

Power Chronicle

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Editorial

Design of electricity markets should continuously strive for economic efficiency, addressing market power and ensuring fairness in distribution of costs. The pilot phase of **Security Constrained Economic Dispatch (SCED)** of electricity would assist regulators as well as policymakers in informed decision-making for market design, keeping long-term objectives in perspective. Although inclusion of a larger number of participants on a market platform improves its efficiency and overall benefits to the society, its implementation however should consider correct price signals along with the existing arrangements so that the benefits of the same are justified for the stakeholders. For instance, the proposed SCED framework utilises variable costs quoted by ISGS plants for the ancillary services market (RRAS), whereas scheduling decisions taken by the distribution utilities across the states are based on the landed variable charges as per the latest bill from the ISGS plants. This information asymmetry would either overestimate or underestimate the benefits of the new market design. Moreover, the SCED framework ignores capacity payments obligation of the respective PPA beneficiaries. This creates a disincentive for utilities to sign capacity-charges-linked PPAs in future, thus undermining investment in capacity adequacy in the long run. Development of a capacity market hence becomes vital for the overall vibrancy of the Indian power sector eventually.

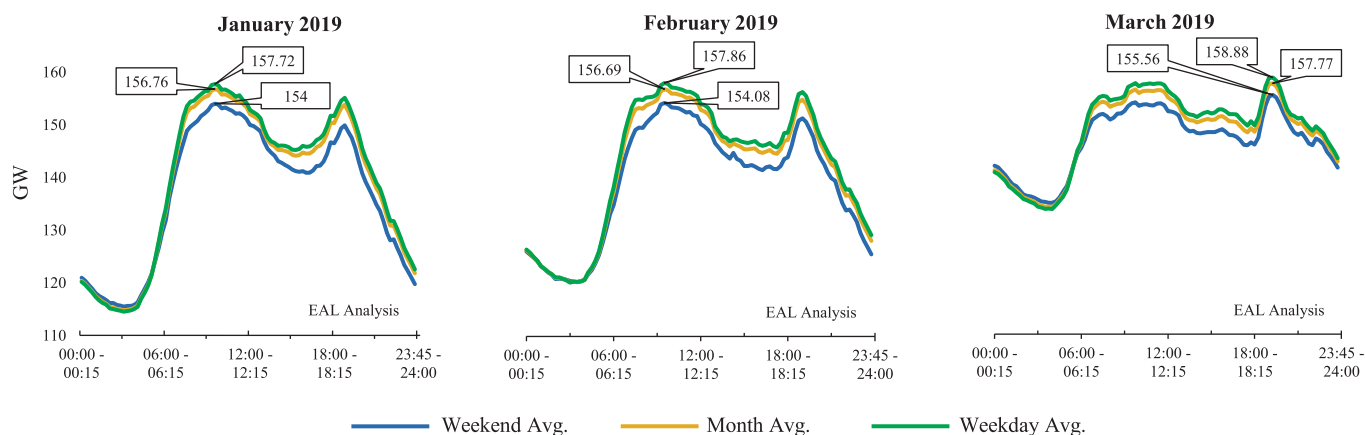
EAL, in its opinion on the SCED framework, identifies key aspects of market design that should guide the development of a long-term market destination for the Indian power sector. The experience and the outcome from the implementation of this SCED framework should then be discussed with a wide set of stakeholders so as to identify the need for modification and improvement in the existing framework.

The current issue of **Power Chronicle** provides a snapshot of the power system as well as the power market for the last quarter, wherein a fairly uniform demand pattern during the winter months was observed to limit the room for credibility of existing portfolio to derive economic gains. A price-duration curve for DSM penalty, as introduced in this issue, highlights the relative deviation penalty vis-à-vis the same derived based on the earlier DSM framework.

