

Impact of ABT on different players

A White Paper

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**Kalki Communication Technologies Private Limited
#147, 2nd Floor, 5th Main Road
Sector 7, HSR Layout
Bangalore 560034
Karnataka
INDIA**

Phone: 080-5721263/4

Fax: 080-5725473

E-mail: info@kalkitech.com

Web: <http://www.kalkitech.com>

Introduction

ABT (Availability Based Tariff) is a new tariff structure recommended by CERC (Central Electricity Regulatory Commission). The main objective of the recommendations is to introduce a tariff regime that will promote responsibility and accountability in power generation and consumption so that overall quality of power in India is improved. The ABT act envisages a phased implementation and the process is already underway. For information on ABT the user is referred to a quick introduction to ABT (URL). The complete text of the ABT act can also be had from the CERC website.

This article describes some of the impacts of ABT for the different players involved in power generation, transmission and distribution. While the proposed tariff structure has wide implications for each player, this paper deals exclusively with the technology challenges/opportunities thrown up by ABT. The attempt here is to deal with each phase of the power network viz. generation, transmission operators (regional power grid companies) and consumers.

Impact on generation utilities

Of the three, power generation utilities will need to adapt most to the ABT regime. This because most of the changes specified in the ABT, such as computation of capacity charges, assessment of plant availability, revised tariff structure, UI (unscheduled interchange) charges etc. will be of direct significance to power generation companies. Initially only those power stations that cater to more than one SEB (state electricity boards) are expected to abide by ABT. However, since the objective of ABT is to usher in more responsibility and accountability and thereby improving the quality power, it is quite likely that all generation companies would soon need to abide by ABT or similar acts. Such abidance and discipline will only increase as ABT slowly paves the way for a completely deregulated and market driven energy economy.

Under ABT, there is a paradigm shift for generating stations from maximum power to maximum reliability. Pre-ABT generating stations used to generate to their capacity irrespective of load demand in the network. Under ABT regime, the loads requirements are given in 15-minute blocks and the generating station needs to closely follow this demand curve so that frequency deviation on either side of 50 Hz is a minimum. Some of the technology requirements thrown up by this paradigm shift are

- a) Advanced control and monitoring systems to closely monitor the ex-bus output of the plant and ensure that it is closely in heel with the 15-minute schedule provided by the RLDC (regional load dispatch centre). Ex-bus output information is already available in all power plants. What will be required of ABT is to integrate this information with the 15-minute load demand information so that plant operators have a clear and up-to-date information on what is the requirement and what is being provided. Alarms can also be incorporated to provide escalation in case of significant deviation of output from demand.
- b) Integrated information and communication system to capture data from all the components in the power generation cycle starting from the fuel store for the plant to the ex-bus point. Unscheduled downtime is not very acceptable in the ABT regime. Plant engineers need to have information regarding all aspects of the power generation such as whether fuel of sufficient quality and quantity is being made available, are all the components of the system (say, the boiler, reheaters, superheaters, economizers, soot blowers etc. for a fossil fired power plant) working without hitches to ensure smooth production. This will require an advanced data acquisition system and other software solutions suitably integrated with each other to provide the most up-to-date information. And smooth functioning of such a system will call for the necessary communication infrastructure.
- c) Production following demand will mean that the plant will not be operating at peak capacity at all times. This will require for an optimization problem between different units

- of a power plant since the cost of generation, ramping, start up and shut down associated with each unit will vary. This is called the merit order dispatch (MOD) problem. MOD solutions can potentially provide huge savings for a power plant and ABT will require most plants to accommodate MOD to ensure economic operation
- d) In addition to MOD, performance calculation for each unit of the power plant and corresponding optimization also needs to be done. Different parameters that may affect the plant performance such as superheat temperature, reheat temperature, inlet/ outlet temperatures, excess air ratio etc. will need to be monitored. It should be possible to suggest to the operator regarding the effects of varying these parameters. Powered with such information the user can attain the optimum plant performance during operation.
 - e) As already mentioned, under the ABT regime unscheduled deviation from the power generation schedule incur considerable penalties (termed UI charges). It is thus in the interest of any generator to ensure that any unexpected downtime of the power plant does not occur. This requirement calls for a more pro-active management plan than is being practiced by most generators now. Equipment condition monitoring is a significant area that can benefit generators by telling them which components in the cycle are likely to fail and for what reason. This will enable the operator to ensure proper and adequate maintenance for such components. In addition the generator is encouraged to plan all activities well in advance and co-ordinate the same between different units in the power plant and to ensure optimal use of plant equipment without overloading.
 - f) The economy of power generation is vastly altered under the ABT regime. Earlier capacity charges were paid against PLF (plant load factor) and power charges against the power sent out. Under ABT capacity charges are payable against declared (deemed) availability and a UI (unscheduled interchange) component is payable as part of the power charges for any grid indiscipline. UI charges are a system of incentives and disincentives and depend on the declared demand, declared availability, deviation from forecasts, grid conditions etc. As a result of this new structure, the parameters influencing the monetary returns from power generation are much more complex. Power generation stations would do well to have a full-fledged tariff calculation system that can do a detailed computation and optimization of power generation from the revenue angle. This kind of digitized linking between power generation and revenue will prove greatly beneficial during the journey to a full-fledged market system.

