IMPLEMENTATION OF ABT : NEW TARIFF MECHANISM AND EXPERIENCES SO FAR

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ABSTRACT

Even though mandated by CERC, the implementation of Availability Based Tariff was delayed due to legal hurdles. Ultimately, due to an unanimous decision by the constituents of Western region, ABT was implemented from 1.7.2002. The change over has been smooth. The paper describes the advantages of ABT over the pre-existing PLF based commercial mechanism. Salient features of ABT and its rule on promoting trading have been described. Major part of the paper deals with the benefits accrued due to ABT based on experience during the three months (July to September '02)

1.0 INTRODUCTION

Bulk power supply in the regional grids mainly constitutes of power from multi-shared projects, better known as central sector stations in India. The tariff mechanism applied to such bulk power supplies at 400 kV & 220 kV levels affects the grid at large and the importance of right mechanism can never be overemphasised. The small changes in tariff structure can result in large savings or losses to the power ports. Disadvantages of PLF linked tariffs and resulting wastage of scare national resource is too well known. Despite such clear disadvantages, the ABT (Availability Based Tariff) implementation is marred with legal hurdles. Till introduction of ABT, the existing mechanism has been in operation for more than a decade and has not resulted in linking system operation with right commercial signals thereby causing problems in the form of a) wastage of national resources b) high frequency operation due to poor planning and lost opportunities for exchange of surplus power from one state / region to another.

Energy cannot be stored as such must be consumed as and when it is generated. In other words, load generation balance has to be maintained. Excess generation results in unnecessary high frequency and shortage of generation results in low frequency, hence poor quality of power supply. To have reliable and quality supply a suitable tariff mechanism needs to be in place, so as to send commercial signals to the generators and beneficiaries. In this paper, an attempt is made to present the pre-ABT tariff methodology, its inadequacies & fallacies, the new mechanism and benefits accrued from its implementation in Western Region w.e.f. 01.07.02.

2.0 PRE-ABT TARIFF MECHANISM

In the pre-ABT tariff mechanism prevailing in almost all the regions, total ex-bus generation of all multi-shared projects form a pool of power. The beneficiaries draw from this pool and pay for actual energy drawals at weighted average pooled rate. The generating stations receive total cost of their generation from this pool. This way each beneficiary pays to each station in proportion to its drawal. The entitlements of beneficiaries in different power projects have no sanctity.

Generation Tariffs of Inter-state generating stations (ISGS) based on coal & gas are calculated in two-parts Fixed charges (Rs/Year) are calculated based on total annual fixed costs comprising of Interest on loan, O&M charges, RoE, taxes, duties, interest on working capital etc. and are recovered in 12 equal monthly instalments through

tariff in proportion to drawals. The ISGS fully recover its fixed charges at PLF of 63.5% and at PLF of over 68%, ISGS receives incentives. However, ISGS recover 50% of the fixed costs even at 0% PLF.

Variable charges (in Rs./Kwh) are recovered as per ex-bus generation of each power station and are payable as per actuals drawals.

The equal-landed cost methodology prevailing in all regions except in NR. There are minor deviations in other regions like WR which has additional frequency-linked hourly charges (paradoxically without the Central generators participating in the FLE scheme) superimposed on the equal-landed monthly billing. But a common feature has been that schedules donot form a component in final energy billing and it had been difficult to trade without prior knowledge of datums of interchanges on which trades can be superimposed. Moreover, the payments as per actual drawals and actual generation donot impose planning on day-ahead or hour-ahead basis. All these had given rise to improper signals for system operation and pool participants had to pay for simplicity.

3.0 INADEQUACIES OF PRE-ABT TARIFF MECHANISM

In so-called two-part tariff, both fixed and variable charges are based on actual energy drawals, the buyer sees the cost of energy as sum of the two, whereas the KP Rao Committee intended that the fixed charges should have been seen as sunk costs and only variable charges should be compared for Merit Order operation. The SEB's compare the variable costs of their units with full cost of Central Sector Generating Stations. The objective of two part tariff is not fully satisfied.

PLF based generation tariffs also encouraged ISGSs to generate irrespective of frequency to maximise their own incentives. This resulted in unwarranted generation during high frequency period resulting unnecessary wastage of fuel.

The pre-ABT commercial mechanism was not inducing trading opportunities and grid discipline but rather preventing development of conducive markets for trading. The setting up of a central regulator (CERC) in 1998 and its subsequent issuance of orders on ABT and IEGC, has addressed both of these problems.