Anoop Singh
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Power System Overview & Analysis

All India Demand Met Profile

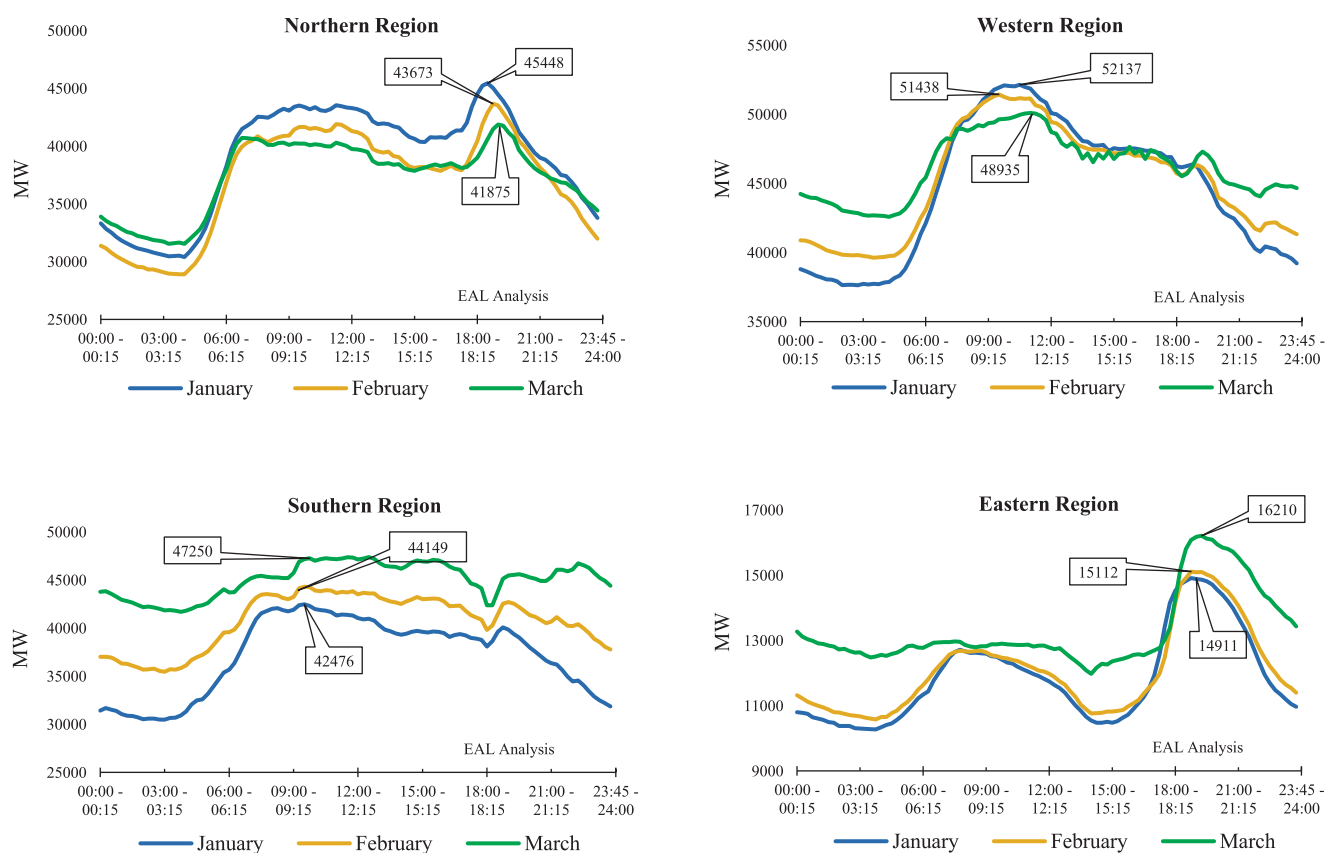


For the months of January to March, all India peak demand reached 163.92 GW on 29th March 2019 – about 4.3 percent higher than the previous year's peak demand during the same quarter (157.16 GW on 28th March 2018).



All India, region-wise and state-wise load profiles can be accessed at EAL web portal.

