AVAILABILITY BASED TARIFF

An Overview

Energy Market Development Program

Kathmandu: August 7, 2008

Colombo : August 22, 2008

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Outline of the presentation

- Need for ABT
- ABT concept
- How UI pricing works?
- Amendments to UI rates
- Payment of capacity & Energy Charges
- Many dimensions of UI mechanism
- Settlement system and logistics
- Impact of ABT
- Limitations and way ahead

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Conditions when ABT was conceived

- **Grid indiscipline**

  No respect for schedule by generating stations as well as beneficiary SEBs

- **Poor Frequency regime**

  Low frequency during peak periods, high frequency during off-peak periods

- **Reason**

  Perverted incentives in the tariff regime at that time – Recover of capacity charges based on PLF and no differential payment for deviations from schedule

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Concept of ABT

- Capacity (fixed) Charge recovery of generator linked to Availability
- Capacity charges payable by beneficiary based on capacity allocated
- Energy (variable) charges based on scheduled energy
- A third component known as Unscheduled Interchange (UI) charge is levied for deviation from the schedules
- Rate of UI Charge is based on frequency
- Settlement period of 15 minutes
- Applicability - Central Generating Stations and drawal from the grid by beneficiaries

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Unscheduled Interchange (UI)

- For Generating Station

  UI = Actual generation - Scheduled generation

- For beneficiary (getting supply from grid)

  UI = Total actual drawal - Total scheduled drawal

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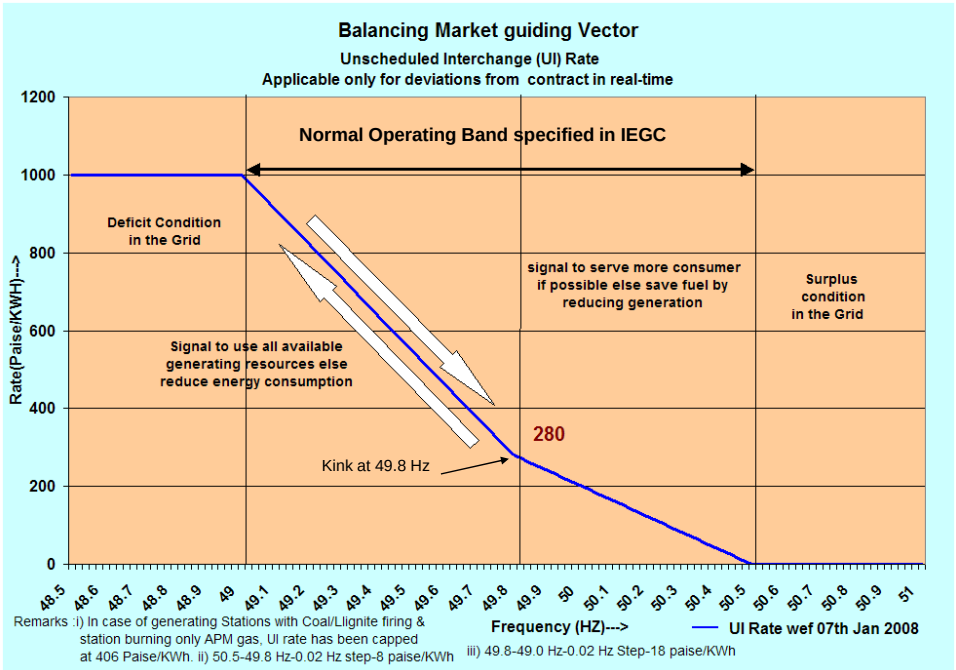

How UI pricing works -High Frequency

Example: Generating Stations

	Generating Station	
	A	B
Energy Charge (INR /Kwh) =	1.04	0.88
Frequency(Hz) =	50.2	
UI Rate (INR /Kwh)=	1.2	
Gain (Paise/ KWh) for generation below schedule =	0.16	0.32
Conclusion:		
Generating station A should srart reducing generation if frequency rises beyond the level at which UI rate is 1.04 INR/KWh i.e. 50.24 Hz		
Generating station B should start reducing generation if frequency rises beyond the level at which UI rate is 88 INR/KWh i.e. 50.28 Hz		

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How UI pricing works -Low Frequency

Example: Generating Station

UI Rate (INR /Kwh)=	2.8
Energy charge of the generating station despatched below availability or having margins	2.4
Gain by generating over the schedule (INR /KWh)	0.4
Conclusion:	
This generating station should, if feasible, start generating above schedule if frequency dips below the level at which UI Rate is equal to its energy charge i.e. 49.9 Hz.	

