Creating Competition

Promoting hydro through power exchanges

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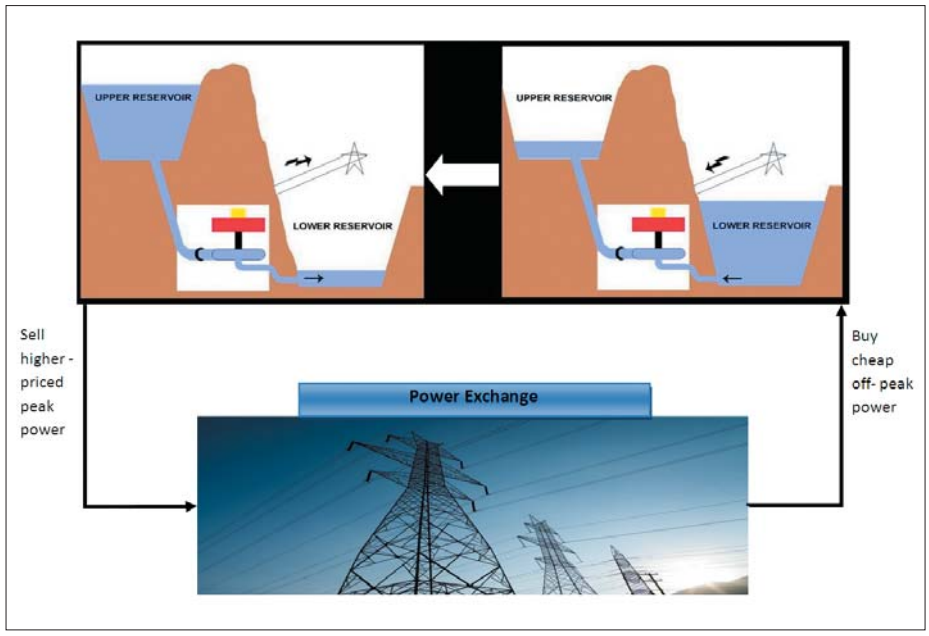
The journey towards setting up a competitive power market in India started with the passage of the Electricity Act, 2003, when the trading of power as a distinct activity was recognised for the first time. In July 2006, the Central Electricity Regulatory Commission (CERC) issued a staff paper on power exchanges. This paper set out the CERC's thoughts on the possible models for the proposed power exchanges in India. Subsequently, guidelines for power exchanges were issued in February 2007, and guidelines for collective and scheduling transactions on power exchanges were issued in January 2008 and June 2008 respectively. Currently, two power exchanges are operating in India.



In addition to offering a day-ahead market, in September 2009 the power exchanges also launched weekly products for trading on a week-ahead basis on the exchange platform. The exchanges have proven to be very important market mechanisms with the exchange prices having become important benchmarks for the entire power trading market in the country. The long-term objective of Power Exchange India Limited is to drive the Indian power sector towards true competition-based pricing, as against scarcity-based pricing, and to stimulate investments into the sector so that the country is able to take advantage of market-based pricing.

Hydro power in India

The first known hydro power installation in India was a 130 kW plant installed at Sidrapong, Darjeeling in 1897. At the time of Independence, India had a total hydro power capacity of 508 MW, which was about 37 per cent of the total installed power generation capacity at that time. Subsequently, the country took up the planned development of several large multi-purpose river valley projects and this pushed up the share of hydro to 50.62 per cent in 1962-63. However, the share of hydroelectric power has since shown a steady downward trend.

In the 1980s, the Central Electricity Authority (CEA) undertook a reassessment of the hydro power resources in India and identified 845 economically feasible schemes in various river basins, with a total potential installed capacity of 1,48,701 MW. Less than 25 per cent of the potential capacity has so far been installed. The scope for further development is, therefore, immense.