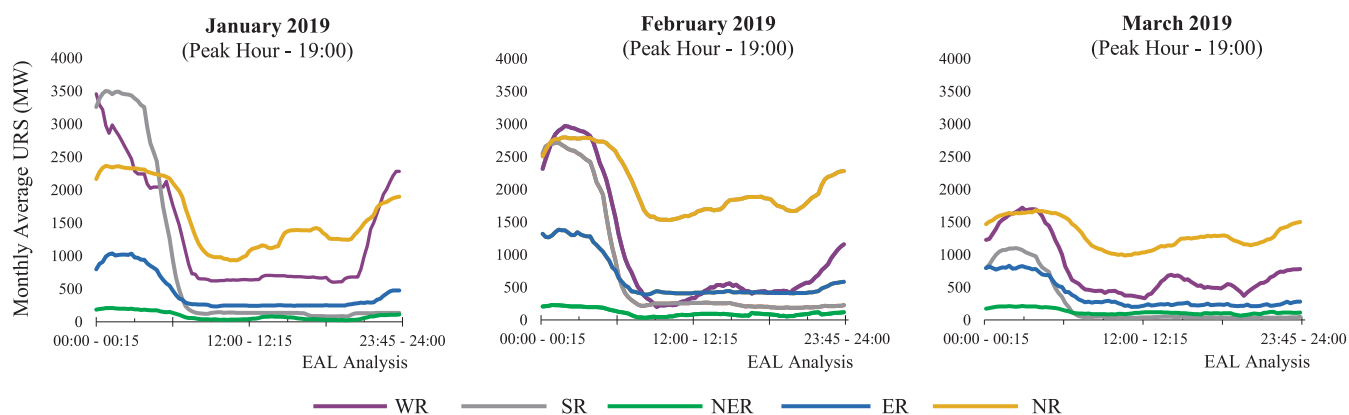
Region-wise Demand Met Profile



Note: Load profile for North-Eastern Region is not reported here due to inaccessibility of data.

