

# **TRENDS IN SHORT-TERM TRANSACTIONS OF ELECTRICITY**

## **(AUGUST 2008 TO JUNE 2009)**

### **I: Introduction**

The report on “trends in short-term transactions of electricity” is being prepared as part of the market monitoring process. The report is mainly based on the data and analysis of the monthly reports of the Market Monitoring Cell (MMC) for the period from August 2008 to June 2009. In this context, “short-term transactions of electricity” means the contracts of less than one year period for electricity transacted through Inter-State Trading Licensees and directly by the Distribution Licensees, Power Exchanges (Indian Energy Exchange Ltd (IEX) and Power Exchange India Ltd (PXIL)), and Unscheduled Interchange (UI). The objective of the report is mainly (i) to analyse the trends in volume and price of the short-term transactions of electricity; (ii) to analyse competition among the market players; and (iii) to disclose/disseminate all relevant market information.

The electricity demand and supply vary from season to season, therefore, it is not appropriate to compare this month’s data with the data of the immediately preceding month or the following month. Hence, there is a need for seasonal adjustment.

The analysis of the report covers (i) Yearly trends in short-term transactions of electricity for the period from 2004-05 to 2008-09; (ii) Monthly trends in short-term transactions of electricity for the period from August 2008 to June 2009; and (iii) Daily trends in short-term transactions of electricity for the period from August 2008 to June 2009, as under:

### **II: Yearly trends in short-term transactions of electricity (2004-05 to 2008-09)**

Here, the short-term transactions are restricted only to the transactions undertaken by trading licensees and power exchanges, therefore, yearly trends has been analysed based on

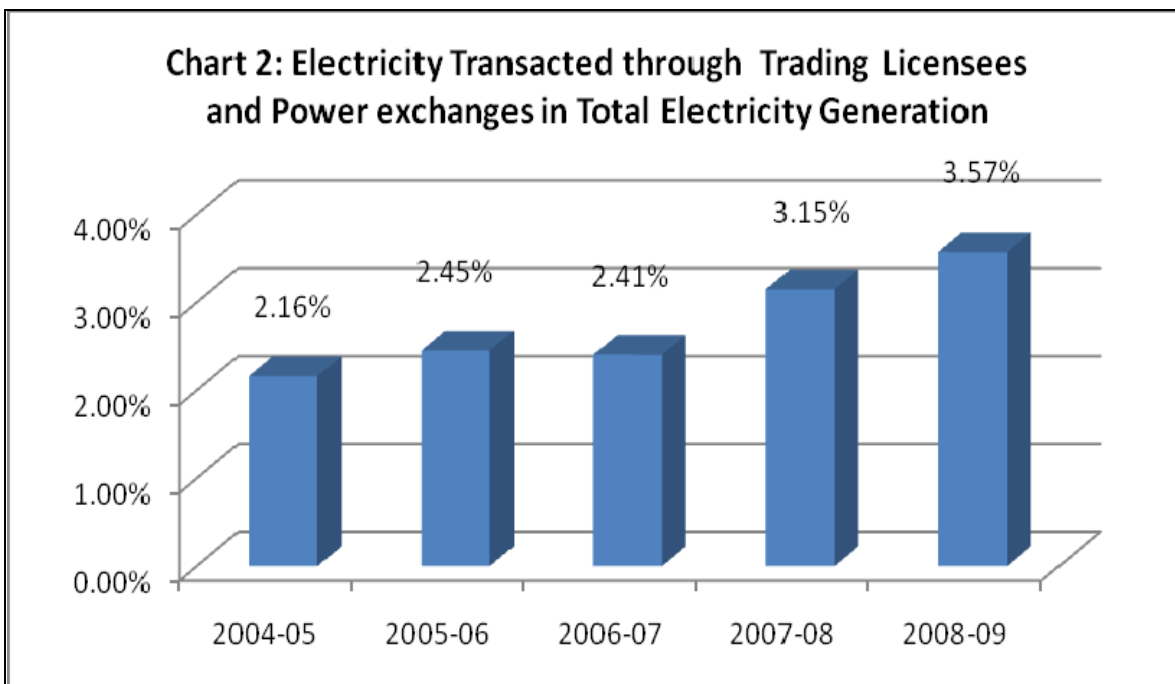
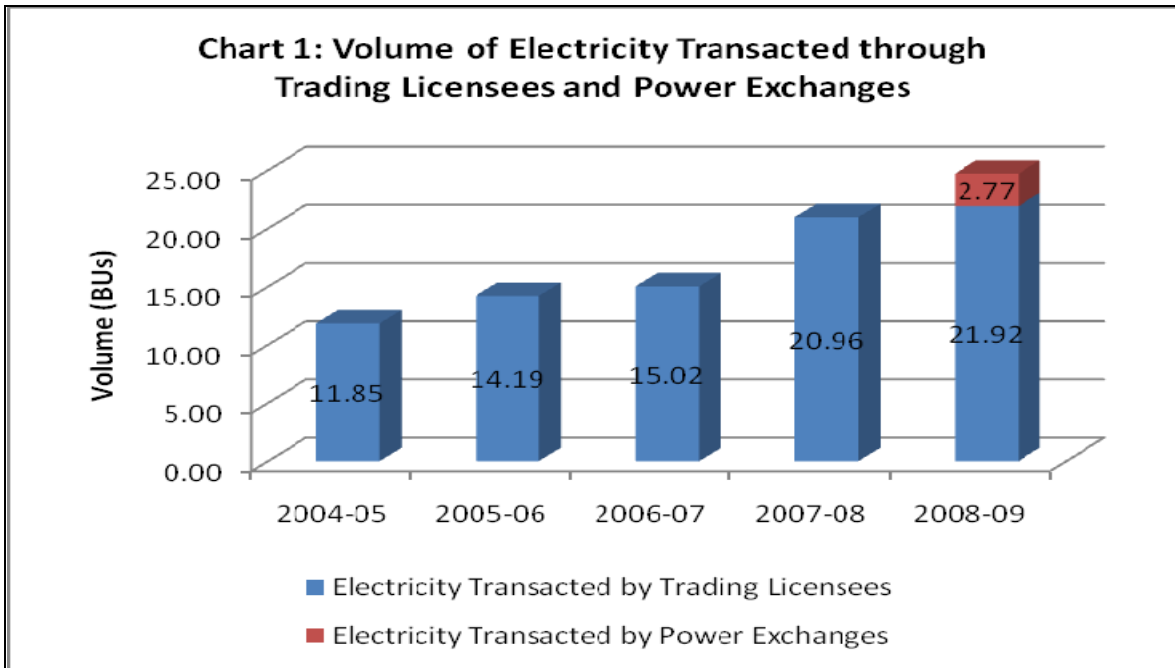
the data on volume and price of electricity transacted through trading licensees and power exchanges only. Inter-state trading licensees have been undertaking trading in electricity since the year 2004-05 and the power exchanges are in operation since the year 2008-09 (IEX and PXI are in operation since June 2008 and October 2008 respectively).

