

Experience of ABT in Western Region

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1.0 Introduction

Western Region has the exclusive distinction in taking the initiative in implementing the Availability Based Tariff (ABT). This was despite lot of apprehensions held by SEBs around the country with regard to legal hurdles. Now, Availability Based Tariff (ABT) was introduced in the Western Region w.e.f 1.7.2002 subsequent to unanimous decision of WREB in its meeting held at Bhopal on 30.4.02. It has now been in operation for more than two months. It is generally felt that its introduction has been very smooth and satisfactory, primarily due to the co-operation extended by all the WR constituents.

CERC in their order dated 4th Jan,2000 stipulated the dates of introduction of ABT in Western region as October,2000. The date was postponed to first August,01 after review petition by NTPC and later to October,01 for commissioning of all SEMs and time required for mock exercise. The SEMs were fully installed all over the region by July,2001.

The total cost of infrastructure required for ABT constituted mainly SEMs and hand-held devices for data collection i.e. DCDs . Through indigenously developed Special Energy Meters of 0.2 S class at very cost effective price of about less than US\$700, the total investments are expected only about half a million dollars for each region. These costs of putting new arrangements are insignificant as compared to millions of dollars spent in each power pool of developed countries for bringing competition at wholesale level. In UK, the cost of development and running the new wholesale market for first 5 years was approx. US\$1.1billion. and after a decade of high prices, Britain spent an additional 100 million pounds to institute NETA(New Electricity Trading Arrangements).This is apart from what electricity industry spent to install computer systems and trading desks to participate in bidding process. Whereas, in ABT mechanism, there are no major changes which are required to be brought out either at utility-level or RLDC-level except change of procedures and of course, bringing in grid discipline.

The full cooperation of all concerned only made it possible to implement the basic infrastructure ready and making arrangements for sending SEM data to WRLDC. The SEM data from all constituents is being received every Monday since September,01 onwards. The mutual cooperation of

each constituent has made it possible to see the Day of 1st July,02 when the ABT was finally implemented in Western Region and has become the first region to implement ABT in the country.

Ensuring UI payments would have profound effect on the success of ABT. The one to one payments system will be complex as each constituent has to raise number of bills against others for each week. To simplify the settlement system, WRLDC has been operating pool account on behalf of WREB.

This paper discusses the experiences and developments that took place after July,02 and the advantages derived from ABT mechanism and constraints faced. This paper also discusses the improvements observed in grid operation and its constraints.

2.0 Salient features of grid operation under ABT

The salient features of Grid Operation in July/August/Sep,2002 under ABT regime are:

- 2.1 ABT has been successful in containing high frequency problem to a great extent. Constituents are currently backing down their costly thermal generation such that drawal is increased during high frequency regime.
- 2.2 ABT has acted as a catalyst in prompting all the constituents to follow merit order generation to gain commercial advantage. It has prompted all the constituents to back down their costlier generation. For eg., as the thermal generation in Gujarat is costlier because their plants are situated away from pithead, Gujarat tends to draw more than schedule from Central Sector during high frequency regime. However, as frequency comes down and UI price goes up, Gujarat maximises its generation / increases load shedding such that their drawal is less than schedule to gain UI advantage. An indicative schedule vs. drawal plot of Gujarat is enclosed at Annex-I.
- 2.3 ABT has aided in controlling the grid parameters by virtue of its mechanism. Intervention of RLDC is not required frequently in improvement of frequency and voltage profile. Constituents on their own are controlling their MW/MVAR drawal to maintain grid parameters in safe range.
- 2.4 Clear cut commercial / operational datum is established for all the constituents as well as generating stations. It has helped all the constituents / generating stations to take proactive measures such that they are commercially benefited. It has also led to better operational performance and improved grid discipline.

