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Market for Tertiary Response in the Indian Market

Highlighting the dynamics of Short Term Market for Tertiary Reserve

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Motivation

- India has set a target to fully integrate 175 GW of renewable energy in the grid by the year 2022.
- Renewable energy comes with its advantage of clean energy but having a lot of unpredictability and therefore requires sufficient availability of reserves
- Tertiary reserve can help restoring the frequency to a value closer to the nominal, following a sudden dip or rise in the frequency.
- In India, Tertiary response is being provided by Central Generating Stations whose tariff is being determined or adopted by the Central Electricity Regulatory Commission of India.
- The un-requisitioned surplus available in these generating stations are used to dispatch the Reserve Regulatory Ancillary Service (RRAS).

Challenges

- When the surrendering beneficiary recalls its power back from the dispatched quantum of RRAS, the quantum of power available for ancillary service reduces

- At times of necessity, the volume of un-requisitioned surplus may not be sufficient, to restore the frequency by the desirable magnitude.

Challenges

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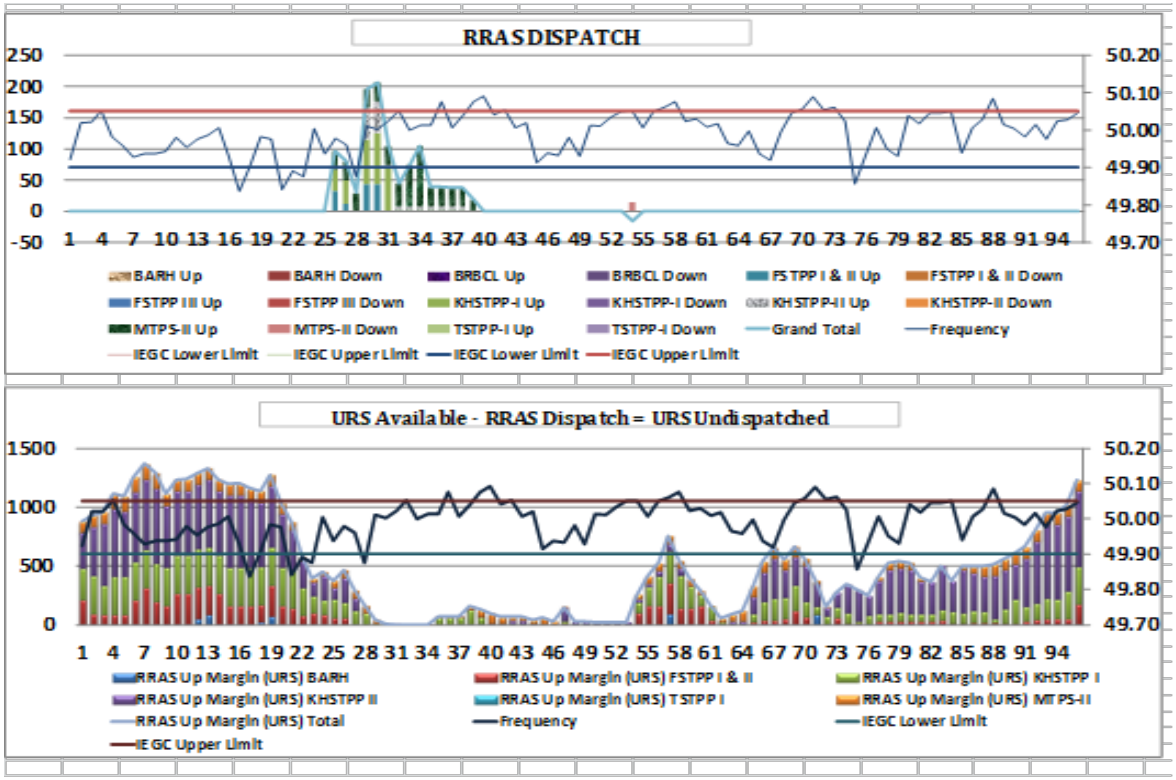


International Practise (Germany)

- Provision of positive and negative FRR (Frequency Restauration Reserve) is tendered separately.
- With FRR, provision of control reserve capacity and deployed control energy are separately paid.
- The bid of each supplier must specify a capacity price bid for provided reserves (paying the provision) as well as an energy price bid for deployed reserves (paying a possible activation)
- FCR (Frequency Containment Reserve) is procured as a symmetrical product.
- With FCR only provision is paid, the deployed energy will not be paid separately.
- While selecting first the Capacity bids are the first criterion, followed by Energy bid, if there are same capacity bids.
- Pay-as-bid, non-uniform pricing.

