

Report on Short-term Power Market in India:2010-11

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Contents

| S.No | Contents | Page No |
|----------|--|-----------|
| | Cover page | 1 |
| | Contents | 2 |
| | List of Tables | 3 |
| | List of Charts | 4 |
| | Abbreviations | 5 |
| | Executive Summary | 7 |
| 1 | Yearly trends in short-term transactions of electricity (2008-09 to 2010-11) | 10 |
| 1.1 | Total Short-term Transactions of Electricity with respect to Total Electricity Generation | 11 |
| 1.2 | Electricity Transacted through Trading Licensees and Power Exchanges | 11 |
| 1.3 | Electricity Transacted through UI | 15 |
| 1.4 | Electricity Transacted Directly Between DISCOMs | 16 |
| 2 | Monthly trends in short-term transactions of electricity (April 2010-March 2011) | 17 |
| 2.1 | Volume of short-term transactions of electricity | 18 |
| 2.2 | Price of short-term transactions of electricity | 21 |
| 2.3 | Time of the day variation in Volume and Price of Electricity transacted through Power Exchanges (Day Ahead Market Sub-Segment) and Traders | 23 |
| 2.4 | Volume of Electricity Transacted in Various Price Slabs | 25 |
| 2.5 | Trading Margin Charged by Trading Licensees for Bilateral Transactions during 2010-11 | 27 |
| 3 | Daily trends in short-term transactions of electricity (1st April 10 to 31st March 11) | 27 |
| 3.1 | Volume of Short-term transactions of Electricity | 27 |
| 3.2 | Price of Short-term transactions of Electricity | 28 |
| 3.2.1 | Trends in price of electricity transacted through Power Exchanges | 28 |
| 3.2.2 | Trends in price of electricity transacted through UI | 29 |
| 4 | Analysis of open access consumers on power exchanges (Day Ahead Market Sub-Segment) | 30 |
| 5 | Major Sellers and Buyers of Electricity through Licensed Traders and Power Exchanges | 34 |
| 6 | Effect of congestion on Volume of Electricity Transacted through Power Exchanges | 38 |
| 7 | Comparison of short term prices with Tariffs of long term sources of power for various distribution companies | 39 |
| 8 | Annexure-I: List of Trading Licensees as on 31.03.2011 | 45 |
| 9 | Annexure-II: Historic Volatility Calculation | 46 |
| 10 | Annexure-III: Herfindahl-Hirschman Index (HHI) Calculation | 47 |

List of Tables

| | |
|----------|--|
| Table-1 | Total Volume of Short-term Transactions of Electricity with respect to Total Electricity Generation |
| Table-2 | Volume of Electricity Transacted through Trading Licensees and Power Exchanges |
| Table-3 | Electricity Transacted through Trading Licensees and Power Exchanges as percentage of Total Volume of Short-term |
| Table-4 | Price of Electricity Transacted through Traders & Power Exchanges |
| Table-5 | Size of the OTC and Power Exchange Market in Monetary Term |
| Table-6 | Volume and Price of Electricity transacted through UI |
| Table-7 | Volume of Electricity Transacted Directly between DISCOMs |
| Table-8 | Volume of Short-Term Transactions of Electricity (MUs) |
| Table-9 | Volume of Short-term transactions of electricity as % of total electricity generation |
| Table-10 | Percentage Share of Electricity Traded by Trading Licensees and HHI in 2010-11 |
| Table-11 | Price of Short-term Transactions of Electricity (₹/kWh) |
| Table-12 | Average Trading Margin Charged by Trading Licensees during 2010-11 |
| Table-13 | Number of Open Access Consumers in IEX, 2010-11 |
| Table-14 | Volume Participation of Open Access Consumers in IEX Day Ahead Market in 2010-11 |
| Table-15 | Number of Open Access Consumers in PXIL, 2010-11 |
| Table-16 | Volume Participation of Open Access Consumers in Day Ahead Market of PXIL in 2010-11 |
| Table-17 | Major Sellers of Electricity through Bilateral Trader Segment (Trading Licensees) in 2010-11 |
| Table-18 | Major Buyers of Electricity through Bilateral Trader Segment (Trading Licensees) in 2010-11 |
| Table-19 | Major Sellers of Electricity in the Day Ahead Market in IEX, 2010-11 |
| Table-20 | Major Buyers of Electricity in the Day Ahead Market in IEX, 2010-11 |
| Table-21 | Major Sellers of Electricity in the Day Ahead Market in PXIL, 2010-11 |
| Table-22 | Major Buyers of Electricity in the Day Ahead Market in PXIL, 2010-11 |
| Table-23 | Details of Congestion in Power Exchanges, 2010-11 |
| Table-24 | Price of Short-Term Transactions of Electricity in 2010-11 |
| Table-25 | Tariff of Thermal Generating Stations of NTPC, NLC and NEEPCO, 2010-11 |
| Table-26 | Composite Tariff of Hydro Stations under the Purview of CERC, 2009-10 |
| Table-27 | Capacity Contracted under Case-I Bidding Route during the year 2010 |

List of Charts

- Chart-1 Total Volume of Electricity Transacted through Traders and Power Exchanges
- Chart-2 Electricity Transacted through Traders and Power exchanges as Percentage of Total Volume of Short-term
- Chart-3 Price of Electricity Transacted through Traders & Power Exchanges
- Chart-4 Volume and Price of Electricity transacted through UI
- Chart-5 Volume of Electricity Transacted Directly between DISCOMs
- Chart-6 Share of Different Segments in Total Electricity Generation in 2010-11
- Chart-7 Share of Different Segments in Short Term Transactions in 2010-11
- Chart-8 Volume of Short-term Transactions of Electricity, 2010-11
- Chart-9 Percentage Share of Electricity Traded by Trading Licensees in 2010-11
- Chart-10 Comparison of price of Bilateral, Power Exchange and UI transactions in 2010-11
- Chart-11 Price of Electricity Transacted through Traders during Round the Clock, Peak and Off Peak periods
- Chart-12 Volume (excluding banking) and Price of Electricity Transacted through Traders during RTC, Peak and Other Than RTC & Peak, 2010-11
- Chart-13 Hour-wise Area Clearing Volume and Price in IEX during 2010-11
- Chart-14 Hour-wise Area Clearing Volume and Price in PXIL in 2010-11
- Chart-15 Percentage of Bilateral Transaction Volume and Price Slabs, 2010-1
- Chart-16 Percentage of IEX Transaction Volume and Price Slabs
- Chart-17 Percentage of PXI Transaction Volume and Price Slabs
- Chart-18 Volume of Short-term Transactions of Electricity, 2010-11
- Chart-19 Price and its Volatility in IEX during 2010-11
- Chart-20 Price and its Volatility in PXIL during 2010-11
- Chart-21 Daily Price of Electricity Transacted through UI during 2010-11
- Chart-22 Participation of Open Access Consumers in IEX, 2010-11
- Chart-23 Open Access Consumer Purchase Volume and IEX Total Volume, 2010-11
- Chart-24 Open Access Consumer Participation in PXIL, 2010-11
- Chart-25 Open Access Consumer Purchase Volume and PXIL Total Volume, 2010-11

Abbreviations

| Abbreviation | Expanded Version |
|---------------------|--|
| AGBPP | Assam Gas Based Power Project |
| APCPDCL | Central Power Distribution Company of Andhra Pradesh Limited |
| APPCC | Andhra Pradesh Power Coordination Committee |
| APTRANCO | Transmission Corporation of Andhra Pradesh Limited |
| BALCO | Bharat Aluminium Company Limited |
| BESCOM | Bangalore Electricity Supply Company Limited |
| BRPL | BSES Rajdhani Power Limited |
| BUs | Billion units (billion kWh) |
| BYPL | BSES Yamuna Power Limited |
| CCGT | Combined Cycle Gas Turbine |
| CGSEB | Chhattisgarh State Electricity Board |
| CSPTCL | Chhattisgarh State Power Trading Company Limited |
| DAM | Day Ahead Market |
| DISCOMS | Distribution Companies |
| FGUTPP | Firoz Gandhi Unchahar Thermal Power Project |
| GEL | GMR Energy Limited |
| GMR | GMR Energy Trading Limited |
| GPS | Gas Power Station |
| GUVNL | Gujarat Urja Vikas Nigam Limited |
| HHI | Herfindahl-Hirschman Index |
| HPPC | Haryana Power Procurement Centre |
| HPSEB | Himachal Pradesh State Electricity Board |
| IEX | Indian Energy Exchange Limited |
| JPL | Jindal Power Limited |
| JSL/JSL_Ltd | Jindal Stainless Limited |
| JSW | JSW Power Trading Company Limited |
| JSWEL | JSW Energy Limited |
| JVVNL | Jaipur Vidyut Vitaran Nigam Limited |
| KISPL | Knowledge Infrastructure & Systems Private Limited |
| KSEB | Kerala State Electricity Board |
| kWh | Kilo Watt Hour |
| LAPL | LANCO Amarkantak Power Limited |
| LKPPL | LANCO Kondapalli Power Private Limited |
| LNG | Liquified Natural Gas |
| Ltd | Limited |
| MPPTCL | Madhya Pradesh Power Trading Company Limited |
| MSEDCL | Maharashtra State Electricity Distribution Company Limited |

| Abbreviation | Expanded Version |
|---------------------|--|
| MUs | Million Units |
| MW | Mega Watts |
| NBVL | Nav Bharat Ventures Limited |
| NDPL | North Delhi Power Limited |
| NEEPCO | North Eastern Electric Power Corporation Limited. |
| NEW Grid | Northern, Eastern, Western and North-Eastern Region Grid |
| NHDC | NHDC Limited |
| NHPC | National Hydro-Electric Power Corporation Limited |
| NLC | Neyveli Lignite Corporation Limited |
| NTPC | National Thermal Power Corporation Limited |
| NVVN | NTPC Vidyut Vyapar Nigam Limited |
| OA | Open Access |
| OAC | Open Access Consumer |
| PCKL | Power Corporation of Karnataka Limited |
| PSEB | Punjab State Electricity Board |
| PSPCL | Punjab State Power Corporation Limited |
| PTC | PTC India Limited |
| PX/PXs/Pxes | Power Exchange/Power Exchanges |
| PXIL | Power Exchange India Limited |
| R Infra | Reliance Infrastructure Limited |
| RLNG | Re-gasified Liquefied Natural Gas |
| RPPC | Rajasthan Power Procurement Centre |
| RTC | Round The Clock |
| SJVNL | Sutlej Jal Vidyut Nigam Limited |
| SPDC-J&K | State Power Development Corporation of Jammu and Kashmir |
| SR Grid | Southern Region Grid |
| ST | Stage |
| STPS | Super Thermal Power Station |
| TAM | Term Ahead Market |
| THDC | Tehri Hydro Development Corporation Limited |
| TNEB | Tamil Nadu Electricity Board |
| TPC-(D) | Tata Power Company Limited - Distribution Business |
| TPS | Thermal Power Station |
| TPTL | Tata Power Trading Company Limited |
| UI | Unscheduled Interchange |
| UMPP | Ultra Mega Power Project |
| UPPCL | Uttar Pradesh Power Corporation Limited |
| WBSEDCL | West Bengal State Electricity Distribution Company Limited |

Executive Summary

An analysis on short-term transactions of electricity in India has been made in this report on short-term power market¹ for the year 2010-11. Here, “short-term transactions of electricity” refers to contracts of less than one year period, for electricity transacted under bilateral transactions through Inter-State Trading Licensees (only inter-state part) and directly by the Distribution Licensees, Power Exchanges (Indian Energy Exchange Ltd (IEX) and Power Exchange India Ltd (PXIL)), and Unscheduled Interchange (UI). The analysis includes (i) Years/Monthly/Daily trends in short-term transactions of electricity; (ii) Analysis of open access consumers on power exchanges; (iii) Major Sellers and Buyers of Electricity through Licensed Traders and Power Exchanges; (iv) Effect of congestion on Volume of Electricity transacted through Power Exchanges; and (v) Comparison of short-term prices with 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.

- Of the total electricity procured in India in 2010-11, the short-term power market comprises only 10 per cent. The balance 90 percent of generation is being procured mainly by distribution companies through long-term contracts and short term intra-state transactions.
- In volume (kWh) terms, the size of the short term market in India was about 81.56 billion kWh (units) in the year 2010-11. As compared to the volume of electricity transacted through short term market in the year 2009-10 (65.90 billion units), this was about 24 percent higher. Majority of this growth in volume of 15.66 billion units (81.56-65.90 =15.66) was accounted for by growth in transactions through the power exchanges (53.3%), followed by growth in direct bilateral transactions between the DISCOMs (about 26%). Transactions through traders accounted for only about 6.3% of the overall growth of about 15.66 billion units and were lower than the contribution of UI to the overall growth (UI contribution in overall growth of 15.66 billion units was about 14.4%). A *caveat*, however, needs to be added here that the transactions through traders considered here are the interstate transactions.
- Excluding UI and direct bilateral sale between the DISCOMs, the volume of electricity transacted was about 43.22 billion units in the year 2010-11. This was about 27.5 percent higher than the year 2009-10. Volume of electricity transacted through power exchanges witnessed a sharp increase of about 116.2% over 2009-10 volumes. On the other hand, the increase in the volume of electricity traded under bilateral transactions through traders was very moderate at 3.7%. In monetary terms, the size of this segment of the short term

¹ 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 2010-11, the volume of UI was about 28.08 billion kWh and that of between distribution companies was about 10.25 billion kWh.

market was about ₹18657 crore in the year 2010-11², which was 5.9% more than in the year 2009-10. About ₹5389 crore of which was the value of electricity transacted through power exchanges (51.3% more than ₹3563 crore done in 2009-10), and the balance of about ₹13271 crore was the value of inter-state transaction of electricity through trading licensees (about 5.6% less than ₹14055 crore done in 2009-10).

- Although in absolute terms, the volume of UI in the year 2010-11 increased by 8.8% over 2009-10 figure, the share of UI as a percentage of total volume of short term transaction of electricity continued the downward trend of past years and UI volume as percentage of total volume of short term transaction of electricity was about 34% in the year 2010-11 (down from 41% and 39% respectively in the years 2008-09 and 2009-10).
- The volume of direct bilateral transactions between DISCOMs witnessed a steep rise of about 65.7% during 2010-11 as compared to 2009-10 volume level. In percentage terms, the share of direct bilateral transactions between DISCOMs as a percentage of total short term transaction volume increased to about 12.4% in the year 2010-11 (as compared to about 9.6% in the year 2009-10).
- The weighted average price of electricity transacted through power exchanges was ₹3.47 per kWh and through trading licensees was ₹4.79 per kWh in the year 2010-11. The corresponding values for the year 2009-10 were ₹4.96 per kWh and ₹5.26 per kWh, respectively. In the year 2010-11, the weighted average price of electricity transacted through Day Ahead Market sub-segment of the power exchanges was ₹3.44/kWh and that through Term Ahead Market sub-segment was ₹3.70/kWh.
- The weighted average price of weekly contracts under the Term Ahead Market sub-segment was ₹3.56/kWh; which was lower than the weighted average price of ₹4.79/kWh for electricity transacted through bilateral contracts through traders.
- During the year 2010-11, 90% of the volume of electricity in the two power exchanges has been transacted at the price less than ₹6/kWh. 73% of the volume in IEX and 67% volume in PXIL transacted at the price less than ₹4/kWh.
- During the year 2010-11, about 80% of the volume of electricity transacted under bilateral transactions through traders has been transacted at the price of less than ₹6/kWh. Almost 58% of the volume has been transacted at prices between ₹4 and ₹5 per kWh.
- During the year 2010-11, only about 495 million units of electricity was exclusively bought during peak hours under bilateral transactions from traders (exclusive of banking). This was about 2.4% of the total electricity bought under bilateral transaction from traders (excluding banking). Majority, about 78.6% , was bought on round the clock (RTC) basis, followed by 19% being 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.*

(₹4.69/kWh), followed by electricity exclusively procured during non-peak hours (₹4.74/kWh) and electricity exclusively procured during peak hours (₹5.59/kWh).

- The beginning of the process of procurement of power by the industrial sector consumers through power exchanges witnessed in the year 2009, continued vigorously during the year 2010-11. At IEX, Open Access industrial sector consumers bought about 4.056 billion units of electricity, which formed about 34.4 % of the total day ahead volume transacted during 2010-11. For PXIL, the respective figures were: 92.72 million units, 5.33% (3.3%).
- The weighted average price of electricity bought by open access consumers at IEX was lower (₹2.72/kWh) when compared with the weighted average price of total electricity transacted through IEX (₹3.38/kWh). The weighted average price of electricity bought by open access consumers at PXIL was lower (₹3.62/kWh) when compared with the weighted average price of total electricity transacted through PXIL (₹3.87/kWh).
- 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 2010-11, the actual volume transacted could have been about 5 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 as of 31st March 2011 was ₹457.04 crore.

