



## CEA: Guidelines for RA Planning Framework for India, 2022

Ministry of Power (MoP), in consultation with Central Electricity Authority has notified 'Guidelines for RA Planning Framework for India' on 28<sup>th</sup> June, 2023. These guidelines are to be followed by the institutions and stakeholders such as CEA, NLDC, RLDCs, SLDCs, DISCOMs, SERCs/JERCs, etc. to ensure sufficient tie up of capacities to meet RA requirements over different time horizons.

**Resource Adequacy (RA)** has been defined as '*tying up sufficient capacity to reliably serve expected demand of the consumers in the DISCOMs license area in a cost effective manner*'. Important aspect of the RA planning is to ensure the availability of adequate generation capacities, round the clock to reliably serve demand under various scenarios. The RA framework lays down the optimal capacity mix to meet the projected demand at minimum cost.

Important definitions:

- (a) **Planning Reserve Margin (PRM)**: It is represented as reserve generation capacity in excess of peak load forecast as a percentage of peak load forecast.
- (b) **Loss of Load Probability (LoLP)**: Measure of probability that a system's load will exceed the generation and firm power contracts available to meet that load in a year.
- (c) **Expected Energy Not Served (EENS)**: Expected amount of load (MWh) that may not be served for each year within the planning period.
- (d) **Net Energy Not Served (NENS)**: Total expected load shed due to supply shortages (MWh) as a percent (%) of the total system energy.
- (e) **Firm Capacity**: Amount of power a generator can reliably provide.
- (f) **Capacity Credit**: Firm capacity expressed as a percentage of nameplate capacity.

There will be four types of plans which will be implemented under the framework:

1. **Long-term National RA Plan (LT-NRAP)**: CEA shall publish LT-NRAP report for 10-year horizon which will be updated annually. The report will include the following:
  - a. National-level PRM
  - b. Optimal generation mix for next 10 years
  - c. Capacity credits of different power generation resources on a regional basis
  - d. State/UT's contribution towards national peak

The process for the calculation of economically optimal PRM is recreated in the chart shown below:

