EXPLANATORY MEMORANDUM FOR REVISION IN UNSCHEDULED INTERCHANGE MECHANISM

1. BACKGROUND AND APPROACH

1.1. Background

The Central Electricity Regulatory Commission (herein referred as 'Commission' or 'CERC') with the objective of facilitating grid discipline, introduced the Availability Based Tariff (ABT) Mechanism vide its Order dated January 4, 2000 at inter-State level, which was implemented in different regions in a phased manner. Under the ABT mechanism, the generator and beneficiaries are required to provide the generation and drawal schedule on day-ahead basis. Any deviation from the scheduled generation and drawal on the day of operation is settled through Unscheduled Interchange (UI) mechanism. The prices for settlement under UI mechanism have been linked with the frequency.

In the past, the UI Ceiling rate and UI rates at various frequencies have been notified by the Commission through different amendments to its earlier Terms and Conditions of Tariff Regulations. However, in the new Tariff Regulations i.e. CERC (Terms and Conditions of Tariff), Regulations, 2009, the Commission has specified that UI charges shall be governed through separate Regulations. The relevant text of Clause 24 is reproduced below for easy reference:

> *"24. **Unscheduled Interchange (UI) Charges** (1) All variations between actual net injection and scheduled net injection for the generating stations, and all variations between actual net drawal and scheduled net drawal for the beneficiaries shall be treated as their respective Unscheduled Interchanges (UI), charges for which shall be governed by the relevant regulations specified by the Commission from time to time."*

Further, the Commission while issuing the Order in the matter of "Measures for restricting the prices of electricity in short-term market" dated December 17, 2008

specified that a comprehensive review of UI pricing is necessary. The relevant text of Para 77 is reproduced below for easy reference:

> *"77. A large number of views have been expressed by the stakeholders regarding the UI mechanism and the UI price vector. We feel that a comprehensive examination of various issues involved is necessary. We, therefore, direct the staff to take up a thorough study of the concept of UI, movement of actual UI prices over the last three years and its impact on the prices of electricity being traded/sold in short-term and place the findings of the study along with proposal for modification in UI mechanism, if any, before the Commission for its decision. This study may be completed within a period of two months."*

With this background, the Commission engaged ABPS Infrastructure Advisory Private Limited (ABPS Infra) for assisting the staff of the Commission in undertaking a comprehensive review of the UI mechanism and to address other associated issues.

The issues raised by stakeholders regarding the UI mechanism and UI price vector include:

- Increase in short-term trading prices with increase in UI ceiling rate
- UI is a disciplinary mechanism, and a grid balancing mechanism is being used as a trading mechanism
- Frequency is not the sole consideration in grid management and even if system frequency is within range, large unscheduled power flows on certain elements can result in catastrophic grid failure.
- UI quantum has increased substantially, which is a threat to grid security
- UI mechanism should be made more stringent for unscheduled interchanges of DISCOMs/(SEBs) as the DISCOMs have the ability and capability to effect load shedding or switching from drawals as per schedule to over/under draw to suit their requirement

Considering the issues raised by various stakeholders, the following aspects of UI mechanism were analysed:

- Analysis of Frequency Variation with UI Price Vector
- Movement of short-term trading prices with UI Prices
- Rationale for UI Ceiling Rate
- Trends of increase in UI Volumes and whether a limit is required to be put on UI volumes
- Necessity of review of operating frequency range
- Review of UI price vector
- Treatment of surplus fund created through UI mechanism

1.2. Approach

For analysing the various aspects discussed above, it was essential to undertake a comprehensive review of UI mechanism in the past in order to assess the extent to which the UI mechanism has been able to achieve its defined objective and to assess whether the modification in UI rates has affected the short-term trading prices.

In this regard, assistance of the the Consultant was taken and the following data was arranged and provided to the Consultant for analysis:

- Time block-wise frequency data was obtained from PGCIL for the period from April 1, 2005 to December 31, 2008.
- Details of all trading contracts of three trading licensees, i.e., PTC India Ltd, Reliance Energy Trading Limited and NVVNL was obtained for the period Feb, 2006 to December 31, 2008
- Time block-wise day-wise UI transactions of all the beneficiaries and generating stations in the Northern Region for the period from January 1, 2007 to January 31, 2009.

The past data was analysed in the following manner:

A. Analysis of change in UI Price vector on movement of frequency

Analysis of the time block-wise frequency data for three distinct time periods incidental to the period of UI revision notified by the Commission as follows:

Period 1: April 1, 2005 to April 25, 2007

Period 2: April 26, 2007 to January 6, 2008

Period 3: Jan 7, 2008 to December 31, 2008

B. Analysis of impact of change in UI Price on short-term traded rate

Analysis of the impact of change in UI Price on the short-term traded rate for three distinct time periods depending on the period of UI revision notified by the Commission as follows:

Period 1: January 2006 to April 25, 2007

Period 2: April 26, 2007 to January 6, 2008

Period 3: Jan 7, 2008 to December 31, 2008

Further, to analyse the seasonal variations and to analyse the average UI rate for energy overdrawal by the beneficiaries, it was decided to carry out the analysis of short-term traded rate and average UI rate of energy drawal by beneficiaries in the northern region for two summer (May and June) and two winter (November and December) months in 2007 and 2008.

C. Extent of UI Overdrawal

Analysis of maximum and minimum UI Overdrawal during the different time blocks of the day by beneficiaries in Northern Region for the period July 1, 2008 to December 31, 2008.

2. OVERVIEW OF UI MECHANISM

The UI Mechanism was introduced through the implementation of Availability Based Tariff (ABT) regime in India based on the Order issued by the CERC on January 4, 2000. The ABT mechanism was implemented in a phased manner across the five regions of India, as under:

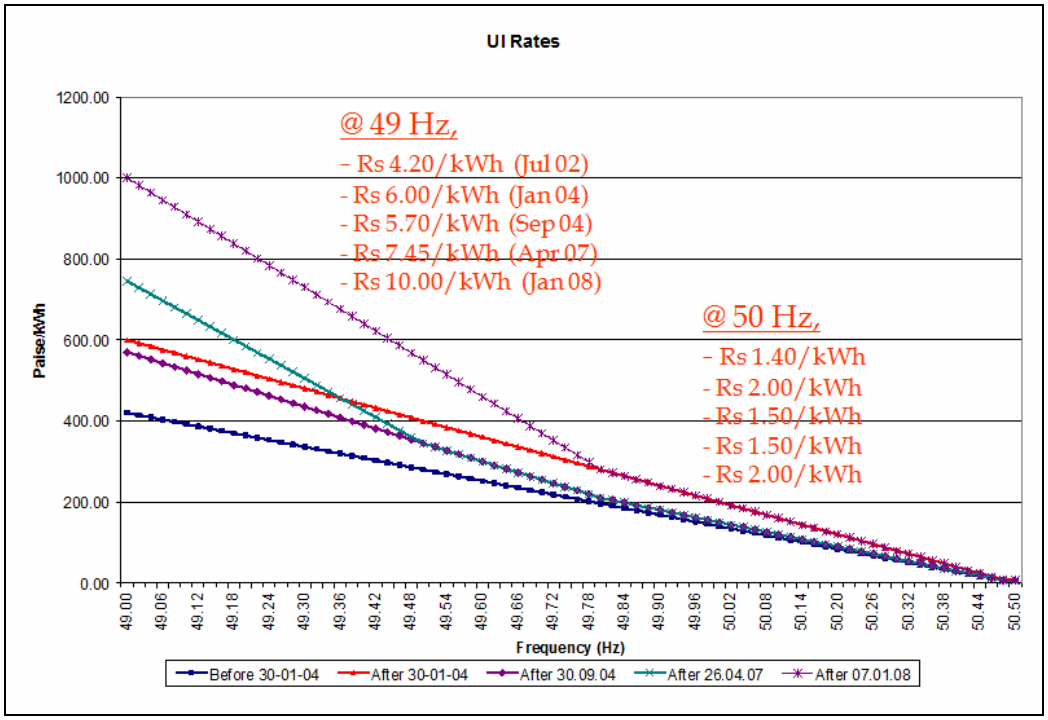
Region	Date of implementation
Western Region	1.7.2002
Northern Region	1.10.2002
Southern Region	1.1.2003
Eastern Region	1.4.2003
North Eastern Region	1.11.2003

Under the ABT mechanism, the generators are required to furnish their declared capacity and generation schedule on day-ahead basis for each 15 minute time block. At the same time, beneficiaries are also required to furnish their day ahead drawal schedule from different inter-State generating stations for each 15 minute time block. The deviation in actual generation from scheduled generation and actual drawal from scheduled drawal is settled in accordance with the UI mechanism. The rate under the UI mechanism is linked to the grid frequency, and has been specified by CERC through its 'Terms and Conditions of Tariff Regulations'. The UI price vector has been revised by CERC from time to time by amending the prevailing Terms and Conditions of Tariff Regulations. Initially, the ceiling price of UI notified in June 2002 was Rs 4.20 per kWh. Through subsequent amendments, the UI ceiling price has been revised and as per the last notification issued on December 28, 2007, i.e., CERC (Terms and Conditions of Tariff) (Fourth Amendment) Regulations, 2007, the UI ceiling price is specified as Rs 10 per kWh, which has been effective since January 7, 2008. The revision in max UI rate is linked to the costliest generation. Earlier it was based on generation based on Diesel and

later based on cost of Naphtha. However, during the last revision, the ceiling rate was kept lower than the rate of generation using Naphtha.

The following chart represents the UI price variation over the last 5 years:

Figure 1: UI Price vector at different time periods



The objective of the UI mechanism was to maintain grid discipline by the generators and beneficiaries and limit the swing of frequency variation within a specified limit. In the initial years of operation, ABT achieved significant success in terms of capping the frequency variation within the range of 49 Hz to 50.5 Hz.

