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Power Chronicle

Editorial

Growing demand for electricity amidst a rising share of renewables, along with associated uncertainties necessitate a dynamic and robust mechanism to ensure resource adequacy. The long-term resource adequacy needs of a Discom are expected to be met through long-term (LT), medium-term (MT) and short-term (ST) contracts with an important role of demand-side flexibility measured.

Changing pattern of electricity demand and its composition, coupled with the availability of resources and growing share of renewable energy, pose a significant challenge to Resource Adequacy Planning (RAP) for the distribution licensees. The RAP needs periodic update to account for deviations from previous projections of electricity demand and availability of resources. The deviations as well as reasons thereof need to be recorded and accounted for appropriately. The subsequent RAP should then be revised on a rolling basis while accounting for the new sources of uncertainty or additional information. This would also enable the respective Commission to review and approve the updated resource plans.

Apart from annual RAP, a granular approach considering expected changes over months/quarters would be critical to planning for the short-term variations due to weather, business trends as well as socio-economic and technological developments. RAPs across states propose that the distribution licensees would be able to demonstrate RA through ST contracts. Due to limited market depth and liquidity for TAM segment, this would remain a challenge for some time. The associated timelines in RAP should allow for some flexibility on that account due to the uncertainty of availability for such contracts over the horizon of planning for the ensuing financial year.

Apart from procurement of capacity through various short-term contracts or power exchange products, the distribution licensee can demonstrate its ability to meet the projected demand through suitably designed demand-response programs as well as Time-of-Day (ToD) tariffs. Adequate attention should thus be accorded to demand-side flexibility options, which can be often low-cost options for a discom. These provisions would help reduce the overall cost of power procurement for Discoms as it will reduce the capacity payment obligation towards long-term contracts, which would only be scheduled for a limited duration over the contract horizon.

Anoop Singh (Editor)
Founder & Coordinator, Energy Analytics Lab

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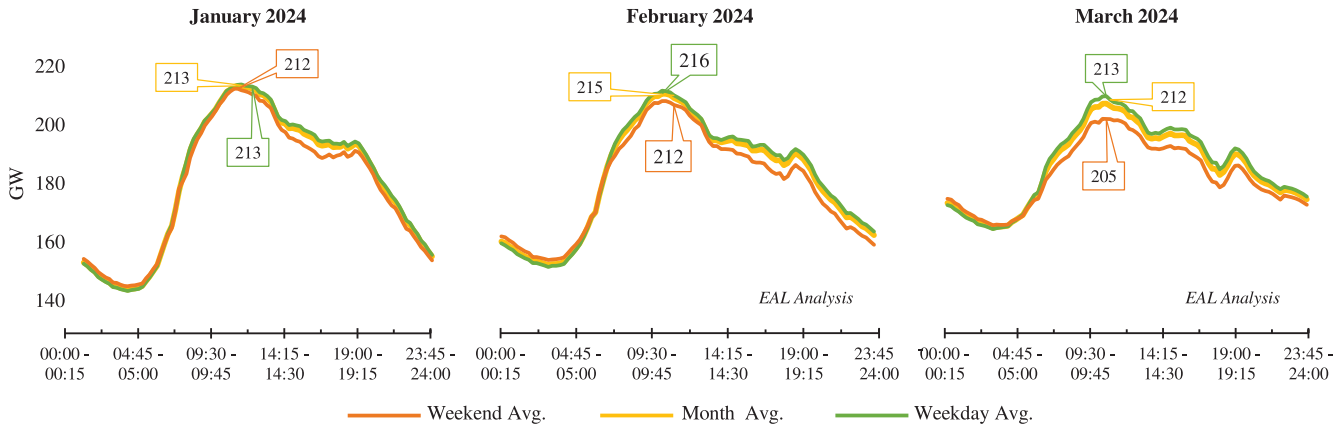
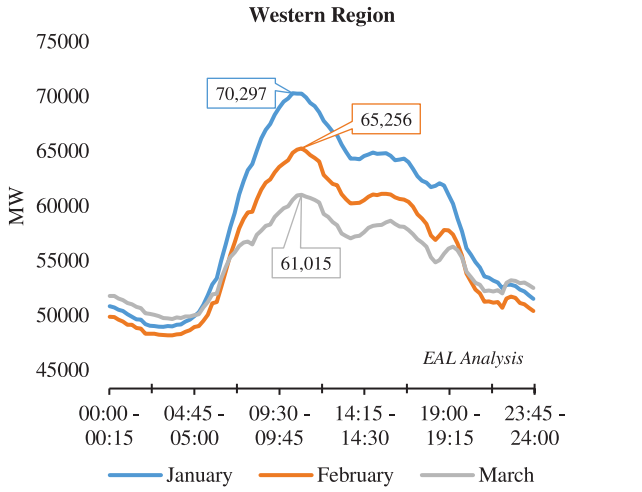
Power System Overview & Analysis