Report on Short-term Power Market in India, 2010-11

An analysis on short-term transactions of electricity in India has been made in this report on short-term power market³ for the year 2010-11. Here, “short-term transactions of electricity” refers to contracts of less than one year period, for electricity transacted under bilateral transactions through Inter-State Trading Licensees (only inter-state part) and directly by the Distribution Licensees, Power Exchanges (Indian Energy Exchange Ltd (IEX) and Power Exchange India Ltd (PXIL)), and Unscheduled Interchange (UI). The analysis includes (i) Years/Monthly/Daily trends in short-term transactions of electricity; (ii) Analysis of open access consumers on power exchanges; (iii) Major Sellers and Buyers of Electricity through Licensed Traders and Power Exchanges; (iv) Effect of congestion on Volume of Electricity transacted through Power Exchanges; and (v) Comparison of short-term prices with tariffs of long-term sources of power for various distribution companies.

1. Yearly trends in short-term transactions of electricity (2008-09 to 2010-11)

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

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

Inter-state trading licensees have been undertaking trading in electricity since the year 2004 and the power exchanges are in operation since the year 2008. The IEX and PXIL are in

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 2010-11, the volume of UI was about 28.08 billion kWh and that of between distribution companies was about 10.25 billion kWh.

operation since June 2008 and October 2008 respectively. As of March 2011, there were 40 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 has increased from 65.90 billion kWh (BUs) in 2009-10 to 81.56 BUs in 2010-11. The growth in volume in absolute terms thus has been 15.66 BUs and in percentage terms, the same has been about 23.76 percent. Total volume of short-term transactions of electricity as percentage of total electricity generation has also increased from 9% in 2009-10 to 10% in 2010-11 (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% |

Source: NLDC

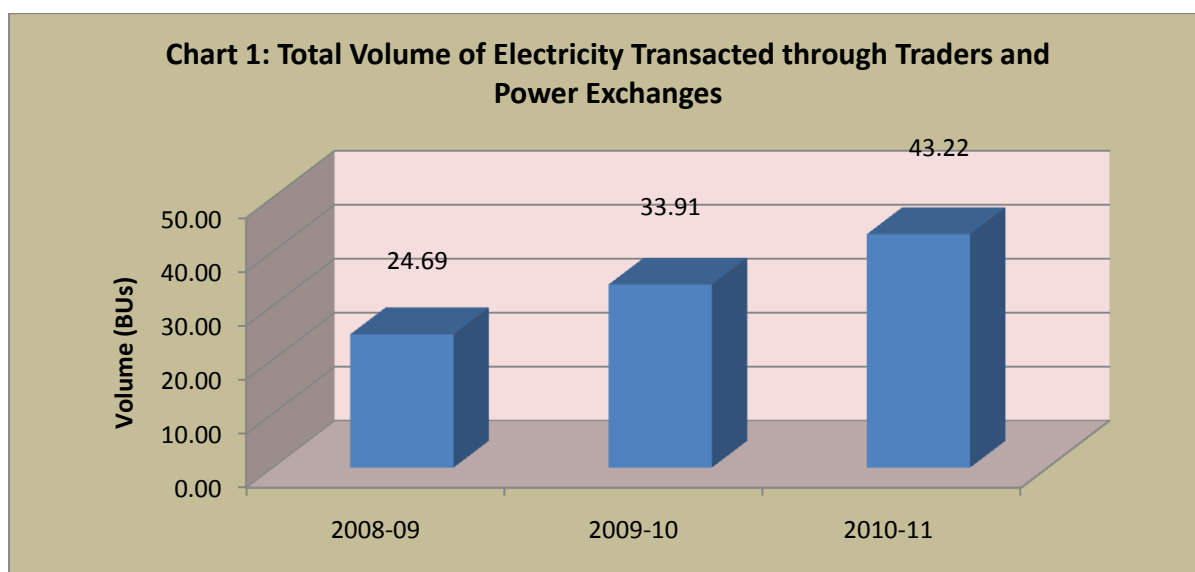
1.2. Electricity Transacted through Trading Licensees and Power Exchanges

Table-2, Table-3, Chart-1 & Chart-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 2010-11. The volume of electricity transacted through inter-state trading licensees and power exchanges has increased from 24.69 BUs in 2008-09 to 43.22 BUs in 2010-11. The share of electricity transacted through trading licensees and power exchanges in volume terms as a percentage of total short-term transactions of electricity in 2010-11 has shown a moderate level of rise (from 51.45% to 53%) over the year 2009-10. The growth in volume for this segment during the year 2010-11 as compared to year 2009-10 thus has been 9.31BUs in absolute terms and about 27.5 in percentage terms. Majority of this growth has come about due to growth in volume of about 6.45 BUs (or 69.3% of total growth) in Day Ahead Market sub-segment, followed by about 1.88 BUs (or about 20.2 % of total growth) in Term Ahead Market sub-segment and about 0.98 BUs (or about 10.5% of the total growth) in the bilateral trader segment. Looking at the individual sub-segment growth

between the years 2009-10 and 2010-11, it is observed that the growth has been highest for Term Ahead Market sub-segment (1822 %), followed by Day Ahead Market sub-segment (91 %), and bilateral trader segment (3.54 %).

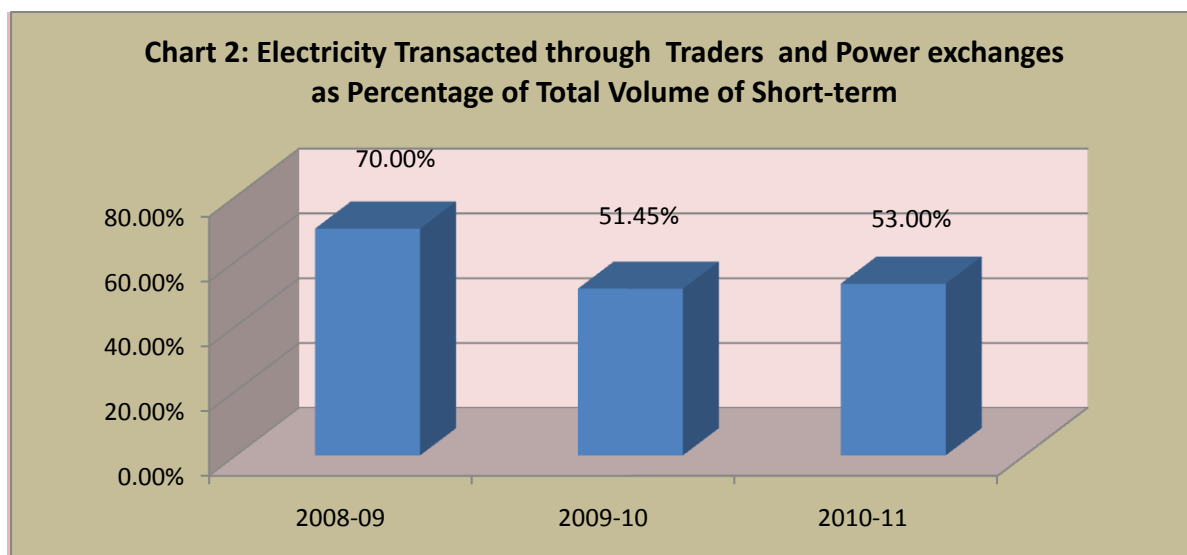
| Table-2: Volume of Electricity Transacted through Trading Licensees and Power Exchanges | | | | | | | |
|--|--|--|-------------------|---|-------------------|---|-------------|
| Year | Electricity Transacted through trading Licensees (BUs) | Electricity Transacted through IEX (BUs) | | Electricity Transacted through PXIL (BUs) | | Electricity Transacted through IEX and PXIL (BUs) | Total (BUs) |
| | | Day Ahead Market | Term Ahead Market | Day Ahead Market | Term Ahead Market | | |
| 2008-09 | 21.92 | 2.62 | | 0.15 | | 2.77 | 24.69 |
| 2009-10 | 26.72 | 6.17 | 0.0952 | 0.92 | 0.003 | 7.19 | 33.91 |
| 2010-11 | 27.70 | 11.80 | 0.91 | 1.74 | 1.07 | 15.52 | 43.22 |

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.



| 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 (BUs) | Total Short-term Transactions of Electricity (BUs) | Electricity Transacted through traders and PXs as % to Total Volume of Short-term |
| 2008-09 | 24.69 | 35.27 | 70.00% |
| 2009-10 | 33.91 | 65.90 | 51.45% |

| | | | |
|--|-------|-------|--------|
| 2010-11 | 43.22 | 81.56 | 53.00% |
| <i>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. Since 2008-09 figures include cross border and intra state trading for part of the year, its comparison with other two years cannot be strictly done.</i> | | | |



The price of electricity transacted through trading licensees and Power Exchanges is shown in Table-4 and Chart-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 ₹4.79/kWh and ₹3.47/kWh respectively in 2010-11. It is thus seen that the price of electricity in the short term market in the year 2010-11 was on the lower side as compared to price prevalent in the previous two years.

During the year 2010-11, the weighted average price of electricity in the Term Ahead Market sub-segment, which registered a growth of 1822% in volume terms, was ₹3.70/kWh. This was slightly higher than the weighted average price discovered in the Day Ahead Market sub-segment where the weighted average price was ₹3.44/kWh. An interesting observation is with respect to the weighted average price of weekly contracts in the Term Ahead Market sub-segment. The same was ₹3.56/kWh during the year 2010-11 for a total volume transaction of about 1.92 BUs. It is thus seen that the weighted average price of Term Ahead Contracts (Weekly contracts) as discovered in the power exchanges was lower than the weighted average price of electricity transacted through trading licensees (bilateral trader segment), which, as mentioned in the preceding paragraph, was ₹4.79/kWh

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 has increased by about 27.5 % in the year 2010-11 as compared to the year 2009-10, in monetary terms the growth has only been about 5.9% (or about ₹1040 crore). In fact the bilateral trader sub-segment, though registering a growth of about 3.54 % in physical terms, has registered a negative growth in monetary terms of about minus 5.6 % (or about minus ₹787 crore). The power exchange segment, however, has registered a healthy growth of 49.9% in monetary terms (or about ₹1826 crore).

| Table-4: Price of Electricity Transacted through Traders & Power Exchanges | | |
|---|--|--|
| Year | Price of Electricity transacted through Trading Licensees (₹/kWh) | Price of Electricity transacted through Power Exchanges (DAM+TAM) (₹/kWh) |
| 2008-09 | 7.29 | 7.49 |
| 2009-10 | 5.26 | 4.96 |
| 2010-11 | 4.79 | 3.47 |

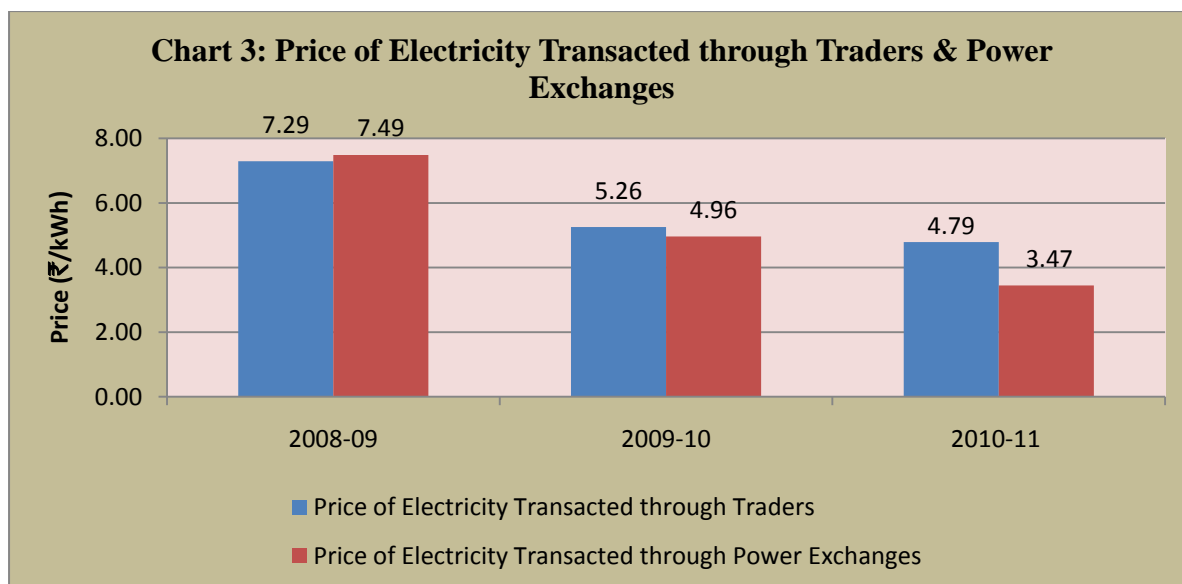


Table-5: Size of the Bilateral Trader and Power Exchange Market in Monetary Terms

| 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 |

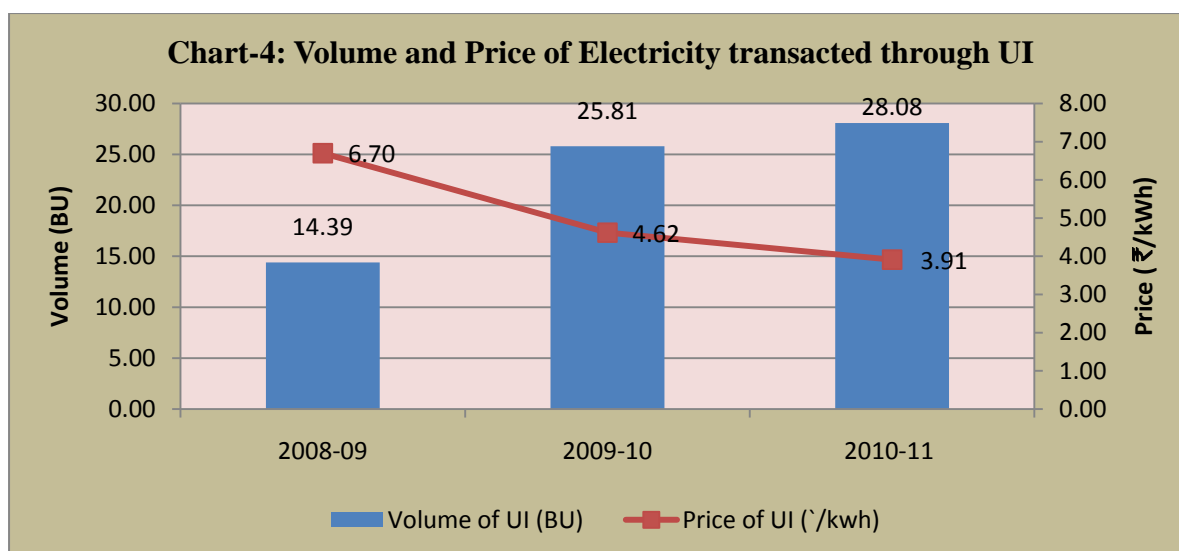
1.3 Electricity Transacted through UI

The volume and price of electricity transacted through UI is shown in Table-6 and Chart-4. The volume and price of electricity transacted through UI in 2008-09 represents the period from August 2008 to March 2009. It is observed from the Table that the volume of electricity transacted through UI has increased from 25.81 BU in 2009-10 to 28.08 BU in 2010-11, the volume of UI as percentage of total short-term volume has declined to a level of 34% in the year 2010-11 as compared to 39% in the year 2009-10. It is also observed from the table that there is a declining trend in the average price of UI (New Grid and SR Grid) during the last 3 years i.e. from ₹6.70/kWh in 2008-09 to ₹3.91/kWh in 2010-11.