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How UI pricing works -High Frequency

Example: Beneficiary

Frequency (Hz) =	50.1
UI Rate (INR /Kwh)=	1.6
Variable cost of costliest operating generating station owned by the beneficairy (INR /Kwh)=	2.4
Gain (INR/ KWh) for drawal above schedule (by reducing generation at own costiliest station)	0.8
Conclusion:	
Beneficiary should start reducing generation at the costliest operating station (and overdraw from the grid) if variable cost of this station exceed prevailing UI Rate.	

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How UI pricing works -Low Frequency

Example: Beneficiary

Frequency (Hz) =	49.9
UI Rate (INR /Kwh)=	2.4
Variable cost of the cheapest standby generating resource owned by the beneficairy (INR /Kwh)=	2
Loss (Paise/ KWh) for each unit of drawal above schedule (and not harnessing own standby generation)	0.4
Conclusion:	
The distribution licensee should start generation at the cheapest standby unit if frequency dips below the value (50 Hz in this case) at which UI rate becomes equal to variable cost of this unit.	
The distribution licensee should start loadshedding if UI rate is beyond its means and there is no standby generating resource.	

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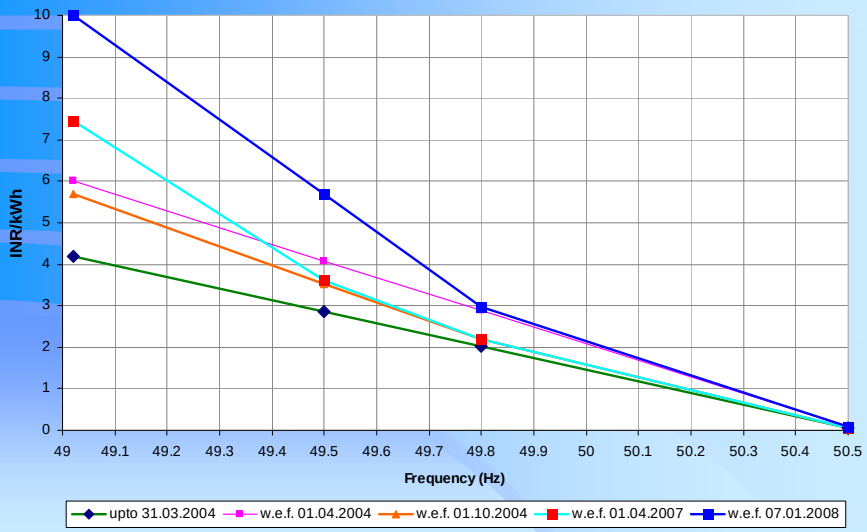
Changing UI Rates



Determination of Availability : Thermal Stations

- Availability means average of daily Declared Capacities expressed as % of Installed capacity minus Normative Auxiliary Consumption
- Declaration of capacity taking into account fuel availability
- Normative Availability 80% (exception for some specified generating stations)
- Availability to be certified by Member Secretary of the RPC concerned.

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Determination of Availability : Hydro Stations

- Capacity Index (CI) as measure of availability
- Daily CI = (Declared Capacity/Max available capacity)*100
- **Declared capacity** over peaking hours of next day (not less than 3 hours each day) taking into account availability of water, optimum use of water and availability of machines.
- **Max. available capacity** is the max. capacity in MW the generating station can generate with all units running, under the prevailing conditions of water levels and inflows, over the peaking hours of next day .
- Normative CI: 90% for Purely Run-of-river (ROR) stations and 85% for Storage and ROR stations with pondage
- CI to be certified by Member Secretary of the RPC concerned.

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Energy Charges

- Based on actually implemented scheduled energy
- Rate for thermal stations based on norms of operation
- Rate for hydro stations equal to lowest energy charge of Central Sector thermal station in the Region

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Mitigation of Gaming

- Thermal Stations: up to 105% of DC in time-block and 101% of average DC over the day allowed. Generation beyond these limits to be investigated by RLDC and UI to be made zero if gaming is found
- Hydro Stations: Schedule prepared for Day 4 (based on DC) is adjusted by deviation from the schedule on Day 1.
- RLDC may ask generating station to demonstrate DC
- Penalty for first mis-declaration equals 2 days fixed charges
- Penalty to be doubled for 2nd mis-declaration and so on and so forth.

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Multi-dimensional ABT

- A commercial mechanism for settlement of deviations from the schedule
- A commercial mechanism for improving grid discipline and frequency regime
- A commercial mechanism to achieve near-merit order operation
- A default market mechanism for trading

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Settlement of Deviations

- Any market –liberalized or regulated, needs a mechanism for balancing to take care of imbalances arising out of deviations from contracted schedules.
- In some markets, there is separate market for balancing.
- In India, UI mechanism attempts real-time balancing.