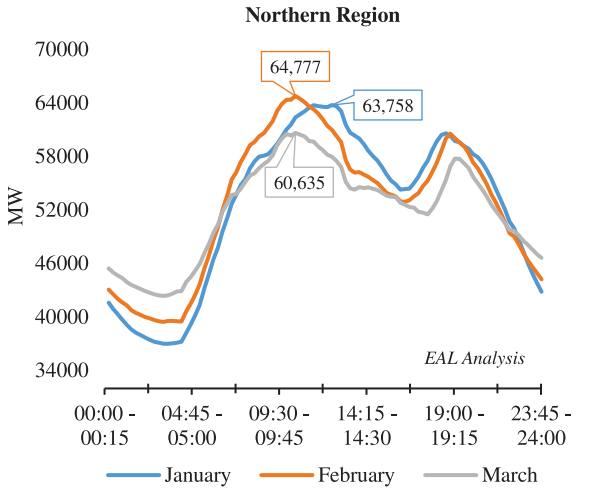
All India Demand Met Profile

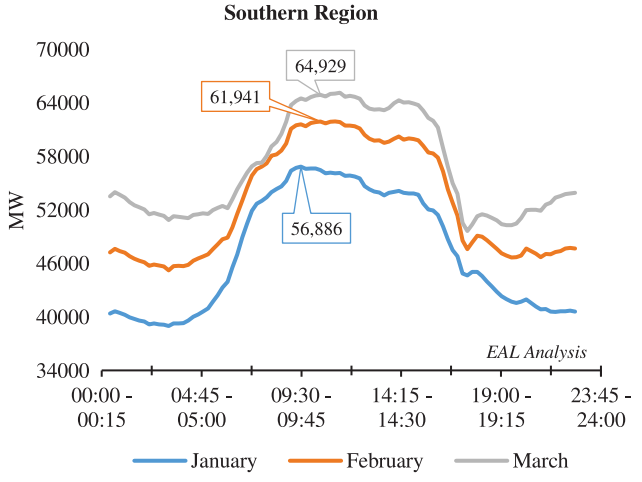


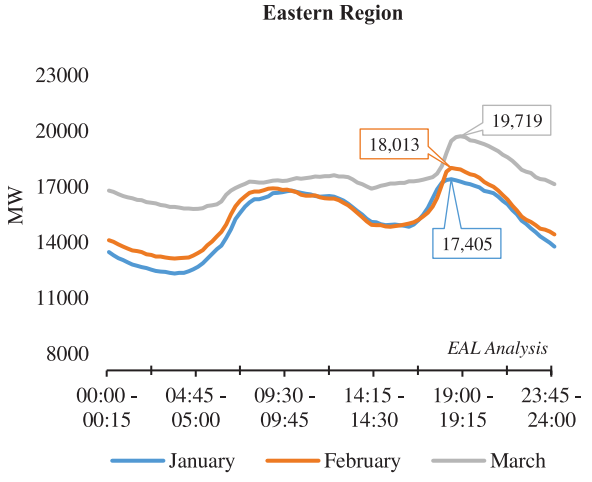
From January to March quarter, all India peak demand reached 233 GW (10:15 - 10:30) on 21st February, 2024, about 9.38 % higher than the previous year's peak demand recorded at 213 GW (09:30 - 09:45) on 10th March, 2023, during the same quarter.

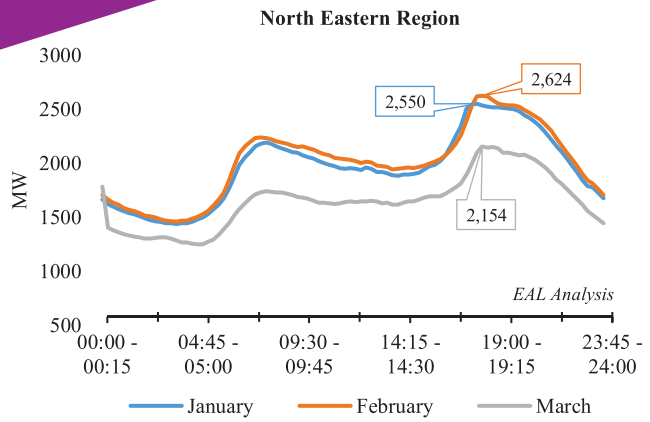
Region-wise Demand Met Profile







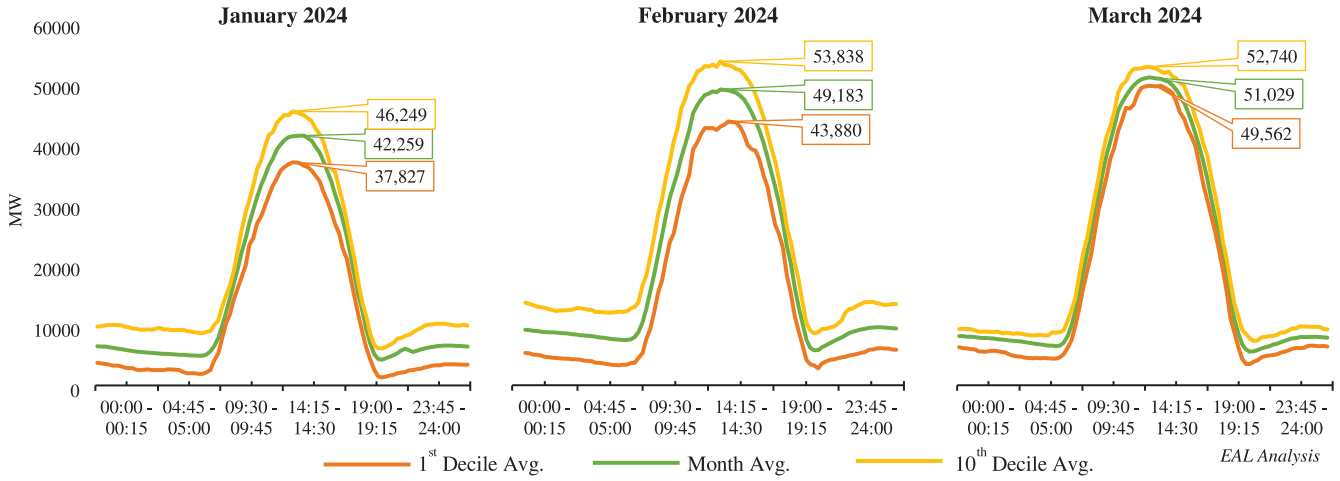




- Significant increase in demand can be observed for Western region from 09:30 to 12:00 & Northen region from 10:00 to 13:00 hrs in all the three months.
- Gradual increase in demand during evening block can be observed for North Eastern regions compared to morning block.
- Average demand is found to be higher for Western region as compared to the other regions in the month of January.

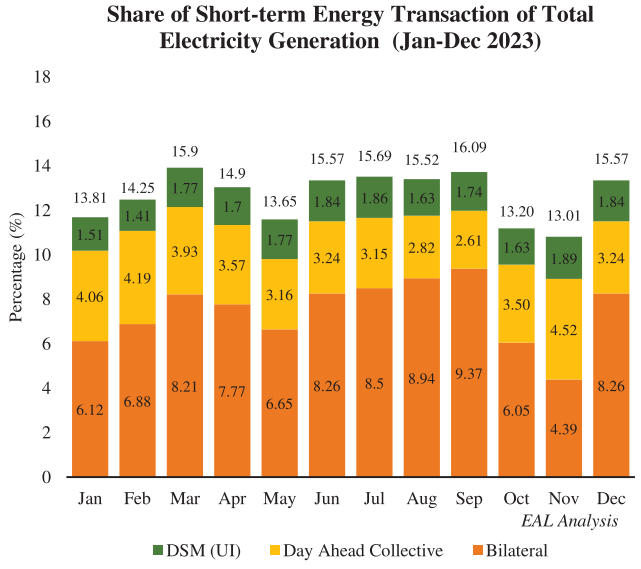
Demand and generation profiles at National, Regional and State-level can be accessed on EAL's web portal.

