ENERGY ANALYTICS LAB
Department of Industrial and Management Engineering
Indian Institute of Technology Kanpur

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In This Issue

❒ **Power System Overview & Analysis**

- All India Demand Met Profile 2
- Region-wise Demand Met Profile 2
- Un-requisitioned Surplus (URS) Analysis
  - Region-wise Scheduled Thermal URS 3
  - Region-wise Unscheduled Thermal URS 3
- State Electricity Tradability Index (SETI) 4
- All India RE Generation Profile 4

❒ **Power Market Overview & Analysis**

- Day-Ahead Market (DAM) – MCP & MCV 5
- Bilateral Power Transactions 5
- Impact of CERC DSM (Fourth Amendment) Regulations, 2018 5

❒ **Regulatory & Policy Perspective**

- CERC – Re-designing of Real Time Electricity Market in India 6
- CERC – Re-designing of Ancillary Services Mechanism in India 7

❒ **About Energy Analytics Lab** 8

Editorial

Energy Analytics Lab (EAL) is an initiative to empower decision-making in the Indian power sector. EAL has put concerted efforts over the last two years to bring forth data analyses and visualisation of the power system and the power market data.

Through this newsletter, we provide a glimpse of EAL's analytics that can provide deeper insights into the understanding of the data and its behaviour so as to assist better visibility of the sector for the participants and to strengthen regulations and policy-making in the sector.

EAL's analysis demonstrates that availability of analytical tools based on its academic and research strengths can help identify and harness the potential for improving the economics of power sector operation, particularly through optimisation of power procurement portfolio. EAL's analysis points towards a greater scope for co-optimisation of the available contracts within and across the portfolios of distribution utilities. This can help in significantly reducing the power procurement cost which contributes to about 75-80 percent of the final consumer tariff.

EAL has developed State Electricity Tradability Index (SETI) – a complementarity index of load profiles of various pairs of states – which would aid in identifying opportunities for economical inter-state trade of Un-requisitioned Surplus (URS), within and across regions.

EAL also provides a perspective on relevant regulatory and policy developments in the power sector. We believe that EAL's analytical ability and the learning tools developed would help in contributing to the overall performance improvement of the sector.

Anoop Singh
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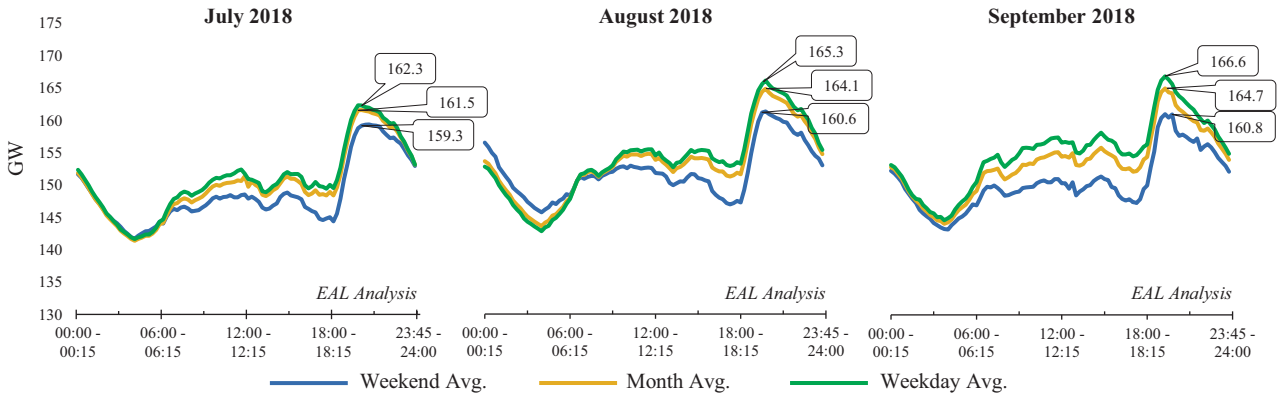
Power System Overview & Analysis

