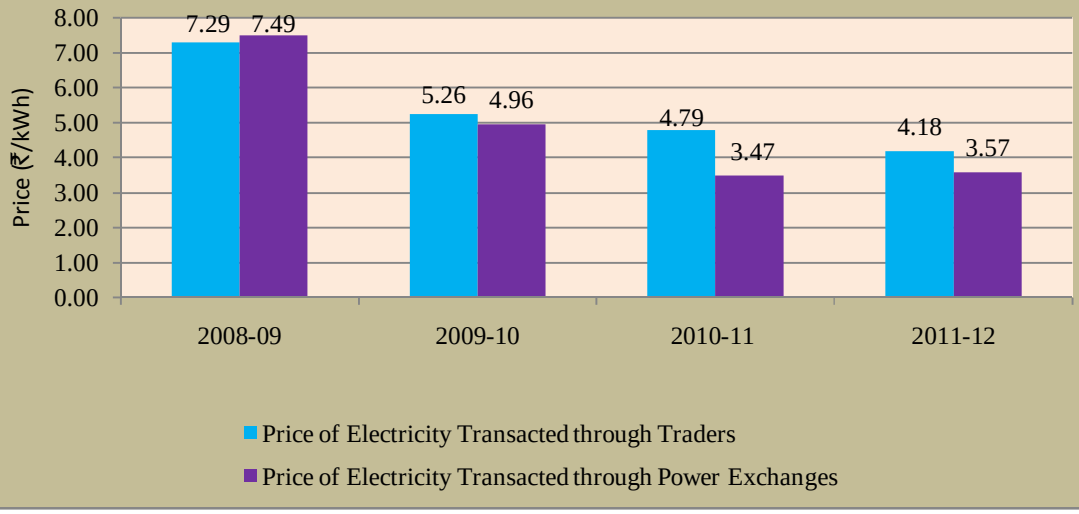
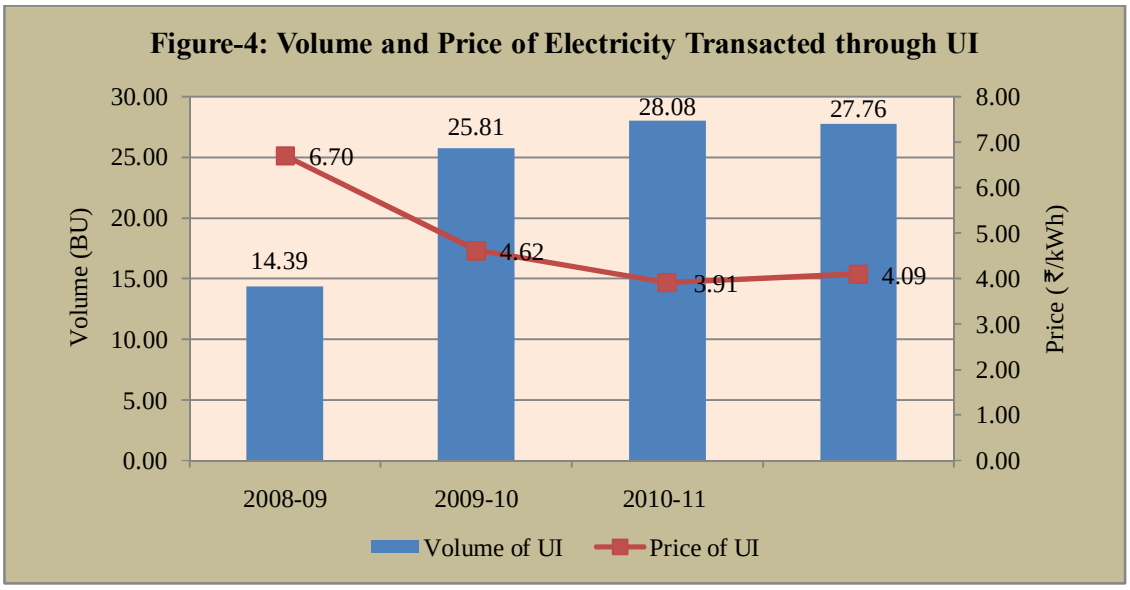


Table-5: Size of the Bilateral Trader and Power Exchange Market in Monetary Terms							
Year	Electricity Transacted through Trading Licensees (BU)	Price of Electricity Transacted through Trading Licensees (₹/kWh)	Size of bilateral trader Market in ₹ Crore	Electricity Transacted through Power Exchanges (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

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 has increased from 25.81 BU in 2009-10 to 27.76 BU in 2011-12, and the volume of UI as percentage of total short-term volume has declined to a level of 29% in the year 2011-12 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 ₹4.09/kWh in 2011-12.

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



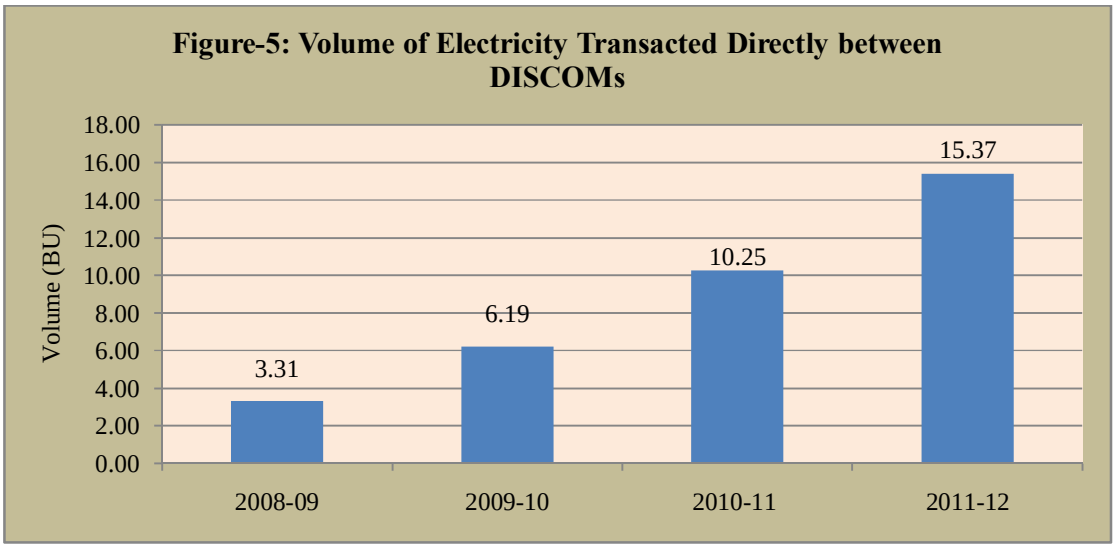
1.1.3 Electricity Transacted Directly Between DISCOMs

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 significantly from 6.19 BU in 2009-10 to 15.37 BU in 2011-12. 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 16% in the same period.

Table-7: Volume of Electricity Transacted Directly between DISCOMs

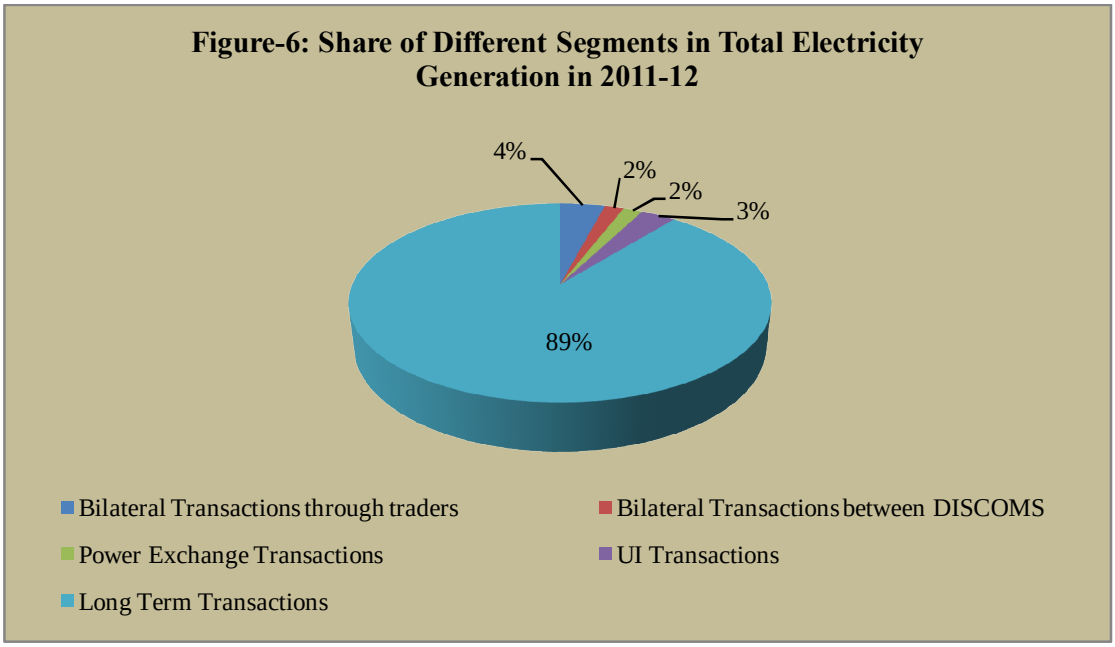
Year	Volume of Electricity Transacted Directly between DISCOMs (BU)	Total Volume of Short-term (BU)	Volume of Bilateral Direct as % of total volume of Short-term
2008-09	3.31	35.27	9%
2009-10	6.19	65.9	9%
2010-11	10.25	81.56	13%
2011-12	15.37	94.51	16%

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

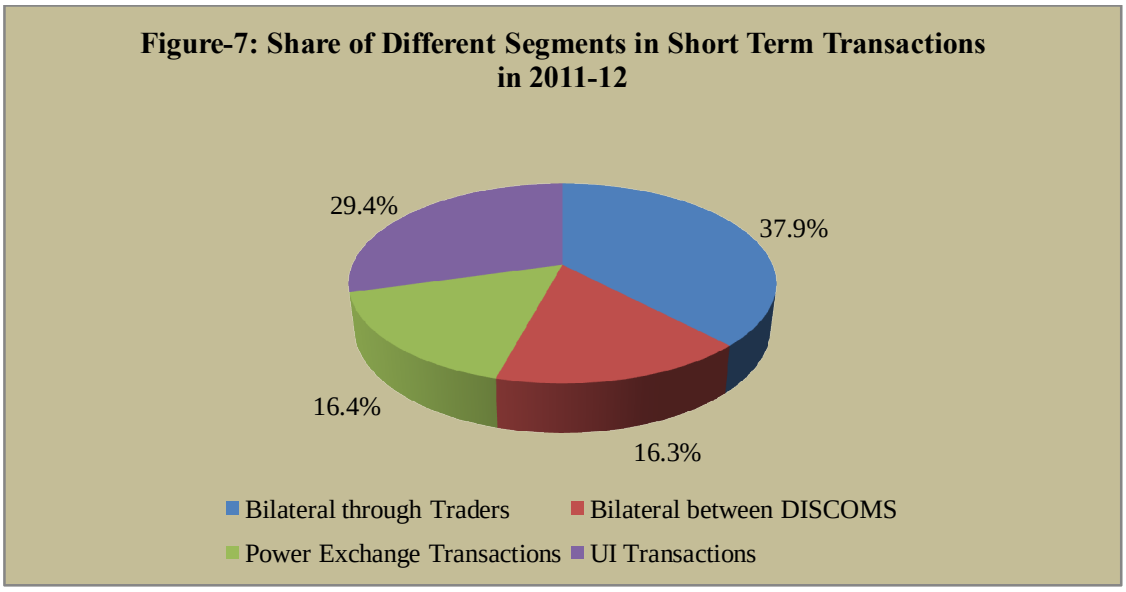


2. Monthly Trends in Short-term Transactions of Electricity (April 2011-March 2012)

During 2011-12, 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 2011-12 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 2011-12 with break-up for different segments is shown in Table-8 and Figure-8.