However, increasing gap between demand and supply, especially during peak hours, has made the beneficiaries to overdraw electricity vis-à-vis their scheduled drawal. The Regional Load Despatch Centres (RLDCs) as well as the Commission have issued warnings and imposed penalties on beneficiaries to avoid over-drawal.

With this brief overview of UI mechanism, the various aspects of UI mechanism as identified in Section 1 have been elaborated in detail in subsequent sections.

3. ANALYSIS OF FREQUENCY VARIATION WITH UI PRICE VECTOR

While introducing ABT at the regional level during July 2002, following conditions were prevalent at that time which was sought to be addressed: (a) frequent large frequency fluctualtions (from 50 Hz) and (b) Frequent grid disturbances resulting in grid failures. The objective for introduction of frequency linked UI Mechanism was stated as under:

> *"**Enhanced grid discipline in the interconnected Region that will pave the way for higher quality power with more reliability and availability and ensure better utilisation of fuel resources and lower total cost of power.** Grid disturbances and frequency fluctuations as occur in our power system today are serious problems and would be considered unacceptable in any advanced economy. The system of incentives and disincentives allow for penalization of the party responsible for any disruption. This will serve all participating bodies in a power grid to be self-disciplined ensuring quality power supply for all consumers."*

Before implementation of the ABT mechanism, i.e., period prior to July 2002, the grid frequency variations were significant, with grid frequency swinging from as low as 48 Hz to as high as 52 Hz during peak and off-peak hours. To reduce the wide swings in frequency, CERC under its ABT Order and Indian Electricity Grid Code Regulations stipulated the frequency range of 49 Hz to 50.5 Hz, i.e., a band of 1.50 Hz, which was still high as compared to international benchmarks.

After introduction of ABT mechanism and provision of UI mechanism, initially there was marked improvement in frequency profile. Further, not even a single case of grid failure has been reported after implementation of ABT mechanism. But the relative success of UI mechanism in bringing in grid discipline has reportedly been declining over the years, despite revisions in the UI ceiling rate and UI pricing vector.

In order to ascertain the above claim, the frequency variation pattern over the past three years was analysed, in terms of three time period blocks, coinciding with the revisions in the UI price vector as notified by the Commission from time to time, as summarised below:

Periods	Period Nomenclature	No. of days	Time Blocks	UI rate (Rs/kWh)
01-Apr-05 to 25-Apr-07	Period 1	755	72480	0.00-5.70
26-Apr-07 to 06-Jan-08	Period 2	256	24576	0.00-7.45
07-Jan-08 to 31-Dec-08	Period 3	360	34560	0.00-10.00

The frequency variation analysis for the above three periods is shown in the following table:

Table: Frequency profile during different time periods

Frequency Range (Hz)	Period-1 (01-Apr-2005 to 25-Apr-2007)		Period-2 (26-Apr-2007 to 06-Jan-2008)		Period-3 (07-Jan-2008 to 31-Dec-2008)	
	No. of time blocks	% of timeblocks	No. of time blocks	% of timeblocks	No. of time blocks	% of timeblocks
<= 49.00	18934	26.1%	1274	5.2%	5107	14.8%
49.01 – 49.20	14356	19.8%	4075	16.6%	9456	27.4%
49.21 – 49.40	12182	16.8%	5065	20.6%	6607	19.1%
49.41 – 49.60	8361	11.5%	5019	20.4%	5222	15.1%
49.61 – 49.80	6350	8.8%	3839	15.6%	3708	10.7%
49.81 – 50.00	5850	8.1%	3002	12.2%	2512	7.3%
50.01 – 50.20	4381	6.0%	1818	7.4%	1461	4.2%
50.21 – 50.40	1590	2.2%	459	1.9%	442	1.3%
>50.40	476	0.7%	25	0.1%	45	0.1%
TOTAL	**72480**	**100.0%**	**24576**	**100.0%**	**34560**	**100.0%**
Average Frquency	**49.37 Hz**		**49.51 Hz**		**49.37 Hz**	
Median Frequncy	**49.26 Hz**		**49.48 Hz**		**49.28 Hz**	

(Source: Northern Regional Load Despatch Centre)

It is established from the above figures that grid frequency was below 49 Hz for 26.1% of total period when UI ceiling price was 570 paisa/kWh, while after upward revision of UI ceiling price to 745 paisa/kWh, the frequency profile below 49 Hz reduced to 5.2%. However, after revising the UI ceiling price to 1000 paisa/kWh, the frequency profile below 49 Hz was prevalent for 14.8% of timeblocks during the Period-3.

Further, the grid frequency was below 49.2 Hz for around 46% of time blocks in Period-1, 22% of time blocks in Period-2, and 42% of the timeblocks in Period-3. The

average frequency over the three block periods of UI revision has varied from 49.37 Hz (Period-1), to 49.51 Hz (Period-2) and to 49.37 Hz (Period-3). Similarly, median frequency over the three block periods of UI revision has varied from 49.26 Hz (Period-1), to 49.48 Hz (Period-2) and to 49.28 Hz (Period-3). The graph of frequency variation has been attached as **Annexure -1.**

Further, for the three periods, frequency variation analysis has been carried out for different hours of the day, i.e. morning and evening peak hours, and day and night off-peak hours, to understand the grid frequency profile during different time periods in a day. The frequency range variation vs. time of day analysis has been summarised in the following table:

Table: Frequency Range variation Vs Time of Day analysis

Time Period	Time of the Day Classification	Timeblocks	<= 49.00	49.01 – 49.20	49.21 – 49.40	49.41 – 49.60	49.61 – 49.80	49.81 – 50.00	50.01 – 50.20	50.21 – 50.40	>50.40	SUM
Period 1 : 01-Apr-2005 to 25-Apr-2007												
0600 - 0900	Morning Peak	9060	3.1%	2.3%	1.9%	1.4%	1.1%	1.2%	1.0%	0.4%	0.1%	**12.5%**
0900 - 1800	Day Off-peak	27180	10.5%	7.1%	6.0%	4.3%	3.4%	3.3%	2.2%	0.7%	0.1%	**37.5%**
1800 - 2200	Evening Peak	12080	4.8%	3.7%	3.1%	1.8%	1.2%	0.9%	0.7%	0.3%	0.1%	**16.7%**
2200 - 0600	Night Off-peak	24160	7.7%	6.8%	5.8%	4.0%	3.1%	2.7%	2.1%	0.8%	0.4%	**33.3%**
	Total	**72480**	**26.1%**	**19.8%**	**16.8%**	**11.5%**	**8.8%**	**8.1%**	**6.0%**	**2.2%**	**0.7%**	**100.0%**
Period 2 : 26-Apr-2007 to 06-Jan-2008												
0600 - 0900	Morning Peak	3072	0.9%	1.9%	1.8%	2.0%	1.9%	1.9%	1.6%	0.4%	0.0%	**12.5%**
0900 - 1800	Day Off-peak	9216	2.5%	6.7%	6.8%	6.5%	6.1%	5.2%	2.9%	0.7%	0.0%	**37.5%**
1800 - 2200	Evening Peak	4096	0.8%	3.3%	4.5%	4.1%	2.2%	1.2%	0.5%	0.1%	0.0%	**16.7%**
2200 - 0600	Night Off-peak	8192	0.9%	4.6%	7.5%	7.9%	5.4%	4.0%	2.4%	0.6%	0.1%	**33.3%**
	Total	**24576**	**5.2%**	**16.6%**	**20.6%**	**20.4%**	**15.6%**	**12.2%**	**7.4%**	**1.9%**	**0.1%**	**100.0%**
Period 3 : 07-Jan-2008 to 31-Dec-2008												
0600 - 0900	Morning Peak	4320	1.4%	3.5%	2.4%	1.8%	1.4%	1.1%	0.7%	0.2%	0.0%	**12.5%**
0900 - 1800	Day Off-peak	12960	6.0%	11.2%	7.3%	5.5%	3.7%	2.2%	1.3%	0.3%	0.0%	**37.5%**
1800 - 2200	Evening Peak	5760	2.5%	5.4%	3.4%	2.4%	1.6%	1.0%	0.3%	0.1%	0.0%	**16.7%**
2200 - 0600	Night Off-peak	11520	5.0%	7.3%	6.0%	5.4%	4.0%	3.0%	1.9%	0.7%	0.1%	**33.3%**
	Total	**34560**	**14.8%**	**27.4%**	**19.1%**	**15.1%**	**10.7%**	**7.3%**	**4.2%**	**1.3%**	**0.1%**	**100.0%**

(Source: Northern Regional Load Despatch Centre)

Further, the average frequency variation with respect to Time of Day is given in following table:

Table: Average Frequency variation Vs Time of Day analysis

Time Period	Time of the Day Classification	Timeblocks	Average Frequency (Hz)	Median Frequency (Hz)
Period 1 : 01-Apr-2005 to 25-Apr-2007				
0600 - 0900	Morning Peak	9060	49.41	49.30
0900 - 1800	Day Off-peak	27180	49.36	49.24
1800 - 2200	Evening Peak	12080	49.32	49.20
2200 - 0600	Night Off-peak	24160	49.39	49.28
	Total	**72480**	**49.37**	**49.26**
Period 2 : 26-Apr-2007 to 06-Jan-2008				
0600 - 0900	Morning Peak	3072	49.58	49.58
0900 - 1800	Day Off-peak	9216	49.51	49.50
1800 - 2200	Evening Peak	4096	49.43	49.40
2200 - 0600	Night Off-peak	8192	49.53	49.50
	Total	**24576**	**49.51**	**49.48**
Period 3 : 07-Jan-2008 to 31-Dec-2008				
0600 - 0900	Morning Peak	4320	49.40	49.32
0900 - 1800	Day Off-peak	12960	49.34	49.24
1800 - 2200	Evening Peak	5760	49.31	49.22
2200 - 0600	Night Off-peak	11520	49.42	49.36
	Total	**34560**	**49.37**	**49.28**

(Source: Northern Regional Load Despatch Centre)

It is evident from above tables that the frequency profile has remained more or less similar throughout the day irrespective of the time of the day. During Period-3, while average frequency was reported at 49.37 Hz, the average frequency during Morning Peak was 49.40 Hz, during Day Off-peak was 49.34 Hz, during Evening Peak was 49.31 Hz and during Night Off-peak was 49.42 Hz. Thus, there is hardly any variation or improvement in frequency profile through different time periods of the day. Similar pattern has been observed in respect of average and median frequency across the Period-1 and Period-2 as well. Contrary to the popular belief that frequency profile during night off-peak (during lesser demand periods) should be better, average frequency and median frequency during night off-peak were not significantly different from the frequency profile as prevalent during Morning Peak or Evening Peak periods.

