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Power Chronicle

Power System Overview & Analysis

Power Market Overview & Analysis

Regulatory & Policy Perspective

EAL News

Editorial

During March 2022, price spikes were witnessed on DAM and RTM for several blocks across multiple days. This situation was a bit alarming as it happened before the onset of monsoon. CERC, drawing powers under Regulation 51(1) of the Power Market Regulations, 2021 specified price limits, initially for DAM & RTM on 1st April, 2022, and then for the GDAM, Intra-day, Day Ahead Contingency, TAM & GTAM on 6th May, 2022.

Coal stock shortages at power plants and the early onset of warm weather leading to higher demand seem to be the major reasons for the price spikes. The experience of October last year was attributed to similar circumstances. While higher than expected demand may not have been foreseen a few weeks to a month ago, maintenance of lower coal stock position at power plants, which are allowed carrying cost of inventory as per the applicable Tariff Regulations, seem to have missed regulatory scrutiny.

The regulatory response to set price limits for PX products is only a short-term solution, till fundamental structural problems with the Indian power market are addressed. The most significant of these include the lack of Demand Response (DR). EAL's preliminary analysis of the market-clearing outcome on the PXs reveals that a DR of 700 - 1000 MW could have limited the price to around ₹10 - 12/ kWh for most time blocks witnessing significant price spike. Scientific design of Time of Day (ToD)/Time of Use (ToU) pricing and a DR program, allowing enrolled consumers to offer measurable demand reductions, need to be undertaken in a systematic way across the country. Last but not the least, CERC's market monitoring framework needs significant strengthening to identify, analyse, investigate, and penalise market participation and its outcome to ensure that there are no attempts to manipulate the market outcome.

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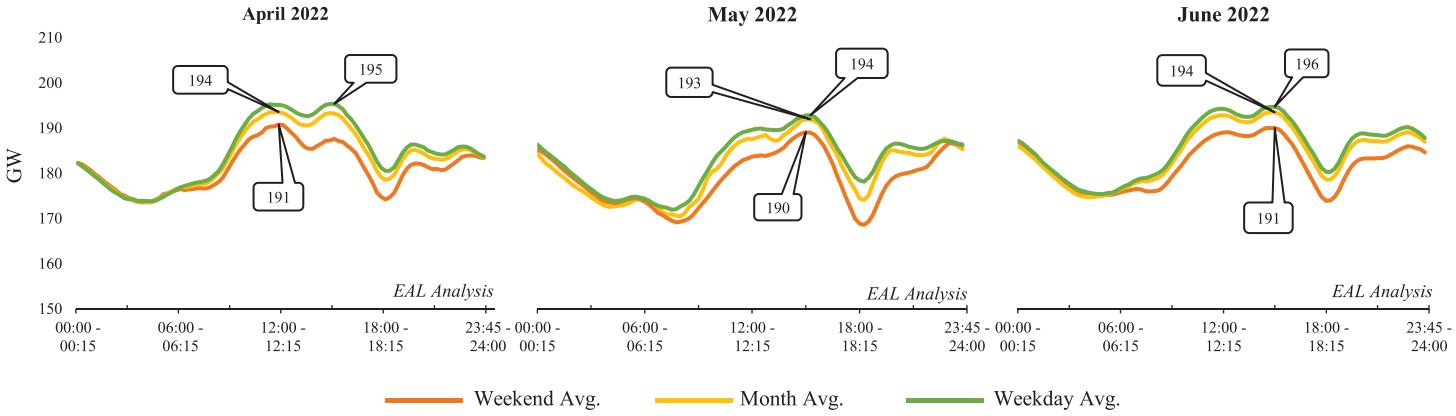
Stay Home, Stay Safe.