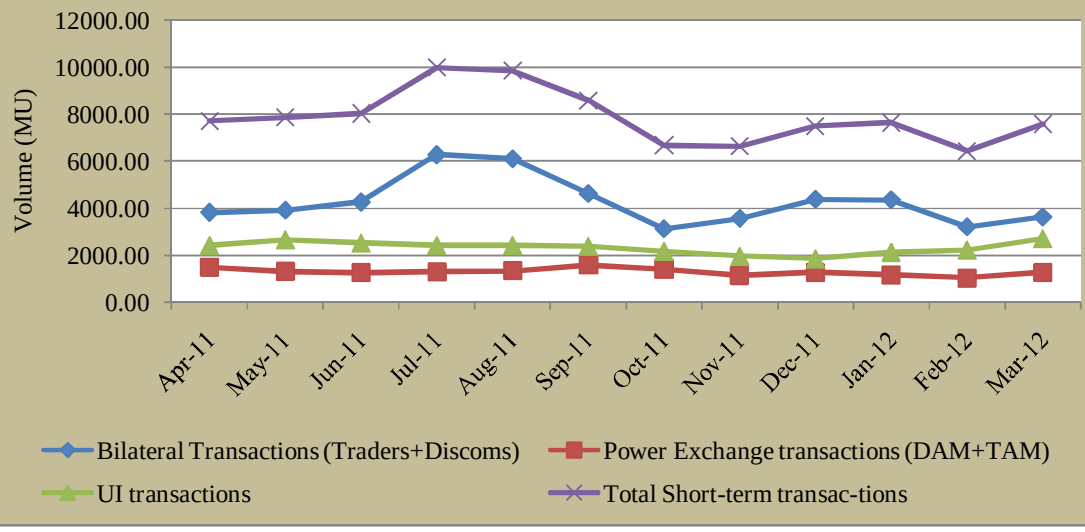
Table-8: Volume of Short-term Transactions of Electricity (MUs)

Period	Bilateral through Traders	Bilateral between DISCOMS	Total Bilateral transac-tions	Power Exchange transactions (DAM+TAM)	UI transac-tions	Total Short-term transac-tions	Total Electricity Generation
Apr-11	2647.31	1169.56	3816.87	1487.00	2415.58	7719.45	71676.12
May-11	2852.29	1051.09	3903.38	1311.50	2646.72	7861.60	75111.16
Jun-11	2846.78	1407.27	4254.05	1259.19	2519.54	8032.78	70742.38
Jul-11	4724.51	1560.37	6284.88	1288.89	2412.18	9985.95	74103.75
Aug-11	4522.13	1590.75	6112.88	1338.16	2406.67	9857.71	72574.12
Sep-11	3883.96	736.32	4620.28	1590.06	2376.77	8587.11	70556.91
Oct-11	2378.38	737.88	3116.26	1409.50	2158.24	6684.00	74167.44
Nov-11	2417.26	1142.22	3559.48	1129.54	1944.93	6633.95	71039.98
Dec-11	2609.48	1767.31	4376.79	1262.15	1847.43	7486.37	72719.02
Jan-12	2737.89	1615.95	4353.84	1167.65	2116.33	7637.82	73373.77
Feb-12	1952.46	1239.26	3191.72	1035.97	2213.87	6441.56	70999.60
Mar-12	2266.78	1353.63	3620.41	1263.85	2699.56	7583.82	77101.84
Total	**35839.23**	**15371.61**	**51210.84**	**15543.46**	**27757.82**	**94512.12**	**874166.09**
% share in total genera-tion	**4%**	**2%**	**6%**	**2%**	**3%**	**11%**	**100%**

% share in Short-term Volume	**37.9%**	**16.3%**	**54.2%**	**16.4%**	**29.4%**	**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.

Figure-8: Volume of Short-Term Transactions of Electricity, 2011-12



The volume of short-term transactions of electricity as percentage of total electricity generation varied between 9.01% and 13.58% 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-11	10.77%
May-11	10.47%
Jun-11	11.35%
Jul-11	13.48%
Aug-11	13.58%

Sep-11	12.17%
Oct-11	9.01%
Nov-11	9.34%
Dec-11	10.29%
Jan-12	10.41%
Feb-12	9.07%
Mar-12	9.84%

There were about 41 inter-state trading licensees as on 31.3.2012. However, of these, only 17 trading licensees were active in trading during the year 2011-12 (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 between 0.15 to 0.25 indicates moderate concentration and a HHI above 0.25 indicates high concentration. The HHI, based on the volume of electricity transacted through trading licensees during 2011-12 was 0.1731, which indicated moderate concentration/market power among the trading licensees.

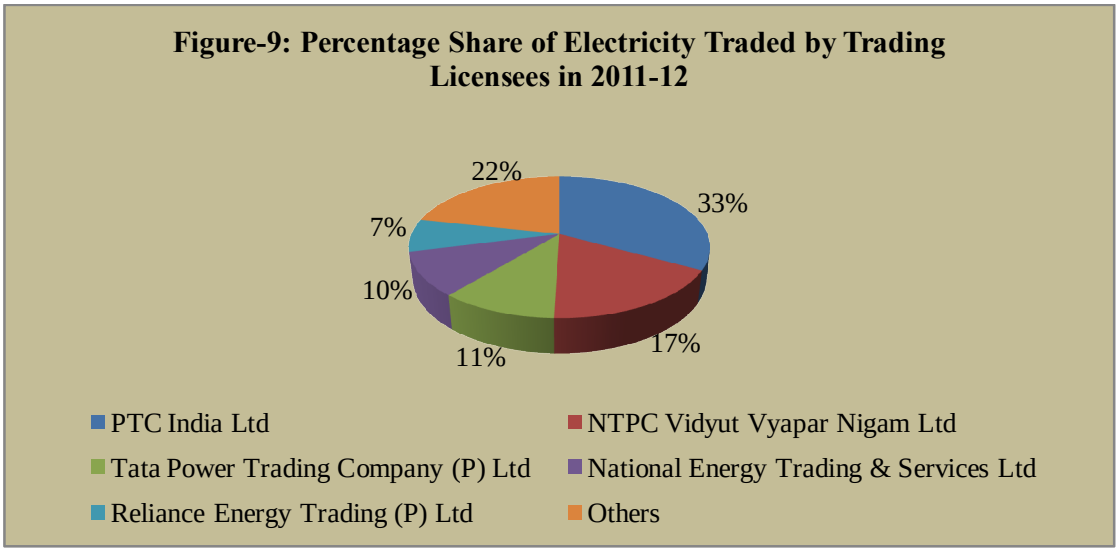
Table-10: Percentage Share of Electricity Traded by Trading Licensees and HHI in 2011-12

Sr No	Name of the Trading Licensee	Share of Electricity traded by Licensees in 2011-12	Herfindahl Herschman Index (HHI)
1	PTC India Ltd	33.05%	0.1092172
2	NTPC Vidyut Vyapar Nigam Ltd	17.44%	0.0304205
3	Tata Power Trading Company (P) Ltd	10.57%	0.0111805
4	National Energy Trading & Services Ltd	9.96%	0.0099150
5	Reliance Energy Trading (P) Ltd	7.47%	0.0055752
6	Adani Enterprises Ltd	4.58%	0.0020939
7	Knowledge Infrastructure Systems (P) Ltd	4.34%	0.0018864
8	JSW Power Trading Company Ltd	3.21%	0.0010315
9	Instinct Infra & Power Ltd.	2.53%	0.0006401
10	Shree Cement Ltd.	2.51%	0.0006304
11	GMR Energy Trading Ltd	1.86%	0.0003466
12	Jaiprakash Associate Ltd.	1.16%	0.0001346
13	Global Energy (P) Ltd.	0.62%	0.0000389

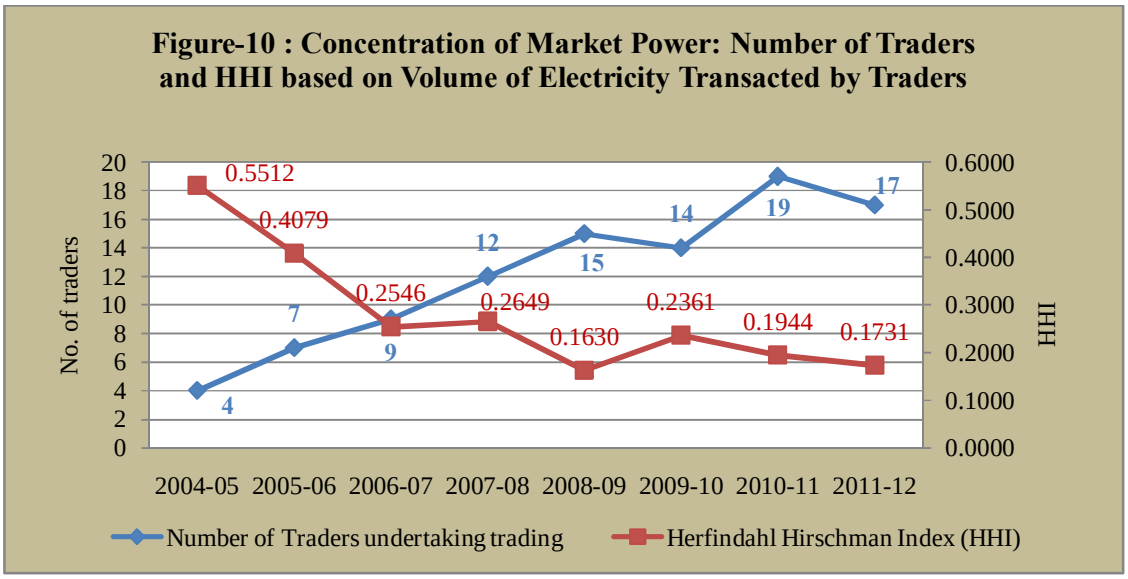
14	Mittal Processors (P) Ltd.	0.32%	0.0000104
15	RPG Power Trading Company Ltd.	0.26%	0.0000067
16	Jindal Power Trading Company Ltd.	0.08%	0.0000006
17	Essar Electric Power Development Corp. Ltd.	0.03%	0.0000001
	Total Volume	**100%**	**0.1731286**
	Top 5 Trading Licensees	**78.49%**	
Note: Percentage share in total volume traded by Licensees in 2011-12 computed based on the volume which includes the volume traded by inter-state trading licensees through bilateral and power exchanges. The volume excludes 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.

Figure-9: Percentage Share of Electricity Traded by Trading Licensees in 2011-12



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 2011-12. Number of inter-state trading licensees, who were undertaking trading bilaterally or through power exchanges, increased from 4 in 2004-05 to 17 in 2011-12. 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 moderate concentration (HHI of 0.1732) in 2011-12. The competition among the trading licensees resulted in increase in volume and decrease in prices in the short-term bilateral market (Table-5).

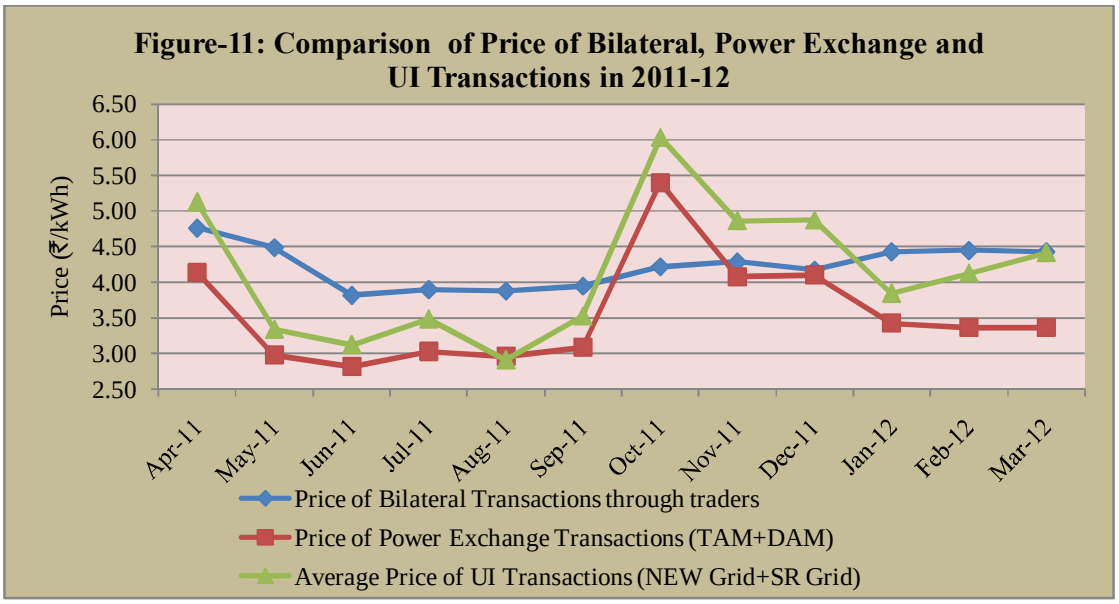


2.2. Price of Short-term Transactions of Electricity

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.

