

Overview of KERC Resource Adequacy Regulations

16.12.2024

- ▶ **The Karnataka Electricity Regulatory Commission (Framework for Resource Adequacy) Regulations, 2024**
 - ▶ In exercise of the powers conferred by section 176 of the Electricity Act, 2003 (36 of 2003), the Ministry of Power, Govt. of India, had issued **Electricity (Amendment) Rules, 2022 on 29th December, 2022.**
 - ▶ In exercise of the powers conferred under **Rule 16(1)** of above Rules, MoP, Gol, issued the '**Guidelines for Resource Adequacy Planning Framework for India**', in consultation with Central Electricity Authority on **28th June 2023.**
 - ▶ Under **Rule 16(2)** of above Rules, the State Commission has to frame **regulations on resource adequacy**, in accordance with the above said **guidelines** and the model Regulations framed by Forum of Regulators, if any.
 - ▶ The Forum of Regulators, has framed model Regulations for Resource Adequacy Framework in June 2023.
 - ▶ The Hon'ble KERC issued above Regulations vide its Notification: KERC/F-30/Vol-10/690, Bengaluru, dated **23.09.2024**, **Gazette Notification: 24.09.2024**

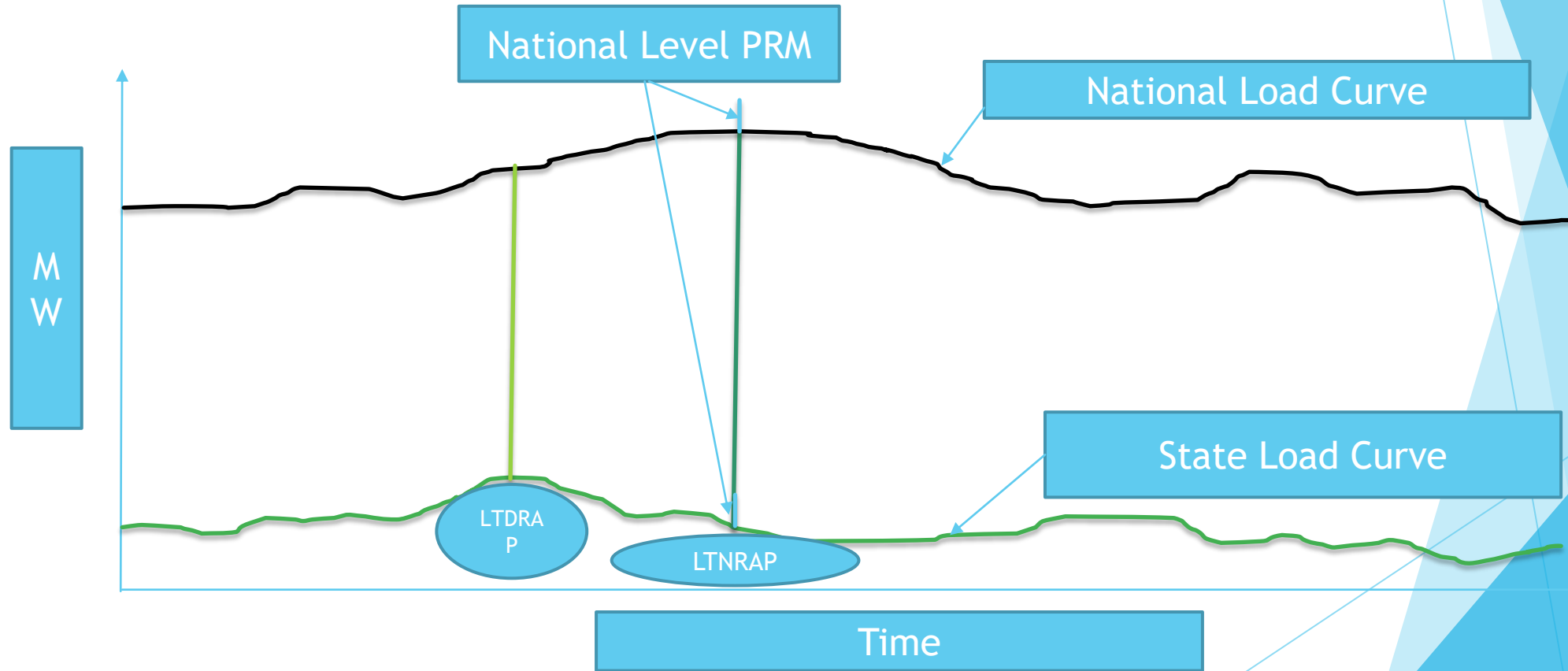
▶ Resource Adequacy Framework

Resource Adequacy framework entails the planning of generation resources for reliably meeting the projected demand in compliance with specified reliability standards for serving the load with an optimum generation mix at least cost and in secure manner.