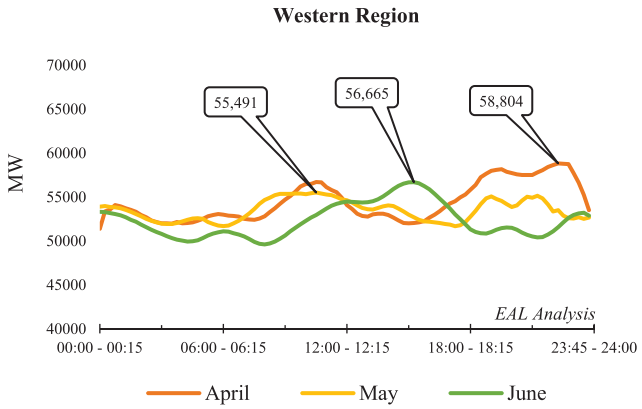
Power System Overview & Analysis

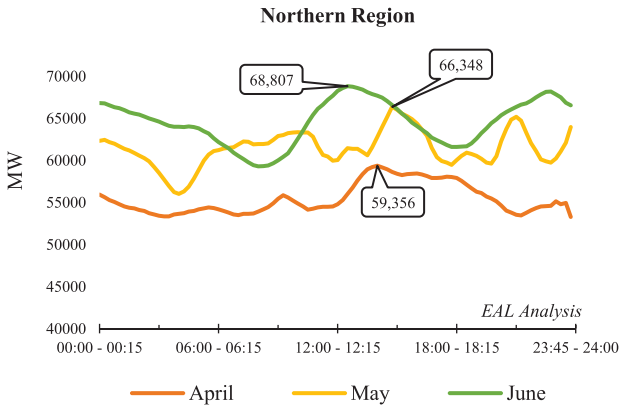
All India Demand Met Profile

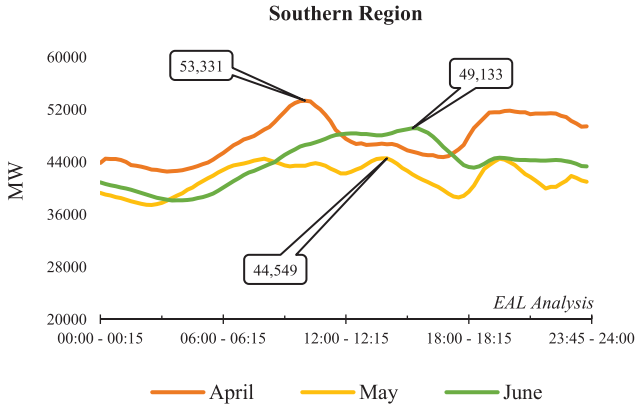


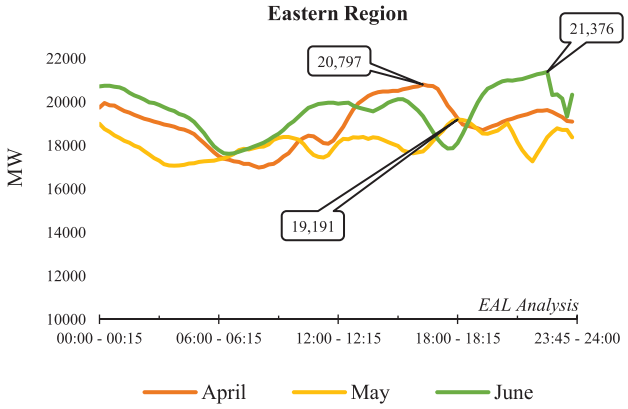
From April to June quarter, all India peak demand reached 211 GW (15:00 - 15:15) on 9th June 2022, about 10.33% higher than the previous year's peak demand recorded at 191.24 GW (12:45 - 13:00) on 30th June 2021, during the same quarter.

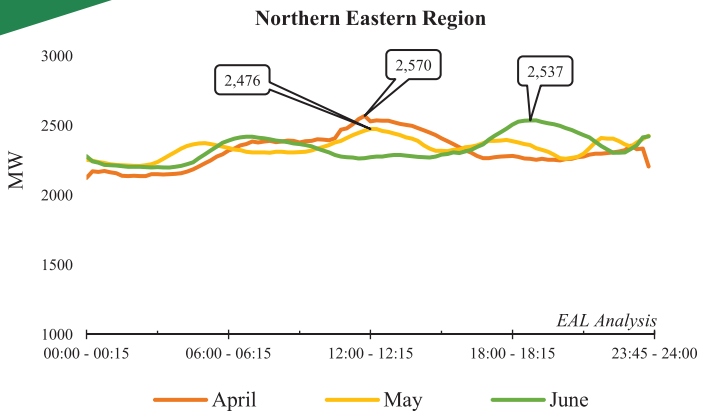
Region-wise Demand Met Profile







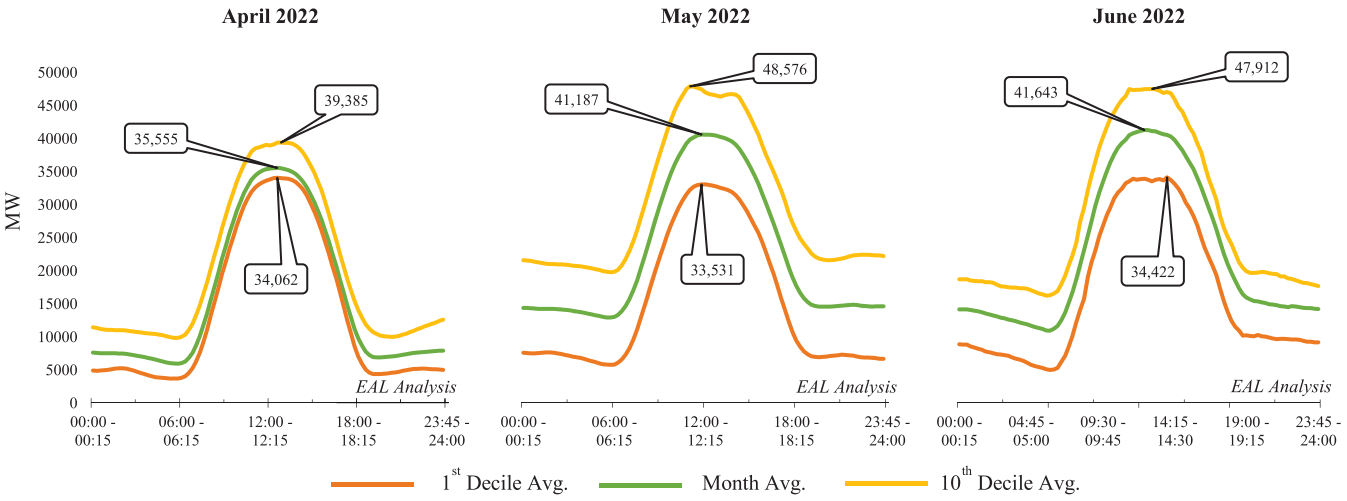




- Significant increase in the demand profile can be seen in the month of April across Eastern, Southern and Western regions as compared to the months of May and June. Average demand is found to be higher for Northern region as compared to the other regions for the month of June.
- Significant rise in demand during the evening time between 16:00 – 19:00 hours for the North Eastern Region in the month of June.

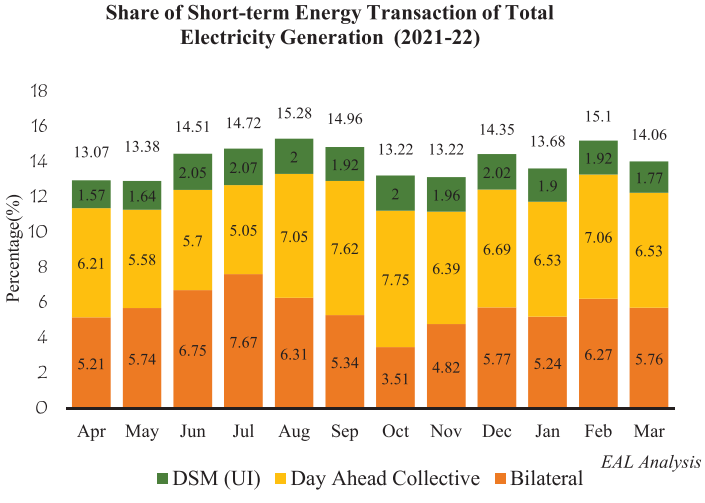
Demand and generation profiles at national, regional, and state-levels can be accessed on EAL's web portal.