## II (A) Volume of short-term transactions of electricity

The volume of electricity transacted through inter-state trading licensees was almost doubled during the period i.e. from 12 BUs in 2004-05 to 22 BUs in 2008-09 (Table-1 & Chart-1). The volume of electricity transacted through power exchanges was 2.62 BUs in IEX and 0.15 BUs in PXI during 2008-09. The total volume of both licensees and power exchanges during 2008-09 was 24.69 BUs. However, the volume of electricity transacted through trading licensees and power exchanges in total electricity generation was increased to less than double i.e. from 2.16% to 3.57% during the period (Chart-2).

Year	Electricity Transacted through trading Licensees (BUs)	Electricity Transacted through IEX (BUs)	Electricity Transacted through PXI (BUs)	Total (BUs)	Total Electricity Generation (BUs)	Electricity Traded as % to Total Generation
	1	2	3	4 (1+2+3)	5	6 (4/5)
2004-05	11.85				548	2.16%
2005-06	14.19				579	2.45%
2006-07	15.02				624	2.41%
2007-08	20.96				666	3.15%
2008-09*	21.92	2.62	0.15	24.69	691	3.57%

\* The volume of electricity transacted through IEX was for the period from June 2008 to March 2009 and the volume of electricity transacted through PXI was for the period from October 2008 to March 2009.

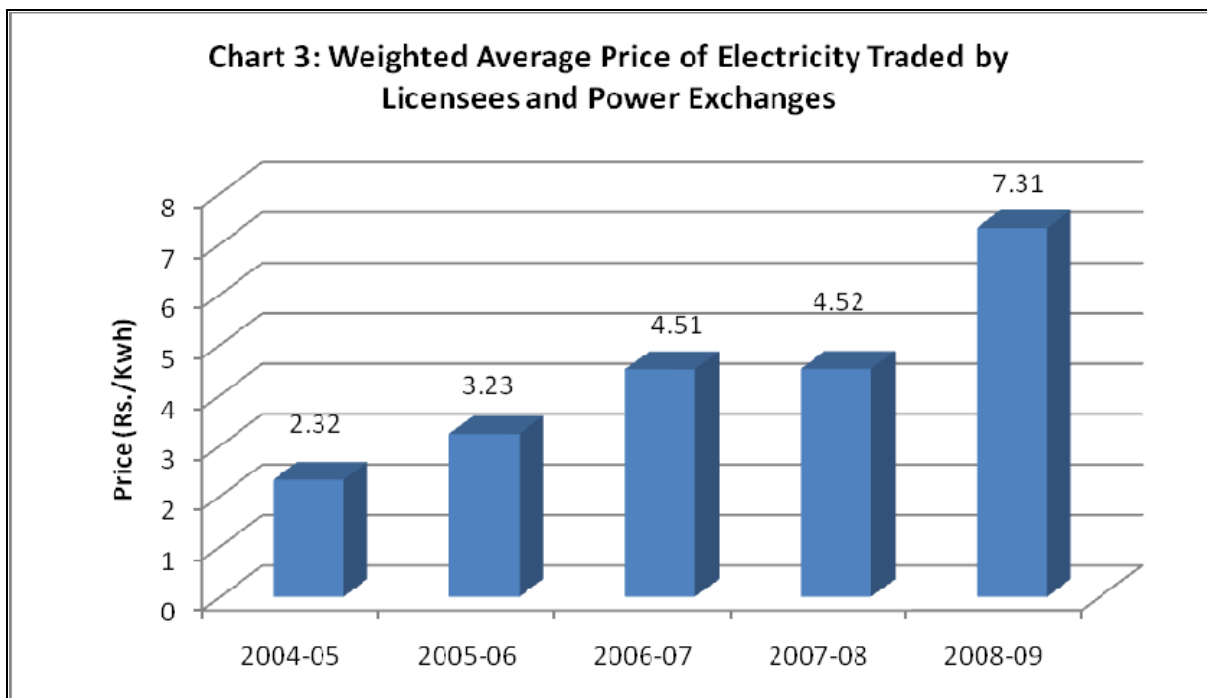


**II (B) Price of short-term transactions of electricity**

The price of electricity transacted through licensees and PXs is shown in Table-2 and Chart-3. The weighted average price of electricity transacted through trading licensees has

increased three times during the period i.e. from Rs.2.32/kwh in 2004-05 to Rs.7.29/kwh in 2008-09. The price of electricity transacted through IEX and PXI was Rs.7.48/kwh and Rs.7.60/kwh respectively in 2008-09. The weighted average price of electricity transacted through licensees and PXs was Rs.7.31/kwh.

Year	Price of Electricity transacted through Trading Licensees (Rs/kwh)	Price of Electricity transacted through IEX (Rs/kwh)	Price of Electricity transacted through PXI (Rs/kwh)	Weighted Average Price of Electricity Transacted through Licensees and PXs (Rs/kwh)
2004-05	2.32			
2005-06	3.23			
2006-07	4.51			
2007-08	4.52			
2008-09	7.29	7.48	7.60	7.31



*Note: The price in 2008-09 represents the Weighted Average Price of electricity transacted through trading licensees and power exchanges and the price in the rest of the years represents the price of electricity transacted through trading licensees only.*