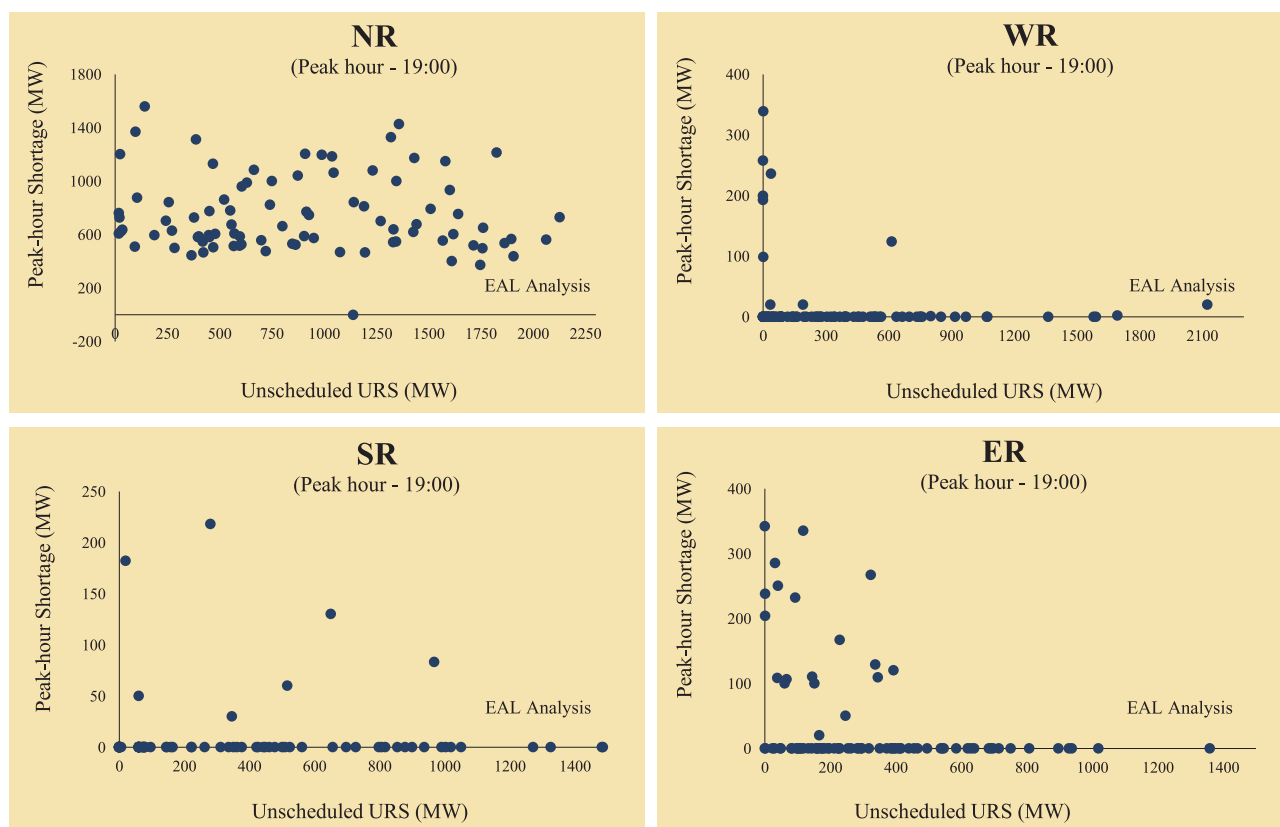
Un-requisitioned Surplus (URS) Analysis

Region-wise Scheduled Thermal URS



Region-wise Unscheduled Thermal URS (Excluding Gas Power Plants)

Highest peak-hour demand shortage during January to March 2019 was recorded to be 1559 MW (on 12th January 2019, for NR). Persistence of shortage amidst availability of unscheduled URS highlights a need to explore the economics of furthering the exchange of unscheduled URS.



Despite peak-hour shortage, NR continues to have unscheduled URS. Subject to intra-regional transmission availability and economics, unscheduled URS can be utilised for reducing the peak-hour shortage. A similar approach can also be adopted at inter-regional level for minimising shortages economically.

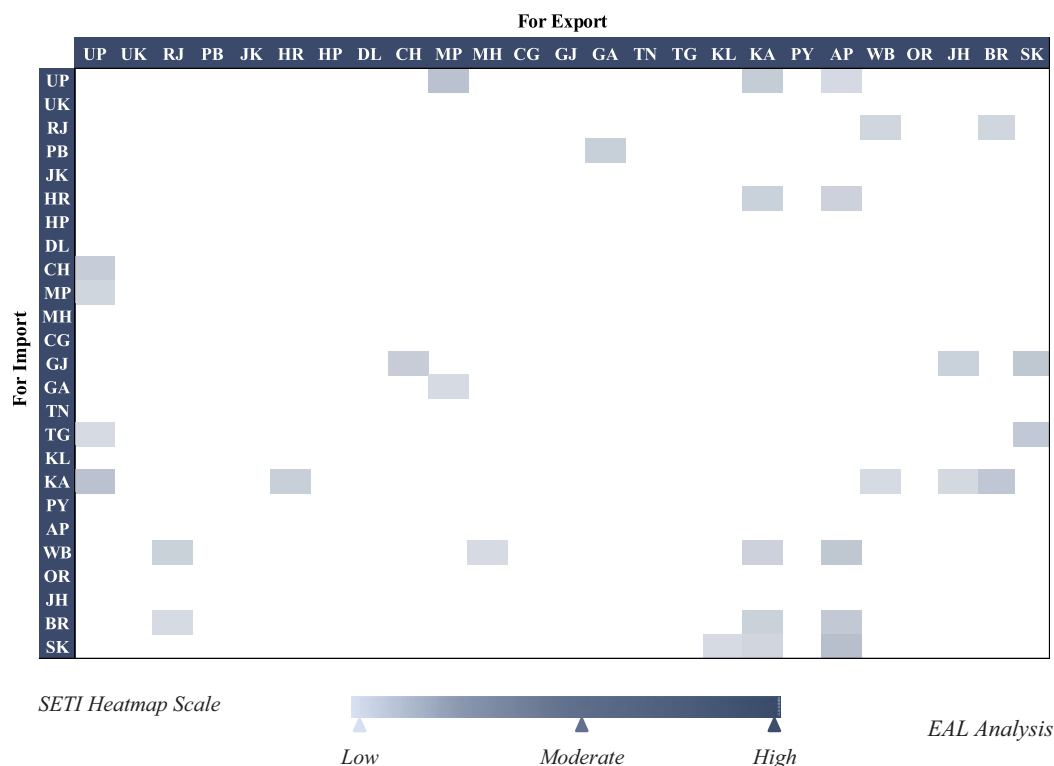


All India and regional URS can be accessed on System Dashboard of EAL web portal.