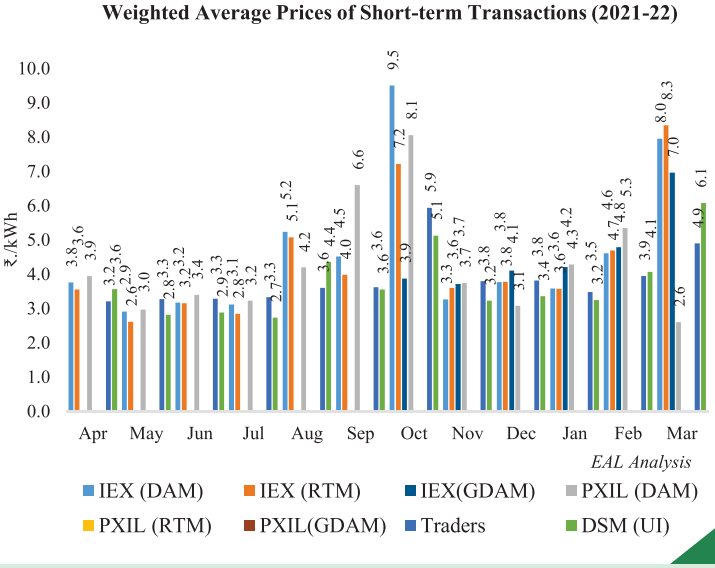
All India Renewable Energy (RE) Generation Profile



All India peak RE generation reached 53.62 GW (12:30 - 12:45) on 22nd May 2022, about 29.83% higher than the previous year's peak of 41.30 GW (11:45 – 12:00) on 11th June, 2021 during the same quarter.

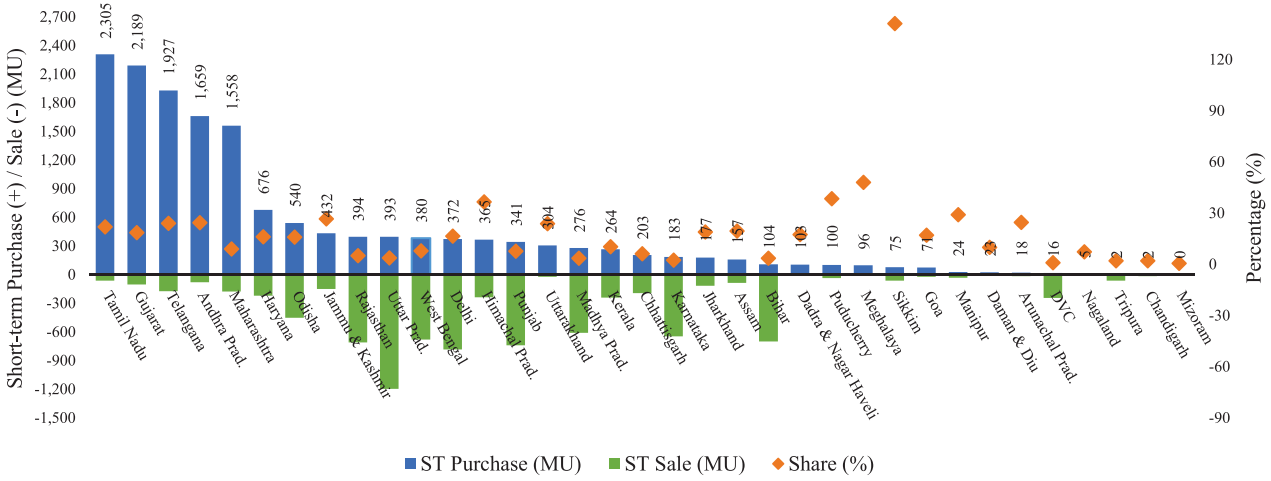
Short-term (ST) Energy Transactions





Monthly Short-term (ST) Purchase and Sale Quantum across States

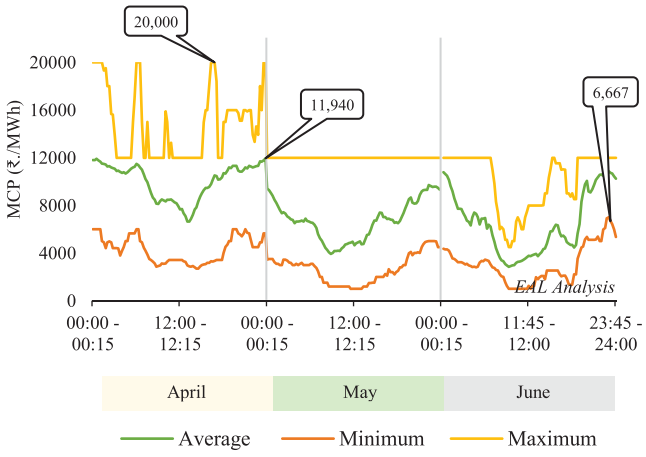
ST Energy Sale, ST Energy Purchase and share of ST Purchase in Total Energy Supplied (March 2022)



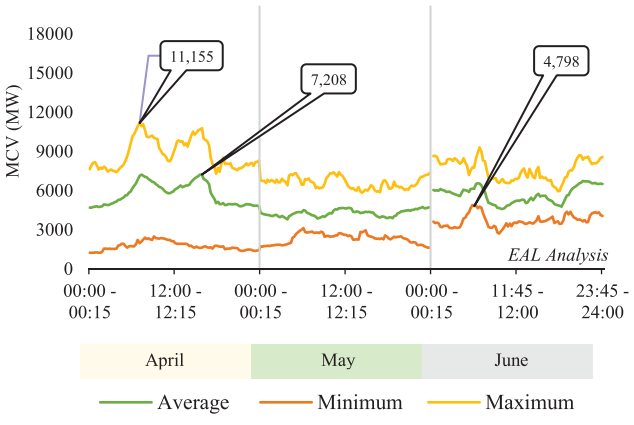
Power Market Overview & Analysis

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

DAM Monthly Average, Maximum & Minimum MCP

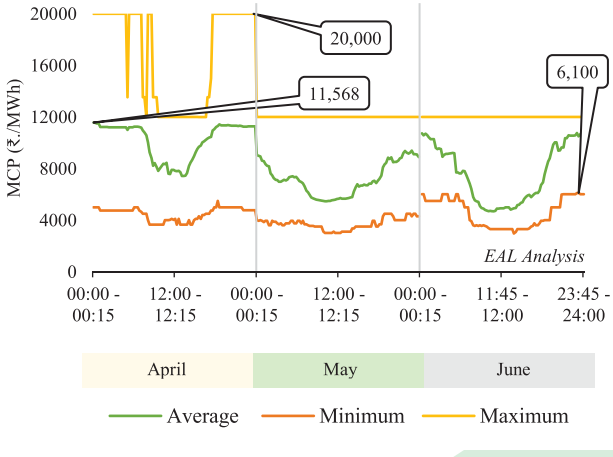


DAM Monthly Average, Maximum & Minimum MCV

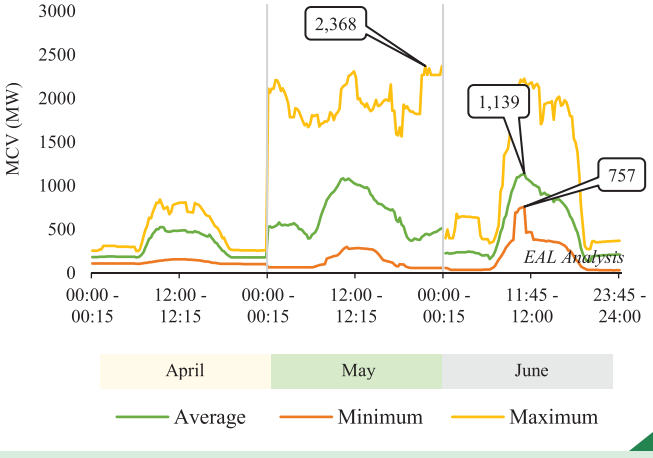


G-DAM – Market Clearing Price (MCP) & Market Clearing Volume (MCV)