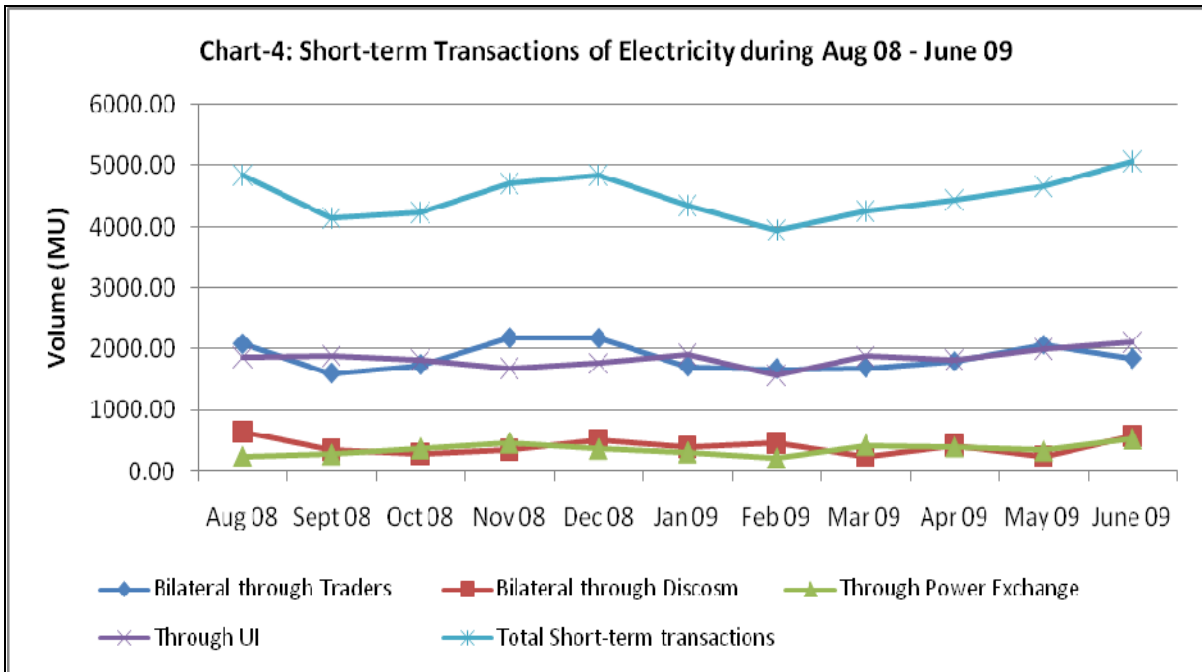
### III: Monthly trends in short-term transactions of electricity (Aug08 to June 09)

#### III (A) Volume of short-term transactions of electricity

The trends in volume of short-term transactions of electricity are shown in Table-3 and Chart-4. It is observed from the table that there is no constant increase/decrease in the volume of short-term transactions of electricity. This trend may be emerged due to demand and supply which vary from season to season. The volume of short-term transactions of electricity in total electricity generation was varying from 6.55% to 8.57% during the period.

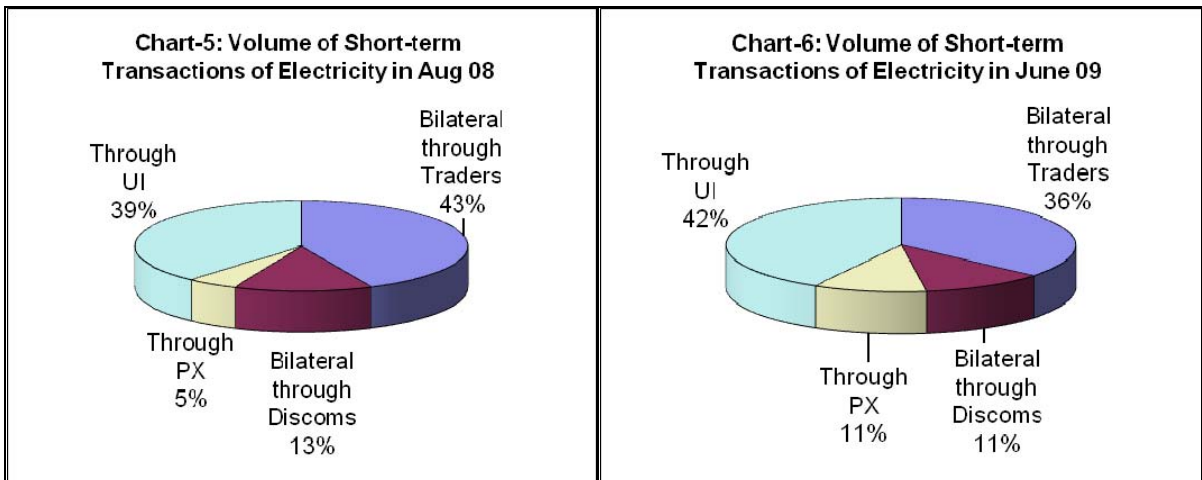
Table-3: VOLUME OF SHORT-TERM TRANSACTIONS OF ELECTRICITY (MUs)								
Period	Bilateral through Traders	Bilateral Direct	Total Bilateral transactions	Power Exchange transactions	UI transactions	Total Short-term transactions	Total Electricity Generation	Short-term transactions as % to total generation
	1	2	3 (1+2)	4	5	6 (3+4+5)	7	8
Aug 08	2085.21	646.24	2731.46	239.81	1860.48	4831.74	56379.77	8.57%
Sept 08	1604.40	366.04	1970.45	278.54	1889.68	4138.67	59019.14	7.01%
Oct 08	1742.20	286.53	2028.73	377.31	1826.14	4232.18	61966.84	6.83%
Nov 08	2182.46	364.78	2547.24	470.05	1686.01	4703.29	58308.33	8.07%
Dec 08	2176.53	522.52	2699.06	369.00	1765.08	4833.13	59635.41	8.10%
Jan 09	1715.29	406.08	2121.37	316.43	1911.39	4349.19	61193.77	7.11%
Feb 09	1677.94	471.00	2148.94	217.57	1569.11	3935.62	57121.74	6.89%
Mar 09	1696.50	245.18	1941.68	428.61	1878.26	4248.55	64841.89	6.55%
Apr 09	1794.80	415.54	2210.34	406.07	1815.66	4432.07	62486.24	7.09%
May 09	2070.01	247.29	2317.30	341.70	1997.38	4656.38	63465.58	7.34%
June09	1843.61	573.90	2417.51	529.49	2118.63	5065.63	62645.64	8.09%
<b>Trend Growth (%)</b>	<b>-0.25</b>	<b>-1.75</b>	<b>-0.43</b>	<b>3.97</b>	<b>0.87</b>	<b>0.40</b>	<b>0.92</b>	

It is also observed from the table that there is a positive trend in the volume of short-term transactions of electricity (0.40%) as well as in the total electricity generation (0.92%). With in the short-term transactions, there is a positive trend in the volume of electricity transacted through power exchanges (3.97%) and through UI (0.87%), whereas there is a negative trend in the volume of electricity transacted through bilateral (-0.43).



It is observed from the above Chart that there is a cyclical trend in the total volume of short-term transactions of electricity. This trend may be emerged due to demand and supply which vary from season to season. The volume of electricity transacted through traders was comparable with the volume of electricity transacted through UI and as well, the volume of electricity transacted through power exchanges was comparable with the volume of electricity transacted directly by the state utilities during the period.

In addition to the monthly trends explained above, a comparison is made explaining the percentage share of electricity transacted by trading licensees, directly by utilities, power exchanges and through UI (Chart-5 & 6).