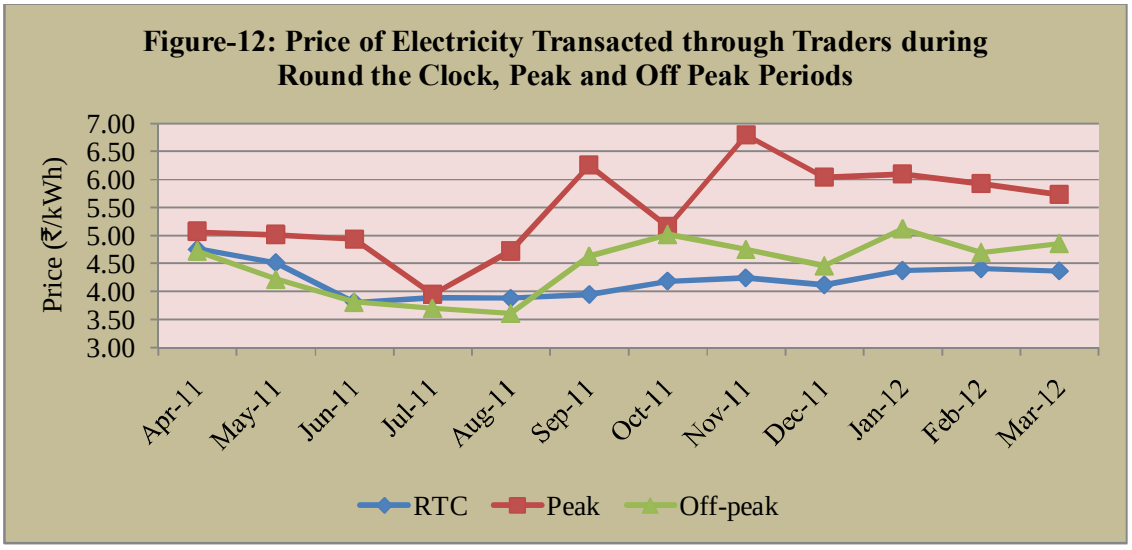
Table-11: Price of Short-term Transactions of Electricity (₹/kWh), 2011-12

Period	Bilateral through Traders				Power Exchange		UI	
	RTC	Peak	Off-peak	Total	IEX	PXIL	NEW Grid	SR Grid
Apr-11	4.76	5.07	4.72	4.76	3.49	4.00	3.91	6.35
May-11	4.52	5.02	4.22	4.49	2.96	3.03	2.86	3.82
Jun-11	3.81	4.94	3.81	3.82	2.80	2.99	2.96	3.29
Jul-11	3.90	3.95	3.70	3.90	2.97	3.22	3.55	3.42
Aug-11	3.88	4.73	3.61	3.88	2.89	3.01	3.14	2.68
Sep-11	3.95	6.26	4.63	3.95	3.00	3.08	3.81	3.24
Oct-11	4.19	5.16	5.02	4.22	5.40	5.42	6.55	5.52
Nov-11	4.25	6.80	4.75	4.29	4.08	4.09	4.81	4.92
Dec-11	4.12	6.05	4.46	4.17	4.05	4.02	5.40	4.35
Jan-12	4.38	6.10	5.12	4.43	3.29	3.36	3.33	4.36
Feb-12	4.41	5.93	4.70	4.45	3.34	3.50	3.17	5.09
Mar-12	4.37	5.74	4.86	4.43	3.32	3.94	2.96	5.87



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 May to September in 2011 and January to February in 2012.

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 when compared with the price during RTC and off peak periods.

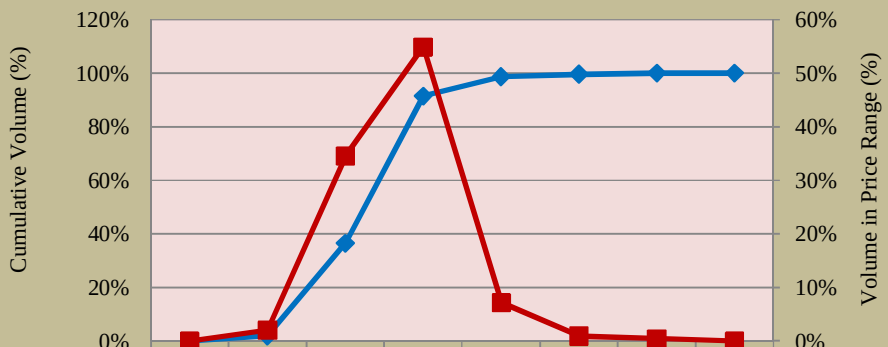


2.3 Volume of Electricity Transacted in Various Price Slabs

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 2011-12 is depicted in Figure -13. The figure shows that only 37% of the volume of electricity through traders has been transacted at less than ₹4/kWh. It can be observed from the figure that 99% of the volume has been transacted at less than ₹6/kWh.

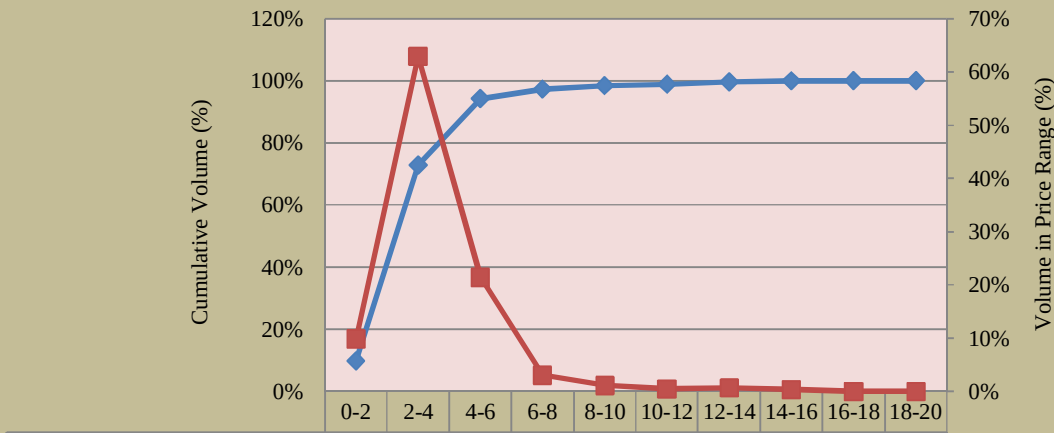
Figure-13: Percentage of Bilateral Transaction Volume at different Price Slabs, 2011-12



	0-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9
Cumulative Volume (%)	0%	2%	37%	91%	99%	100%	100%	100%
Volume in Price Range (%)	0%	2%	35%	55%	7%	1%	0%	0%

Cumulative volume and price of IEX Transactions in 2011-12 is depicted in Figure -14. The figure shows that 73% of the volume of electricity in IEX has been transacted at less than ₹4/kWh.

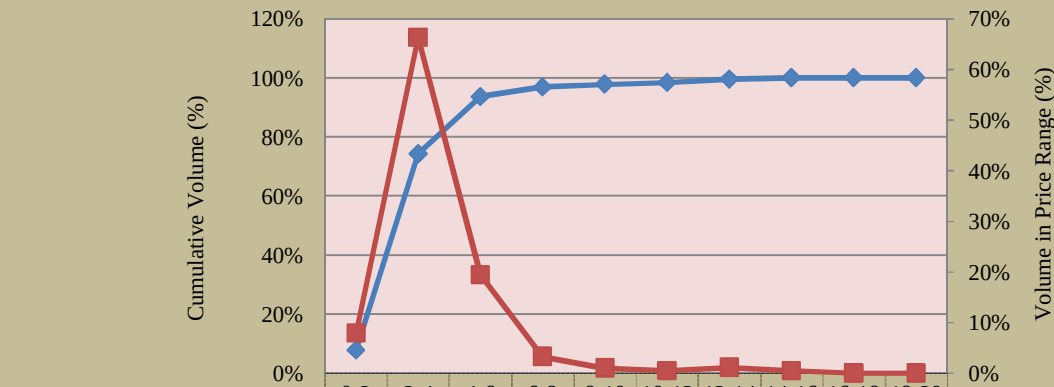
Figure-14: Percentage of IEX Transaction Volume at different Price Slabs, 2011-12



	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20
Cumulative Volume (%)	10%	73%	94%	97%	98%	99%	100%	100%	100%	100%
Volume in Price Range (%)	10%	63%	21%	3%	1%	0%	1%	0%	0%	0%

Cumulative volume and price of PXIL Transactions in 2011-12 is depicted in Figure - 15. The figure shows that 74% of the volume of electricity in PXIL has been transacted at less than ₹4/kWh.

Figure-15: Percentage of PXIL Transaction Volume at different Price Slabs, 2011-12



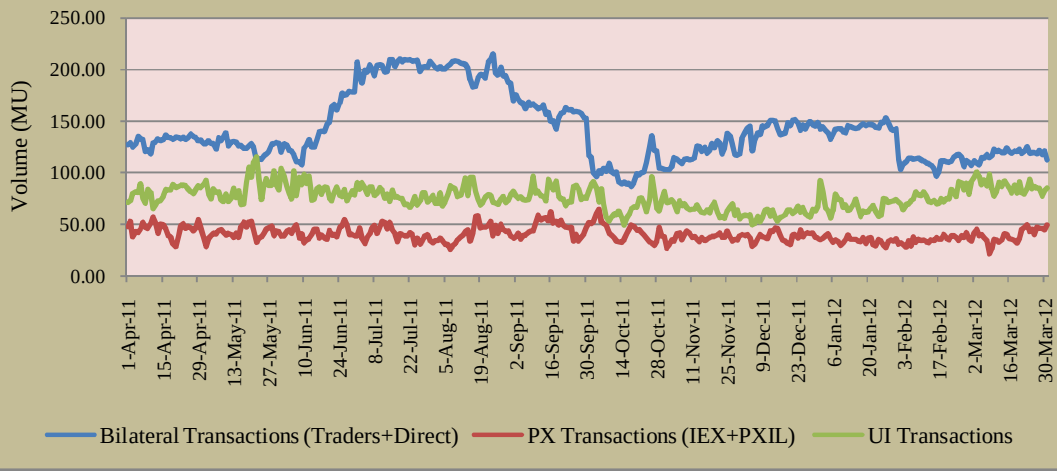
	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20
Cumulative Volume (%)	8%	74%	94%	97%	98%	98%	99%	100%	100%	100%
Volume in Price Range (%)	8%	66%	19%	3%	1%	1%	1%	0%	0%	0%

3. Daily Trends in Short-term Transactions of Electricity (1st April 2011 to 31st March 2012)

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 2011-12.