G-DAM Monthly Average, Maximum & Minimum MCP

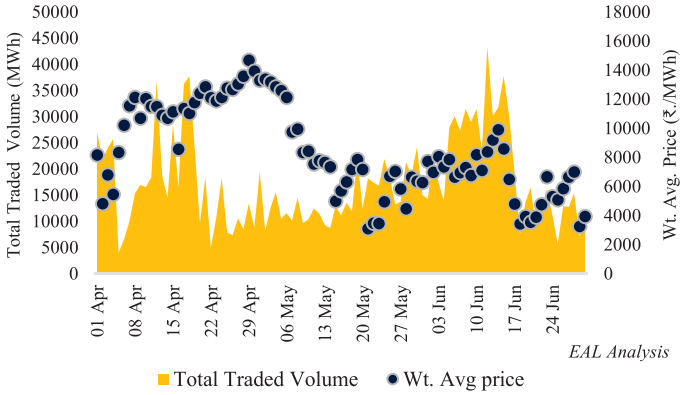


G-DAM Monthly Average, Maximum & Minimum MCV

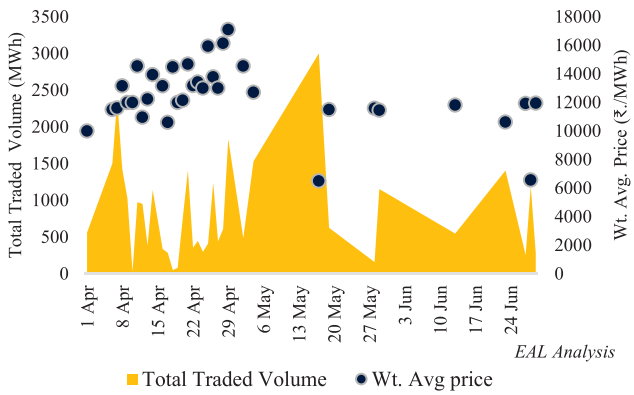


Term-ahead Market (TAM)

Daily Day-ahead Contigency Transactions



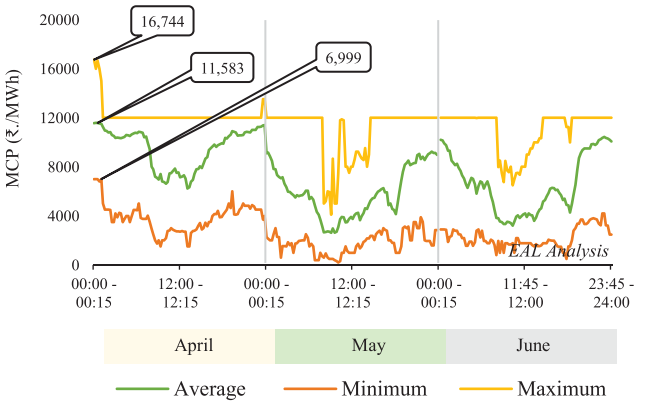
Daily Intra-day Transactions



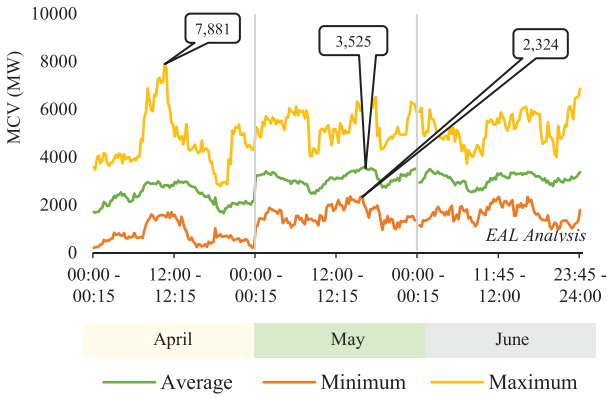
The total traded volume in Day-ahead Contingency is much higher than the Intra-day transaction but weighted average clearing price is lower as compared to Intra-day Transactions during April to June quarter.

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

RTM Monthly Average, Maximum & Minimum MCP

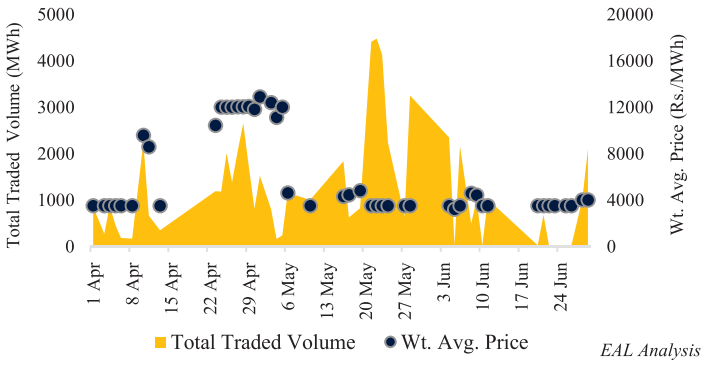


RTM Monthly Average, Maximum & Minimum MCV

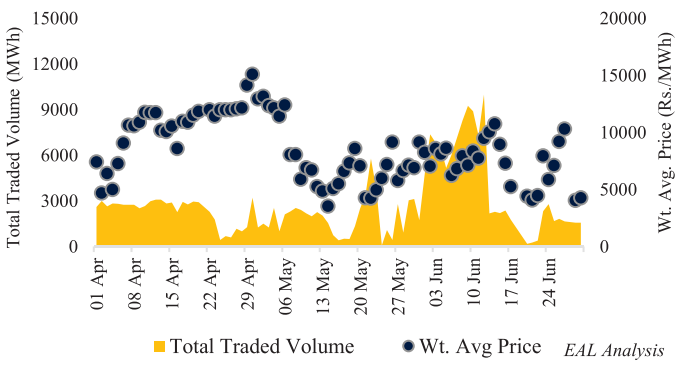


Green Term-ahead Market (G-TAM)