Pricing Reserve

- Price of any product or service can be different for the participants or uniform.
- Introduction of a new product needs to have uniform price due to uncertainty in the Market, and to increase participation.
- Competition may be introduced later.
- In India, Tertiary response from un-regulated generating plants is new.

Indian Model : Selection of Generators

- The willing generator after taking necessary consent will bid the Volume in MW and a price in Rs/MWh in each time block.
- Selection of Generators will be from lower to higher bids until the volume in MW of the reserve required in each time block is met.

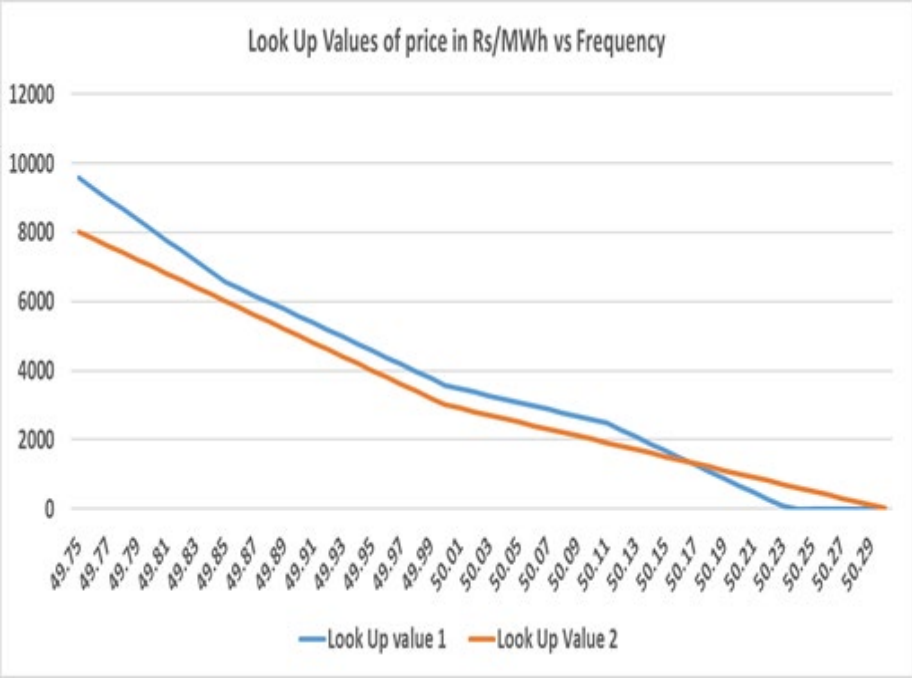
Indian Model : Payment of fixed charges

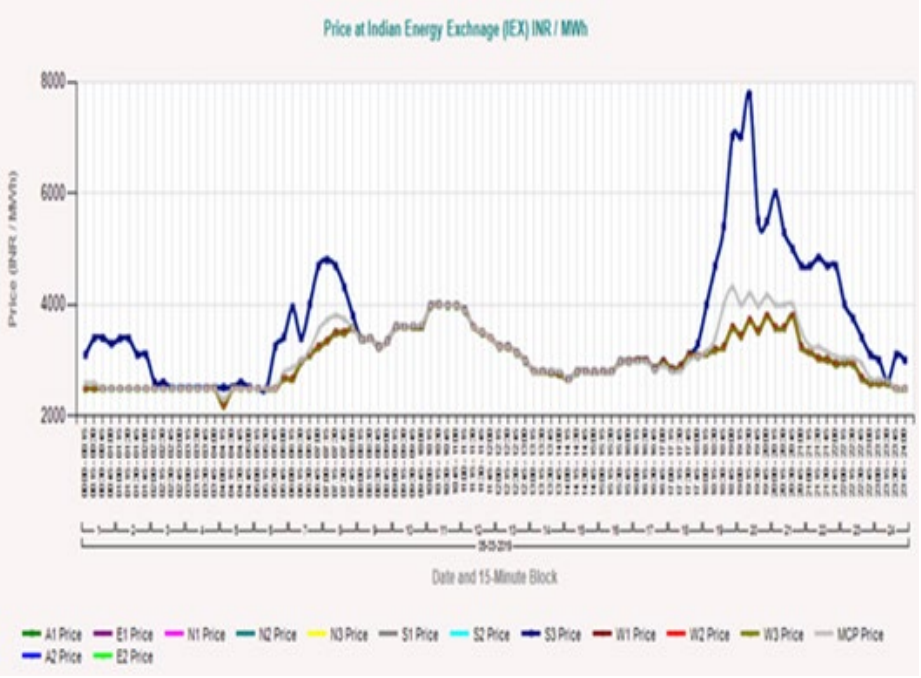
- The average price at the Day-Ahead Energy Exchange will be the fixed charge of the accepted capacity at each time block.
- A pool will be created to pay to the generators.
- A introduction of Reliability support charge of Rs 0.02/kWh to be billed to the Short-Term Open Access customers.
- Even without real-time dispatch, the fixed charge will be payable to the accepted generator.

Indian Model : Payment of variable charges

- The variable charge of the ancillary will be linked to the actual average frequency of the block in real time of the dispatch.
- At 50 Hz frequency the average Area Clearing Price in the Day-ahead energy market shall be the variable charge applicable to the scheduled quantum of dispatch.
- With each decrement of frequency by 0.01 Hz from 50 Hz the variable price is increased by 200 Rs/MWh.
- For every increase in frequency by 0.01 Hz from 50 Hz the variable price is decreased by 100 Rs/MWh.

Indian Model : Payment of variable charges





The average ACP of the split region is 3575.03 Rs/MWh and
The average ACP of the rest of India is 3011.50 Rs/MWh

Indian Model : Payment of variable charges

- For ancillary up service, variable charge payment will be given to the Ancillary provider.
- For the purpose of RRAS down service, the payment is to be by the generators participating in the tertiary to the Deviation pool.