State Electricity Tradability Index (SETI)

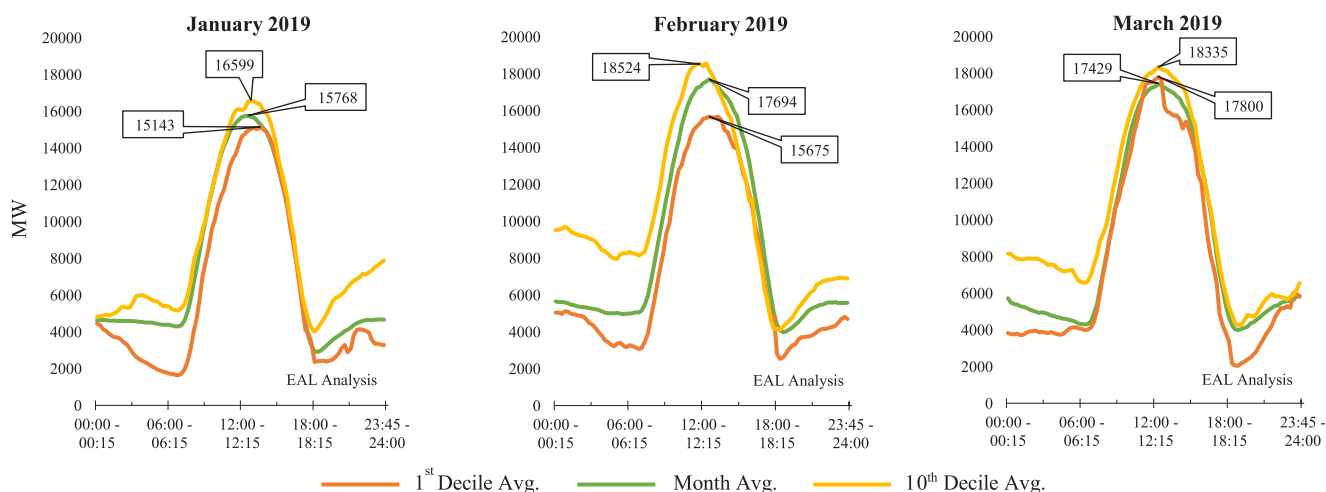
The load profiles of certain pairs of states are complementary in nature. SETI, developed by EAL, gauges such complementarity between pairs of states, for both import and export of power. Given adequate transmission capacity and favourable economics, such complementarities indicate opportunities for trade of URS across states. Further, this also indicates potential for trade under SCED framework.

State Electricity Tradability Index (January-March 2019)



Owing to low demand in Eastern, Northern and Western Regions, less opportunities for economical power trading among states is observed during this quarter, compared to those in the previous quarter(s). This dynamic behaviour of complementarity in demand suggests that short-term power procurement planning should be reviewed on a quarterly basis, considering demand variation and peak load requirement.

All India Renewable Energy (RE) Generation Profile

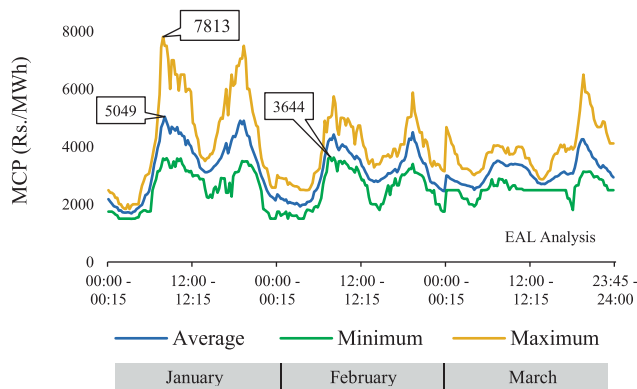


All India RE generation profile can be accessed on System Dashboard of EAL web portal.

