# Adequacy Challenges for Emerging Systems

## Seminario ISCI

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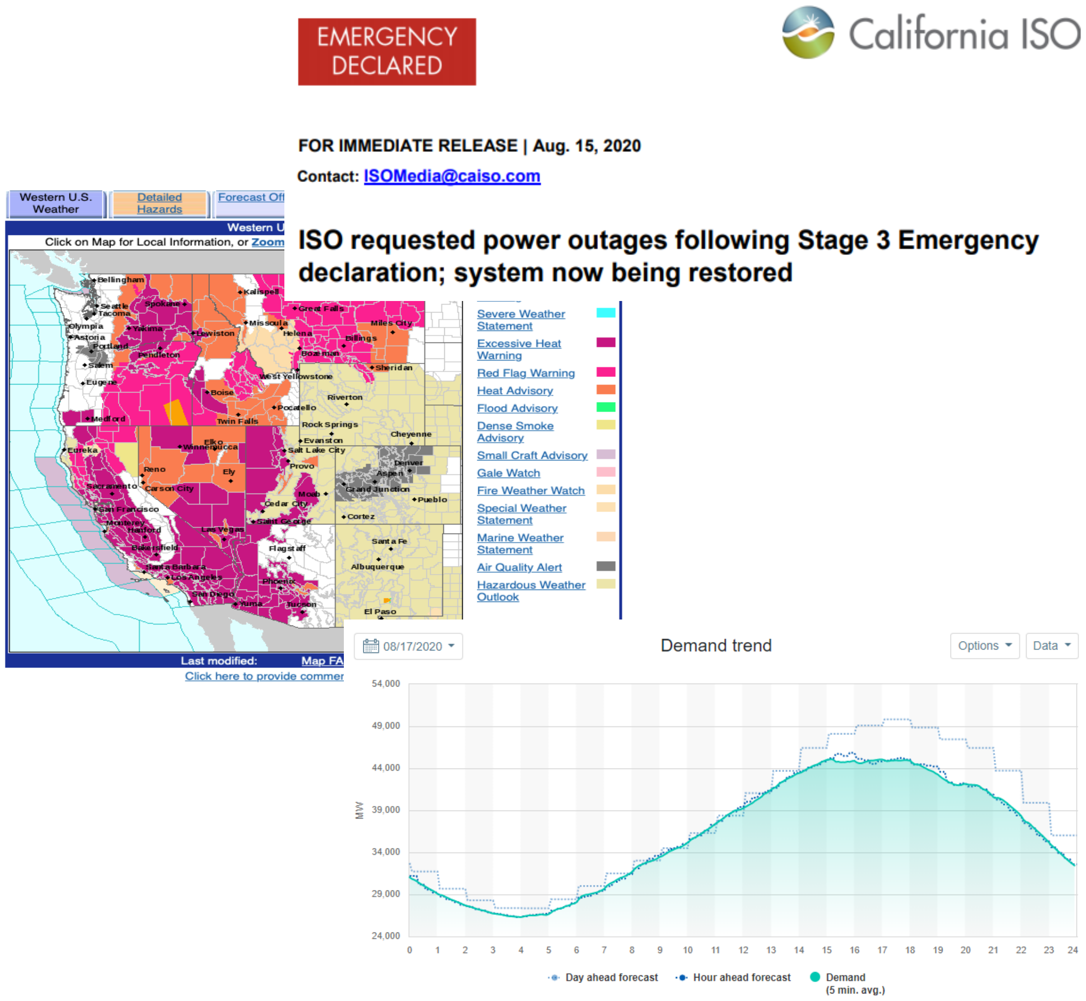
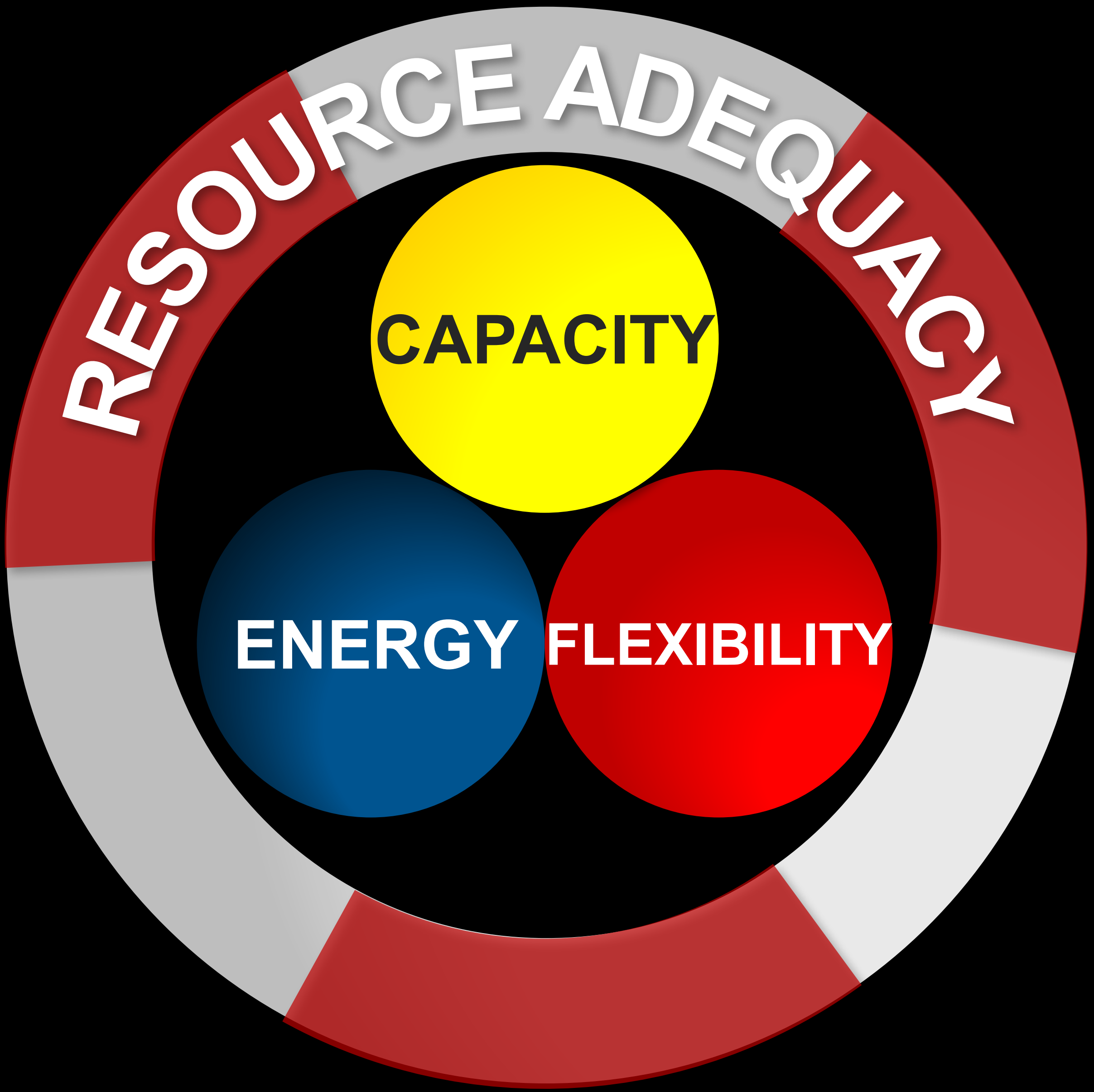
# Recent Load Shedding Events