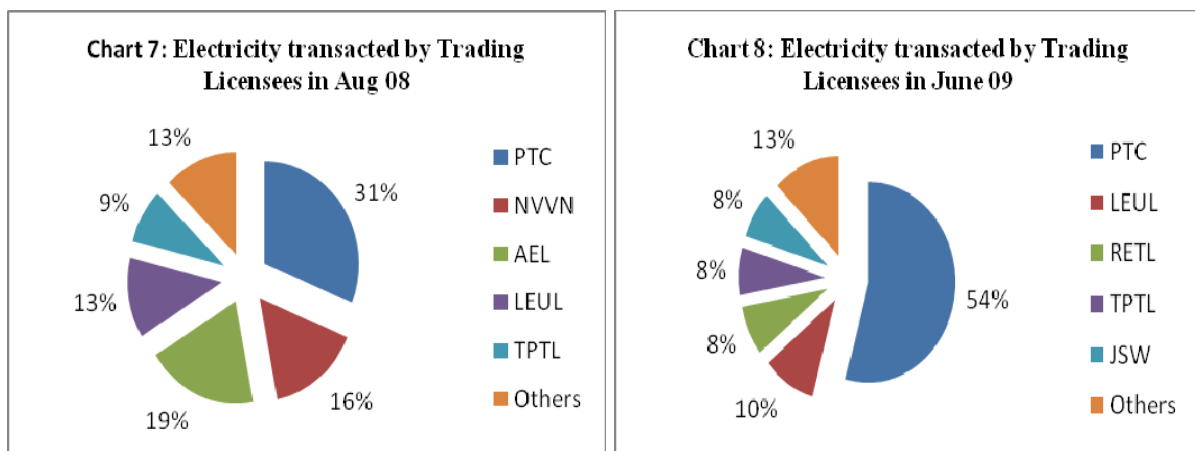


It is observed from the Charts that the share of bilateral transactions through traders was 43% in August 2008 whereas it was 36% in June 2009. The share of power exchange transactions was 5% in August 2008 whereas it was 11% in June 2009.

Of the bilateral, the volume of electricity transacted through trading licensees is analysed using the Herfindahl-Hirschman Index (HHI) for measuring the competition among the trading licensees (Table-4). Increases in the HHI generally indicate a decrease in competition and an increase of market power, whereas decreases indicate the opposite. A HHI between 0.10 to 0.18, indicates moderate concentration and A HHI above 0.18 indicates high concentration. The HHI computed for volume of electricity transacted by trading licensees in August 2008 was 0.19 whereas it was 0.33 in June 2009. However, the HHI computed for the period from August 2008 to June 2009 was 0.18 which shows moderate concentration/competition among the trading licensees.

<b>Table-4: Percentage Share of Electricity Traded by Trading Licensees during Aug 08 to June 09</b>			
<b>Sr. No</b>	<b>Name of the Trading Licensee</b>	<b>Share of Electricity traded by Licensees</b>	<b>Herfindahl-Herschman Index (HHI)</b>
1	PTC India Ltd	33.122%	0.1097
2	NTPC Vidyut Vyapar Nigam Ltd	16.126%	0.0260
3	Lanco Electric Utility Ltd	11.498%	0.0132
4	Tata Power Trading Company (P) Ltd	10.477%	0.0110
5	Reliance Energy Trading (P) Ltd	8.578%	0.0074
6	Adani Enterprises Ltd	7.798%	0.0061
7	JSW Power Trading Company Ltd	7.453%	0.0056
8	GMR Energy Trading Ltd	3.274%	0.0011
9	Kalyani Power Development (P) Ltd	0.915%	0.0001
10	Instinct Advertisement & Marketing Ltd	0.371%	0.0000
11	RPG Power Trading Company Ltd	0.213%	0.0000
12	Vinergy International Private Ltd	0.140%	0.0000
13	Knowledge Infrastructure & Systems Ltd	0.019%	0.0000
14	Karam Chand Thapar & Brothers Ltd	0.009%	0.0000
15	Mittal Processes Private Ltd	0.007%	0.0000
	<b>Total</b>	<b>100.00%</b>	<b>0.1801</b>
<i>Note: Percentage Share in total volume traded by licensees computed based on the volume which includes the volume traded by trading licensees through power exchanges also.</i>			
Source: Information submitted by trading licensees			

The percentage share of each trading licensee in total volume of electricity transacted by all the licensees is shown in Chart-7 & 8.



It is observed from the above charts that the share of PTC India Ltd was 31% and 54% respectively in August 2008 and June 2009.

### III (B) Price of short-term transactions of electricity

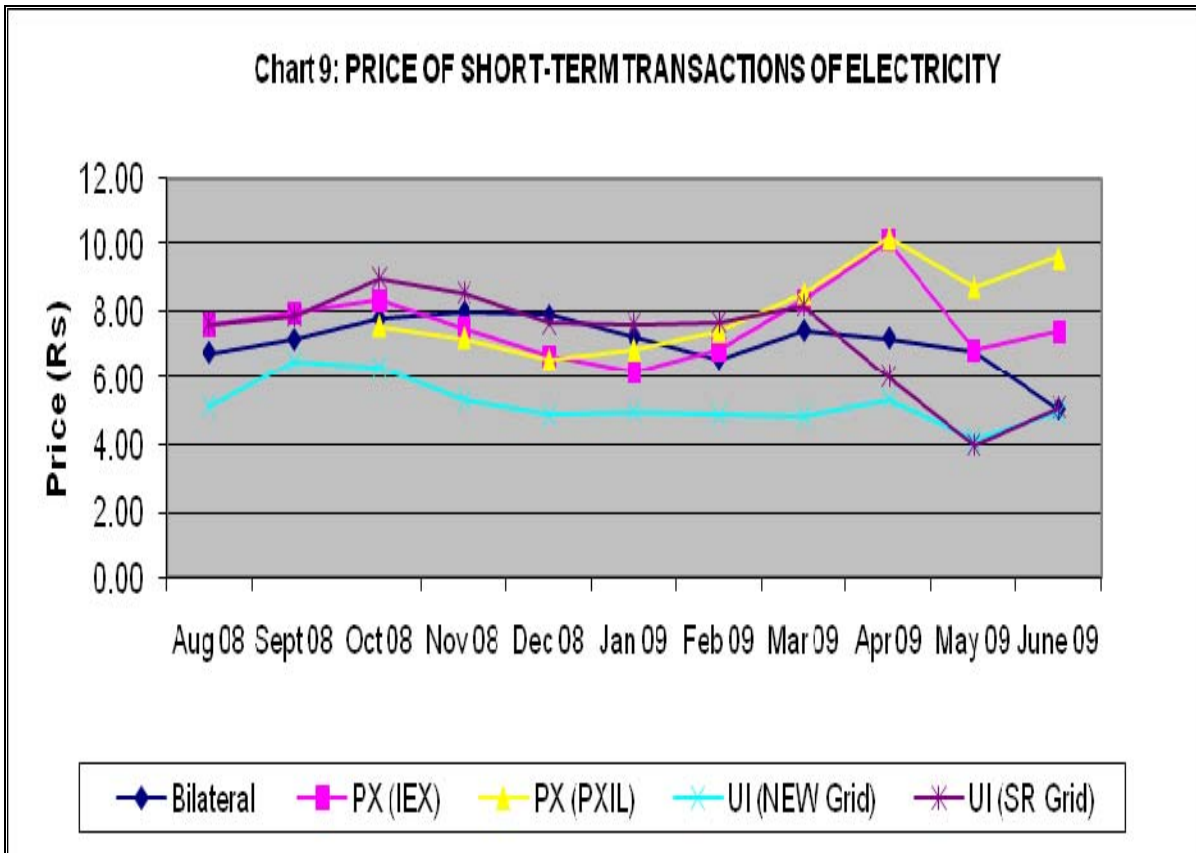
The trends in price of short-term transactions of electricity are shown in Table-5 and Chart 9 & 10. The price analysis is mainly based on the average price of UI and the weighted average price of other short-term transactions of electricity. The price of bilateral transactions represents the price of electricity transacted through trading licensees. The trends in price of electricity transacted through trading licensees are studied separately for total transactions as well as the transactions undertaken during RTC, Peak and Off-peak periods.