Figure-16: Volume of Short-Term Transactions of Electricity, 2011-12

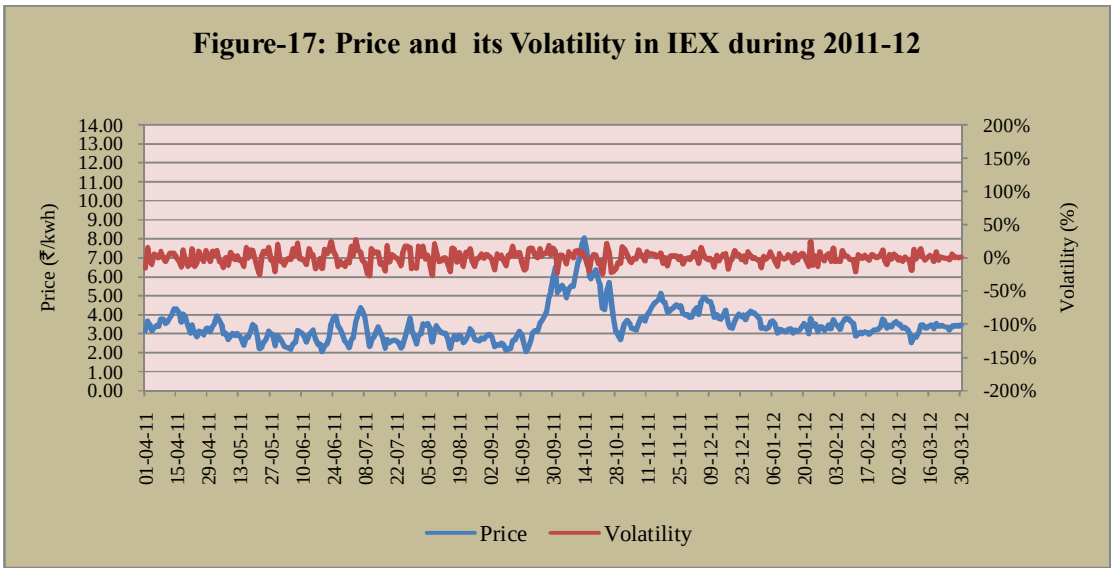


3.2 Price of Short-term Transactions of Electricity

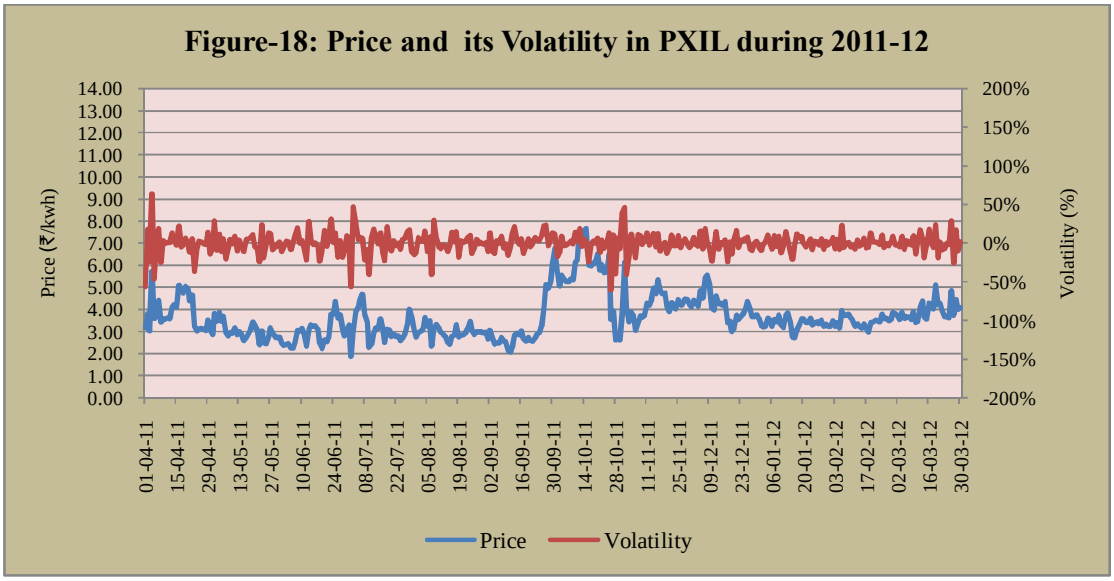
Trends in daily price of short-term transactions have been illustrated in this section for power exchanges and UI transactions.

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 2011-12 and it came out 9.40%. (See Annexure-II for historic volatility formula).

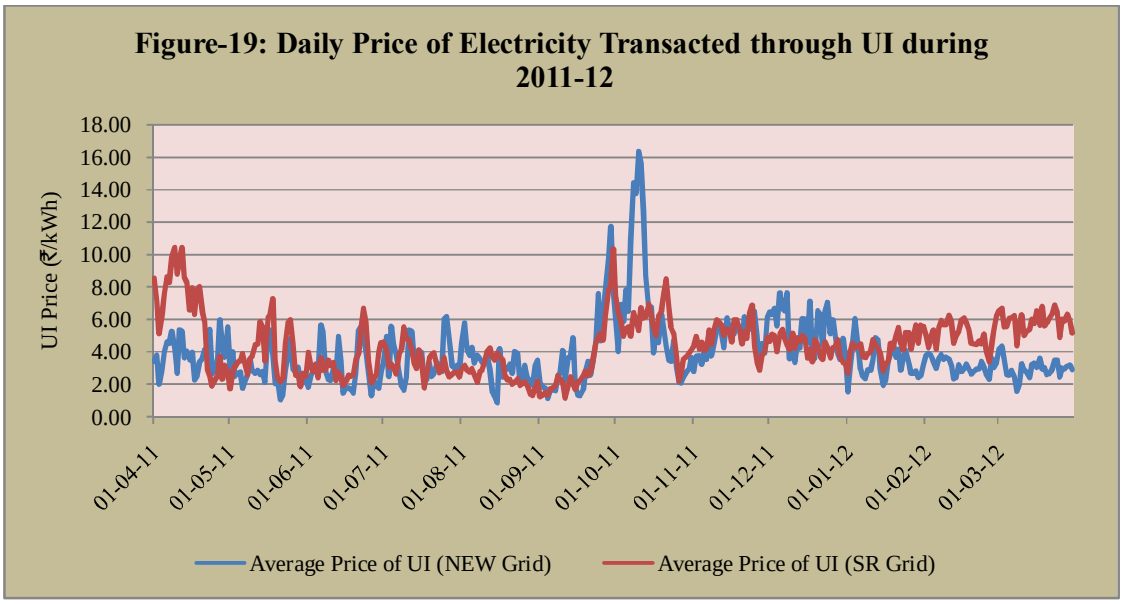


The weighted average price of electricity transacted through PXIL and its volatility is shown in Figure-18. Volatility in the Price of electricity transacted through PXIL has been computed using daily data for the year 2011-12 and it came out 13.67%.



3.2.2 Trends in Price of Electricity Transacted through UI

Trends in daily price of electricity transacted through UI, i.e. 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 2011 and in January and February 2012 (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. It can also be observed from the above figure that the UI price in the NEW Grid was high for a few days in October 2011, when compared with the UI price in SR Grid. The divergence was due to higher demand in the two Southern states of Tamil Nadu and Kerala.

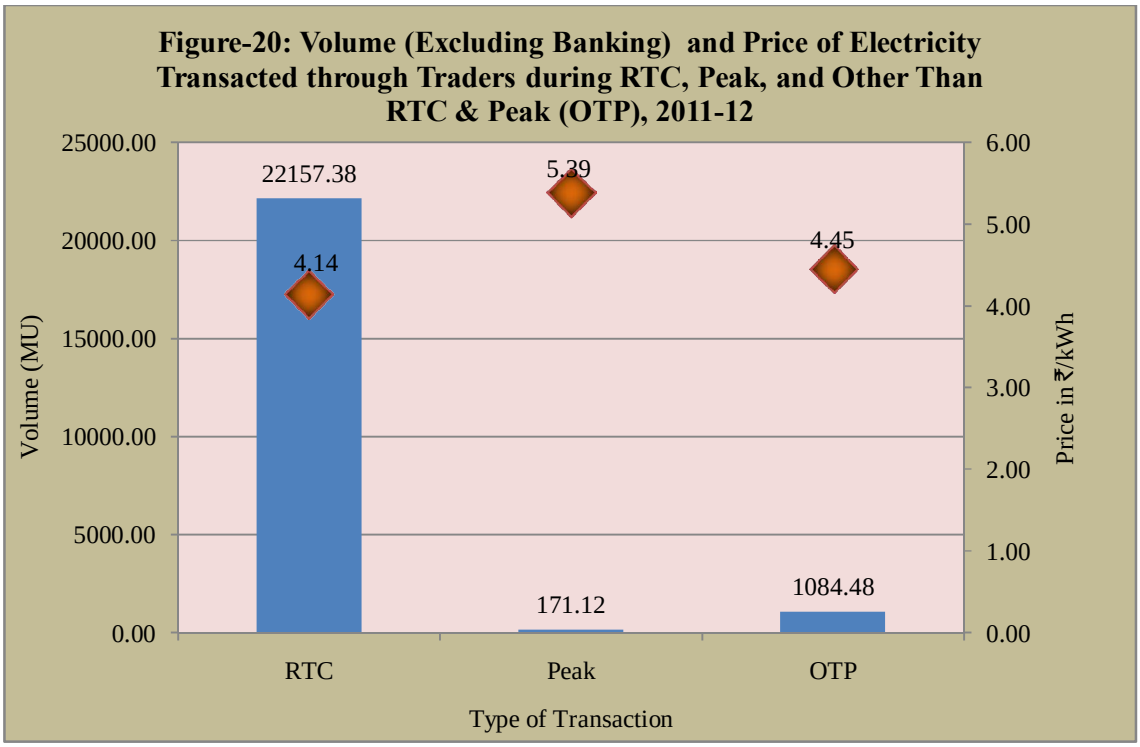
4. Time of the Day Variation in Volume and Price of Electricity Transacted through Traders and Power Exchanges (Day Ahead Market Sub-Segment)

In this section, time of the day variation in volume and price of electricity transacted through traders has been illustrated during RTC (Round the Clock), Peak period and other than RTC & Peak period, and time of the day variation in volume and price of electricity transacted through power exchanges is shown hour-wise. Price of electricity transacted through power exchanges is also shown region-wise and hour-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, 94.64% was transacted during RTC followed by 4.63% during OTP, and about 0.73% 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 (₹5.39/kWh), as expected, when compared with the price during RTC and OTP.

Figure-20: Volume (Excluding Banking) and Price of Electricity Transacted through Traders during RTC, Peak, and Other Than RTC & Peak (OTP), 2011-12



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 hour-wise. It can be observed from the figures that during peak period (between hours 18:00 to 23:00), the price 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 PXIL during peak period is high when compared with the rest of the hours, indicating that there is more demand during peak period. On the other hand, the volume of electricity transacted in IEX during evening peak hours is relatively lower compared to other periods.

Figure -21: Hour-Wise Market Clearing Volume and Price in IEX during 2011-12

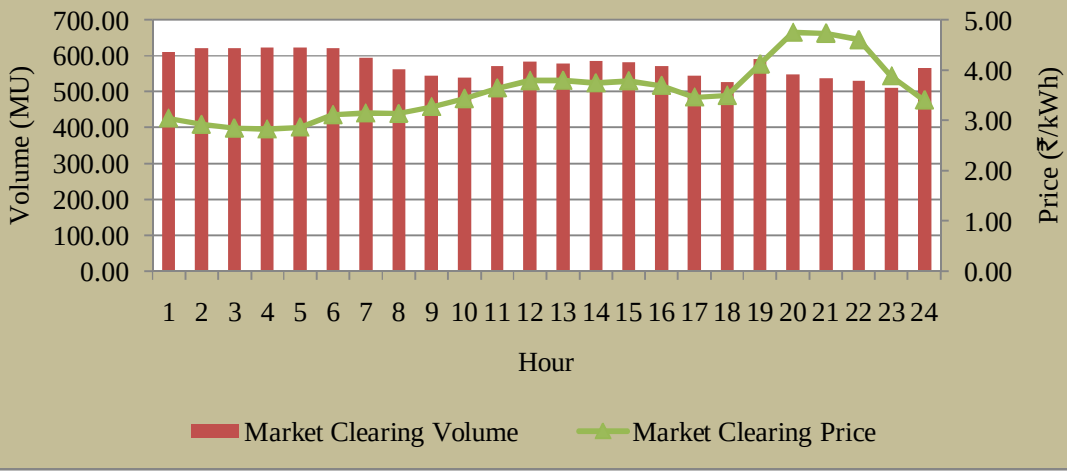
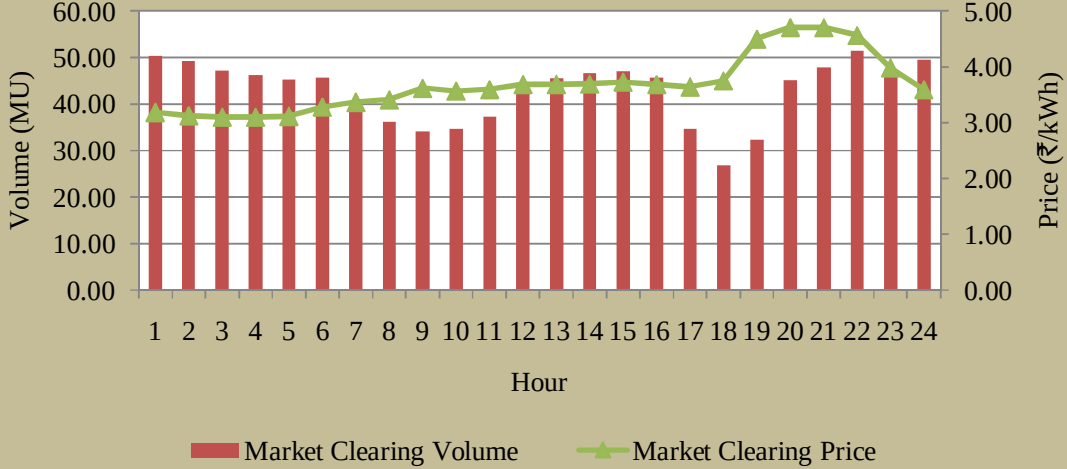


Figure-22: Hour-Wise Market Clearing Volume and Price in PXIL during 2011-12



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 2011-12, 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.

