Report on

Capacity Building Workshop on Resource Adequacy for the State of Maharashtra

Submitted By

Idam

Enabling Carbon Minimal World!

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1. Introduction

India has set five ambitious clean energy targets for its power sector, also known as five nectar elements or "Panchamrit", as follows:

1. India will reach its non-fossil energy capacity to 500 GW by 2030.
2. India will meet 50% of its energy requirements from renewable energy by 2030.
3. India will reduce total projected carbon emissions by one billion tonnes from now onwards till 2030.
4. By 2030, India will reduce the carbon intensity of its economy by less than 45%.
5. By the year 2070, India will achieve the target of Net Zero.

India is committed to achieving approximately 50% of cumulative electric power installed capacity from non-fossil fuel sources by 2030. It has set targets for CO_2 reduction and aims to reach net zero emissions by 2070[1]. Between FY15 and November 2024, the renewable energy (RE including hydro) capacity increased around five times from 40 GW to almost 205 GW[2], supplying nearly 23% of the total electricity generated as November 2024[3]. Various studies suggest a significant increase in the share of RE in the next 10 years. Maharashtra is among the RE-rich states in India, boasting an installed RE capacity of 17.6 GW, making up 38% of the total installed capacity as of FY24[4]. RE is only expected to expand, with untapped potential of 64 GW of solar and 98 GW of wind across the state[5]. Maharashtra is set to play a pivotal role in India's energy transition and commitments.

As Maharashtra embarks on this RE expansion, its electricity sector faces several challenges, such as:

- Variability at multiple levels (day/night, seasonal etc.)
- Unavailability during peak demand periods
- Increased ramping from conventional plants
- Creation of "duck curve" situations and high peak power requirement

In such situations, ensuring sufficient firm capacity on the grid to always meet the demand becomes critical. At the same time, procurement of thermal capacity to meet peak load without considering RE or other flexible resources can result in an oversized system and inflated costs. Hence, a scientifically and mathematically driven system simulation and optimization is important to ensure that ramping needs and load curve are reliably always met in a least-cost manner. Resource Adequacy (RA) considering flexibility in demand profile and conventional generation coupled with flexibility resources would be key to large scale integration of RE.

RA entails the planning of generation and transmission resources for reliably meeting the projected demand in compliance with specified reliability standards for serving the load with optimum generation mix. This would also facilitate the scaling of RE while considering the need, inter alia, for flexible resources, storage systems for energy shift, and demand response

1 Press Information Bureau Release | 28 Sept 2023
2 NPP Dashboard
3 NPP Dashboard
4 CEA Dashboard
5 Akshayurja

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measures for managing the intermittency and variability of renewable energy sources. RA analysis provides the tools to determine whether there are enough resources and, if not, what type of resource is needed to meet reliability needs and contract these capacities. At the same time, any surplus resulting in the analysis would facilitate the trading of the same with other constituents ensuring optimal capacity utilisation.

1.1. Evolution of RA

On 29 December 2022, the Central Government published the Electricity (Amendment) Rules, 2022, mandating State Electricity Regulatory Commissions (SERCs) to frame RA Regulations in accordance with Guidelines issued by the Central Government and Model Regulations by the Forum of Regulators (FoR). Accordingly, in June 2023, the Central Electricity Authority (CEA) notified "Guidelines for Resource Adequacy Planning Framework for India" (CEA Guidelines) and the FoR published State Model Regulations. Subsequently, in September 2024, Maharashtra Electricity Regulatory Commission (MERC) notified MERC (Framework for Resource Adequacy) Regulations, 2024. Many other states have notified Final/Draft Regulations.

