

# New Resource Adequacy Criteria for the Energy Transition

ESIG Redefining Resource Adequacy Task Force

Derek Stenclik, ESIG Spring Workshop, March 2024



TELOS ENERGY



**ESIG**

ENERGY SYSTEMS  
INTEGRATION GROUP

# ESIG Redefining Resource Adequacy Task Force



1

## Redefining Resource Adequacy for Modern Power Systems



A Report of the Redefining Resource Adequacy Task Force  
2021



**Probabilistic Analysis & First Principles**

*Chronology & Correlation*

2

## Ensuring Efficient Reliability NEW DESIGN PRINCIPLES FOR CAPACITY ACCREDITATION



A Report of the Energy Systems Integration Group's Redefining Resource Adequacy Task Force  
February 2023



**Capacity Accreditation and Procurement**

*Capacity accreditation for all resources*

3

**NEW!**

## New Resource Adequacy Criteria for the Energy Transition MODERNIZING RELIABILITY REQUIREMENTS



A Report of the Energy Systems Integration Group's Resource Adequacy Task Force  
March 2024



**New Reliability Criteria & Capacity Needs**

*Moving beyond 1-day-in-10 LOLE*

## Task Force Members

40 recognized experts across:

### **5 Utilities**

Duke, Xcel, Tri-State, HECO, SCE, SRP

### **7 System Operators**

MISO, ERCOT, NYISO, SPP, Amprion GmbH, Nat Grid ESO, AEMO

### **2 Regulators**

Texas PUC, Minnesota PUC

### **3 Reliability Coordinators**

NERC, NWPCC, NPCC

### **3 Developers**

Form Energy, Grid United, NextEra,

### **6 Researchers**

NREL, EPRI, University of Edinburgh, Boise State, Cornell University, RMI

# Building blocks of resource adequacy



## Adequacy assessments and studies

- Forward looking, probabilistic resource adequacy simulations
- What is the collective adequacy of the entire power supply?



## Resource Adequacy Metrics

- Quantifies resource adequacy risk
- What is the size, frequency, duration, and timing of system risk?



## Capacity Accreditation

- Measures the capacity contributions of individual resources (or classes of resources)
- How do resources compare to one another for their RA benefits?



## Resource Adequacy Criteria

- Sets the threshold for an acceptable level of risk
- How adequate of a system should we have?