Figure-23: Region-wise and Hour-wise Price of Electricity Transacted through IEX, 2011-12

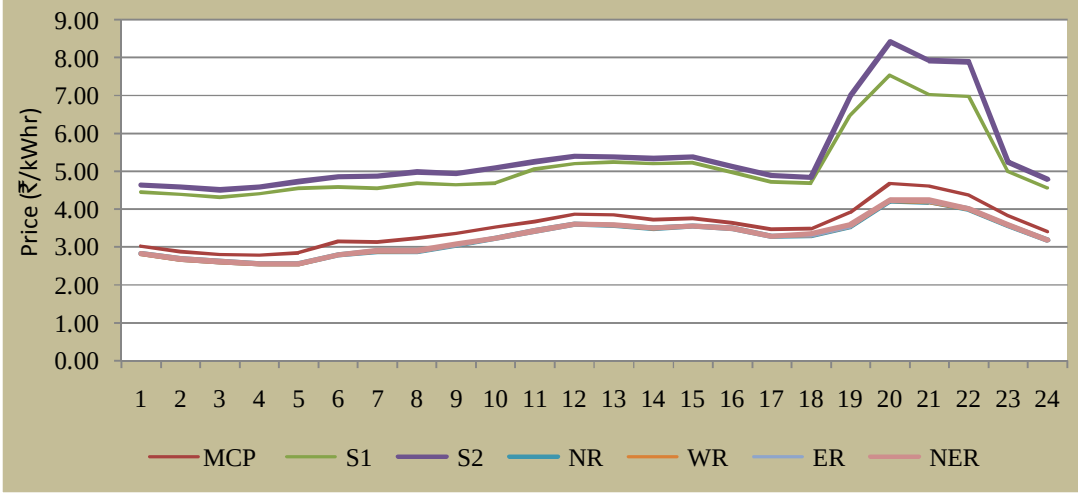
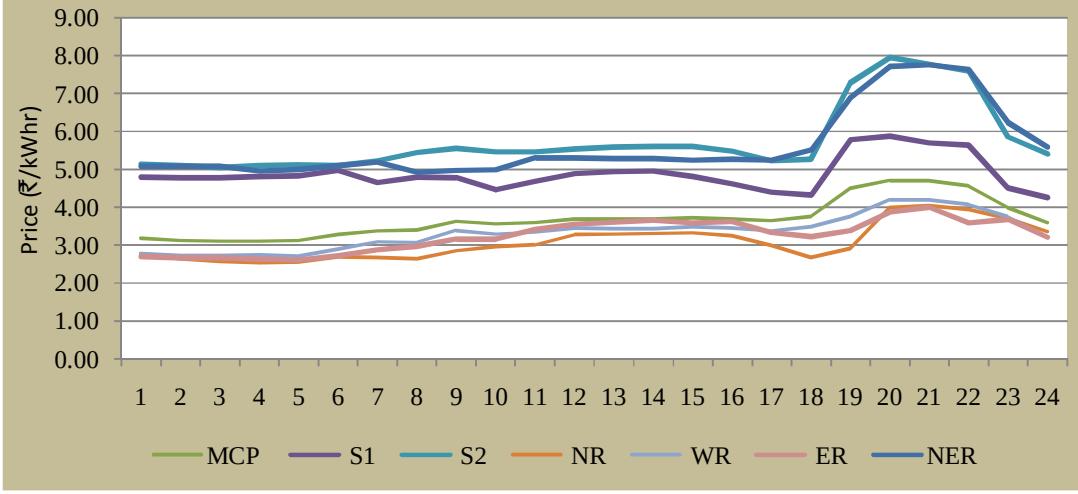


Figure-24: Region-wise and Hour-wise Price of Electricity Transacted through PXIL, 2011-12



It can be observed from Figure-24 that the prices were high in the North-eastern region when compared with other regions. This could be due to high market clearing prices for some delivery dates in all regions.

5. Trading Margin Charged by Trading Licensees for Bilateral Transactions

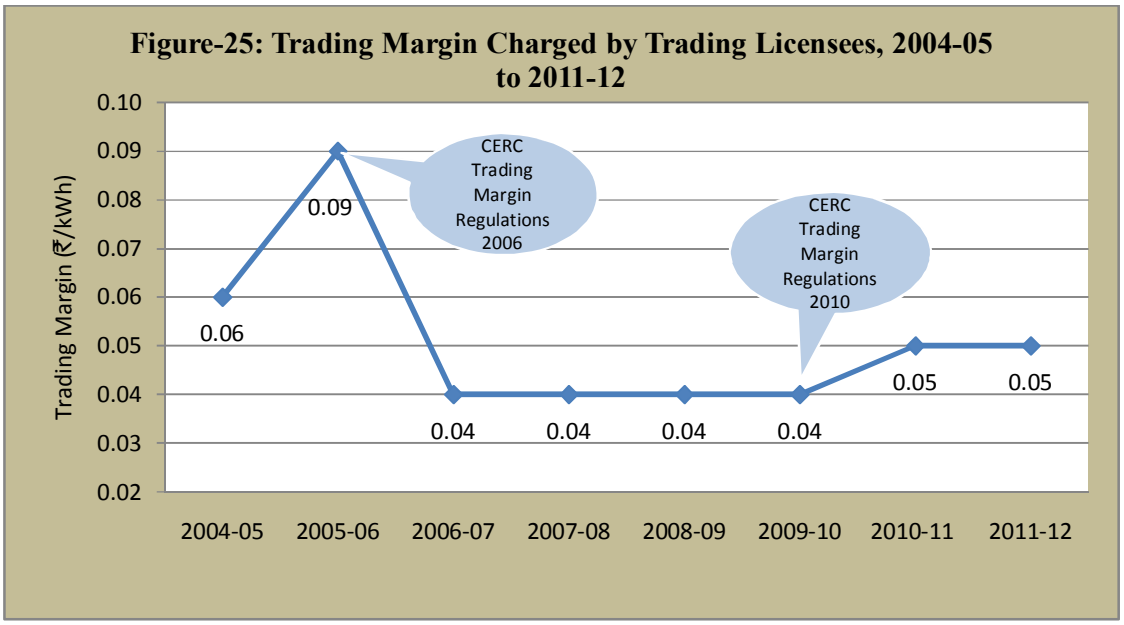
It was a voluntary practice during the year 2004-05 (when trading started) that licensees charged 5 paise/kwh or less as the trading margin. However, the weighted average trading margin charged by the licensees went up to 10 paise/kwh during April to September 2005. Considering this increase and other factors, the Commission 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 issue of revised Trading Margin Regulations, 2010 on 11.1.2010 (see Table-12, Table-13 & Figure-25).

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. Accordingly, the trading licensees have charged the trading margin, details of which are indicated in Table-12, Table-13 & Figure-25.The weighted average trading margin charged by trading licensees for bilateral transactions during 2004-05 to 2011-12 is given in Table-12 & Figure-25.

Table-12: Weighted Average Trading Margin Charged by Trading Licensees, 2004-05 to 2011-12

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

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 2011-12 is provided in Table-13 below.

Table-13: Weighted Average Trading Margin Charged by Trading Licensees during 2011-12

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	0.0400
When Sale Price is greater than ₹3/kWh	0.0508
₹3-4/kWh	0.0512
₹4-5/kWh	0.0498
₹5-6/kWh	0.0581
₹6-7/kWh	0.0319
₹7-8/kWh	0.0697
₹8-9/kWh	0.0420

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 shown in Figure-26 and Figure-27. 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 state utilities, industrial consumers and private distribution licensees.

Figure-26: Sell and Buy Volume of Various Types of Participants in IEX, 2011-12

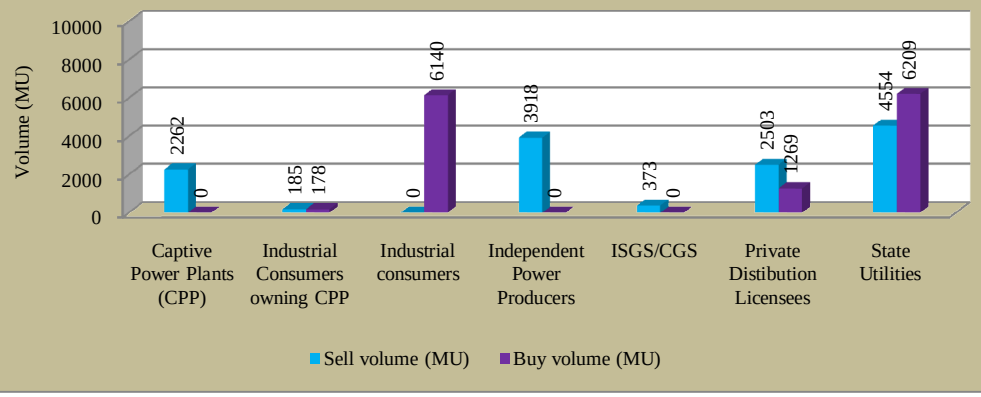
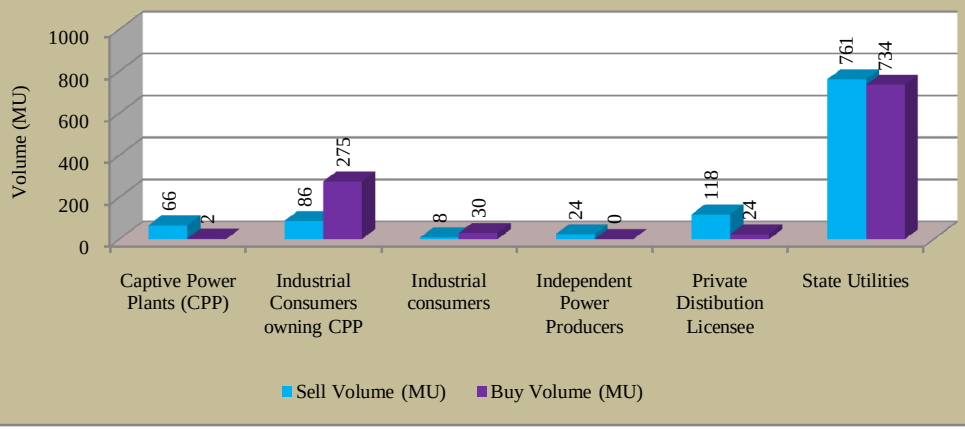
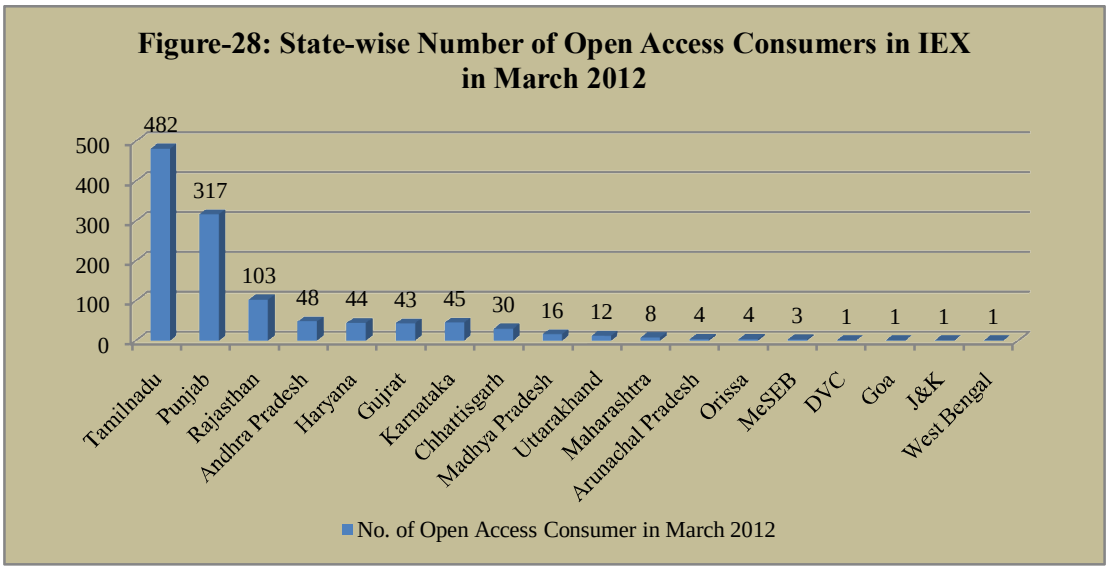


Figure-27: Sell and Buy Volume of Various Types of Participants in PXIL, 2011-12



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 968 Open Access (OA) Consumers were procuring part of their power requirements through IEX at the end of March 2012. These consumers were mostly located in Tamil Nadu, Punjab and Rajasthan (Figure-28). During the year, these OA consumers procured a total of about 6275 MU of electricity through IEX. In 2011-12, the weighted average price of electricity bought by open access consumers at IEX was lower (₹3.06/kWh) compared to the weighted average price of total electricity transacted through IEX (₹3.47/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 about 85% at the beginning of the year in April 2011 to about 90% at the end of the year in March 2012. The volume procured by OA consumers as a percentage of total volume transacted in IEX, however, went up dramatically as the year progressed ï starting with 38 % in April 2011, it reached 63% in March 2012. The percentage share of OA consumers, however, did not have secular growth- it was 15% and 24% in October and November 2011 respectively. For the year as a whole,

volume procured by OA consumers as a percentage of total volume transacted in IEX was about 45%.