1.2. Key Aspects of RA

Following are the key aspects of RA framework:

1. Demand assessment and forecasting
   In this step, the future demand requirement is assessed and forecasted considering various input parameters, policies and drivers, uncertainty analysis, and scientific forecasting methodologies.
2. Generation resource planning
   Based on the forecasted demand, it is important to assess existing available capacity for identifying the need for incremental capacity for meeting RA requirement. This process will involve the following three sub-steps:
   a. Capacity crediting (CC)
   b. Planning reserve margin (PRM)
   c. RA requirement and allocation
3. Procurement planning
   Once the RA requirement has been identified and allocated, it is important to plan out procurement of the same. This will involve the following three sub-steps:
   a. Procurement resource mix
   b. Procurement type and tenure
   c. Capacity trading/sharing constructs
4. Monitoring and compliance
   This will involve the development of an overarching framework, process flowchart and timeline, matrix for roles and responsibilities, and matrix for deliverables to ensure smooth and successful implementation of the RA framework.

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1.3. Objective of Workshop

RA is a relatively new concept and has evolved only in the last 2-3 years in India. Hence, there is need for capacity building and handholding at state level to ensure successful and sustainable implementation going forward. Through this workshop, we aim to help stakeholders understand key aspects of RA Regulations as well as optimal approaches for RA planning and reliable RE integration for the state of Maharashtra.

2. Workshop Sessions

The workshop was designed into 4 sessions: inaugural session followed by three technical sessions.

2.1. Inaugural Sessions

The inaugural session of the workshop was graced by esteemed dignitaries, including:

- Sh. Balawant Joshi, Managing Director, Idam Infra
- Sh. Jitendra Meena, Director (IRP), CEA
- Sh. Sanjay Kumar, Chairperson, MERC

Lamp-Lighting Ceremony

The workshop began with a ceremonial lamp-lighting led by the distinguished dignitaries: Sh. Sanjay Kumar, Sh. Ashok Pendse, Sh. Kapil Sharma, Sh. Shrikant Jaltare, Sh. Balawant Joshi, and Sh. Ajit Pandit, symbolizing the initiation of the discussions ahead.

Welcome Address

***Sh. Balawant Joshi**, MD, Idam Infra*

Sh. Balawant Joshi commenced the workshop with a fervent welcome to all esteemed dignitaries and participants. He meticulously introduced the session speakers and delineated the workshop's core themes, establishing a robust foundation for profound discussions on resource adequacy. He highlighted the rapid evolution of our power sector, driven by transformative policies and operations. With ambitious targets set by the Prime Minister, including initiatives like the PM Suryaghar Yojna that will pose significant challenges for DISCOMs due to over 50GW generation integration at the consumer end, Sh. Joshi emphasized the necessity for comprehensive revamping of our planning methodologies. The power sector will witness generation from both the load and the consumer ends, making it imperative to rethink our planning approaches. Integrated Resource Planning and the EPS play pivotal roles, but flawed EPS projections have led to criticism of the CEA, particularly the 19th EPS, for causing substantial stranded capacity in our nation. Hence, there is a pressing need to overhaul the process and adopt resource adequacy, conducting sub-hourly or hourly analyses even for medium and long-term projections. He meticulously outlined the session plans, underscoring the crucial importance of transmission adequacy. With the ISTS waiver expected to expire in the next two years, significant generation will need to originate within states, placing immense stress on intra-

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state transmission lines. Maharashtra, Sh. Joshi proudly noted, is pioneering in conducting transmission adequacy studies.

Overview of RA Framework

***Sh. Jitendra Meena**, Director (IRP), CEA*

Sh. Jitendra Meena initiated the technical discussions by elucidating the rationale behind the Resource Adequacy framework, detailing the roles and timelines for each entity. The CEA is tasked with developing the Long-Term National Resource Adequacy Plan (LT-NRAP) for 10 years, publishing PRM and reliability indices, capacity credits for all generation, optimal national generation mix, and the state's share in national peak demand. Sh. Meena underscored the framework's critical role in energy planning, ensuring reliability, and addressing future challenges in energy demand and supply. The NLDC's role is to publish the Short-Term National Resource Adequacy Plan (ST-NRAP) for one year, factoring in reserves, maintenance, and forced outages. DISCOMs are responsible for publishing the Long-Term Distribution Resource Adequacy Plan (LT-DRAP) for ten years as per CEA requirements. STU/SLDCs must provide inputs for LT-NRAP, while SERCs must approve LT-DRAP and monitor resource adequacy. Sh. Meena explicated the reliability criteria and indices, advocating for the application of stochastic methods to incorporate demand and generation variability. He provided a status update on CEA state-wise studies, highlighting completed, ongoing, and data-required projects. The complementary analysis of states, such as the load profile synergy between Madhya Pradesh and Punjab, showcased how diversification can optimize resource adequacy. Sh. Meena also presented CEA's RA study for Maharashtra, emphasizing the need for additional capacity and the critical importance of four-hour storage.