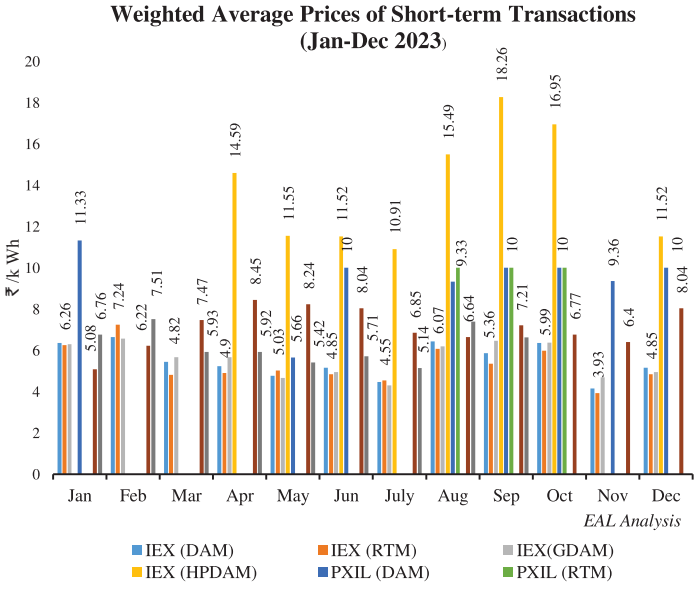
All India Renewable Energy (RE) Generation Profile



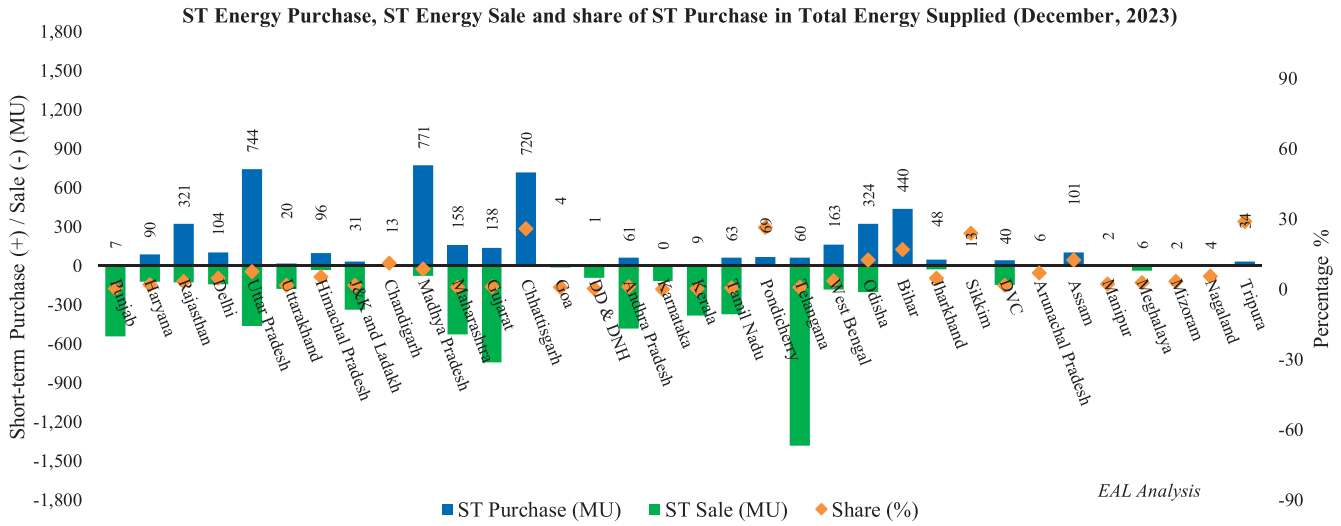
All India peak RE generation reached 59.63 GW (11:45- 12:00) on 19th February, 2024, about 8.38% higher than the previous year's peak of 49.48 GW (12:45 - 13:00) on 27th Janruary, 2023.

Short-term Energy Transactions



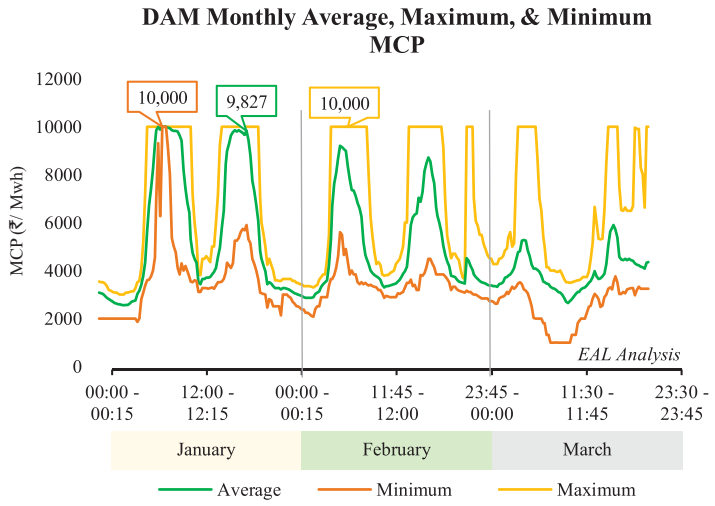


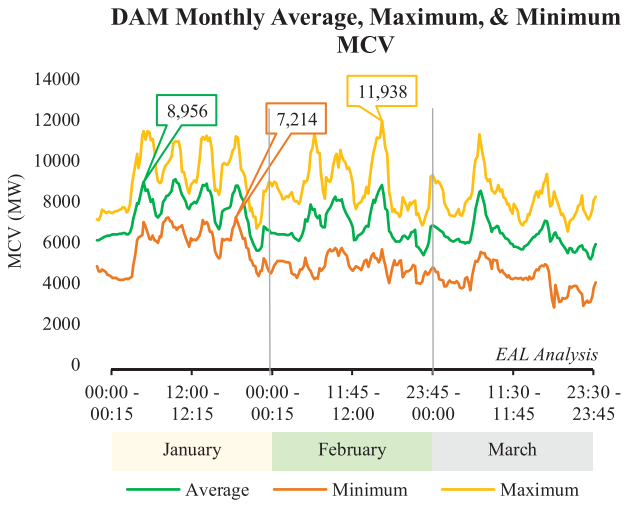
Monthly Short-term (ST) Purchase and Sale Quantum across States