One of the important objectives of introducing ABT mechanism was to bring grid discipline among the beneficiaries and generators connected with the inter-State transmission system. During the initial period, i.e., period from 2002 to 2006, the ABT mechanism through frequency linked UI rates achieved significant success in curtailing the wide swings in frequency variations. However, in the recent past, the upward revision in UI price has had less than expected impact in further improving the frequency profile perhaps due to the fact that endeavour has been to remain within the operating range rather than narrowing down the operating range and the fact that UI overdrawal constitutes a small part of the overall basket.

In the present context, it is high time that the options of further narrowing down of the frequency band for grid operations be explored.

4. MOVEMENT OF SHORT TERM TRADING PRICES WITH UI PRICES

Some stakeholders while making representation before CERC during the consultation process in the matter of 'Measures for restricting the prices of electricity in short-term market' have claimed that the rise in short term power purchase rate is not due to actual increase in cost of generation or purchase but is due to upward revision in UI ceiling prices. High UI prices are working as a proxy value for determining the prices of electricity transaction through trading route.

The Commission while issuing the Order in this matter on date December 17, 2008 passed the ruling that comprehensive examination of various issues is necessary and therefore directed its Staff to carry out a study of concept of UI, movement of actual UI prices over the last three years and its impact on the prices of electricity being traded/sold in the short-term.

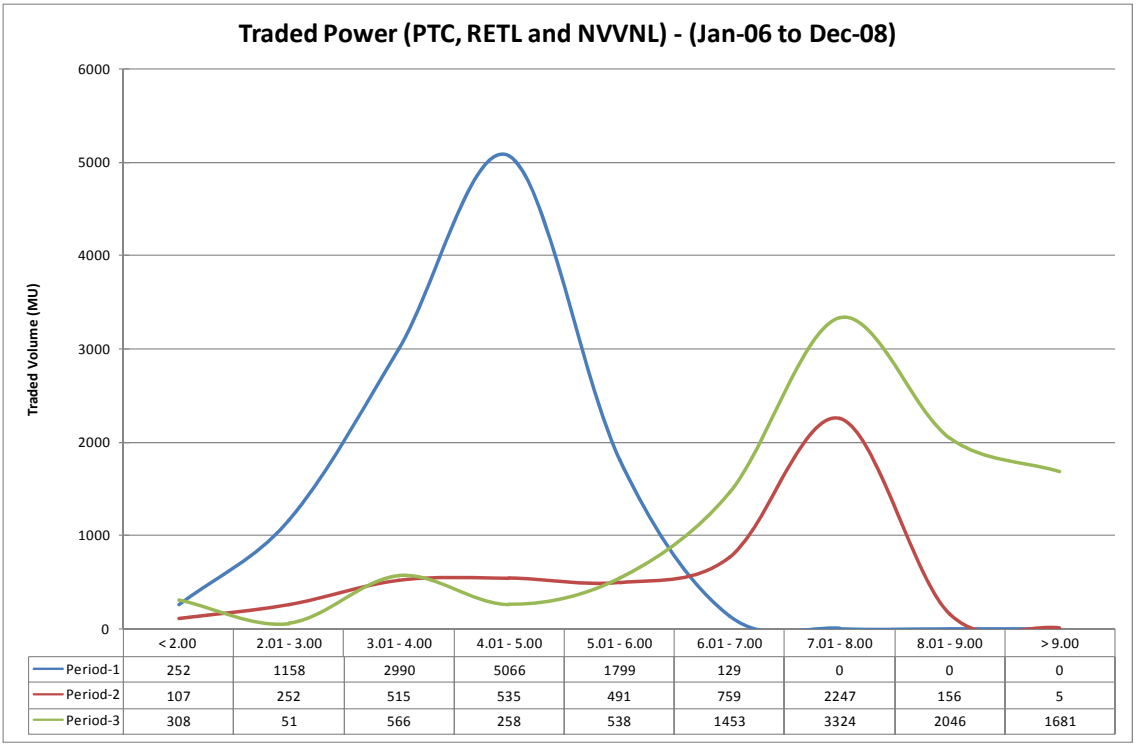
Details of all trading contracts of three trading licensees, i.e., PTC India Ltd, Reliance Energy Trading Limited and NVVNL have been obtained for the period from January 2006 to December 31, 2008. Analysis of the change in UI Price on short-term traded rate for three distinct time periods has been carried out depending on the period of UI revision notified by the Commission as follows:

- Period 1: January 2006 to April 25, 2007
- Period 2: April 26, 2007 to January 6, 2008
- Period 3: Jan 7, 2008 to December 31, 2008

Total Traded Power	**TOTAL (MU)**	***< 2.00***	***2.01 - 3.00***	***3.01 - 4.00***	***4.01 - 5.00***	***5.01 - 6.00***	***6.01 - 7.00***	***7.01 - 8.00***	***8.01 - 9.00***	***> 9.00***
Period-1	**11394**	252	1158	2990	5066	1799	129	0	0	0
Period-2	**5066**	107	252	515	535	491	759	2247	156	5
Period-3	**10225**	308	51	566	258	538	1453	3324	2046	1681
TOTAL Trade volum	**26685**	**666**	**1462**	**4070**	**5859**	**2828**	**2341**	**5571**	**2202**	**1686**

The total traded volume over the three-year period for which bilateral contract information was made available by select traders, viz. PTC, RETL and

NVVNL amounted to 26685 MU. The traded power data was categorised in terms of the volume and trade price range.



	< 2.00	2.01 - 3.00	3.01 - 4.00	4.01 - 5.00	5.01 - 6.00	6.01 - 7.00	7.01 - 8.00	8.01 - 9.00	> 9.00
Period-1	252	1158	2990	5066	1799	129	0	0	0
Period-2	107	252	515	535	491	759	2247	156	5
Period-3	308	51	566	258	538	1453	3324	2046	1681

As it is evident from above chart that during period-1, the majority of transactions have taken place within the price band of Rs 4.01 – 5.00 per kWh, when UI ceiling price prevalent during Period-1 was Rs 5.70 per kWh. With each subsequent revision in the UI price and ceiling rate, the price of traded transactions have also moved upwards over Period-2 and Period-3, with majority of transactions taking place at Rs 7.00 – 8.00 per kWh during Period-2 (i.e., when UI ceiling price was Rs 7.45 per kWh) and between Rs 7.00 – 9.00 per unit during Period-3 (i.e., when UI ceiling price was Rs 10.00 per kWh).

Further, to analyse the seasonal variations and to analyse the average UI rate for energy overdrawal by the beneficiaries, an analysis of short-term traded rate and average UI rate of energy drawal by beneficiaries in the northern region have been carried out for two summer (May and June) and two winter (November and December) months in 2007 and 2008.

Analysis of Short Traded Power Data

For the above analysis, the Commission's Staff collected data from various traders, covering details of number of contracts entered by them, sale price, purchase price, selling entities, buying entities, start date and end date of the trade transaction, etc., for the past 3 years. In order to co-relate the trade price movement with the latest UI rate revision effected on Jan 6, 2008, the trade transactions carried out two months prior to the UI rate revision and two months after the said revision were scrutinised and analysed in detail.

Thus, analysis of traded power data has been carried out for the following periods:

Type-1 Analysis (UI Rate revision Immediate Impact Assessment)

- 07-Nov-2007 to 06-Jan-2008 v/s 07-Jan-2008 to 06-Mar-2008

Type-2 Analysis (Seasonal Impact Assessment)