▶ Resource Adequacy framework shall cover the following important steps:

- ▶ Demand assessment and forecasting
 - ▶ Generation resource planning
 - ▶ Power procurement planning
 - ▶ Monitoring and compliance
- ## ▶ The CEA and NLDC will be developing Long Term National Resource Adequacy Plan (LT-NRAP) for a period of 10 years and Short Term National Resource Adequacy Plant(ST-NRAP) for 1 year respectively on rolling basis in accordance with RA Guidelines issued by MoP, GOI.
- ## ▶ Similarly, the distribution licensee and SLDC respectively shall develop and prepare Long-Term Distribution Resource Adequacy Plan (LT-DRAP) and Short-Term Distribution Resource Adequacy Plan (ST-DRAP) in accordance with the conditions outlined under these Regulations.
- ## ▶ The capacity which the distribution licensees tie up shall be a judicious mix of long/medium and short term contracts to ensure security of supply to their consumers at least cost. Over reliance on the electricity market is to be avoided.

Illustration: Difference between LTNRAP and LTDRAP



▶ Demand assessment and forecasting

- ▶ Demand assessment and forecasting is an important step for Resource Adequacy assessment.
- ▶ It shall entail **at least hourly, or sub-hourly or time interval as may be notified by the Commission from time to time**, assessment and forecasts of demand within the distribution area of distribution licensee for **multiple planning horizons (short/long-term)** using comprehensive, realistic and authenticated data, policies, drivers and scientific mathematical modelling tools.
- ▶ The distribution licensee shall determine the load forecast for a customer category by adopting any of the following and/or combination of following methodologies, subject to methodologies as specified in the guidelines issued by the Authority from time to time:
 - ▶ compounded annual growth rate (CAGR);
 - ▶ end use or partial end use;
 - ▶ trend analysis;
 - ▶ Auto-regressive integrated moving average (ARIMA);
 - ▶ AI including machine learning, ANN techniques; and
 - ▶ Trend method/Time Series/Econometric methods or any state-of-the art methods (specifying the parameters used, algorithm, and source of data).

► Demand assessment and forecasting

- The **peak demand (in MW)** shall be determined by considering the **average load factor, load diversity factor, seasonal variation factors for the last three years** and the **load forecasts (in MWh) obtained**. If any other appropriate load factor is considered for future years, a detailed explanation shall be provided.
- The distribution licensee shall conduct sensitivity and probability analysis to determine the most probable demand forecast. **The distribution licensee must also develop long-term and short-term demand forecasts for possible scenarios**, while ensuring that at least three different scenarios (**most probable, business as usual, and aggressive scenarios**) are developed on a rolling basis and **submit the best suitable scenario of the above three to SLDC by 30th April of each year for the ensuing year(s)**.
- If any of the Distribution Licensee(s) do not furnish the necessary data as required under these Regulations in a time bound manner to SLDC, then in place of it, SLDC can use such necessary data available with them on behalf of the Distribution Licensee(s). The SLDC can also furnish such data to NLDC/SRLDC/CEA or any other entity under these Regulations. **Further, the Distribution Licensee(s) cannot make SLDC liable for any future consequences due to such action by the SLDC.**
- SLDC shall aggregate demand forecasts of distribution licensees considering the load diversity, congruency, seasonal variation aspects and shall submit state-level aggregate demand forecasts (MW and MWh) including break-up of State demand forecasts (MW and MWh) at different voltage levels along with corresponding losses accounted to the Authority, NLDC and SRLDC by 31st May of each year for the ensuing year(s).

▶ Generation Resource Adequacy Plan

- ▶ **Methodology of preparation of Resource Adequacy Plan:**
- ▶ Planning Reserve Margin as prescribed by CEA (National Level PRM) or such higher planning reserve margin determined by the distribution licensee, subject to maximum limit of optimal PRM and approved/ or specified by the Commission (State Level PRM).
 - ▶ $\text{RAR} = \text{contribution to forecasted national peak demand in GW} * (1 + \text{National level PRM})$
- ▶ Actual demand met by the State / distribution licensee in granular time block resolutions (hourly) for last 5 years.
- ▶ Estimated load growth during the planning period.
- ▶ **Technical parameters of conventional generation plants viz.** Name of plant, location (State/Region), Capacity (MW) (for existing and planned capacities), Auxiliary Consumption (MW), **Maximum and Minimum Generation Limits (MW)**, Ramp Up and Ramp Down Rate (MW/min), Minimum up and down time, Plant Availability Factor (% of time), etc.