Table-14: Number of Open Access Consumers in IEX, 2011-12

Month	No. of Open Access Consumers	Total No. of Portfolios in IEX	% of Open Access Consumers
Apr-11	453	533	84.99%
May-11	528	611	86.42%
Jun-11	579	663	87.33%
Jul-11	625	709	88.15%
Aug-11	673	757	88.90%
Sep-11	708	793	89.28%
Oct-11	743	829	89.63%
Nov-11	787	873	90.15%
Dec-11	829	916	90.50%
Jan-12	876	965	90.78%
Feb-12	919	1015	90.54%
Mar-12	968	1073	90.21%

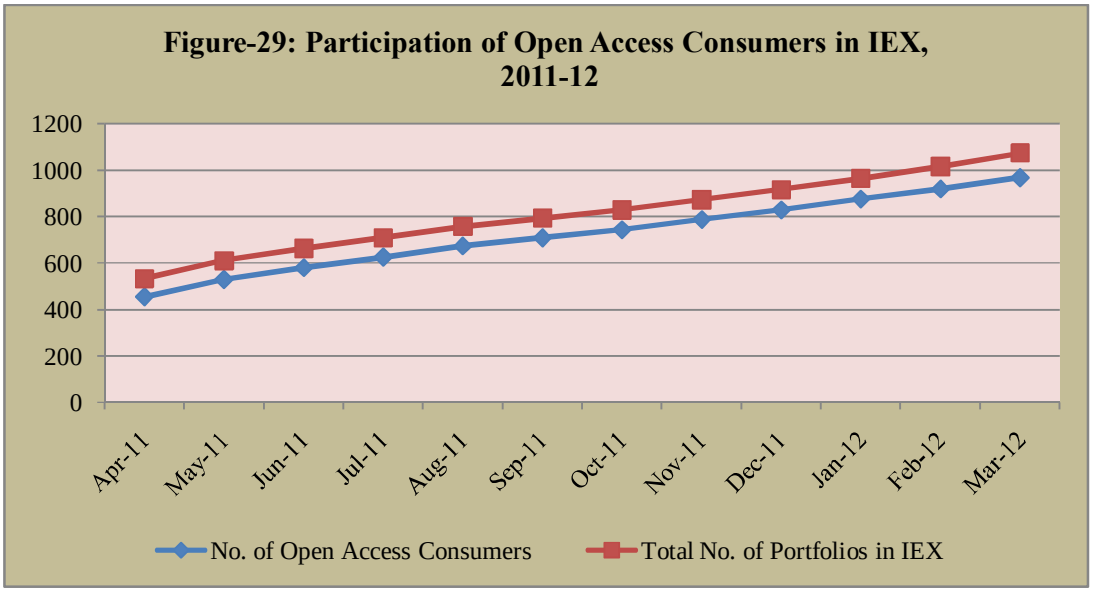
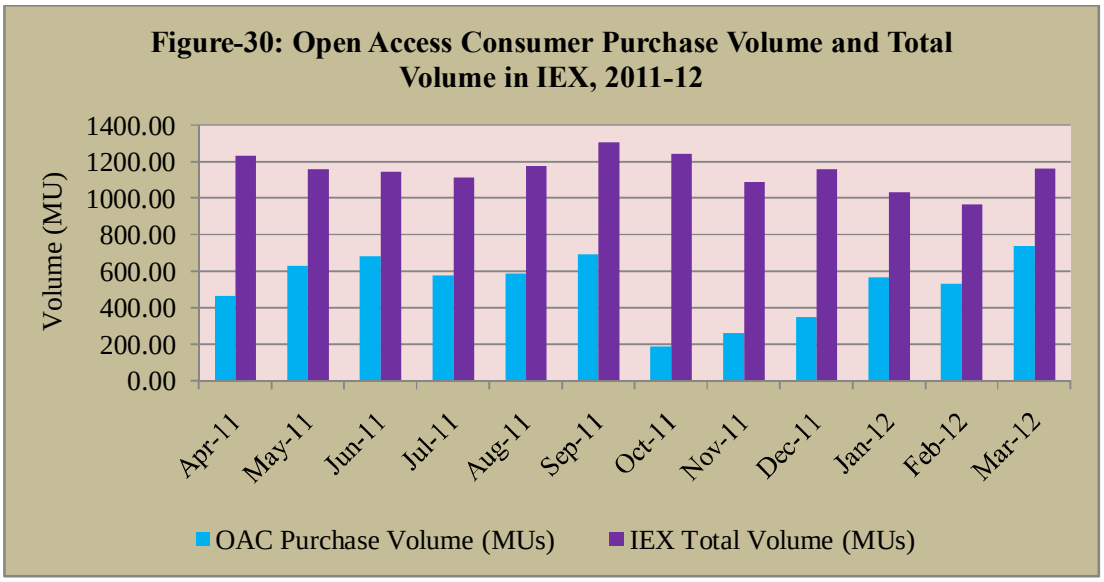
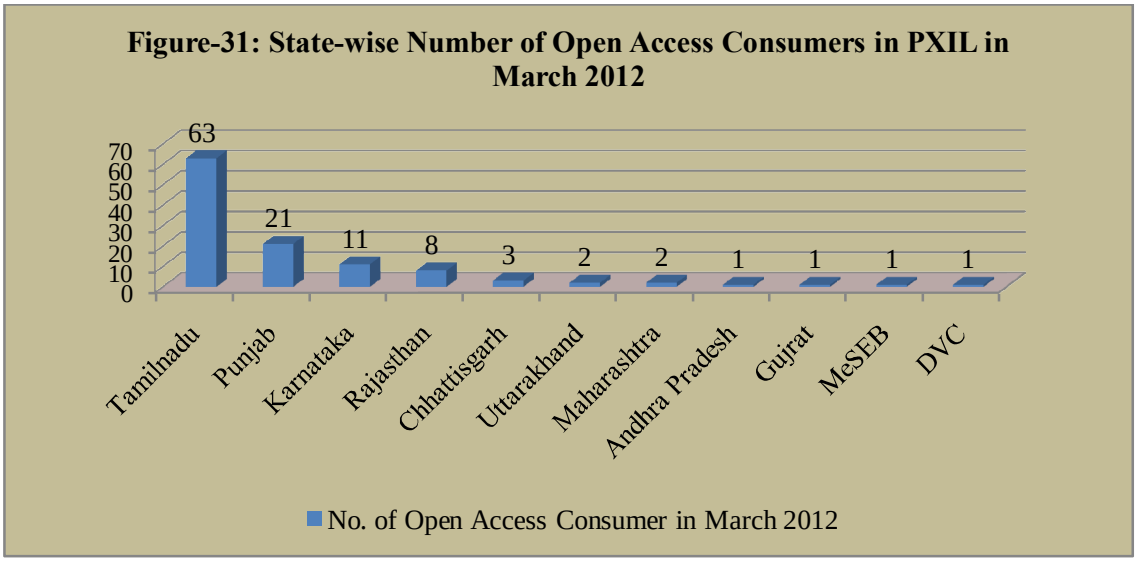


Table-15: Volume Participation of Open Access Consumers in IEX Day Ahead Market in 2011-12			
Month	**OAC Purchase Volume (MUs)**	**IEX Total Volume (MUs)**	**% OAC Purchase Participation**
Apr-11	464.24	1231.55	37.70%
May-11	629.97	1159.43	54.33%
Jun-11	682.88	1147.44	59.51%
Jul-11	575.14	1114.43	51.61%
Aug-11	588.51	1176.54	50.02%
Sep-11	693.46	1307.70	53.03%
Oct-11	189.33	1244.12	15.22%
Nov-11	262.14	1090.10	24.05%
Dec-11	349.88	1159.28	30.18%
Jan-12	567.28	1034.11	54.86%
Feb-12	534.27	970.07	55.08%
Mar-12	738.21	1164.09	63.41%
Total	**6275.30**	**13798.88**	**45.48%**



About 231 Open Access Consumers procured a part of their power requirements through PXIL. These consumers were mostly located in Tamil Nadu, Punjab and Karnataka (Figure-31). During the year, these OA consumers procured a total of about 307 MU of electricity through PXIL. In 2011-12, the weighted average price of electricity bought by open access consumers at PXIL was higher (₹3.64/kWh) when compared with the weighted average price of total electricity transacted through PXIL (₹3.56/kWh).



In Table-16 & Figure-32, a month-wise comparison is made between number of open access consumer participants 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 came down from about 61.42% at the beginning of the year in April 2011 to about 49.68 % at the end of the year in March 2012. However, once OA consumers started their procurement in PXIL, as in case of IEX, the volume procured by OA consumers as a percentage of total volume transacted in PXIL went up rapidly ï starting with 3.97 % in April 2011, it went up to 29.05% by March 2012. In between, in the month of October 2011, the share of OA consumers was about 7.23%. For the year as a whole, volume procured by OA consumers as a percentage of total volume transacted in PXIL was about 14.90 %.

Table-16: Number of Open Access Consumers in PXIL, 2011-12

Month	No. of Open Access Consumers	Total No. of Portfolios in PXIL	% of Open Access Consumers
Apr-11	121	197	61.42%
May-11	135	235	57.45%
Jun-11	146	249	58.63%
Jul-11	152	258	58.91%
Aug-11	161	267	60.30%
Sep-11	172	292	58.90%
Oct-11	174	298	58.39%

Nov-11	180	334	53.89%
Dec-11	184	342	53.80%
Jan-12	187	353	52.97%
Feb-12	194	398	48.74%
Mar-12	231	465	49.68%