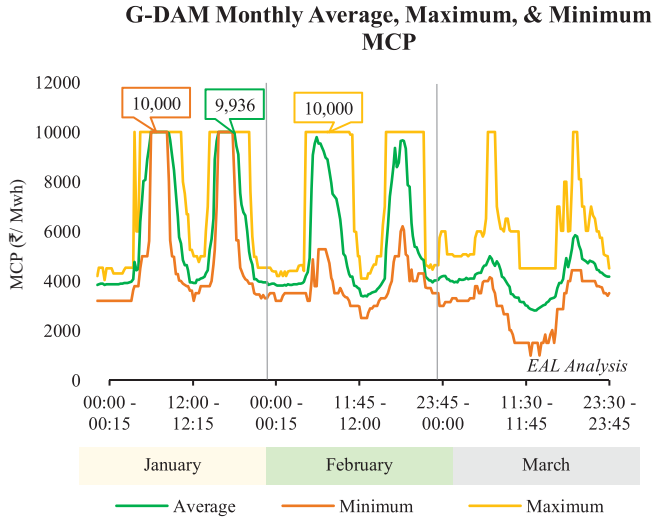
Power Market Overview & Analysis

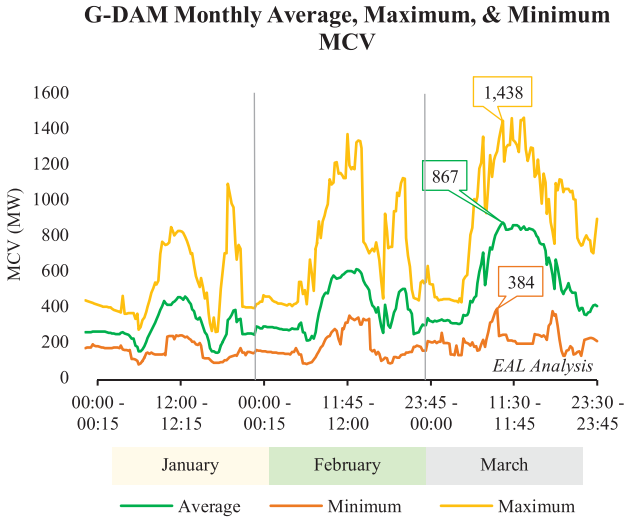
DAM - Market Clearing Price (MCP) & Market Clearing Volume (MCV)





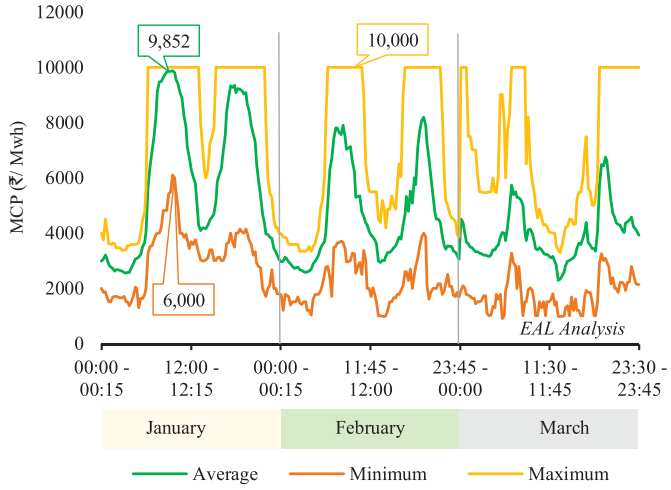
G-DAM - Market Clearing Price (MCP) & Market Clearing Volume (MCV)



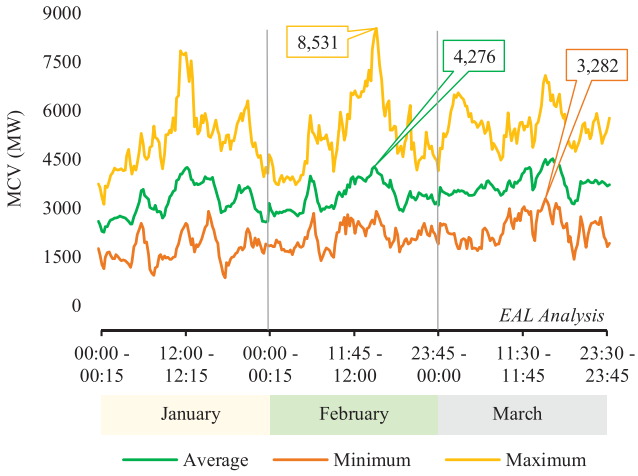


RTM -Market Clearing Price (MCP) & Market Clearing Volume (MCV)

RTM Monthly Average, Maximum, & Minimum MCP

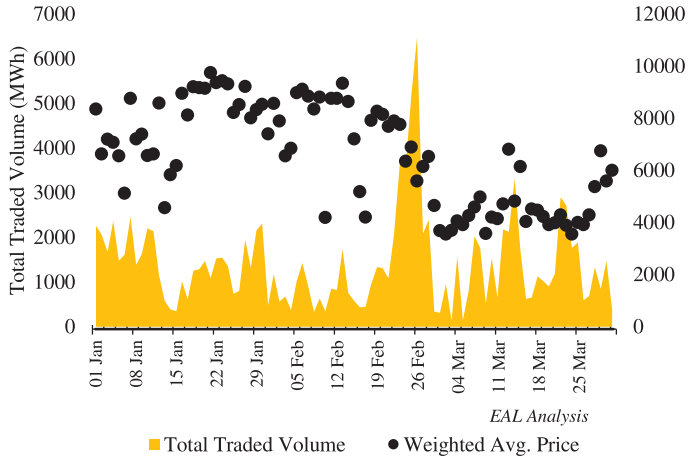


RTM Monthly Average, Maximum, & Minimum MCV



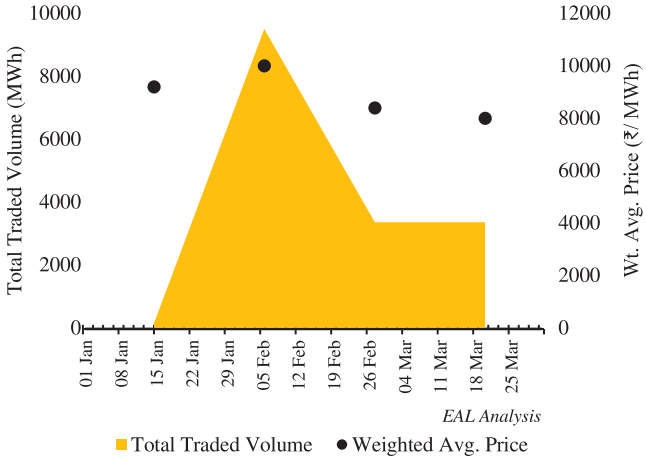
Term-Ahead Market

Day-Ahead Contigency & Daily Transactions (FY 2023-24)



