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| **The availability based tariff (ABT)** |
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| Apart from the regulatory, institutional and ownership changes, some changes in the operations took place in the Indian power sector which can not be overlooked. Introduction of frequency linked unscheduled interchange pricing under Availability Based Tariff is one such example. |
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| The Indian power system is characterized by low frequency operation due to continuous power deficit situation for majority of time. The financial constraints typical of a developing country with large population and unequal distribution of resources also led to inadequacies of transmission and distribution network with critical line loadings and low voltage profile. The consumer demands far exceed the available generating capacity. The scarcity of power and the commercial mechanism before ABT (based on take-off of power by States rather than schedules from Central pool) led to low frequency operation. The tariff mechanism did not provide any incentive to reduce generation under high frequency or to maximize generation under low frequency. In other words, the tariff mechanism encouraged grid indiscipline. The new commercial mechanism (Availability Based Tariff) was introduced in the country from 1st July, 2002. The commercial mechanism is specifically defined to suit the deficit power systems. The mechanism streamlined the operation of regional grids. |
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| **Why was ABT necessary?** |
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| Prior to the introduction of Availability Tariff, the regional grids had been operating in a very undisciplined and haphazard manner. There were large deviations in frequency from the rated frequency of 50.0 Hz. The earlier tariff mechanisms did not provide any incentive for either backing down generation during off-peak hours or for reducing consumer load / enhancing generation during peak-load hours. In fact, it was profitable to go on generating at a high level even when the consumer demand had come down. This led to gross grid indiscipline and some mechanism was necessary to provide price signals to various constituents depending on the grid condition. |
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| The Availability Tariff that operates on regional basis is meant to address these issues. Firstly, by giving incentives for enhancing output capability of power plants, it enables more consumer load to be met during peak load hours. Secondly, backing down during off-peak hours no longer results in financial loss to generating stations, and the earlier incentive for not backing down is neutralized. Thirdly, the shares of beneficiaries in the Central generating stations acquire a meaning, which was previously missing. The beneficiaries now have well-defined entitlements, and are able to draw power up to the specified limits at normal rates of the respective power plants. In case of over-drawal, they have to pay at a higher rate during peak load hours, which discourages them from over-drawing further. This payment then goes to beneficiaries who received less energy than was scheduled, and acts as an incentive/compensation for them. Thus, ABT provides a mechanism wherein the loads and generators take suitable actions considering the state of the grid and thereby contribute to stabilize the frequency in a tighter band. |
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| **The Mechanism** |
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| The mechanism essentially consists of three parts: The capacity charge, energy charge and unscheduled interchange (UI) charge. Figure 4 shows the block schematic of this commercial mechanism. |
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| **Figure 4: Block schematic of ABT mechanism** |
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| **The Capacity Charge** |
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| The power plants have fixed and variable costs. The fixed cost elements are interest on loan, return on equity, depreciation, O&M expenses, insurance, taxes and interest on working capital. The variable cost comprises of the fuel cost, i.e., coal and oil in case of thermal plants and nuclear fuel in case of nuclear plants. In the Availability Tariff mechanism, the fixed and variable cost components are treated separately. The payment of fixed cost to the generating company is linked to availability of the plant, that is, its capability to deliver MWs on a day-by-day basis. The total amount payable to the generating company over a year towards the fixed cost depends on the average availability (MW delivering capability) of the plant over the year. In case the average actually achieved over the year is higher than the specified norm for plant availability, the generating company gets a higher payment. In case the average availability achieved is lower, the payment is also lower. Hence the name ‘Availability Tariff’. This is the first component of Availability Tariff, and is termed ‘capacity charge’. The fixed charges are linked to availability rather than plant load factor (PLF). |
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| **The Energy Charge** |
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| The second component of Availability Tariff is the ‘energy charge’, which comprises of the variable cost (i.e., fuel cost) of the power plant for generating energy as per the given schedule for the day. It may specifically be noted that energy charge (at the specified plant-specific rate) is not based on actual generation and plant output, but on scheduled generation. |
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| **The Unscheduled Interchange (UI) Charge** |
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| In the real time, the actual dispatch is likely to be different from the schedule. Incase there are deviations from the schedule (e.g., if a power plant delivers 600 MW while it was scheduled to supply only 500 MW), the energy charge payment would still be for the scheduled generation (500 MW), and the excess generation (100 MW) would get paid for at a rate dependent on the system conditions prevailing at the time. If the grid has surplus power at the time and frequency is above 50.0 cycles, the rate would be lower. If the excess generation takes place at the time of generation shortage in the system (in which condition the frequency would be below 50.0 cycles), the payment for extra generation would be at a higher rate. The Unscheduled Interchange (UI) price curve is shown in Fig. 5. The UI price curve has seen four changes so far. Initially, in 2001, when frequency linked UI was proposed for the first time, the ceiling rate for UI curve was 420 paise / kWh. The UI price curve was a single slopped straight line at that time. The ceiling price was set considering the price of the costliest fuel at that time – high speed diesel (HSD). The ceiling rate of UI was modified thrice since then depending upon the prevailing price of HSD, from 420 paise / kWh to 570 paise / kWh and then to 745 paise / kWh and finally at 1000 paise / kWh. In addition, UI curve became a dual slope curve with less penalty (incentive) around the nominal frequency; while heavy penalty (incentive) at lower frequencies. |