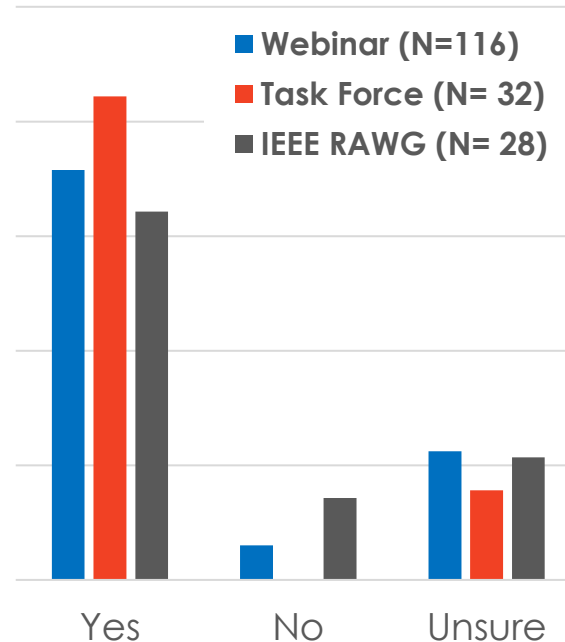


# Limitations of the current use of LOLE

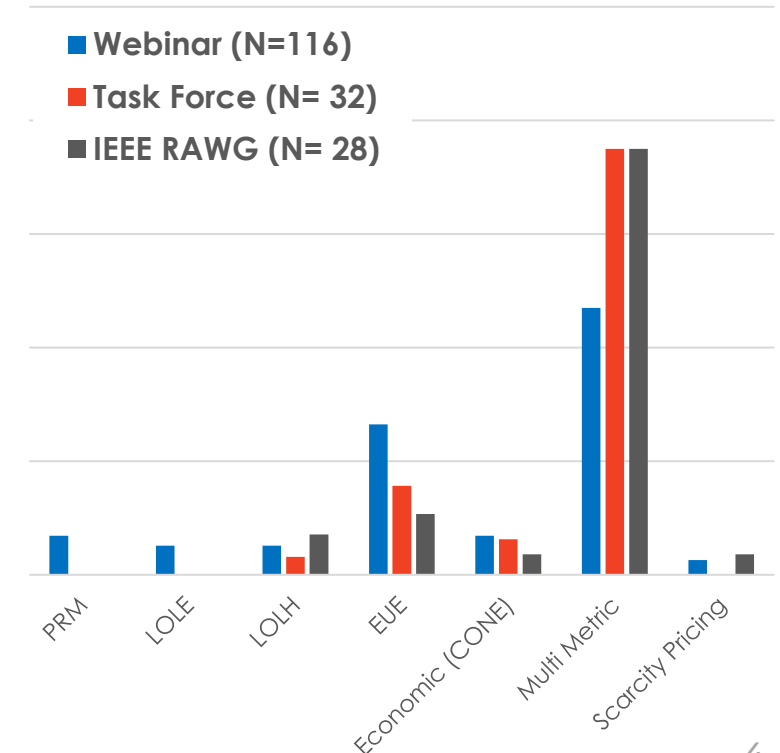
Needs to capture size, frequency, duration, and timing of risk

1. Constitutes a line in the sand, instead of a continuum
2. Inadequate differentiation among the size, frequency, duration, and timing of shortfalls
3. Static criteria are used to represent a dynamic system
4. The risk profile is changing as the resource mix evolves

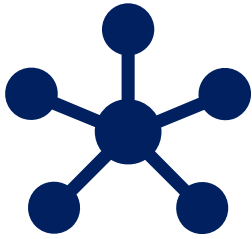
Should the industry consider a new resource adequacy criterion?



If you had to pick one resource adequacy criterion, which would you pick?

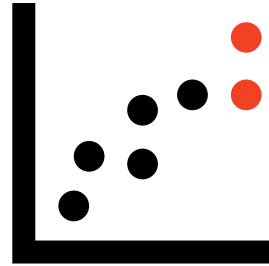


# Final Recommendations from the Task Force



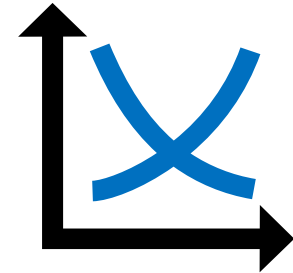
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**Transition to a  
multi-metric  
criteria**