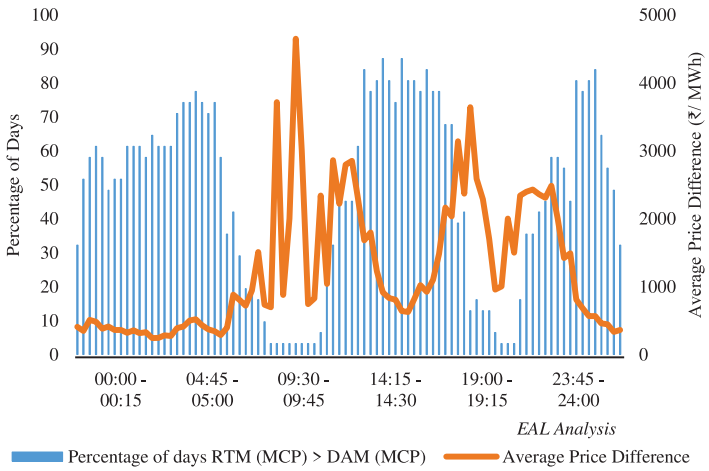
Green Term-Ahead Market (G-TAM)

Intra-Day Transactions (FY 2023-24)

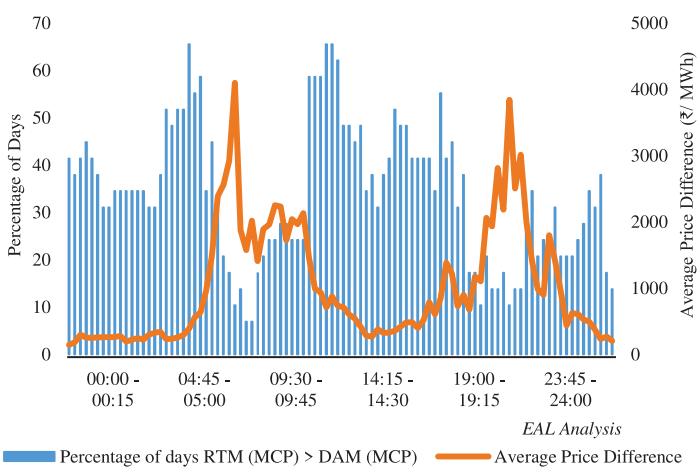


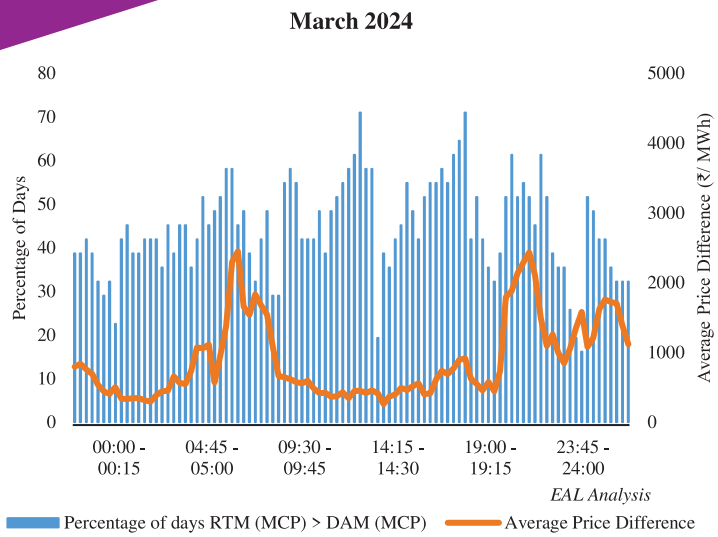
Price Difference between RTM vs DAM

January 2024



February 2024

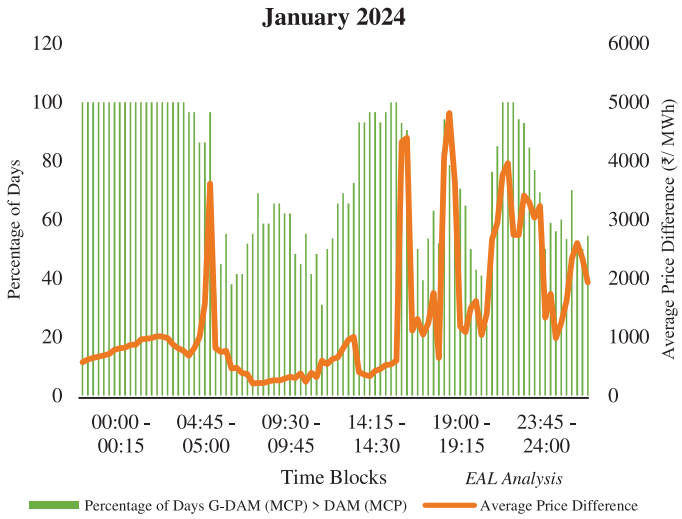


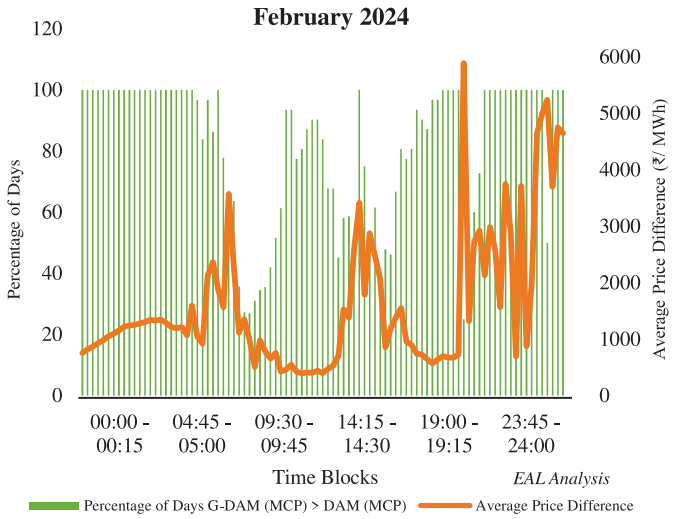


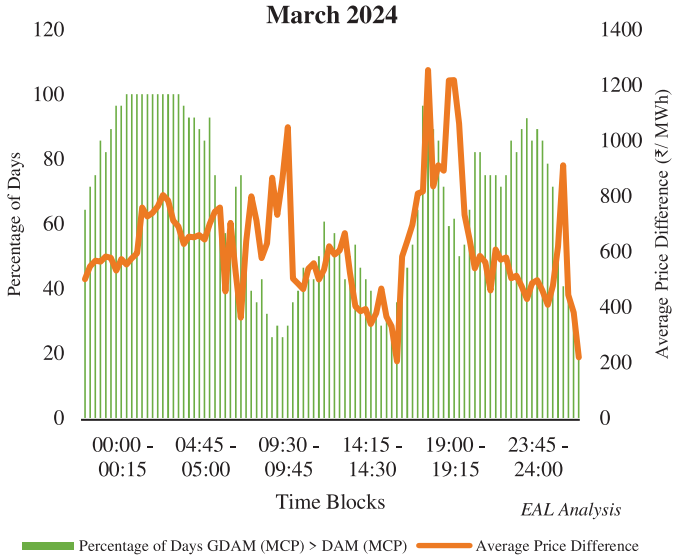
EAL Analysis

- The analysis is based on comparison between the average price difference of RTM and DAM, when MCP of RTM is greater than DAM for the fourth quarter of year 2023-24.
- The graph shows the percentage of days, price for RTM is greater than DAM on the primary axis and the average price difference between the two on secondary axis.
- The maximum price difference between RTM and DAM has been observed in the morning blocks for the month of March.
- The maximum of average price difference between RTM and DAM is ₹ 4.68/ kWh in the 09:30 - 09:45 block in the month of January.