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 |

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

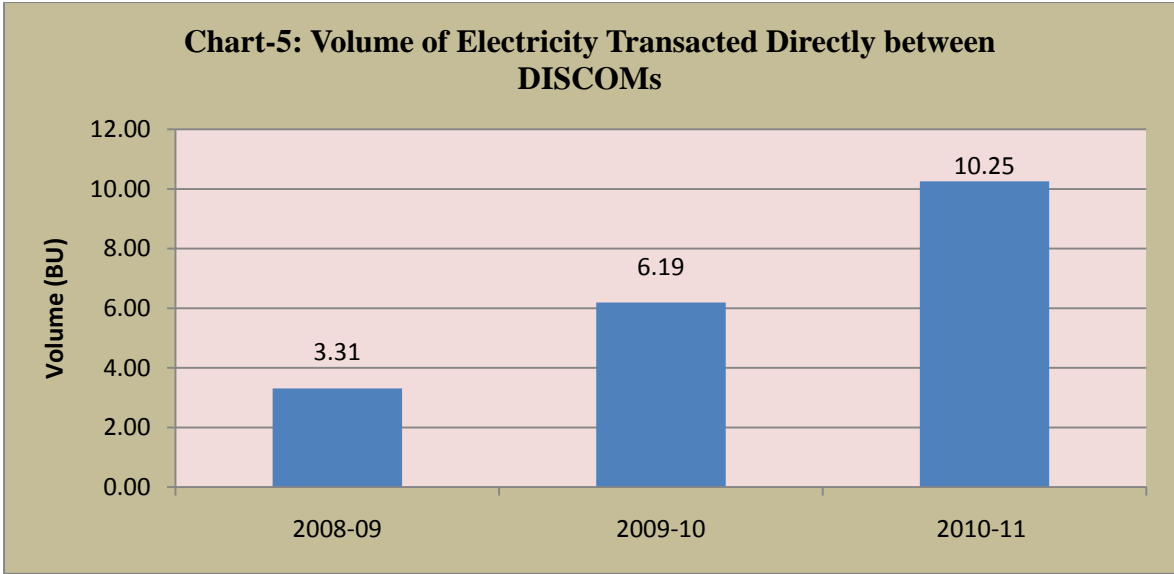


1.4 Electricity Transacted Directly Between DISCOMs

The volume of electricity transacted directly between distribution companies (DISCOMs) is shown in Table-7 and Chart-5. It is observed from the table that the volume of electricity transacted directly between DISCOMs increased significantly from 6.19 BU in 2009-10 to 10.25 BU in 2010-11. It is also observed that, in the year 2010-11, 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 13%.

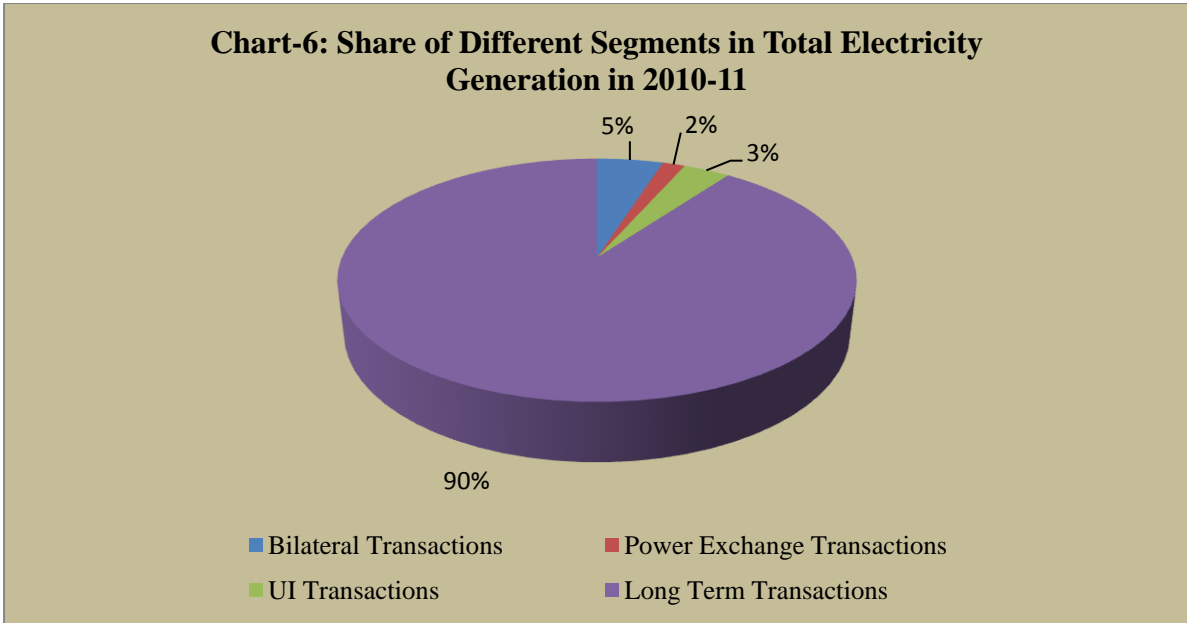
| Table-7: Volume of Electricity Transacted Directly between DISCOMs | | | |
|---|---|--|--|
| Year | Volume of Electricity Transacted Directly between DISCOMs (BU) | Total Volume of Short term (BU) | Volume of Bilateral Direct as % of total volume of Short term |
| 2008-09 | 3.31 | 35.27 | 9% |
| 2009-10 | 6.19 | 65.90 | 9% |
| 2010-11 | 10.25 | 81.56 | 13% |

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



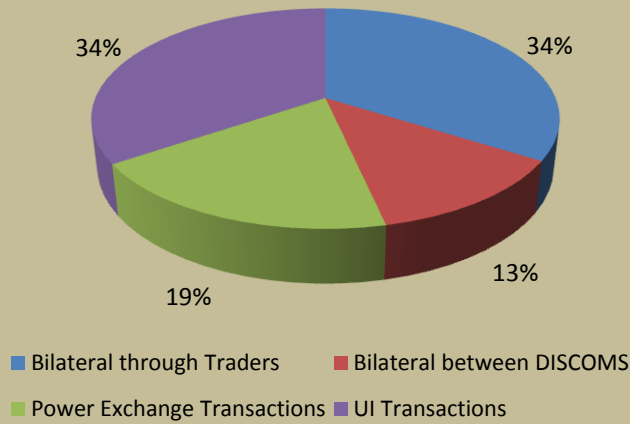
2. Monthly trends in short-term transactions of electricity (April 2010-March 2011)

During 2010-11, the share of the total short term transactions in volume terms, including UI and bilateral transactions between distribution companies, as a percentage of total electricity generation in the country was about 10 percent (Chart-6).



The share of different segments within the total short term transaction for the year 2010-11 has been shown in the Chart-7 below.

Chart-7: Share of Different Segments in Short Term Transactions in 2010-11



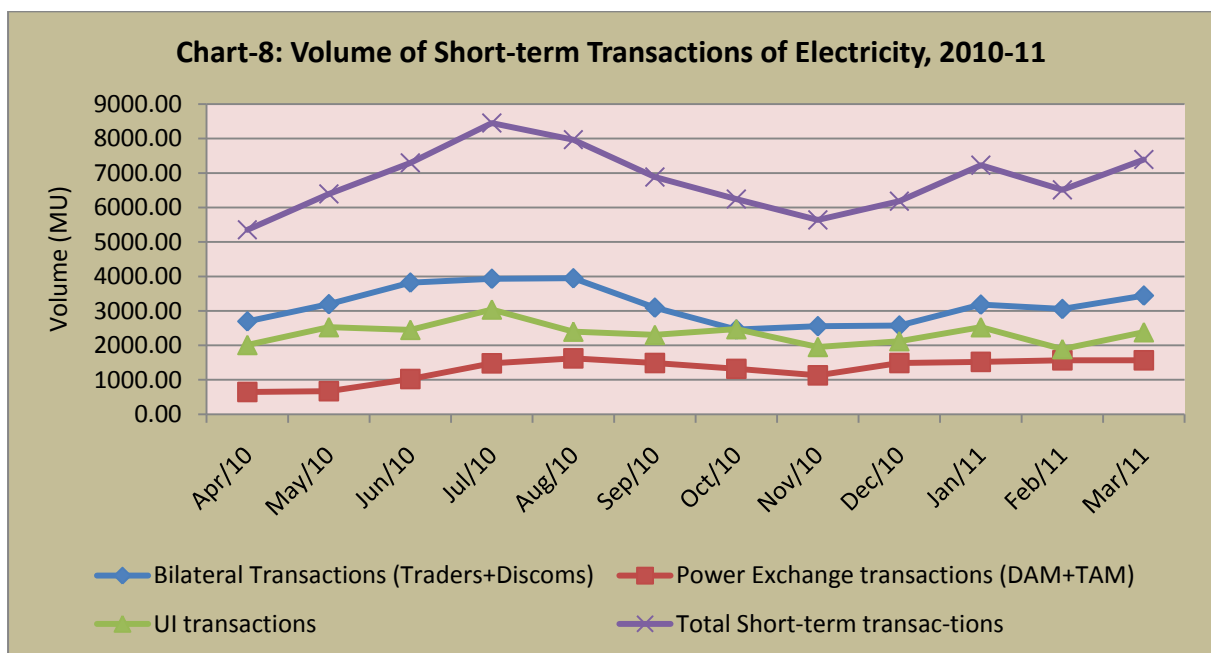
2.1. Volume of short-term transactions of electricity

The volume of short-term transactions of electricity during different months of the year 2010-11 with respect to different segments of transaction is shown in Table-8 and Chart-8.

| Table-8: VOLUME OF SHORT-TERM TRANSACTIONS OF ELECTRICITY (MUs) | | | | | | | |
|--|----------------------------------|----------------------------------|-------------------------------------|--|------------------------|--------------------------------------|-------------------------------------|
| Period | Bilateral through Traders | Bilateral between DISCOMS | Total Bilateral transactions | Power Exchange transactions (DAM+TAM) | UI transactions | Total Short-term transactions | Total Electricity Generation |
| Apr-10 | 2092.18 | 604.01 | 2696.19 | 646.70 | 2010.96 | 5353.85 | 66572.47 |
| May-10 | 2560.20 | 634.43 | 3194.63 | 670.49 | 2529.56 | 6394.67 | 67980.40 |
| Jun-10 | 2609.91 | 1211.62 | 3821.52 | 1024.11 | 2450.00 | 7295.64 | 65211.13 |
| Jul-10 | 2701.39 | 1231.55 | 3932.95 | 1478.21 | 3041.12 | 8452.28 | 65632.15 |
| Aug-10 | 2834.87 | 1112.16 | 3947.03 | 1623.60 | 2398.99 | 7969.62 | 67174.98 |
| Sep-10 | 2290.14 | 804.10 | 3094.23 | 1488.53 | 2302.70 | 6885.46 | 64315.24 |
| Oct-10 | 1908.17 | 549.50 | 2457.66 | 1318.29 | 2470.02 | 6245.96 | 70558.09 |
| Nov-10 | 1823.91 | 732.02 | 2555.93 | 1130.88 | 1953.60 | 5640.41 | 62583.80 |
| Dec-10 | 1691.21 | 884.55 | 2575.76 | 1486.80 | 2121.38 | 6183.94 | 67079.74 |
| Jan-11 | 2287.06 | 895.45 | 3182.51 | 1519.46 | 2527.68 | 7229.65 | 71282.05 |
| Feb-11 | 2271.85 | 783.76 | 3055.61 | 1566.50 | 1890.66 | 6512.77 | 65566.23 |
| Mar-11 | 2632.84 | 811.79 | 3444.64 | 1566.83 | 2381.60 | 7393.07 | 75497.39 |
| Total | 27703.73 | 10254.93 | 37958.66 | 15520.40 | 28078.28 | 81557.34 | 809453.67 |
| Compounded monthly growth rate | 2.11% | 2.72% | 2.25% | 8.38% | 1.55% | 2.98% | 1.15% |

It is observed from the above table (Table-8) that the volume of short-term transactions of electricity has grown steadily over the months at the compounded monthly rate of 2.98 %. Volume of transactions through power exchanges has shown a healthy growth and has grown at the monthly compounded rate of 8.38%. It is observed from the table that the monthly compounded growth rate in UI volume (1.55%) is lower than the monthly compounded growth rate in volume of electricity transacted through all other segments of short-term transactions. It is also observed that the monthly compounded growth rate in volume of electricity transacted through short-term is relatively high (2.98%) when compared with the monthly compounded growth rate in total electricity generation (1.15%).

It is observed from the chart below (Chart-8) that there is a cyclical trend in the total volume of short-term transactions of electricity. It is also observed from the chart 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 demand and supply of electricity which vary from season to season. However, a rising trend in the volume of total short term transactions as well as in the volumes of all segments of the short term transactions, albeit with differing growth rates, is clearly discernable from the Chart-8.



The volume of short-term transactions of electricity as % of total electricity generation is varying between 8.04% and 12.88% 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-10 | 8.04% |
| May-10 | 9.41% |
| Jun-10 | 11.19% |
| Jul-10 | 12.88% |
| Aug-10 | 11.86% |
| Sep-10 | 10.71% |
| Oct-10 | 8.85% |
| Nov-10 | 9.01% |
| Dec-10 | 9.22% |
| Jan-11 | 10.14% |
| Feb-11 | 9.93% |
| Mar-11 | 9.79% |

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). Increases in the HHI generally indicate a decrease in competition and an increase of market power, whereas decreases indicate the opposite. A HHI between 0.15 to 0.25 indicates moderate concentration and a HHI above 0.25 indicates high concentration. The HHI computed for volume of electricity transacted by trading licensees during 2010-11 is 0.1943 which shows moderate concentration/market power among the trading licensees.

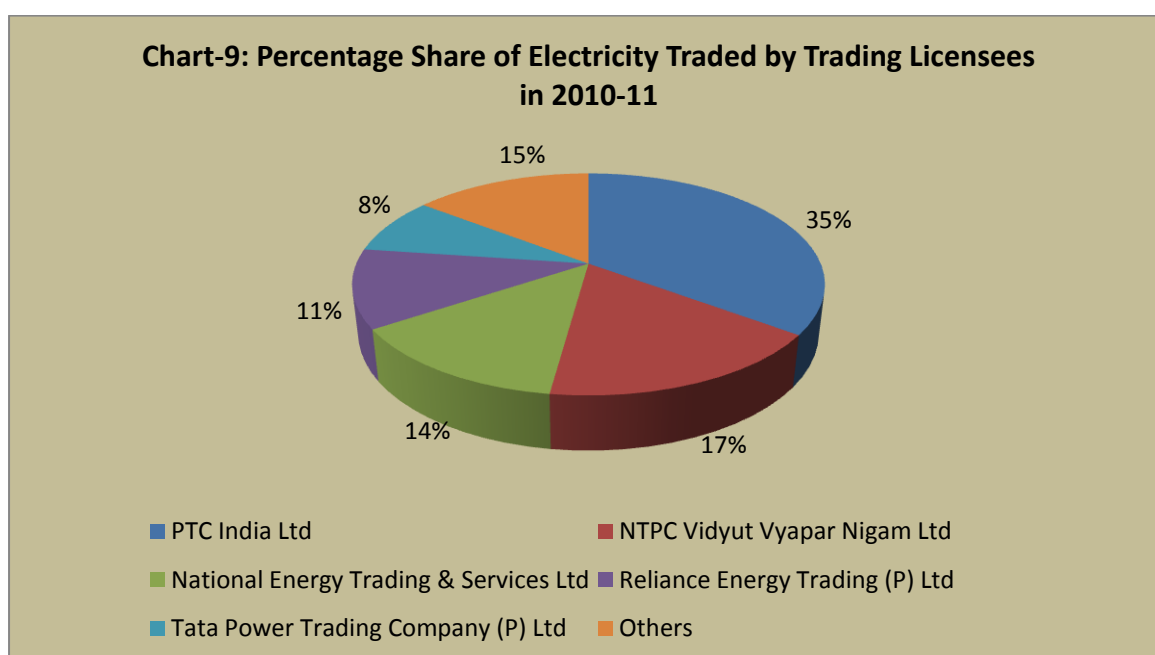
| Table-10: Percentage Share of Electricity Traded by Trading Licensees and HHI in 2010-11 | | | |
|---|--|--|---|
| Sr No | Name of the Trading Licensee | Share of Electricity traded by Licensees in 2010-11 | Herfindahl Herschman Index (HHI) |
| 1 | PTC India Ltd | 35.11% | 0.1233 |
| 2 | NTPC Vidyut Vyapar Nigam Ltd | 17.07% | 0.0291 |
| 3 | National Energy Trading & Services Ltd | 13.52% | 0.0183 |
| 4 | Reliance Energy Trading (P) Ltd | 11.48% | 0.0132 |
| 5 | Tata Power Trading Company (P) Ltd | 8.25% | 0.0068 |
| 6 | JSW Power Trading Company Ltd | 4.40% | 0.0019 |
| 7 | Knowledge Infrastructure Systems (P) Ltd | 2.31% | 0.0005 |
| 8 | GMR Energy Trading Ltd | 2.22% | 0.0005 |
| 9 | Instinct Infra & Power Ltd | 1.99% | 0.0004 |
| 10 | Adani Enterprises Ltd | 1.31% | 0.0002 |

| | | | |
|----|--|----------------|---------------|
| 11 | Shree Cements Ltd | 1.11% | 0.0001 |
| 12 | Pune Power Development (P) Ltd | 0.42% | 0.0000 |
| 13 | Mittal Processes (P) Ltd | 0.27% | 0.0000 |
| 14 | RPG Power Trading Company Ltd | 0.26% | 0.0000 |
| 15 | Indrajit Power Technologies (P) Ltd | 0.08% | 0.0000 |
| 16 | Godavari Power & Ispat Ltd | 0.08% | 0.0000 |
| 17 | Essar Electric Power Development Corp. Ltd | 0.06% | 0.0000 |
| 18 | Jindal Power Trading Company Ltd | 0.03% | 0.0000 |
| 19 | Global Energy (P) Ltd | 0.02% | 0.0000 |
| | Total | 100.00% | 0.1943 |
| | Top 5 Trading Licensees | 85.43% | |

Note: Percentage share in total volume traded by Licensees in 2010-11 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 Chart-9.