India currently has a total installed power generation capacity of 155,859 MW (as of November 30, 2009). Of this, 36,885 MW is hydro based. This does not include small hydro stations of sub-25 MW capacity that are categorised as renewable. Thus, the share of hydro power capacity in the country is only about 24 per cent of the total installed capacity. This is significantly lower than the 40:60 hydro-thermal mix that is said to be ideal. This indicates that the country has not been able to keep up with the desired pace of development of its hydro power resources.

To give an impetus to the sector, the prime minister launched the 50,000 MW Hydro Power Initiative on May 24, 2003. This scheme was formulated by the CEA for the preparation of preliminary feasibility reports (PFRs) of 162 new hydroelectric schemes totalling over 50,000 MW. All the PFRs were completed ahead of schedule by September 2004. Detailed project reports (DPRs) of these projects have now been prepared for 21 projects totalling 7,476 MW while DPRs of 22 more projects totalling 15,439 MW (as per the PFR) are currently under preparation.

Why promote hydro power

Hydro power is an important component in the country's generation portfolio as it provides substantial economic

and functional benefits over other mainstream sources of power.

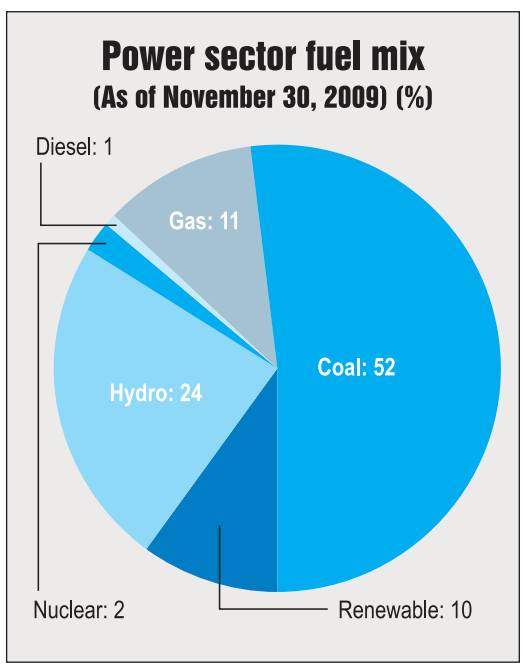
- Economics: Hydro is one of the few sources of power that becomes cheaper with time and has no significant linkage with inflation. The only recurring expenditure a hydro power station incurs is towards O&M, which is a very small component of the cost of power generated.
- Peaking support: Hydro power stations can also be used as peaking power stations if associated with a storage reservoir. Except during the monsoon season, when most hydro power stations operate as baseload stations, they can store water during off-peak hours and generate water during peak hours to match the grid demand. This mode of peaking power generation is more economical in comparison to other alternatives like open cycle gas power plants.
- Grid support: Hydro power stations can support a grid in the event of a grid disturbance by providing black-start support.
- Environmental benefits: Hydroelectric power is an environment-friendly form of energy.

Given the above benefits, it is necessary that hydro power generation be supported by all available means so as to enable the country's power system to achieve a healthier hydro-thermal mix.

Types of hydro power projects

Hydro power schemes can be categorised under the following major types based on their construction and mode of operation:

- Large reservoir storage hydro projects: These are projects associated with large reservoirs that can store water for long durations. They can generate power on demand and can store water for seasonal requirements. These projects are typically more expensive to construct due to the requirement of a massive reservoir and huge tracts of land that will be submerged.
- Run-of-the-river hydro projects with diurnal pondage: These projects have small reservoirs that enable them to store water on a daily basis to meet about four to six hours of power generation requirement.
- Pure run-of-the-river hydro projects: These projects have no water storage facility and generate power according to the available water flow. It is desirable to operate these projects on a must-run basis in order to avoid wastage of energy. These projects are relatively less complex to build on account of low land acquisition requirements.
- Pumped storage projects: These projects have a lower as well as an upper reservoir. They consume energy from the grid to pump water from the lower to the upper reservoir and then generate power on demand by releasing water from the upper reservoir, through the turbines, to the lower reservoir. These generation schemes are actually energy storage solutions that are used to consume off-peak power and generate power to meet peak load requirements. These projects typically have an energy conversion loss of 20-25 per cent, that is, they generate about 20-25 per cent less energy than they consume. However, they are typically viable on account of the large price differential that exists between peak and off-peak power.