Price Difference b/w G-DAM & DAM







EAL Analysis

- The analysis is based on comparison between the average price difference of G-DAM and DAM, when MCP of G-DAM is greater than DAM for the fourth quarter of year 2023-24.
- The graph shows the percentage of days, price for RTM is greater than DAM on the primary axis and the average price difference between the two on secondary axis.
- The highest average price difference between G-DAM and DAM is observed to be Rs. 5.89/ kWh in February.

Regulatory & Policy Perspective

APSERC (Framework for Resource Adequacy) Regulations , 2024 [Draft]

The Arunachal Pradesh Electricity Regulatory Commission notified draft "Framework for Resource Adequacy" on 28th February, 2024. The key highlights of the draft are mentioned below.

- **Objective**: The sole objective of Resource Adequacy framework is the reliable fulfilment of the peak demand with the help of adequate supply of generation and demand response.
- **Important aspects of Regulation:**
  - Availability of adequate generation capacities to reliably serve demand under multiple scenarios.
  - Optimal capacity mix based on minimization of overall system cost.
  - Time horizon for the implementation of the framework should be 5-10 years.
  - Energy storage, short-term sale/ purchase and other flexible resources under bilateral contracts will be incorporated into the resource adequacy framework.
- **Important Definitions:**
  - Loss of Load Probability: Measure of probability that a systems load will exceed the generation and firm power contracts available to meet that load in a year.
  - Expected Energy Not Served: Expected amount of load (MWh) that may not be served for each year within the planning period.
  - Net Energy Not Served: Total expected load shed due to supply shortages (MWh) as a percent (%) of the total system energy.
  - Planning Reserve Margin: It is expressed as a certain percentage of peak load forecast of the system.
- **Procedure to determine Resource Adequacy targets:**
  - Step1: Initialization of nominal value of Planning Reserve Margin.
  - Step 2: Determination of generation capacities at nominal Planning Reserve Margin.
  - Step 3: To meet the demand reliably for multiple future scenarios by calculating Loss of Load Probability and Energy Not-Served.
  - Step 4: The whole process above will iterate again and again until the value of Loss of Load Probability and Energy Not-Served does not converge to a minimum standard value.
  - Step 5: To estimate the value of the Planning Reserve Margin based on the evaluation of the optimized marginal cost of reducing load shed.

EAL Opinion

- **Necessity of resource adequacy framework:** The ongoing challenge of catering to the peak demand reliably is currently being faced by the utilities in India. Sufficient amount of power supply coupled with demand response framework and sharing of inter-state and inter-region power should be adopted to meet the peak demand reliably. The overall objective of Resource Adequacy (RA) framework is to avoid demand-supply mismatch, ensure system security and reliability at the national level.

  Power procurement cost is a major part of the RA study. Power procurement plans and contracts typically have a long-term horizon and hence, need to be worked out well in advance, based on reliable and dependable forecast. EAL, IIT Kanpur carried out a research on the importance of these aspects and published a book on "Regulatory Framework for Long-term Demand Forecasting and Power Procurement Planning"[1] . EAL have also worked on numerous similar assignments and have provided their opinion on "Power Purchase and Procurement Process Regulations"[2], and "Terms and Conditions for short-term procurement/sale of power Regulation, 2021"[3].

[1] Singh et al. (2019), Regulatory Framework for Long-term Demand Forecasting and Power Procurement Planning, CER Monograph, Book ISBN:978-93-5321-969-7, https://cer.iitk.ac.in/assets/downloads/CER_Monograph.pdf

[2] Draft Detailed Procedure for Madhya Pradesh Electricity Regulatory Commission (Power Purchase and Procurement Process) Regulations, Revision-II, 2022 (RG-19(2) of 2022), https://cer.iitk.ac.in/odf_assets/upload_files/blog/Revision_2_2022_Power_Procurement_Draft_Regulation.pdf

Given the experience of CER and EAL in carrying out Long-term Demand Forecasting and Power Procurement Planning for the states of Uttar Pradesh and Chhattisgarh, we reinforced the need for a robust regulatory framework for the same. From these studies, it was inferred that significant economic benefits in terms of reduced private and social costs is possible through RA.

Comments[4] provided on 'Draft Guidelines for Resource Adequacy Planning Framework for India' guidelines issued by the Central Electricity Authority (CEA) can also be reviewed from Volume 2 Issue 3 of Power Chronicle, a quarterly newsletter of the Energy Analytics Lab (EAL).

- **Long-term Distribution Licensee RA Plan (LT-DRAP):** Clause 12(3) *"In its overall power procurement planning approach, the distribution licensee shall lay greater emphasis on adequate contracting through Long Term contract (at least 75%)."*

  Previous studies carried out by CER, IIT Kanpur for long-term demand forecasting and power procurement planning (spanning a horizon of ten years, has revealed that such long-term analysis enables the discom to take timely decision for contracting capacity over a period time while keeping in mind long-term demand trajectory and economics thereof.

- **Flexibility regarding Contract Capacity Timeline:** *Clause 12(5) "The distribution licensee shall contract capacities by 30th November of each year and submit the Annual Rolling Plan to STU/SLDC by 31st December of each year for ensuring year(s)."*

  By November 30th, all the short-term requirement cannot be contracted. The RA framework desires that such contracts be in place by the cut-off date. By the very nature of the ST contract which can be done within a gap of few hours to few months in advance. Contracts spanning few months are not available through the competitive platforms like the power exchanges (PXs). The dynamic nature of the power market would have a significant bearing on the price discovered for such ST contracts.