- 2.5 ABT has incorporated sanctity in intra-regional transfer. There is a clear shift from earlier commercial mechanism which was based on actual drawals. The intra-regional exchanges are in-built in schedule which has helped them to derive advantages in UI thus helping in improving the grid discipline.
- 2.6 ABT has prompted constituents to be more realistic in planning their Load Generation Balance. It has resulted in realistic requisition from all the constituents for scheduling of ISGS generation.
- 2.7 Constituents are now looking for bilateral exchanges rather than overdraw power as latter entails financial disincentives. It has resulted in more bilateral exchanges among the States. For eg., in Western Region, CSEB has entered into bilateral agreement with GEB for 100 MW of power. Similarly, Goa has entered into bilateral agreement with GEB for 50 MW of power and with UTC/PSEB for 25 MW each.
- 2.8 NTPC stations were adhering to ISGS schedule as PLF for incentives will be computed on schedule.
- 2.9 Frequency linked despatch coupled with merit order is leading towards flattening of load curve. It is also forcing constituents to implement time of the day tariff for their HT consumers. For eg, CSEB has implemented time of the day tariff for HT consumers.
- 2.10 ABT has also prompted constituents to harness captive generation within their control area to maintain drawal against schedule particularly during low frequency regime. For eg. GEB has harnessed captive power in the order of 140 MW from various CPPs.
- 2.11 All the constituents of Western Region have been convinced about the utility of UI pool account which will be operated by WRLDC, Mumbai. This would facilitate in speedy payment of UI charges thereby improving grid operation.
- 2.12 With the implementation of ABT frequency profile has improved which has generated positive signals towards the implementation of Free Governor Mode of Operation of generating units in Western Region.
- 2.13 SEBs are on their own started curtailing their overdrawals even under the prevailing deficit situation.
- 2.14 The dispute regarding booking of Kakrapar energy to MPSEB even when the latter was not having a share in the NPC stations stands resolved.
- 2.15 The dispute between the WR constituents regarding bilateral sales, both intra-regional and inter-regional, stands resolved.

- 2.16 GEB has harnessed captive generation which was idling earlier. In fact these captive generators become despatchable with the current level of deficits.
- 2.17 A frame work has been put in place wherein inter-regional and intra-regional bilateral trading can take place in a rational manner. Also, captive generation can be harnessed, and even embedded utilities/plants (e.g Tata Power, Essar) can sell surplus power to other SEBs. Pumped storage plants too can be beneficially utilized.
- 2.18 Once the UI payments are made regularly, overdrawn SEBs also would curtail their load (load shedding) to match their schedules.

3.0 Benefits accrued from ABT for Grid Operation

3.1 Better Grid Parameters

We must keep in view the following aspects while comparing the frequency profiles of pre-ABT and ABT periods.

- ABT is a commercial mechanism, which provides strong commercial signals to all constituents to do the right thing, e.g., enhancing cheaper generation and reducing over drawal during deficit conditions having high UI rate. The resulting improvement in load-generation balance (and consequent to improvement in frequency profile) depends on how much the constituents respond to these signals.
- After improvement in the first few days of July 02 due to rains, the load generation balance in W.R has significantly deteriorated due to subsequent failure of monsoon. While hydro generation had gone down and load had gone up, the problems compounded by pre-planned annual overhauls and other outages of thermal stations.
- Grid discipline would mainly be induced by the U.I mechanism and therefore timely payment of U.I is most essential. As the constituents get to know their liabilities only after a delay of nearly two weeks, the impact of U.I would take some time to take effect.

It would be appreciated that ABT provides a strong commercial signals to all constituents to maximise the generation during deficit conditions. This is the best that can be done to improve the load generation balance, but it may not be sufficient to lift the frequency.

The daily duration of frequency above 50.5 Hz had reduced during the periods of low demand due to rains. While increased system load (due to present dry spell in entire WR) and considerable generating capacity outage are contributory factors, frequency rise is getting checked due to backing down of generation by the SEBs during off-peak hours. And this is being done by the SEBs on their own, due to the commercial signals provided by ABT.