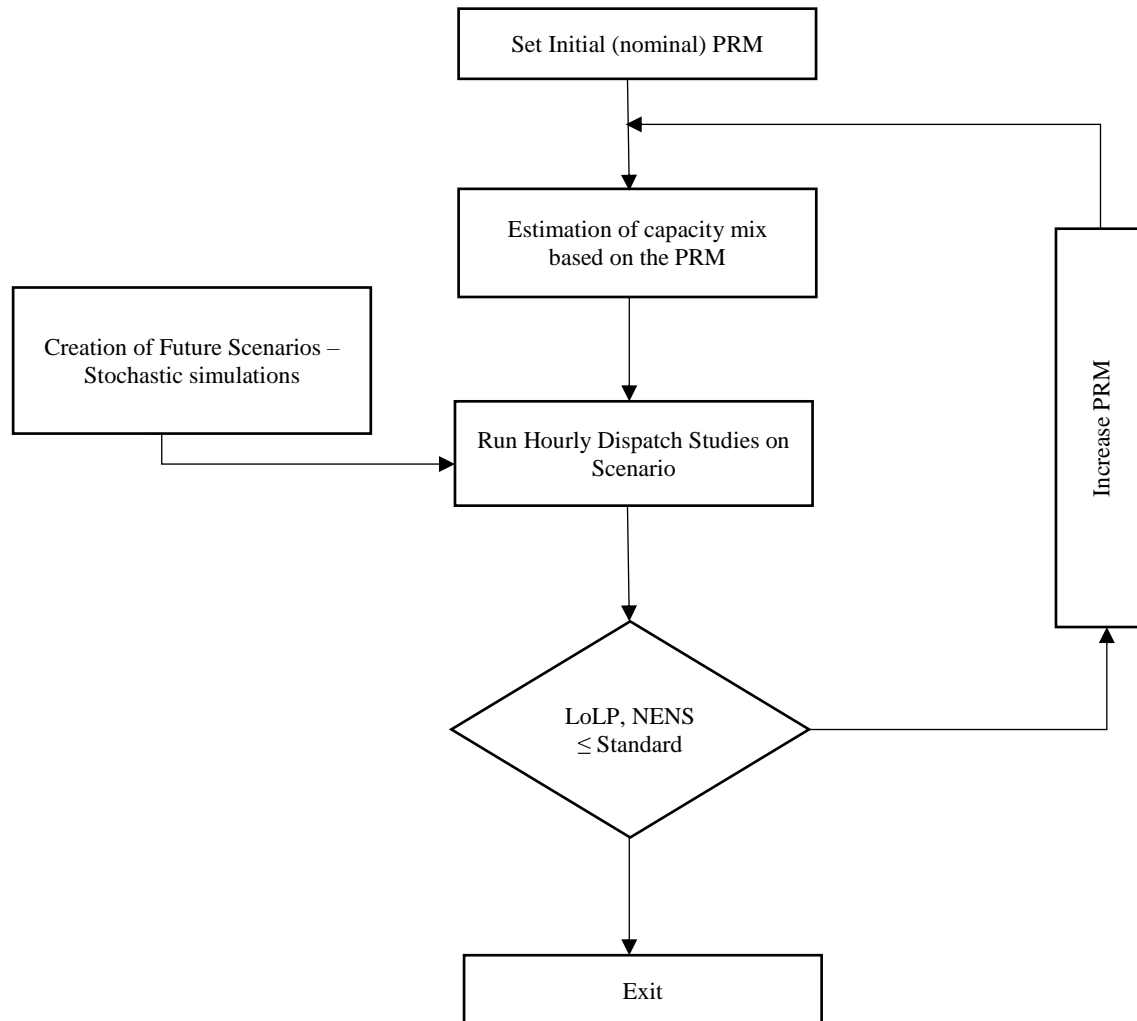


Figure 1: Flowchart for optimal PRM study

It is important to note that at the economically optimal PRM, which the marginal cost of reducing load shed is equal to the value of lost load.

2. **Short-term National RA Plan (ST-NRAP):** NLDC shall annually publish a one-year look ahead ST-NRAP report which will include the following:
  - a. Demand forecasts
  - b. Resource availability based on under construction status of new projects
  - c. Planned maintenance schedules of existing stations
  - d. Station-wise historic forced outage rates
  - e. Decommissioning plans

To conduct the study of LT-NRAP and ST-NRAP, STU/ SLDC on behalf of the distribution licensees in the state shall provide the details regarding hourly demand forecast (peak and energy requirement) for 10 years, assessment of existing generation resources, etc. to CEA and NLDC.

3. **Long-term Distribution Licensee RA Plan (LT-DRAP):** Each distribution licensee shall undertake LT-DRAP for a 10 year horizon on annual rolling basis to meet their own peak load



and electrical energy requirement. Based on the share in national peak demand provided in LT-NRAP, each licensee shall plan to contract the capacity that will be computed as:

RA Requirement (RAR) (Demand Side) = Contribution to forecasted national peak demand \* (1 + PRM)

The demand side RAR will be matched with the supply side RAR (the overall sum of product of generation capacities and their respective capacity credits for all type of generation portfolios) to get the sufficient capacity for that particular area of supply of the licensee.

The LT-DRAP prepared by respective distribution licensees shall be vetted/ validated by the CEA and subsequently be submitted to SERC/JERC for their approval. **It will be required to maintain at least 75% of required capacities in LT-DRAP to be met through long-term contracts.**

The approval process by the SERC/JERC will be followed by the submission of details of contracted capacities by DISCOMs to the respective STU/SLDC. The capacities will be aggregated at state level by STU/SLDC and will be shared to the respective RLDC. The capacities will be aggregated at regional level by RLDC and will be shared to the NLDC. NLDC shall aggregate the capacities at the national level and will compare the same with ST-NRAP to identify shortfall for the next year. The shortfall will be communicated by NLDC to SERC/JERC for compliance or facilitate a national-level auction for the balance capacity with participation from distribution licensees with capacity shortfall.