Inaugural Address

***Sh. Sanjay Kumar**, Chairperson, MERC*

In his inaugural address, Sh. Sanjay Kumar provided a comprehensive overview of Maharashtra's impressive growth trajectory and the corresponding surge in energy demand. He underscored the necessity of adopting a holistic and forward-looking approach to energy planning to meet the state's evolving requirements effectively. Having been involved in RA planning from its inception, Sh. Sanjay Kumar acknowledged the formidable challenges of implementing these plans across institutions and ensuring their practical application. He expressed confidence that the RA plan would function correctly. Sh. Kumar elaborated on the integration of renewable energy into the DSM mechanism, despite its challenges and the substantial feedback from utilities

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grappling with issues. He emphasized that frameworks improve through feedback and iterative improvements, and similarly, RA will face challenges that need to be addressed and refined. Sh. Sanjay Kumar highlighted Maharashtra's mix of successes and setbacks, underscoring their commitment to continuous improvement.

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2.2. Technical Session-I: RA Rules and Regulations

The inaugural session transitioned into the Technical Session I, featuring key presentations by:

- Sh. Ajit Pandit, Founding Director & CEO, Idam Infra
- Dr. Prafulla Varhade, Director (EE), MERC
- Sh. Vikrant Dhillon, Deputy Director (IRP), CEA
- Sh. Vivek T, Manager, AFRY

This session focused on the rules and regulations of Resource Adequacy (RA), addressing key topics such as roles and responsibilities, challenges, and implementation steps.

Session Chair

***Sh. Shrikant Jaltare**, Former ED, MSLDC*

Sh. Shrikant Jaltare underscored the paramount importance of resource adequacy in managing the complexities of integrating 6,000 MW of renewable energy into the grid. He emphasized India's bold target of 500 GW renewable capacity and advocated for meticulous planning and a resilient framework for seamless implementation. He further recommended incorporating the generation of Distributed Renewable Energy (DRE) into forecasts rather than solely relying on the derived demand of SLDC, as DRE is not reflected in traditional demand projections.

National RA Framework and Model RA Regulations & State Experiences

***Sh. Ajit Pandit**, Founding Director & CEO, Idam Infra*

Sh. Ajit Pandit provided a comprehensive overview of the Resource Adequacy (RA) framework, outlining its guiding principles. These included starting with a shortfall assessment, conducting dynamic evaluations across multiple scenarios, planning resource diversity to achieve cost efficiency, and enabling resource sharing to minimize system costs and avoid stranded capacities. He traced the framework's evolution, starting with its mention in the draft IEGC by CERC two years ago, followed by CEA's guidelines, MoP's rules, and the eventual formulation of the FoR report and model

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regulations, which states adopted. Maharashtra was highlighted as a pioneer in implementing these regulations.

Mr. Pandit presented a detailed comparison matrix of frameworks from CEA, CERC, and FoR how CEA approach is top to bottom and FoR gives bottom-up appraoch, delving into the FoR framework's step-by-step approach and highlighting state-specific variations in RA regulations. Key challenges were identified, including the need for standardized data templates, capacity-building for scientific demand forecasting, better synergy among agencies, and managing the fast-paced RA timelines in the initial years. Stressing the importance of support akin to the DSM framework rollout, he emphasized collaborative handholding to address issues like para-licensing for contracting capacities on LT, MT, and ST bases, urging further dialogue with the CEA.