Period	Bilateral through Traders				Power Exchange		UI	
	RTC	Peak	Off-peak	Total	IEX	PXIL	NEW Grid	SR Grid
Aug 08	6.51	7.43	7.29	6.78	7.61		5.17	7.64
Sept 08	7.27	6.60	6.90	7.17	7.95		6.50	7.87
Oct 08	6.99	8.90	8.51	7.78	8.32	7.57	6.32	8.97
Nov 08	7.56	8.82	8.35	7.98	7.47	7.22	5.33	8.55
Dec 08	7.77	8.37	8.04	7.89	6.64	6.58	4.89	7.66
Jan 09	7.43	8.55	6.78	7.23	6.16	6.86	4.99	7.61
Feb 09	6.89	8.16	6.19	6.58	6.85	7.42	4.89	7.68
Mar 09	7.35	8.08	7.53	7.43	8.33	8.54	4.85	8.20
Apr 09	6.83	9.05	8.47	7.21	10.10	10.18	5.36	6.04



May 09	6.60	8.18	8.03	6.82	6.84	8.74	4.17	3.99
June 09	5.04	6.44	5.07	5.05	7.39	9.60	4.94	5.10
<b>Trend</b>								
<b>Growth (%)</b>	<b>-1.72</b>	<b>-0.01</b>	<b>-1.53</b>	<b>-2.00</b>	<b>0.08</b>	<b>4.46</b>	<b>-2.41</b>	<b>-5.31</b>

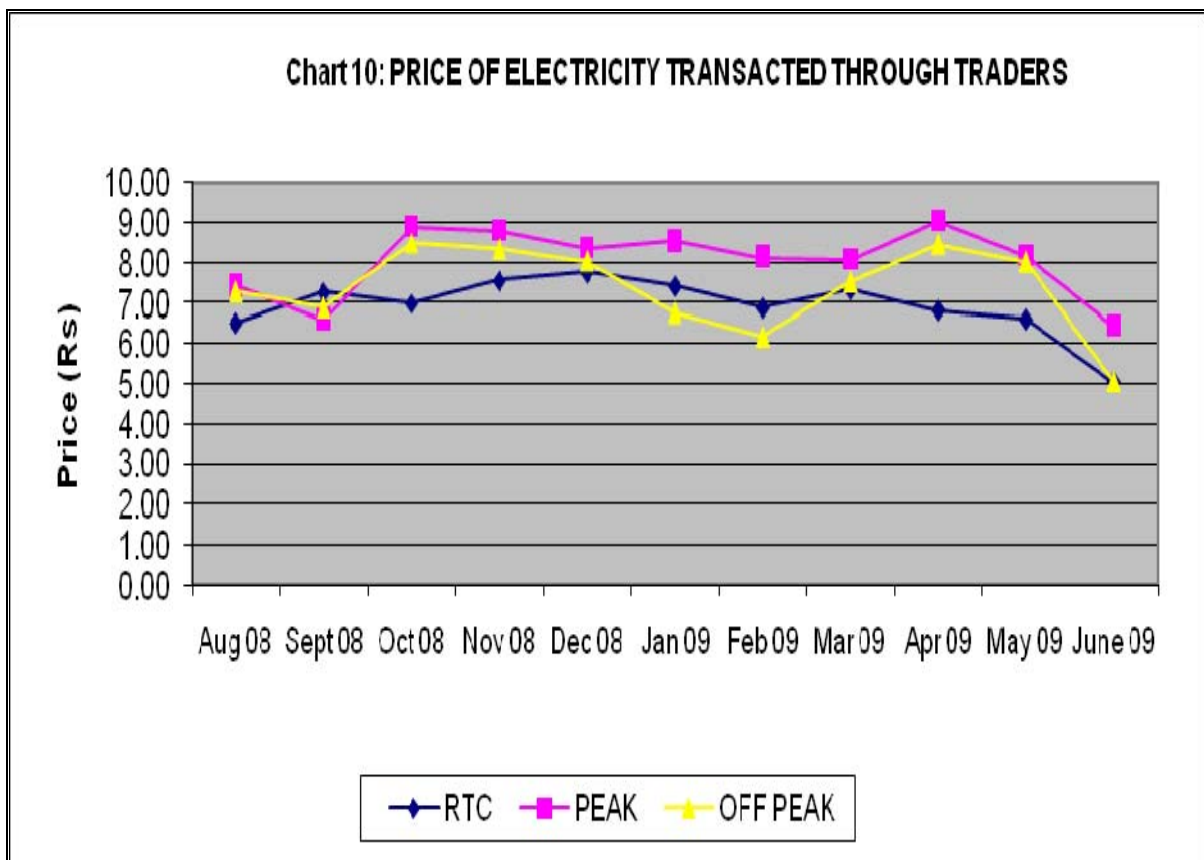
It is observed from the above Table that there is no constant increase/decrease in the price of short-term transactions of electricity during the period. There is a positive trend in the price of electricity transacted by power exchanges whereas there is a negative trend in the price of electricity transacted by trading licensees and UI.



It is observed from Chart-9 that the price of electricity transacted through power exchanges are relatively high when compared with the price of electricity transacted through trading licensees and UI from March 2009 onwards. The price of UI transactions in the NEW Grid was always lower when compared with the price of UI in the SR Grid. This trend may

be for the reason that the power deficit is more in the Southern Region when compared with other regions.