  Some amount of flexibility should be available to the distribution licensee to enable it to tie up ST procurement spread over a period. This would also avoid rush to the market (by all discoms across the country with similar provisions), and thus influencing the electricity prices for ST contracts. This flexibility would also allow the discom to fine tune its projects on an ongoing basis and thus adjust its power procurement needs. **Quarterly update may be provided for fine-tuning the ST needs and be reported to the Commission within 2 weeks of end of each quarter.**

- **Timelines for approval of respective contract capacity:** *Clause 16 (3) states "...Distribution licensees shall perform LT-DRAP, MT-DRAP and ST-DRAP exercise by 31st August of each year for the ensuring year(s)".* The draft should clearly specify a timeline for information sharing with the respective STU / SLDC regarding contracted capacities for the ensuing year for meeting RAR, after approval of APSERC.

- **Explicit role of Demand Response and TOD tariff:** The draft proposes achieving resource adequacy through increased generation capacity and power procurement planning, but does not take into account the role of demand response and demand shift caused by the implementation of TOD tariffs. The discom should be allowed flexibility to implement/fine-tune such programs, in case of a mismatch between the peak demand and the adequacy of resources to meet the same.

- **Energy Banking:** As per the prevailing practices, discoms resort to energy banking across hours of the day or eve across seasons. Role of banking should be accounted for while preparing the short term resource adequacy plan. Discoms may have such short term agreements in place by November of a previous year, and thus should be reflected in the resource adequacy plan of the discoms.

- **Compliance Framework:** Non-compliance for securing adequate resource adequacy for meeting the forecasted demand of the proceeding years may be dis-incentivised by limiting the amount of procurement of power through ST contracts/ PXs. This limit may only be relaxed in case of say extenuating circumstances that may lead to sudden

[3] APERC (Terms and Conditions for Short-term Procurement/sale of power) Regulation, 2021, https://cer.iitk.ac.in/odf_assets/upload_files/Draft_APERC_Terms_and_Conditions_for_short_term_procurement_sale_of_power_Regulation_2021.pdf

[4] Anoop Singh, "Comments on CEA (Resource Adequacy Framework for India), 2022[draft]" Power Chronicle, Volume 5, Issue 5 https://eal.iitk.ac.in/assets/docs/power_chronicle_vol_5_issue_3.pdf

and unforeseen demand in a particular month, beyond a limit of set 5% of the forecasted amount. The discoms should demonstrate this along with its petition for true up later.

- **Review of historical RA plans:** The discom should provide a report, along with its true up petition, on the efficacy of its resource adequacy plan for the year (for which true up is being submitted). Such a review should identify reasons for departure from the historical forecast and deviation in resource adequacy plan. The discoms should identify measures to address the same while submitting the RA plan for the proceeding years.
- **Information Sharing:** The discoms should share the resource adequacy reports/ plans through a special webpage on its web portal. This should be archived and searchable so that it can be easily accessed later by the stakeholders. The uploaded documents should be in PDF format (not scanned) along with any supporting files.

EAL News

Centre for Energy Regulation Spearheads Dialogue on Power Market Derivatives

In a pivotal step towards addressing the evolving dynamics of the Indian Power Sector, the Centre for Energy Regulation (CER) at the Indian Institute of Technology Kanpur organized a Stakeholder Consultation Workshop on **"Developing Power Market Derivatives for the Indian Power Sector."** The event on 1st March 2024, held at the India Habitat Centre in New Delhi, brought together key stakeholders to explore innovative solutions and develop risk mitigation strategies amidst the growing share of renewables and market volatility.

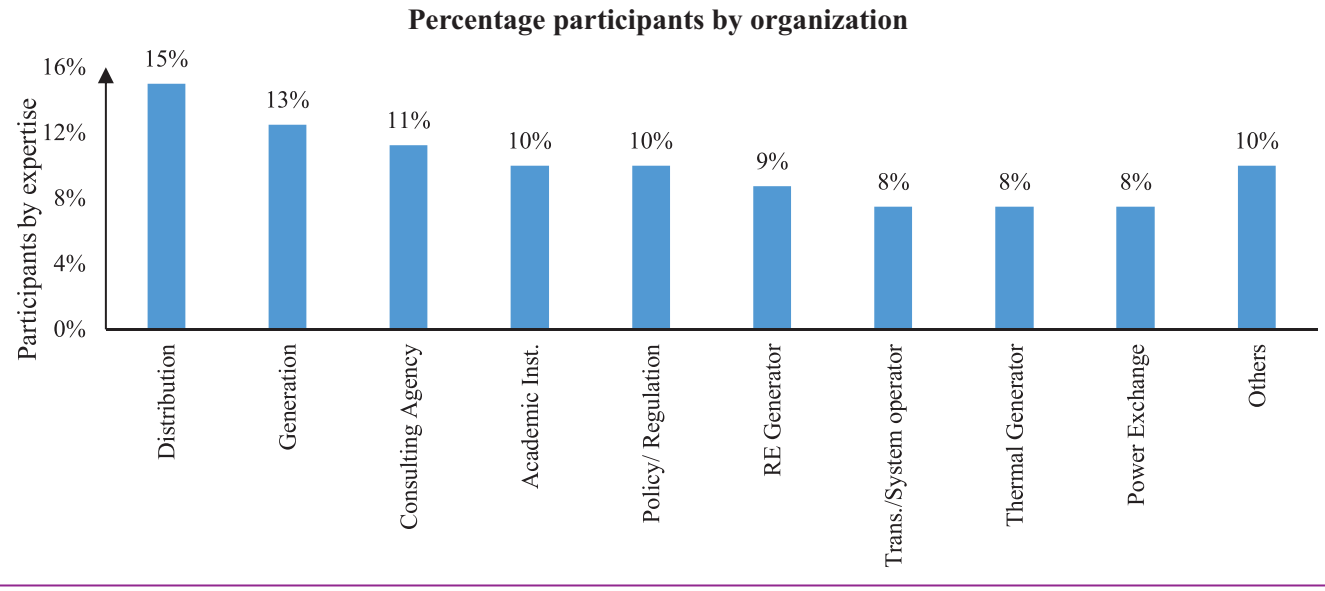
Professor Anoop Singh, Department of Management Sciences, IIT Kanpur, a leading authority in the field, presented the key outcomes of an ongoing study conducted by CER (for more details of CER activities and studies please visit https://cer.iitk.ac.in) with support from the Shakti Sustainable Energy Foundation. Through his presentation, Professor Singh shared insights into derivative product design, regulatory frameworks, and policy implications vital for successful implementation of power market derivatives in the country. He proposed an innovative approach to facilitate sector-wide participation in financially settled and physically delivered derivatives, aimed at mitigating risks encountered by DISCOMs, Open Access Consumers, and Thermal/RE generators.