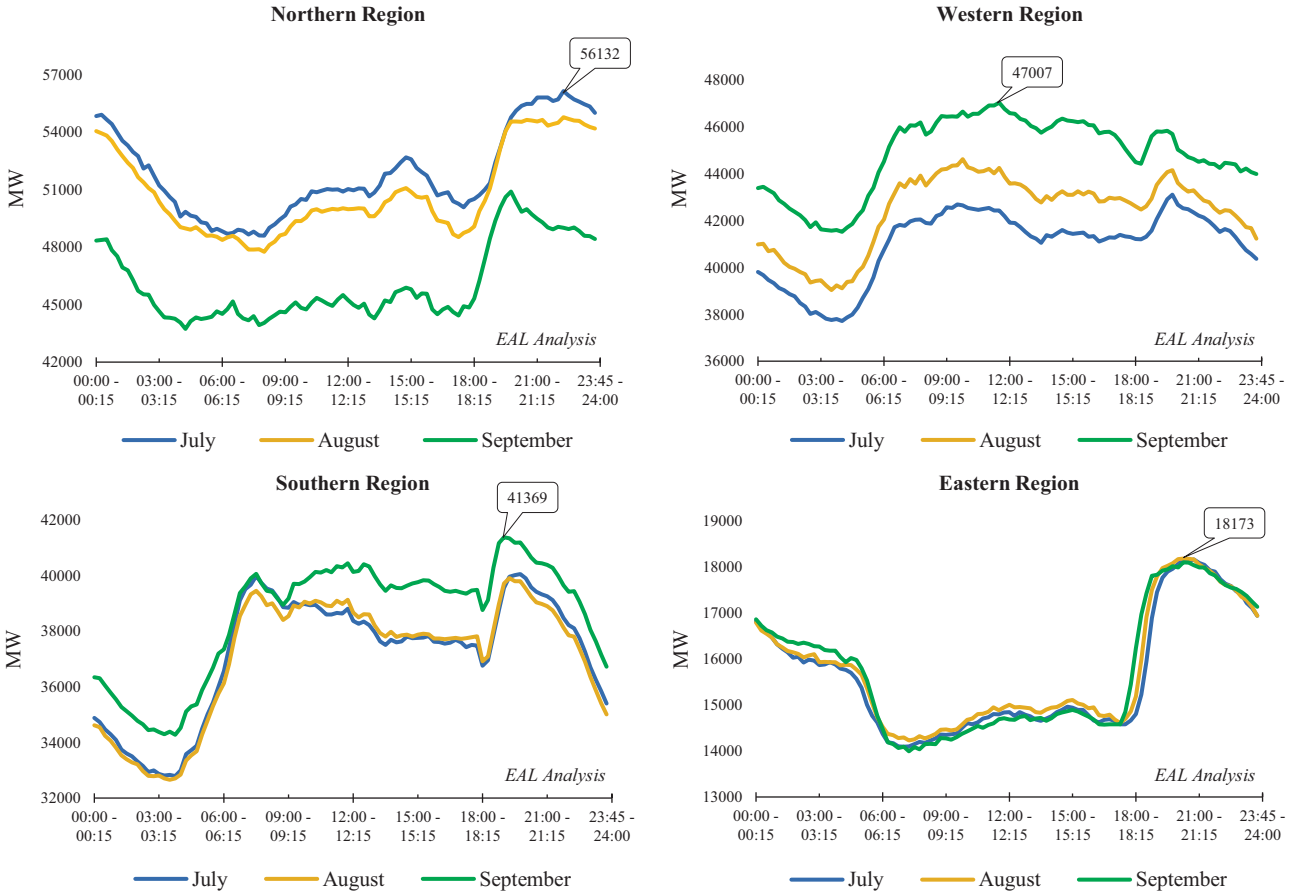
All India Demand Met Profile



All India peak demand reached 175.6 GW on 18th September 2018, about 9 percent higher than the peak demand recorded in the previous year (160.4 GW on 18th August 2017).

