



Resource Adequacy Reform Program Calibration

August 17, 2022 RA Reform Implementation Workshop (R. 21-10-002)

NP Energy on behalf of the Natural Resources Defense Council



Disclaimer: This presentation is offered for policy development and discussion purposes only. Formal positions offered by NRDC within the proceeding may evolve through the stakeholder process.

Key Takeaways

The Slice of Day Resource Adequacy framework should be calibrated to deliver the portfolio of resources that has been assessed as reliable through a Loss of Load Expectation (LOLE) study.

➤ ***LOLE Study as the Analytical Foundation***

- A stochastic LOLE study must be performed to determine the portfolio of resources necessary to meet a specific reliability threshold, e.g. 0.1 LOLE.

➤ ***Translate Study to Compliance Requirement through Counting Rules***

- Counting rules and the compliance requirement (MW or PRM) must align to require LSEs to show, at minimum, the portfolio tested through the LOLE analysis.

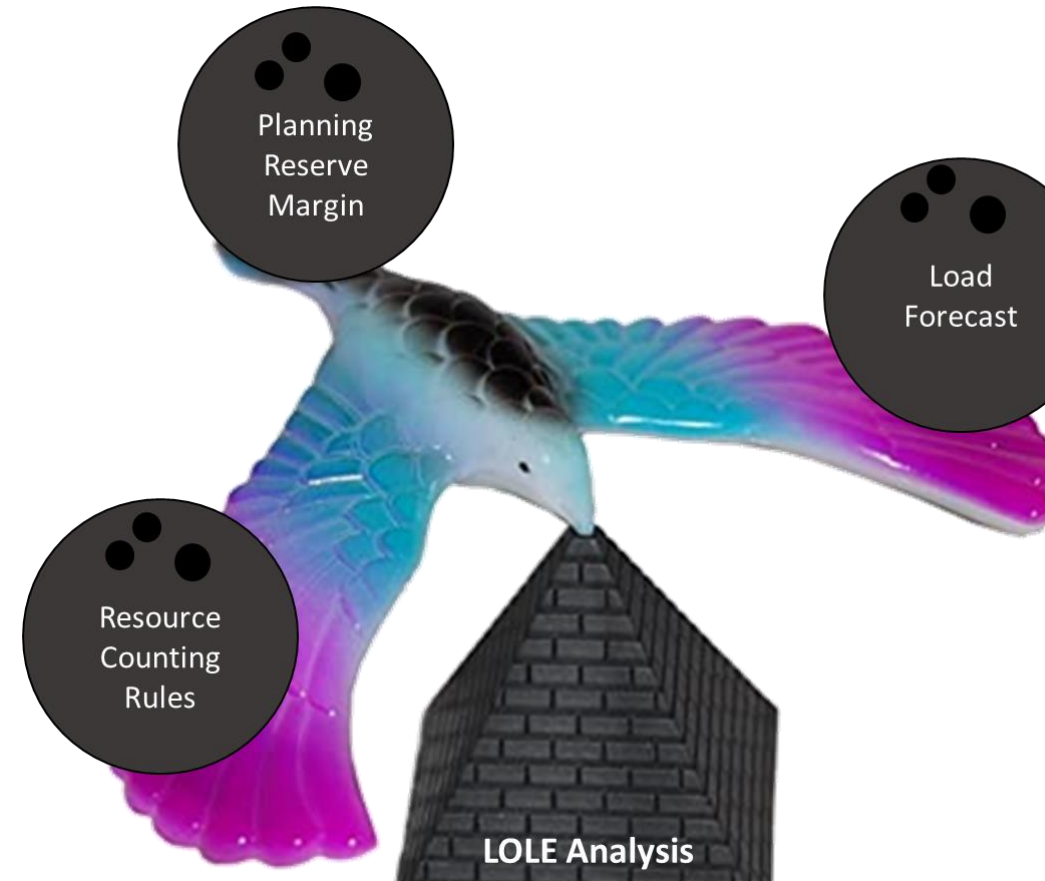
➤ ***Accuracy and Precision in Rules Improve Durability and Reliability***

- Improving alignment between counting rules and “reality” reduces year-to-year recalibration impacts and addresses reliability gaps from resource substitution