Overview of MERC RA Regulations

***Dr. Prafulla Varhade**, Director (EE), MERC*

Dr. Varhade analyzed Maharashtra's demand scenario, underlining the critical role of solar energy, particularly during peak demand hours that coincide with solar availability. However, he highlighted the challenges posed by solar energy fluctuations and stressed the importance of system security, which has been integrated into CERC's IEGC. He elaborated on the MERC RA regulation, noting that Maharashtra lacked interface metering infrastructure before 2020, but significant progress was made in 2021, enabling accurate RA assessments.

He emphasized the regulation's requirement for demand forecasting across three scenarios—business as usual, most probable, and aggressive. Maharashtra has been proactive in implementing the RA framework post-regulation notification, with most DISCOMs submitting RA plans. He advocated for scenario-based demand assessments, uniform Planning Reserve Margins (PRM) across states, and integrating RA into the Multi-Year Tariff (MYT) framework.

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Overview of Capacity Crediting

***Sh. Vikrant Dhillon**, Dy. Director (IRP), CEA*

Sh. Vikrant Dhillon, provided an in-depth overview of capacity crediting, tracing its evolution from Integrated Resource Planning (IRP) to the Resource Adequacy (RA) framework. He explained how IRP, rooted in the Electricity Act 2003, focused on long-term planning through the National Electricity Plan (NEP) prepared by the CEA every five years, while short-term planning was addressed by CERC and operational planning by NLDC, RLDC, and SLDC. However, the lack of coordination among these agencies prompted the Ministry of Power (MoP) to institutionalize the RA framework through the Electricity Amendment Rule 2022.

- **Coincidental Peak Planning**
  Sh. Dhillon emphasized the importance of adopting a national coincidental peak approach for capacity planning to prevent stranded capacities. He highlighted analysis showing that the top 5% of national peak demand occurs during solar hours in August, yet capacity shortages primarily arise during non-solar hours. Both solar and non-solar periods must be integrated into capacity planning for a balanced approach that ensures grid reliability.
- **Methodologies for Capacity Crediting (CC)**
  He detailed various methodologies for determining capacity credit, including critical day analysis and demand-based approaches for solar and non-solar hours. Sh. Dhillon explained that while solar and non-solar demand methodologies are optimal for coincidental peak planning, critical day analysis is best suited for accurate CC calculations. These approaches provide a comprehensive framework to assess the contribution of different energy resources toward meeting peak demand.
- **Challenges in Implementation**
  Sh. Dhillon highlighted key challenges in implementing capacity crediting, including the need for better inter-agency coordination and robust enforcement mechanisms. Addressing these gaps is critical to ensure the successful integration of RA frameworks and prevent operational inefficiencies.

Through his presentation, Sh. Dhillon underscored the significance of capacity crediting methodologies and coincidental peak planning in achieving a reliable and optimized energy system while aligning with the goals of the RA framework.

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Review of Various RA Tools

***Sh. Aniket Ghosh**, Principal, AFRY*

Sh. Aniket started the session by explaining PRM, its mathematical interpretation, and its impact on UE and demand. He explored advanced modeling tools like Capacity Expansion Model, Production Cost Model, and Generation Resource Adequacy Model, highlighting their uses, limitations, and metrics addressed, including PRM, costs, and reliability. Sh. Aniket explained stepwise planning for generation resource adequacy, applying Monte Carlo for reliability assessment, and calculating reliability metrics. He provided a design and metric for evaluating RA tools based on their capabilities, whether open-source or licensed, and ease of use. Sh. Aniket noted that Maharashtra's RA guidelines introduced reliability metrics like LOLE and energy not served, advocating for PRM alignment to meet these standards when not explicitly defined.

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2.3. Technical Session-II: Generation RA Planning for Maharashtra

The Technical Session II featured key presentations by:

- Dr. K. Balaraman, Executive Director, IDAM
- Sh. Yogesh Gadkari, Director, MSEDCL
- Sh. Nitin Lothe, Manager, TATA Power
- Sh. Ashwin Gambhir, Fellow, Prayas

This session focused on generation RA planning, including approaches, findings, and associated challenges.

***Sh. Balawant Joshi**, MD, Idam Infra,* Initiated the session by giving introduction of the speakers in this session, setting the stage for discussions on generation planning approaches and challenges.