- 4. Short-term Distribution Licensee RA Plan (ST-DRAP):** The STU/SLDC shall prepare one-year look ahead ST-DRAP on an annual basis based on LT-DRAP results. The ST-DRAP shall be reviewed by SLDC on a daily, monthly or quarterly basis based on actual availability of generation resources.

The timeline of the RA exercise is shown in the figure below<sup>1</sup>:

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<sup>1</sup> Please note that the terminology used by EAL for the target year is “n<sup>th</sup> year” whereas “(n-1)<sup>th</sup> year” is the year in which forecasting exercise is being carried out for that target year. Following the standard approach to identify the target block, we differ from the notations given in the CEA “Guidelines for Resource Adequacy Planning Framework for India” and have adopted the terminology as shown in the timeline. The reason to avoid the use of terminology as mentioned in the document is to indicate other years in reference to the target year, thus adding more clarity in the understanding of the timelines.

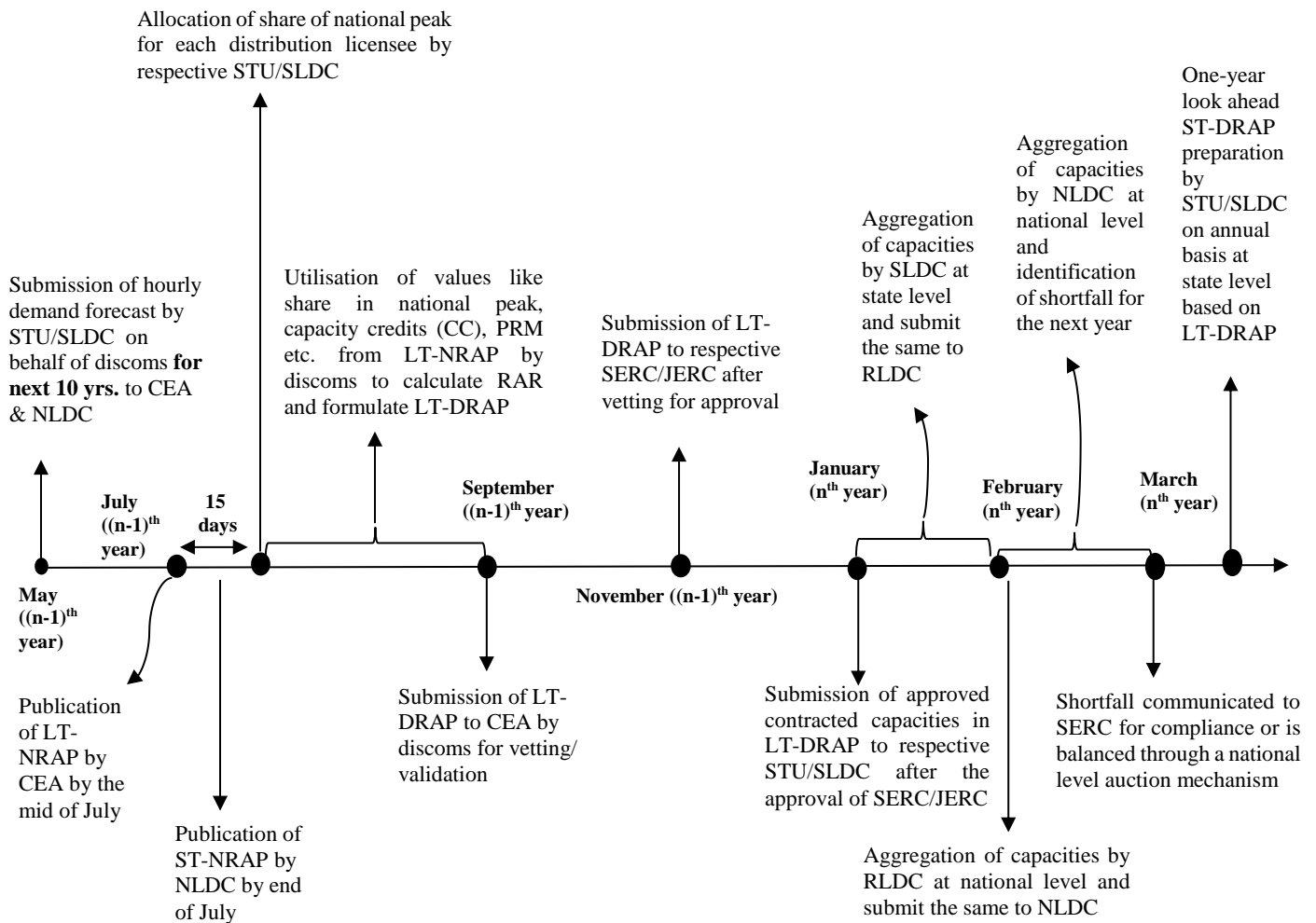


Figure 2: RA Implementation Timeline

The document can be accessed [here](#).

## CER Opinion

- 1. Necessity of Resource Adequacy Framework:** The overall objective of Resource Adequacy (RA) framework is to avoid demand-supply mismatch, ensure system security and reliability at the national level. 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. 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. CER, 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*”<sup>2</sup>, highlighting the need for a regulatory framework for the same. CER and EAL, IITK have undertaken Long-term Demand Forecasting (LTDF) and Power Procurement Planning (PPP) studies for the states of Uttar Pradesh as well as Chhattisgarh and have also undertaken LTDF for the state of Rajasthan and Gujarat. Apart from this, CER/EAL have

contributed with their opinion to MPERC's "Power Purchase and Procurement Process Regulations"<sup>3</sup>, and APERC's "Terms and Conditions for short-term procurement/sale of power Regulation, 2021"<sup>4</sup>.

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 reinforce 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.**

- 2. Resource Adequacy Vs Generation Adequacy:** Clause 1(2) states "Resource Adequacy means tying up sufficient capacity to reliably serve expected demand of the consumers in the DISCOMs license area in a cost effective manner...".

