

## **ISSUES IN UNSCHEDULED INTERCHANGE IN INDIA**

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## **Introduction**

Unscheduled Interchange (UI) is the mechanism developed to improve grid efficiency, grid discipline, accountability and responsibility by imposing charges on those who defer from their scheduled generation or drawal. Unscheduled generation and drawal of electricity puts the whole grid and many other electrical equipment in to danger by dumping large fluctuations in frequencies. Unscheduled Interchange is a part of three part tariff put forward by GoI in the name of Availability Based Tariff on 4<sup>th</sup> January 2000 at inter-state level. A proposal for ABT, as a three-part tariff, was first mooted in the year 1994 in a report submitted by an International Consultant (ECC Report) to the Government of India. The Government then constituted a National Task Force (NTF) as well as Regional Task Force (RTFs) to debate on various issues in the introduction of ABT for bulk power. Based on the recommendation of NTF, Central Government has prepared a draft notification and submitted to Central Electricity Regulatory Commission (CERC) for finalisation. As a result ABT was implemented at different regions at these dates.

Western Region: 1<sup>st</sup> July 2002

Northern Region: 1<sup>st</sup> December 2002

Southern Region: 1<sup>st</sup> January 2003

Eastern Region: 1<sup>st</sup> April 2003

North Eastern Region: 1<sup>st</sup> October 2003

## **What is “Availability” Based Tariff & UI?**

Any power plant is having fixed and variable costs, the fixed cost comprise of interest on loan & working capital, return on equity, O&M expenses, insurance, taxes & depreciation. The variable costs are the fuel costs. In Availability Based Tariff these two costs are treated separately. The payment of fixed cost is dependent on Availability of the plant, i.e. whether the plant is available for MW generation or not on a day to day basis. The amount payable to the company as a part of fixed cost depends on the average availability of the plant over the year. If the average availability of the plant over the year is more than the specified norm of the plant, the generator gets higher payment and vice versa. This first component of the ABT is also called as the “Capacity Charge”.

The second part of this ABT is the variable cost i.e. the energy charge which is charged as per the fuel consumption given by the schedule of the day and not on the actual generation. If there are deviations in generation, i.e. if scheduled generation of the plant is 100 MW and the plant generates 110 MW, the energy charge would still be paid for 100 MW of energy generation and the remaining 10 MW will be paid as per the system conditions prevailing during that extra generation. If the grid already

had surplus power when this extra 10 MW was generated and the frequency was above 50 Hz the rate at which this power is sold will be lower and vice versa.

This leads us to conclude that there are three parts in ABT, 1) Capacity charge 2) Energy charge and the 3) Payment for deviations from schedule at the conditions prevailing at the time of deviation. The negative third part would signify that the payment is made by the generator for violating the schedule.

### **Before ABT& UI**

Prior problem in the Indian power sector was not only the shortage of power but also the difficulty in performing grid operations due to acute indiscipline shown by the generators as well as the beneficiaries. The incentives to the generator were linked to actual generator and not on availability. The generators could pump as much power in the grid as they could irrespective of the frequencies and still get acknowledged for the wastage of the valuable resource. The load serving SEBs would compare the variable cost of their generator to the composite cost of the external generator causing a skewed dispatch. The regional grid operators ironically had a horrifying time trying to get generators backed down to protect the turbines of the same generator causing the situation. On the other end the stated utilities could overdraw from the grid even during deficit and still escape creating a chaos and despair all around.

### **Sharing of Payments by the affected parties**

The energy charge to be paid by the beneficiaries to the generating stations would be the fuel cost for the scheduled energy to be supplied during the day and in case the beneficiary draws more power than what was scheduled then he will have to pay for the excess drawal at a rate dependent on the system conditions prevailing at that time. The rate will be higher if the frequency is lower and low if higher.