Pre-ABT commercial mechanism (before CERC's order of 17th Aug,2000) has major flaw that schedules are not known in advance. The real-time entitlements are taken as schedules which do not give datum for trading to take place. The basic reasons for little trading opportunities is absence of proper framework for trading. The following are, inter alia, the trading opportunities lost typically in a regional power grid in India. The examples quoted are from Western regional grid.

a. Absence of merit-order operation
b. Scheduling and Commercial Aspects delinked.
c. Less inter-state transactions despite Availability
d. Non-utilisation of Utility's surplus power (within region)
e. Non-utilisation of embedded IPP/Licensee's surplus power
f. Non-utilisation of Pumped Storage Schemes
g. Inability to despatch generation according to grid requirement

a. Non-utilisation of Utility's surplus power

Since the overdrawals are not properly priced in the present mechanism, the trading is not being resorted to by deficit states. In Western region, CSEB has surplus power but neighbouring state of MP which is having deficit, overdraws from the grid rather than going in for purchase of power from CSEB. CSEB will not utilize additional captive generation till the time bilateral transactions are made with a state in neighbouring region. This is because their own surplus (including captive) will be overdrawn by other states in the region, which is priced at regional pool rate (generally less than captive power costs) giving wrong economic signals thus restraining CSEB to maximise captive generation. As such, the intra-regional trading is seriously affected. However, only some inter-regional trading takes place.

Incidentally, there exists a scheme for pricing deviations linked to frequency in Western Region, but the same is not effective due to non-participation of generators.

b. Non-utilisation of embedded IPP/Licensee surplus power

The licensees are having surplus power in state of Maharashtra, but due to ineffective commercial mechanism and other administrative problems, the surplus power could not be exported to other needy states. In the present

mechanism, both fixed and variable costs are charged for IPP's surplus power irrespective of time when surplus is available i.e. peak/off-peak. The cost of off-peak power is not distinguished vis-a-vis peak power resulting into unattractive proposals.

c. Non-utilisation of Pumped Storage Schemes

The Pumped Storage schemes are not being utilised by the utilities due to absence of proper pricing mechanism.

d. Inability to despatch generation according to grid requirement

Tata Power, a licensee of Maharashtra runs 300MW hydro during their peak (11 hrs to 14 hrs) when the system frequency is high. Thermal generation surplus from the grid can be utilised during this time, the hydro generation can be displaced to evening peak hours i.e. 19 to 22 hrs when grid frequency is low. Due to differential cost of pricing in MSEB-to-Tata and Tata-to-MSEB transactions, such desired redespatch is not possible even though beneficial for the grid. Moreover, during evening peak hours the onset of loads have to be matched with fast-start generation thereby precious hydro resources are wasted in a region deficient in hydro.

e. Curtailment of bilateral transactions due to grid indiscipline

A case in point is when CSEB had surplus power which it was trading with DVB, serious impediment was faced due to other state's (MPSEB) overdrawal resulting into termination of trading. A point to be noted is that even when CSEB was underdrawing to the extent of its export , transaction had to be terminated for no default on the part of CSEB. A similar case could also be cited when MSEB was trading its surplus power with TNEB.

f. Absence of merit-order operation

The fixed costs, in the present mechanism, are not perceived as sunk costs due to payments based on drawals and not on shares/schedules. Therefore, economic signals for true merit order operation are absent.

4.0 PREREQUISITES FOR A TARIFF MECHANISM TO FOSTER TRADING

i. ***Time-block-wise Schedules***

Tariff mechanism should be able to establish datum for interchange schedule with respect to which trading quantum is to be negotiated.

ii. ***Adequate authority with CLDs and Transparency***

System operator of each utility should have the **requisite authority to negotiate** over telephone the quantum and price of such trading with his counterparts, and is willing to take crucial on-the-spot decisions having high monetary value.