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

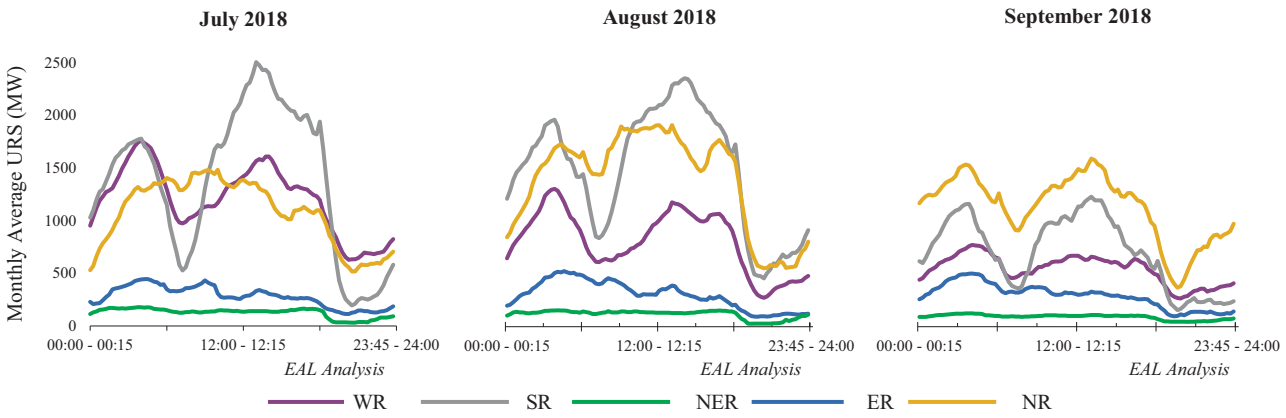
Region-wise Demand Met Profile



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

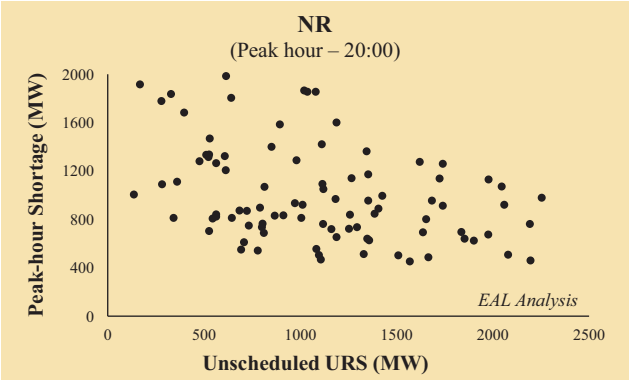
Un-requisitioned Surplus (URS) Analysis

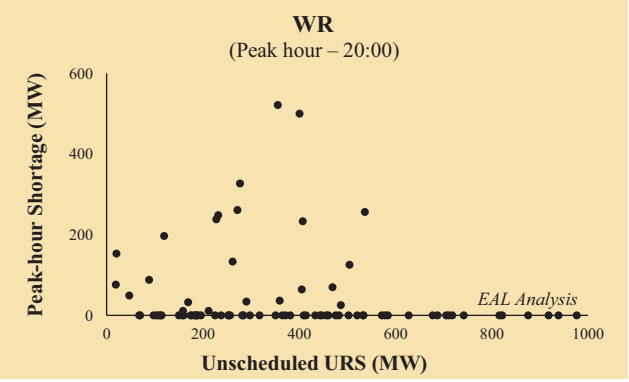
Region-wise Scheduled Thermal URS

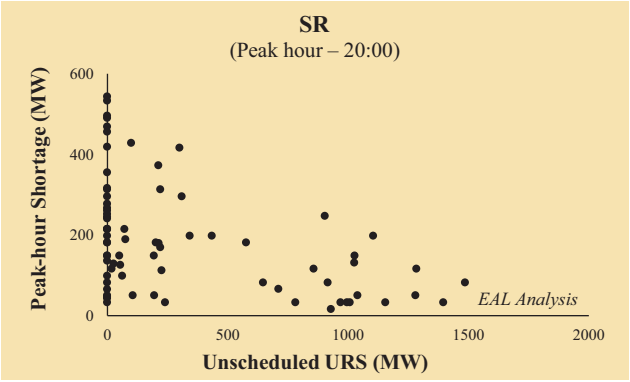


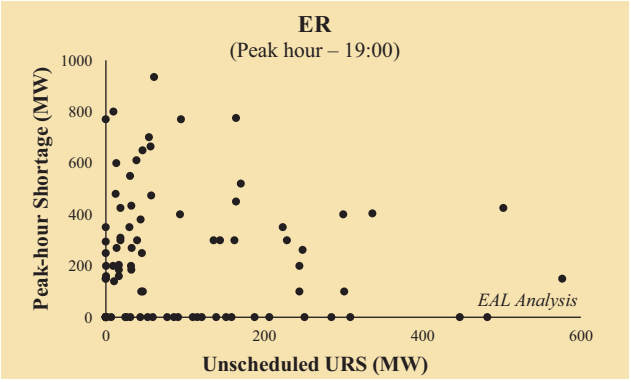
Region-wise Unscheduled Thermal URS

All India highest peak-hour demand shortage during July to September 2018 was recorded to be 2798 MW, on 29th September 2018. Persistence of shortage amidst availability