Day-ahead Contingency Transaction - Solar



Day-ahead Contingency Transaction - Non Solar

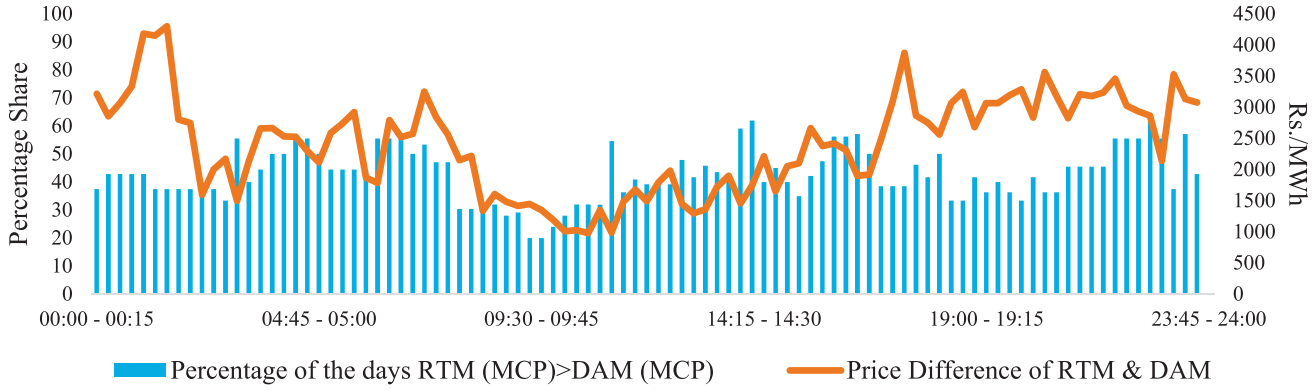


The total traded volume and weighted average clearing price of Non-solar is higher in comparison to Solar in the Day-ahead Contingency transaction during April to June quarter.

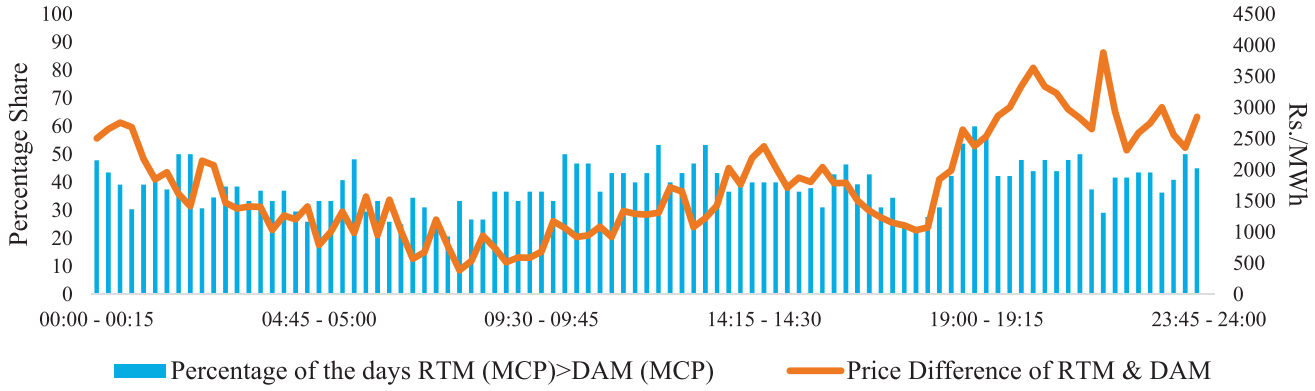
Note: The above power market overview and analysis are based on the data from IEX Website.

RTM Vs DAM on Market Clearing Price (MCP)

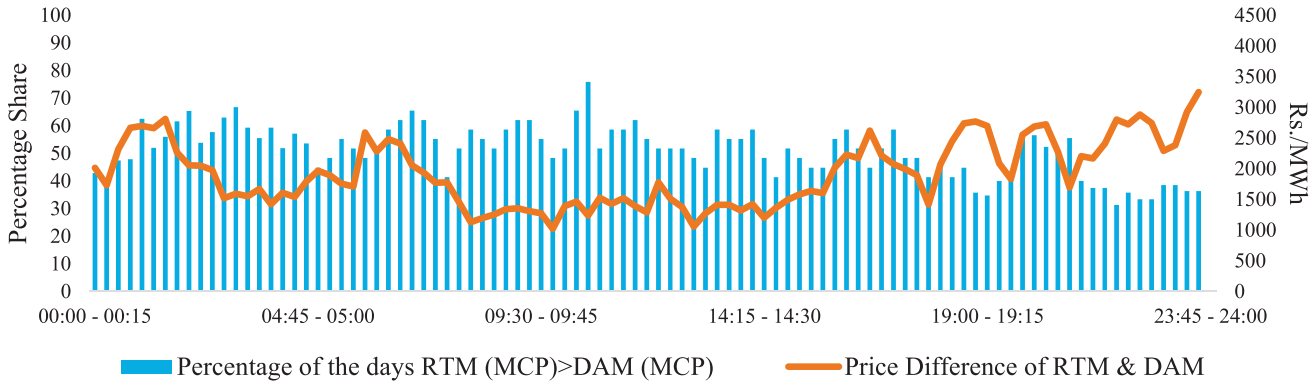
April 2022



May 2022



June 2022



- The price difference between RTM and DAM is calculated only in cases where the former exceeds the latter. The block-wise RTM price exceeds the DAM price for about 42.79%, 39.11%, and 51.04% of the days for the month of April, May, and June, respectively.
- For block (10:45 - 11:00), 75.86% of the days in June, RTM prices surpass DAM prices.
- Maximum difference between RTM and DAM price was observed to be 4299.57/MWh (01:30 -01:45), 3884.35/MWh (21:30 - 21:45), and 3244.4/MWh (23:30 - 23:45) in April, May, and June, respectively.