▶ **Generation Resource Adequacy Plan**

- ▶ **Methodology of preparation of Resource Adequacy Plan:**
- ▶ Under-construction capacity/retirement of generation capacity/contracted capacity/bilateral contracts, including status of Fuel Supply Agreement, **Associated Transmission Facilities**, wherever applicable and **timelines for completion of the project.**
- ▶ Potential investment options, technologies, gestation periods and lifetime of different assets.
- ▶ Capacities and generation profile of renewable generation.
- ▶ Capital costs, variable costs, O&M costs, reserve offers, start up and shut down Cost of generators, etc.
- ▶ **Historical forced outage rates and planned maintenance rates of generation capacities.**
- ▶ **Tie line details and transmission and distribution expansion plans including Transmission/Distribution Sub-Stations/line Constraints.**
- ▶ Spinning reserve requirements.
- ▶ Renewable Purchase Obligation (RPO), Energy Storage Obligation targets, etc.

▶ Generation Resource Adequacy Plan

- ▶ **Capacity Crediting of Generation Resources and Calculation of Firm Capacity:**
- ▶ Following are the various methodologies to determine capacity credits of Renewable energy adopted internationally:
- ▶ **Capacity credit approximation with Top Demand Hours:** In this case, a basic approximation of capacity credit can be obtained by **averaging the historical contribution of a generator / generator class during peak demand hours**. The selection of how many peak demand hours to include, however, often varies across geographies.
- ▶ **Capacity credit approximation with Top Net Load Hours:** In this case, consideration is given to the fact that **periods of system stress occur when high demand coincides with low renewable energy generation**. A metric called 'net load' is defined as 'total renewable energy generation subtracted from overall demand', which must be met from dispatchable resources like thermal plants, hydro plants, etc. **Due to system stress caused by the duck curve, net load is a better proxy for system stress for new capacities than peak demand**. In this method, capacity credit can be obtained by averaging the contribution of a generator / generator class during top net load hours.
- ▶ **Expected Load carrying capability:** In this method, a model uses an hourly time-series demand data for a particular period. The model also uses the availability of different generation resources in each hour of the year. Random outages of generators are also applied considering the historical and expected outage conditions. Determine supply matching is used to determine the LOLP of the system.

► Generation Resource Adequacy Plan

► Calculation of Firm Capacity:

- The calculation of firm capacity to meet the Resource Adequacy Requirement (RAR) is shown below:

$$\begin{aligned} \text{RAR} = & \sum_{i=1}^{\text{num_solar}} \text{Solar_Capacity} * \text{Solar_Capacity_Credit} \\ & + \sum_{i=1}^{\text{num_wind}} \text{Wind_Capacity} * \text{Wind_Capacity_Credit} \\ & + \sum_{i=1}^{\text{num_hydro}} \text{Hydro_Capacity} * \text{Hydro_Capacity_Credit} \\ & + \sum_{i=1}^{\text{num_thermal}} \text{Thermal_Capacity} * \text{Thermal_Capacity_Credit} \\ & + \sum_{i=1}^{\text{num_nuclear}} \text{Nuclear_Capacity} * \text{Nuclear_Capacity_Credit} \\ & + \sum_{i=1}^{\text{num_storage}} \text{Storage_Capacity} * \text{Storage_Capacity_Credit} \\ & + \sum_{i=1}^{\text{num_other}} \text{Other Resource_Capacity} * \text{Other Resource_Capacity_Credit} \\ & + \sum_{i=1}^{\text{num_other}} \text{Import_limit} * \text{capacity_credit} \end{aligned}$$

▶ **Generation Resource Adequacy Plan**

- ▶ **Ascertaining Resource Adequacy Requirement and its Allocation for Control Area:**
- ▶ **The reports of LT-NRAP and ST-NRAP** as published respectively by Authority and NLDC by **31st July of every year**, in line with CEA RA Guidelines, for the period starting from the month of April in the subsequent year, specifies the following:
- ▶ **The report of LT-NRAP, published by Authority:**
 - ▶ The National level PRM as a guidance for the States/UTs to consider while undertaking their RA exercises.
 - ▶ The Optimal Generation mix for the next 10 years required to ensure that the national-level system is RA compliant while meeting the All-India demand at least-cost. This shall guide capacity buildout investments in the country.
 - ▶ The capacity credits for different resource types on a regional basis.
 - ▶ Each State/UT's contribution towards national peak (peak contribution).
- ▶ **The report of ST-NRAP published by NLDC:**
 - ▶ The parameters such as demand forecasts, resource availability based on under-construction status of new projects, planned maintenance schedules of existing stations, station-wise historic forced outage rates and decommissioning plans.