Given the fact that volatility in electricity prices have been witnessed in the recent years, some of preliminary analysis by EAL<sup>5</sup> suggests that demand response could have played an important role in addressing the price spikes, If we view the price spike only from the context of capacity addition, one would end up recommending even higher capacity to meet the growing demand and to address such kind of situation in the future, However, it is highlighted Demand Side Management (DSM) measures including demand response can contribute to address the demand supply imbalance in the short run.

- 3. Implementation of Alternate Approach to Demand Forecasting:** The implementation of LT-NRAP and ST-NRAP is to be preceded by the submission of demand forecast by the STU/SLDC on behalf of their respective discoms. The methodological approach to load forecasting may vary across discoms/states due to differing data availability, seasonal impact on demand, etc. Studies carried out by CER and EAL for the states of Chhattisgarh, Rajasthan and Uttar Pradesh highlight the evolution of methodological approach for load forecasting.<sup>6</sup>

- 4. Necessity of Block-wise Demand Forecast:** Clause 3 (3) states "The hourly demand forecasts used by CEA and NLDC shall be aligned with the projections furnished by individual Distribution Licensees to CEA and NLDC..."

The system operation and market products for the Indian power sector are implemented on a 15 minute time block basis. Furthermore, greater penetration of VRE requires better visibility across granular time scale which could potentially improve demand forecasting and reduce forecasting errors.<sup>7</sup> Hence, the RA study should be implemented for the block-wise demand forecast instead of hourly demand forecast. Although in the RA Guidelines, it provides for that forecast as per the availability of demand and RE generation data. This approach gives precedence to hourly forecast over the block wise forecast.

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<sup>2</sup> 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](https://cer.iitk.ac.in/assets/downloads/CER_Monograph.pdf)

<sup>3</sup> *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](https://cer.iitk.ac.in/odf_assets/upload_files/blog/Revision_2_2022_Power_Procurement_Draft_Regulation.pdf)

<sup>4</sup> 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](https://cer.iitk.ac.in/odf_assets/upload_files/Draft_APERC_Terms_and_Conditions_for_short_term_procurement_sale_of_power_Regulation_2021.pdf)