Multiple Approaches and Scenarios for RA Planning in Maharashtra
***Dr. K. Balaraman**, ED, Idam Infra*

Dr. Balaraman highlighted the paradox of India's 340 GW installed capacity struggling to meet a 170 GW peak demand. He detailed IDAM's methodology for RA studies, contrasting spreadsheet-based approaches for smaller entities with advanced software-driven methods for larger systems. Presenting Maharashtra-specific findings, he revealed capacity contribution (CC) values of 47% for solar and 7% for wind, supported by load duration curves showing their contribution during the top 250 demand hours.

For software-driven analysis, he explained its objectives and multi-phase processes, providing transparency into how resources were modeled. Two scenarios were analyzed—one based on 20th EPS projections, and another incorporating agricultural load shifts and adjusted patterns. The study demonstrated the reliability criteria under existing and planned capacities, identified additional capacity needs, and presented load-generation balances for FY30. He also shared insights on the average power purchase cost for each scenario.

RA Plan – DISCOM Perspective
***Sh. Yogesh Gadkari**, Director, MSEDCL*

Sh. Gadkari discussed MSEDCL's RA strategies, emphasizing challenges like rooftop solar integration, green open access, transmission constraints, and resource tie-ups for peak demand and solar pumps. He elaborated on these issues with real-world examples,

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highlighting difficulties in contracting additional peak capacity, which often leads to off-peak surpluses and increased costs. He also flagged uncertainties regarding aging thermal plants and the lack of real-time demand and generation monitoring, stressing their impact on planning.

He suggested considering the top 10% of load hours for CC calculations to minimize stranded capacity, as lower CC values might lead to inflated additional capacity requirements. He noted STU and SLDC efforts toward achieving real-time demand visibility to enhance demand-side management. He shared MSEDCL's demand forecast using SARIMA and econometric models, projecting peaks of 35 GW by FY30 and 43 GW by FY35, along with resource planning through LT-DRAP, specifying additional capacity needs across different resources.

RA Plan – Private DISCOM Perspective
***Sh. Nitin Lothe**, Manager, Tata Power*

Sh. Lothe outlined TATA Power's RA methodology, focusing on demand segmentation and consumer-specific planning. Load forecasting was divided into four categories: industrial load (constant), changeover load, weather-dependent load (analyzed using specialized software with five years of data), and new load additions (e.g., data centers and new consumers). Procurement planning was conducted generator-wise, and CC values averaged over five years were 26% for solar and 15% for wind.

He identified challenges such as frequent consumer migration, intra-state renewable energy measurement issues, and long-term contracting hurdles. He advocated for using smart meters and flexible resources to improve planning accuracy. Notably, he highlighted that wind CC is higher during solar hours and critiqued the impracticality of contracting capacities based on a net-load approach. From a DISCOM perspective, he recommended implementing settlement periods to avoid suboptimal investments and inefficient resource allocation.

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Emerging Issues in RA Framework

***Sh. Ashwin Gambhir**, Fellow, Prayas*

Sh. Gambhir, highlighted critical issues and gaps in the Resource Adequacy (RA) framework during his discussion. He underscored the importance of adopting a national-level approach to RA planning while addressing key methodologies and challenges. His insights focused on demand assessment, capacity credit calculations, transparency, and the role of trial periods in refining RA processes.

- **National-Level Planning for RA**

  Sh. Gambhir emphasized that effective RA planning requires coordination at the national level before cascading to individual states. He explained that short-term capacity issues, often overlooked in state-level studies, must be addressed through a unified national framework to ensure alignment across regions. This would enable better resource sharing and optimize the overall RA process.

- **Comprehensive Demand Assessments**

  He stressed the need for thorough demand assessments to improve RA planning accuracy. This includes considering factors like sales migration, rigorous weather analysis, and the impact of distributed renewable energy (DRE) on load profiles. These factors, if ignored, could lead to inaccurate demand forecasts and misaligned resource planning.