▶ Generation Resource Adequacy Plan

- ▶ **Ascertaining Resource Adequacy Requirement and its Allocation for Control Area:**
- ▶ The SLDC shall allocate each distribution licensee's share in the national peak within 15 days of the publication of LT-NRAP.
- ▶ Based on the share in national peak provided in LT-NRAP, each distribution licensee shall plan to contract the capacities (peak contribution * (1+National level PRM)) to meet their Resource Adequacy Requirement (RAR) at the time of national peak.
- ▶ The distribution licensees shall demonstrate to the Commission 100% tie-up for the first year and a minimum 90% tie-up for the second year to meet the requirement of their contribution towards meeting national peak. Only resources with long / medium / short-term contracts shall be considered to contribute to the RAR.
- ▶ Further, Each Distribution licensee shall undertake a Resource Adequacy Plan (RAP) for a 10-year horizon (Long-term Distribution Licensee Resource Adequacy Plan (LT-DRAP)) to meet their own peak and electrical energy requirement. The plan shall be vetted/validated by the Authority for leveraging the benefit of national level optimization for the Distribution licensees. The LT-DRAP shall be undertaken as per the methodology outlined in these Regulations.

▶ Generation Resource Adequacy Plan

- ▶ Ascertaining Resource Adequacy Requirement and its Allocation for Control Area:
- ▶ Distribution licensees, through the LT-DRAP, shall also demonstrate to the Commission, 100% tie-up for the first year and a minimum 90% tie-up for the second year to meet the requirement of their peak demand and energy requirement, subject to adequately addressing the demand and supply variations/to meet the prescribed standard of LOLP/NENS conditions as stipulated by the Authority/Commission from time to time, with a mix of long-term, medium-term and short-term contracts, including power exchanges.
- ▶ Distribution licensees shall demonstrate to the Commission, 100% tie-up to meet the requirement of peak demand and energy requirement for the entire control period for which application for determination of retail supply tariff shall be made before the Commission under KERC (Multi Year Transmission, Distribution and Retail Supply Tariff) Regulations, 2024 and its amendments from time to time, subject to other constraints in meeting the peak demand and energy requirement.
- ▶ For subsequent years of the planning horizon, distribution licensees shall demonstrate their plans to contract existing capacities and plans to build or contract future capacity.
- ▶ Keeping reliability and cost economics, the Commission from time to time by an order can prescribe 'State Level PRM' by itself and same needs to be considered by the SLDC/distribution licensees w.r.t their peak demand and energy requirement.

▶ Generation Resource Adequacy Plan

- ▶ **Ascertaining Resource Adequacy Requirement and its Allocation for Control Area:**
- ▶ The share of long-term contracts in the entire mix of the contracts of the distribution licensees/utility shall be atleast the maximum of the quantum of long term contracts determined for meeting RAR of national peak and quantum obtained from LT-DRAP for fulfilling own energy and peak requirement.
- ▶ The **Distribution Licensee** shall submit the details of the contracted capacities for the ensuing year for meeting RAR of national peak to the SLDC after approval of the Commission by **31st January of each year**.
- ▶ The **SLDC** shall **aggregate** the total contracted capacities at the state level and submit the information to the SRLDC by **15th February** of each year.
- ▶ The **SRLDC** will be **aggregating** the capacities at the regional level and will be submitting the information to the NLDC by **28th of February** of each year.
- ▶ NLDC will be aggregating the capacities at the national level and check compliance with ST-NRAP and identify shortfall **for the ensuing year**, if any.
- ▶ In case of shortfall, NLDC will either communicate the shortfall to the Commission for compliance by distribution licensees or facilitate a national-level auction for the balance capacity with participation from distribution licensees with capacity shortfall.

▶ Generation Resource Adequacy Plan

- ▶ Ascertaining Resource Adequacy Requirement and its Allocation for Control Area:
- ▶ The contracting for the balance capacity shortfall shall be completed by the month of March prior to the start of the delivery year (1st April). The procedure notified by NLDC shall be adopted by the distribution licensees to participate in the national level auction for the procurement of the balance capacity.
- ▶ In similar lines with ST-NRAP, the SLDC shall prepare one-year look ahead ST-DRAP, on an annual basis for operational planning, at the state level based on the LT-DRAP study results.
- ▶ The SLDC shall aggregate the capacities at the State level and check compliance with ST-DRAP and identify shortfall for the ensuing year, if any. In case of shortfall, SLDC will communicate the shortfall to the distribution licensees for compliance.
- ▶ Further, the SLDC shall review the ST-DRAP on a daily, weekly, monthly and quarterly basis based on actual availability of generation resources and coordinate with the distribution licensees for compliance.