- **Recent load shedding in California during widespread hot weather in the West. Various factors likely contributed:**
  - Loss of generating units on the day
  - Low imports/hydro
  - Generation derating/outages
  - Weather & COVID-19 impacts
  - Other potential risks – full story being investigated by CAISO



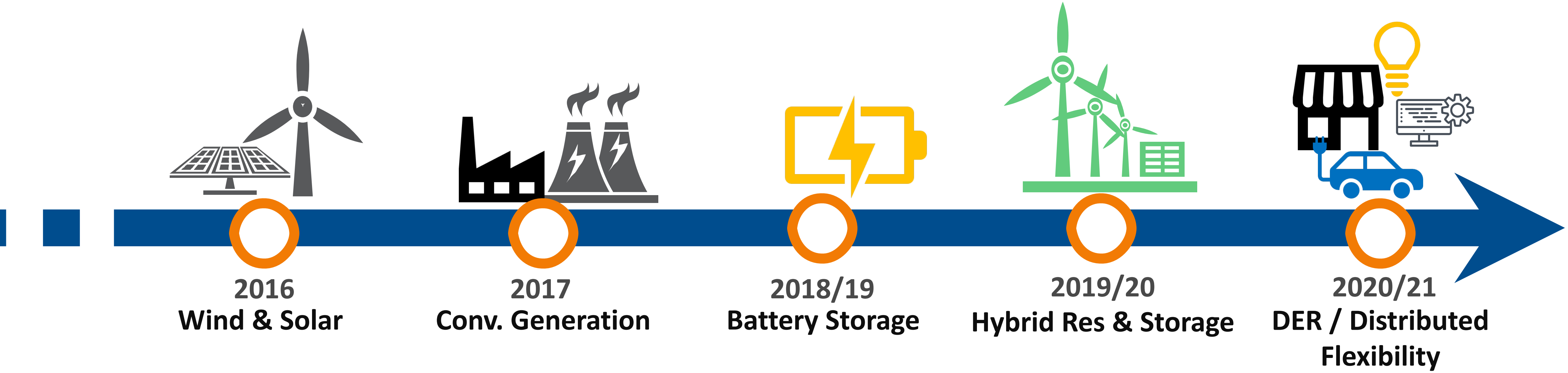

- **Significant interest in this, especially given high solar and wind penetration in CAISO**
  - Initial indications were renewables performed as expected
  - Demand response (voluntary) seemed to help in days after