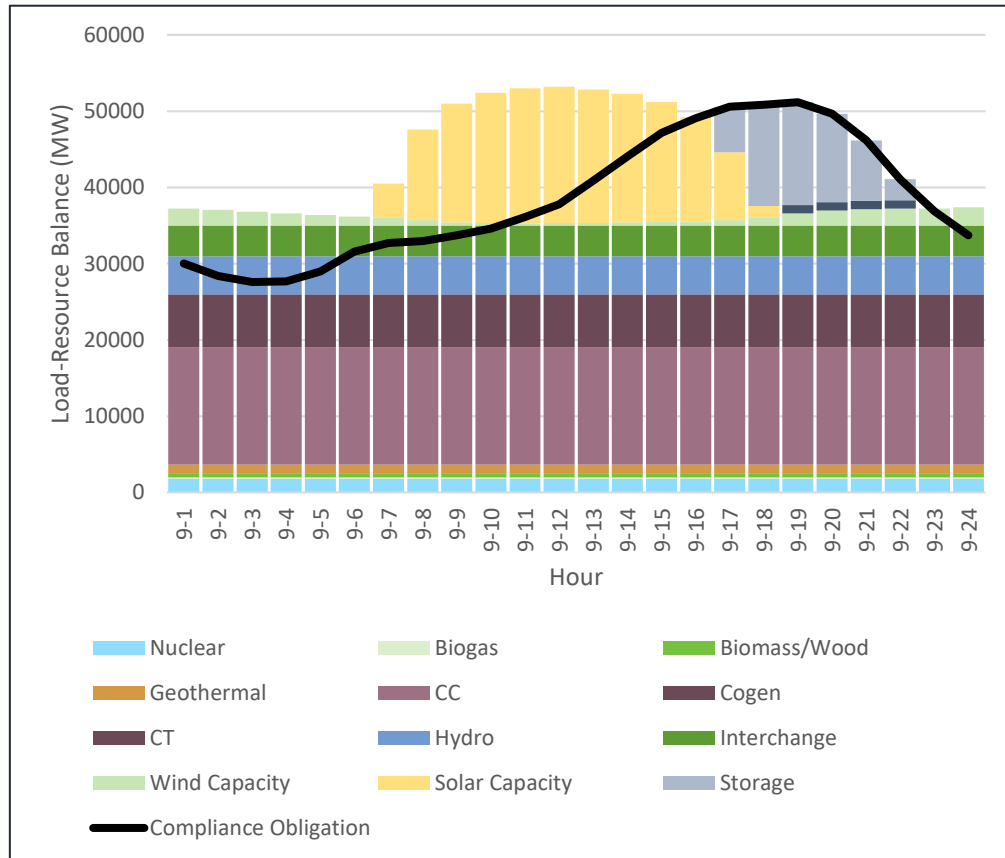
NRDC’s calibration proposal and tool are available in its [comments on the Future of Resource Adequacy Working Group Report](#) (served 3/24/22)

Calibration Background: Balancing Inputs

- **Focus on the Portfolio:** Resource Adequacy calibration is a balancing act of PRM, resource counting, and the selected load forecast to maintain the same base portfolio:
 - Adopting a 1-in-10 load forecast (higher peak load) would result in a lower PRM
 - Adopting UCAP (lower resource counting) would result in a lower PRM
 - Adopting a 50% exceedance for wind in lieu of a 60% exceedance (higher resource counting) would result in a higher PRM
- **PRM is Just a Number:** The numerical value of the PRM (5%, 10%, 15%, 20%) *does not matter* as long as it works in tandem with counting rules and load forecast to result in the same *reliable portfolio* as tested in the LOLE study