▶ Power Procurement Planning

- ▶ Procurement planning shall consist of:
 - ▶ determining the optimal power procurement resource mix,
 - ▶ deciding on the modalities of procurement type and tenure, and
 - ▶ engaging in the capacity trading or sharing to minimize risk of resource shortfall and to maximize rewards of avoiding stranded capacity or contracted generation.
- ▶ Procurement of Resource Mix
 - ▶ The distribution licensee in its power procurement strategy shall identify an optimal procurement of generation resource mix to enable smooth RE integration in its portfolio of power procurement resource options while meeting reliability standards.
 - ▶ The distribution licensee must ensure that procurement process for the projected demand is undertaken and completed sufficiently in advance so that the procured capacity becomes available when it is required to serve the projected load.

► Power Procurement Planning

The following table gives the number of years before which procurement process must be completed in advance as compared to the year of projected requirement for various types of generation and types of procurement:

Resource	Long Term	Medium Term
Coal/Lignite based Capacity	7	2
Hydro	9	2
Solar	2	1
Wind	3	1
PSP	5	3
Other Storage	2	1
Nuclear	9	3

► Special Provisions

- In case uniform tariff at the State level/among a set of distribution licensees in a State is a necessity and due to which resource adequacy plan at the distribution licensee level couldn't be implemented in terms of these Regulations, then with the approval of the Commission and the Authority, such Distribution licensees in combination through their special purpose vehicle, designated for the purpose can opt for Resource Adequacy plan at the State level/as a combination among them, subject to all other terms and conditions of these Regulations.

▶ Generation Resource Adequacy Plan

▶ Resource Adequacy Implementation Timeline

- ▶ **30th April:** Distribution licensees shall submit demand forecasts to SLDC by 30th April of each year for the ensuring year(s) along with requisite information/details.
- ▶ **31st May:** The SLDC, on behalf of the distribution licensees in the State shall provide to Authority, NLDC and SRLDC by 31st May every year, the details regarding demand forecasts (peak and energy requirement) for the next 10 years, assessment of existing generation resources and such other details as may be required for LT-NRAP and ST-NRAP.
- ▶ **31st July:** Publishing of LT-NRAP and ST-NRAP respectively by Authority and NLDC by 31st July for the period starting from the month of April in the subsequent year.
- ▶ **30th September:** The distribution licensees shall formulate their LT-DRAP and submit their resource adequacy plans to CEA by 30th September for the period starting from the month of April in the subsequent year for its vetting/validation.
- ▶ **30th November:** After being vetted by CEA, the LT-DRAP along with details for meeting the RAR of national peak for the Distribution licensee/utility and its own peak and energy requirement shall be submitted to the Commission by the Distribution licensee(s) by 30th November for the period starting from the month of April in the subsequent year for approval.

▶ Generation Resource Adequacy Plan

▶ Resource Adequacy Implementation Timeline

- ▶ **31st December:** The Commission shall approve the Distribution licensee(s) contracting plan for coincident peak contribution and to meet their own energy and peak by 31st December of each year for the period starting from the month of April in the subsequent year.
- ▶ **31st January:** The Distribution Licensee by 31st January shall submit the details of the contracted capacities for the ensuing year for meeting RAR of national peak to the SLDC after approval of the Commission.
- ▶ **15th February:** The SLDC shall aggregate the total contracted capacities at the state level and submit the information to the SRLDC by 15th February.
- ▶ **28th February:** SRLDC shall aggregate the capacities at the regional level and submit the information to the NLDC by 28th February.
- ▶ **March:** In case of shortfall, NLDC communication to the Commission on shortfall for compliance or NLDC will 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 (1st April).

▶ Monitoring and Compliance

- ▶ **Monitoring and Reporting:** The distribution licensees, SLDC, Utilities shall abide by the timelines, procedure and methodology specified under these Regulations. **The SLDC should monitor the entire process and shall submit monthly compliance to the Commission.**
- ▶ **Treatment for shortfall in RA Compliance:** Distribution licensees shall comply with the RA requirement and in case of non-compliance, non-compliance charges equivalent to Marginal Capacity Charge (Rs/kW/month) or 1.25 times the Average Capacity Charge (Rs/kW/month) whichever is higher for the power procurement by concerned distribution licensee under its APR/Tariff Order for the relevant financial year is applicable for the shortfall in RA compliance, shall be disallowed by the Commission in its APR and same shall not be claimed for recovery by distribution licensees in future in any manner including through its future ARR/APRs.

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Thank You