Regulatory & Policy Perspective

POSOCO (Detailed Procedure for Estimation of the Requirement of SRAS & TRAS at Regional Level), 2022 [Draft]

POSOCO on 24th May 2022 notified the draft Detailed Procedure for Estimation of the Requirement of Secondary Reserve Ancillary Services (SRAS) & Tertiary Reserve Ancillary Services (TRAS) at Regional Level. The key highlights of the draft are mentioned below.

Methodology for assessment of the SRAS & TRAS reserves includes:-

- 99 percentile of the Area Control Error (ACE) of the respective control area
- Net demand forecast error
- Variability in Net demand forecast error
- Variability in Net demand

Amongst these, provisionally NLDC has considered the *'99 Percentile of ACE of the respective control areas'* method for the assessment of SRAS & TRAS reserves. NLDC is exploring other methodologies parallelly. Any improved methodology would be subsequently adopted subject to approval by CERC. Required quantum estimation of SRAS & TRAS has to be done by NLDC in coordination with the RLDCs and SLDCs as per the methods specified in the draft Guidelines. This data must be furnished by the SLDCs which must maintain reserves as estimated by NLDC.

Area Control Error (ACE) = (Ia-Is) – 10* Bf * (Fa-Fs) + Offset

Where,

Ia & Is = Actual and scheduled net interchange in MW respectively (+ve value for export)
Bf = Frequency Bias Coefficient in MW/0.1 Hz (negative value)
Fa & Fs = Actual and schedule system frequency respectively (default = 0)
Offset = Provision for compensating errors such as measurement error; default value zero

Reserve	Start of activation	Full deployment	Ability to sustain the full deployment
Primary Response	Instantaneous	<= 30 sec	<= 5 min
Secondary control reserve	>= 30 sec	<= 15 min	<= 30 min or till replaced by tertiary reserves
Tertiary control Reserve	Usually > 15 min to 1 hour		

Table 1: Type of the reserves for frequency control, regulating ACE and their Deployment

Estimation of the reserves: The most credible reference contingency for maintaining primary reserve is the outage of the largest power plant or sudden load throw-off of 4500 MW.

For the capacity requirement of SRAS & TRAS, the data is to be furnished by the SLDCs to the NLDC on year ahead and quarter ahead basis within the timelines specified in the draft in the format as given by the Nodal Agency.

For week-ahead, reserve required for the next week shall be computed from the data of past 4 weeks and the same week of the past year; day-ahead reserve estimation, last seven days' data to be used; and for real time estimation, the day-ahead requirement, availability of reserves on day ahead basis, real time system conditions, load/RE forecast, load generation balance, weather contingencies, congestion and other related parameters shall be used.

Secondary Reserves: The 99 percentile values of each state scaled using the 99 percentiles of the regional ACE values shall be used for inter-state and intra-state requirement of the reserves. The all-India total of positive and negative secondary requirements shall be equal to the reference contingency or the aggregated state level and regional level requirement, whichever is higher.

Tertiary reserves:-

For regional level,

Tertiary Reserve Requirement (TRR) = Secondary Reserve Requirement (SRR)

At state level,

TRR = SRR at state level + 50% of the largest unit size in the respective control area.

- Information Dissemination: The requirement of SRAS and TRAS reserves on year ahead, quarterly and week ahead basis shall be declared by the NLDC in the specified format and within the timelines specified for each format.
- Revision of the Procedures: The NLDC/RLDCs may take decisions in the interest of the system operation under intimation to CERC and the procedure shall be modified/ amended with proper approval.

EAL Opinion

- **Evolution of Market for Ancillary Services:** CERC's Ancillary Services Regulations, 2021 laid down the framework for rollout of ancillary services in the country[1]. Evolution from charges for Unscheduled Interchange to Deviation Settlement Charges was based on the premise that there were shortages of power in general and the discoms avoided power procurement and pushed the deviations into the system. While most discoms have increasingly been active in the short-term market making short-term purchases and balancing their short- term portfolios, rising RE penetration is also contributing to the system deviations. The market design goal should aims at settling deviations through the ancillary services, once the options for market procurement are closed. The detailed procedure for estimation of SRAS and TRAS aims to put forward a methodology. Implementation of the same would also require capacity building at the level of SLDC, additional telemetry and standardization of data protocols, if required. The procedure provides for the interim mechanism in case of unavailability of data or suspect data quality.
- **Day Ahead Reserve Estimation (Clause No. 8.4.2):** Draft procedure suggests that *"For the day ahead reserve estimation, last seven days data shall be used"*. Given the demand profile and the relative contribution of variable renewable energy (VRE), reserve needs for a high demand (high VRE) day would be different from a low demand (low VRE) day. It is suggested that for the calculation of day ahead reserve estimation for a weekday (weekend day), from the past 7 days weekday (weekend day) data of the weekends may be excluded while considering the last seven days, and vice versa for a non-working day.

  Illustration: In case an estimate is made for a Friday of Week 'W_n', the last seven days data may be taken into consideration by excluding the Saturday of Week 'W_{n-1}' and the Sunday of Week 'W_n'. Instead, the Thursday and Friday of Week 'W_{n-1}' maybe considered in the calculation.
- **Observed Reading of the Frequency Sample (Clause No. 2 of Annexure I):** Draft clause states, *"Hence it should suffice that the system frequency signal is captured using a sampling time of a few seconds for calculation of ACE.*

[1] For a discussion and comments on the same refer to Power Chronicle (EAL's Newsletter) Volume 4 No. 1, July 2021 (eal.iitk.ac.in)

Suggested sampling time for frequency: 4 seconds, i.e., take a fresh frequency data point every four seconds." It is suggested that the data collection/ sampling rate should be equal for every parameter for the calculation of ACE, which is not clarified in the current draft. The solution to the challenge of low rate of data acquisition by the SCADA system **(Clause No. 3.1 of Annexure I)** needs to be explored as it might cause data discrepancy.

In case the frequency is measured every 4 seconds, a sample set S_1 having huge variation levels and a sample set S_2 having very low variation levels may have the same average frequency. It is not clear that whether average, high percentile, or low percentile frequency within the sample set would be used while recording the readings of sample sets.

- **Inclusion of RRAS (Clause No. 2 (b) of Annexure I):** Draft clause states, *" Tertiary frequency control through RRAS ."* It may be clarified in these Guidelines if RRAS will be continued and carried on, or it will be replaced by TRAS, as specified in the *'CERC (Ancillary Services) Regulations, 2022'*. Given that there are couple of references to RRAS in the document, a clarification would be desirable.