2

**Specifically  
consider  
extreme events**

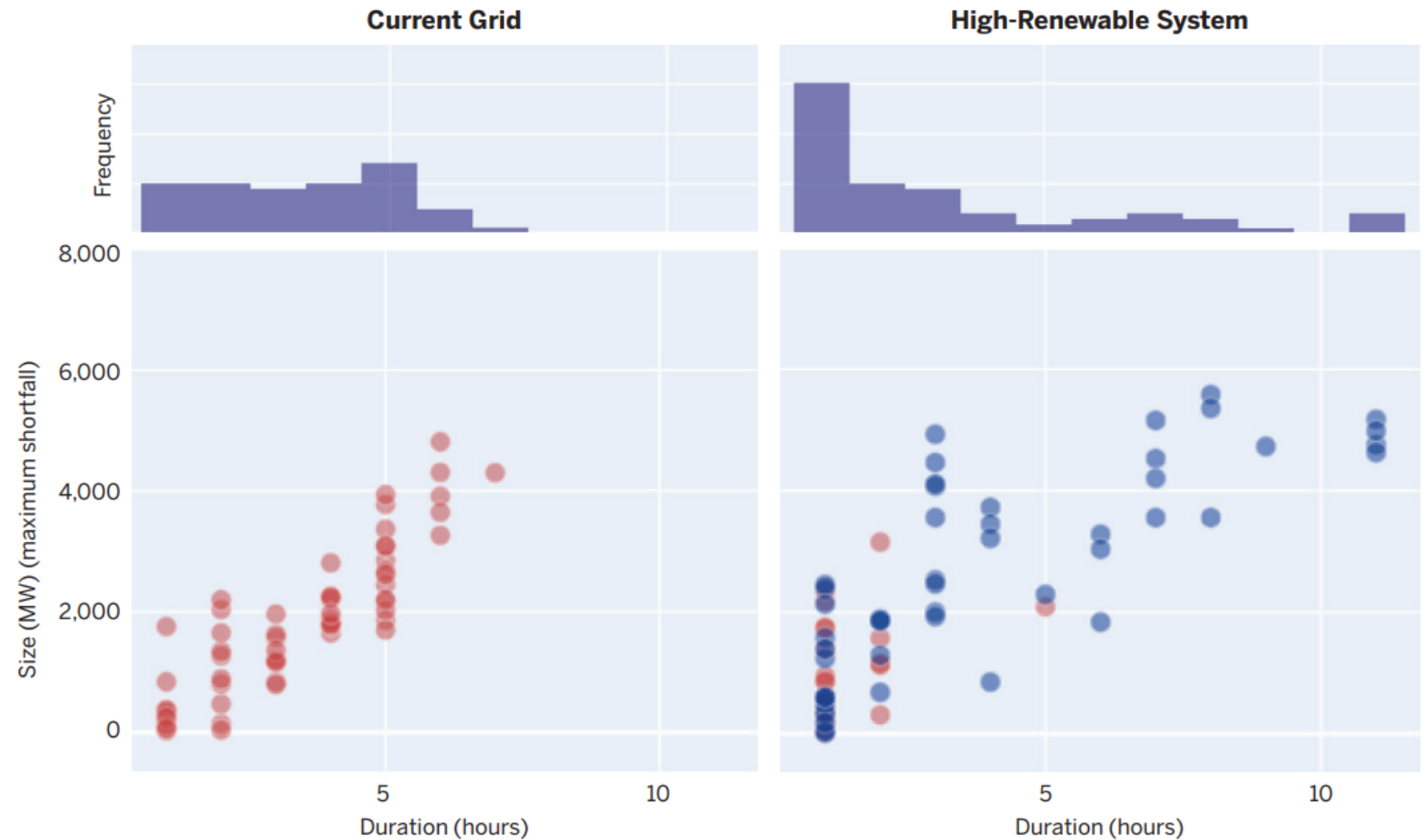


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**Incorporate  
economics**

# Transition to a multi-metric criteria

Loss-of-load expectation as the sole resource adequacy criterion only represents a single dimension of risk. It needs to be supplemented