Figure-32: Participation of Open Access Consumers in PXIL, 2011-12

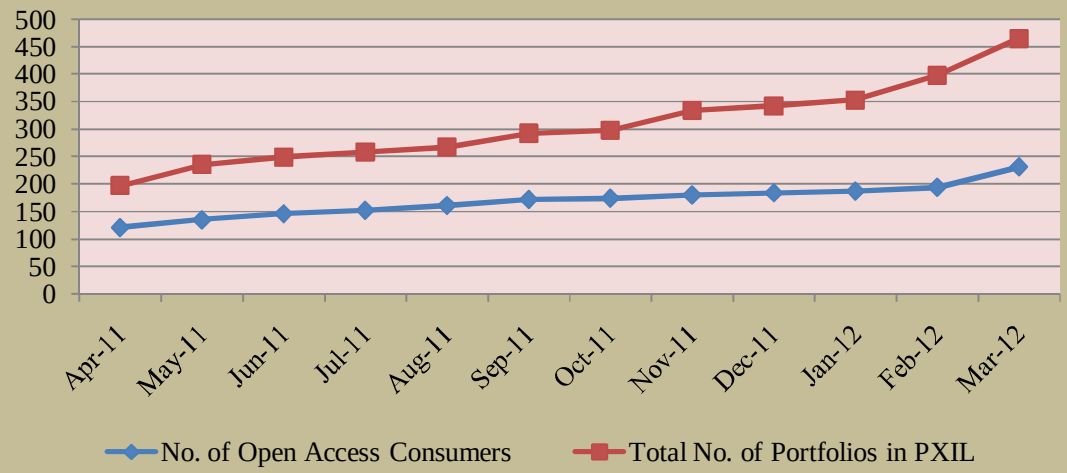
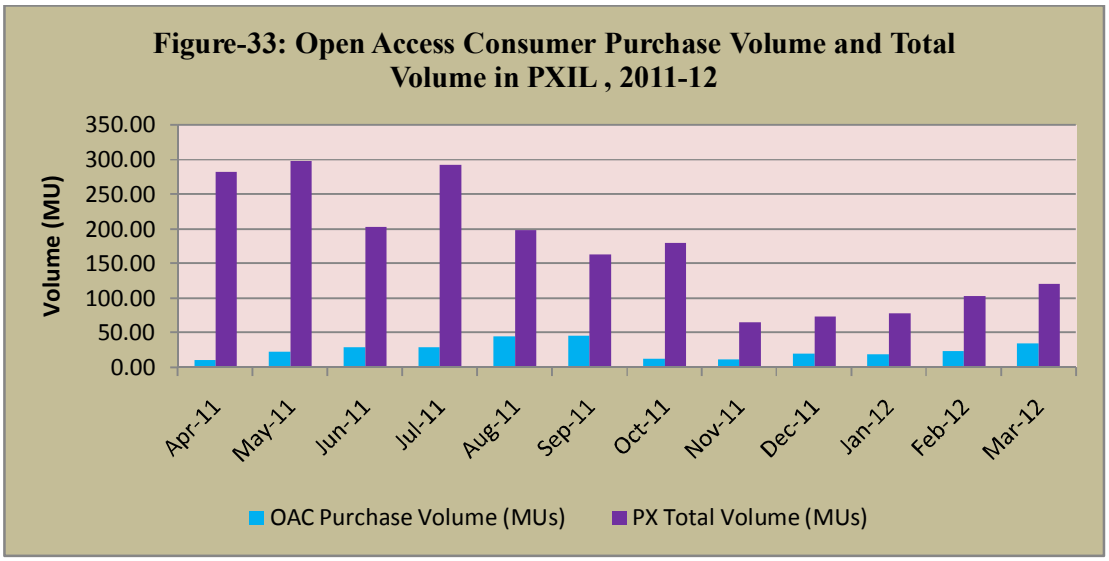


Table-17: Volume Participation of Open Access Consumers in Day Ahead Market of PXIL in 2011-12

Month	OAC Purchase Volume (MUs)	PX Total Volume (MUs)	% OAC Purchase Participation
Apr-11	11.18	281.92	3.97%
May-11	22.51	297.65	7.56%
Jun-11	29.67	202.93	14.62%
Jul-11	29.59	292.37	10.12%
Aug-11	44.80	199.31	22.47%
Sep-11	46.46	162.91	28.52%
Oct-11	13.01	179.90	7.23%
Nov-11	12.27	65.02	18.87%
Dec-11	20.13	73.60	27.35%
Jan-12	18.80	78.16	24.05%
Feb-12	23.14	103.24	22.41%
Mar-12	35.03	120.58	29.05%
Total	**306.58**	**2057.60**	**14.90%**



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 through 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 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 2011-12

S. No	Seller	State	Volume (MU)	Approximate percentage of total volume transacted through traders	Weighted Average Sale Price in ₹/kWh
1	LANCO (LAPL+LKPPL)	Andhra Pradesh	3630.00	15.50%	4.39
2	Sterlite Energy Ltd	Orissa	3222.41	13.76%	3.74
3	GOHP+ADHPL (GOHP)+KWHEPS (GOHP)	Himachal Pradesh	2735.90	11.69%	4.04
4	Jindal Power Ltd.	Chhatisgarh	2458.94	10.50%	4.16

5	Adani Power Ltd	Gujarat	1660.88	7.09%	4.58
6	CSPTCL+CSPDCL	Chhatisgarh	1211.52	5.17%	4.21
7	BALCO	Chattisgarh	1117.69	4.77%	4.12
8	KWHEP+JKHCL	Himachal Pradesh	1015.45	4.34%	3.79
9	JSW Energy Ltd	Karnataka	782.63	3.34%	4.45
10	SPDC J&K	Jammu & Kashmir	605.53	2.59%	3.73

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 2011-12

S. No	Buyer	State	Volume (MU)	Approximate percentage of total volume transacted through traders	Weighted Average Purchase Price in ₹/kWh
1	UPPCL	Uttar Pradesh	5563.46	23.76%	4.44
2	TNEB+TANGEDCO	Tamilnadu	2994.23	12.79%	3.98
3	PSPCL	Punjab	2498.37	10.67%	3.61
4	APPCC+APCPDCL	Andhra Pradesh	2239.97	9.57%	4.84
5	BSEB	Bihar	1483.00	6.33%	4.19
6	MSEDCL	Maharashtra	1126.60	4.81%	4.10
7	BESCOM	Karnataka	1039.80	4.44%	4.59
8	HPSEB	Himachal Pradesh	1029.25	4.40%	3.66
9	KSEB	Kerala	604.12	2.58%	3.77
10	WBSEDCL	West Bengal	580.51	2.48%	4.74

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 UPPCL, APPCC, BSEB, BESCOM and WBSEDCL from traders (bilateral transactions) were higher than the weighted average price for the entire bilateral trader segment (₹4.18/kWh).

Table-20: Major Sellers of Electricity in the Day Ahead Market in IEX, 2011-12					
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	1066.27	7.73%	3.11
2	BRPL	Delhi	929.78	6.74%	2.97
3	GOHP+GOHP (KWHEP)+GOHP (ADHPL)	H.P.	604.25	4.38%	3.58
4	Reliance Energy Ltd	Maharashtra	546.62	3.96%	2.96
5	Torrent Power (Sugen)	Gujarat	505.31	3.66%	3.24
6	Karcham Wangtoo HEP	Karcham Wangtoo HEP	487.27	3.53%	3.74
7	JPL	Jindal Power	476.77	3.46%	3.33
8	WBSEDCL	West Bengal	475.75	3.45%	3.10
9	MPPTC	Madhya Pradesh	450.51	3.27%	2.79
10	BYPL	Delhi	416.00	3.02%	2.95
Note: Total Volume transacted through Day Ahead Market in IEX was about 13796 MU.					

Table-21: Major Buyers of Electricity in the Day Ahead Market in IEX, 2011-12					
S.No.	**Name of Buyer**	**State**	**Buy Volume (MU)**	**Percentage of the Total Volume Transacted in IEX**	**Weighted Average Buy Price (₹/kWh)**
1	MSEDCL	Maharashtra	1014.79	7.36%	3.87
2	UPPCL	U.P.	932.32	6.76%	3.44
3	Tamilnadu	Tamilnadu	772.85	5.60%	6.91
4	JVVNL	Rajasthan	741.52	5.38%	3.25
5	Torrent Power (Ahmedabad+Surat)	Gujarat	735.41	5.33%	3.84
6	APCPDCL	Andhra Pradesh	726.77	5.27%	4.72
7	KSEB	Kerala	494.01	3.58%	5.63
8	MPPTC	Madhya Pradesh	471.32	3.42%	4.23
9	JSL Ltd	Haryana	294.06	2.13%	2.54
10	WBSEDCL	West Bengal	267.16	1.94%	3.70
Note: Total Volume transacted through IEX was about 13796 MU.					

From Table-21 it can be seen that major buyers such as MSEDCL, Tamil Nadu, Torrent Power, APCPDCL, KSEB, MPPTC and WBSEDCL were able to procure electricity from IEX day ahead market at weighted average prices which were higher than the weighted average price for the entire day ahead market in IEX (₹3.47/kWh).

Table-22: Major Sellers of Electricity in the Day Ahead Market in PXIL, 2011-12

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	499.47	48.55%	3.05
2	UT Chandigarh	Chandigarh	88.65	8.62%	3.03
3	BRPL PMG+BSES Yamuna Power Ltd	New Delhi	74.77	7.27%	3.17
4	WBSEDCL	West Bengal	60.71	5.90%	3.24
5	Jaypee Karcham Hydro Corporation Ltd	Uttar Pradesh	55.95	5.44%	4.46
6	Jindal Steel Plant	Chhatisgarh	35.86	3.49%	5.11
7	NDPL	New Delhi	32.00	3.11%	2.97
8	GEL Barge Mounted Po	Andhra Pradesh	20.63	2.01%	3.62
9	Nandi SSK Niyamit	Karnataka	18.30	1.78%	4.35
10	Govt.of Himachal Pradesh	Himachal Pradesh	16.84	1.64%	2.87

Note: Total Volume transacted in the Day Ahead Market in PXIL was about 1029 MU.

Table-23: Major Buyers of Electricity in the Day Ahead Market in PXIL, 2011-12

Sr. No	Name of the Buyer	State	Buy Volume (MU)	Percentage of the Total Volume Transacted	Weighted Average Buy Price (₹/kWh)
1	Rajasthan	Rajasthan	234.99	22.84%	3.24
2	TNEB	Tamil nadu	95.96	9.33%	6.73
3	UPPCL	Uttar Pradesh	69.06	6.71%	3.18
4	KSEB	Kerala	68.71	6.68%	4.86
5	UPPCL	Uttar Pradesh	66.81	6.49%	3.17
6	APCPDCL/APPCC	Andhra Pradesh	42.27	4.11%	5.14
7	MSEDCL	Maharashtra	35.44	3.44%	5.10
8	WBSEDCL	West Bengal	27.44	2.67%	3.15

9	Power Company of Karnataka	Karnataka	22.38	2.18%	4.50
10	Hinduja Foundries HTSC	Tamil nadu	18.86	1.83%	4.49
Note: Total Volume transacted through PXIL was about 1029 MU.					

From Table-23 it can be seen that major buyers such as TNEB, KSEB, APPCC, MSEDCL, Power Company of Karnataka and Hinduja Foundries HTSC were able to procure electricity from IEX Day Ahead Market at weighted average prices which were higher than the weighted average price for the entire day ahead market in PXIL (₹3.56/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 2011-12, in IEX, the unconstrained cleared volume and the actual volume transacted were 15.52 billion kWh and 13.79 billion kWh respectively. This indicates that the actual transacted volume could have been 12.53 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 1.52 billion kWh and 1.03 billion kWh respectively. This indicates that the actual transacted volume could have been about 48.08 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 of the fund. The congestion amount collected during the year 2011-12 was ₹484.76 crore.

Table-24: Details of Congestion in Power Exchanges, 2011-12			
	Details of Congestion	**IEX**	**PXIL**
A	Unconstrained Cleared Volume* (MU)	15521.35	1523.36
B	Actual Cleared Volume and hence scheduled (MU)	13792.99	1028.73
C	Volume of electricity that could not be cleared and hence not scheduled because of congestion (MU) (A-B)	1728.36	494.63
D	Volume of electricity that could not be cleared as % to Actual Cleared Volume	12.53%	48.08%
* *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 2011-12. 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 2011-12, accounted for about 42 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 2011-12 (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 ₹1.19 and ₹4.28 per kWh for procuring power from coal and lignite based stations, between ₹2.72 and ₹6.99 per kWh from gas/RLNG based power stations, between ₹8.49 and ₹12.01 per kWh from liquid fuel based power stations (Table-25), and between ₹0.77 per kWh and ₹5.90 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, 2011-12					
Sl. No.	**Name of the Generating Station**	**Installed Capacity (MW) as on 31.3.2011**	**Fixed charges (Paise/kWh)**	**Energy Charges (Paise/kWh) as on March, 2012**	**Total (Paise/kWh)**
I: Coal Based thermal generating Stations of NTPC					
A.	**Pit head Generating Stations**				
1	Rihand STPS (St-I) *	1000	80	113	193
2	Rihand STPS (St-II)	1000	92	116	208
3	Singrauli STPS	2000	49	111	160
4	Vindhyachal STPS (St-I)	1240	58	151	209
5	Vindhyachal STPS (St-II)*	1000	74	142	217
6	Vindhyachal STPS St-III*	1000	113	142	255
7	Korba STPS	2100	47	72	119
8	Ramagundam STPS (St-I&II)	2100	53	141	193
9	Ramagundam STPS (St-III)*	500	97	146	243
10	Talcher TPS#	460	-	46	-
11	Talcher STPS (St-I)*	1000	81	149	230
12	Talcher STPS (St-II)	2000	78	148	227
13	Sipat-I	660	137	92	228
14	Sipat-II*	1000	124	92	216
15	Korba STPS-III*	500	147	72	219
	Sub-Total	**17560**			
B.	**Non-Pit head Generating Stations**				
16	FGUTPP TPS (St-I)*	420	85	242	326
17	FGUTPP (St-II)	420	97	242	339
18	FGUTPP (St-III)*	210	141	242	383
19	NCTP Dadri (St-I)	840	82	298	380
20	NCTP Dadri (St-II)*	980	156	264	420
21	Farrakka STPS (St-I&II)*	1600	77	298	375
22	Tanda TPS	440	112	316	428
23	Badarpur TPS*	705	80	341	421
24	Kahalgaon STPS (St-I)*	840	93	242	335
25	Kahalgaon STPS (St-II)*	1500	114	228	342
26	Simhadri (St-I)	1000	99	217	316
27	Simhadri (St-II)	500	162	216	378
28	Farakka STPS(St-III)	425	126	-	-
	Sub-Total	**9880**			
	Total Coal	**27440**			