Impact on grid operator

Grid operator typically manages the power transmission infra-structure. This will correspond to the role of the ISO (independent system operator) in more evolved power markets. ISO's are typically no-profit organizations formed by a consortium of all interested parties in a specific geographic area for a power market. Their goal is to ensure smooth operation of the grid and to ensure adequate load-supply balance in the grid. In India this role of power transmission and coordination is handled by PGCL (Power Grid Corporation of India Limited) which incidentally is the single largest power transmission utility in the world. PGCL is responsible for operating the national and regional power grids as well as managing the RLDCs (Regional Load Dispatch Centres). Under ABT regime, the role of balancing the demand and generation side of power is vested with the RLDCs. As such some of the system requirements at the grid operator for the successful implementation of ABT will be:

- a) Improved and efficient transmission systems: A unique nature of electricity as a commodity is that it needs to be generated just in time for consumption. With addition and modernization of different power resources adding the total generating capacity, transmission is soon going to present one of the major bottlenecks in the smooth operation of our power systems. It will be the responsibility of the grid operator to ensure that such a scenario is averted. Merely adding of transmission capacity to the existing infrastructure may prove inadequate. It will be equally imperative to smoothly and efficiently manage the system with proper simulation tools, load balancing features etc. to

- ensure that the bottleneck in transmission is removed and that all the available energy is efficiently delivered to the needy consumers.
- b) Better forecasting systems: Presently the RLDCs are vested with the role of coordination between consumers and generators regarding the demand and generation schedule for each day split into 15-minute intervals. Since UI charges are payable by the generator or consumer, it may seem that the onus of forecasting more lies with these parties (especially consumers). However to ensure that the spirit and objective of ABT is not thwarted, it would indeed be important for the PGCL to predict as accurately as is possible the demand in different consuming regions. Variations as a result of climate, festivals and other events also need to be taken into consideration. Only then can they ensure that enough bandwidth is available across different routes to carry adequate power to each region.
 - c) Better communication and information systems: It is the responsibility of the RLDC to communicate the 15 minute generation and consumption schedule to each party. It is also the role of the RLDC to convey any unforeseen change in such a schedule. ABT envisages that the UI charges will get suspended for specific periods in the event of an unforeseen disruption in the grid for which responsibility cannot be pinned down on any particular generator or consumer. It is very important that the disruption and revised schedule is communicated in a timely fashion to all the concerned parties failing which the credibility of the whole system may soon get pulled into the question. This aspect requires the grid operator to have excellent communication and information infrastructure in place.
 - d) Improved metering and billing system: Under ABT specifications it is the responsibility of the PGCIL/RLDC to ensure adequate metering capabilities for proper implementation of the tariff structure. Under the revised structure, specialized energy meters that can keep track of 15-minute energy aggregates as well as frequency for each 15 minute interval need to be implemented to take care of the normal energy charges and the UI charges. Telemetry capabilities (with associated hardware and software solutions) also need to be put in place to ensure accurate and timely completion of the exercise. The alternate of manual reading of meters will prove too much extensive, time consuming and likely to be error prone and may jeopardize the credibility of the ABT regime.

Impact on consumers

As already mentioned, the major thrust of ABT is to improve the reliability and quality of the power grid. Primary beneficiary of such an enhanced system would be the consumers. Consumers in the ABT regime consist of SEBs (State Electricity Boards) and other major distribution companies. Most important benefit they can realize from an improved power grid is to pass on these benefits of quality and reliability to their consumers in turn, who are typically the end user links in the T&D (transmission and distribution) chain. While providing these benefits, ABT also confers some responsibility on the consumers which will require them to fine-tune their process. Some of the requirements ABT will make on consumers are:

- a) Enhanced load forecasting system: Under ABT regime, each SEB will need to provide their load requirements in ninety six 15-minute intervals for each day. The consumer is expected to stick to this schedule in the absence of external grid disturbances and corresponding revisions by the RLDC. Failure to comply with the schedule will attract penalty in the form of UI charges. Thus it becomes very critical for the SEBs to have accurate short-term load forecasting systems in place. Once the ABT regime moves to further deregulation, long term forecasting will also become critical since only on that basis can the SEBs enter into commercial agreements with the generating utilities.
- b) Reliable communication and information infrastructure: Any load forecasting solution (short term or long term) is highly reliant on historical data for delivering accuracy. This remains true irrespective of the algorithm employed by the forecasting solution (with the possible exception of astrology). Thus it becomes very important for the consumers to have highly reliable and available information management systems that can make

- available historical consumption data. Communication systems are also called for to ensure smooth coordination with the RLDC and generating stations as well as to ensure proper integration with the telemetry systems.
- c) Provision for in-house generation: UI charges can be termed as vague and distant forerunners of a market aligned price (may be what the Neanderthals are to homo sapiens). This can be reasoned out as the following: when the grid frequency is low it indicates a situation where demand for power is in excess of supply in the grid. If at this time a consumer needs to draw more power, he needs to pay a heavy penalty in terms of UI charges. This can be compared to a consumer paying a premium in the market for additional power than what he has hedged for. The comparison is not fully justified, but was put forward to indicate that SEBs at some point of time will have to face a make or buy decision in terms of power, to avoid customer wrath and UI charges alike in a high demand situation. And this may manifest in terms of captive power plants that are going to be more and more popular during the slow but sure transition to a decentralized and deregulated power market. And with captive power plants need to be integrated with the power grid will come a host of other technology challenges that are best dealt as a separate paper.