<sup>5</sup> Refer the EAL Newsletter. [https://eal.iitk.ac.in/assets/docs/power\\_chronicle\\_vol\\_5\\_issue\\_1.pdf](https://eal.iitk.ac.in/assets/docs/power_chronicle_vol_5_issue_1.pdf)

<sup>6</sup> Singh, Anoop (2021), *Long-term Energy/Load Forecasting and Power Procurement Planning: Case Study of Uttar Pradesh and Chhattisgarh*, Centre for Energy Regulation (CER), Indian Institute of Technology Kanpur. [https://cer.iitk.ac.in/assets/downloads/FOR\\_CBPI4/presentations/CBPI4\\_PPT\\_anoops@iitk.ac.in\\_LTDF.pdf](https://cer.iitk.ac.in/assets/downloads/FOR_CBPI4/presentations/CBPI4_PPT_anoops@iitk.ac.in_LTDF.pdf)

<sup>7</sup> The extensively discussed '5 Minute Framework' holds the possibility of future implementation.

Alternatively, the RA should have 15 minute forecast for the yearly data & higher time block of 30 minute/60 minute in case of unavailability of data. In the absence of the same, most of the RA studies would be tilted to hourly forecast making it even less relevant for such studies in future, when more data over 15 minute basis may be available.

- 5. Overlapping Timelines to Conduct Tariff Determination Exercise and LT-DRAP Approval by ERCs:** Clause 3 (7) (2) states “...the plan LT-DRAP along with details for meeting the RAR of national peak for the utility may be submitted to SERC/JERC by the month of November for the period starting from the month of April in the subsequent year for their approval...” while Clause 3 (10) states “The Distribution Licensee shall submit the details of the contracted capacities for the ensuing year for meeting RAR of national peak to the respective STU/ SLDC after approval of respective SERC/JERC by the month of January”.

The timelines for approval of tariff generally starts around the end of November for most of the states. With January being the deadline of submission of LT-DRAP by discoms to their respective STU/SLDC, the Commission would likely be engaged in the approval of tariff petition and may find it challenging to undertake the process of approval in parallel. It is suggested that the process of approval of LT-DRAP should be implemented well in advance before filing of the tariff petition. This would also ensure that the tariff petition also incorporates any relevant inputs from LT-DRAP. Singh et al. (2019)<sup>8</sup> recommended that the regulatory framework would thus, for power procurement planning should adopt a separate exercise for LTDF and PPP and before the approval of ARR and tariff determination.

- 6. Uncertainty Among Discoms Due to National Level Auction Mechanism:** Clause 3 (10) states “In case of shortfall, NLDC shall either communicate the shortfall to the SERC/JERC for compliance or facilitate a national-level auction for the balance capacity with participation from distribution licensees with capacity shortfall. The contracting for the balance capacity shortfall shall be completed by the month of March prior to the start of the delivery year (1<sup>st</sup> April)...”

The shortfall in the resource adequacy plan will be notified in the month of March of the n<sup>th</sup> year whose plan is to be submitted for approval in November of (n-1)<sup>th</sup> year. By this time, the tariff petition would have already been submitted by the distribution licensees to the SERCs/JERCs. The notification of shortfall in RA by the month of March for the year beginning April may lead to a panic buy to procure ST capacity and that would adversely affect the market outcome for the distribution licensees.

- 7. Standard Terminology for Numbering of Target Year:** The detailed timeline as shown in the RA guidelines has labelled ‘n+1’ as the target year for which the forecasting is to be done. The standard terminology should be to refer the target year as ‘n’ instead of something like ‘n-1’ or ‘n+1’. The reason to avoid the use of terminology as mentioned in the document is to set other years in reference to the target year, thus adding more clarity in the understanding of the timelines.

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<sup>8</sup> Singh et al. (2019), “Regulatory Framework for long-term Demand Forecasting and Power Procurement Planning”, 2019. Centre for Energy Regulation (CER), Indian Institute of Technology Kanpur. ISBN: 978-93-5321-969-7  
[https://cer.iitk.ac.in/assets/downloads/CER\\_Monograph.pdf](https://cer.iitk.ac.in/assets/downloads/CER_Monograph.pdf)