of unscheduled URS highlights a need to explore the economics of furthering the exchange of unscheduled URS.









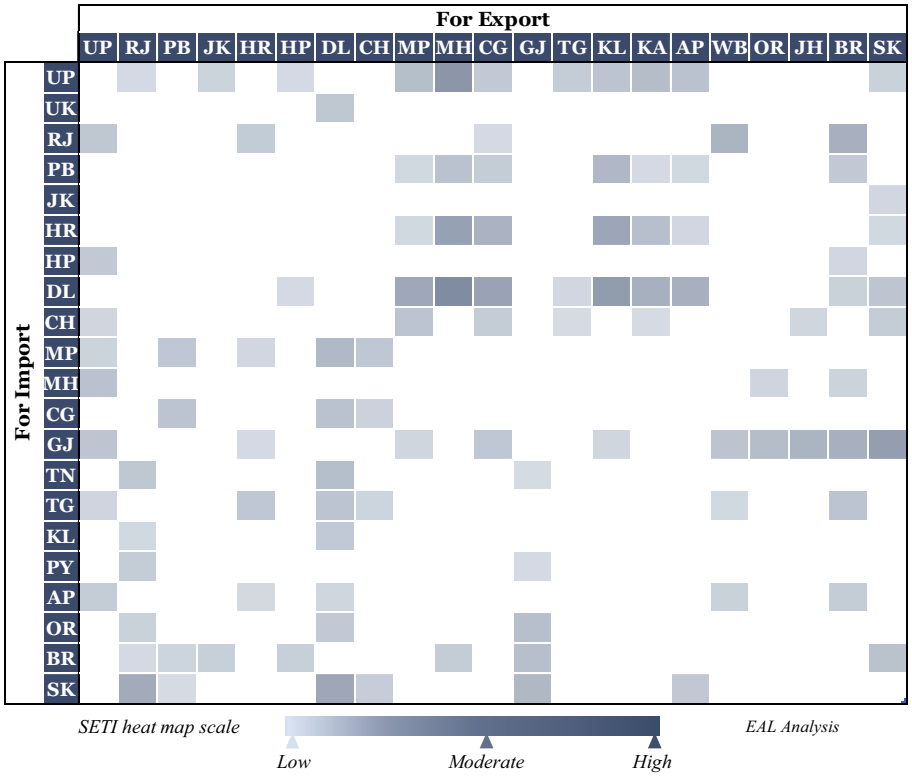
Although NR records peak-hour shortage, the region continues to have unscheduled URS. Subject to intra-regional transmission availability and economics, unscheduled URS can be utilised for reducing the peak-hour shortage. A similar approach can also be adopted at inter-regional level for minimising shortages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

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

State Electricity Tradability Index (SETI)