**Details are still being examined - confluence of events seems to have resulted in load shedding**

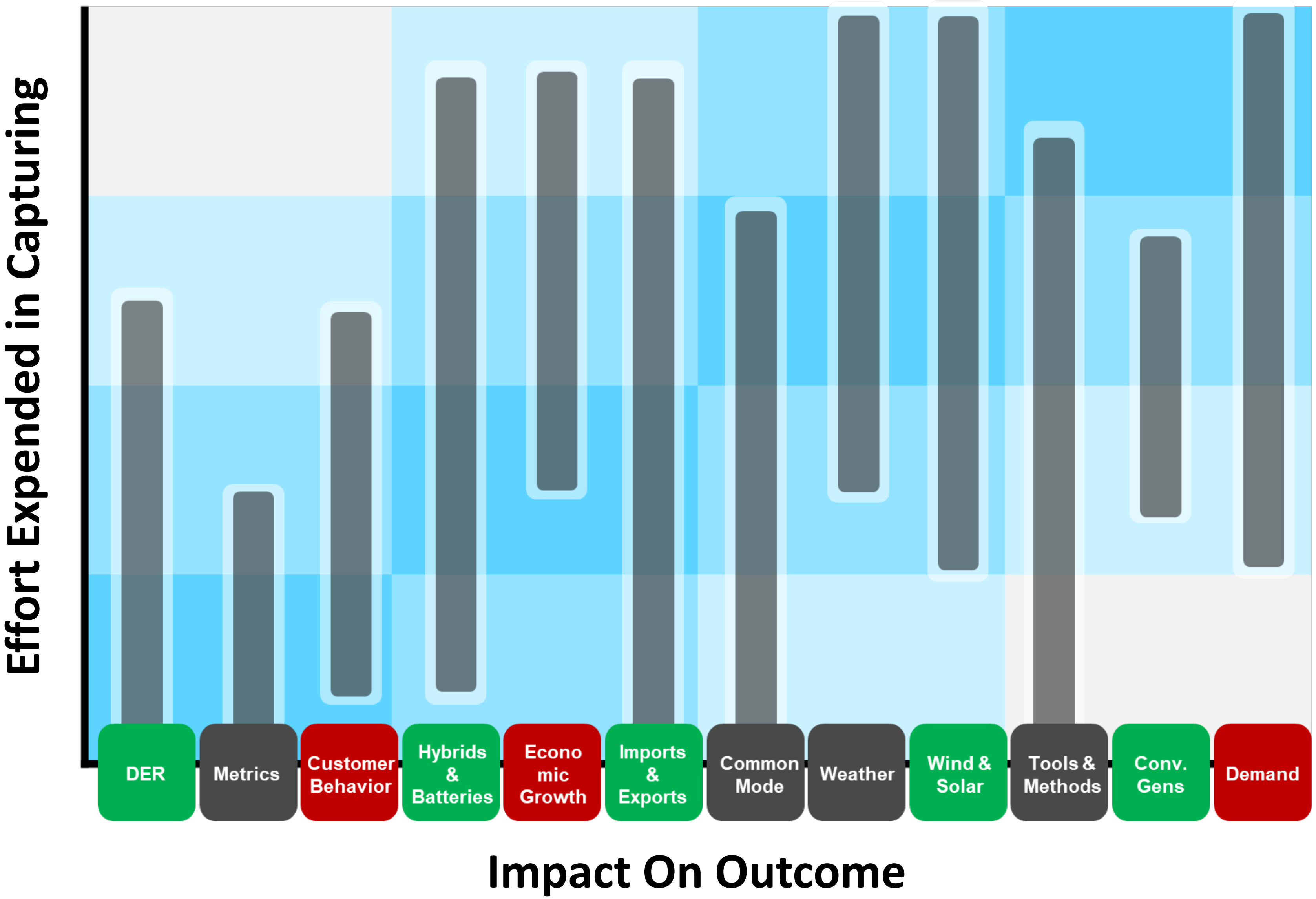

RESOURCE ADEQUACY
CAPACITY
ENERGY
FLEXIBILITY

# EPRI Resource Adequacy Action Plan

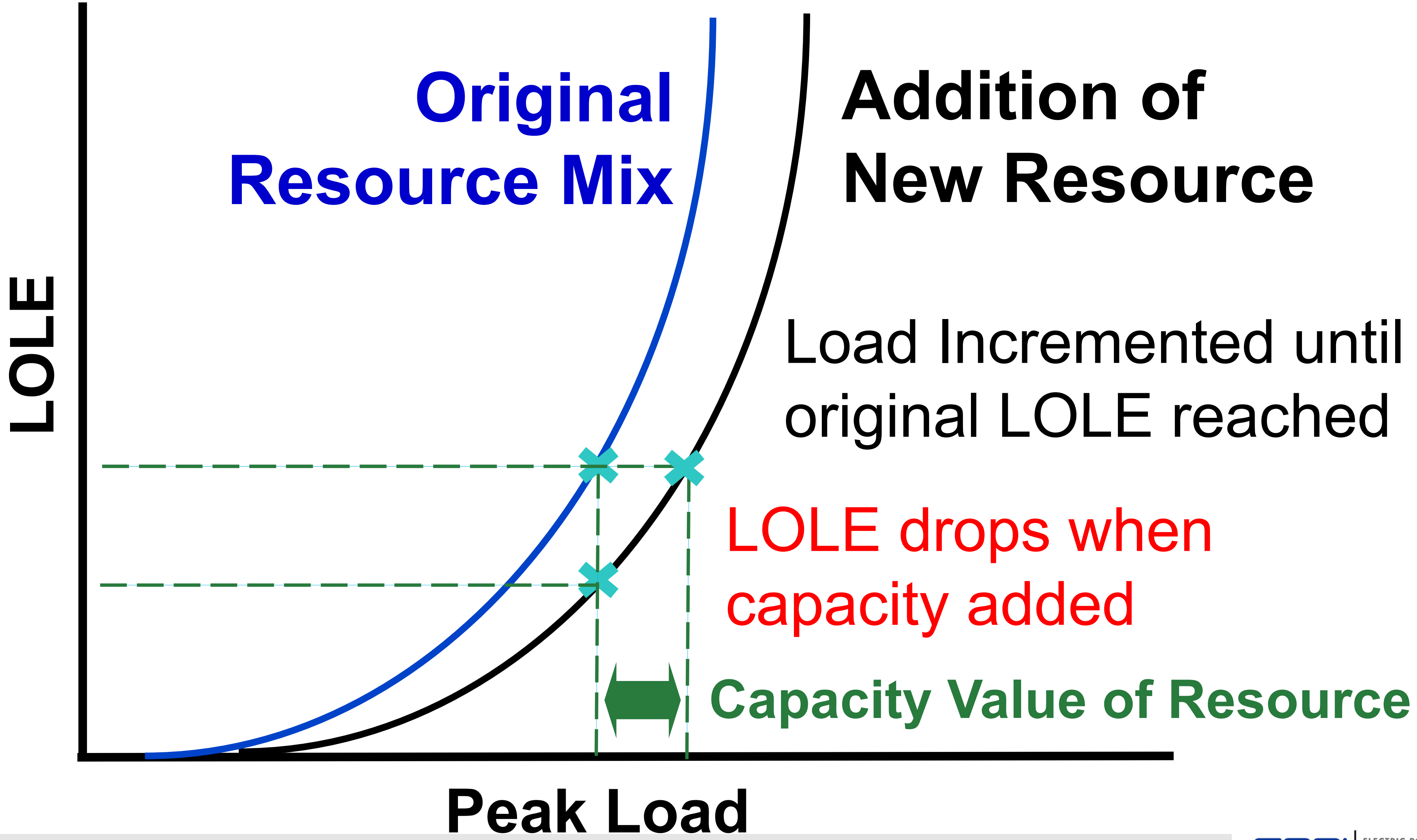
5 TOPICS

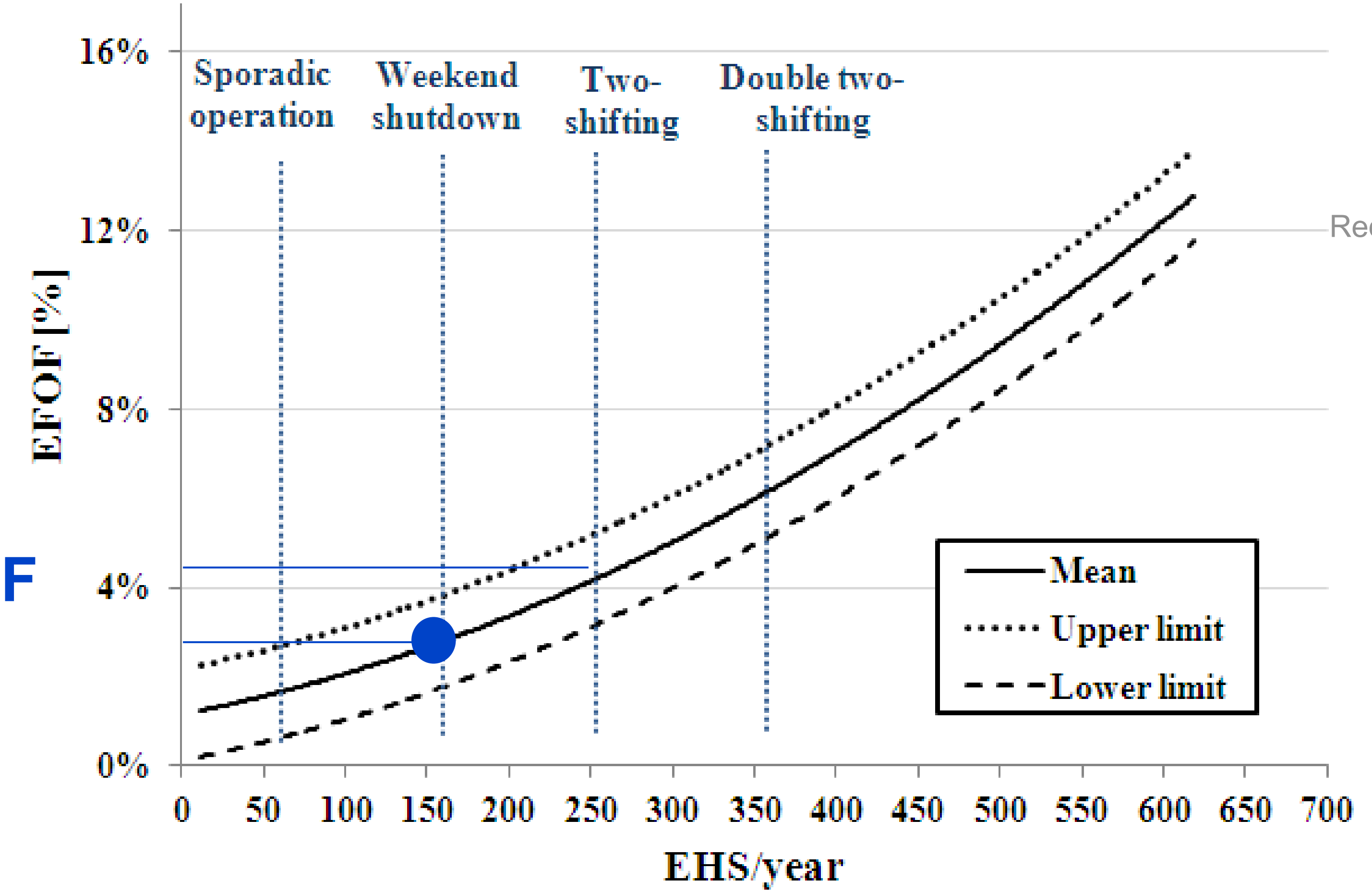