Trading hydro power on the exchange

One of the key objectives of setting up a power market in India was to promote investments in the sector and aid it in achieving massive capacity addition requirements. The hydro power sector also needs to be able to benefit from the power market in order to provide a fillip to the sector.

Power exchange operation

The power exchanges have been operating a day-ahead market for over a year now. Recently, they have introduced longer tenure contracts of one-week duration. The exchanges provide a platform on which power generators submit their bids to sell electricity and buyers submit theirs to buy electricity. The exchange aggregates these bids and runs its algorithm to determine the buy and sell bids that will be cleared by the market and also the price at which such trades shall be settled. Subsequently, the exchange also provides clearing house services to ensure financial settlement of such trades and to insulate the market participants from any financial risk.

To successfully participate on the exchange, power generators must meet the following criteria:

- They must be connected to the regional or state grid. When connected to the state grid, they need to obtain open access from the state load despatch centre (SLDC) to export power outside the state.
- They must be able to schedule their generation according to the availability-based tariff (ABT) scheduling requirement.
- They must be able to generate power at a tariff that is competitive with the market.

These issues need to be looked at in order to examine the viability of hydro power stations participating on the exchange.

Grid connectivity

The hydro power station needs to be grid connected and also needs to obtain open access from the SLDC for

the export of power, in the case of connection to the state grid.

Generation scheduling

To participate effectively on the exchange, all participants need to be able to schedule their power generation on an hourly basis. Pumped storage projects are ideally suited for this and can generate power on demand on a round-the-year basis. Reservoir-based hydro projects, including those with diurnal pondage, can also schedule their generation by storing water during a period of low hydrology. However, during the monsoon they become must-run projects as the reservoir will overflow if power generation is stopped. Scheduling of generation is not difficult during this season as they will mostly be running at full capacity throughout the day.

Pure run-of-the-river projects are the ones that will find it most difficult to schedule their generation as they are totally dependent on water availability (except during monsoons when they operate at full capacity). However, there are many hydrology forecasting tools available that could help one make accurate forecasts. With increasing refinement and accuracy of these tools, these power stations should also be effectively able to participate on the exchange. Another factor to be considered is that even now, most run-of-the-river schemes generate the bulk of their annual generation during the monsoon months when they operate on a must-run mode and consequently run the scheduling risk on a relatively small percentage of their power generation.

Cost of generation

The most important factor that would affect the viability of any project participating in the power exchange would be the cost of generation vis-à-vis the expected average price realisation on the power exchanges.

The cost of power generation from hydro power schemes can differ significantly, varying from one scheme to the next, based on hydrology, topography, civil work and underground excavation requirement, geological variations, etc. However, given the historical trend of the cost of generation from run-of-the-river as well as reservoir-based hydro power schemes, it is expected that they should not have much trouble achieving reasonable financial returns on the power exchange.

Pumped storage schemes have been typically used by utilities to balance their peak/off-peak generation to suit the demand pattern, and so their economics are based on increased system efficiencies on account of higher plant load factors achieved by other baseload generating stations. However, these schemes could operate just as effectively as merchant projects and take advantage of the difference in peak and off-peak rates on the exchange.

Therefore, pumped storage schemes could also find it financially viable to participate on the power exchange. With the price gap between peak and off-peak power widening with the maturing of the economy, pumped storage schemes can only get more viable in the years to come.

Conclusion

Hydro power generators are of many different types, each with its own power generation characteristics and its own cost of generation. However, the power exchange can help most of them to operate in a commercially feasible manner. The power exchange can bring the many benefits of a competitive power market to this sector and can accordingly aid in its growth. ■