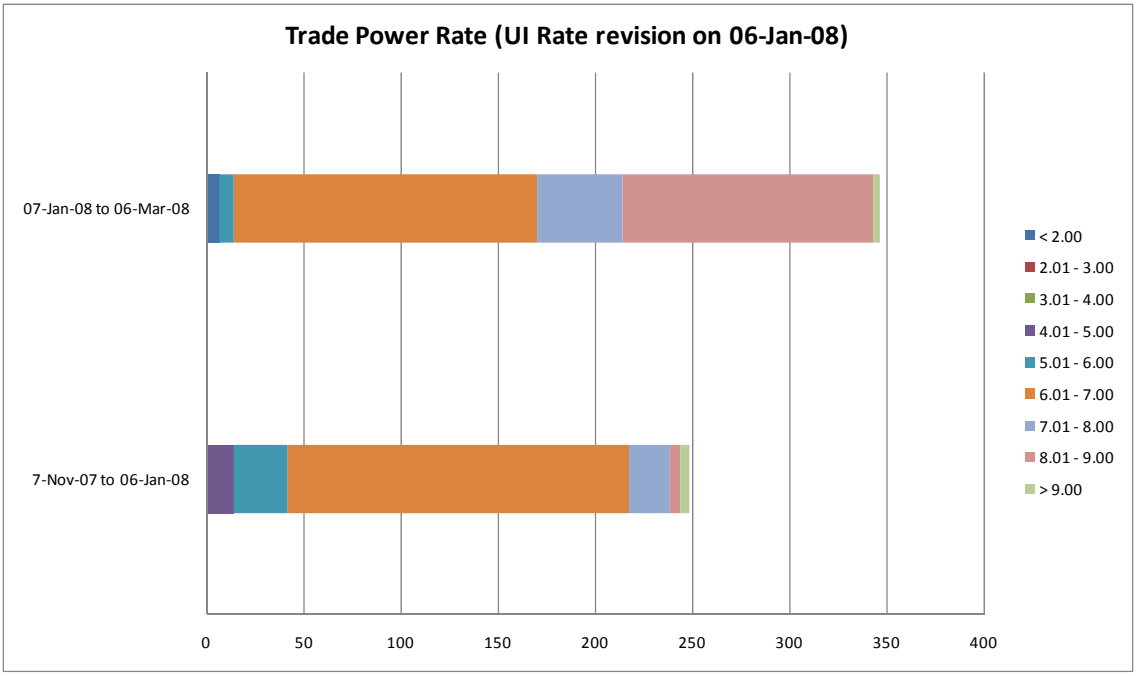
- 01-May-2007 to 30-Jun-2007 v/s 01-May-2008 to 30-Jun-2008
- 01-Nov-2007 to 31-Dec-2007 v/s 01-Nov-2008 to 31-Dec-2008

Type-1 Analysis (UI Rate revision Immediate Impact Assessment)

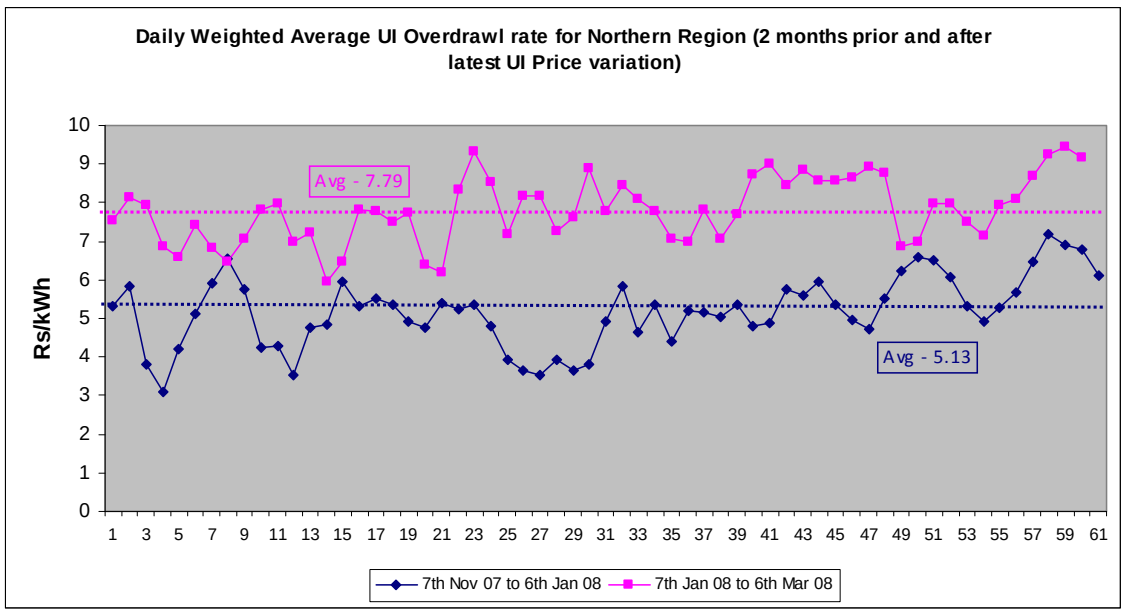
The UI mechanism was revised with effect from January 7, 2008 with ceiling in UI rate revised from Rs 7.45 per kWh to Rs 10.00 per kWh.

The weighted average rate of the traded transactions 2 months **prior** to revision in UI rate (i.e., for the period 07-Nov-2007 to 06-Jan-2008) was around **Rs 6.53 per kWh,** whereas the weighted average rate for the trade transactions 2 months **after** the revision in UI mechanism (i.e., for the period 07-Jan-2008 to 06-Mar-2008) was around **Rs 7.19 per kWh**. Further, it is evident that more number of trade transactions has taken place within the price band of Rs 8.00 – 9.00 per kWh. It is evident that an increase of around Rs 0.66 per kWh is reflected in the weighted average rate of trade transactions immediately after revision in UI rate mechanism.

The trade rate and corresponding trade volumes over the two monthly periods is presented in the following chart.



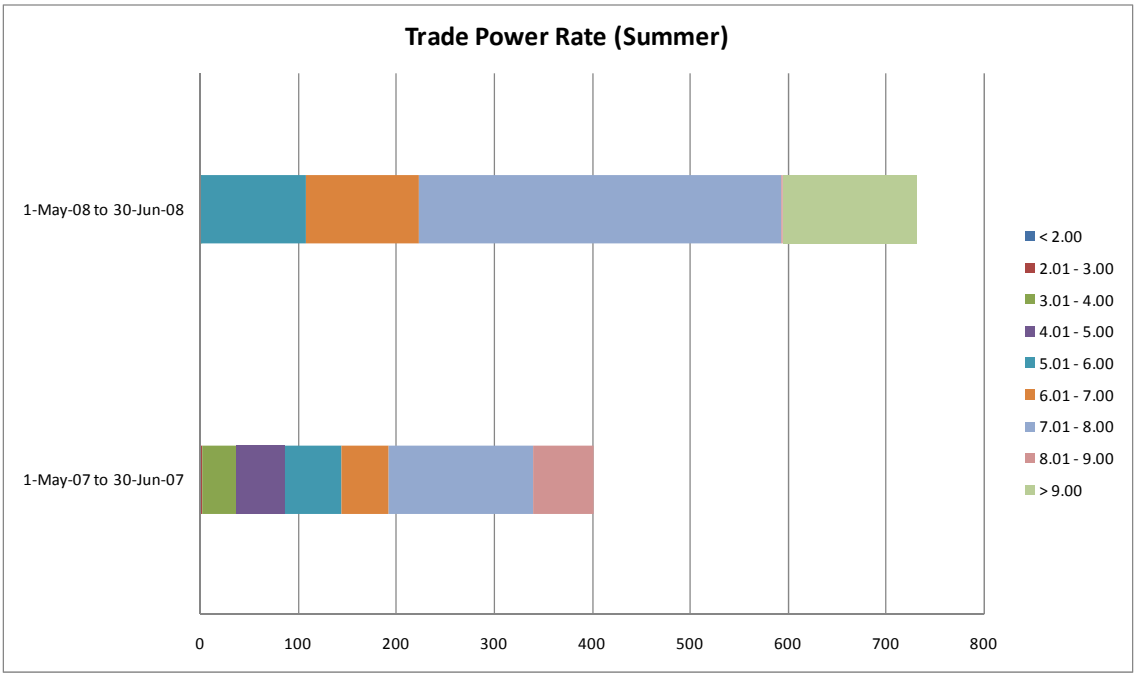
Apart from the UI ceiling cap, a daily average UI rate for energy over-drawal by beneficiaries in the Northern Region has been assessed for two months prior and after the latest revision in UI rates w.e.f. January 7, 2008, which is pictorially depicted below:



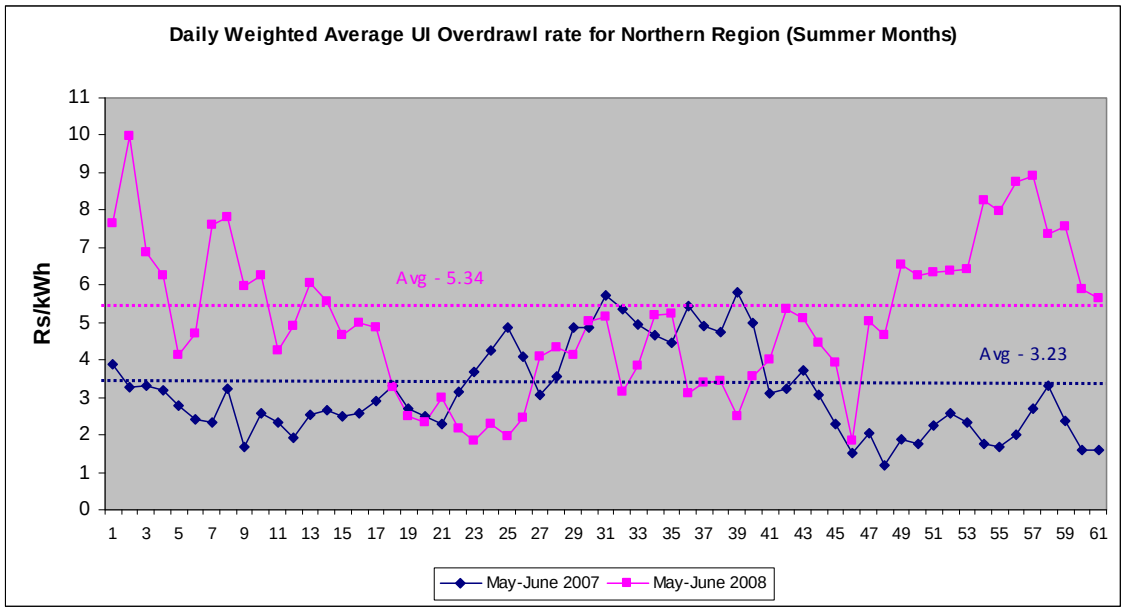
It is observed that the weighted average UI price for energy over drawal by beneficiaries in Northern Region during two months post latest UI revision was **Rs 7.79/kWh** as compared to weighted average UI price of **Rs 5.13/kWh** during the two months prior to latest revision in UI rates.

