A Market Simulation Model for Implementation of Market Based Economic Dispatch (MBED) in India

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Overview

The Indian power sector has witnessed the evolution of a competitive framework, particularly for short-term power procurement through power exchanges as well as licence traders, tendering in another mechanism that is available through over the counter platform (for example Discovery of Efficient Electricity Price (DEEP) portal) [1]. Furthermore, the procurement of renewable energy under long-term contracts particularly for solar energy is largely being undertaken through competitive bidding, thus leading to the discovery of significantly lower price than those determined under prevailing regulation framework at centre as well as state level.

In the Indian power sector, individual state SLDCs prepare their day ahead schedule on basis of the self-scheduling method (Merit Order Despatch (MOD)) to meet the forecasted demand. The optimization is done at state level, hence state SLDCs are not able to achieve optimum solution (i.e., sub-optimal utilization of cheaper generation) and Un-Requisitioned Surplus (URS) available from Inter-State Generating Station (ISGS) [2-4]. Few state SLDCs draw power from expensive plants but are not able to suitably identify cheaper generation capacities available from other states, for their power procurement cost optimsation. Hence, there is a requirement to understand the economics of URS which leads to the further scope of optimization. In case there are shortages at the state level, then state SLDCs availed URS to optimize their power procurement cost.

To encourage greater economy in managing short-term power procurement regulatory measures led to framework for procurement for optimization the cost of power procurement at marginal price which lead to Security Constrained Economic Dispatch (SCED) [5-7]. From April, 2019, POSOCO has carried out implementation of SCED after gate closure for one time block only. According to feedback report on SCED published by POSOCO in March, 2021, the total saving in system cost on all India basis was Rs. 1624 Cr for April, 2019 – January, 2020 [8]. Singh *et al.* has proposed multi-period optimisation that decrease the system cost as compared to the block-level optimisation [9]. SCED implemented after preparation of final schedule, hence model does not explore the optimum schedule of plants on a day-ahead basis *i.e.,* once expensive plants are committed, it is continuous to be operated.

To enhance the spectrum of cost optimization across the overall power procurement basket in the country. Draft paper for implementation of Market based economic. dispatch (MBED) was brought out by CERC in December, 2018 [10-11]. The benefits of MBED framework for stakeholders are reduction in overall power procurement cost of DISCOMs, generators get additional revenues for selling their URS power, systematic implementation of MOD, transparency in system marginal price *etc*. This document also highlights benefits on account of limited study simulated for five states (Chhattisgarh, Karnataka, Andhra Pradesh, Telangana, and Maharashtra). This draft paper reported that the net benefits obtained by implementation of MBED on five states for FY17 is Rs. 6220 crore. In June, 2021, Ministry of Power issued discussion paper on MBED, in which evaluation in reduction in power procurement was approximate Rs. 1825 crore/year while implementation of proposed MBED on all ISGS plants whereas if all plants in India are participated in MBED then net benefit would be Rs. 12000 Crore [12]. In MBED model, the total system cost was evaluated with consideration of technical minimum capability, ramp up/down capability (1%/minute) and point of connection charges as per CERC orders. It was assumed that hydro plants are to be operating at full availability. Both these studies did not consider anomaly of landed cost on account of transmission charges and losses, start-up and shut-down cost, minimum up and down time constraints, direct and indirect incentives [13]. The economic motivation towards adoption of MBED should depend on direct as well as indirect benefits and associated costs while accounting for prevailing regulatory framework for generation tariff determination and, technical and operational constraints.

Methods

A market simulation model is developed as a centralised unit commitment model [14-15] using data for all generation sources and the associated power purchase contracts, and their tariff structure for five Indian states. This paper would analysis the net benefit on account of MBED implementation using block-wise system demand as well as generation availability while considering the variety of economic aspects as well as technical constraints such as technical minimum, minimum-up and down time, ramping up and down capability, transmission losses, start-up and shut-down cost, transmission charges etc. For these models, we will also take consideration number of regulatory provision which influence final regulatory tariff to be paid to individual generators. Such as differentiated fixed charges for the peak

and off-peak hours on account of higher availability, incentive to be paid to generating units for attaining minimum ramp rate etc.

Results

It is ongoing work where we are simulating MBED framework on group of five states as a test case and while also identifying the number direct and indirect cost on account of prevailing regulatory and policy framework for tariff determination in the Indian power sector. The final outcome of MBED is compared with results of a unit commitment model on self-scheduling basis for the individual states.

Conclusions

The result will enable the regulators and policymakers to take better-informed decisions in phasing and implementation of the MBED. This would also help identify the existing aberrations in the framework for regulated tariff determination that influence the market outcome under the MBED framework. A clear assessment of direct as well as indirect costs, and their distributional impact would assist regulators and policymakers to provide for the distributional impact and address the stakeholders' concerns for early implementation of MBED.

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