Effort Expended in Capturing
DER
Metrics
Customer Behavior
Hybrids & Batteries
Econo mic Growth
Imports & Exports
Common Mode
Weather
Wind & Solar
Tools & Methods
Conv. Gens
Demand
Impact On Outcome

# Loss of Load Expectation & Capacity Value



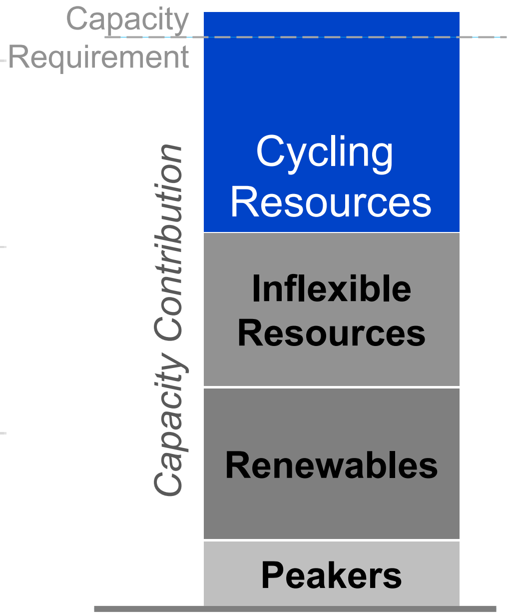

 