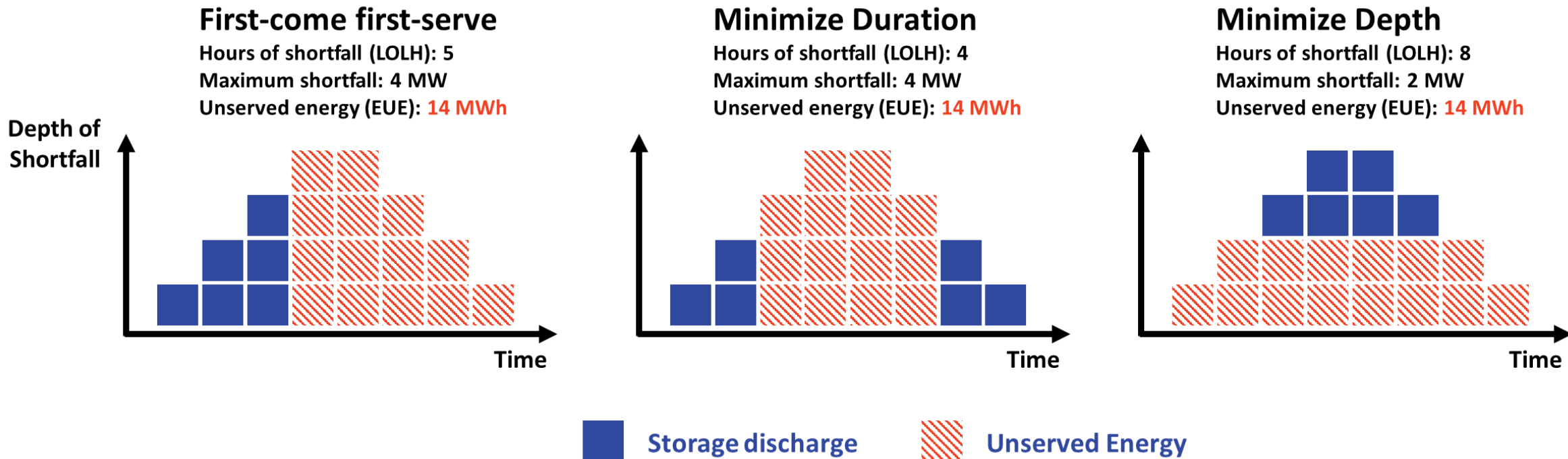


Source: EPRI, Telos Energy

● Summer Event ● Winter Event

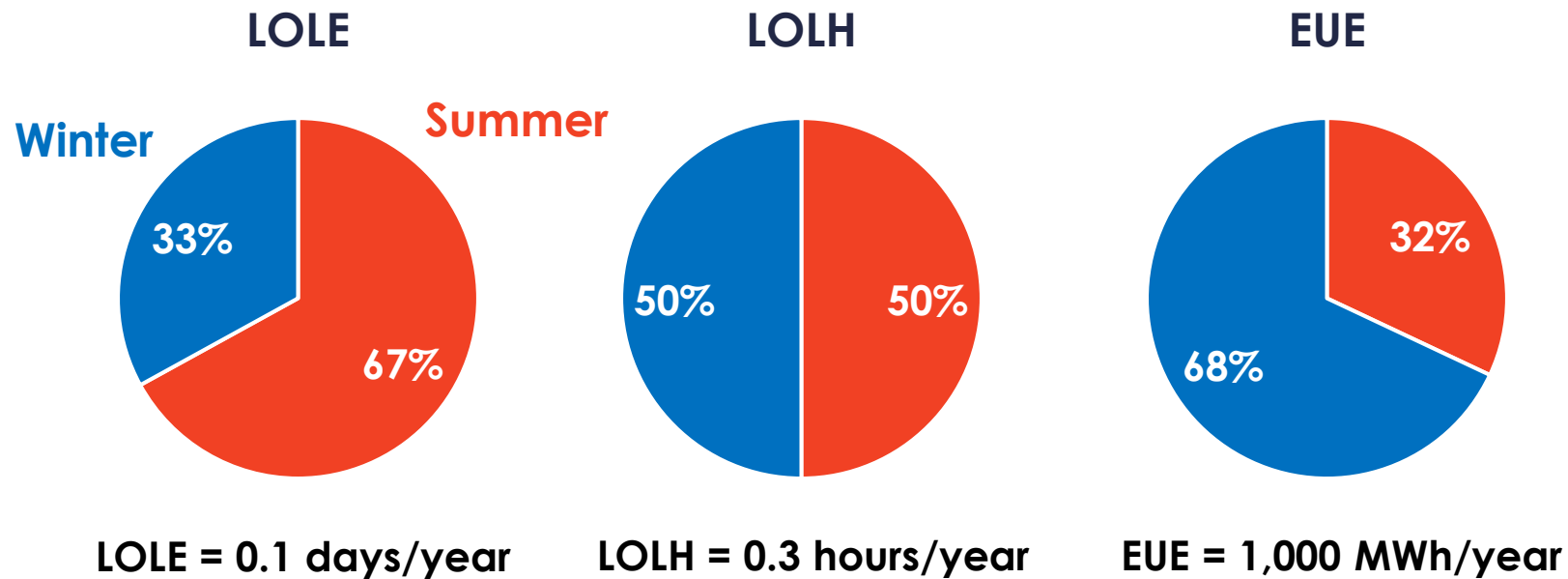
# Transition to a multi-metric criteria

**Expected unserved energy** is a preferred addition to incorporate size of shortfalls, especially as the system moves toward energy limitations



# Transition to a multi-metric criteria

No one metric is the solution, and a multi-metric framework is needed to consider size, frequency, duration of shortfalls