Type-2 Analysis (Seasonal Impact Assessment – Summer Period)

The weighted average rate of the trade transactions during 2 monthly summer period of 2007 (i.e., for the period 01-May-2007 to 30-Jun-2007) was around **Rs 5.76 per kWh** whereas the weighted average rate for the trade transactions during 2 monthly summer period of 2008 (i.e., for the period 01-May-2008 to 30-Jun-2008) was around **Rs 7.35 per kWh**. Further, it is evident that more number of trade transactions have taken place at price range in excess of Rs 9.00 per kWh during summer period of 2008. It is evident that an increase of around Rs 1.59 per kWh is reflected in the weighted average rate of trade transactions during summer months of 2007 and 2008, when UI rate mechanism was revised mid-way during two summer periods (i.e., as on 06-Jan-2008). The traded power rate and corresponding trade volumes over the two monthly periods is presented in the following chart.



Apart from the UI ceiling cap, a daily average UI rate for energy over-drawal by beneficiaries in the Northern region has been assessed for two summer months, i.e., May and June of year 2007 and 2008. The daily average UI Prices for energy over-drawal by beneficiaries in the Northern region for two summer months, i.e., April and May of year 2007 and 2008 is pictorially depicted below:

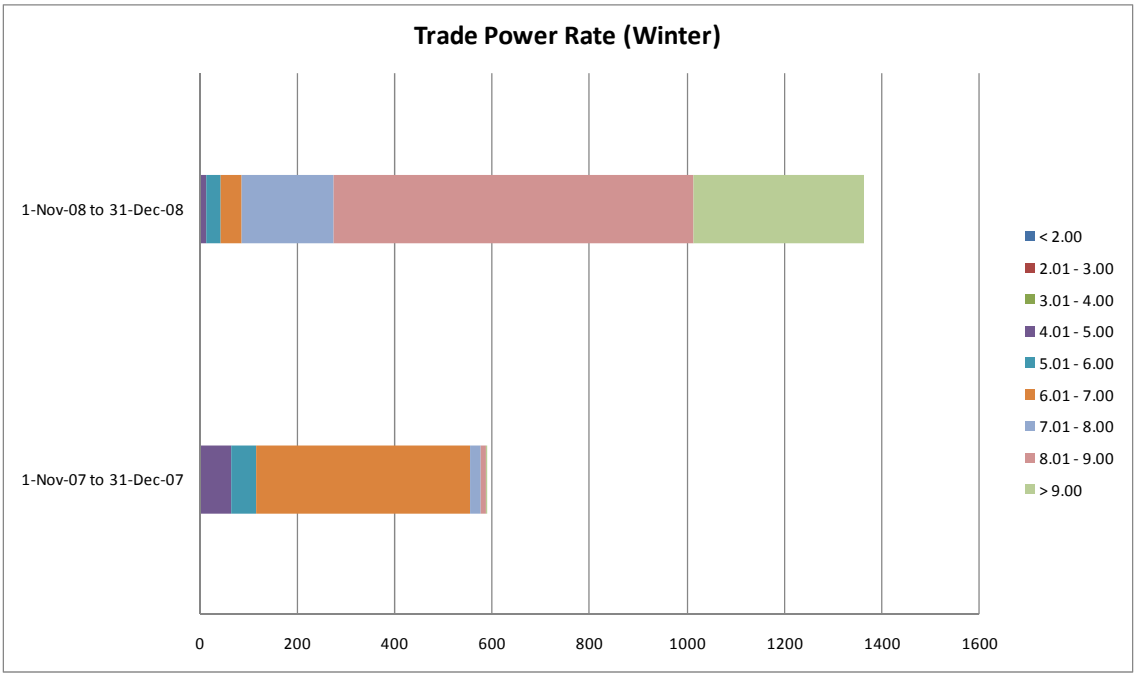


It is observed that the weighted average UI price for energy over drawal by beneficiaries in the Northern Region during the summer months (May-June) of 2008 was Rs 5.34/kWh as compared to weighted average UI price of Rs 3.23/kWh during the same period of 2007.

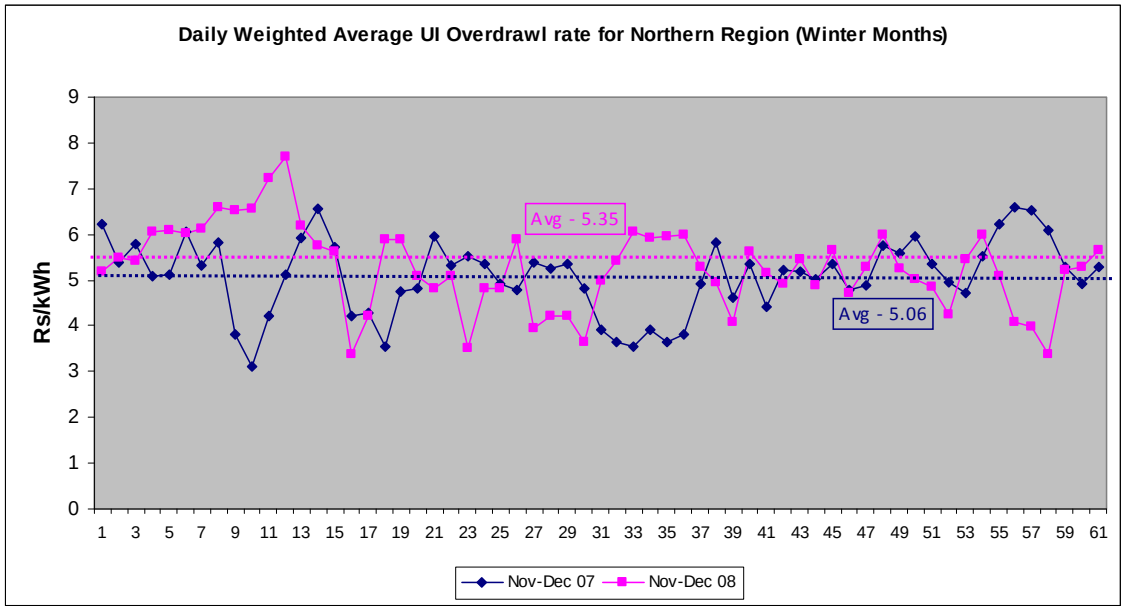
Type-2 Analysis (Seasonal Impact Assessment – Winter Period)

The weighted average rate of the trade transactions during 2 monthly winter period of 2007 (i.e., for the period 01-Nov-2007 to 31-Dec-2007) was around **Rs 6.26 per kWh** whereas the weighted average rate for the trade transactions during 2 monthly winter period of 2008 (i.e., for the period 01-Nov-2008 to 31-Dec-2008) was around **Rs 8.42 per kWh**. Further, it is evident that more number of trade transactions have taken place within the price band of Rs 8.00- 9.00 per kWh and at price range in excess of Rs 9.00 per kWh during winter period of 2008. It is evident

that an increase of around Rs 2.16 per kWh is reflected in the weighted average rate of trade transactions during winter over two yearly periods of 2007 and 2008 when UI rate mechanism was revised mid-way during two summer periods (i.e., as on 06-Jan-2008). The traded power rate and corresponding trade volumes over the two monthly periods is presented in the following chart.



Apart from the UI ceiling cap, the daily average UI rate for energy over-drawal by beneficiaries in the Northern region has been assessed for two winter months, i.e., November and December of year 2007 and 2008, as pictorially depicted below:



It is observed that the weighted average UI price for energy over drawal by beneficiaries in Northern Region during the winter months (November –December) of 2008 was Rs 5.35/kWh as compared to weighted average UI price of Rs 5.06/kWh during the same period of 2007.

Demand-Supply Position during Summer and Winter Months

Apart from analysing the short-term traded prices, it is also important to analyse the demand-supply position during the corresponding period. The actual demand supply position of beneficiaries in the Northern Region is given in the following Table:

Energy Requirement and Availability for Beneficiaries in Northern Region (MU)

	May-June 2007	**May-June 2008**	**Nov-Dec 2007**	**Nov-Dec 2008**
Energy Requirement	37,426	36,726	34,520	36,328
Energy Availability	35,167	33,632	29,922	32,051
Surplus/(Deficit) (%)	**-6.42%**	**-9.20%**	**-15.37%**	**-13.34%**

It is observed that during the summer months, energy deficit in 2008 was higher than the corresponding period in 2007, while during the winter months, the energy deficit in 2008 was slightly lower than the corresponding period in 2007.

Based on Type-1 as well as Type-2 analysis, it is evident that the short-term trade prices have moved upwards with revision in the UI rate mechanism in the short-term as well as in the long term. The impact of such revisions is reflected predominantly while comparing two seasonal periods (summer and winter). As the independent assessment of traded price movement provides limited insight, the average UI price for overdrawal by beneficiaries in Northern Region has been assessed and it is observed that both the short term trade prices and average UI prices have moved upwards with each revision in UI rate mechanism.

5. RATIONALE FOR UI CEILING RATE

The objective for introduction of frequency linked UI Mechanism was to enhance grid discipline in the interconnected Region that will pave the way for higher quality power with more reliability and availability and ensure better utilisation of fuel resources and lower total coast of power.