# Generator Cycling
## Impact of cycling on EFOR in resource adequacy

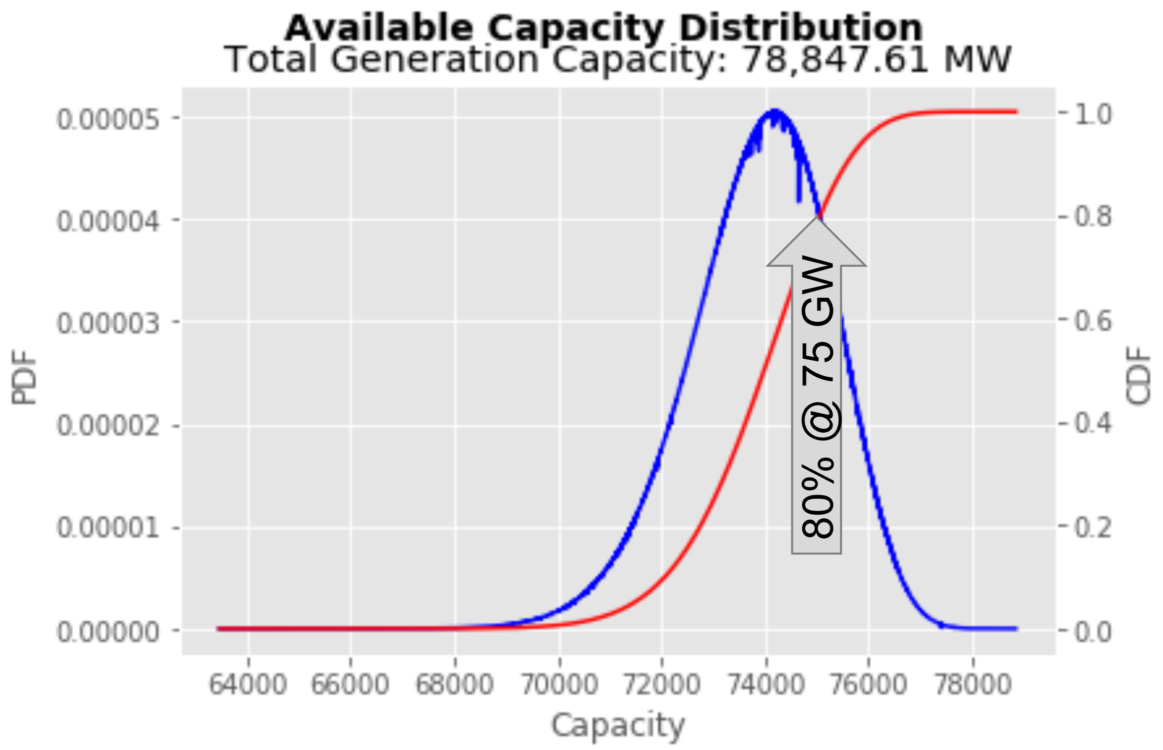



**Example: ~+1.5% EFOF rate per mid merit unit**

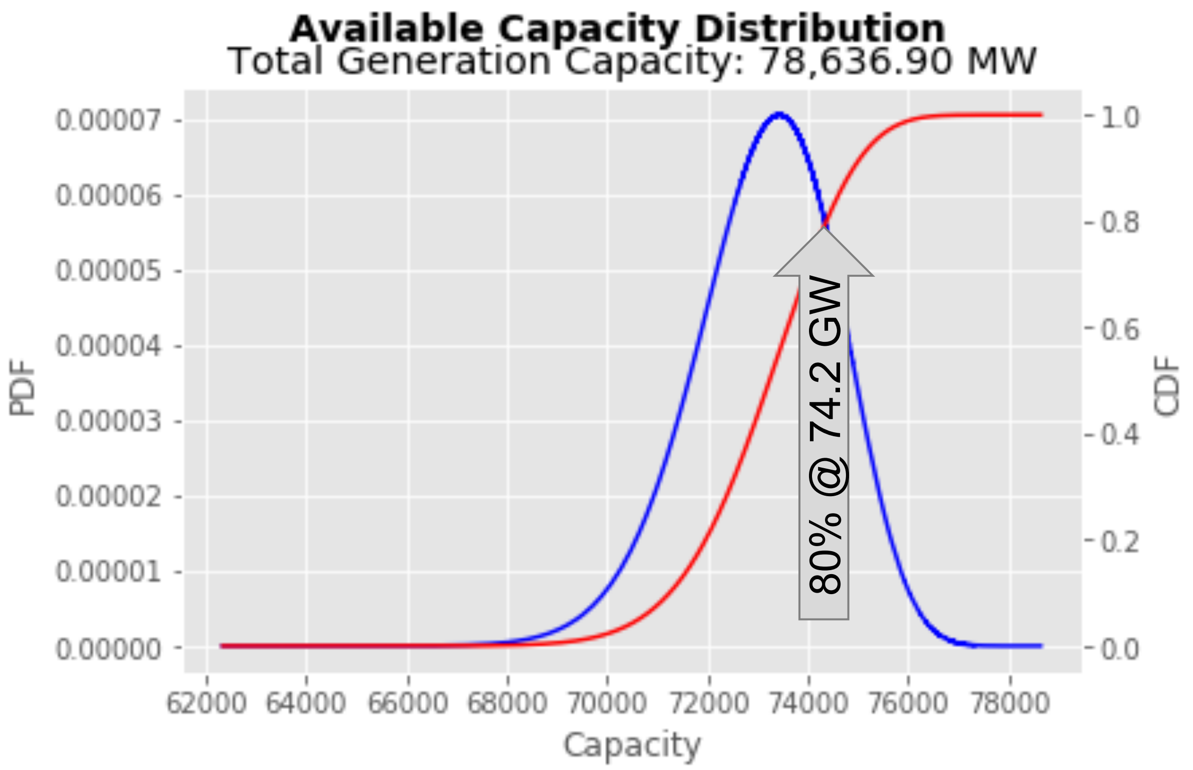
**How big is this effect?**



# Capacity Adequacy
## Generation Availability Distribution




**Base Case**

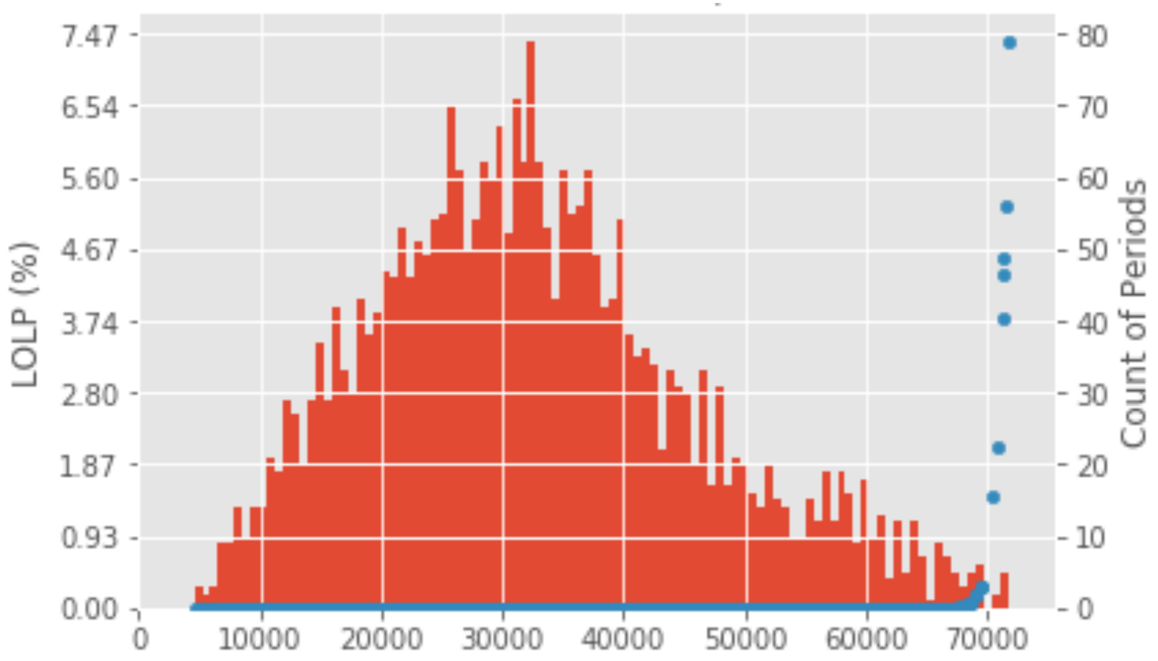



**+2% FOR on Old Gas Units Case**

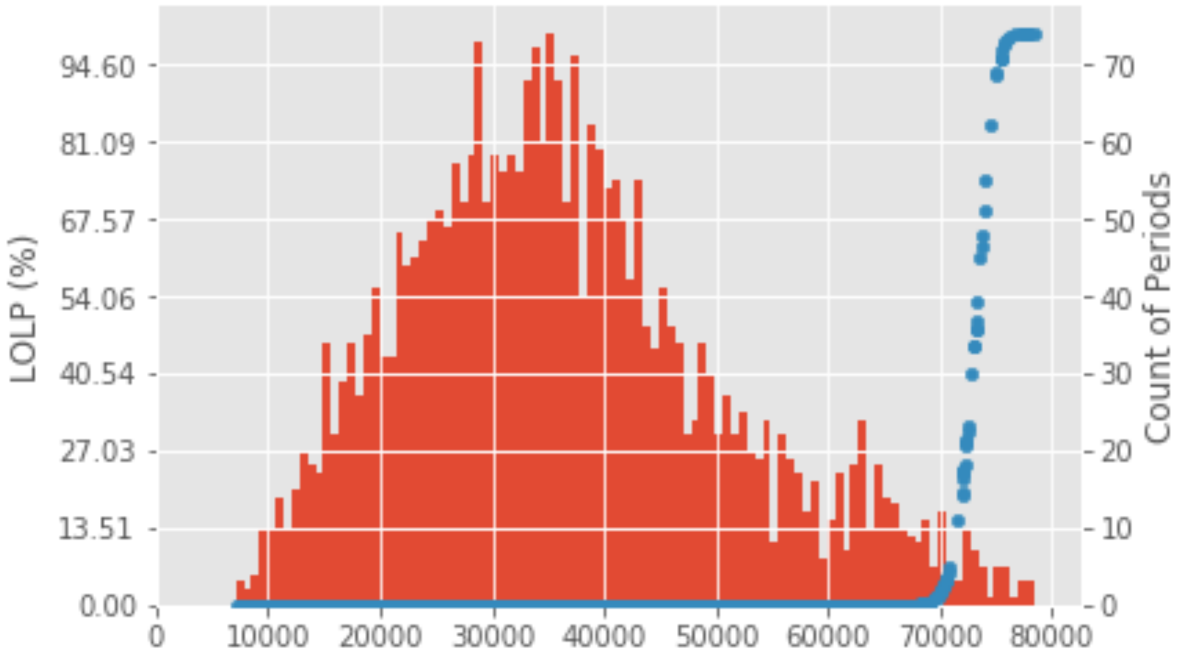
# Capacity Adequacy

## Loss of Load Probability in Each Interval

**LOLP vs Net Load**



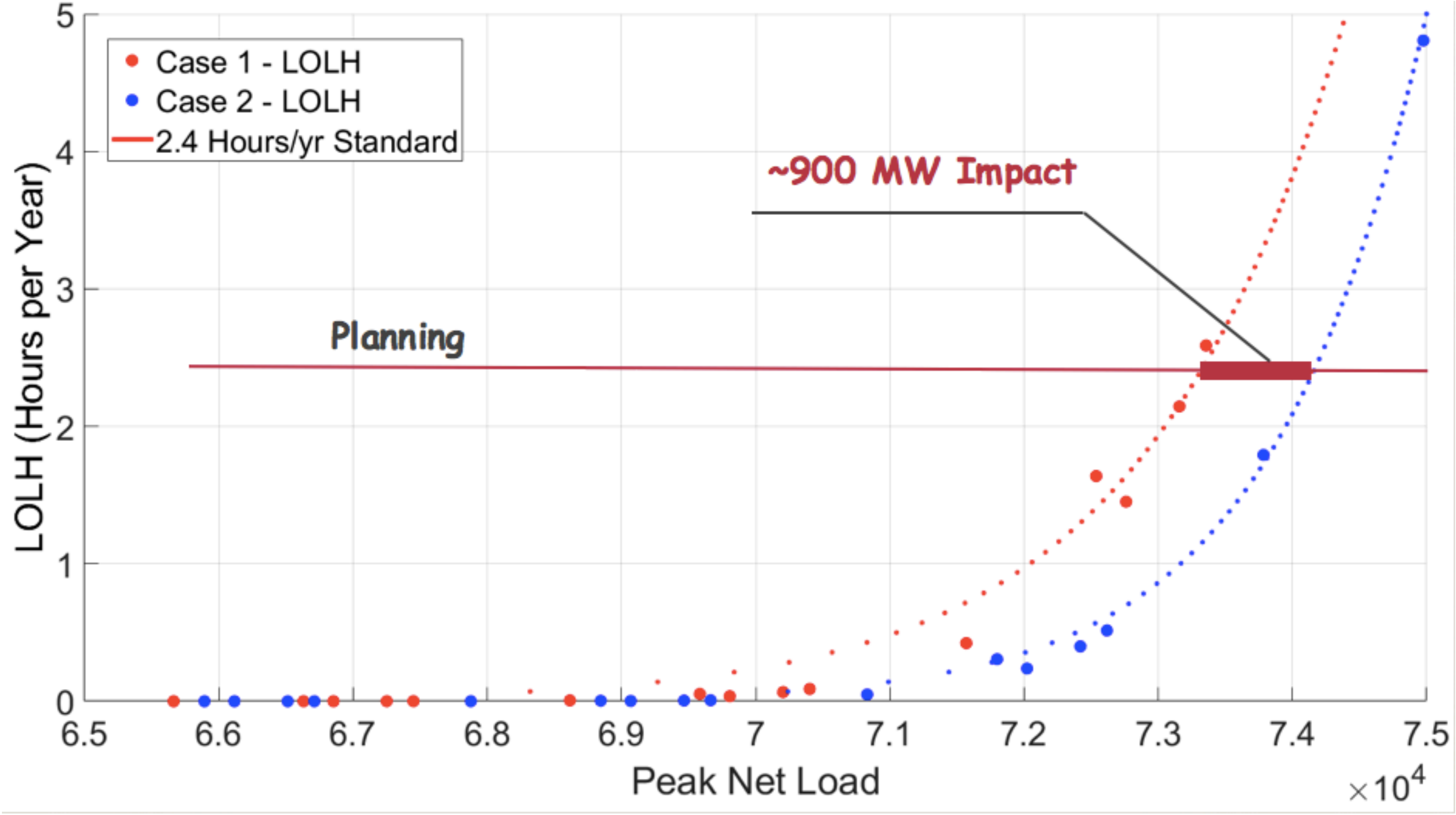

**Base Case**




**+2% FOR on Old Gas Units Case**

# Impact of Increased FOR on LOLH

## Estimate impact of assumption



# Previous Studies on Standalone Storage in 2017/18

3002013491