- **Effective Load Carrying Capability (ELCC) for Capacity Credit**

  Sh. Gambhir advocated for the use of the ELCC methodology for calculating Capacity Credit (CC), as it provides more accurate results than using top net-load hours. He explained how CC values are dynamic, influenced by changes in the energy mix. For instance, increasing solar capacity reduces CC, while adding storage systems enhances it. He also critiqued the CEA's CC methodology for storage, suggesting states define peak demand hours for Battery Energy Storage System (BESS) dispatch to improve reliability.

- **Transparency and Trial Periods in RA Studies**

  He called for greater transparency in RA studies, emphasizing the need for openly shared data and methodologies. To refine the RA framework, he recommended implementing trial periods for RA activities, allowing stakeholders to identify and address challenges before full-scale implementation.

- **National-Level Coincidental Peak Analysis**

  Sh. Gambhir proposed conducting a national-level coincidental peak analysis across various scenarios, including monsoon and non-monsoon periods. This would provide

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insights into seasonal and regional variations, helping to develop a more resilient and coordinated RA framework.

By addressing these emerging issues, Sh. Gambhir highlighted the importance of robust, transparent, and well-coordinated RA planning to ensure grid reliability and effective renewable energy integration.

2.4. Technical Session-III: Transmission RA Planning and Operational Challenges

The Technical Session III featured key presentations by:

- Sh. Peeyush Sharma (MSETCL)
- Sh. Shashank Jewalikar (MSLDC)
- Sh. Ajit Pandit (IDAM)

The session addressed the importance of transmission planning, challenges, and strategic approaches.

Session Chair

Sh. Rajendra Ambedkar*, Secretary, MERC*

Sh. Ambedkar emphasized the foundational role of transmission adequacy in achieving resource adequacy. He noted that without adequate transmission infrastructure, resource evacuation would be hindered, undermining RA goals.

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Transmission Adequacy for RA

***Sh. Peeyush Sharma**, CE (STU), MSETCL*

Sh. Sharma underscored the critical role of transmission adequacy in Resource Adequacy (RA) planning, emphasizing the need for proactive measures to address emerging challenges. He outlined the complexities of transitioning from traditional grid systems to future networks incorporating advanced technologies like High Voltage Direct Current (HVDC), open access, smart meters, energy storage, and bidirectional energy flows. Adaptive planning, he argued, is essential to prevent infrastructure from lagging behind capacity additions, which could result in renewable energy curtailment and inefficiencies.

- **Transmission Network Inadequacies**
  Sh. Sharma highlighted how network inadequacies could undermine the benefits of renewable energy integration. He stressed that delayed transmission infrastructure development often leads to energy curtailment, counteracting efforts to meet clean energy targets. To address this, he advocated prioritizing transmission adequacy in RA frameworks to ensure alignment between generation capacity and grid readiness.
- **Maharashtra's Transmission Planning Approach**
  He detailed Maharashtra's three-tiered transmission planning strategy, covering high voltage (400-765 kV), low voltage (66-220 kV), and distribution (33 kV) networks. This comprehensive approach identifies critical corridors needing augmentation by FY27, ensuring the state's grid is prepared for increasing demand and renewable energy integration.
- **Key Demand Drivers and Projections**
  Sh. Sharma identified major demand drivers for Maharashtra's energy network, including data centers, metro projects, green hydrogen production, pumped storage plants (PSPs), and agricultural load shifts. These drivers, predominantly concentrated in coastal regions, are expected to push Maharashtra's energy demand to 80-85 GW by FY30, necessitating the expansion of a 130-150 kMVA transmission and distribution (T&D) network.
- **Shift in Demand Hotspots**
  He noted a geographic shift in demand hotspots from eastern to western Maharashtra, driven by renewable energy installations and industrial growth. Aligning transmission planning with these evolving demand patterns is crucial to optimize energy distribution and minimize losses.

Sh. Sharma's insights emphasized the importance of synchronized planning and infrastructure development to support the evolving energy landscape and meet Maharashtra's ambitious energy goals.

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Short-term RA & Operational Challenges

***Sh. Shashank Jewalikar**, ED, MSLDC*

Sh. Jewalikar examined the complex expectations surrounding RA and presented various definitions of similar studies. He outlined six core principles of RA and emphasized the importance of reserves and ancillary services in managing growing demand and variable generation. He cautioned against over-reliance on traditional capacity planning, as this risks underutilizing resources in the context of a rapidly evolving grid.