The rationale for originally keeping high UI ceiling price was that any generation over and above the scheduled generation during low frequency periods should be treated as generation coming from alternate available source. The ceiling price of UI was determined on 'alternate cost of generation' philosophy and therefore, during the initial period, it was linked with cost of electricity generation from the diesel based generating stations, which were the highest cost generating stations. The ceiling rate of 420 paise/kWh was originally specified as the rate which was the prevailing diesel generation cost corresponding to HSD rate of Rs 13.3/litre. The same criteria was applied again in 2004 while revising the ceiling UI rate to 600 paise/kWh, which was subsequently changed to 570 paise/kWh corresponding to the prevailing HSD rate of about Rs 21/litre.

However, in April 2007, the cost of electricity generation from diesel based generation increased to a very high level of around Rs 9.30 per kWh, mainly due to steep rise in diesel prices. Further, considering the paradoxical situation of the State Utilities losing money on account of non-remunerative consumer tariffs, the Commission looked into all other possible alternatives with which UI price could be linked, while also representing the marginal cost. The Commission at that time linked the UI price with naphtha based generating stations as those were the highest cost grid connected generating stations, with generation cost in the range of Rs 7.20/kWh. The Commission vide its Order dated April 5, 2007, raised the UI ceiling rate to 745 paise/kWh, which was below the variable cost of HSD generation, but

higher than the variable cost of combined cycle plants and heavy oil based generation. Subsequently, the Commission vide its Order dated December 4, 2007, raised the UI ceiling rate to 1000 paise/kWh, which is in effect since January 7, 2008.

With the significant reduction in crude oil prices and naphtha fuel, it is imperative to revise the UI Price. Further, as elaborated in earlier sections, it is observed that initial implementation of UI mechanism has resulted in frequency improvement while the subsequent revisions in UI ceiling rate have neither resulted in improving the frequency profile nor reduction in overdrawal by the beneficiaries which is mainly due to huge demand-supply shortages prevalent in the country. On the other hand, as discussed in previous sections, the UI cap rate has worked as a benchmark cost of electricity to other alternative options of electricity transaction. Therefore, with the change in market conditions, a downward revision in UI ceiling price needs to be considered.

The immediate issue is what should be the new ceiling price? Whether it should be revised to the level prevalent before the revision in January 07, 2008, i.e., 745 Paisa/kWh or to some other rate?

The share of grid connected diesel based generating stations in the total installed capacity is very miniscule and does not reflect the marginal generation cost in the true sense. Further, the Commission had also considered the variable cost of generation of combined cycle plants and heavy oil based generation while revising the UI ceiling price in April 2007. As the cost of electricity generation from combined cycle based generating stations was considered while revising the UI ceiling prices to 1000 paisa/kWh, therefore, as one option, the existing methodology can be continued. For this, actual cost of generation from combined cycle based generating stations with the current fuel prices needs to be checked. For this purpose, the prevailing variable cost of generation for NTPC combined cycle generating stations has been collected, which has been summarised in the following table:

Table: Variable Cost of Generation for NTPC Stations

S. No.	Name of Station	Region	Variable cost of generation (Rs/kWh)	
			For RLNG	For Naphtha
1.	Kawas	Western Region	5.84	6.06
2.	Gandhar	Western Region	5.73	-
3.	Auraiya	Northern Region	6.97	6.47
4.	Anta	Northern Region	5.64	5.78
5.	Faridabad	Northern Region	5.44	5.25
6.	Dadri	Northern Region	6.88	6.86 (Diesel)
7.	Kayamkulam	Southern Region	-	4.52

From the above table, it is evident that highest variable cost of generation with Diesel as fuel, is Rs 6.86 per kWh for Dadri power plant. At the same time, it is important to note that variable cost of generation for Auraiya Power Plant with RLNG as fuel is Rs 6.97 per kWh, higher than cost of generation for naphtha/Deisel power plant. Thus, the prevalent variable cost of generation of combined cycle generating stations is around Rs 7 per kWh.

Though the variable cost of generation of combined cycle generating stations works out to around Rs 7 per kWh, it is proposed to revise the UI ceiling price to 735 paise/kWh, which is slightly higher than the variable cost of combined cycle generating stations, to provide for some variation in fuel prices over the period of operation of the proposed UI mechanism.

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6. TRENDS OF INCREASE IN UI VOLUMES AND WHETHER A LIMIT IS REQUIRED TO BE PUT ON UI VOLUMES

The Scheduling and Despatch procedure for inter-State transactions has been notified by CERC under the Indian Electricity Grid Code. At present, under the limits for deviation prescribed for generators on technical considerations, the generators is allowed to generate upto 105% of the declared capacity in any time block of 15 minute duration and averaging up to 101% on overall day basis and beyond this RLDCs are empowered to investigate possibility of 'gaming', if any and if no gaming is found then generator is allowed generation even beyond 105% also to take advantage of favourable ambient conditions etc. Similarly, there is no limit on overdrawl by the beneficiaries in excess of schedule given by RLDCs

The rationale behind such an approach was that all possible generation during real time operation should be accommodated if necessary and earn incentive through UI mechanism. The beneficiaries on the other hand, are expected to maintain the frequency within the operating range by resorting to load shedding,

However, in many instances in the recent past years, indiscriminate overdrawal by the beneficiaries without any regard to their scheduled drawal has led to situations when frequency going below 49 Hz and sometime, very close to grid failure. The beneficiaries have continued to over-draw without considering the low grid frequency despite repeated warnings issued by RLDCs. The situation was so aggravated that the Commission had to intervene by way of issuing warnings, and imposing penalty on some of the beneficiaries.

Further, it has also been noticed that the beneficiaries are earning significant revenue through UI by way of reducing their actual drawal vis-à-vis their committed

schedule. The reduction in actual drawal does not mean that the beneficiary does not require power or have surplus power but they carry out load shedding to reduce their actual drawal. Thus optimising their UI cost and ensuring servicing during peak hours.

In order to understand the trend of overdrawl by the States, the actual over-drawal by the beneficiaries of Northern region during the last six month period (i.e. 1-Jul-2008 to 31-Dec-2008 covering period of 184 days or 17664 time-blocks) has been analysed. Percentage of maximum deviation from schedule when grid frequency was below 49.5 Hz has been considered for this analysis. Further, such analysis has been done on sample basis for three beneficiaries, viz. Punjab, Rajasthan and UP in the Northern Region, as presented below:

% overdrawl over the time blocks

Table: Maximum Overdrawal (%) when frequency was < 49.5 Hz

Max Overdrawal (%) when freqn < 49.5 Hz	No. of Days				
	Punjab	Rajasthan	UP	Avg	% avg
< 10%	29	44	31	35	**18.8%**
11 - 20%	45	44	41	43	**23.6%**
21 - 30%	53	46	51	50	**27.2%**
31 - 40%	16	29	24	23	**12.5%**
> 40%	41	21	37	33	**17.9%**
TOTAL	**184**	**184**	**184**	**184**	**100.0%**
Average Max Overdrawal (%)	38.7%	22.4%	25.4%	28.8%	
Median Max Overdrawal (%)	23.1%	20.7%	23.8%	22.5%	

(Source: Northern Regional Load Despatch Centre)

It is observed that the % of maximum overdrawal has varied from 22.4% to 38.7% on average basis across three beneficiaries. There are incidences where maximum overdrawal has exceeded 40%, which needs to be curtailed. Therefore, it is important that indiscriminate over-drawal needs to be minimised, particularly when frequency is lower, in the interest of disciplined grid operations. Apart from

percentage terms, the volume cap needs to be specified in absolute number also, as operationalising the volume cap limit in case of small beneficiaries with significantly lower entitlements in percentage terms would not be feasible.

% Overdrawl on overall Daily basis

Table: Daily deviation (%)

Daily deviation (%)	No. of Days				
	Punjab	Rajasthan	UP	Avg	% avg
< 2%	87	113	96	99	**53.6%**
2% - 5%	34	15	13	21	**11.2%**
5% - 10%	33	19	22	25	**13.4%**
10% - 15%	18	21	16	18	**10.0%**
>15%	12	16	37	22	**11.8%**
TOTAL	**184**	**184**	**184**	**184**	**100.0%**
Daily Avg. deviation (%)	1.2%	-1.5%	3.7%	1.1%	
Daily Median deviation (%)	2.2%	-1.9%	1.0%	0.4%	

(Source : Northern Regional Load Despatch Centre)

In this context, the key issue is how to bring discipline among the beneficiaries, and at the same time, what measures should be taken for reducing the gaming practices?

One of the solutions for handling this issue is that maximum limit for variation from scheduled drawal, should be specified. Imposing the over-drawal limit will serve both the purposes, as it will deter the beneficiaries from indiscriminate over-drawal and at the same time, lower over-drawal by such overdrawing beneficiaries will automatically result into lower under-drawal by other beneficiaries. However, several considerations need to be addressed in case limit (or volume cap) is sought to be imposed on beneficiaries, as outlined below:

- What should be over-drawal limit?
- Should it be specified in terms of MW for a particular time-block or daily limit in MWh terms or both?

- Should over-drawal limit (or volume cap) be specified for entire frequency range or only for the low frequency period?

In this regard, it also needs to be borne in mind that under the prevailing severe supply constrained environment, load management and control by beneficiaries, particularly distribution licensees is an extremely difficult task, and planned measures and initiatives of load management and control need to be rewarded. Further, short-term (or hourly) demand forecasting practices at distribution level are yet to be established in the country with little experience available with some distribution companies. Therefore, the variation limit should not be as stringent for beneficiaries. Further, there are several other factors beyond the control of distribution licensees that may be responsible for over-drawal, such as seasonal variation, change in climatic conditions, festive season, variation in agricultural load, etc. Therefore, it may not be proper to specify a static over-drawal limit. The over-drawal limit should be specified by the Commission from time to time considering various factors as discussed above.