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| **Figure 5: UI Rate** |
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| The UI price curve has two slopes. The price of UI at 50.2 Hz is zero and increased unto 49.70 (387.50 paisa per unit) linearly with a slope of 15.5 paisa per 0.02 Hz. The price of UI thereafter linearly increased at the rate of 47 paisa per 0.02 Hz till 49.5 Hz. At 49.5 Hz and below, the price of UI power is 873 paisa per unit. The UI mechanism of ABT serves the purpose of balancing market in real time. Any generator or utility is allowed to inject power into the pool or draw from the pool at UI prices as long as the frequency is maintained within the stipulated band of 49.5-50.2 Hz. |
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| **Working of the Mechanism** |
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| The process starts with the Central generating stations in the region declaring their expected output capability for the next day to the Regional Load Dispatch Center (RLDC). The RLDC breaks up and tabulates these output capability declarations as per the beneficiaries' plant-wise shares and conveys their entitlements to State Load Dispatch Centers (SLDCs). The latter then carry out an exercise to see how best they can meet the load of their consumers over the day, from their own generating stations, along with their entitlement in the Central stations. The SLDCs then convey to the RLDC their schedule of power drawal from the Central stations (limited to their entitlement for the day). The RLDC aggregates these requisitions and determines the dispatch schedules for the Central generating stations and the drawal schedules for the beneficiaries duly incorporating any bilateral agreements and adjusting for transmission losses. These schedules are then issued by the RLDC to all concerned and become the operational as well as commercial datum. These values are put on respective RLDCs’ websites. The schedules are also used for determination of the amounts payable as energy charges, as described earlier. Deviations from schedules are determined in 15-minute time blocks through special metering, and these deviations are priced depending on frequency. As long as the actual generation/drawal is equal to the given schedule, payment on account of the third component of Availability Tariff is zero. Table 2 and 3 summarize the responses of constituent states (loads) and generators to variation in frequency. |
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| |  |  |  | | --- | --- | --- | | **Frequency** | **Constituent States' Response** | **Effect** | | f>50.2 | Deviations priced at zero INR. Tendency to draw more than schedule | Help grid to pull down frequency to nominal value | | f<49.0 | Deviations priced at maximum rate, i.e., 10 INR / kWh. Tendency to overdraw only if absolutely essential. Tendency to under-draw to accrue gain. | Does not encourage further decrease in the frequency | | 49.5<f<50.2 | Trade-off between state's own generation marginal price and UI price | Helps grid to maintain frequency between a certain band | |
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| **Table 2: Constituent States’ response at various frequency levels** |
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| |  |  |  | | --- | --- | --- | | **Frequency** | **Constituent States' Response** | **Effect** | | f>50.2 | Deviations paid at zero INR. Tendency of not to generate excess | Does not encourage further increase in the frequency | | f<49.0 | Deviations paid at maximum rate, i.e., 10 INR / kWh. Tendency to generate excess power to accrue gain. | Helps grid to improve on the frequency | | 49.5<f<50.2 | Trade-off between own marginal price and UI price | Helps grid to maintain frequency between a certain band | |
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| **Table 2: Generators' response at various frequency levels** |
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| **Effects of ABT** |
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| One of the major achievements of ABT was the grid discipline. In the pre-ABT era, the grid discipline was linked to the conscience of the stake holders wherein the day-ahead schedules had no sanctity. In other words, the commercial signal (which is understood by everybody) was absent and hence, the stake holders were least bothered about the grid condition. However, in the ABT era, the actions taken by various entities had a direct impact on the grid condition. Further, this action of the stake holder had economical impact on itself, either in positive or negative direction. Thus, a rational entity is expected to take those steps which would help the grid. As an effect of this, the frequency profile in all the regional grids improved. In the pre-ABT era, the frequency used to touch as low as 48 Hz! However, after implementation of the commercial mechanism, the frequency of various grids was arrested in a tighter band. Further, the day-ahead scheduling got due importance as the deviation from the same was termed as unscheduled interchange (UI) and was settled directly with the frequency linked price. |
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| **Intra-state ABT** |
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| The ABT mechanism and the frequency linked UI pricing described above pertains to commercial mechanism operating on regional basis such that one state cumulatively acts as one load and has schedule for the entire state. |
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| After the unbundling of SEBs, state’s distribution system is divided into distribution zones. Each distribution zone will have schedule for power to be received from the state owned generators. Thus, the intra-state system would look much like the regional system. In other words, the intra-state generators and distribution zones would have schedules, metering and energy accounting done by the state load dispatch center. The Forum of Indian Regulators (FOIR) has recommended states to adopt the similar system of availability tariff for the intra-state system. This is termed as intra-state ABT. |
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| As of writing this book, some of the state electricity regulatory commissions have come out with the draft reports on the modalities associated with intra-state ABT. Some states will adopt the system of regional ABT with frequency linked UI pricing in to-to, while some states respecting the state specific constraints have adopted (or likely to adopt) mechanism with variations from that of ABT on regional basis. For example, state of Gujarat has adopted intra-state ABT with concepts similar to that of inter-state ABT. It has formed four distribution zones for this purpose. The mechanism will be applicable for state-owned generators, distribution zones and all other IPPs and CPPs in private sector. State of Maharashtra, on the other hand, has proposed the UI pricing to be done system marginal price (SMP) rather than the frequency linked pricing. |
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