Dr. Srikant Nagulapalli, Additional Secretary of the Ministry of Power, delivered the Keynote Address, acknowledging CER's accomplishments in the study and highlighting the government's initiatives for Renewable Energy (RE) integration and market development. He empahsied on the workshop's importance in shaping the power sector's future.

The event featured two insightful panel discussions and deliberations among esteemed industry professionals. The first panel, comprising representatives from the Central Electricity Authority, PTC India Ltd, Indian Energy Exchange, and EY Parthenon, explored the **theme "Identifying Risks and Hedging Avenues in the Indian Power Market: Role of Derivatives".** The second panel delved into **the "Regulatory Framework for Power Market Derivatives"** with Professor Singh setting the stage through a presentation. Eminent panellists from the Punjab State Electricity Regulatory Commission, Central Electricity Regulatory Commission, Grid India, Securities and Exchange Board of India, and The Lantau Group offered valuable insights and perspectives on this critical aspect. The discussions highlighted the pivotal role of derivatives in power market development and the need to enhance understanding among key stakeholders, particularly distribution companies. These entities could leverage such instruments to effectively hedge their exposure to short-term power market volatility, ensuring greater stability and risk mitigation.

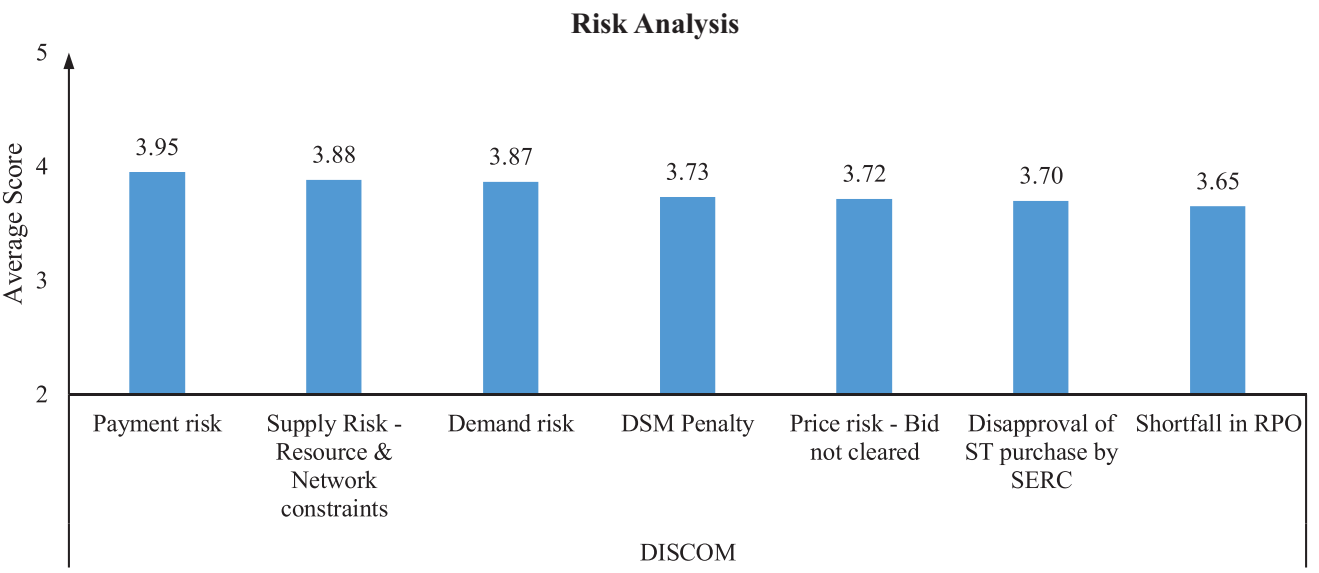
The workshop concluded with a consensus on the potential of power derivatives to enhance market efficiency and manage risks in the Indian power sector. CER's pioneering initiative garnered appreciation from attendees for its timely and comprehensive approach to addressing the sector's evolving challenges, encouraging dialogue, and exploring innovative solutions for a sustainable and resilient power ecosystem.

Overview of Power Market data Collection



Scrutinizing the organization profiles of the survey participants as shown in the figure above, it becomes clear that respondents were from varying credentials and experiences of distribution, generation, consultancy, academic institutions, regulation, Transmission System operator, etc.

Participants from different background and expertise had the choice to analyse the risk from more than one perspective out of total **7 risk perspectives.** More than 58% of participants had filled the survey from multiple perspectives of discom, hydro generators, merchant renewable generators, merchant thermal generators, open access / captive consumers, renewable generators and thermal generators with long-term PPA as represented in example for DISCOMs as shown in figure below.



From the discom perspective the **payment risk** comes out to have the highest weightage followed by supply risk due to resource and network constraints. **Shortfall in RPO** seems to be the least significant risk from discom perspective.

Regulatory Certification Programme on "Power Sector Regulation: Theory and Practice"

CER in collaboration with EAL, conducted the Regulatory Certification Program titled **"Power Sector Regulation: Theory and Practice"** from 17th February 2024 to 3rd March 2024. The program aimed to delve into the evolution, economic dynamics, and regulatory frameworks governing the power market within India. Hosted under the umbrella of the Centre for Continuing Education at IIT Kanpur, the inaugural session was honored by the presence of Shri P.W. Ingty, Former Chairman of the Meghalaya State Electricity Regulatory Commission.

Distinguished speakers such as Mr. S. C. Srivastava (Former Chief (Engg.), CERC), Mr. H.T. Gandhi (Former Chief (Finance), CERC), Prof. Anoop Singh (Founder & Coordinator, EAL, IIT Kanpur), and Ms. Shilpa Agarwal (Jt. Chief (Engg.), CERC) among others facilitated enlightening lectures throughout the program.

The valedictory session under the auspices of Shri. Arvind Kumar, IAS (Chairman, UPERC) marked the conclusion of the program, bringing together insights and reflections from the extensive discourse on power sector regulation.

Regulatory Certification Programme on "Renewable Energy: Economics, Policy and Regulation"

CER in association with EAL, is pleased to announce the Regulatory Certification Program on **"Renewable Energy: Economics, Policy and Regulation"** commencing from **07th June to 23rd June, 2024.** The program on Renewable Energy Regulation focuses on regulatory and policy framework for Renewable Energy (RE). The program would be conducted under the aegis of Centre for Continuing Education, IIT Kanpur. The last date for registration is **04th June, 2024.** For further program details including program duration, key topics, schedule, admission process and fee, please visit: https://cer.iitk.ac.in/RCP

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Other Initiatives

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