The frequency profile of W.R had radically changed from 28th July. Instead of going below 49.0 Hz only during peak-load hours, the frequency

was below 49.0 Hz for most of the time. This could be attributed to the deteriorated load-generation balance, due to a combined effect of (i) increased outages of generating units, (ii) increase in system load, (iii) reduction in load shedding by the SEBs and (iv) the CSEB/MPSEB dispute. While MPSEB continued to overdraw claiming surplus unutilised shares of CSEB without limiting their drawals to shares notified by MoP.

The frequency profile improved substantially in the month of August, 02 as compared to August, 01 despite having higher (unrestricted) demand. The frequency profiles are as enclosed at Annexure II.

3.2 Better Grid Discipline

The number of violations in the months of August'02 and September'02 in the current and previous years are as shown in the table. This is a significant improvement considering that the ABT is hardly three months old.

Number of Violations of Grid Discipline

	This Year		Last Year	
	<49 Hz	>50.5Hz	<49 Hz	>50.5 Hz
July	91	4	70	5
August	17	18	78	13
September (Upto 16.9.02)	3	2	119	0

3.3 Strategic drawals

The ABT mechanism allows for overdrawals / under drawals within the frequency band of 49 to 50.5 Hz with the deviations priced at frequency linked UI prices. A state can get advantage if it overdrawing from the grid at high frequency. GEB had overdrawn from the grid during high frequency conditions during August'02 and September'02. MSEB regulated their drawals on most of the occasions by varying their hydro generation with the intention of and reducing the UI payments.

3.4 Better Generation Despatches by ISGS

NTPC has been regulating its generation to avoid negative UI. They are declaring marginally less than the actual availability and trying to generate slightly more than schedule so that negative UI is avoided. This is resulting into additional generation availability to constituents without paying for the same. NTPC stations are now trying to earn UI (in case of schedule < DC) whereas they were not interested in earning UI earlier.

3.5 Utilisation of Bottled-up Resources

3.5.1 TPC to MSEB :

Tata Power Company(TPC) had unutilised capacity of 100-300MW in the off-peak hours which was utilised by MSEB which otherwise was not being exploited by MSEB. The utilisation of 150MW pumped storage plant at Bhira is also being discussed. MSEB can draw power at low UI price which TPC can utilise for pumping. The power can be generated when the UI prices are higher. The plant(which was so far idling) becomes now despatchable with a win-win case for TPC and MSEB .

3.5.2 IPPs of Gujarat

GPEC, Essar, GIPCL and other CPPs are being scheduled by GEB to avoid UI at low frequency. The UI rate at low frequency below 49.5Hz is more than 280p/kWh, whereas the cost of naphtha based IPPs which is varying from 250-350p/kWh, become despatchable and they are being utilised. In pre-ABT scenario, there was no additional cost to energy overdrawn and the naphtha-based IPPs were never cost-effective, therefore remained unutilised.

GPEC brought 2 units of 138MW each on 1st and 2nd Aug,02 and run up to 5th August '02 and again run on 22/8/02 and 23/8/02.

3.6 Increased Bilateral Agreements

The bilateral agreements between SEBs of WR and other regions have increased substantially. The major bilateral agreements took place in July-Aug,02 are:

Goa to GEB

CSEB to GEB

Goa to UT of Chandigarh

Goa to Punjab

There was lot of scope for intra-regional trading which however was not utilised due to dispute arising from allocations subsequent to reorganisation of states of MP and Chhattisgarh. The other reason was uncertainty of financial payments from the potential buyers.

Prior to ABT, bilateral transactions for intra-regional exchanges were unheard of as there was no sanctity for schedule and the states can overdraw as much as they can and whenever they can as the commercial mechanism prior to ABT was based on drawals and all drawals are priced at pool price (weighted average cost). There was no sanctity to entitlements or schedules.