He identified challenges across sourcing, network management, and control operations, emphasizing the need for both active and reactive power adequacy to maintain grid stability. He underscored the variability introduced by EVs as "moving demand," suggesting the future need for distribution adequacy studies at a granular level. Using examples like sudden demand drops during solar eclipses, he highlighted the importance of investigating such anomalies to refine planning models.

Finally, he stressed aligning RA with consumer-specific liabilities to avoid surplus energy and excessive costs, while calling for robust reserves and a focus on ancillary services to address grid variability effectively.

Closing Remarks

***Sh. Ajit Pandit,** Founding Director & CEO, Idam Infra*

Sh. Pandit summarized the session by reiterating the need for aligning RA planning with consumer-specific needs. He encouraged Maharashtra to continue its proactive efforts, setting an example for other states. He concluded by thanking the speakers for their valuable contributions.

3. Key Takeaways

- The workshop emphasized the critical role of resource adequacy (RA) in energy planning, focusing on ensuring reliability, balancing demand and supply, and preparing for future energy needs.
- Discussions highlighted the challenges of integrating renewable energy, particularly India's ambitious 500 GW target, which requires careful planning to overcome operational and infrastructural hurdles.
- The evolution of RA frameworks through collaboration among MoP, CERC, CEA, and states was discussed, with a call for harmonization and streamlined implementation processes. Uniform planning reserve margins (PRM) and integration of RA into tariff frameworks were identified as key priorities.
- Advanced tools and methodologies were explored, with participants emphasizing the importance of capacity expansion models, real-time monitoring, and the adoption of smart meters to improve accuracy in forecasting and decision-making.
- Transmission adequacy was recognized as the backbone of RA, with the need for robust infrastructure and expanded corridors to support future energy demands.
- Participants addressed emerging challenges, including transparency in RA assumptions, the need for trial periods and validation studies, and proactive management of peak demand surpluses, aging infrastructure, and consumer migration.
- A collaborative approach was strongly advocated, starting with national-level strategies and cascading to state-level implementations. Stakeholder engagement, through public consultations and technical validation, was deemed essential for fostering accountability and data accuracy.

4. Workshop Agenda

The workshop agenda of Maharashtra workshop is as follows:

Time (h)	Session	Speaker
10:00 – 10:30	***Registration***	
10:30 – 11:30	**Inaugural Session**	
	Welcome Address	Sh. Balawant Joshi, MD, Idam Infra
	Overview of RA Framework	Sh. Jitendra Meena, Director (IRP), CEA
	Inaugural Address	Sh. Sanjay Kumar, Chairperson, MERC
	Vote of Thanks	Sh. Ajit Pandit, Director, Idam Infra
11:30 – 11:45	***Tea Break***	
11:45 – 13:15	**Technical Session 1: RA Rules and Regulations, Session Chair: Sh. Shrikant Jaltare, Former ED, MSLDC**	
	National RA Framework and Model RA Regulations & State Experiences	Sh. Ajit Pandit, Director, Idam Infra
	Overview of MERC RA Regulations	Dr. Prafulla Varhade, Director (EE), MERC
	Overview of Capacity Crediting	Sh. Vikrant Dhillon, Dy. Director (IRP), CEA
	Review of Various RA Tools	Sh. Aniket Ghosh, Manager, AFRY
	Q&A	
13:15 – 14:15	***Lunch Break***	
14:15 – 16:00	**Technical Session 2: Generation RA Planning for Maharashtra Session Chair: Sh. Balawant Joshi, MD, Idam Infra**	
	Multiple Approaches and Scenarios for RA Planning in Maharashtra	Dr. K. Balaraman, ED, Idam Infra
	RA Plan – Discom Perspective	Sh. Yogesh Gadkari, Director, MSEDCL
	RA Plan – Private Discom Perspective	Sh. Nitin Lothe, Tata Power
	Emerging Issues in RA Framework	Sh. Ashwin Gambhir, Fellow, Prayas
	Q&A	
16:15 – 16:30	***Tea Break***	
16:30 – 17:45	**Technical Session 3: Transmission RA Planning and Operational Challenges Session Chair: Sh. Rajendra Ambekar, Secretary, MERC**	
	Transmission Adequacy for RA	Sh. Peeyush Sharma, CE (STU), MSETCL
	Short-term RA & Operational Challenges	Sh. Shashank Jewalikar, ED, MSLDC
	Q&A	
17:45 – 18:00	**Closing Remarks**	Sh. Ajit Pandit, Director, Idam Infra