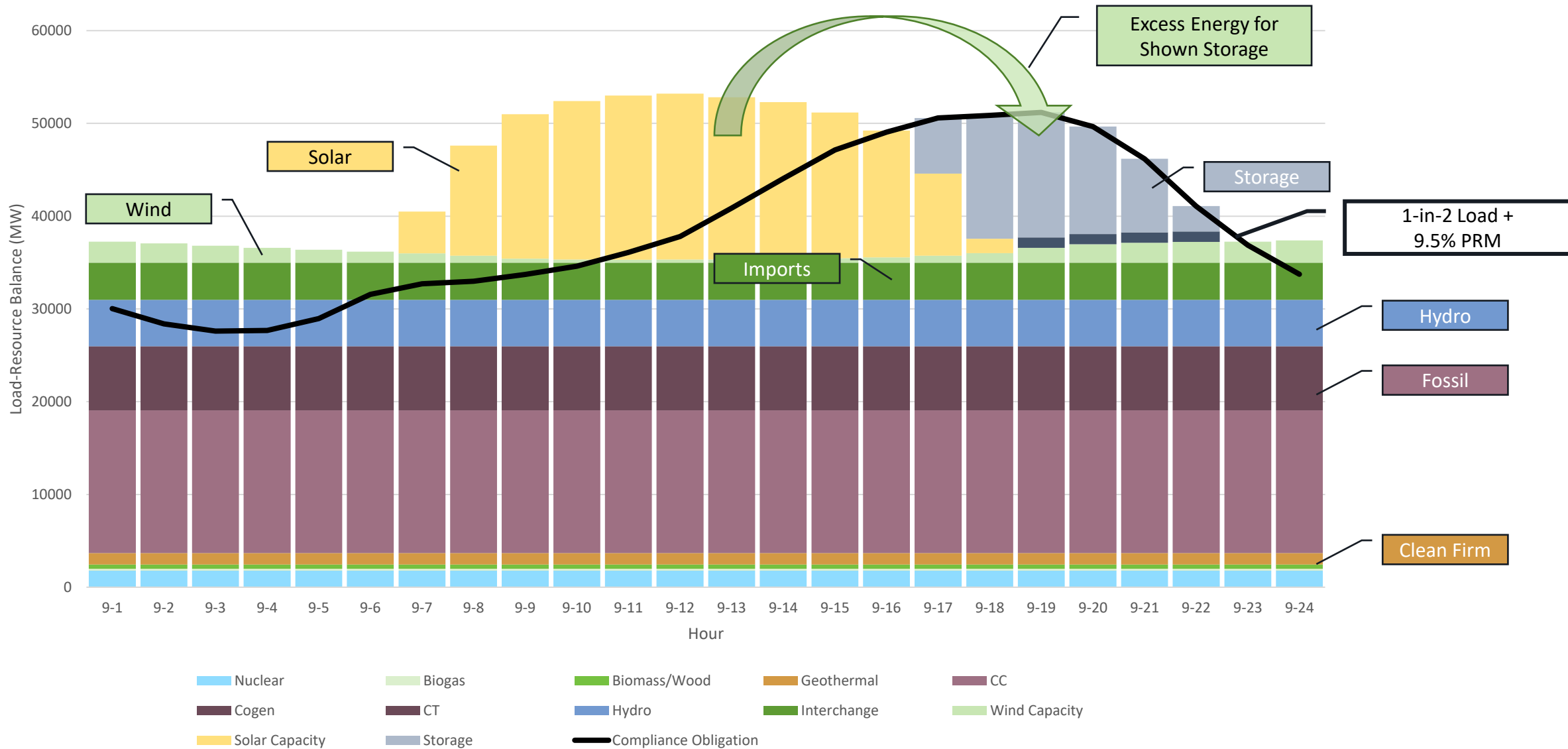


Calibration: Getting the PRM “Just Right”



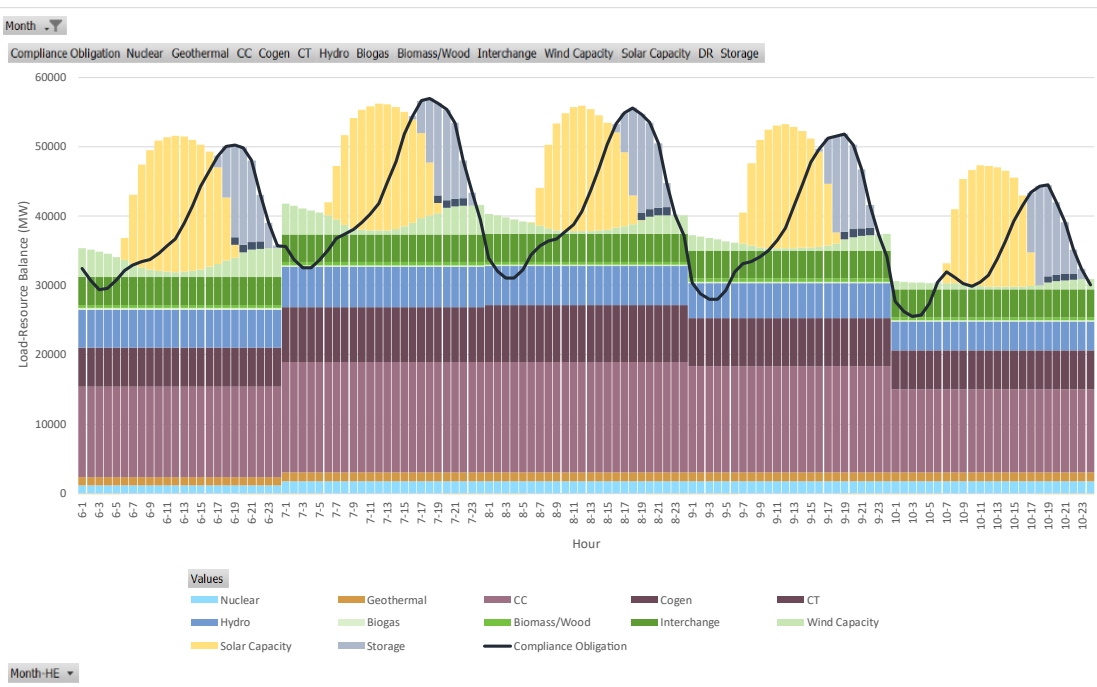
- “Calibrating the PRM” means setting the PRM at a level that requires all resources identified in the LOLE study to be shown to be in compliance
 - **Too High:** Above this PRM threshold, compliance would require additional resources beyond the portfolio
 - **Too Low:** Below this PRM threshold, compliance could exclude resources identified as necessary in the portfolio
- Explicit representation of hourly needs supports better substitutability – divergence from the tested portfolio requires replacement with resources with similar attributes
- The PRM impacts all hours proportionally – using a load profile that better matches the load shape on stressed grid days (e.g. 1-in-10) would produce better hourly results