### **Important issues concerning UI**

- **Compatible software requirement:** This is the most important issue faced by the management of power systems. Implementation of software which does all the functions of a power system is user friendly and acceptable to all the persons using it is very much important for the implementation unscheduled interchange. The software should be able to compute all the results desired, should be robust to address all regulatory issues and should be modifiable as per all the state regulatory commission requirements.
- **Avoidance of Gaming:** The provision of gaming have been done away with a view to provide economic disincentive for over injection by a generating station other than hydro stations in excess of 105% of the declared capacity of the station in a time block or in excess of 101% of the average declared capacity over a day. There also are allegations made against this such as the one made by RRVPNL stating that the provisions would encourage generators

to declare less availability and hence should be deleted. To this the CERC replied that this tendency may not be with the intention of earning more UI but with the intention of avoiding paying UI charges. Also, Shri Padamjeet Singh has argued that gaming is going unchecked in several cases of the gas based power plants. This allegation is not accepted by CERC and it has said that it would like to draw its attention to the commissioner's order in the petition no. 148/2005 dated 06/02/2007 and the various aspects of scheduling and dispatch has been discussed and resolved. A new provision has also been added in the regulation 6 as follows.

*“The Commission may, either suo motu or on a petition filed by RLDC, initiate proceedings against any generating company or seller on charges of gaming and if required, may order an inquiry as decided by the Commission. When the charge of gaming is established in the above inquiry, the Commission may, without prejudice to any other action under the Act or regulations there under, disallow any UI charges received by such generating company or the seller during the period of such gaming.”*

- **Open Access & Wheeling w.r.t UI:** ABT is not directly related to open access and wheeling but its third component (UI) has a great relevance. Open Access regulations 2008 issued by CERC says that UI rate can be applied to such open access transaction where ABT based accounting mechanism is not in place. The provision of CERC for open access is as under:

*“20.(4) Any mismatch between the scheduled and the actual drawal at drawal points and scheduled and the actual injection at injection points for the intra-State entities shall be determined by the concerned State Load Despatch Centre and covered in the intra-State UI accounting scheme.*

Open Access involves two parties one who supply the power and the other who receives, if there is no appropriate framework, disputes are bound to arise in scheduling, energy accounting and commercial settlement. CERC has been reasonably successful in implementing an appropriate platform for foolproof performance of UI.

- **Trading of State's surplus generation:** Suppose a generating station is scheduled to give 100 MW of power to the state but the off-peak demand is only 90 MW in this case the generator has an option of either backing down on supply and save on energy charge anyhow by getting the actual payment required for scheduled generation. The other very attracting option is to trade the surplus 10 MW of power to a third party at a market determined rate without backing out the power supply. This option is most viable if the traded price is higher than the energy charge (mostly the case) which the generator would be getting because the generator is anyway paid for the capacity charge for the scheduled generation i.e. 100 MW.

This can also negate the technical problems associated with backing down of the generator and improve the plant's efficiency.

- **Addressing grid disturbance problems:** The whole motto of UI mechanism is to get away with the grid disturbance issues faced by Indian power sector. There was very low frequency down to 48Hz during peak hours due to over drawal by the SEBs and a frequency as high as 51Hz during off-peak hours because of not backing down the generation during this period. This was the case for several hours every day. This caused frequent grid disturbance, tripping of huge turbine & generators, transmission & distribution lines and the supply to huge block of customers was affected for several hours in a day. This was because of the type of tariff structure prevailing during that period. The previous tariff was energy tariff rather than power tariff. It was allowing over drawal by the SEBs during peak hours by compensating the same by under drawing during off-peak hours and all the generators got the same rate of return for 24hours irrespective of the system prevalent operating conditions. All the ABT and UI regulations brought by CERC try to negate these effects and the national grid is moving towards a stable path with no black outs.
- **Special meters & communication system requirement:** According to ABT, UI has to be determined for each 15-minutes time block. This inherently requires metering of power supply and usage on every 15-minutes time block at very interchange points. These meters are required for both inter-state and intra-state constituencies if the same time block is applied to both. As some states already had meters for 30-minutes time block a question was raised that UI metering could be allowed for 30 minutes time range for intra-state UI. Corresponding to the same concern raised, a procedure was adopted as an interim arrangement for determination of UI charges for 15 minutes time block from readings given by 30 minutes recording meters. An advanced communication system is also a must requirement for the recorded data's to be transmitted to the respective load despatch centres for timely decisions to be made. The responsibility of installation, testing and maintenance of meters and the installation of communication facility for the transmission of data rests with STU.
- **Application of UI mechanism to hydro stations:** Completely different UI regulations have to be adopted for hydro power generating stations because of its very nature and being a peak load supporter. Calculation of availability in hydro power stations is based on capacity index, different from PLF for thermal stations, energy rates of hydro stations, UI mechanism not applicable for hydro during high flow, system of incentive payments; all these and many other issues puts hydro as a completely different subject for UI mechanism. Hydro stations with storage system should produce power only during peak demands and stop the production during off-peak hours. Also, the energy charge for a hydro generating station is nil, but their

generation is restricted by the flow of water. To replace this behaviour of flow an energy charge is included for hydro.