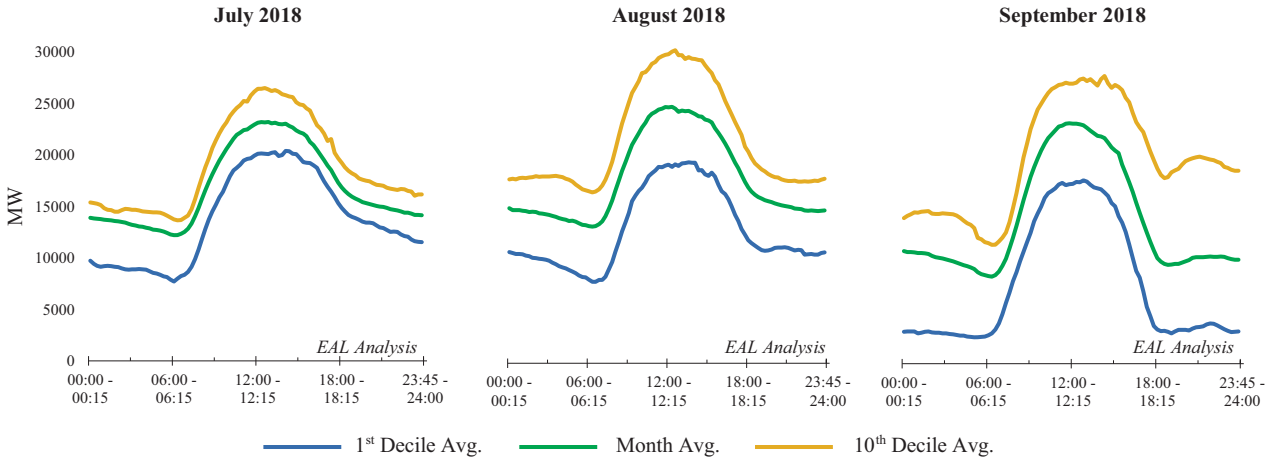
The load profiles of certain pairs of states are complementary in nature. EAL developed an index – State Electricity Tradability Index (SETI) – to gauge such complementarity between pairs of states, for both import as well as export. Given adequate transmission capacity and favourable economics, such complementarities highlight opportunities for inter-state trade of URS within as well as across regions.

State Electricity Tradability Index (July – September 2018)



SETI compares daily demand patterns of a pair of states, showing that there is significant scope for re-balancing of their power procurement portfolios. Load profiles of pairs of states with moderate to high SETI should explore avenues for co-optimisation.

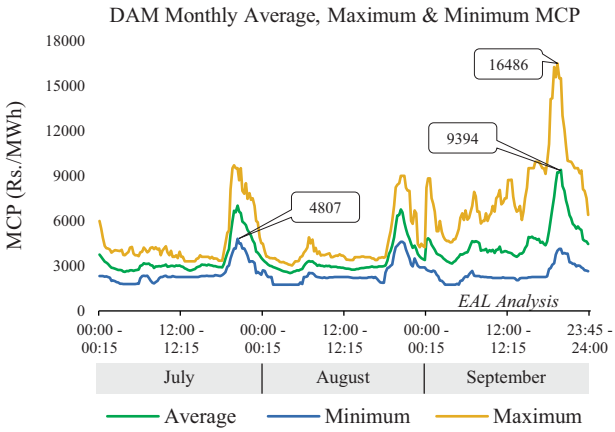
All India RE Generation Profile

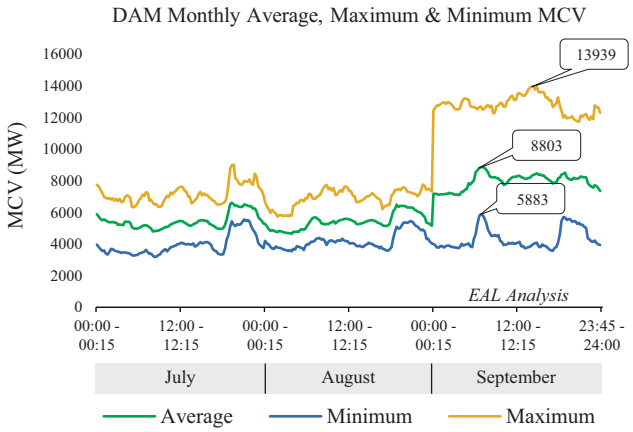


All India RE Generation Profile can be accessed on System Dashboard of EAL web portal.