The Hourly Framework: September 2024, LOLE Study Baseline Portfolio



NRDC's Calibration Tool – Monthly PRM Results

- NRDC's tool provides monthly results consistent with the monthly LOLE study
- As noted by various parties, monthly portfolios (which remove many resources expected to be available) can produce odd results
- Regardless of technical process, the PRM should be informed by good judgment:
 - Does this result in a reasonable showing for a given month?
 - Does this result significantly over/under-state reliability requirements for a given month?
 - *These questions are much harder to get right with a single annual PRM.*
- Load profiles, resource counting, and portfolio will vary by month; unlikely to scale proportionally with single PRM across all months



Illustrative Monthly PRM Calibration (June-October)

Next Steps / Outstanding Issues

- **Finalize LOLE Study:** Update LOLE study based on stakeholder concerns, updated portfolio, etc
- **Monthly/Annual:** Resolve process for addressing reliability needs at the monthly level (monthly v annual PRM)
- **Resolve Counting Rules:** Finalize counting methods for PRM calibration (exceedance process, fossil limitations, etc)
- **Populate Data:** Integrate LOLE study portfolio with counting and showing rules
- **Sanity Check:** Does the final result provide a reasonable and sufficient representation of operational needs across different months/hours?



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Appendix Slides

Directional Impacts to PRM from “Error”

$\Delta\text{PRM} \uparrow$ (PRM Increases If):

- Overcount capacity in constrained hours
- Overcount energy (excess capacity) in energy-constrained months
- Undercount load, reserves, other contingencies

$\Delta\text{PRM} \downarrow$ (PRM Decreases If):

- Undercount capacity in constrained hours
- Undercount energy (excess capacity) in energy-constrained months
- Overcount load, reserves, other contingencies

$\Delta\text{PRM} \emptyset$ (No Change in PRM If):

- Error in capacity counting in unconstrained hours
- Error in energy counting in energy unconstrained months
- Error in load shape / magnitude in unconstrained hours

Parallelism: Operations, Simulations, Compliance

CAISO Market Operations



“Reality”

Operates System

- Operational, high-resolution
- Historical data serves as basis for all modeling and compliance rules
- Historical data may or may not reflect future weather, resource performance, etc

LOLE Modeling



Simulation

Determines Reliability Risks / Needs

- Stochastic, medium-resolution
- Simplified but pressure-tested
- Simulated data serves as basis for reliability needs and informs compliance rules
- No competitive dynamics

RA Compliance Rules



Compliance

Governs Bilateral Marketplace

- Deterministic, low-resolution
- Heavily simplified
- Must address competitive dynamics for market participants with *private economic incentives* rather than *social reliability incentives*

Assumptions Flow Left to Right

Parallelism: Operations, Simulations, Compliance

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Only MOO Flows from Right to Left

Assumptions in simulation and compliance space do not affect resource availability or dispatch in operations space.