The inter-regional trading of in-firm power initially was discouraged since WREB advised not to trade without bilateral agreements with other states. Later, a mechanism evolved for importing of power from NR which is cheap and being asked for by all the constituents. In this case, clearly merit-order despatching signals of ABT was the reason for increased imports of in-firm power from NR since this power was cheapest power station of NR i.e. Singrauli.STPS with some of the constituents opting for less requestion from ISGS stations of WR .The exports to SR was not

ratified by our constituents for the reason that payments are not forthcoming from SR constituents. Though in the month of August,02 Maharashtra had agreed to sell power to SR at the rate 190p/kWh when frequency was above 50Hz thereby earning profits of at least 50p/kWh. PTC has submitted a proposal of trading between constituents of two regions wherein one region has ABT implemented and other not yet. Only uncertainty regarding receipt of payments has been removed after PTC's proposal of UI trading from 1st of August'2002 came into effect. The readiness for effecting trading based on UI prices has clearly been the major victory achieved from ABT mechanism since same UI price are not only for penalties/incentives but also reflect incremental costs. The opposition existing prior to 1st July '02 disappeared, now with ABT in place.

3.7 Utilisation of cheaper resources from NR

It has been observed that constituents are asking for cheaper power from NR (which is at Singraulli rate) despite their underdrawals from the grid. A case in point is that of MPSEB drawing cheaper NR power even though they were under drawing by 300 to 400MW. This indicates clear understanding on the part of constituents with regard to Frequency-linked Despatch guidelines. The cost of Singraulli STPS is about 80p/kWh which corresponds to UI price at frequency of 50.2Hz. Therefore, till the time frequency is below 50.2Hz, it is prudent to import power from NR by backing down in SEBs' own stations and asking for less requisitions from costlier ISGS. But this would require to compare VC of ISGS with total cost of SSTS (as ABT is not effective in NR).

3.8 Utilisation of Hydel Resources

Constituents are now being aware of frequency based UI prices and the incremental cost of their power system based on frequency. They have started utilising scarce Hydel resources only when the cost of power is high. Slowly, constituents are adopting frequency based despatch guidelines. Once all the stations (including those of NTPC) follow frequency linked despatch guide lines, the operating cost will reduce further.

3.9 Deficient states looking for more allocations from cheaper ER NTPC generating stations

Power starved states which used to overdraw from the grid and did not agree to sign BPSAs for cheaper power have started asking more allocations from ISGS. In the 119th WREB meeting, the scenario after commissioning of Raipur-Rourkela lines was discussed and all the constituents were found to be competing for allocations from ER.

3.10 Merit Order Scheduling for NTPC Stations

The scheduling process as per ABT orders and IEGC was implemented by WRLDC. The ISGS except nuclear based stations are being scheduled as per requisitions from SEBs/SEDs. The constituents started giving requestions based on the variable cost of power stations. The SEBs who were deficient and required full requisitions from all NTPC stations indented for full entitlements even during the monsoon days viz. GEB, MPSEB, DD and DNH. Though, Goa is a surplus state, Goa gave a standing instruction for full entitlements from KSTPS and VSTPS, the cheaper ISGS stations whereas they have already surrendered their entitlements from costlier power stations of Kawas and Gandhar GPS. MSEB showed their choice for cheaper power during surplus times. All SEBs had utilised the choices offered by ABT in reducing their bill of energy charges by opting power based on their merit order costs. Some typical cases are being mentioned below:

Scheduling of all ISGS stations except liquid-fired Kawas CCGTs were straightforward and constituents continued to avail power from them. Scheduling of three gas turbines units at Kawas, which are available but can be run only on liquid fuel due to shortage of gas, had posed a special problem. Due to the high fuel cost (about 250 p/kWh in combined cycle mode), these units had not been running at all since 26.6.02. For 1.7.02, NTPC had declared an ex-power plant capability of 489 MW for these units. The aggregate requisition of the SEBs out of the above, in the first instance, varied from 25 MW during off peak hours to 333 MW during evening peak hours. Since this was not a practicable schedule, the matter was discussed with NTPC and the SEBs, the requisitions were modified, and a schedule was finalized in which the liquid-fired gas turbines are not required to run during off-peak hours, and two gas turbines on combined cycle mode are to run during evening hours.