Power Market Overview & Analysis

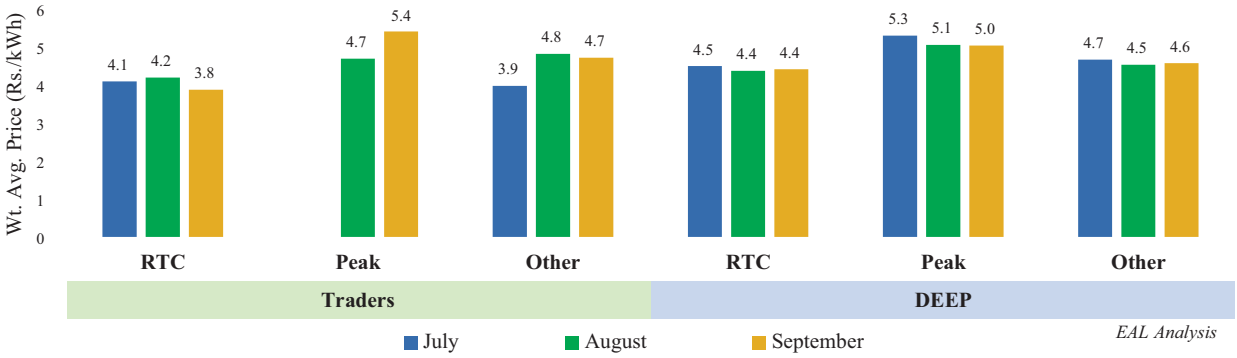
Day-Ahead Market (DAM) – MCP & MCV



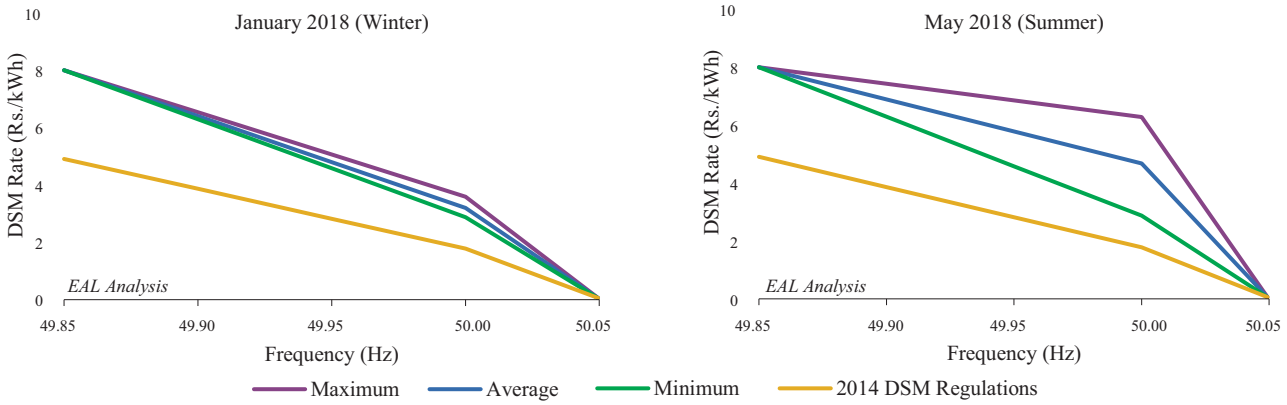


September 2018 experienced a general price rise in DAM, with MCP peaking at Rs. 16486 per MWh, on 29th September 2018.

Bilateral Power Transactions



Impact of CERC DSM (Fourth Amendment) Regulations, 2018



The modified regulations would render the slope of the DSM price vector variable and steeper by linking it with the average Area Clearing Price (ACP) in DAM. This would encourage better short-term power procurement planning. A representative estimate of DSM vector based on historical prices provides a glimpse of the difference in slopes of deviation price vectors in the two DSM pricing mechanisms.

Daily DSM price vector for all regions discovered as per CERC DSM (Fourth Amendment) Regulations, 2018 applicable from 1st January 2019 can be accessed at EAL web portal.