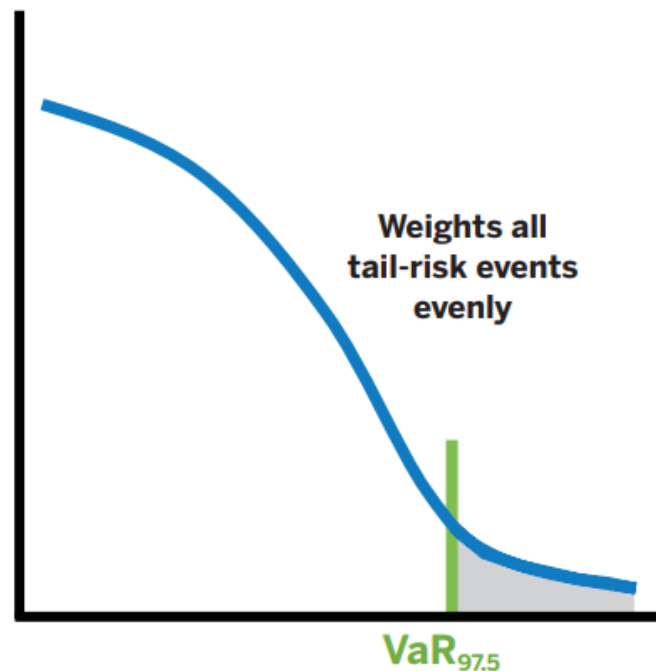
Source: PJM



# Specifically consider extreme events

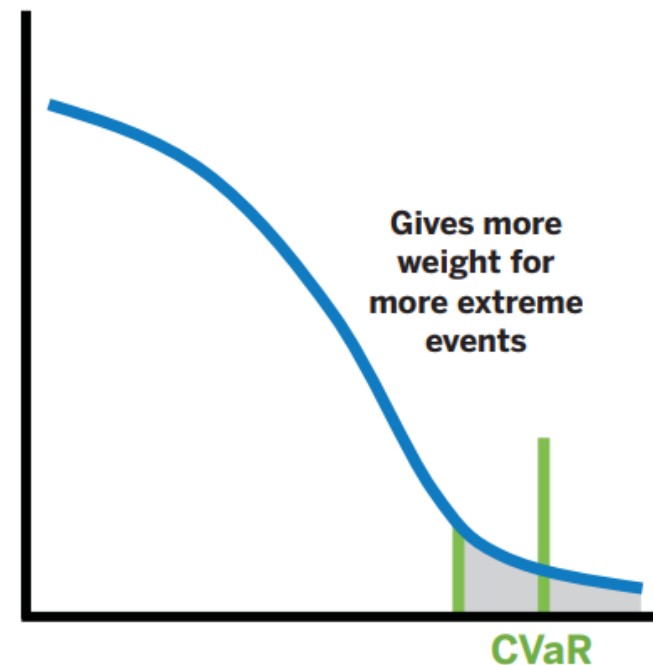
Not all resource adequacy loss-of-load events are the same. **Tail risks** can have a disproportionate impact on reliability and costs and should be quantified

The **Value at Risk (VaR)** metric notes the size or duration of the largest and longest shortfall event for each simulation year (including zero for years with no events) and notes the  $N^{\text{th}}$  percentile of observations.



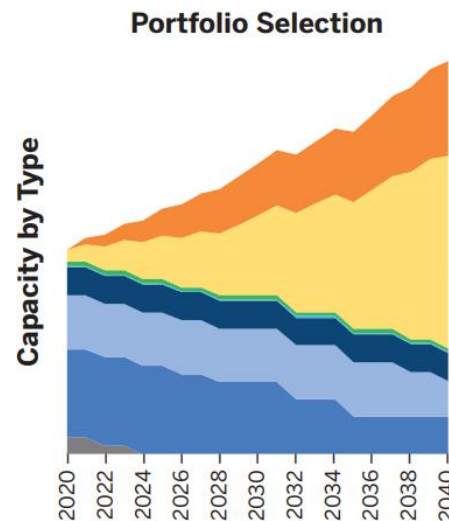
Size of Shortfall Events -or- Energy (MWh) -or- Peak (MW)

The **Conditional Value at Risk (CVaR)** metric calculates the average of the observations above the  $N^{\text{th}}$  percentile of observations.



# Specifically consider extreme events

Limited data are available to determine with confidence the probability of extreme events. This reality may require discrete analysis or stress-testing



Source: GridLab, Telos Energy

Is the portfolio  
resource-adequate?

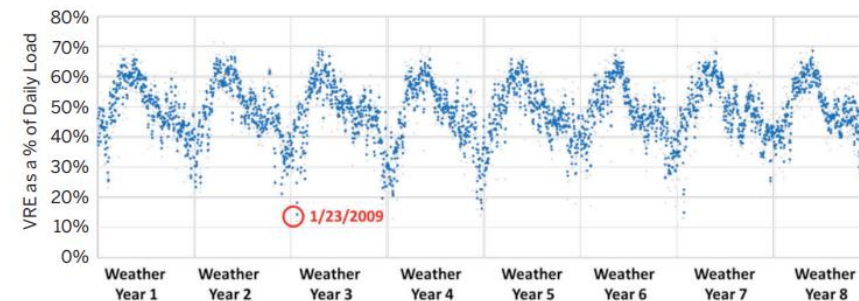
## Probabilistic Resource Adequacy Analysis



**Key Outputs**  
Probability and expected value metrics (LOLE, LOLP, EUE)

- Probabilistic assessment of weather and random outage draws
- Simplified model for hundreds or thousands of samples
- Aggregated results for probabilities, but limited specific insights