The above was agreed to, with considerable reluctance, by NTPC, and two gas turbines along with the idling steam turbine were run up at Kawas on the evening of 1.7.02. It being the first day of such operation, there were some operational problems and a consequent 2-hour delay in reaching full load. The requisition for 2.7.02 were also on a similar pattern, and a similar schedule was issued for 2.7.02, but with increased hours of operation. For the third day (3.7.02), requisitions for liquid-fired gas turbines have increased further, and operation of one unit in morning-peak hours, and of two units in evening peak hours was scheduled. However, NTPC had advised that these gas turbines/steam turbines cannot be started and stopped every day. No gas turbine on liquid firing was scheduled for many days when there was demand reduction due to rains in several parts of the region.

SEBs' requisitions from Central generating stations gradually improved from 8th July, 02 onwards as the SEBs have realised that it is now in their own interest not to ask Central stations (except the gas turbines on liquid firing) to back down. There was a very minimal backing down in scheduling of NTPC stations on 10th, 11th and 12th, and that too was due to Gujarat and Goa taking time to appreciate the various aspects and

implications of ABT. The schedules issued for 13.7.02 required no backing down at all for any of the Central stations. Even the liquid fired gas turbine units of Kawas are being asked to run round-the-clock at full capacity.

The problem of low schedules to liquid-fired gas turbines of Kawas subsided due to generation deficit, but resurfaced again when rains restarted from 2nd August'02.

4.0 ALLIED ISSUES:

4.1 *Separate notification for gas/liquid for dual-fuel CCGTs energy charges*

As per CERC's order dated 4.1.00, the ISGS will declare separate capabilities for both gas and liquid fuels. But it is observed that energy charges for both the fuels are not separately notified. This creates inconsistency between actual Operation and Commercial signals. Even though a particular constituents do not give requisition for liquid fuel generation, they are required to pay weighted average VC of Kawas GPS. This needs to be avoided to drive maximum advantages from commercial signals of ABT.

4.2 Segregation of VSTS Stage-I & II Actual Generation

When two stages of a power station are scheduled separately, they are to be notionally treated as two ISGS and accordingly there shall be separate DCs and SGs. AGs of the two stages should also have to be calculated separately. CERC's interim order on Vindhyachal tariff for stage-I and Stage-II of VSTPS have different fixed charges and also allocations for constituents are separately given. It becomes important to record actual ex-bus generation of Stage-I and Stage-II separately so that DC and AG can be compared stage wise for calculation of UI as per the clause 6 of Schedule-1 of ABT order of 4.1.2000.

Even though VCs are almost same for two stages, the merit order will not get affected by separate scheduling for two stages. But here the clauses related to 'mis-declarations' become important. Therefore, to check AG is not going beyond DCs, we need to calculate AG for each stage separately. In absence of AGs, it would not be possible to check the declarations for each stage. Therefore, the GT/ST-side meters are required to identify stage-wise generation for checking mis-declarations. However, NTPC is not furnishing these meter recordings even though directed by the WREBoard.

4.3 Frequent Changes of ISGS Schedules

The problem of too many plant availability revisions being advised by NTPC persists. (A list of availability changes for 8.7.02 is enclosed as Annexure-III, as a typical example.) The resulting frequent rescheduling exercise diverts the attention of WRLDC from its other important

responsibility of monitoring the healthiness of the grid. NTPC should avoid such frequent and minor changes, some of which are as small as 1-2 MW. CERC is also requested to review the provisions in its order which are prompting NTPC to insist on such changes.