Regulatory & Policy Perspective

CERC – Re-designing of Real Time Electricity Market in India

On 25th July 2018, CERC released a discussion paper proposing to redesign the real time electricity market for optimal utilisation of available unscheduled resources and to improve imbalance handling in the grid.

Overview

- Real time energy imbalances in India are currently being addressed through Deviation Settlement Mechanism (DSM) and Ancillary Services (AS).
- Use of DSM as a market is discouraged as it is essentially a frequency deviation dependent decentralised system for handling imbalances.
- AS, introduced in 2015-16 by CERC, utilises the un-despatched power from Inter-State Generating Stations (ISGS) as Reserves Regulation Ancillary Services (RRAS) to handle region-specific grid imbalances. Hence, AS should not be used as a substitute for real time energy needs.
- Intra-day market and schedule revisions just before the gate closure (60 minutes prior the time of delivery) are the existing provisions closest to real time operation.
- It has been proposed to introduce a gate closure 90 minutes prior to the time of delivery, and a 30-minute auction-based Real Time Market (RTM) for every hour (4 time blocks from the time of delivery).
- It is also proposed to use double-sided auction with uniform market clearing price in the RTM.
- The net gains realised upon selling URS in RTM, if sold by the generator, are to be shared between the generator and distribution licensee(s) as per section 6.2 (1) of the tariff policy. The distribution licensee(s) may retain the entire revenue by selling surplus power themselves.

EAL Opinion

- The existing DSM mechanism and AS (RRAS) are frequency-dependent imbalance handling tools, not to be used as markets. The design of RTM as a balancing market must ensure participation and reduce dependence on AS (RRAS) and DSM for real time energy needs.
- A time gap of 10 minutes is required between gate closure and opening of bid (auction) for RTM.
- Distribution utilities should be allowed to provide demand side ‘up regulation’ and ‘down regulation’ bids to enhance the overall market efficiency.
- DSM price vector, currently linked with prices in DSM, could be linked to the prices discovered in RTM, at a later stage, for reflecting the true cost of deviation.
- For participating in RTM, RE generators would have to be well equipped with more reliable generation forecast.
- The RTM would require real time exchange of information on congestion, injection/drawl schedules, cleared price, cleared volumes, etc., between power exchange(s), system operators and market participants. Availability of adequate infrastructure in such regards must be ensured in advance.
- With the introduction of RTMs, better market monitoring would be required to avoid the abuse of market power.

CERC – Re-designing of Ancillary Services Mechanism in India

CERC's consultation paper, released on 6th September 2018, proposes to redesign the AS mechanism by reforming the market design, procurement process, pricing mechanism, clearing mechanism and performance monitoring of AS.

Overview

Proposed Market Design

- Classification of tertiary reserves into fast spinning, fast non-synchronised and slow tertiary reserves
- Demand curves for tertiary reserves, subject to a price cap equivalent to the highest variable cost of available CERC regulated generators, plotted for relevant products by Regional Load Despatch Centres (RLDCs), with the consent of State Load Despatch Centres (SLDCs)
- Inclusion of renewables and intra-state generators (provided they have the required setup)
- A generator to be used for multiple flexibility services instead of long-term bilateral contracts for AS

Proposed Procurement Process

- Setting up of slow tertiary reserves by National Load Despatch Centre (NLDC) in coordination with RLDCs and SLDCs
- Mandatory submission of bids by each entity (zero bid in case of non-participation) for every hour of the upcoming slot
- Daily selection of tertiary reserve suppliers through a co-optimised day-ahead unit commitment process
- Submission of report by the supplier to NLDC, 90 minutes prior to the first hour of delivery, in case of inability to provide tertiary reserves in real time under normal operating conditions
- Unserved quantum of power to be bought back by the supplier in case of a change in the requirement of the system or an inability to supply
- Real time selection of supplier on the basis of their response rates, operating limit and energy bid

Proposed Pricing Mechanism

- Uniform clearing price auctions
- Rewards and obligations for developing a least-cost option