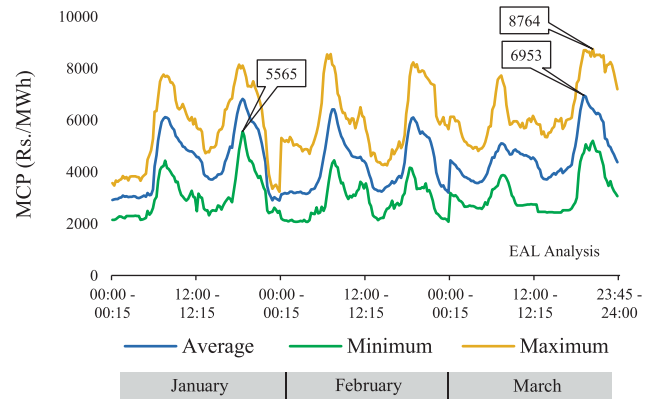
Power Market Overview & Analysis

DAM – Market Clearing Price (MCP) & Market Clearing Volume (MCV)

DAM Monthly Average, Maximum & Minimum MCP

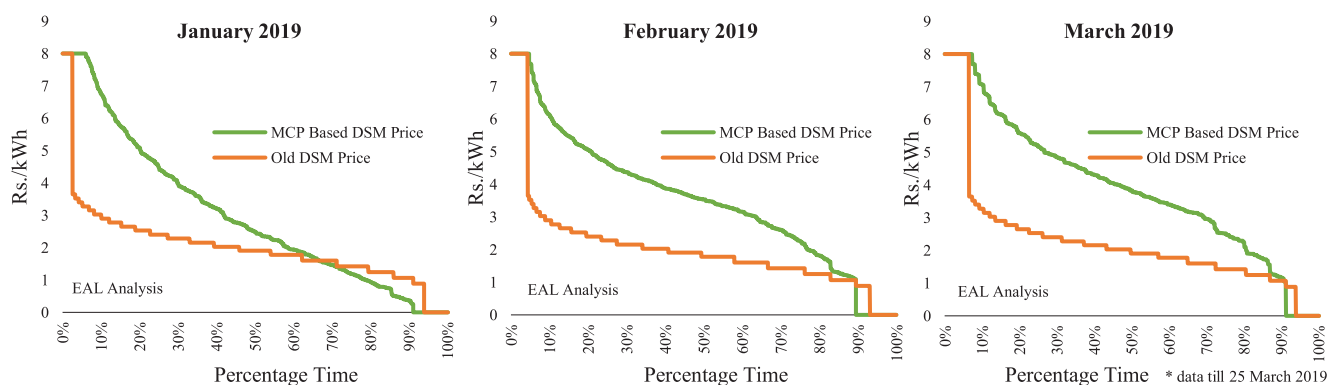


DAM Monthly Average, Maximum & Minimum MCP



January 2019 experienced a general fall in DAM price, with MCP peaking at Rs. 7813 per MWh on 19th January 2019.

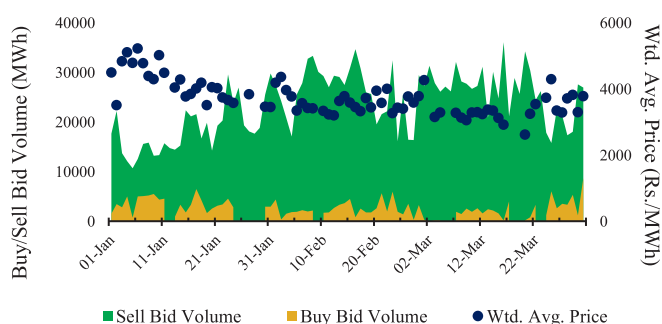
Deviation Settlement Mechanism (DSM) – Price Duration Curves