4.4 MPSEB's claim on CSEB's unutilised shares

After the bifurcation of the erstwhile State of Madhya Pradesh, the Ministry has specified the allocations for the two States, with certain adjustments from time to time. The latest order from the Ministry is issued on 17.6.02, as per which the entire share of Chattisgarh has been restored to Chattisgarh w.e.f 1.7.02. Based on the above order, the WREB Secretariat issued its advice dated 28.6.02 specifying the shares of all States in percentages, which formed the basis for determining the States day-to-day entitlements, requisitions and schedules. The schedules so derived also become the datum for determination of overdrawals and underdrawals and levy of UI charges w.e.f. 1.7.02, the date from which Availability tariff (ABT) has been introduced in the Western Region.

The above referred order dated 17.6.02 of the MoP also provides that any allocation which Chattisgarh is unable to consume will be allocated to MP. MP is claiming an enhanced share on the premise that any underdrawal by Chattisgarh should automatically be added to its specified share. The Ministry of Power order dated 17.6.02 clearly states that any unutilised allocation of Chattisgarh WILL BE ALLOCATED to MP. Any such reallocation can be done only by the MoP, unless some other agency is authorized by the Ministry to do so. The WREB Secretariat has then to revise the allocations advised by it on 28.6.02. All this has to be done prospectively, and only then such reallocation can be considered by the WRLDC for determining the day-by-day entitlements, requisition and schedules. Any reallocation on the above count has to be formally notified by the Ministry of Power, for prospective application, and is not automatic.

5.0 Conclusions:

- 5.1 All constituents of WR are continuously making serious efforts to ensure that their injection/drawals are according to the respective schedules. The magnitude of overdrawals (a serious problem earlier) has substantially come down and corrective actions are being taken much faster. Previously, whereas the overdrawals used to touch 300-800MW regularly despite *persuasions from WRLDC, now occur only up to 200MW and rarely above 300MW.*
- 5.2 GEB has decided to harness the captive generation idling within the State to curtail its overdrawal from the regional grid. This additional energy input into the regional grid would enable the SEBs to supply additional load and effect corresponding reduction in load shedding. We hope that other SEBs would follow and create an encouraging environment for CPPs.
- 5.3 The WR constituents are expected to gradually understand various nuances of ABT and exploiting the opportunities the scheme offers.

These include not only entering into negotiated bilateral contracts, but also deliberately deviating from the schedules for on-line trading through the U.I mechanism.

- 5.4 Merit order operation has been clearly established. ABT has acted as a catalyst in prompting all the constituents to follow merit order generation to gain commercial advantage. It has prompted all the constituents to back down their costlier generation during high frequency regime and overdraw from the grid. However, as frequency comes down and UI price goes up, constituents maximise their generation / increase load shedding such that their drawal is less than schedule to gain UI advantage.
- 5.5 The bandwidth of frequency has come to a large extent between 49 to 50Hz., ensuring/making it possible for the governor to be operated in the free mode.

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Changes in availability for 8.7.2002 (NTPC)

1

S. No.	Station	MW	Time	Advised at
1.	Gandhar	420	0000 hrs. to 0500 hrs.	2126 hrs. on 7.7.02
2.	Gandhar	425 400	0000 hrs. to 0800 hrs. 0815 hrs. to 0900 hrs.	2339 hrs. on 7.7.02
3.	Gandhar	390	0915 hrs. to 1200 hrs.	0745 hrs. on 8.7.02
4.	Gandhar	380	1215 hrs. to 1800 hrs.	1100 hrs. to 8.7.02
5.	Kawas (Gas)	145 146 147 148	1500 hrs. to 1600 hrs 1600 hrs. to 2000 hrs, 2000 hrs. to 2200 hrs 2200 hrs. to 2400 hrs.	1457 hrs. to 8.7.02
	Kawas (Liquid)	230 232 231 232 234 235	1500 hrs. to 1600 hrs. 1600 hrs. to 1700 hrs. 1700 hrs. to 1900 hrs. 1900 hrs. to 2000 hrs. 2000 hrs. to 2200 hrs. 2200 hrs. to 2400 hrs	-do-
6.	Gandhar	385 390	1800 hrs. to 2000 hrs. 2000 hrs. to 2400 hrs.	1650 hrs. on 8.7.02