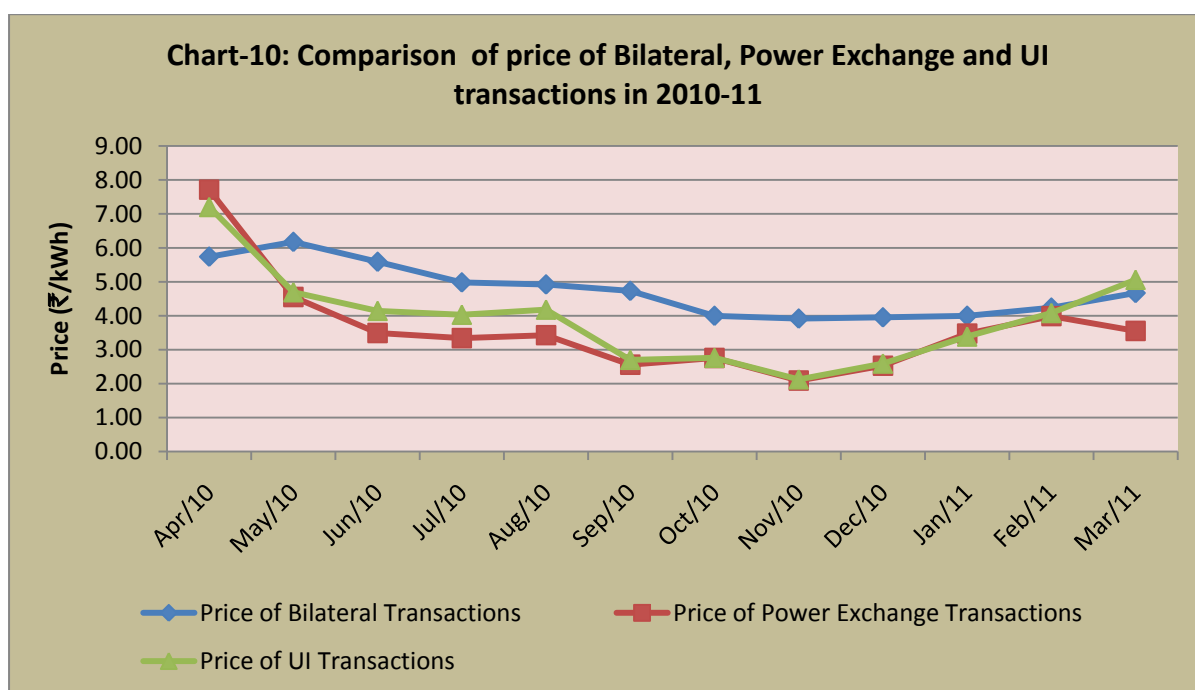


2.2. Price of short-term transactions of electricity

The trends in price of short-term transactions of electricity are shown in Table-11 and Chart-10 & 11. 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) have been studied separately for total transactions as well as the transactions undertaken Round the Clock (RTC), during Peak, and during Off-peak periods.

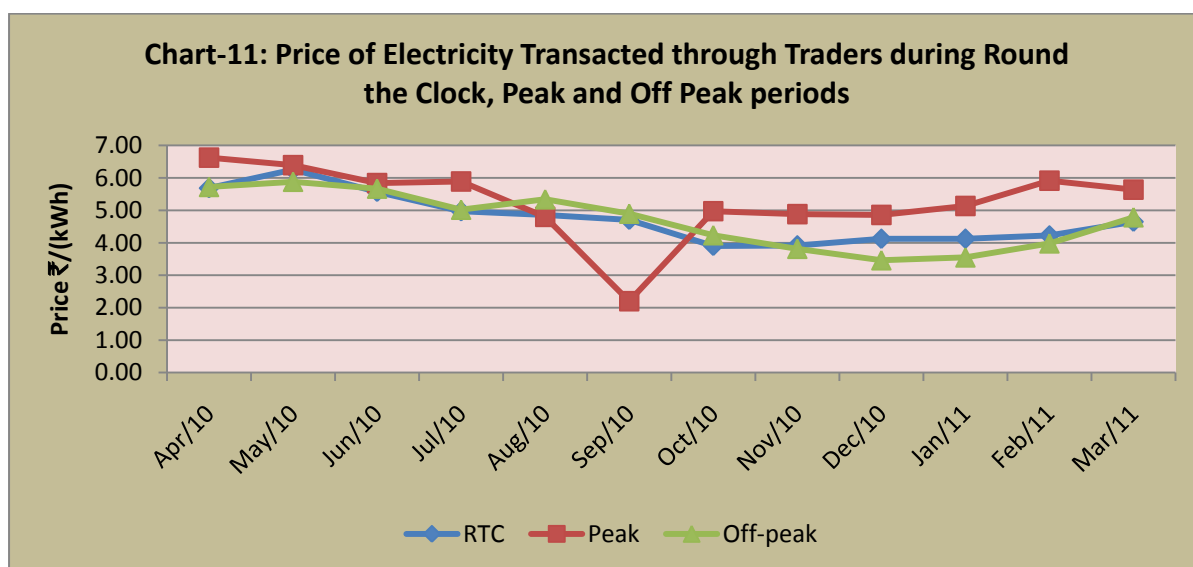
| Table-11: Price of Short-term Transactions of Electricity (₹/KWh) | | | | | | | | |
|---|---------------------------|------|----------|-------|----------------|------|----------|---------|
| Period | Bilateral through Traders | | | | Power Exchange | | UI | |
| | RTC | Peak | Off-peak | Total | IEX | PXIL | NEW Grid | SR Grid |
| Apr-10 | 5.68 | 6.62 | 5.72 | 5.74 | 7.75 | 7.43 | 7.75 | 6.66 |
| May-10 | 6.26 | 6.39 | 5.88 | 6.17 | 4.54 | 4.65 | 5.14 | 4.25 |
| Jun-10 | 3.23 | 7.28 | 5.59 | 5.59 | 3.50 | 3.47 | 3.61 | 4.67 |
| Jul-10 | 4.97 | 5.89 | 5.02 | 4.98 | 3.36 | 3.23 | 4.11 | 3.95 |
| Aug-10 | 4.86 | 4.80 | 5.34 | 4.92 | 3.41 | 3.52 | 3.45 | 4.91 |
| Sep-10 | 4.71 | 2.20 | 4.90 | 4.73 | 2.53 | 2.82 | 2.02 | 3.38 |
| Oct-10 | 3.90 | 4.97 | 4.23 | 4.00 | 2.73 | 3.00 | 2.27 | 3.25 |
| Nov-10 | 3.92 | 4.88 | 3.81 | 3.91 | 2.04 | 2.65 | 1.79 | 2.46 |
| Dec-10 | 4.12 | 4.86 | 3.46 | 3.95 | 2.47 | 2.99 | 2.54 | 2.64 |
| Jan-11 | 4.12 | 5.13 | 3.55 | 4.00 | 3.44 | 3.66 | 3.29 | 3.48 |
| Feb-11 | 4.22 | 5.91 | 3.98 | 4.24 | 3.88 | 4.54 | 3.00 | 5.16 |
| Mar-11 | 4.65 | 5.64 | 4.79 | 4.67 | 3.34 | 5.13 | 3.12 | 7.00 |



It is observed from the above Chart 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 2010 to February 2011. It is also

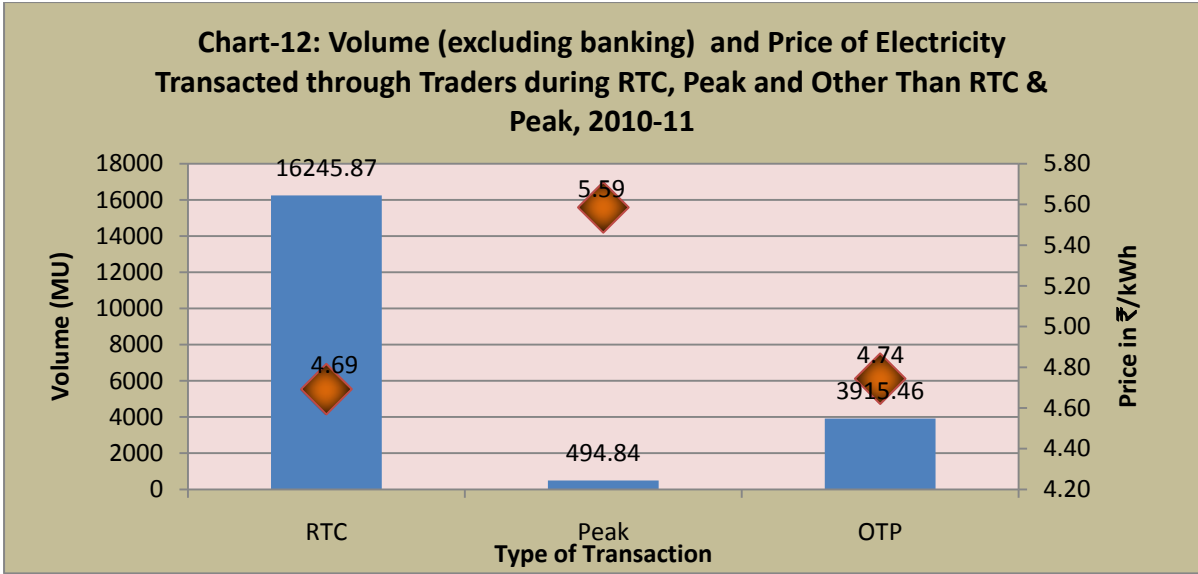
observed that there was divergence of prices of power transacted through different short term segments in the month of April 2010 and March 2011.

The trends in price of electricity transacted by trading licensees during RTC, Peak and Off-peak periods are shown in Chart-11. The price of electricity transacted during peak RTC and Off-peak periods shows a slight declining trend. In the month of September 2010, the price during peak period is very low when compared with the price during RTC and off peak periods. This is mainly for the reason that the volume of electricity transacted during peak period was very less (5.7 MU) and it was sourced from hydro generation.

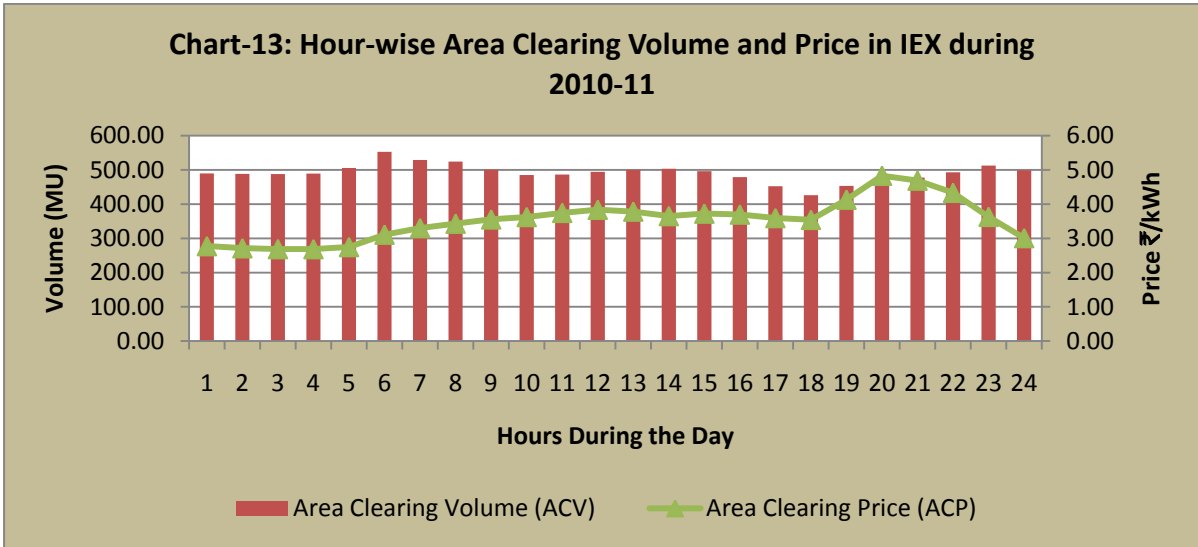


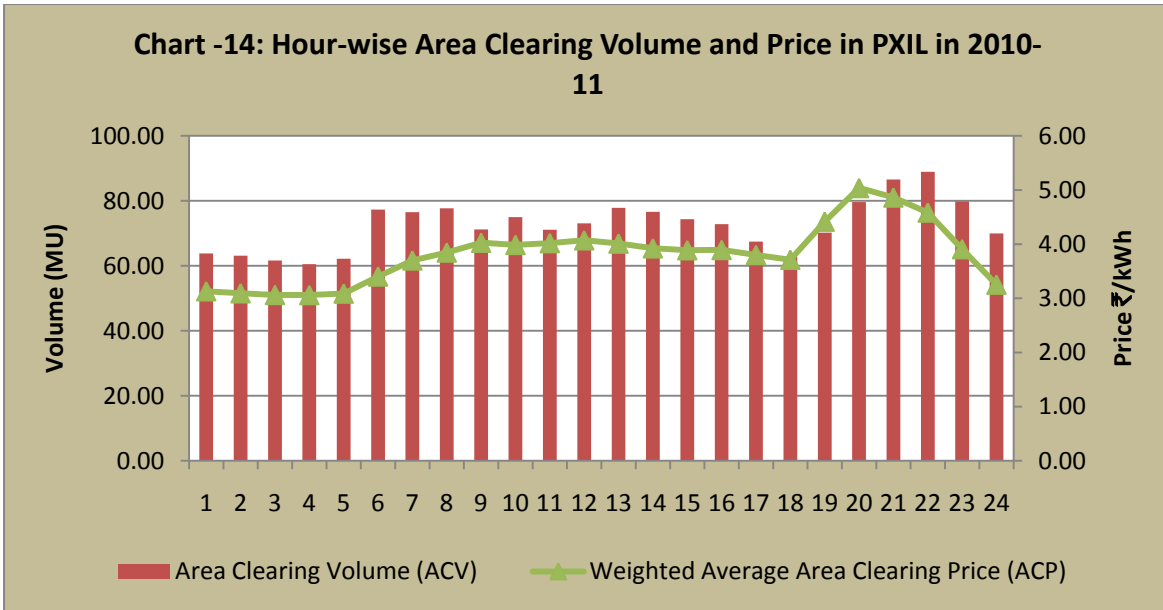
2.3 Time of the day variation in Volume and Price of Electricity transacted through Power Exchanges (Day Ahead Market Sub-Segment) and Traders

Time of the day variation in volume and price of electricity transacted through bilateral trader transactions is shown in Chart-12. 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 other than RTC & Peak period. Of the total volume, 79% of the volume has been transacted during RTC followed by 19% exclusively during Other than RTC & peak and only about 2% exclusively during Peak period. It is observed from the chart that there is hardly any volume transacted exclusively during peak period. It is also observed that the price during peak period is high (₹5.59/kWh), as expected, when compared with the price during RTC and other than RTC & Peak period.



Time of the day variation in volume and price of electricity transacted through IEX and PXIL is shown in Chart-13 & Chart-14. Time of the day variation in volume and price of electricity transacted through power exchanges is shown hour-wise. It is observed from the charts that during Peak period (between hour 18 to 24), the price in both the exchanges is high when compared with the rest of the hours. It is also observed that volume of electricity transacted in PXIL during Peak period is high when compared with the rest of the hours which shows 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.