Sl. No.	Name of the Generating Station	Installed Capacity (MW) as on 31.3.2011	Fixed charges (Paise/kWh)	Energy Charges (Paise/kWh) as on March, 2012	Total (Paise/kWh)
II: Using Natural Gas as Fuel					
1	Dadri CCGT*	830	53	267	320
2	Faridabad	431	84	221	305
3	Anta CCGT*	419	67	244	312
4	Auraiya GPS*	663	50	264	315
5	Gandhar GPS *	657	103	208	311
6	Kawas GPS *	656	80	208	288
	Total Natural Gas	**3656**			
III: Using LNG as Fuel					
1	Dadri CCGT	830	53	645	699
2	Faridabad	431	84	505	589
3	Anta CCGT	419	67	418	485
4	Auraiya GPS	663	50	645	695
5	Gandhar GPS (NAPM)	657	103	363	467
6	Kawas GPS (NAPM)	656	80	369	449
	Total LNG	**3656**			
IV: Using (Naphtha/HSD) as Fuel					
1	Dadri CCGT	830	53	795	849
2	Faridabad	431	84	767	851
3	Anta CCGT	419	67	812	880
4	Auraiya GPS	663	50	989	1040
5	Kayamkulam CCGT	360	96	1105	1201
	Total Naphtha/HSD	**2703**			
V: Lignite Based thermal generating Stations of NLC					
1	TPS-I	600	-	49	-
2	TPS-II (St-I)	630	60	185	245
3	TPS-II (St-II)	840	62	185	247
4	TPS-I (Expansion)	420	143	185	328
	Total Lignite	**2490**			
VI: North Eastern Electric Power Corporation Ltd.					
1	Assam GBPP	291	-	204	-
2	Agartala GTPP	84	120	152	272
	Total NEEPCO	**375**			
** Final orders issued by CERC, however, tariff is subject to true up. Tariff of all others are provisional.*					
# Talcher TPS 460 MW- pending for Legal Issue					

Table-26: Composite Tariff of Central Hydro Power Stations, 2011-12				
Name of Generating Company	**Name of the Generating Station**	**Installed Capacity (MW)**	**Annual Fixed Charges (₹/Lakhs)**	**Composite Tariff (₹/kWh)**
NHPC				
1	Baira siul	180	9301.10	1.37
2	Loktak	105	9579.35	2.45
3	Salal	690	23314.04	0.87
4	Tanakpur	123	8112.18	2.06
5	Chamera -I	540	25547.60	1.77
6	Uri-I	480	32868.18	1.46
7	Rangit	60	9232.72	3.13
8	Chamera-II	300	34294.49	2.63
9	Dhauliganga-I	280	27015.81	2.74
10	Dulhasti	390	97819.36	5.90
11	Teesta-V *	510	47070.89	2.10
12	Sewa-II	120	19615.19	4.23
	Total	**3778**		
NHDC				
1	Indira Sagar	1000	51895.72	2.65
2	Omkareshwar#	520		
	Total	**1520**		
THDC				
1	Tehri stage-I#	**1000**		
SJVNL				
1	Nathpa Jhakri#	**1500**		
NEEPCO				
1	Khandong	50	3388.60	1.40
2	Kopili Stage-I	200	7978.49	0.77
3	Doyang#	75		
4	Ranganadi	420	29073.01	1.78
5	Kopili Stage-II	25	1332.50	1.77
	Total	**770**		
# Tariff of the hydro stations for the period 2011-12 is yet to be finalised.				
* Tariff of Teesta-V is provisional				

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	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		3.280	Tariff adopted dated 28-12-2010	
7	Maharashtra	M/s Emco Energy Ltd.	MSEDCL	200		2.879	Tariff adopted dated 28-12-2010	
8	Maharashtra	M/s Adani Power Maharashtra Ltd.	MSEDCL	125		3.280	Tariff adopted dated 19-05-2011	
9	Maharashtra	M/s KSK Wardha Power Ltd.	Rinfra-D	260		4.850	Tariff adopted dated 01-07-2011	Medium Term (1-7 yrs)
10	Maharashtra	M/s Vidharbha Industries Power Ltd.	Rinfra-D	134		4.240	Tariff adopted dated 31-05-2011	
11	Maharashtra	M/s Abhijeet	Rinfra-D	55		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	

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	Coal	2.89	Tariff adopted dated 14.07.2010	Long-term
2	Uttar Pradesh	Prayagraj Thermal Power Project (Bara)	UPPCL	1980	Coal	3.02	Tariff adopted dated 27.8.2010	
3	Uttar Pradesh	Sangam Thermal Power Project (Karcchana)	UPPCL	1320	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	

Annexure-I

List of Trading Licensees as on 31.3.2012					
Sr. No	**Name of Licensee**	**Present Category of License**	**Address**	**Contact Number**	**Email-ID**
1	Tata Power Trading Company (P) Ltd.	I	34, Sant Tukaram Road, Carnac Bunder, Mumbai-400009	022-67172863; 8097089124	power@tatapowertrading.com; saurabhaggrawal@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 Center, Santa Cruz(E), Mumbai-400055	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	Subhash Kabini Power Corporation Ltd.	IV	8/2 Ulsoor Road, Bangalore ï 560042	080-41229490	prem.bhatia@spml.co.in, atp@sums.in
9	Special Blast Ltd	IV	Nathani Building, Shastri Chowk, Raipur-492001, Chattisgarh	0771- 4065900	pecpltd@specialblasts.com

Sr. No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
10	Instinct Infra & Power Ltd.	IV	C-201, Naraina Ind. Area ,Phase-1, New Delhi-110028	011-25893495; 011-41410259	salil@instincttrade.com
11	Essar Electric Power Development Corporation Ltd.	III	Essar House, 11, Keshavrao Khadye Marg, Mahalaxmi, Mumbai-400034	022-66601100	Anil.Sharma2@essar.com
12	Suryachakra Power Corporation (P) Ltd.	IV	725,1st floor, Street No.11, Himayathnagar, Hyderabad-500029	040-23550597	admin@suryachakra.com
13	JSW Power Trading Company Ltd.	I	Jindal Mansion, 5-A, G Deshmukh Marg, Mumbai-400026	011-46191101	hiralal.chaudhary@jsw.in
14	Visa Power Ltd.	IV	9, Shakespeare Sarani, Kolkata-700071	033-30119000	r.bose@visapower.net.in
15	Pune Power Development Pvt. Ltd	IV	Anmol, 25, Yashwant Nagar,Range Hill Corner, Pune ï 411007	020-25560186	punepower.power@gmail.com
16	Ispat Energy Ltd.	IV	202 Town Centre , 2nd Floor, Marol , Andheri (East), Mumbai - 400 059	022-66542222; 022-66542398	saurabh_chaturvedi@ispatind.com
17	Greenko Energies (P) Ltd.	IV	#1071, Road No. 44, Jubilee Hills, Hyderabad-500033	040-40301000 040-32915858	surya.pery@greenkogroup.com, info@greeenkogroup.com
18	Vandana Vidyut Ltd.	IV	Vandana Bhawan;M. G.Road,Raipur-492001,Chhattisgarh	0771-4006000	vvl@vandanavidyut.com
19	Indrajit Power Technology (P) Ltd.	III	1, Pearl Mansion(N),91,M. Karve Road, Mumbai-400 020.	022-0418260; 022-22006969	rmalegavi@indrainfra.in
20	Adhunik Alloys & Power Ltd.	IV	Lansdowne, Towers,2/1A Sarat Bose Road, Kolkatta-700020	033-30915300; 033-30915344	vksarawagi@adhunikgroup.co.in

Sr. No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
21	Indiabulls Power Trading Ltd.	IV	Indiabulls House, 448-451,Udyog Vihar, Phase-V, Gurgaon-122001	0124-6682101; 011-30252900	manish.s14@indiabulls.com
22	Jindal Power Trading Company Ltd.	IV	12, Bhikaiji Cama Place, New Delhi-110066	011-26973915; 011-26739151	shalabh.tandon@jindalsteel.com
23	RPG Power Trading Company Ltd.	II	6th Floor, Agrawal House, 2 St George Gate Road, Kolkatta-700022	033-66252012; 033-66252010	suman.ghosh@rp-sg.in
24	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	sunil.agarwal@gmrgroup.in; Madhusmita.Mahapatra@gmrgroup.in
25	Jain Energy Ltd.	III	39, Shakespeare Sarani,Kolkata-700017	9893128710; 033-4002777	info@jaingroup.com
26	Shyam Indus Power Solutions (P) Ltd.	IV	129, Transport Centre, Rohtak Road, Punjabi Bagh, New Delhi-35	011-45764400, 011-45764444	pdgoyal@shyamindus.com,shyamindus@vsnl.net
27	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
28	Knowledge Infrastructure Systems (P) Ltd.	I	G-02, Salcon Aurum Complex,4, Commercial Centre, Jasola, New Delhi-110076	011-46067070	arustagi@knowledgegroup.in
29	Mittal Processors (P) Ltd.	III	GF-71,Vardman Apartment, Abhay Khand-III, Indira Puram, Ghaziabad-201010, U.P.	0180-6612531/532	rdjain@mittalsgroup.com
30	Shree Cement Ltd.	I	101, Hans Bhawan, Bahadur Shah Zafar Marg, New Delhi-2	011-23370320, 011-23370829	bhargavaabhinav@shreecementltd.com

Sr. No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
31	PCM Power Trading Corporation Ltd.	III	PCM Tower, Sevoke Road, Siliguri - 734001, West Bengal.	0353-2777028/29/40	infopcmpowertrading.co.in
32	Abellon Clean Energy Ltd.	IV	Sangeeta Complex, Near Parimal Crossing, Ellisbridge, Ahmedabad-380006	079-66309332	mandavi.singh@abellonpower
33	Jay Polychem (India) Ltd.	I	D-143, Defence Colony, New Delhi-110024	011-4279100	info@jaypolychem.com
34	Jai Prakash Associates Ltd.	I	JA House, 63 Basant Lok, Basant Vihar, New Delhi-110057	011-26141540, 011-26147411	sarabjeet.dhingra@jalindia.co.in
35	My Home Power Ltd.	III	3rd Block, 5th Floor, My Home Hub, Madhapur, Hyderabad ï 500081	040- 66139240	projects@myhomepower.in
36	Customised Energy Solutions India Private Ltd.	IV	A 501,GO Square, Waquad, Hinjewadi link Road, Pune-411057	0997 1174089	abhatnagar@ces-ltd.com
37	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
38	Chromatic India Ltd.	III	207,Vardhaman Complex Premises co-op Soc Ltd, L.B.S Marg,Vikhroli(W), Mumbai:-400083,	022-61369800	dyestuff@bom3.vsnl.net.in
39	Kandla Energy & Chemical Ltd.	III	4th Floor, Sarthik Annexe, Besides Fun Republic, Satellite Road,Ahmedabad ï 380015, Gujarat	9925203780	sales@keclsolvents.com

Sr. No	Name of Licensee	Present Category of License	Address	Contact Number	Email-ID
40	Marquis Energy Exchange Limited	III	#45 & 46, 3rd Floor, Hansraj Damodar Building, 277, S.B.S.Road, Fort, Mumbai-400 001	022-22621518	contact@maxpowerexchange.com
41	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

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. Ln is natural logarithm
4. n is the number of observations
5. u is the average daily returns

Herfindahl-Hirschman Index (HHI) Calculation

Formula for computing the HHI is as under:

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

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.