Increasing Penalties for Unavailability

Increasing Duration

| Duration | No Penalty | 1000 $/ MWh Penalty | $5000 / MWh Penalty | $9000 / MWh Penalty |
|---|---|---|---|---|
| 1 hr | 32-42% | 81-83% | 89-91% | 92% |
| 2 hr | 60-67% | 89-95% | 96% | 98% |
| 4 hr | 81-92% | 100% | 100% | 100% |
| 6 hr | 95-97% | 100% | 100% | 100% |
| 8 hr | 95-100% | 100% | 100% | 100% |

# Traditional Resource Representation

## Conventional Thermal & Hydro

- Availability independent of dispatch level
- Availability modeled using Multi State Model

*[Available, Unavailable, Planned Outage, Partial Derating]*

- Statistical availability model built using historically derived probabilities (Failure rate, Mean Time To Repair)
- Monte Carlo availability sampling for availability
- Loss of load expectation developed from multiple scenarios

## Wind & Solar

- Multiple historical output years scaled to anticipated capacity in target horizon
- Subtracted from anticipated demand
- Conventional generation availability model built per traditional approach

**CAPACITY AVAILABILITY INDEPENDENT OF DISPATCH**

# Hybrid Renewable + Storage Resource Modeling Differences

## Energy Constraints

1. State of charge influences when capacity is available
2. Economic dispatch influences state of charge
3. Smaller energy storage (MWh)results in lower likelihood of sustained capacity availability