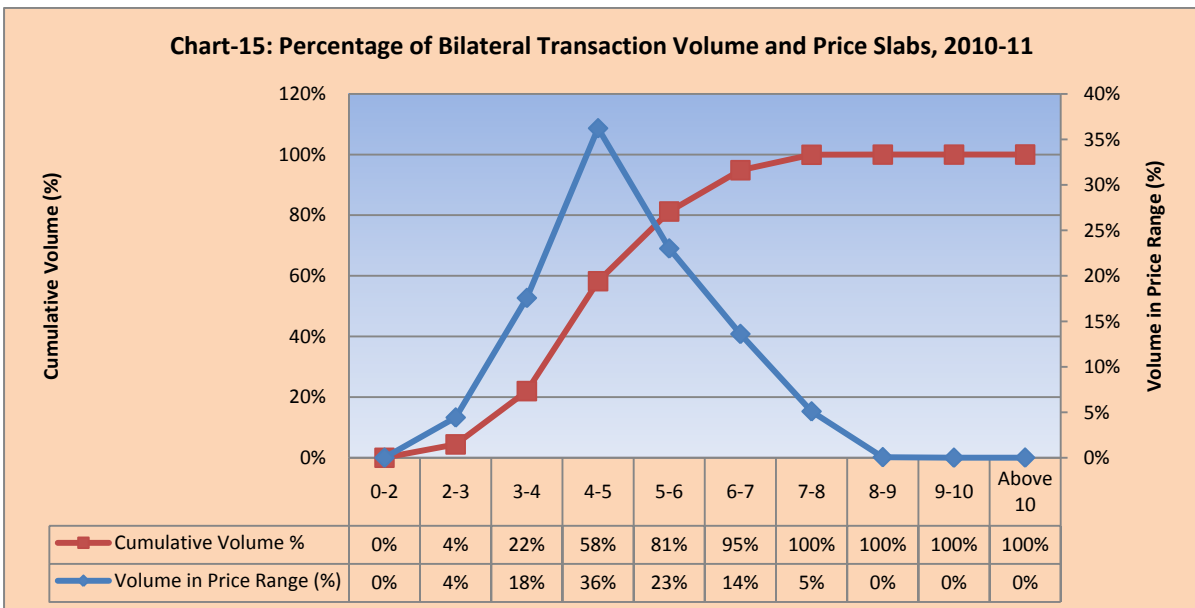




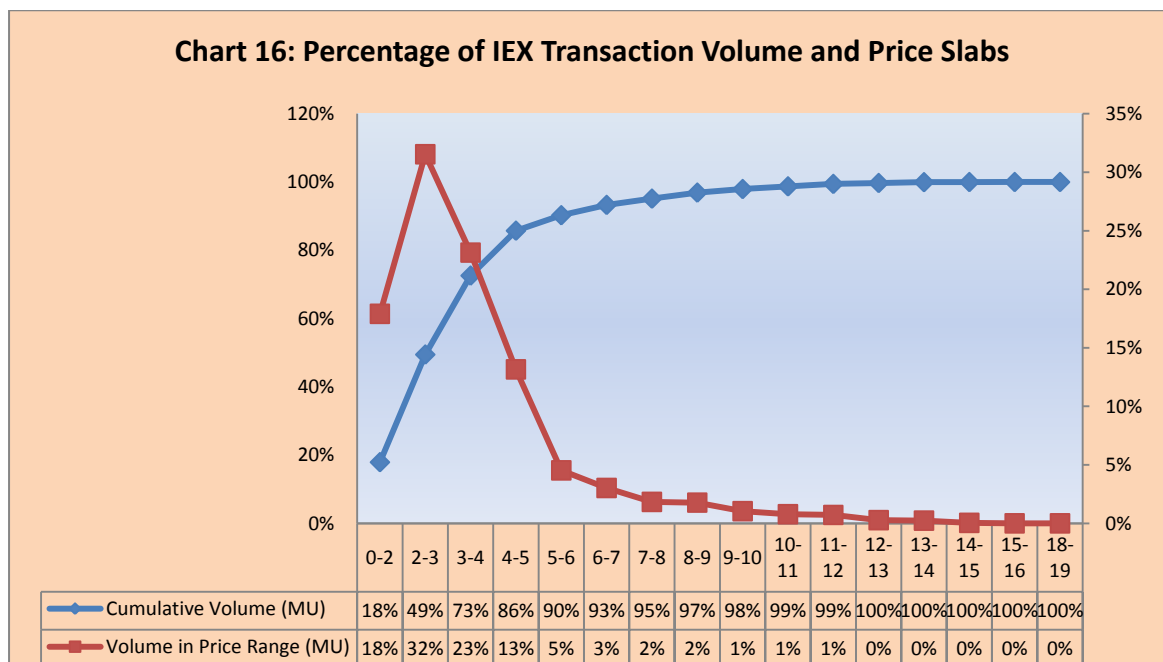
2.4 Volume of Electricity Transacted in Various Price Slabs

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

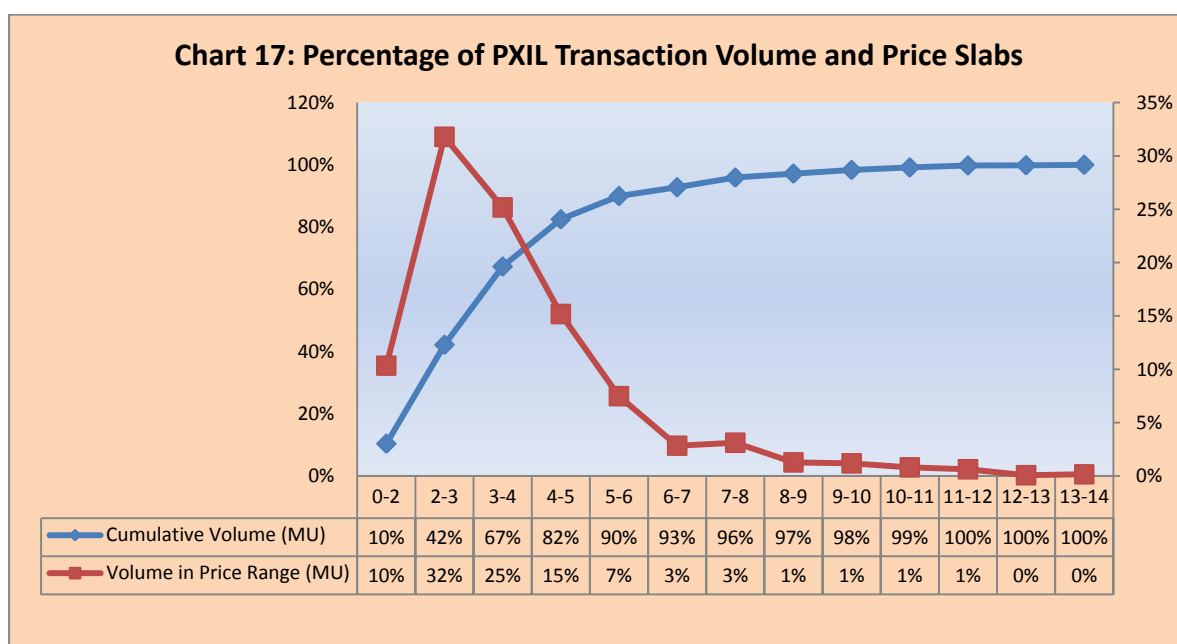
Cumulative volume and price of bilateral trader segment transactions in 2010-11 is depicted in the following chart (Chart -15). The chart shows that only 22% of the volume of electricity through traders has been transacted at the price less than ₹4/kWh. It is observed from the chart that 81% of the volume has been transacted at the price of less than ₹6/kWh.



Cumulative volume and price of IEX Transactions in 2010-11 is depicted in the following chart (Chart -16). The chart shows that 73% of the volume of electricity in IEX has been transacted at the price less than ₹4/kWh.



Cumulative volume and price of PXIL Transactions in 2010-11 is depicted in the following chart (Chart -17). The chart shows that 67% of the volume of electricity in PXI has been transacted at the price less than ₹4/kWh.



2.5 Trading Margin charged by Trading Licensees for Bilateral Transactions during 2010-11

As per the Central Electricity Regulatory Commission (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 is exceeding ₹3/kWh and 4 paise/kWh where the sale price is less than or equal to ₹3/kWh.

Average trading margin charged by the trading licensees for bilateral transactions during 2010-11 is provided in Table-12 below.

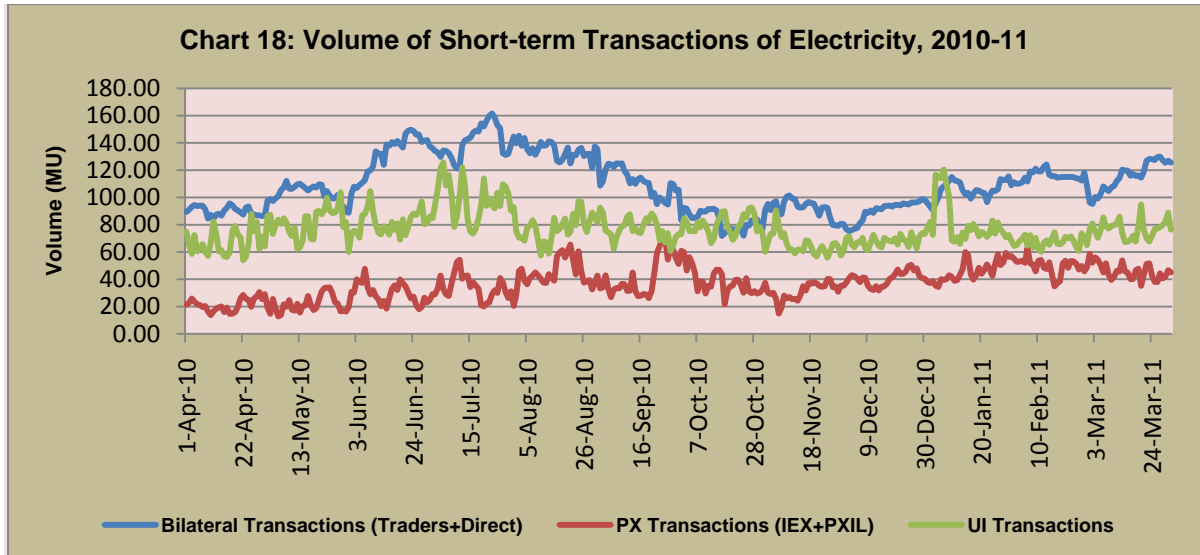
| Table-12: Average Trading Margin Charged by Trading Licensees during 2010-11 | |
|---|--|
| Sale Price of Electricity Transacted by Trading Licensees (₹/ kWh) | Average Trading Margin charged by Trading Licensees (Paise/kWh) |
| when sale price is less than or equal to ₹3/kWh | 4.00 |
| when sale price is greater than ₹3/kWh | 4.81 |
| 3-4 | 5.74 |
| 4-5 | 4.68 |
| 5-6 | 4.57 |
| 6-7 | 4.73 |
| 7-8 | 5.36 |
| 8-9 | 6.43 |
| 9-10 | 4.00 |
| > 10 | 7.00 |

Note: Average trading margin computed based on all Inter-state Trading Transactions excluding Banking Transactions.

3. Daily trends in short-term transactions of electricity (1st April 10 to 31st March 11)

3.1 Volume of Short-term transactions of Electricity

Trends in daily volume of short-term transactions are shown in Chart-18. It is observed from the chart that there is an increasing trend in the volume of electricity transacted through power exchanges during the year 2010-11.

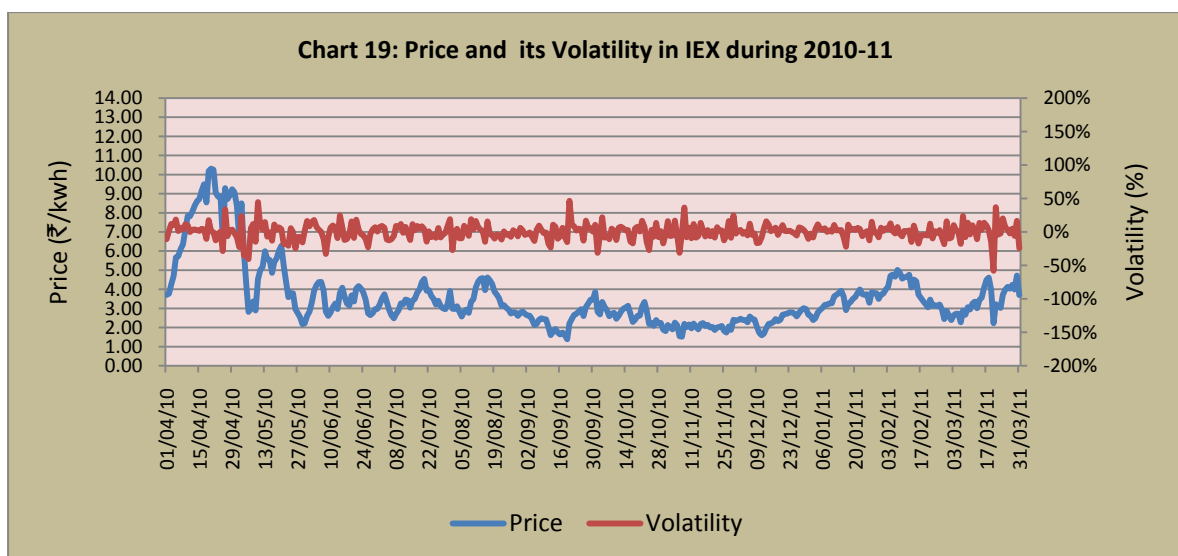


3.2 Price of Short-term transactions of Electricity

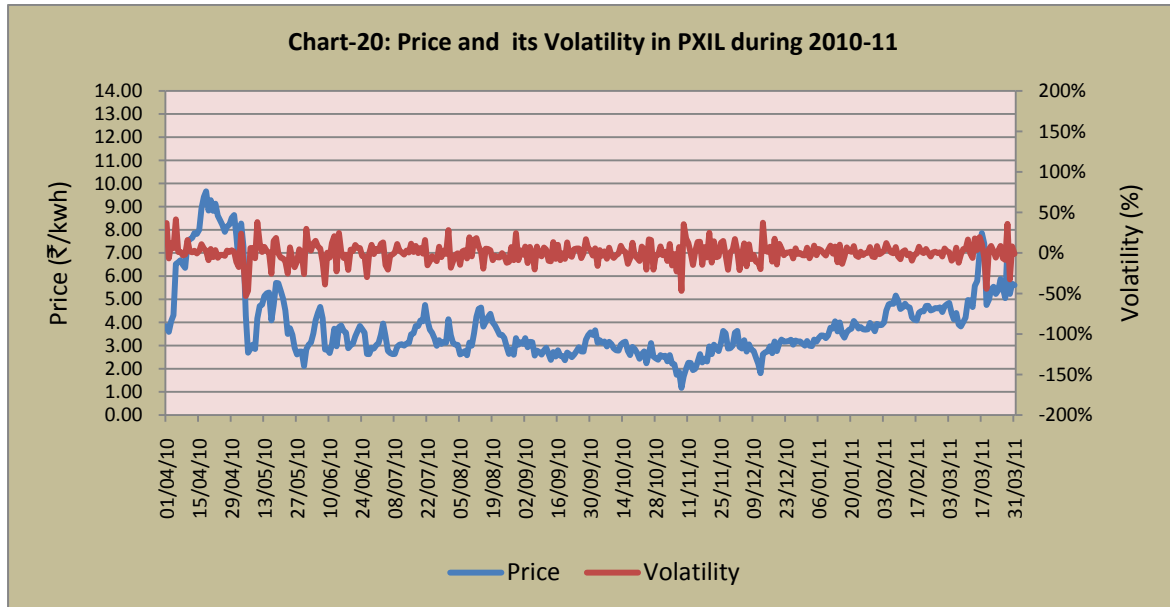
Trends in daily price of short-term transactions are shown for transactions of power exchanges and UI.

3.2.1 Trends in price of electricity transacted through Power Exchanges

The weighted average price of electricity transacted through IEX and its volatility is shown in Chart-19. Volatility in the Price of electricity transacted through IEX has been computed using daily data for the year 2010-11 and it was 11.97%. (See Annexure-II for historic volatility formula).