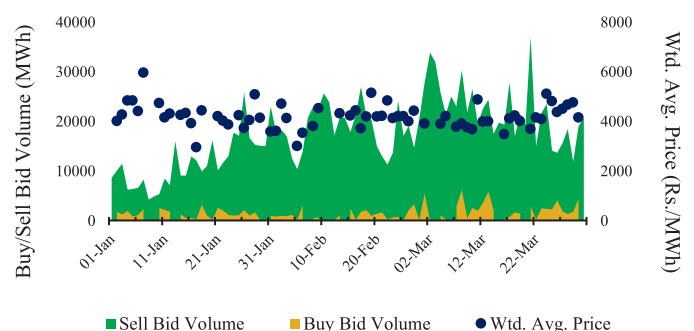
Compared to the price duration curve based on the erstwhile DSM price vector, the scenario post CERC DSM (fourth amendment) regulations, 2018 implementation (from 1st January 2019) indicates higher price penalties for a greater proportion of time blocks, a step towards ensuring better short-term power scheduling by utilities and large consumers.

Term-Ahead Market (TAM) Transactions

Daily Average Day-Ahead Contingency Transactions



Daily Average Intra-Day Transactions



Regulatory & Policy Perspectives

CERC – Pilot on SCED of Inter-State Generating Stations PAN India

Owing to the diversity of demand profile and supply portfolios across states, the current Merit Order Dispatch (MOD) adopted by individual state SLDCs, which optimises power procurement cost on a day-ahead basis, has a scope for further optimisation. To address this, Central Regulatory Electricity Commission (CERC) directed Power System Operation Corporation Limited (POSOCO) to implement Security Constrained Economic Despatch (SCED) of Electricity for Inter-State Generating Stations (ISGS) on a pilot basis from 1st April 2019.

OVERVIEW

Guidelines for SCED on Pilot Basis

- ❑ POSOCO would implement SCED for ISGS whose tariff is determined by the Commission, for their full capacity and for a trial period of six months.
- ❑ Variable charges declared by the ISGS for the purpose of Reserve Regulation Ancillary Services (RRAS) would be considered for the optimisation process.
- ❑ Schedules of the state/beneficiary would remain unchanged, and payment would be as per the existing practices.
- ❑ NLDC would open a separate bank named 'National Pool Account (SCED)'. All SCED transactions (payments) would be done through this account.
- ❑ For increment or decrement in injection due to optimisation, the payment would be from or to the National Pool Account respectively at its variable charge. No incentives would be provided for incremental changes.

- ❑ Regional Power Committees (RPCs) would issue weekly SCED accounts, along with other relevant accounts such as DSM, RRAS, Fast Response Ancillary Services (FRAS), etc.
- ❑ Methodology for sharing of benefits would be decided by CERC after the results of the pilot and the extent of savings are available.
- ❑ POSOCO would maintain relevant data during the operation of the pilot scheme, including station-wise installed capacity, URS, variable cost, optimisation up/down, part-load compensation, Distribution Company (DISCOM)-wise share in respective generating stations, and requisition from the generating stations.
- ❑ POSOCO would develop the necessary hardware and software for the implementation of SCED.
- ❑ The implementation date of SCED is 1st April, 2019.

EAL OPINION

- ⚡ Savings on account of SCED implementation, for which methodology is yet to be specified by CERC, should only be apportioned to the respective beneficiaries. Generators, who are otherwise compensated for all the associated cost, should not be a party to such savings.
- ⚡ The variable cost quoted by the ISGS for RRAS is vetted by neither CERC nor POSOCO. Moreover, it is not specified if this variable cost should be based on the previous month's billing or the current month's expected billing, or on the basis of the cost of recent delivery of fuel (in case of coal-based thermal station).
- ⚡ The asymmetry of variable cost used by state utilities and that quoted by ISGS plants (and used for SCED) would lead to over-/under-estimation of benefits.