In ABT, the incremental cost vs. frequency relationship would be identical for all SEBs, all utilities can reasonably be assumed to be having the same incremental cost at a particular time, such that the transparency is automatic and therefore, ***no negotiations between load despatchers are necessary*** regarding fixation of transaction price, substantially meeting the intents of the this requirement.

iii. ***Adequate transparency and/or faith between utilies***

In economy transactions, incremental costs of available/avoided generation as stated by one utility must be accepted by other in good faith. This requirement for effective economy transactions disappears in case of ABT where the system-wide incremental cost are well known to all.

iv. ***Measurement of deviations***

There must be a mechanism for determining periodic (15-minute block-wise) deviations from net-interchange schedule for each utility, and then either attaching a monetary value to it or making a compensatory adjustment in future schedules.

v. ***Willingness to draw as per schedule***

There should be willingness on part of all **utilities to maintain their drawals from the grid as per schedules** even during conditions of generation shortage. They should be willing to buy the deficit from their neighbours through advance negotiations to meet their consumers' total demand and they should have the capability to pay a reasonable price for the same.

5.0 NEW TARIFF MECHANISM : AVAILABILITY BASED TARIFF

Indian power sector comprises of SEBs(the vertically integrated utilities) and their licensees/IPPs and central generators. The Availability Based Tariff notified is a scheme of tariff for central generators as well as tariff for deviations in SEB drawals. As the name signifies, the major part of payment for the stations' output in this tariff scheme is based on station's availability, rather than on MWH/MVAH output or peak MW/MVA as in conventional two-part tariff applicable presently.

Payments under ABT basically comprise of three parts –capacity charge, energy charge and charges for deviations. The *capacity charge* for a time block (15-minute time block or one day) is paid for the declared MW output capability of the station for that particular time block (for target availability of 80% in the year). The capacity charge is meant to cover the total fixed cost for the generating station i.e. interest on loan, return on equity, loan repayment provision or depreciation/ amortisation, fixed O&M cost, insurance, taxes, interest on working capital etc.

The *energy charge* is meant to cover the variable cost of the station, that is the fuel cost component which goes up with amount of energy generated. They are payable on schedules and not actual drawals.

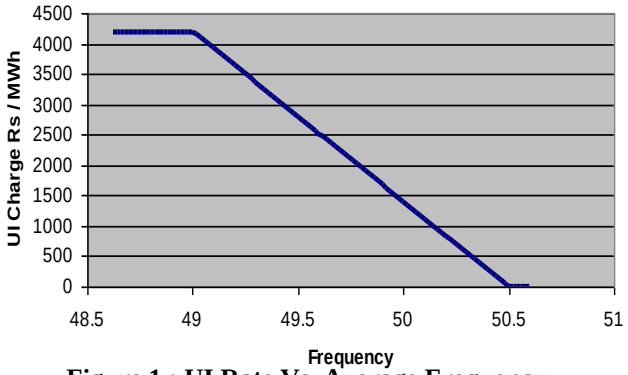

Figure 1 : UI Rate Vs. Average Frequency

The third part which is of much importance is – *charges for deviations*. These charges are payable for deviations of injections of Central plants and drawals of SEBs from their respective schedules and are linked to average frequency in particular 15-minute time-block. Schedules for SEBs shall be prepared on the basis of their requisitions from the declared capabilities of Central plants. The charges for deviations i.e. unscheduled interchange(UI) rates are maximum at 49Hz and below and is zero at 50.5Hz and above, with constant slope between two extremes. The maximum rate (presently 420paise/kWh) has been linked to diesel-generation cost of power and minimum of zero is linked to over-flowing hydro power with zero incremental cost.

Any extra generation beyond the schedule is deemed to be going to replace the generation of highest incremental cost operating at that time. Similarly, when SEBs draw more (or less) than the schedule at a particular frequency, they are deemed to be drawing power from the grid at these frequency-linked charges i.e. third part which should always be more than their own incremental cost. It would be therefore logical to fix the pool price equal to incremental cost of that generating unit which has the highest incremental cost and is not inflexible i.e. it can increase or reduce its output. As the regions' demand goes up or down, different generators are taken to full or minimum load, the systems' incremental cost would also go up and down. In general, the pool price would rise to a ceiling level (say 420p/kWh) when all generation is in and load shedding is required (peak load hours) and frequency dipping to lowest allowable limit i.e. 49.0Hz, and would fall to zero when all generation has already been backed down to the lowest technically allowable level (off-peak hours) and frequency touching highest allowable limits i.e. 50.5Hz.

A very important change brought out by this mechanism is linking of schedules and system operation. The figures in ensuing pages clearly shows the prompt response of participants to frequency signals.

6.0 WESTERN REGION : TAKING INITIATIVE IN IMPLEMENTING NEW MECHANISM

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 date 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.