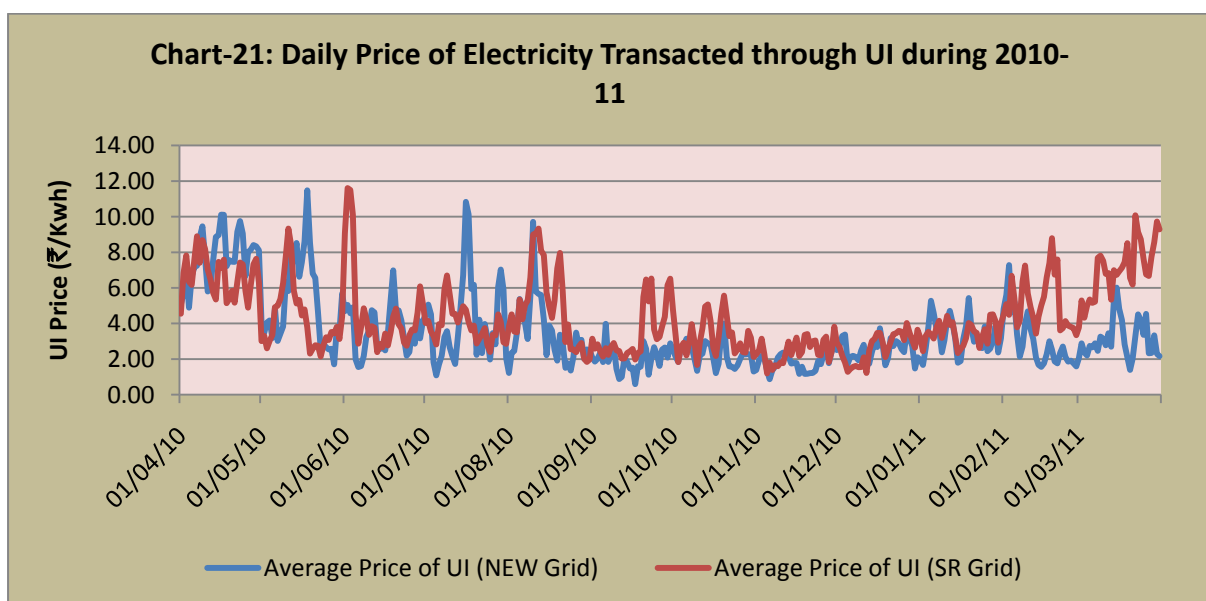


The weighted average price of electricity transacted through PXI and its volatility is shown in Chart-20. Volatility in the Price of electricity transacted through PXI has been computed using daily data for the year 2010-11 and it was 12.08%.



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 Chart-21.



It is observed from the above chart that there was divergence in the price of UI in the NEW Grid and SR Grid in the last two months (with prices in SR Grid registering higher levels than price in the NEW Grid) and that there was convergence in the price of UI in the rest of the months. The divergence was due to higher demand in the two Southern states of Tamil Nadu and Kerala due to state elections.

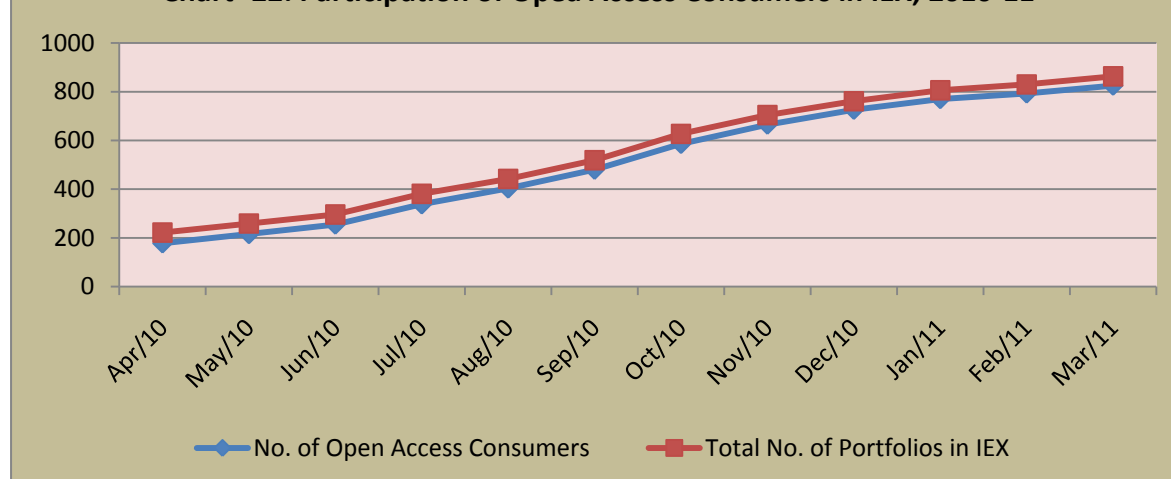
4. Analysis of open access consumers on power exchanges (Day Ahead Market Sub-Segment)

The year witnessed significant development in the process of procurement of power by the industrial sector consumers through power exchanges (collective open access transactions). It is observed that, as of end March 2010-11, 825 Open Access (OA) Consumers were procuring part of their power requirements through IEX. These consumers were mostly located in Punjab, Tamil Nadu, Haryana, Rajasthan and Madhya Pradesh. During the year, these OA consumers procured a total of about 4056 MU of electricity through IEX. In 2010-11, the weighted average price of electricity bought by open access consumers at IEX was lower (₹2.72/kWh) when compared with the weighted average price of total electricity transacted through IEX (₹3.38/kWh).

In Table-13 & Chart-22, a monthly comparison is made between number of open access consumer participation and total number of portfolios in IEX. In Table-14 & Chart-23, a monthly comparison is shown between purchase volume of open access consumers and total volume of IEX. It is seen that the number of OA consumers as a percentage of total number of portfolios in IEX has steadily gone up from about 80% at the beginning of the year in April 2010 to about 95% at the end of the year in March 2011. The volumes procured by OA consumers as a percentage of total volume transacted in IEX, however, has gone up dramatically as the year progressed – starting with mere 2.8 % in April 2010 to 36.6% by the end of the year in March 2011. In between, in the months of November and December 2010, the percentage of total volume procured by OA consumers was about 63% and 56% of total volume transacted in respective months. For the year as a whole, volume procured by OA consumers as a percentage of total volume transacted in IEX was about 34.38%.

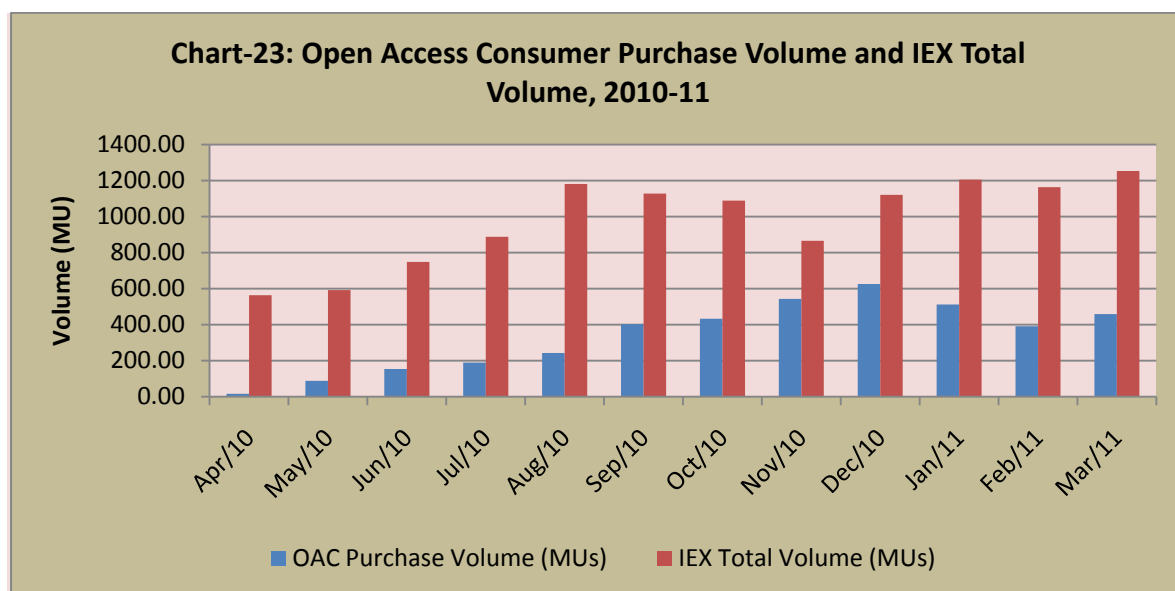
Table-13: Number of Open Access Consumers in IEX, 2010-11

| Month | No. of Open Access Consumers | Total No. of Portfolios in IEX | % of Open Access Consumers |
|--------|------------------------------|--------------------------------|----------------------------|
| Apr-10 | 178 | 222 | 80.18% |
| May-10 | 216 | 259 | 83.40% |
| Jun-10 | 255 | 296 | 86.15% |
| Jul-10 | 338 | 381 | 88.71% |
| Aug-10 | 403 | 442 | 91.18% |
| Sep-10 | 480 | 519 | 92.49% |
| Oct-10 | 586 | 627 | 93.46% |
| Nov-10 | 665 | 704 | 94.46% |
| Dec-10 | 726 | 761 | 95.40% |
| Jan-11 | 770 | 806 | 95.53% |
| Feb-11 | 793 | 830 | 95.54% |
| Mar-11 | 825 | 863 | 95.60% |

Chart -22: Participation of Open Access Consumers in IEX, 2010-11**Table-14: Volume Participation of Open Access Consumers in IEX Day Ahead Market in 2010-11**

| Month | OAC Purchase Volume (MUs) | IEX Total Volume (MUs) | % OAC Purchase Participation |
|--------|---------------------------|------------------------|------------------------------|
| Apr-10 | 15.96 | 563.54 | 2.83% |
| May-10 | 88.07 | 591.86 | 14.88% |
| Jun-10 | 153.68 | 748.39 | 20.54% |
| Jul-10 | 189.58 | 888.05 | 21.35% |
| Aug-10 | 242.96 | 1181.30 | 20.57% |
| Sep-10 | 403.01 | 1127.85 | 35.73% |
| Oct-10 | 433.07 | 1089.46 | 39.75% |
| Nov-10 | 542.75 | 865.62 | 62.70% |

| | | | |
|--------------|----------------|-----------------|---------------|
| Dec-10 | 625.98 | 1121.37 | 55.82% |
| Jan-11 | 512.10 | 1205.64 | 42.48% |
| Feb-11 | 390.84 | 1163.61 | 33.59% |
| Mar-11 | 458.51 | 1253.88 | 36.57% |
| Total | 4056.51 | 11800.58 | 34.38% |



About 155 Open Access Consumers were procuring part of their power requirements through PXIL. These consumers were mostly located in Tamil Nadu, Punjab and Rajasthan. During the year, these OA consumers procured a total of about 93 MU of electricity through PXIL. In 2010-11, the weighted average price of electricity bought by open access consumers at PXIL was lower (₹3.62/kWh) when compared with the weighted average price of total electricity transacted through PXIL (₹3.87/kWh).

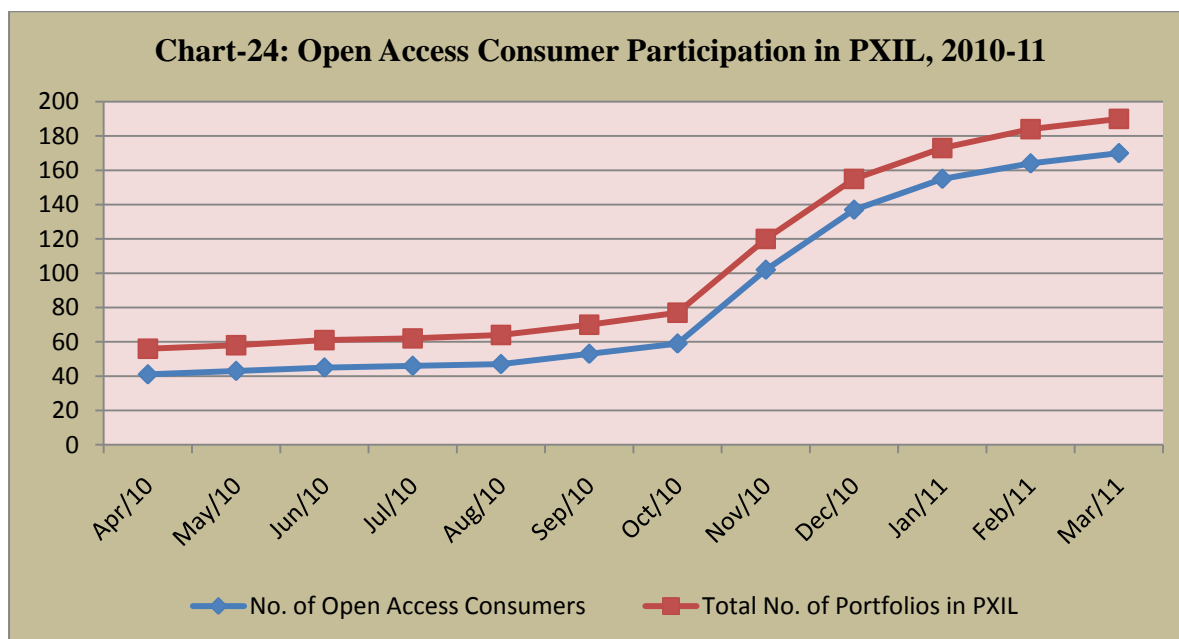
In Table-15 & Chart-24, a monthly comparison is made between number of open access consumer participation and total number of portfolios in PXIL. In Table-16 & Chart-25, a monthly comparison is shown between purchase volume of open access consumers and total volume of PXIL. It is seen that the number of OA consumers as a percentage of total number of portfolios in PXIL has steadily gone up from about 73% at the beginning of the year in April 2010 to about 89.5 % at the end of the year in March 2011. Surprisingly, however, as per the data from PXIL, it is seen that it is only from the month of October 2010 that OA consumers started procuring power in PXIL. Like IEX, however, once OA consumers started their procurement in PXIL, here too the volumes procured by OA consumers as a percentage of total volume transacted in PXIL went up rapidly – starting with

mere 1.9 % in October 2010, the percentage of total volume procured by OA consumers went up to as much as 6.2% by the end of the year in March 2011. In between, in the month of December 2010, the percentage of total volume procured by OA consumers was about 21%. For the year as a whole, volume procured by OA consumers as a percentage of total volume transacted in PXIL was about 5.33 %.