- The Deviation Pool as maintained by the Indian Power System will be utilized to pay-in-out of the variable charges.

AS Dispatch Efficiency

- A zero deviation in the schedule of the generator will mean that:
  - Energy Component : There is no deviation in the actual generation against the schedule of the beneficiary
  - Reserve Component : There is no deviation in the actual generation against the Ancillary schedule.

AS Dispatch Efficiency

- Deviation charges are applied on the principle of energy component applied to the full deviation in a time block.
- AS dispatch efficiency will be applied as per the applied bid in Rs/MWh of the selected generator to the full deviation quantum in a time block.
- AS dispatch efficiency will be defined as :
  - Positive : If the actual generation is more than the scheduled generation in a time block where AS up schedule has been given. And if the actual generation is less than the scheduled generation in a time block where AS down schedule has been given.
  - Negative : If the actual generation is less than the scheduled generation in a time block where AS up schedule has been given. And if the actual generation is more than the scheduled generation in a time block where AS down schedule has been given.

AS Dispatch Efficiency

- For Deviation in the direction of AS: Amount is to be paid to the generator which is the value obtained by multiplying the bid price to the deviation quantum.
- For Deviation in the opposite direction to AS: Amount is to be paid by the generator to the pool which is the value obtained by multiplying the bid price to the deviation quantum.
- The Deviation Pool will be utilized for the pay-in-out of the AS dispatch efficiency prices.

Future Scope of Research

- The value in MW of reserve requirement in each time block.
- For example, the solar ramping up and down, may require reserve requirement to be unequal than the rest of the blocks.
- After suitable experience being gathered, option for Pay-as-bid mechanism may be opted.

Thank You ...