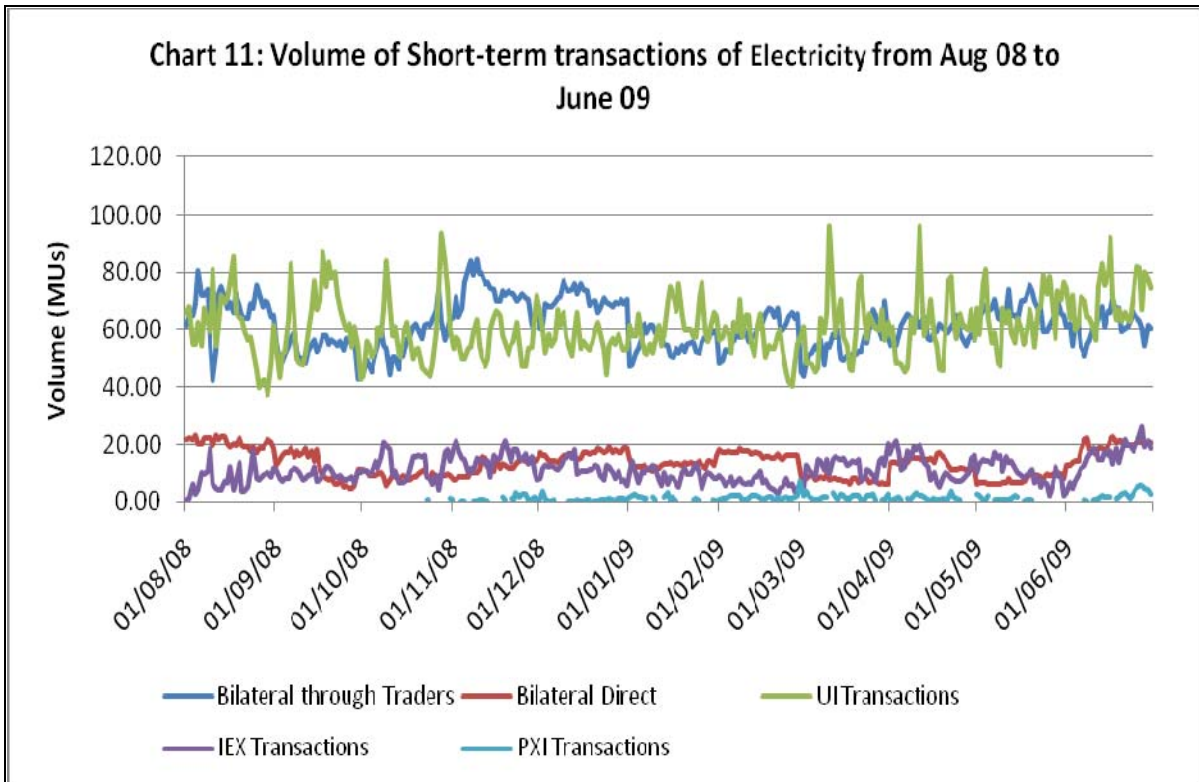
The trends in price of electricity transacted by trading licensees during RTC, Peak and Off-peak periods are shown in Chart-10. The price of electricity transacted during peak was high when compared with the price of electricity transacted during RTC and Off-peak periods. The price of electricity transacted during RTC, Peak and Off-peak are comparable every 3 months i.e. during September 08, December 08, March 09 and June 09.



#### **IV: Daily trends in short-term transactions of electricity (Aug08 to June 09)**

##### **IV (A) Volume of Short-term transactions of Electricity**

Trends in daily volume of short-term transactions are shown in Chart 11.