Based on above, it is considered that a volume cap of 12% of the schedule of beneficiary in MW terms (or 150 MW, whichever is lower), for any time block, particularly, when grid frequency is below 49.5 Hz, should be reasonable to be introduced. RLDCs should monitor beneficiaries' drawal below 49.5 Hz and exercise control to ensure overdrawing beneficiaries whose overdrawal exceeds 12% in any timeblock and direct them to curtail their drawal first.

It is also observed that the % of daily deviation has varied from -1.5% to 3.7% on average basis across three beneficiaries. There are incidences where daily deviation has exceeded 15%, which needs to be minimised. Further, as it is evident from the above table, majority of incidences of such daily overdrawals (around 55%) are lower than 3%. **Hence, it is proposed that the volume cap of 3% of the schedule of beneficiary on a daily aggregate basis in MWh terms for the timeblocks during which frequency is less than 49.5 Hz should be introduced. RLDCs should**

monitor beneficiaries drawal on daily basis and exercise control to ensure overdrawing beneficiaries whose overdrawal exceeds 3% on a daily aggregate basis in MWh terms for the timeblocks during which frequency is less than 49.5 Hz within a day are directed to curtail their drawal.

After careful analysis of all the issues, it is urgently required to impose certain limit for restricting the over-drawal of electricity by the beneficiaries. Issue of under-drawal will automatically get addressed with the cap on over-drawal. Over-drawal should be restricted only during the low frequency period, i.e. 49.5 Hz and below. For the time being, the limit of over-drawal can be kept as 112% of the schedule of the beneficiary in MW terms (or 150 MW whichever is lower), for any time block when frequency is below 49.5 Hz and 103% on a daily aggregate basis in MWh terms for the timeblocks during which frequency is less than 49.5 Hz.

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7. NECESSITY OF REVIEW OF FREQUENCY RANGE

The introduction of ABT mechanism has brought in focus the benefits of narrowing the frequency swings within the band of 49.00 Hz to 50.5 Hz and its beneficial impact on grid operations, power system management and electricity market development has been well recognised. The demonstrated improvement in grid frequency (and reduced frequency variations) over the period from 2002 to 2007 due to ABT has come on account of several factors such as:

- Improved scheduling by all the participants, viz., Generators and Beneficiaries.
- Adherence to the schedules due to the incentive/disincentive mechanism
- High quality metering and on-line connectivity enabling the System operator to know the actual flows and take appropriate action.
- Transparency and sharing of the information with all participants.
- Faster settlement process and well demonstrated dispute resolution mechanism.

However, despite continuance of above conditions, the efforts for improvement in grid frequency operations seem to have reached saturation point, particularly over the past one year. As highlighted earlier, grid operations within the preferred range of grid frequency from 49.5 Hz to 50 Hz has occurred only for about 22% of timeblocks since revision in UI mechanism on January 7, 2008.

It is preferred that there should be lower variation in grid frequency for smooth operation of the power system. Further, the integration of regional grids has led to significant improvement in the 'K' factor or Power Number of the integrated grid. In this context, findings of the Study on "Frequency Response Characteristics of an Interconnected Power System – A Case Study of Regional Grids in India"[1] carried out by Shri. S.K.Soonee and Shri. S.C. Saxena of Power Grid Corporation of India Limited,

[1] *"Frequency Response Characteristic of an Interconnected Power System – A Case Study of Regional Grids in India*

may be referred.

> *"Frequency response is defined as the automatic, sustained change in the power consumption by load or output of generators that occurs immediately after a change in the control area's load generation balance and which is in a direction to oppose a change in inter-connection's frequency.*
>
> ……
>
> *On 26th August, 2006, the Northern Grid was synchronized with the Central Grid (Western, Eastern and North Eastern Grids). Post synchronization, three events occurred which have been captured to calculate the frequency response characteristics of the combined grid.* ***The frequency response has been found to vary from 1550 MW/Hz to 1664 MW/Hz with an average of 1611 MW/Hz and a median value of 1620 MW/Hz.*** *The number of events captured so far is not adequate to give a figure with higher confidence level and more events need to be captured. Theoretical simulation studies carried out prior to the synchronization of the two large grids (North and Central) suggest that the* ***frequency response of the combined system should be of the order of 1800 MW/Hz.*** *" **(emphasis added)***

Further, frequency response essentially indicates system inertia and reflects response of system frequency in case of varying demand (or loss of load) or variation in generation (or loss of generation). In this context, the findings and recommendations of the **Expert Committee** constituted by the **Central Electricity Authority** for recommendations of largest Unit size are useful. The Expert Committee has deliberated on the aspects of the System Stability, System Capability and Grid Integration related aspects in its Report. The relevant extracts of the Report[2] of the Expert Committee is as under:

> *"At present, ER, NER and WR are already in synchronous operation and NR would also be integrated with Tala Transmission system, which is expected to be commissioned by the end of 10th Plan. As such, the "K" factor (Power Number) of*

[2] Report of Expert Committee by CEA, 2003

this network by the end of 10th ***Plan would be quite large- in the range of 2000 to 3000 MW/Hz. In such system dip in frequency following outage of 1000 MW unit would be less than 0.5 Hz.***

The Southern Region would remain asynchronously interconnected with rest of the all-India Grid till the end of 11th Plan. The present power number of Southern Region is of the order of 700 MW and with growth in demand and generation capacity, the power number of SR System would be in the range of 1000-1200 MW/Hz by the end of 10th Plan. For this power number, the dip in frequency, following outage of a 1000 MW unit would be in the range of 0.8 Hz to 1.0 Hz. As such unit size of up to 1000 is adoptable in SR from 10th Plan end onwards.

After integration of all India grid, the power number from beginning of 12th Plan and onwards would be more than 3000 MW per Hz and unit size of 1000 MW would be acceptable anywhere in the system."

Thus, despite improvement in the power number, improvement in grid frequency operations is far from desired. The beneficiaries located in Western and Eastern Regions have repeatedly expressed concern over the heavy over-drawal by the beneficiaries in the Northern Region. Hence, regulatory intervention is desirable to emphasize the need for conscious efforts to be undertaken by all concerned for narrowing the frequency range of operation.

In order to improve frequency performance of the grid, various options and regulatory intervention strategies needs to be employed simultaneously. Introduction of volume caps on beneficiaries together with narrowing the band for grid frequency operation should be attempted.

Considering the huge demand-supply gap and inadequate load forecasting techniques with distribution licenses for predicting the day-ahead load, the reduction in frequency range at par with the international standards is not possible at present. Therefore, the ideal approach would be to reduce the frequency range in a gradual manner. Therefore, we recommend that 0.2 Hz reduction should be made in higher and lower level of frequency range, and therefore, the new frequency range should be

49.2 Hz to 50.3 Hz. It will compel the beneficiaries to take measures for improving load forecasting and accordingly contract for the required generating capacity, which shall be beneficial for long-term development of the power sector.

8. REVIEW OF UI PRICE VECTOR

As discussed earlier in this Report, it is proposed to modify the UI ceiling price to 735 paise/kWh and the frequency range to 49.2 Hz to 50.3 Hz.

As regards the lower limit of UI prices, there has been no change during the last 8 years so as to give signal to the generators to reduce the generation during high frequency period and to beneficiaries for over-drawing electricity during high frequency period as it helps in correction of grid frequency. The lower level of UI price was specified as zero to provide incentive to beneficiaries for over-drawing and to act as deterrent for generators to increase the generation by way of lower price or no price after the specified frequency range. Further, there had been no circumstances during the last 8 years of UI operation when grid frequency crossed the limit of 50.5 Hz. Thus, there is no requirement of changing the lower limit of UI price and it should remain at 0.0 paisa/kWh at 50.3 Hz grid frequency.

After the setting of UI ceiling price at 735 paisa/kWh at 49.2 Hz frequency and lower limit of 0 paisa/kWh at 50.3 Hz frequency, the UI prices for intervening frequency range also needs to be specified. At normal frequency of 50 Hz, the UI rate should be close to cost of generation of base load power plant, i.e., coal based power plant. Presently, the cost of generation for such coal based power plants varies substantially based on the location of the station. However, considering the prevalent market trends, the variable cost for most of the coal based power plants is less than around Rs 1.80 per kWh and therefore, the UI price at 50 Hz frequency should not be more than 180 paise/kWh. The UI price for each 0.02 frequency interval for the frequency range of 49.2 Hz to 50.3 Hz has been summarised in the following table:

Average frequency of time block (Hz)		**UI Rate**
Below	Not below	(Paisa per kWh)
----	50.30	0
50.30	50.28	12
50.28	50.26	24
-----	-----	-----
-----	-----	-----
50.04	50.02	168
50.02	50.00	180
50.00	49.98	192
-----	-----	-----
-----	-----	-----
49.52	49.50	480
49.50	49.48	497
49.48	49.46	514
-----	-----	-----
----	-----	-----
49.24	49.22	718
49.22	49.20	735

- Gradient @ 12 paise/unit for each 0.02 Hz frequency drop between 50.3 Hz and 49.5 Hz
- Gradient @ 17 paise/unit for each 0.02 Hz frequency drop between 49.5 Hz and 49.2 Hz

The graph indicating the proposed UI price vector is enclosed at Annexure 2.

UI price cap for Generators

The Commission under its Terms and Conditions of Tariff (Fourth Amendment), Regulations, 2007 dated December 28, 2007, has imposed the cap on UI rate @ 406 paisa/kWh, when actual generation exceeds scheduled generation for

coal or lignite fired generating stations or gas based generating stations using APM gas. The relevant text of the Regulation 24 is reproduced for easy reference:

"...

Provided that in case of generating stations with coal or lignite firing and stations burning only APM gas, UI rate shall be capped at 406 paisa per kWh when actual generation exceeds the scheduled generation.