7.0 BENEFITS ACCRUED FROM ABT FOR GRID OPERATION

7.1 Better Grid Parameters

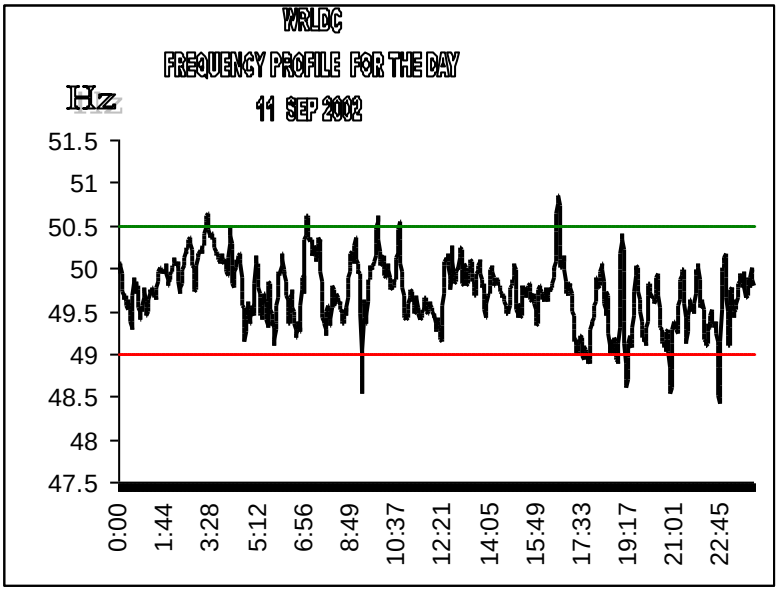

Fig-2: Typical frequency profile : High frequency beyond 50.5Hz is limited du to 0 variable cost

ABT has been highly successful in limiting the high frequency periods. Whereas in the previous years the frequency used to go beyond 51.5Hz tripping the nuclear units several times in the rainy season. This year the frequency has gone beyond 50.5 Hz at few times and rarely above 51Hz. There was no tripping of nuclear units this year despite large load reductions due to rains. Constituents are currently backing down their costly thermal generation such that drawal is increased during high frequency regime. The low UI tariff during high frequency (i.e. low demand period) has given enough incentives to constituents to draw more and back down in higher cost generation.

The low frequency operation had increased due to large increase in demand largely on account of failure of monsoon and planned unit outages during this time of the year.

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. Fig-2 shows the typical frequency profile where particularly high frequency is limited due to low incremental cost of energy.

7.2 Better Grid Discipline

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. 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.

The number of violations in the months of July to September in the current and previous years are as shown in the table. The violations came down after ABT introduction. This is a significant improvement considering that the ABT is hardly three months old.

Table 1 : Number of Violations of Grid Discipline

	This Year		Last Year	
	<49 Hz	>50.5Hz	<49 Hz	>50.5 Hz
July	91 (56%)	4 (4%)	70 (17%)	5 (8%)
August	**17** (8%)	**18** (10%)	**78** (27%)	**13** (6%)
September	**22 (10%)**	**2 (4%)**	**119 (64%)**	**0 (1%)**

Note: Figures in bracket indicate % time frequency was in this range.

7.3 Better planning and scheduling

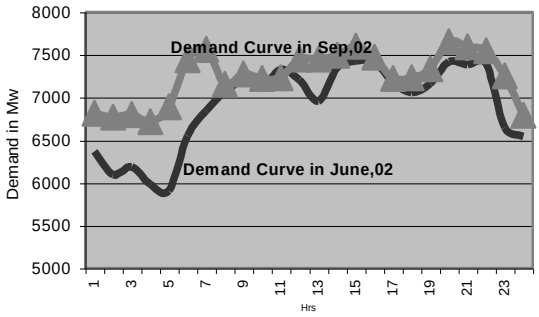

Fig-3: Demand Curve of GEB in June and September, 02 : Flattened load curve

ABT has prompted constituents to be more realistic in planning their Load Generation Balance. It has resulted in realistic requisitions from all the constituents for scheduling of ISGS generation. 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.

Fig-3 shows the demand curve of GEB in June and September,02. There is marked change brought out new mechanism in planning of load shedding.