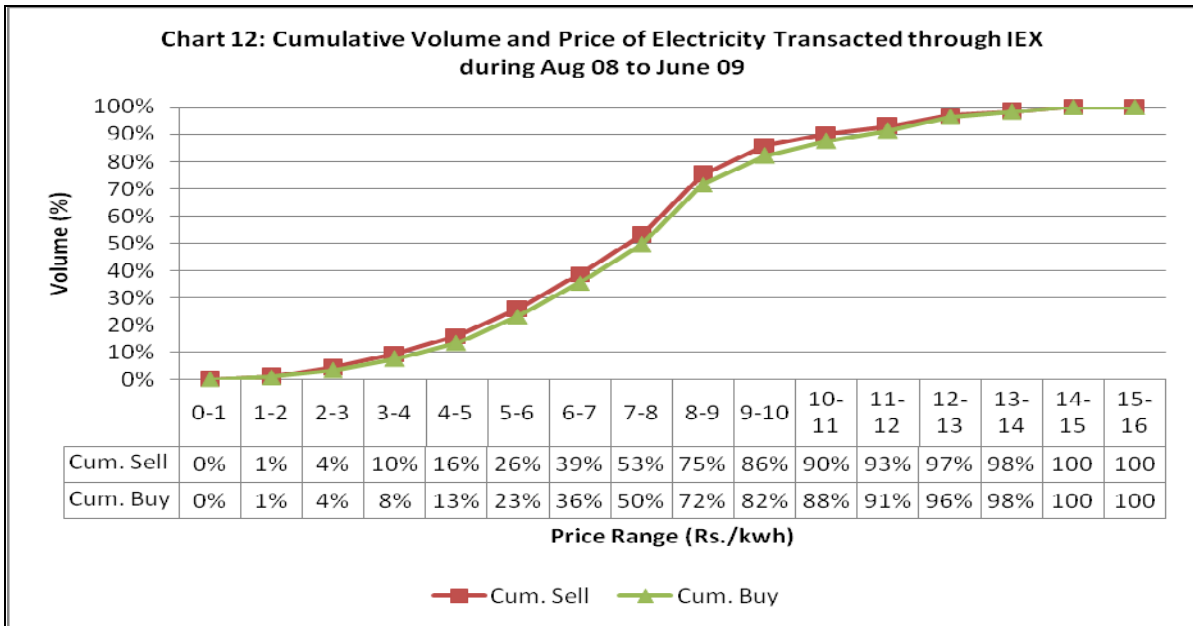


#### **IV (B) Price of Short-term transactions of Electricity**

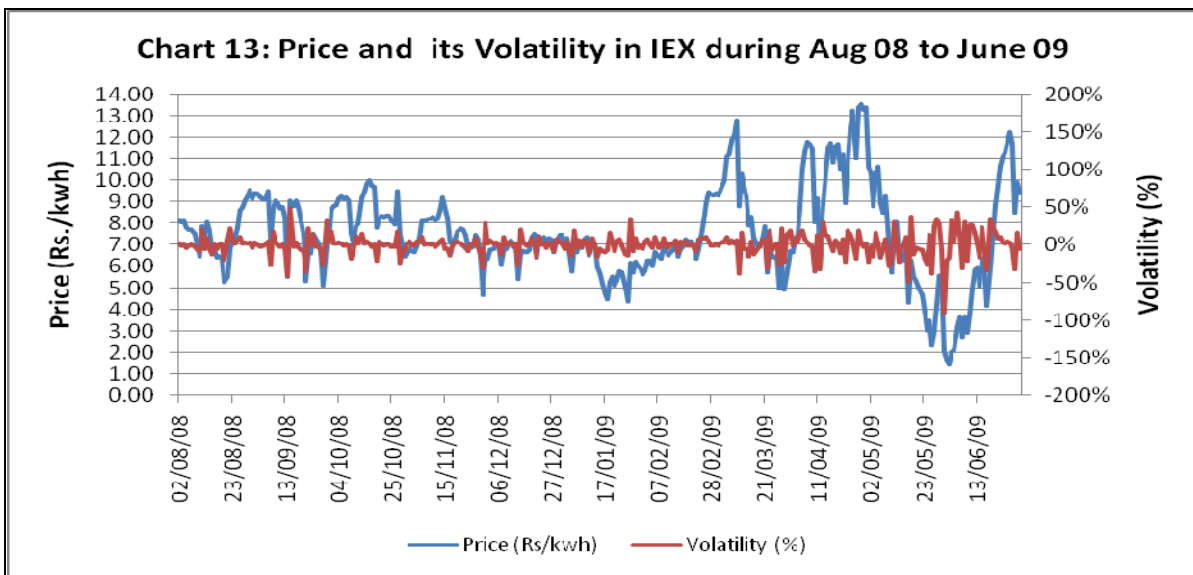
Trends in daily price of short-term transactions are shown for transactions of power exchanges and UI.

##### **IV (B) (i) Trends in price of electricity transacted through Power Exchanges**

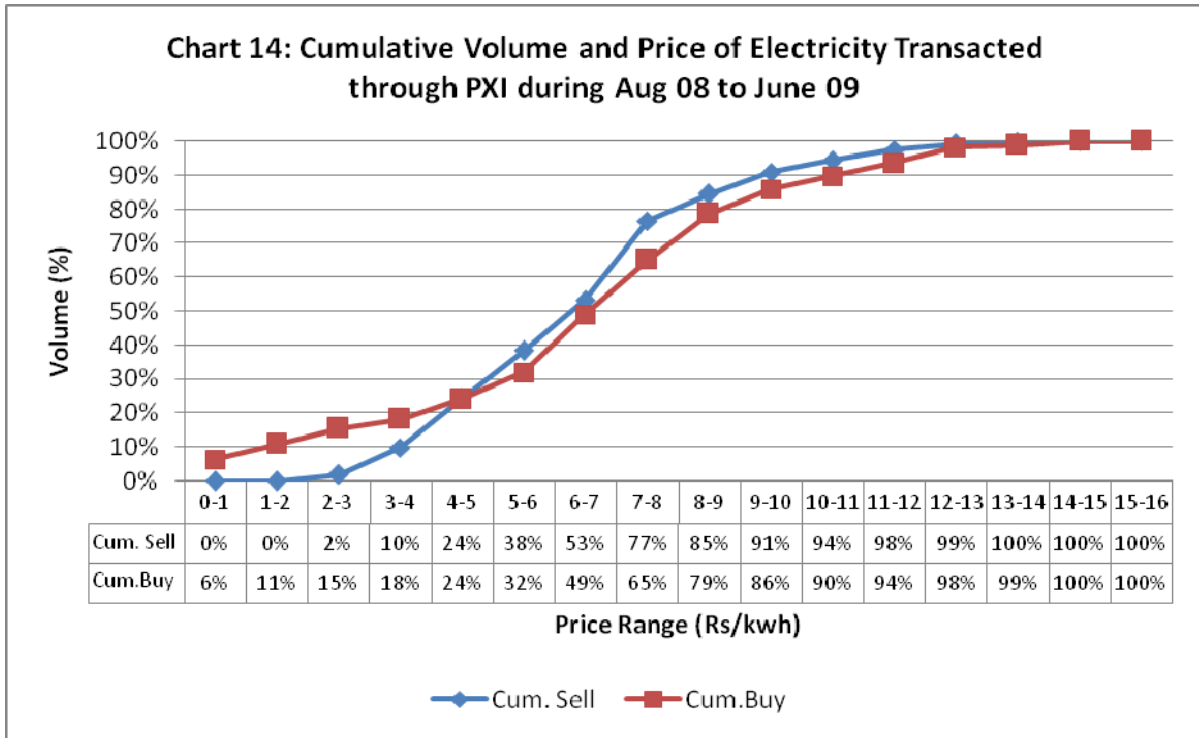
Cumulative volume and price of electricity transacted through IEX are shown in Chart 12. It is observed from the chart that 86% of the volume of electricity sale through IEX was less than Rs.10/kwh.



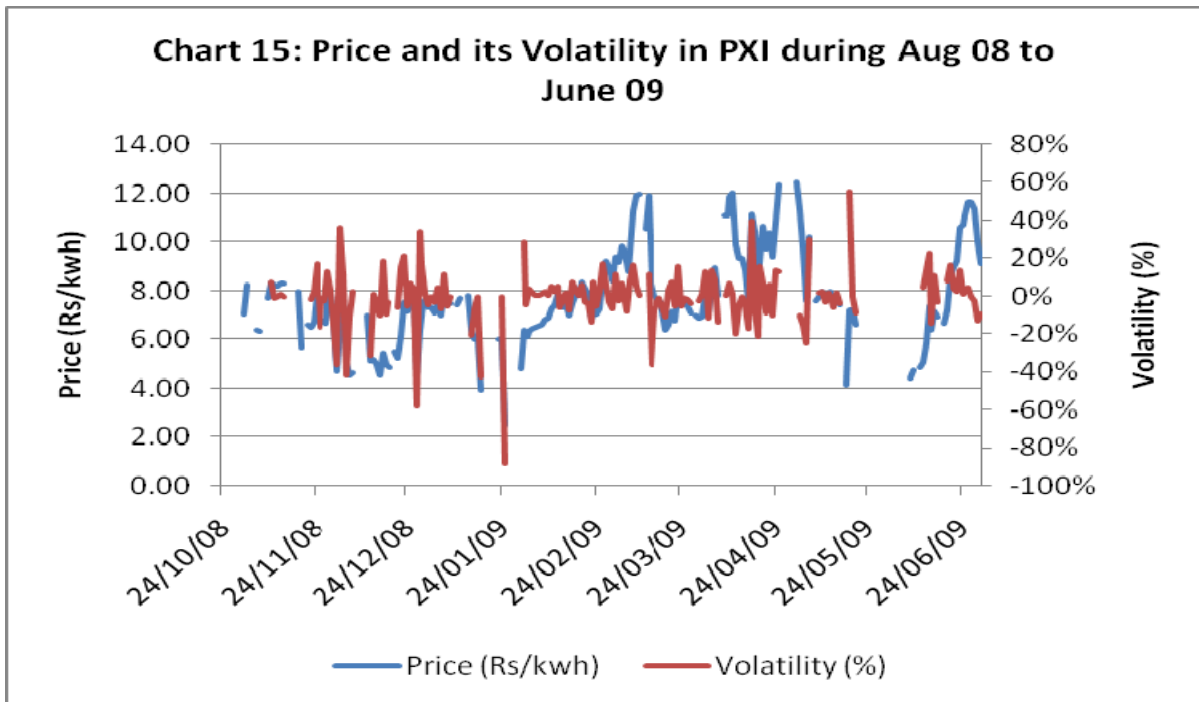
The weighted average price of electricity transacted through IEX and its volatility is shown in Chart 13. It is observed from the chart that there was high volatility during May and June 2009 and it was above 20% (See Annexure-I for historic volatility formula).