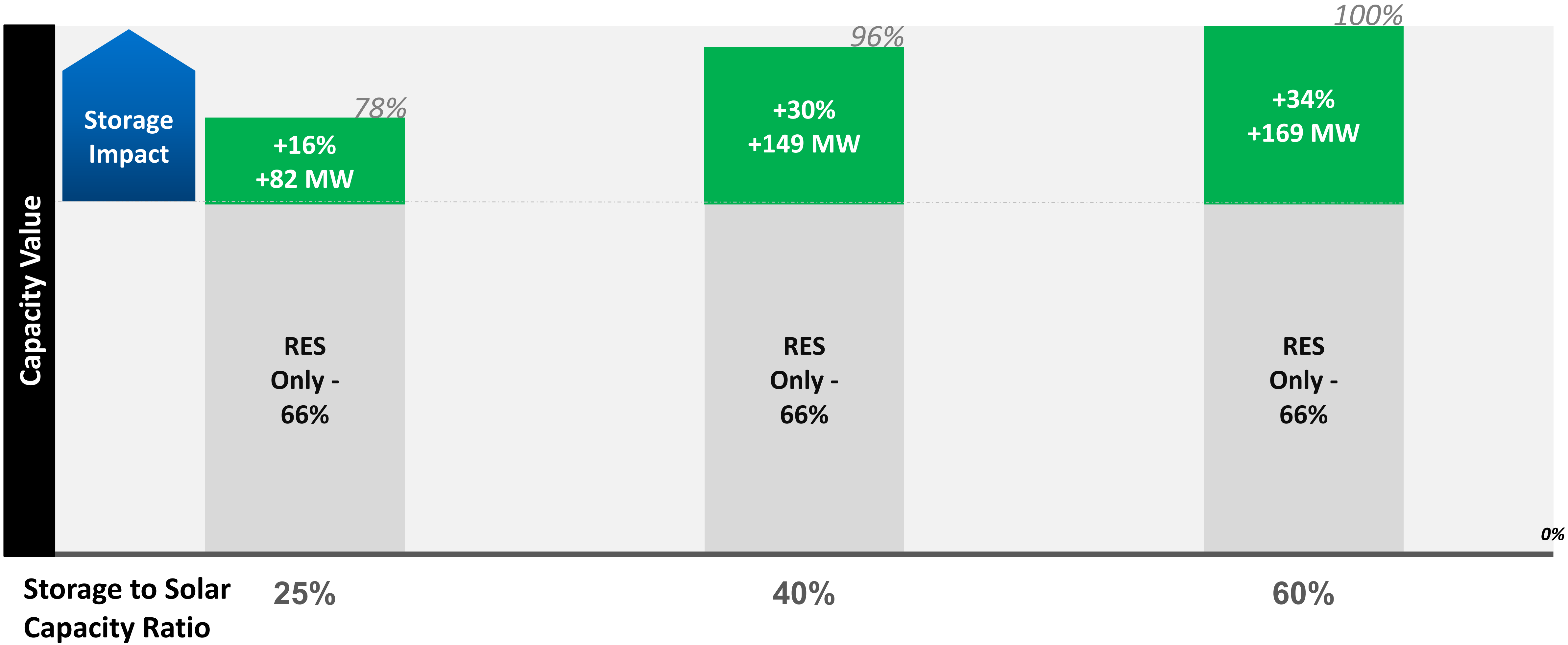
## Operational Constraints

Charging influenced by:

- Renewables’ pairing (Solar / Wind)
- Coupling arrangement (DC / AC)
- Over-panneling practices at solar plants
- Influence of incentives (Investment Tax Credit)
- Capacity ratio (Plant inverter to storage)
- Storage duration
- Background storage and renewables penetration in the system

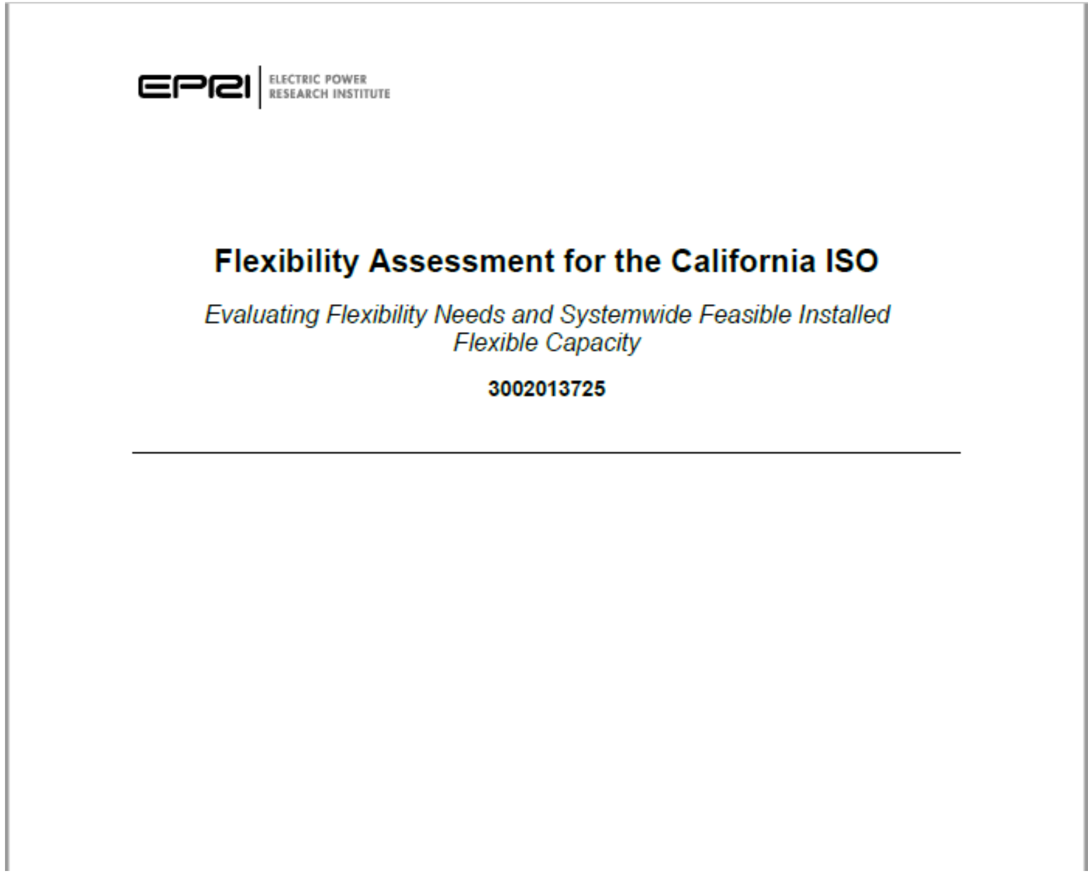
# How Does The Storage To Solar Capacity Ratio Affect Marginal Capacity Value?

500 MW Solar, 4 Hrs.. Storage, near term background solar, 100% ITC



# A new way to quantify essential needs (installed flexibility)

- InFLEXion Tool can be useful for flexible capacity needs assessment and must offer time frames
- Use of percentile analysis to avoid data issues and noise
- Recommend IFLEX method for system-wide flexible capacity calculation
- True flexibility is reduced due to meeting min-load conditions
- Choice of 3-hour horizon validated using study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**Flexibility Assessment for the California ISO**

*Evaluating Flexibility Needs and Systemwide Feasible Installed Flexible Capacity*

**3002013725**

**Flexibility on future systems is crucial. Inherent flexibility in fleet may not always be feasible.**



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# Online Resource Centers

## RESOURCE ADEQUACY

### What's Contained?

Metrics | Methods | Tools | Practices

### When to use it?

- Before conducting an RA study
- When assessing the impact of new technology in RA
- When evaluating study tools setups
- When researching practices in other jurisdictions
- For clarification on basic to complex RA questions

## FLEXIBILITY ASSESSMENT

### What's Contained?

Metrics | Methods | Tools | Practices

### When to use it?

- When choosing methods to study system flexibility
- When evaluating the use of a particular tool
- When seeking practices from other systems
- For basic to advanced level information on flexibility assessment

## Consolidate Industry Learnings On The Topic

# Together…Shaping the Future of Electricity