Performance Monitoring

- Performance of ancillary service suppliers to be monitored in terms of accuracy, delay and precision in response to requests from RLDCs
- Penalties to be imposed in case of non-compliance with the rules of procurement, and disqualification for a defined period in extreme cases
- Supplier failing three successive evaluation tests by NLDC to be debarred from the market for 3 years

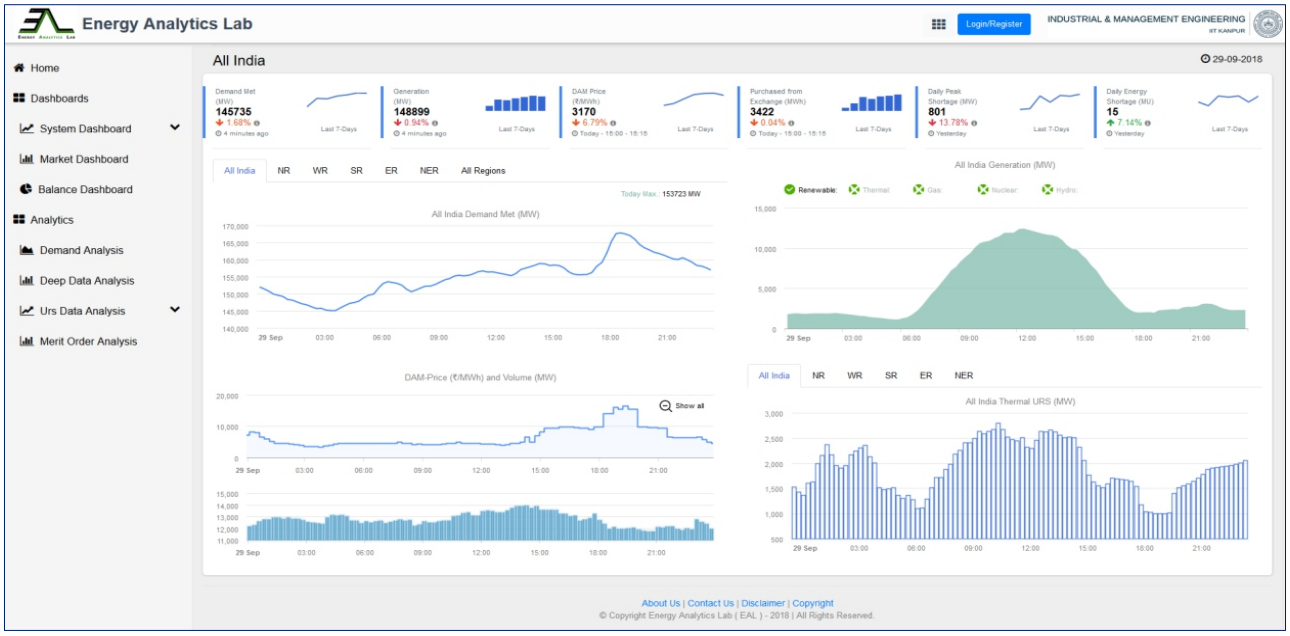
EAL Opinion

- Efficiently designed ancillary services market along with proposed real-time market should ultimately render DSM operation irrelevant.
- At the end of the debarment period, an evaluation process should be put in place to strengthen compliance framework for debarred participants to regain entry in the Ancillary Services market. Failure in qualifying the evaluation should lead to extension in the debarment period.
- Based on relative technical capability, inter-/intra-state plants/facilities participating in ancillary services market should be classified into Ramp Resources, Ramp Limited Resources and Energy Limited Resources.

About Energy Analytics Lab

Energy Analytics Lab (EAL) 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. Energy Analytics Lab is supported by CSR funding from Indian Energy Exchange Ltd. EAL 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.

The EAL web portal has three dashboards – System Dashboard, Market Dashboard and Balance Dashboard – each designed with the aim of data visualisation and analysis of the relevant data. These dashboards allow users to select appropriate duration and level of aggregation – state, regional and national – for customised visualisation of block-wise data.



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Note: Additional information can be accessed through the hyperlinks provided in the online version.