- **Interface options:** ABT mechanism should provide interface option between the stakeholders to impart benefits of the system to all. ABT interface and complaint meters should be provided at all injection and drawal points as per the CEA's (Installation & Operation of meters) regulations, 2006. The time synchronization should be done by Global Positioning System. An IT interface is a must for a smooth and transparent operation of UI mechanism which works for grid improvement and maintenance. IT interface would allow/allows access to the data, data storage by all the stakeholders, allows for preparation of reports based on the data's, tariff calculation can be done by one and all by just putting in the data, different queries of the stakeholders and beneficiaries can be entered and can be entertained upon very quickly. All these beneficial reasons make an Interface system very essential for the implementation of UI mechanism.

**Benefits arising from UI implementation:** Huge benefits can be incurred by following the UI mechanism of tariff both on the monetary side as well discipline side. Listed are some of the benefits of the UI mechanism.

1. **UI is a real time pricing mechanism:** UI rate is dependent on frequency signal received by every generator. Each generator then reacts to this frequency change and adjusts their supply to reach a new allowable frequency level. The decreasing returns by the deviations from the scheduled supply/drawal makes each generator/drawer think before deviating from the scheduled supply/drawal. The collective action thus plays a vital role in the game of making the frequency stable at the equilibrium level. This results in a win-win situation for all the stakeholders.
2. **UI can be used for Merit Order Despatch:** A perfect market is the one which does not have any one player in it who can guide the proceedings of the market. This tells that every player in a perfectly competitive market is small enough and is aware of the market conditions. Each generator is aware of the UI mechanism and in real time the UI rate applies to all the utility transactions. Each utility has its say in the market and no one can undermine its rights in real time mechanism. This tends to dispatch least cost power first than the other.
3. **UI increases efficiency of the grid:** Grid efficiency is definitely increased by meeting merit order despatch, charging utilities and beneficiaries for deviating from the scheduled supply/drawal, incentive for withdrawing the load during the peak hours etc.
4. **Capacity best matched with load by UI mechanism:** It tends to match the demand/supply by provision of incentives/disincentives and for the want of generating more revenues.

5. **Power exchange along with UI mechanism:** The proponents of the power trading market of India say that the lack of investor confidence in the Indian market is due to absence of the organized day ahead market. Lack of transparency is also a big deterrent towards the same. Introduction of UI has supported the development of a trading market and exchanges which serve for day ahead schedule and real time trading by bringing all the consumers and sellers together on a single platform with standardized contracts, trading procedures and bid formats. This would also lead to much transparency in the pricing mechanism and the confidence of investors is bound to increase.
6. **Implications of deviating from scheduled supply/drawal known:** If the implications of deviating from a law or a rule are well known the crime/violation of a rule can be controlled on a large scale. This is what UI has done to the Indian power industry in a short time and the progress is being continued at a larger pace. Recent amendments have narrowed the frequency to 50.2-49.5Hz and the overall charges payable for over drawal/under injecting at a frequency lower than 49.5Hz has been increased sharply. This would further help in strengthening the grid discipline. As an example, Uttarakhand Power Corporation Limited, due to the rapid industrialization of the state is finding it very difficult to keep pace of power capacity addition with the growth observed. It has paid more than 370 Crores as UI charges in the period April 2008 to October 2009 due to overdrawing from the central grid. This figure in itself acts as a boost towards power sector development.
7. **Improvement in grid parameters such as Frequency and Voltage**
8. **A mechanism for harnessing Captive & Co-generation:** If the existing captive/cogeneration facilities are harnessed within the grid the demand/supply gap in the country can be substantially bridged off. This can be done very quickly by stipulating that any injection or drawal by such plants will be paid for as per the frequency linked UI rate.
9. **More consumer load can be catered at any time:** This is due to the incentives given for reducing the load during the peak hours. Those who don't have very important use of power during peak load period can shed their load and gain from it. This is very closely related to the Demand Side Management.
10. **UI prevents costly damage to electrical & mechanical equipment:** Frequency variation is the very cause of damage to electrical equipments and indirectly to the mechanical equipments too. When frequency management is looked in to so deeply the damage to the equipments is also reduced drastically.