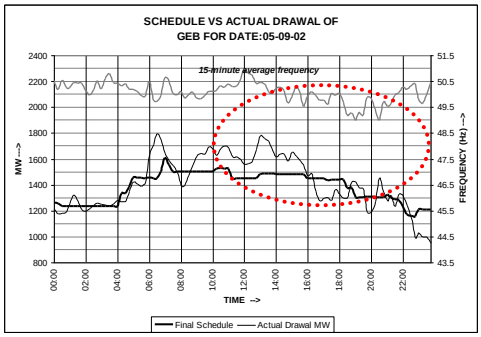

Fig-4: More GEB's Drawals during high frequency regime

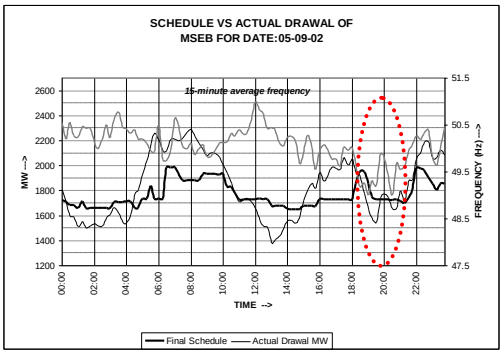

Fig-5 : MSEB responding to low frequency

7.4 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 (Fig.-4). MSEB regulated their drawals on most of the occasions by varying their hydro generation with the intention of and reducing the UI payments. (Fig-5)

7.5 Better Generation Despatches by ISGS

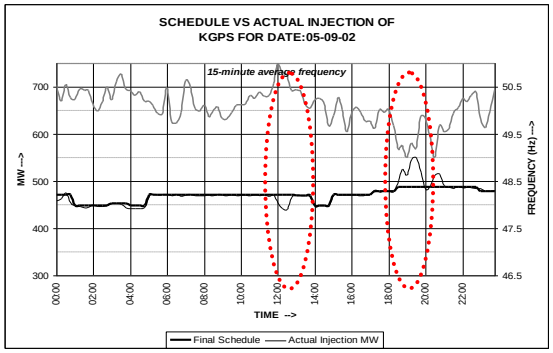

Fig-6 : Kawas GPS responding to frequency signals

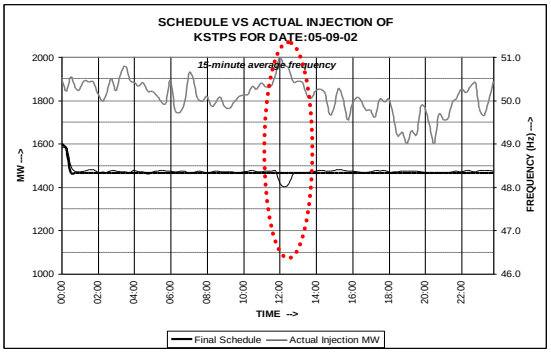

Fig-7 : KorbaSTPS (cheapest generator) responding to Frequency-Linked Desptach Guidelines

NTPC stations were adhering to ISGS schedule as PLF for incentives will be computed on schedule. 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. (Ref Fig- 6 and 7)

7.6 Utilisation of Bottled-up Resources

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 ans MSEB .

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.

7.7 Increased Inter-state Sales

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.

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. MPSEB was able to get 50 MW more allocation from ER (w.e.f 7th Oct.) and also made bilateral agreement with CSEB for drawing 100 MW during off-peak hours (w.e.f 11.10.02). Gujarat is planning to buy capacity in a hydro power station coming up in Himachal Pradesh. Plans are also afoot by Gujarat to set up a jointly owned power plant with CSEB in Chattisgarh. The spurt in power trading is an outcome of the commercial signals generated by ABT.

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. Singraulli.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.

7.8 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 SSTPS (as ABT is not effective in NR).

7.9 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.

7.10 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.

7.11 Merit Order Scheduling by SEBs

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. During the first eight

weeks, Gujarat was able to draw 108 MUs at a cost of Rs.1.58 per unit which is less than the weighted average cost of Central Sector power stations (Rs.1.80 per unit) in the pre-ABT commercial mechanism.

7.12 Resolution of major dispute

Previous mechanism based on equal-landed cost principle had given rise to dispute. A particular SEB who does not have shares in particular costlier ISGS i.e. KAPS , and was booked total weighted average cost same as previous by enhancing the deemed drawals from other costlier ISGS. The issue was resolved in the new tariff mechanism.

7.13 Boost to intra-regional trading

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.

8.0 Conclusions:

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.*

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.

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.

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.

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