## Stress-Testing Specific Conditions



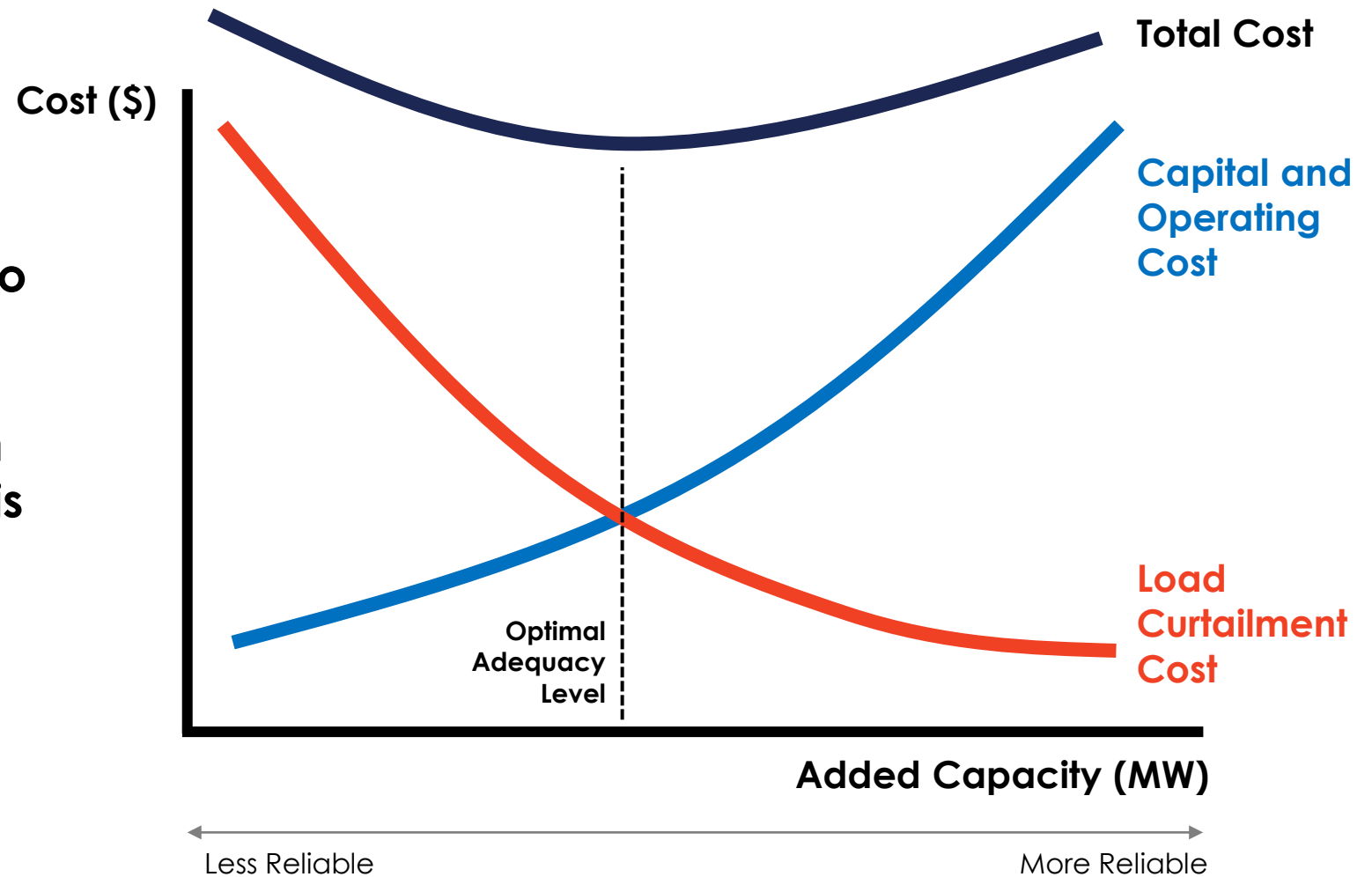
- Detailed stress tests of specific conditions
- Deeper insights into specific weather events
- Additional information in availability of imports and region-wide analysis

**Key Outputs**

- Unserved energy margin (close calls)
- Reliance on imports
- Key stressors

# Incorporate economics

The resource adequacy criterion should be used to establish the appropriate trade-off between reliability and cost, which are intrinsically linked. This should be transparent.



# New Resource Adequacy Criteria for the Energy Transition

MODERNIZING RELIABILITY REQUIREMENTS



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**March 2024**



**New Report!**

<https://www.esig.energy/new-resource-adequacy-criteria>



# THANK YOU

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T E L O S E N E R G Y