…"

In the present context, the issue is whether differential price cap on generators should be continued or it should be made at par with the UI ceiling cap specified for beneficiaries. The argument for putting such ceiling for generators is that cost of generation through coal, lignite or gas fuel is much lower than the ceiling price specified by the Commission and it was considered that there is sufficient incentive for the generator even with a ceiling price of Rs. 4.06 paise/kWh..

In view of the above, it would be desirable to continue with the price cap for generators in the new Regulations. **However, in order to fit this price cap in the proposed UI vector, the cap rate is proposed as Rs 4.08 per kWh.**

9. TREATMENT OF FUND COLLECTED THROUGH UI MECHANISM

The Commission through the amendment in Tariff Regulations, 2007 dated January 07, 2008, imposed the UI ceiling cap of Rs 4.06 per kWh for generators while UI ceiling price for beneficiaries was increased to Rs 10.00 per kWh. In such case, the differential UI pricing for generators and beneficiaries has led to accumulation of significant amount of fund, left after final UI claim settlement. As per the information received from the Commission staff, currently, the accumulated fund is around Rs 500 Crore.

With the increasing amount of fund, the issue of optimal utilisation of this fund needs to be addressed.

In this regard, one option is to utilise the fund for creation of additional transmission capacity. The rationale behind such proposition is that currently transmission capacity is being added to meet the short-term and long-term load and generation requirement. In future, there may be certain other issues, which could limit the creation of additional marginal system capacity.

In this regard, the example of north-eastern region would be relevant as the region has got significant hydro potential, major part of which is yet to be harnessed. The transmission capacity for power evacuation from north-eastern region to other regions needs to be created from a long-term perspective. In future, the issue of right of way for additional transmission lines may be the single biggest hurdle. Therefore, certain proportion of the transmission capacity created considering the long-term perspective shall remain partially utilised for some period due to under utilisation till all the planned generating stations are commissioned. In such case, the issue would be of funding those schemes and why beneficiaries should pay extra charges for such transmission schemes which are partially utilised.

Therefore, for such cases, the servicing of capital cost in the form of capital recovery cost can be arranged through the UI fund. It is proposed that Central Transmission Utility in consultation with Central Electricity Authority shall identify the inter-State transmission schemes, which are of strategic importance from a long-term perspective but presently have got limited utilisation, and approach the Commission for obtaining approval for servicing of capital costs during the initial years from the UI fund. The servicing of investment during the initial years can be made available from the UI account. Once the utilisation of such transmission schemes reaches an optimum level, the cost for such system can be recovered from the transmission system users through transmission charges.

The other option of utilisation of this fund could be to strengthen the RLDCs for providing ancillary services. The fund in UI account has been collected through the daily system operation activities.. Therefore, such fund should be utilised for 'load following' service to be used during low grid frequency by the RLDC. Internationally, the system operators use ancillary services, among other things, to maintain stable grid frequency. There is no reason why RLDC should not be doing so in India.

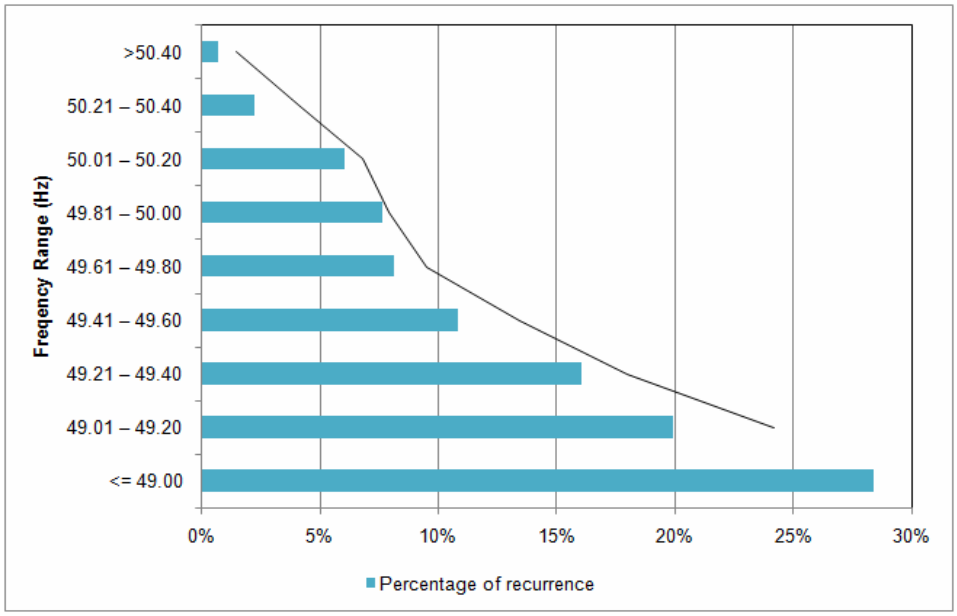
It would be the first time when such an initiative is being proposed for strengthening of the power system operations, therefore,, close monitoring by the Commission shall be required to ensure the optimum utilisation of fund. Therefore RLDC shall take prior approval of the Commission for procurement of power from such generation sources, which are to be utilised for 'load following'.

As both the options, i.e., creation of additional transmission capacity and maintaining spinning reserves are important for long-term development of the power system, therefore, the fund collected in UI account should be utilised for both the purposes. The proportion of allocation of fund can be decided by the Commission on merit basis.

Annexure – 1

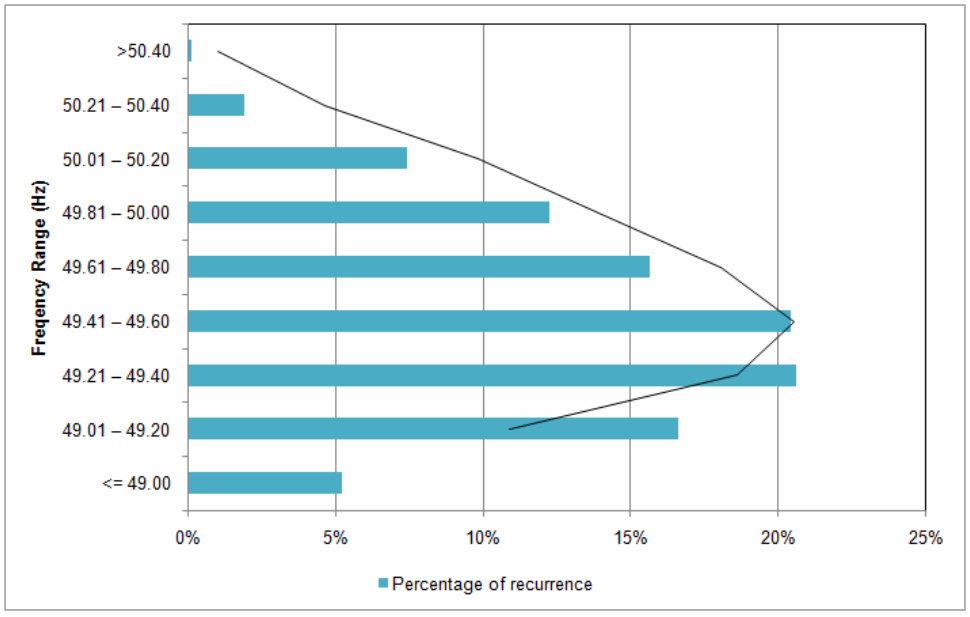
Frequency variation profile incidental to UI Price revision Period

Frequency variation for 01 Apr, 2005 to 25 Apr, 2007



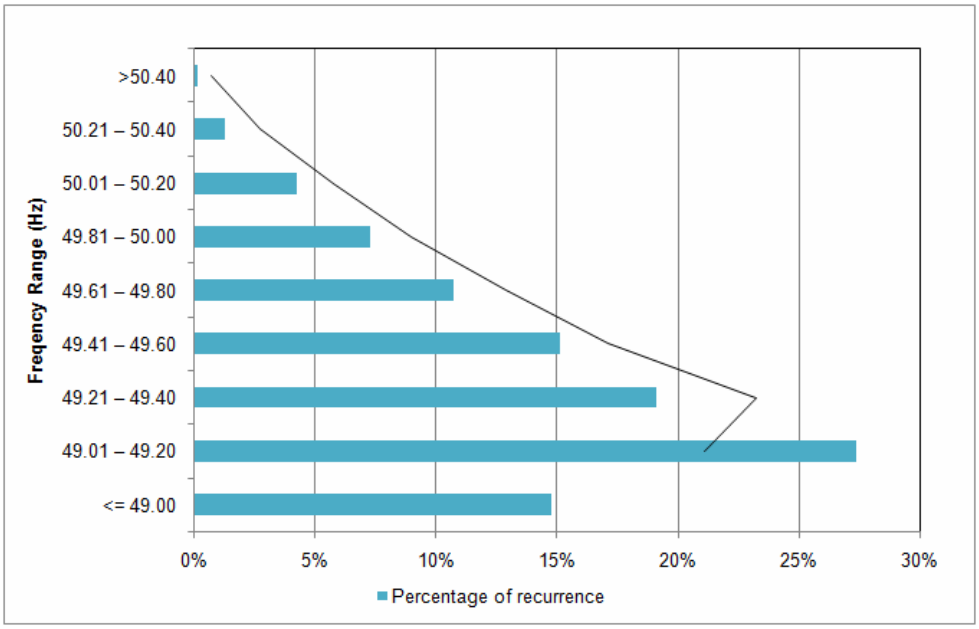
(Source: NRLDC)

Frequency variation for 26 Apr, 2005 to 06 Jan, 2008



(Source: NRLDC)

Frequency variation for 07 Jan, 2008 to 31 Dec, 2008



(Source: NRLDC)

Annexure – 2

Proposed UI Price Vector