### **Improvements brought about by UI mechanism:**

- Grid frequency has drastically reduced from 48 to 52 Hz earlier to 49.5 to 50.5 Hz for most hours in a day.
- The hydro electric utilities are handled in an efficient manner than it was done before.
- States share have acquired a new meaning in the central generating stations and grid discipline is promoted.
- Power deficit states can meet their occasional excess demand by over drawing from the grid and paying the UI charges to the state which has under drawn.

### **Conclusion:**

The UI mechanism has dramatically reduced the problems faced by the Indian power sector in the field of grid management and discipline. It has developed investors' confidence in investing in Indian power sector by creation of transparent pricing system. UI mechanism in itself supports other reform policies such as open access, demand side management, efficiency, conservation etc. Huge resources of developing India are saved by this mechanism, supporting both over injection as well as under injection depending on the conditions prevailing in the system. It will also be not wrong to say that UI mechanism has alone brought more amount of discipline that could not have been brought by the collective influence of all other reforms. If all the generators participate equally in UI mechanism, it can bring down UI obligation of participants. UI w.r.t demand side management can be brought by implementing intra-state UI mechanism where much work still needs to be done.

## **References:**

1. Statement of Reason on UI Amendments dated 26.4.2010 taken from [http://cercind.gov.in/Regulations/Unscheduled\\_SOR-UI-final\\_26052010.pdf](http://cercind.gov.in/Regulations/Unscheduled_SOR-UI-final_26052010.pdf)
2. [http://www.powermin.nic.in/distribution/availability\\_based\\_tariff.htm](http://www.powermin.nic.in/distribution/availability_based_tariff.htm)
3. <http://hydropowerstation.com/?cat=1&paged=2>
4. Recommendations regarding implementation of Availability based tariff at Intra state level from [http://www.foir-india.org/upload/recomm\\_abt.pdf](http://www.foir-india.org/upload/recomm_abt.pdf)
5. ABC of ABT from [http://www.nldc.in/docs/abc\\_abt.pdf](http://www.nldc.in/docs/abc_abt.pdf)
6. Bulk Power Tariff - with specific reference to Availability Based Tariff in the country by Shri B.K. Mishra, Member Secretary, Eastern Regional Electricity Board Kolkata
7. Significance of Unsheduled Interchange mechanism in the Indian Electricity supply industry by S.K. Soonee, S.R. Narasimhan and V. Pandey from [wrlde.in/docs/Significance\\_of\\_UI.pdf](http://www.nldc.in/docs/Significance_of_UI.pdf)
8. [www.nldc.in/docs/gridcode.pdf](http://www.nldc.in/docs/gridcode.pdf)
9. <http://www.indiainfoline.com/Markets/News/New-amendments-in-Unsheduled-Interchange-UI-and-Grid-Code-norms-to-benefit-trading-companies-ICRA/4852925770>
10. Power sector reforms and information technology, from [www.tcil-india.com/.../TCIL%2026%20Power%20Sector%20Reforms%20&%20IT\\_1807200.ppt](http://www.tcil-india.com/.../TCIL%2026%20Power%20Sector%20Reforms%20&%20IT_1807200.ppt)
11. <http://www.gercin.org/docs/Orders/Other%20orders/Year%202006/Intra-State%20ABT%20order.pdf>
12. Investigation and analysis of Indian power grid after regulatory reforms and dynamic pricing from <http://www.ijest.info/docs/IJEST10-02-05-47.pdf>
13. Explanatory Memorandum to the Draft Central Electricity Regulatory Commissions (Unsheduled Interchange Charges and Related Matters) (Amendment) Regulations, 2010, [www.cercind.gov.in/2010/.../Explanatory\\_Memorandum\\_for\\_UI\\_Amendments\\_29.1.pdf](http://www.cercind.gov.in/2010/.../Explanatory_Memorandum_for_UI_Amendments_29.1.pdf)
14. [www.sldeguj.com/compdoc/abtintro.doc](http://www.sldeguj.com/compdoc/abtintro.doc)