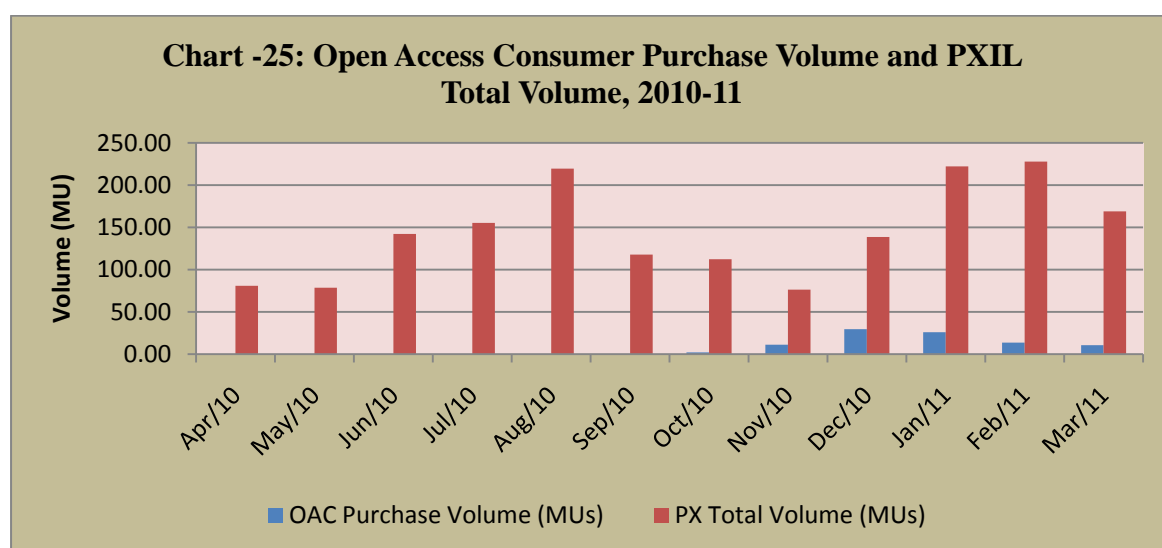
Table-15: Number of Open Access Consumers in PXIL, 2010-11

| Month | No. of Open Access Consumers | Total No. of Portfolios in PXIL | % of Open Access Consumers |
|--------|------------------------------|---------------------------------|----------------------------|
| Apr-10 | 41 | 56 | 73.21% |
| May-10 | 43 | 58 | 74.14% |
| Jun-10 | 45 | 61 | 73.77% |
| Jul-10 | 46 | 62 | 74.19% |
| Aug-10 | 47 | 64 | 73.44% |
| Sep-10 | 53 | 70 | 75.71% |
| Oct-10 | 59 | 77 | 76.62% |
| Nov-10 | 102 | 120 | 85.00% |
| Dec-10 | 137 | 155 | 88.39% |
| Jan-11 | 155 | 173 | 89.60% |
| Feb-11 | 164 | 184 | 89.13% |
| Mar-11 | 170 | 190 | 89.47% |

Chart-24: Open Access Consumer Participation in PXIL, 2010-11



| Table-16: Volume Participation of Open Access Consumers in Day Ahead Market of PXIL in 2010-11 | | | |
|---|----------------------------------|------------------------------|-------------------------------------|
| Month | OAC Purchase Volume (MUs) | PX Total Volume (MUs) | % OAC Purchase Participation |
| Apr-10 | 0.00 | 80.77 | 0.00% |
| May-10 | 0.00 | 78.53 | 0.00% |
| Jun-10 | 0.00 | 142.25 | 0.00% |
| Jul-10 | 0.00 | 155.19 | 0.00% |
| Aug-10 | 0.00 | 219.44 | 0.00% |
| Sep-10 | 0.00 | 117.80 | 0.00% |
| Oct-10 | 2.08 | 112.31 | 1.86% |
| Nov-10 | 11.17 | 76.22 | 14.66% |
| Dec-10 | 29.57 | 138.60 | 21.34% |
| Jan-11 | 25.89 | 222.14 | 11.66% |
| Feb-11 | 13.53 | 227.90 | 5.94% |
| Mar-11 | 10.47 | 169.01 | 6.19% |
| Total | 92.72 | 1740.17 | 5.33% |



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

Table-17 and Table-18 below show top 10 sellers and buyers of electricity through trading licensees (bilateral trader segment transactions). The same data with respect to IEX is shown in Table-19 and Table-20 and the same data with respect to PXIL is shown in Table-21 and Table-22. It is seen that dominant sellers at both, the power exchanges and through licensed traders, re a mixed group comprising of independent power producers, distribution

companies, state government agencies/bodies, and captive power plants. The major buyers through trading licensees and at power exchanges are mostly Northern and Southern region distribution companies and state electricity boards.

| Table-17: Major Sellers of Electricity through Bilateral Trader Segment (Trading Licensees) in 2010-11 | | | | | |
|--|--------------------------------|-------------------------------|--------------------|--|---|
| S.No | Seller | State | Volume (MU) | Approximate percentage of total volume transacted through traders | Weighted Average Sale Price in ₹/kWh |
| 1 | LANCO + LAPL+LKPPL | Chhattisgarh + Andhra Pradesh | 2949.62 | 16.33% | 4.71 |
| 2 | Government of Himachal Pradesh | Himachal Pradesh | 2807.24 | 15.54% | 5.06 |
| 3 | JPL | Chhattisgarh | 2200.14 | 12.18% | 4.66 |
| 4 | JSWEL | Karnataka | 1363.27 | 7.55% | 4.76 |
| 5 | SPDC J&K | Jammu & Kashmir | 1349.19 | 7.47% | 4.13 |
| 6 | Torrent Power Limited | Gujarat | 984.78 | 5.45% | 4.81 |
| 7 | CSPTCL | Chhattisgarh | 911.60 | 5.05% | 4.52 |
| 8 | Adani Power Limited | Gujarat | 806.80 | 4.47% | 4.85 |
| 9 | NBVL | Orissa + Andhra Pradesh | 741.72 | 4.11% | 4.67 |
| 10 | BALCO | Chhattisgarh | 719.92 | 3.99% | 4.91 |
| <i>Note: Volume sold by major sellers and total volume transacted through trading licensees does not include the volume through banking arrangement.</i> | | | | | |

| Table-18: Major Buyers of Electricity through Bilateral Trader Segment (Trading Licensees) in 2010-11 | | | | | |
|--|--------------|------------------|--------------------|--|---|
| S.No | Buyer | State | Volume (MU) | Approximate percentage of total volume transacted through traders | Weighted Average Purchase Price in ₹/kWh |
| 1 | BESCOM | Karnataka | 2329.53 | 11.60% | 4.57 |
| 2 | PSEB | Punjab | 2293.37 | 11.42% | 5.28 |
| 3 | TNEB | Tamil Nadu | 2184.30 | 10.88% | 5.36 |
| 4 | APPCC | Andhra Pradesh | 1679.63 | 8.36% | 5.09 |
| 5 | MSEDCL | Maharashtra | 1191.29 | 5.93% | 4.77 |
| 6 | HPSEB | Himachal Pradesh | 1116.62 | 5.56% | 3.30 |
| 7 | HPPC | Haryana | 1107.27 | 5.51% | 5.01 |

| | | | | | |
|----|-------|--------|--------|-------|------|
| 8 | NDPL | Delhi | 925.74 | 4.61% | 6.02 |
| 9 | BRPL | Delhi | 798.13 | 3.97% | 5.87 |
| 10 | PSPCL | Punjab | 776.87 | 3.87% | 4.51 |

Note: Volume bought by major buyers and total volume transacted through trading licensees does not include the volume through banking arrangement.

From the above Table-18 it is seen that major buyers such as PSEB, TNEB, APPCC, HPPC, NDPL and BRPL have bought electricity from traders under bilateral transactions at weighted average prices which were higher than the weighted average price for the entire bilateral trader segment, which was ₹4.79/kWh

| Table-19: Major Sellers of Electricity in the Day Ahead Market in IEX, 2010-11 | | | | | |
|---|--------------------------------|------------------|------------------|--|-------------------------------------|
| 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 | 1541.54 | 13.06% | 3.81 |
| 2 | BRPL | Delhi | 951.56 | 8.06% | 3.31 |
| 3 | CGSEB | Chhattisgarh | 791.09 | 6.70% | 2.64 |
| 4 | Torrent Power, Sugen | Gujarat | 651.29 | 5.52% | 3.63 |
| 5 | BYPL | Delhi | 618.61 | 5.24% | 3.40 |
| 6 | BALCO | Chhattisgarh | 528.83 | 4.48% | 2.89 |
| 7 | WBSEDCL | West Bengal | 483.79 | 4.10% | 3.07 |
| 8 | Government of Himachal Pradesh | Himachal Pradesh | 458.70 | 3.89% | 3.36 |
| 9 | LANCO Kondapalli Power | Andhra Pradesh | 401.09 | 3.40% | 3.77 |
| 10 | JPL | Jindal Power | 397.93 | 3.37% | 2.83 |

Note: Total Volume transacted through Day Ahead Market in IEX was about 11800 MU.

| Table-20: Major Buyers of Electricity in the Day Ahead Market in IEX, 2010-11 | | | | | |
|--|---------------|---------------|-----------------|--|------------------------------------|
| S.No. | Name of Buyer | State | Buy Volume (MU) | Percentage of the Total Volume Transacted in IEX | Weighted Average Buy Price (₹/kWh) |
| 1 | TNEB | Tamil Nadu | 2043.57 | 17.32% | 4.95 |
| 2 | UPPCL | Uttar Pradesh | 1185.15 | 10.04% | 3.32 |
| 3 | JVVNL | Rajasthan | 1136.76 | 9.63% | 4.19 |
| 4 | MSEDCL | Maharashtra | 674.70 | 5.72% | 3.70 |
| 5 | R Infra | Maharashtra | 641.65 | 5.44% | 3.62 |

| | | | | | |
|----|----------------------|----------------|--------|-------|------|
| 6 | HPPC | Haryana | 440.56 | 3.73% | 5.31 |
| 7 | JSL Ltd | Haryana | 384.28 | 3.26% | 2.43 |
| 8 | APCPDCL | Andhra Pradesh | 262.87 | 2.23% | 4.42 |
| 9 | KSEB | Kerala | 215.30 | 1.82% | 3.71 |
| 10 | Torrent Power, Surat | Gujarat | 200.58 | 1.70% | 4.30 |

Note: Total Volume transacted through IEX was about 11800 MU.

From the above Table-20 it is seen that major buyers such as Tamil Nadu, UPPCL, APPCC, JVVNL, MSEDCL, HPPC, APCPDCL and KSEB 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, which was ₹3.38/kWh

| Table-21: Major Sellers of Electricity in the Day Ahead Market in PXIL, 2010-11 | | | | | |
|--|---------------------------|------------------|-------------------------|--|--|
| 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 | 962.5744 | 55.31% | 3.77 |
| 2 | CSPTCL | CHHATTISGARH | 156.4561 | 8.99% | 2.56 |
| 3 | APTRANSCO | ANDRA PRADESH | 87.1786 | 5.01% | 3.51 |
| 4 | Uttarakhand Power Company | UTTARAKHAND | 72.8866 | 4.19% | 2.44 |
| 5 | BYPL | DELHI | 51.9797 | 2.99% | 2.82 |
| 6 | BRPL | DELHI | 44.6012 | 2.56% | 3.49 |
| 7 | HPSEB | HIMACHAL PRADESH | 44.1187 | 2.54% | 2.61 |
| 8 | WBSEDCL | WEST BENGAL | 39.6440 | 2.28% | 3.41 |
| 9 | LANCO, Kondapalli | ANDRA PRADESH | 34.1623 | 1.96% | 5.63 |
| 10 | GEL | ANDRA PRADESH | 33.2685 | 1.91% | 3.74 |

Note: Total Volume transacted in the Day Ahead Market in PXIL was about 1740 MU.

| Table-22: Major Buyers of Electricity in Day Ahead Market in PXIL, 2010-11 | | | | | |
|---|--------------------------|----------------|------------------------|--|---|
| Sr. No | Name of the Buyer | State | Buy Volume (MU) | Percentage of the Total Volume Transacted | Weighted Average Buy Price (₹/kWh) |
| 1 | TNEB | TAMILNADU | 560.92 | 32.23% | 4.83 |
| 2 | RPPC | RAJASTHAN | 309.46 | 17.78% | 4.11 |
| 3 | UPPCL | UTTAR PRADESH | 283.38 | 16.28% | 3.28 |
| 4 | KSEB | KERALA | 201.91 | 11.60% | 3.53 |
| 5 | APTRANSCO | ANDRA PRADESH | 101.57 | 5.84% | 4.80 |
| 6 | TPC D | MUMBAI | 62.56 | 3.59% | 3.05 |
| 7 | Wardha Power Company Ltd | MAHARASHTRA | 40.89 | 2.35% | 3.81 |
| 8 | PCKL | KARNATAKA | 21.18 | 1.22% | 3.81 |
| 9 | MPPTCL | MADHYA PRADESH | 19.38 | 1.11% | 3.02 |
| 10 | NDPL | DELHI | 16.65 | 0.96% | 7.07 |

Note: Total Volume transacted through PXIL was about 1740 MU.

From the above Table-22 it is seen that major buyers such as NDPL, Tamil Nadu, Rajasthan, and APTRANSCO 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, which was ₹Rs. 3.87/kWh.

6. 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-23.

During 2010-11, in IEX, the unconstrained cleared volume and the actual volume transacted was 12.26 billion kWh and 11.80 billion kWh respectively. This is indicating that the actual transacted volume could have been about 3.94 percent higher had there been no congestion present in the system. During the same year, in PXIL, the unconstrained cleared volume and the actual volume transacted was 2.01 billion kWh and 1.74 billion kWh respectively. This is indicating that the actual transacted volume could have been about 15.45 percent higher had there been no congestion present in the system.

Congestion, consequent market splitting and the resultant difference in market prices in different regions give rise to congestion amount. This congestion amount is being

deposited in to the Power System Development Fund, created pursuant to CERC (Power System Development Fund) Regulations, 2010. Congestion in power exchanges thus, apart from affecting the volume, also results in formation of a fund. The congestion revenue/amount as of 31st March 2011 was ₹457.04 crore.

| Table-23: Details of Congestion in Power Exchanges, 2010-11 | | | |
|--|--|------------|-------------|
| | Details of Congestion | IEX | PXIL |
| A | Unconstrained Cleared Volume* (MU) | 12264.46 | 2009.09 |
| B | Actual Cleared Volume and hence scheduled (MU) | 11800.57 | 1740.17 |
| C | Volume of electricity that could not be cleared and hence not scheduled because of congestion (MU) (A-B) | 463.90 | 268.93 |
| D | Volume of electricity that could not be cleared as % to Actual Cleared Volume | 3.93% | 15.45% |
| * This power would have been scheduled had there been no congestion. | | | |

7. Comparison of short term prices with Tariffs of long term sources of power for various distribution companies

It is seen that short term market, including UI, power transacted through licensed traders (inter-state part), bilateral power transactions directly between DISCOMs, and power transacted through power exchanges met about 10 percent of the power requirement of the distribution companies in the year 2010-11. The balance i.e., about 90 percent of the power requirement of the distribution companies in the country was met from power procured under long term contracts from state and central government owned power generating companies and independent power producers (also intra-state power purchases from traders under bilateral transactions). The central government power generating companies in 2010-11, accounted for about 43 percent of the total power generation in the country. From the data presented earlier, it is seen that during the year 2010-11, the weighted average cost of electricity procured through different segments of short term power market was as follows:

| Table-24: Price of Short-Term Transactions of Electricity in 2010-11 | |
|--|----------------------|
| Description | Price (₹/kWh) |
| Weighted average price of power procured through Power exchanges | 3.47 |
| Weighted average price of power procured through Traders | 4.79 |
| Weighted average price of power procured through Traders and Power exchanges | 4.32 |
| Average price of power through UI | 3.91 |
| Combined weighted average price of electricity procured UI, traders, and power exchanges | 4.15 |

The distribution companies thus paid about ₹ 4.32 for procuring one unit of electricity through short term market, if UI is excluded and about ₹ 4.15 per unit if UI is included.

As against this, the prices paid by distribution companies to procure power from central government owned generating companies (about 43 percent of total generation in the country) for the year 2010-11 (under long term Power Purchase Agreements) are shown in Table-25 and 26. It is seen that, on an average, the distribution companies paid between ₹1.29 and ₹3.71 per kWh for procuring power from coal and lignite based stations, between ₹2.50 and ₹5.95 per kWh for procuring power from gas/RLNG based power stations, between ₹8.27 and ₹10.14 per kWh for liquid fuel based power stations (Table-25), and between ₹0.56 per kWh and ₹6.01 per kWh for procuring power from hydro stations (Table-26).