- **Selection of Stations as Redundant Frequency Sources (Clause No. 2.1 of Annexure I):** Draft clause states, *"Choose 10 such stations to act as redundant frequency sources in ACE calculation."* It may be clarified in these Guidelines whether the 10 stations taken into consideration will be ISGS/ SGS/ IPP. The basis of consideration of these 10 stations as the redundant frequency sources may be specified in these Guidelines and whether these 10 stations will be taken for each SLDC. It is important to clarify this from an SLDCs point of view so that the respective SLDC would compile data related to the events recorded (from the list shared by the NLDC) within the state or even otherwise.

- **Electromagnetic Transients in the System (Clause No. 2.2 of Annexure I):** Draft clause states *"Typically, in time frame of a few seconds, all the electromagnetic transients and most of the electromechanical transients usually get damped and settled. Hence, stations from different geographic locations can be chosen as redundant frequency sources"*. The transients in the system may be created at any instance of the observation. Thus, in case the observer waits for a transient to get damped and settled, a new transient may have arisen, and system may not have settled in the meanwhile.

- **Good Quality Tag (Clause No. 2.3 of Annexure I):** Draft clause states *" In case the quality of the primary frequency source becomes 'suspect', then the next signal with 'good quality tag' shall be selected as the primary frequency source automatically"*. It is suggested that the frequency of upgradation of the *'good quality tag'* and their standards may be further clarified/specified in these Guidelines.

- **Clock calibration & synchronization (Clause No. 3.1 of Annexure I):** Draft clause states *"Actual tie-line flows shall be sampled every 4 seconds similar to frequency and shall be used in the ACE calculation. Say, the data is acquired only every 12s by the SCADA because of delays, the ACE calculation program shall repeat the data thrice in those 12s"*. It should be ensured that the clock synchronization across all the stations taken into consideration by the respective LDC and its calibration are done more frequently in order to ensure the synchronicity of time stamping of the collected data.

- **Seasonality effect on Occurrence of Events (Clause No. 4 of Annexure I):** Draft clause states *"FRC shall be computed for every control area for all events involving a sudden 1000 MW or more load/generation loss or a step change in frequency by 0.10 Hz. All these FRC values shall be archived along with date, time and reasons of the event."* It is suggested that the distribution of these events be plotted for the previous year on a yearly, quarterly, monthly and weekly basis. This will enable the LDC to analyse the variations in demand, generation and occurrence of events depending upon the seasonal and festive changes. It is suggested that the events should be taken for the analogous period of estimation.

- **Calculation of Frequency Bias Coefficient (Clause No. 4.1 of Annexure I):** Draft clause states *" In the calculation of ACE, the value of Frequency Bias Coefficient in MW/0.1 Hz (negative value) shall be based on median Frequency Response Characteristic during previous financial year of each region ."* It is suggested that for the calculation of ACE, Frequency Bias Coefficient should be based on the median Frequency Response Characteristic (FRC) according to the below given list,

  1. Day Ahead1 (Working Day): FRC of Previous Working Day
  2. Day Ahead2 (Non-working Day): FRC of Previous Non-working Day
  3. Week Ahead: FRC of Previous Week
  4. Month Ahead: FRC of Same Month of Previous Financial Year, i.e., Month-on-Month basis
  5. Quarter Ahead: FRC of Same Quarter of Previous Financial Year, i.e., Quarter-on-Quarter basis
  6. Year Ahead: FRC of Previous Financial Year, i.e., Year-on-Year basis

- **Discrepancy between Clause No. 4.1 & Clause No. 4.2 of Annexure I:** Draft clause no. 4.2 states *'The Bias (Bf) value may be updated in the ACE calculations at the LDCs, once in every quarter on the 24th day of the month after the completion of the previous quarter"*. While Clause No. 4.1 suggests the upgradation of the ACE calculations *" based on median Frequency Response Characteristic during previous financial year of each region"* , contrarily Clause No. 4.2 suggests the upgradation *" once in every quarter "*. Although footnote 12 clarifies the reason for updating the Bf value on a quarterly basis, the draft Guidelines may clarify the same.

  Although Clause No. 4.1 suggests the upgradation of the ACE calculations on a yearly basis, but Clause No. 4.2 suggests the upgradation on a quarterly basis, from which it seems as if the time scale given in Clause 4.1 is not fixed for the financial year, rather it is initially fixed for 1 year, and then updated on a rolling 1 year basis. In the current draft, Clause Nos. 4.1 and 4.2 do not have parity with each other, as such there is a need for further clarification.

- **Data Format for Estimation of Reserves (RAS1 & RAS2):** NLDC at the national level will consider all events that have occurred in the past year in the country. It may be possible that a specific SLDC may not consider the events of other states and may say that no *"event"* has occurred in its control area. Thus, it is suggested that the selection of *"events"* may be specified clearly for filling the data by the states in the format RAS1 & RAS2 for Estimation of Reserves. It is suggested that the SLDCs should consider all events in the nation irrespective of whether the event has occurred in it control area, as the Regional Grids are now connected in synchronicity with each other.

Price capping of ₹12/kWh on 7th April, 2022

IEX had implemented the ceiling cap of ₹12/kWh, with reference to CERC vide order dated 1st April, 2022 in Petition No. 4/SM/2022 (Suo-Motu), on 7th April, 2022. Some effects of this caping can be seen as analysed bellow,