5. Workshop Participants

5.1. Speakers

Sr.	Name	Designation	Company
1	Jitendra Meena	Director (IRP)	CEA
2	Sanjay Kumar	Chairperson	MERC
3	Shrikant Jaltare	Former ED	MSLDC
4	Prafulla Varhade	Director (EE)	MERC
5	Aniket Ghosh	Principal	AFRY
6	Vivek T	Manager	AFRY
7	Yogesh Gadkari	Director (Commercial)	MSEDCL
8	Nitin Lothe	Manager	Tata Power
9	Ashwin Gambhir	Fellow	Prayas
10	Rajendra Ambekar	Secretary	MERC
11	Peeyush Sharma	CE (STU)	MSETCL
12	Shashank Jewalikar	ED	MSLDC
13	Vikrant Dhillon	Dy. Director (IRP)	CEA

5.2. Participants

Sr.	Name	Designation	Company
1	Sachin Lomate	Executive Engineer (REMC) I/c	MSLDC
2	Narendra Jagtap	DYEE	MSLDC
3	BHASHKAR KUMAR	Additional Executive Engineer	MSLDC
4	Umesh Kumar Sharma Ramamoorthi	Senior Research Associate	WRI India
5	HARSHITA SRIVASTAVA	lead Associate	TATA POWER
6	Krishan Gopal Sharma	Energy Manager	WRI India
7	Suraj Swayamprakash	Lead	Tata Power
8	KIRAN VINAYAK DESALE	Chief Transmission (O & M)	TATA POWER CO
9	Pravinkumar Lalit Patle	Assistant Engineer	MSEDCL
10	Mr. Yogesh Prakash Sawant	Group Head- Transmission Network Planning	The Tata Power Company Ltd.
11	Ganesh S Tawre	Chief Manager - Transmission Network Planning	Tata Power Company Limited
12	Arushi Relan	Programme Associate	CEEW
13	Rekha Kolhe	Assistant Engineer	MSEDCL
14	Madhukar M Rane	Deputy Chief Engineer (Regulatory)	BEST Undertaking, Mumbai
15	Satish Jadhav	Divisional Engineer (Power Purchase)	BEST Undertaking, Mumbai
16	Gagan Shrivastav	Manager	KPMG India
17	Vikas S. Pimpalshende	Assistant Engineer	MSEDCL
18	AJAY S NIKALE	ASSISTANT ENGINEER	MSEDCL
19	Asmita Bajirao Patil	Executive Engineer	MSEDCL
20	Kapil Sharma	CEO	Adani
21	Rohit Khare	Senior Program Research Analyst	WRI

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Sr.	Name	Designation	Company
22	Damini Hivrale	Lead Engineer	Tata Power
23	Varun Potty	Research Associate	Prayas
24	Prajwal Thakre	Research Associate	Prayas
25	Kishor P. Shirsat	Assistant Engineer	MSPGCL
26	Kailas lavekar	Executive Engineer	MSEDCL
27	Mr. Ashok Pendse	Senior Consumer Representative	
28	Mr. Abaji Naralkar	Additional Vice President	Adani
29	Ms. Jayati Nandan	Deputy Manager	Renew
30	Mr. Rakesh Guhagarkar	Deputy Director (Technical)	MERC
31	Mr. Ghanshyam Patil	Director (Tariff)	MERC
32	Mr. Praveen	Joint Director	MERC
33	Mr. Popal Khand		MERC
34	Mr. Deshpande		
35	Mr. Ajay Bagade		