Assumptions Flow Left to Right

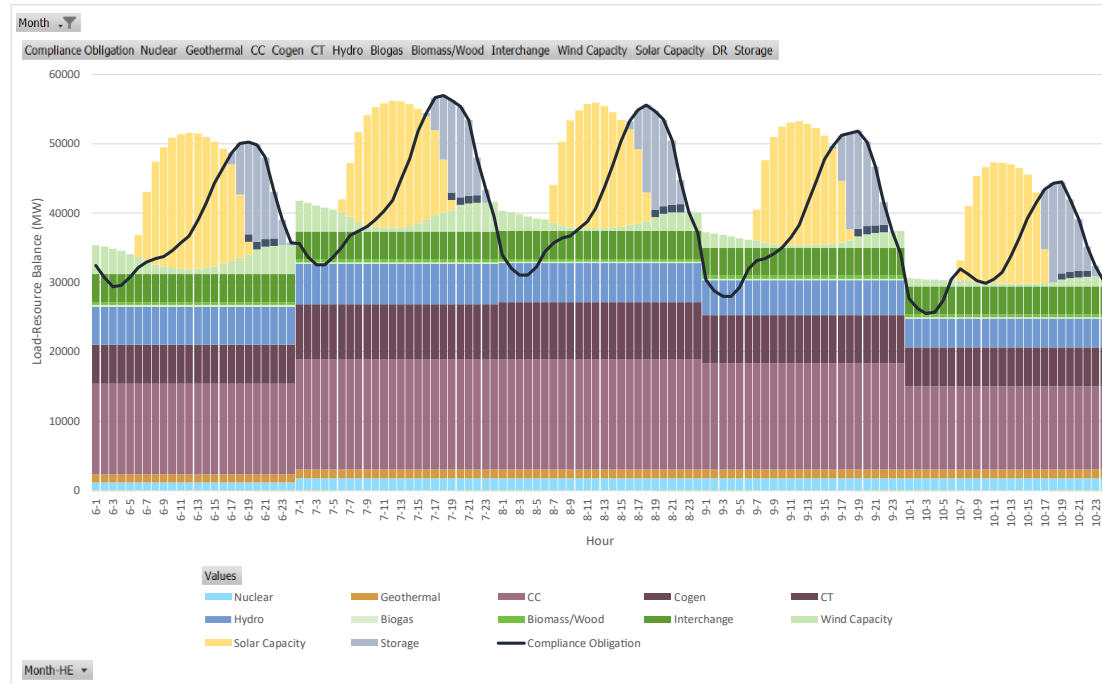
Resource Counting Comparative – Storage Example

Assumption	Current Framework (ELCC)	Slice of Day	Difference
Portfolio Reliability Analysis	Tested in LOLE Model	Tested in LOLE Model	No Change
LOLE Modeled Charge/Discharge	Optimized with Perfect Foresight	Optimized with Perfect Foresight	No Change
Shape in Showing	LSE does not indicate shape but constrained by MCC	Shaped to LSE requirement in lieu of MCC	LSE excess / deficiency replaces MCC
Energy Sufficiency Test	Tested in ELCC analysis, but may be shown w/o energy resources used by ELCC model	LSE required to bring sufficient energy resources to charge storage	Addition of explicit energy sufficiency test
Market Operations	Governed by CAISO MOO Rules, Not Compliance Assumptions	Governed by CAISO MOO Rules, Not Compliance Assumptions	No Change
Outages	Tested w/in LOLE study and reflected in ELCC	Tested w/in LOLE study and reflected in UCAP or similar (backstopped by PRM)	Shift from ELCC to UCAP for storage
Divergence from Modeled Portfolio	Divergence from LOLE tested portfolio does not “refresh” ELCC values	Divergence from LOLE tested portfolio does not “refresh” counting rules, but explicit representation of hours constrains replacement resources	Requires portfolio divergence to replace resources with similar attributes (e.g. can’t substitute solar for storage)

Why Explicit Representation Matters – Supply Chain Disruptions Example:

- Under the current structure, if a significant share of modeled storage does not materialize in the month-ahead time-frame, solar showings will be overvalued based on an ELCC calculated with higher storage assumptions, resulting in an under-reliable portfolio.
- Under Slice of Day, the “missing storage” must be replaced with resources capable of providing similar attributes – peak hour production – for LSEs to remain in compliance.

NRDC Calibration Tool Constraints



PRM Tool Optimization: $\text{Max } \sum_{m=1}^{12} PRM_m$

Subject To:

Compliance Constraints:

- **Capacity Sufficiency:** Shown Capacity_{m,h} > Capacity Requirement_{m,h}
- **Energy Sufficiency:** Shown Capacity_{m,h} - Capacity Requirement_{m,h} > $(\sum_h \text{Modeled Storage Dispatch}_m) \times \text{Loss Parameter}$

Storage Allocation Constraints:

- **Storage Limitation (MW):** Shown Storage Capacity_{m,h} > Modeled Storage Dispatch_{m,h}
- **Storage Limitation (MWh):** $\sum_h \text{Shown Storage Capacity}_m > \sum_h \text{Modeled Storage Dispatch}_m$