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Grid discipline and frequency profile

- Payment of Capacity Charges based on capacity available rather than energy generated - Avoidance of unwanted generation
- UI Charges - Load shedding/ increased generation at low frequency and reduction in generation at high frequency

ABT encourages grid discipline leading to better frequency profile

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Merit order operation

- Strict merit order operation - if generation scheduling is done for all the generating stations in the grid by single entity (Centralized scheduling)
- In Indian decentralized scheduling system UI Rate encourages:
  - * Backing down of generation in decreasing order of variable cost as frequency goes up
  - * Picking up of generation in increasing order of variable cost as frequency goes down

ABT encourages merit order operation in spite of decentralized scheduling.

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Default market for trading

- Underdrawals with respect to schedule may be viewed as supply to the grid (at UI rate) and vice-versa
- Similarly, under generation with respect to schedule may be viewed as drawal from the grid (at UI rate)

UI rate serves as default rate for trading

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Settlement System

- Settlement period- 15 minutes
- Declaration, scheduling and UI accounting on 15 minute basis
- Special Energy Meters - for time differentiated measurement of energy
- Energy Accounting (capacity and energy charges) - on monthly basis
- UI accounting on weekly basis
- UI payments are received in a pool and payments are made from the pool

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Logistics

- SEMs installed by CTU (POWERGRID)
- Meter readings downloaded and sent to RLDCs every week by staff of generating stations, POWERGRID and beneficiaries
- RLDCs validate and submit data to RPC Secretariat by Thursday noon for the week ending midnight of previous Sunday
- RPC Secretariat to carry out UI charge accounting (weekly basis) and energy accounting (monthly basis)

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ABT Implementation

Western Region	**-**	**1.07.2002**
Northern Region	**-**	**1.12.2002**
Southern Region	**-**	**1.01.2003**
Eastern Region	**-**	**1.04.2003**
North-Eastern Region	**-**	**1.11.2003**

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Impact of ABT

Comparison of frequency profile - Full year after and before ABT

Region	Percentage of time when frequency was					
	< 49.0 Hz		49.0 - 50.5 Hz		> 50.5	
	2001-02	2003-04	2001-02	2003-04	2001-02	2003-04
Northern	11.2	4.8	76.2	89.4	12.6	5.8
Western	31.4	2.8	61.6	89.4	7.0	2.4
Southern	78.0	2.3	17.9	97.3	4.1	0.4
	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04
Eastern	13.0	2.9	55.7	95.9	31.3	1.2

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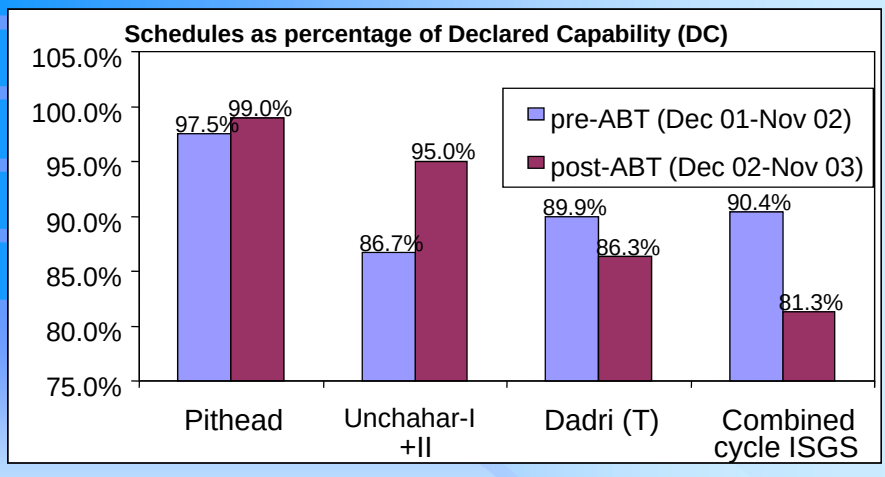
Impact of ABT

Merit order



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Limitations / Constraints

- Shortage conditions
- Regular and timely payments to UI pool
- Expectation of rational behabiour from utilities and operating personnel
- Demand forecasting
- Control over generation level and demand

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What lies ahead?

- Intra-State ABT
- Modulating UI prices according to changing situations
- Adopt operating practices and commercial mechanism for stricter frequency control (when shortages are eliminated?)

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Tank You

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