Procedure for Pilot on SCED for ISGS PAN India

POSOCO formulated a detailed procedure for the implementation of Security Constrained Economic Despatch (SCED) of Electricity for Inter-State Generating Station (ISGS) PAN India, in response to CERC's directions regarding the same. The procedure would be implemented on a pilot basis for six months effective from 1st April, 2019.

OVERVIEW

Objective

- ❑ To optimise despatch from participating generation resources at inter-state level to reduce the variable cost of electricity and to lay down the framework methodology to be followed by organisations such as NLDC, RLDCs, SLDCs and RPCs

Scope

- ❑ Thermal ISGS participating in RRAS mechanism, whose tariff (for their full capacity) is determined by CERC (SCED Generators)
- ❑ Excludes gas, RLNG and liquid fuel ISGS on account of additional complexity due to unit commitment or open/closed cycle operation to be factored in real time

Role of NLDC

- ❑ Obtaining the optimised schedules and communicating with RLDCs to update it, honouring the current schedule as specified by IEGC
- ❑ Maintaining the 'National Pool Account' to settle payments to/from SCED generators

Role of RLDCs

- ❑ Incorporating the obtained SCED schedules as directed by NLDC and maintaining the operational data of the SCED pilot
- ❑ Reconciliation of schedules on account of SCED; despatch by RLDC based on the data furnished by NLDC, before forwarding to RPCs

Role of RPCs

- ❑ Issuance of Statement of Compensation due to part load operation on account of SCED

Scheduling and Despatch of ISGS under SCED

- ❑ NLDC to prepare schedules based on relevant data such as normative on-bus declared capacity ramp rates, quoted variable charges, technical minimum, etc.
- ❑ The SCED software program to consider only the units on bar (unit commitment not envisaged)
- ❑ A virtual SCED regional entity to be created in the scheduling process of RLDCs to act as a counter-party to the SCED; the virtual entity not to form a part of the regional DSM pool
- ❑ URS available due to Regulation of Power Supply provisions as per CERC Regulations also to be used for SCED procedure similar to RRAS

Data and Voice Communication

- ❑ Information related to SCED generators to be provided by RLDCs, on their website

Energy Accounting and Settlement

- ❑ Energy accounting for the SCED schedules to be done by RPC on a weekly basis, along with DSM, RRAS, FRAS and AGC; accounts based on data to be provided by RLDC
- ❑ Variable charges (paise/ kWh) for RRAS declared by generators to be considered in SCED

EAL OPINION

- ⌘ The SCED being implemented is based on variable cost at the generator bus bar, where states consider the landed cost of such power, including transmission charges and transmission losses, while determining the MoD. Hence, the results provided by SCED may be suboptimal for a state sometimes.
- ⌘ In the absence of UC, all the units on bar would be allowed to run up to technical minimum along with heat rate compensation, thus imposing a higher overall cost on the system and ultimately the final consumers, whereas SLDCs can opt for shutdown of a unit as well.
- ⌘ In future, SCED should also consider unit commitment taking into account the strategy of shutting down of a unit, particularly under low-demand conditions.
- ⌘ The concept of retrospective changes in the SCED schedule, in the context of infeasible/nonconvergent solution, may expose the constituent to 'Unscheduled' DSM penalty/incentives as its treatment is not specified.
- ⌘ The inclusion of URS in SCED optimisation may leave no economics in it.
- ⌘ The objective function used for SCED (as given in the document) is based on an individual block basis and does not consider optimisation feasible across time blocks where ramping constraints would influence the solution.
- ⌘ There is no provision for passing the baton; provisions for roll-over must be provided through the mathematical formulation.

About Energy Analytics Lab

Energy Analytics Lab (EAL), supported by CSR funding from Indian Energy Exchange Ltd., is an endeavour of Department of Industrial and Management Engineering (IME) at Indian Institute of Technology Kanpur (IITK). EAL presents relevant data and independent analysis of the Indian power sector, both from the system's and the market's perspective. The Lab is also engaged in developing analytical and visualisation tools to aid decision-making for the sector/market participants, and to assist regulators and policy makers.

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