From Table-27, it is also seen that the levelised tariff for power long term available from power projects bid in the year 2010 under Case I varies in the range of ₹2.35 per kWh to ₹3.28 per kWh.

| Table-25: Tariff of Thermal Generating Stations of NTPC, NLC and NEEPCO, 2010-11 | | | | | |
|---|---------------------------------------|--|----------------------------------|---|--------------------------|
| Sl. No. | Name of the Generating Station | Installed Capacity (MW) as on 31.3.2010 | Fixed charges (Paise/kWh) | Energy Charges (Paise/kWh) as on March, 2011 | Total (Paise/kWh) |
| I: Coal Based thermal generating Stations of NTPC | | | | | |
| A. Pit head Generating Stations | | | | | |
| 1 | Rihand STPS St-I | 1000 | 50 | 144 | 194 |
| 2 | Rihand STPS St-II | 1000 | 76 | 153 | 228 |
| 3 | Singrauli STPS | 2000 | 26 | 138 | 163 |
| 4 | Vindhyachal STPS St-I | 1260 | 35 | 156 | 191 |
| 5 | Vindhyachal STPS St-II | 1000 | 58 | 151 | 209 |
| 6 | Vindhyachal STPS St-III | 1000 | 88 | 151 | 239 |
| 7 | Korba STPS | 2100 | 29 | 100 | 129 |
| 8 | Ramagundam STPS St-I & II | 2100 | 33 | 152 | 185 |
| 9 | Ramagundam STPS St-III | 500 | 76 | 225 | 301 |
| 10 | Talcher TPS | 460 | 60 | | 60 |
| 11 | Talcher STPS St-I | 1000 | 58 | 172 | 230 |
| 12 | Talcher STPS St-II | 2000 | 63 | 172 | 235 |
| 13 | Sipat-II | 1000 | 102 | 77 | 179 |
| | Sub-Total | 16420 | | | |
| B. Non-Pit head Generating Stations | | | | | |
| 14 | FGUTPP TPS St-I | 420 | 50 | 186 | 236 |
| 15 | FGUTPP St-II | 420 | 62 | 187 | 249 |
| 16 | FGUTPP St-III | 210 | 104 | 187 | 291 |
| 17 | NCTP Dadri (stage-I) | 840 | 56 | 219 | 275 |
| | NCTP Dadri (stage-II) | 490 | 0 | 0 | 0 |
| 18 | Farrakka STPS | 1600 | 47 | 282 | 329 |
| 19 | Tanda TPS | 440 | 60 | 243 | 303 |
| 20 | Badarpur TPS | 705 | 46 | 325 | 371 |
| 21 | Kahalgaon STPS St-I | 840 | 61 | 199 | 260 |
| 22 | Kahalgaon STPS St-II | 1500 | 50 | 193 | 242 |
| 23 | Simhadri | 1000 | 68 | 171 | 238 |
| | Sub-Total | 8465 | | | |
| | Total Coal | 24885 | | | |
| II: Using Natural Gas as Fuel | | | | | |
| 1 | Dadri CCGT | 830 | 31 | 238 | 270 |
| 2 | Faridabad | 431 | 61 | 207 | 267 |
| 3 | Anta CCGT | 419 | 34 | 248 | 282 |
| 4 | Auraiya GPS | 663 | 24 | 237 | 261 |
| 5 | Gandhar GPS | 657 | 77 | 192 | 269 |
| 6 | Kawas GPS | 656 | 56 | 194 | 250 |
| | Total | 3657 | | | |

| III: Using LNG as Fuel | | | | | |
|---|----------------------|-------------|-----|-----|------|
| 1 | Dadri CCGT | 830 | 31 | 485 | 516 |
| 2 | Anta CCGT | 419 | 34 | 406 | 440 |
| 3 | Auraiya GPS | 663 | 24 | 495 | 519 |
| 4 | Gandhar GPS | 657 | 77 | 518 | 595 |
| 5 | Kawas GPS | 656 | 56 | 527 | 583 |
| 6 | Faridabad | 431 | 61 | 370 | 430 |
| | Total | 3226 | | | |
| IV: Using (Naphtha/HSD) as Fuel | | | | | |
| 1 | Dadri CCGT | 830 | 31 | 795 | 827 |
| 2 | Faridabad | 431 | 61 | 0 | 0 |
| 3 | Anta CCGT | 419 | 34 | 811 | 845 |
| 4 | Auraiya GPS | 663 | 24 | 990 | 1014 |
| 5 | Kawas GPS | 656 | 56 | 0 | 0 |
| 6 | Kayamkulam CCGT | 360 | 72 | 926 | 998 |
| | Total | 3359 | | | |
| <i>Note1: For NTPC stations : AFC for 2010-11 , Provisional as approved AFC by CERC for the period 2008-09</i> | | | | | |
| V: Lignite Based thermal generating Stations of NLC | | | | | |
| 1 | TPS-I | 600 | 42 | 132 | 174 |
| 2 | TPS-II Stage-I | 630 | 29 | 121 | 150 |
| 3 | TPS-II Stage-II | 840 | 32 | 121 | 153 |
| 4 | TPS-I (Expansion) | 420 | 91 | 184 | 274 |
| | Total Lignite | 2490 | | | |
| <i>Note2: For NLC TPS-I&II &stage-II : AFC for 2010-11 , Provisional as approved AFC by CERC for the period 2008-09</i> | | | | | |
| <i>Note3: For NLC TPS-I Expansion : AFC for 2010-11 , Approved AFC by CERC for the period 2009-14</i> | | | | | |
| VI: North Eastern Electric Power Corporation Ltd. | | | | | |
| 1 | AGBPP | 291 | 133 | 137 | 270 |
| 2 | AGTPP | 84 | 129 | 175 | 304 |
| | Total NEEPCO | 375 | | | |
| <i>Note4: For AGTPP : AFC for 2010-11 , Approved AFC by CERC for the period 2009-14</i> | | | | | |
| <i>Note5: For AGBPP : AFC for 2010-11 , Provisional as approved AFC by CERC for the period 2008-09</i> | | | | | |

| Table-26: Composite Tariff of Hydro Stations under the purview of CERC, 2009-10 | | | | |
|--|--------------------|--------------------------------|---------------------------------------|---------------------------------|
| Name of Generating Company | Station | Installed Capacity (MW) | Annual Fixed Charges (₹/Lakhs) | Composite Tariff (₹/kWh) |
| NHPC | | | | |
| 1 | Baira siul | 180 | 8481.19 | 1.25 |
| 2 | Loktak | 105 | 8485.87 | 2.17 |
| 3 | Salal | 690 | 17674.23 | 0.66 |
| 4 | Tanakpur | 123 | 7462.67 | 1.89 |
| 5 | Chamera -I | 540 | 19952.65 | 1.38 |
| 6 | Uri-I | 480 | 45062.96 | 2.00 |
| 7 | Rangit | 60 | 4860.23 | 1.65 |
| 8 | Chamera-II | 300 | 34737.20 | 2.66 |
| 9 | Dhauliganga-I | 280 | 26881.76 | 2.72 |
| 10 | Dulhasti | 390 | 99656.42 | 6.01 |
| 11 | Teesta-V | 510 | 36300.00 | 1.62 |
| | | 3658 | | |
| NHDC | | | | |
| 1 | Indira Sagar | 1000 | 50014.00 | 2.55 |
| 2 | Omkareshwar | 520 | 26327.00 | 2.97 |
| | | 1520 | | |
| THDC | | | | |
| 1 | Tehri stage-I | 1000 | 110825.46 | 3.50 |
| | | 1000 | | |
| SJVNL | | | | |
| 1 | Nathpa Jhakri | 1500 | 131243.00 | 2.16 |
| | | 1500 | | |
| NEEPCO | | | | |
| 1 | Khandong | 50 | 1963.28 | 0.81 |
| 2 | Kopili Stage-I | 200 | 5767.38 | 0.56 |
| 3 | Doyang | 75 | 5850.00 | 2.95 |
| 4 | Ranganadi | 420 | 29848.51 | 1.83 |
| 5 | Kopili Stage-II | 25 | 1295.11 | 1.72 |
| | | 770 | | |
| | Total Hydro | 8448 | | 2.33 |
| Note: Figures are provisional | | | | |

| Table-27: Capacity Contracted under Case-I Bidding Route during 2010 | | | | |
|---|--------------------|----------------------|------------------|---------------------------------|
| State | Developer | Capacity (MW) | Fuel Used | Levelised Tariff (₹/kWh) |
| Gujarat | KSK Energy | 1010 | Domestic Coal | 2.35 |
| Gujarat | Essar | 800 | Imported Coal | 2.80 |
| Gujarat | Shapoorji Pallonji | 800 | Imported Coal | 2.80 |
| Maharashtra | Adani | 1320 | Domestic Coal | 3.28 |
| Maharashtra | India Bulls | 1200 | Domestic Coal | 3.26 |
| Maharashtra | Emco | 300 | Domestic Coal | 2.88 |

| List of Trading Licensees as on 31.3.2011 | | | | |
|--|---|---|--------------------------------|---|
| Sr. No. | Name of Licensee | Address | Contact Number | Email-ID |
| 1 | Tata Power Trading Company (P) Ltd. | 34, Sant Tukaram Road, Carnac Bunder, Mumbai-400009 | 022-67172863 022-67172852 | power@tatapowertrading.com jdk@tatapower.com |
| 2 | Adani Enterprises Ltd. | Adani House, Plot No 83, Sector 32, Institutional Area, Gurgaon - 122001 | 0124-2555332 0124-2555555 | praveen.tamak@adani.in, rahul.sharma@adani.com |
| 3 | PTC India Ltd. | 2nd Floor ,NBCC Towers, 15 Bhikaji Cama Place, New Delhi-110066 | 011 -46026724 | hde@ptcindia.com |
| 4 | Reliance Energy Trading (P) Ltd. | Reliance Energy Center, Santa Cruz(E), Mumbai-400055 | 011-30323444 | Mahendrakumar.Garg@relianceada.com |
| 5 | Vinergy International (P) Ltd. | Shivsagar Estate, "A" Block 1st Floor South Wing, Dr. Annie Besant Road Worli, Mumbai – 400 018. | 022 6653 7221 / 7222/7179 | spverma@vinergy.in |
| 6 | NTPC Vidyut Vyapar Nigam Ltd. | NTPC Bhawan, Core 7, Scope Complex, 7 Institutional Area, Lodhi Road, New Delhi-110003. | 011- 24387741 011- 24364775 | sanehirk.63@gmail.com |
| 7 | National Energy Trading & Services Ltd. | B-Block, 10th Floor, Statesman House, Barakhamba Road, New Delhi-110001 | 011-66035888 | rajendran@lancogroup.com |
| 8 | Karam Chand Thapar & Bros Ltd. | Thapar House, 25 Brabourne Road ,Kolkata, West Bengal-700001 | 033- 4005 7000 | kctpowertrading@yahoo.in |
| 9 | Subhash Kabini Power Corporation Ltd. | 8/2 Ulsoor Road, Bangalore – 560042 | 080-41229490 | prem.bhatia@spml.co.in |
| 10 | Maheshwari Ispat Ltd. | D-404, City Centre Sec - 1, Salt lake City, Kolkata - 700064 | 033- 23588985/8993 | |
| 11 | Special Blast Ltd | Nathani Building, Shastri Chowk, Raipur-492001(C.G.) | 0771 – 4065900 | pecpltd@specialblasts.com |

| Sr. No. | Name of Licensee | Address | Contact Number | Email-ID |
|---------|---|---|--|---|
| 12 | Instinct Infra & Power Ltd. | C-201, Naraina Ind. Area ,Phase-1, New Delhi-110028 | 011-25893432 011-257796209 | salil@instincttrade.com swati@instincttrade.com |
| 13 | Essar Electric Power Development Corporation Ltd. | Essar House, 11, Keshavrao Khadye Marg,Mahalaxmi, Mimbai – 400034 | 02266601100 | Anil.Sharma2@essar.com |
| 14 | Suryachakra Power Corporation (P) Ltd. | 725,1st floor, Street No.11, Himayathnagar, Hyderabad-500029 | 040-23550597 | admin@suryachakra.com |
| 15 | JSW Power Trading Company Ltd. | Jindal Mansion, 5-A, G Deshmukh Marg, Mumbai-400026 | 011-46191101 | hiralal.chaudhary@jsw.in satish.jindal@jsw.in |
| 16 | Visa Power Ltd. | 9, Shakespeare Sarani, Kolkata- 700071 | 033-305191202 | paramesh.bhattacharyya@visapower.net.in, r.bose@visapower.net.in |
| 17 | Pune Power Development Pvt. Ltd | Anmol, 25, Yashwant Nagar, Range Hill Corner, Pune – 411007 | | tarti30@gmail.com, punepower.power@gmail.com |
| 18 | Ispat Energy Ltd. | 202, Town Centre, Andheri – Kurla Road, Marol, Andheri (East) Mumbai – 400059 | 022-66542222 022-66542398 | saurabh_chaturvedi@ispatind.com |
| 19 | Greenko Energies (P) Ltd. | #1071, Road No. 44, Jubilee Hills, Hyderabad - 500033 | 0771-4266902 040 40301000 04032915858 04032946868 | vandanaavidyut@rediffmail.com |
| 20 | Vandana Vidyut Ltd. | Vandana Bhawan M.G. Road, Raipur – 492001 Chhattisgarh | 077140060000 | agmfinance@vanadanaaglobal.com |
| 21 | Indrajit Power Technology (P) Ltd. | 1, Pearl Mansion (N), 91, M. Karve Road, Mumbai-400 020. | 022-0418260 022-22006969 | rmalegavi@indrainfra.in |
| 22 | Adhunik Alloys & Power Ltd. | Crescent Tower (3rd Floor), 229 A.J.C. Bose Road, Kolkatta-20 | 033-30915300 | vksarawagi@adhunikgroup.co.in |
| 23 | Indiabulls Power Trading Ltd. | Indiabulls House, 448 – 451,Udyog Vihar, Phase – V, Gurgaon – 122001 | | prashantpanda@indiabulls.com |

| Sr. No. | Name of Licensee | Address | Contact Number | Email-ID |
|---------|---|---|--------------------------------|---|
| 24 | Jindal Power Trading Company Ltd. | 12, Bhikaiji Cama Place, New Delhi 110 066, India | 011-1619674 011-25928038/45 | |
| 25 | RPG Power Trading Company Ltd. | 6th Floor, Agrawal House, 2 St George Gate Road, Kolkatta-700022 | 033-2109358 033-66252010 | sk.dube@rpg.in |
| 26 | GMR Energy Trading Ltd. | IBC- knowledge Park, Phase 2, 9th Floor, Tower-D, 4/1, Bannerghatta Road, Near Dairy Circle, Bangalore-560029 | 080-40432000 080-40432744 | sunil.agarwal@gmrgroup.in Surajeet.Mukherjee@gmrgroup.in |
| 27 | Jain Energy Ltd. | 39, Shakespeare Sarani, 5th Floor, Premlata Kolkata – 700017 | 080-40533249 | info@jaingroup.com |
| 28 | Righill Electrics Ltd. | Righill Electric Pvt Ltd. 5/1 to 5/3, Sector – H, Industrial Area, Govindpura, Bhopal – 462023 | 0755-4284170 | |
| 29 | Shyam Indus Power Solutions (P) Ltd. | 129, Transport Centre, Rohtak Road, Punjabi Bagh, New Delhi – 110035 | | pdgoyal@shyamindus.com shyamindus@vsnl.net |
| 30 | Global Energy (P) Ltd. | 1st Floor, Shangri La's Eros Corporate Plaza, 19 Ashoka Road, Connaught Place, New Delhi-11001 | 011-47334444 | gace@gecindia.com |
| 31 | Knowledge Infrastructure Systems (P) Ltd. | G-02, Salcon Aurum Complex, 4, Commercial Centre, Jasola, New Delhi-110076 | 011-1651074 011-46067070 | mahajan@knowledgegroup.in |
| 32 | Mittal Processors (P) Ltd. | GF-71, Vardman Apartment, Abhay Khand-III, Indira Puram, Ghaziabad-201010, U.P. | 0180-6612531/532 | info@mittalsgroup.com controlroom@mittalgroup.com |
| 33 | Godavari Power & Ispat Ltd. | Hira Arcade Pandri, Raipur, Chhattisgarh | 0771-4082333 | tradepower@gpilindia.com igl@hiragroup.india.com |

| Sr. No. | Name of Licensee | Address | Contact Number | Email-ID |
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| 34 | Shree Cement Ltd. | 101, Hans Bhawan, Bahadur Shah Zafar Marg, New Delhi-110002 | 011-23370320 011-23370828 | muley@shreecemetltd. com |
| 35 | PCM Power Trading Corporation Ltd. | PCM Power Trading Company Limited Dabriwala House, 10 – C, Middleton Row, 4th Floor, Block – C, Kolkata – 700071 | 0353-2777028 /29/40 | infopcmpowertrading. co.in |
| 36 | Abellon Clean Energy Ltd. | Sangeeta Complex, Near Parimal Crossing, Ellisbridge, Ahmedabad- 380006 | 079-663093382 | mandavi.singh@abell onpower |
| 37 | Jay Polychem (India) Ltd. | D-143, Defence Colony, New delhi-110024 | | info@jaypolychem.co m |
| 38 | Jai Prakash Associates Ltd. | JA House, 63 Basant Lok, Basant Vihar, New Delhi-110057 | 011-26141540 011-26147411 | |
| 39 | My Home Power Ltd. | 3rd Block, 5th Floor, “My Home Hub”, Madhapur, Hyderabad – 500081 | 40 6622 2700. | projects@myhomepo wer.in |
| 40 | Customised Energy Solutions India Private Ltd. | A 501,GO Square, Waquad, Hinjewadi link Road, Pune-411057 | | |

Historic Volatility Calculation

Volatility = Standard deviation of daily prices returns.

Historical Volatility Formula:

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

where

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

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

Herfindahl-Hirschman Index (HHI) Calculation

Formula for computing the HHI is as under:

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

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

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

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

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