Cumulative volume and price of electricity transacted through PXI are shown in Chart 14. It is observed from the chart that 91% of the volume of electricity sale through PXI was less than Rs.10/kwh.

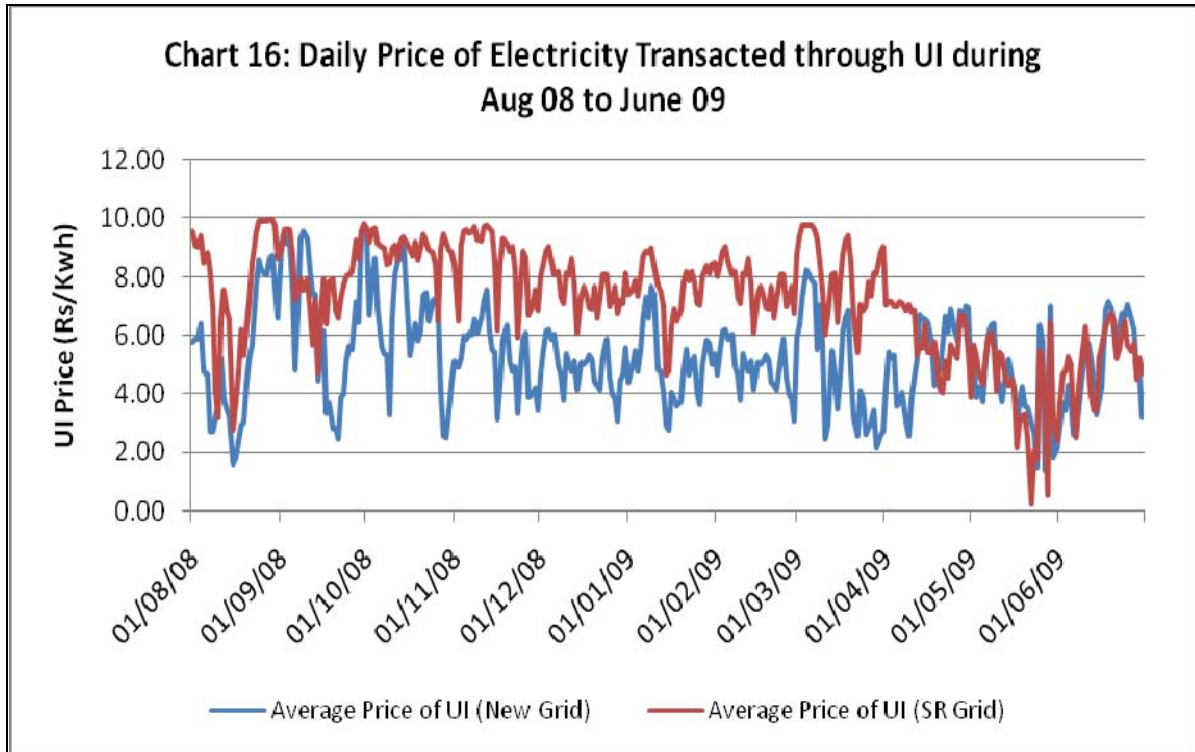


The weighted average price of electricity transacted through PXI and its volatility is shown in Chart 15.



#### IV (B) (ii) 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 Chart16.



It is observed from the above chart that the price of UI in the SR Grid was high when compared with the price of UI in the NEW Grid except during May and June 2009. The price of UI in both the Grids was comparable during these two months.

#### V: Inferences

##### Yearly Trends (2004-05 to 2008-09)

1. The volume of electricity transacted through trading licensees almost doubled from 12 BUs in 2004-05 to 22 BUs in 2008-09. However, the volume of electricity transacted through trading licensees and power exchanges (2.77 BUs in 2008-09) together in total electricity generation increased from 2.16% to 3.57% during the period.

2. The weighted average price of electricity transacted through trading licensees was increased three times i.e. from Rs.2.32/kwh in 2004-05 to Rs.4.52/kwh in 2007-08 and then to Rs.7.29/kwh in 2008-09. The sharp increase in the price of traded power in 2008-09 may be due to price discovery in the power exchanges and price increase in UI apart from other reasons.

Monthly Trends (Aug 08 to June 09)

3. There is a positive growth in the volume of short-term transactions of electricity (0.40%) as well as in the total electricity generation (0.92%) during Aug 08 to June 09.
4. The volume of short-term transactions of electricity in total electricity generation was varying between 6.55% and 8.57%.
5. There is a positive growth in the volume of electricity transacted through Power Exchanges (3.97%) and UI (0.87%) whereas there is a negative growth in the volume of electricity transacted through bilateral (-0.43%).
6. The HHI computed based on the volume of electricity transacted by trading licensees was 0.18 which shows the level of competition among the licensees was moderate.
7. There is a positive trend in the price of electricity transacted through power exchanges whereas there is a negative trend in the price of electricity transacted through trading licensees and UI.
8. The price of electricity transacted during peak was high when compared with the price of electricity transacted during RTC and off-peak during the period.
9. The price of electricity transacted during RTC, Peak and Off-peak are comparable every 3 months i.e. during September 08, December 08, March 09 and June 09.

Daily Trends (Aug 08 to June 09)

10. Around 90% of the volume of electricity transacted through IEX and PXI was less than Rs.10/kwh.
  
11. There is a high volatility in price of electricity transacted through IEX in May and June 2009 and it was above 20% when compared the volatility in other months. The high volatility in the price of electricity may be due to demand and supply of electricity before and after the parliament elections and the effect of monsoon.
  
12. The price of UI in the SR Grid was high when compared with the price of UI in the NEW Grid except during May and June 2009. The trend of high price of UI in the SR Grid may be due to more power deficit in the Southern Region when compared with other regions.

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### Historic Volatility Calculation

Volatility = Standard deviation of daily prices returns.

#### Historical Volatility Formula:

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

where

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

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