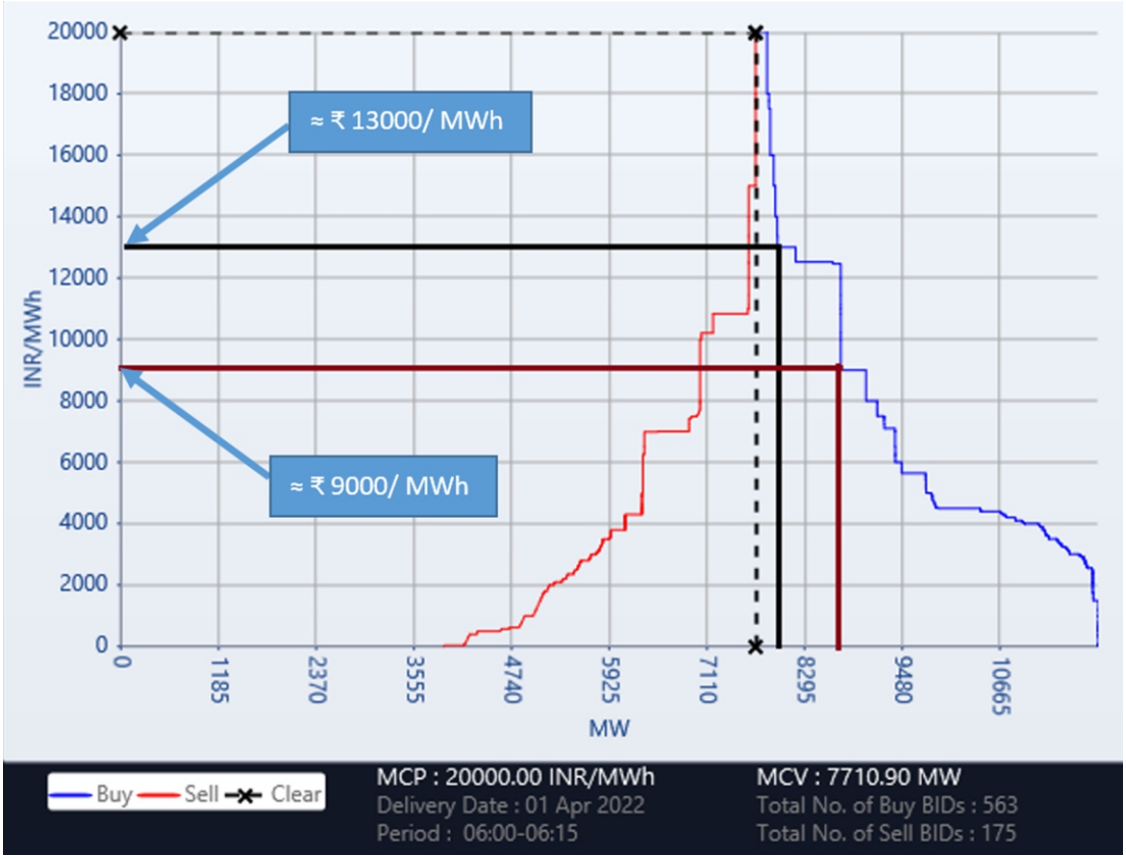


Fig. Market Clearing for DAM on 1st April for block 06:00-06:15 hrs

Power exchanges (PXs) witnessed price spikes consecutively from 4th to 15th October, 2021, and again on 20th, 21st and 23rd October, 2021, with market prices on DAM (242 of 2976 blocks) and RTM (203 of 2976 blocks) hitting the technical exchange limit of ₹20/kWh at IEX. Declining coal stock and rising demand have been attributed to the unprecedented rise in market prices. While this raised a cause for concern, steps were undertaken to shore up the coal supply, which witnessed an annual decline in coal production with the onset of the monsoon season.

In January 2022, prices hit ₹20/kWh on RTM for 4 blocks, and in February 2022, spikes of ₹20/kWh were witnessed on DAM for 3 blocks and on RTM for 12 blocks.

During March 2022, price spikes were witnessed again on DAM and RTM for several blocks across multiple days. This time the situation was a bit alarming as it happened even before the onset of monsoon. CERC, drawing powers under Regulation 51(1) of the Power Market Regulations, 2021 specified price limits, initially for DAM & RTM on 1st April, 2022, and then for the GDAM, Intra-day, Day Ahead Contingency, TAM & GTAM on 6th May, 2022.

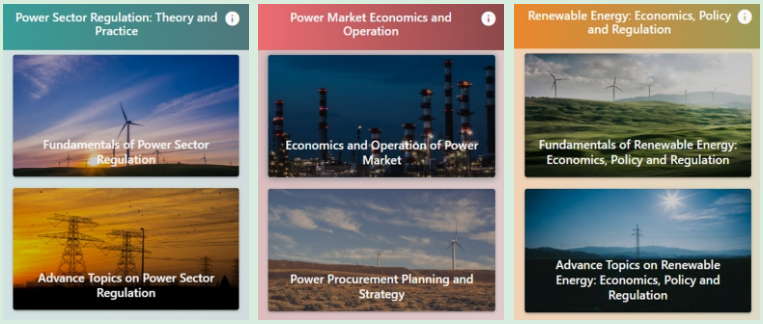
EAL observed the block-wise data of DAM for 1st April, 2022. MCP has reached ₹20/kWh for blocks 1-6, 25-27, 67 & 68 and 95 & 96. As per observation, the market may have cleared at a much lower price of approx ₹13/kWh if the reserves of around 250 MW had been available for the block as shown in the figure. Similarly, the market may have cleared at a much lower price of approx ₹9/kWh if the reserves of around 1000 MW had been available for the same block as shown in the above figure. Alternatively, the proper implementation of Demand Response Program/Demand Side Management would have resulted in similar reduction in MCP.

EAL News

Regulatory Certification Programme

CER in association with EAL, organised the 2nd Regulatory Certification Programme on **"Power Sector Regulation: Theory & Practice"** from 29th May, 2022 to 12th June, 2022. The valedictory session was held on 17th June, 2022 who's chief guest was Shri Sutirtha Bhattacharya, Chairperson, WBERC.

The 2nd Regulatory Certification Programme on **"Power Market Economics and Operation"** is being held from 26th June, 2022 and will be continuing till 10th July, 2022. The programme was inagurated by Mr. Amal Sinha, CEO, BRPL. This programme provides insights to the economic and operational aspects of power market, its products, and their role in the Indian power market. The Program would be conducted under the aegis of Centre for Continuing Education, IIT Kanpur. The chief guest of the valedictory session is Shri Sutirtha Bhattacharya, Chairperson, WBERC.



CER would soon announce registration for a Regulatory Certification Program on **"Renewable Energy: Economics, Policy and Regulation"**, which focuses on the regulatory and policy framework for renewable energy development. Building on economic foundations, the program would enable a better understanding of evolving regulatory and policy framework for Renewable Energy (RE). The Program would be conducted under the aegis of Centre for Continuing Education, IIT Kanpur. The key topics to be covered in the programme include: -

- Evolution of Renewable Energy Development
- Policy and Regulatory Framework for Renewable Energy Development
- Regulated Tariff Determination for RE
- Combetitive Bidding for RE Procurement
- Designing and Implementing a Roof top SPV Program: Net Metering vs Gross Metering
- Solarisation of Agriculture Pumps
- RE Procurement in Practice: GTAM, GDAM & Beyond

For further programme details including key topics, registration fee, etc., please visit **https://cer.iitk.ac.in/olet/rcp**

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Other Initiatives

Centre for Energy Regulation

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