Ensuring Efficient Reliability

NEW DESIGN PRINCIPLES FOR CAPACITY ACCREDITATION

Derek Stenclik, Telos Energy

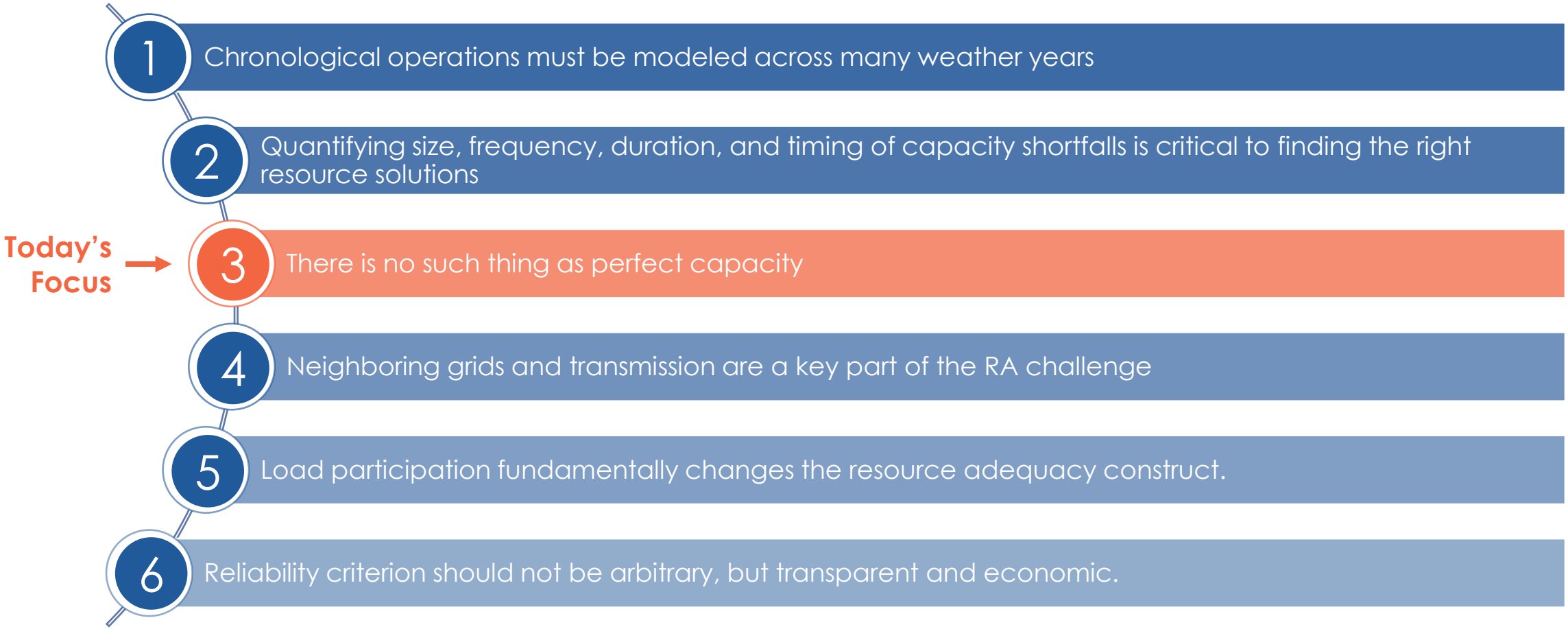
ESIG
ENERGY SYSTEMS INTEGRATION GROUP

NARUC Resource Adequacy Training

May 18, 2023

TELOS ENERGY

Six principles of resource adequacy for modern power systems



For more information, see **ESIG, Redefining Resource Adequacy for Modern Power Systems**, 2021

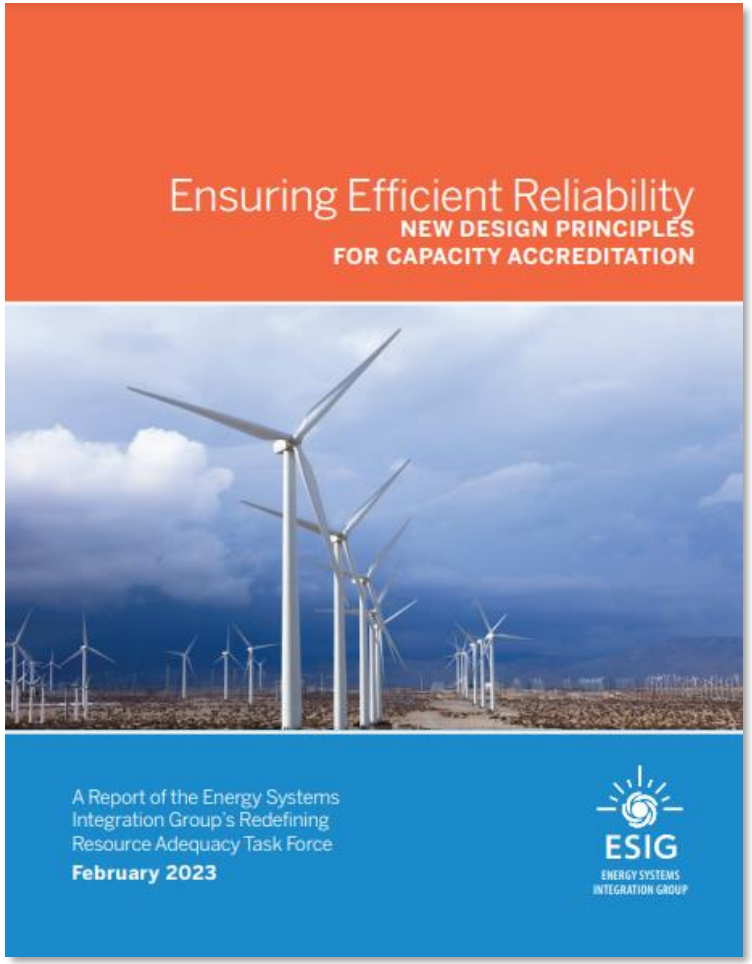
How do we compare different resources for resource adequacy?

From Elaine's presentation… **when does it get more complicated?**

Decentralized resource decision making (e.g. capacity markets, capacity payments, or RA programs that span multiple utilities) require attribution of needs and accreditation of resource contributions.

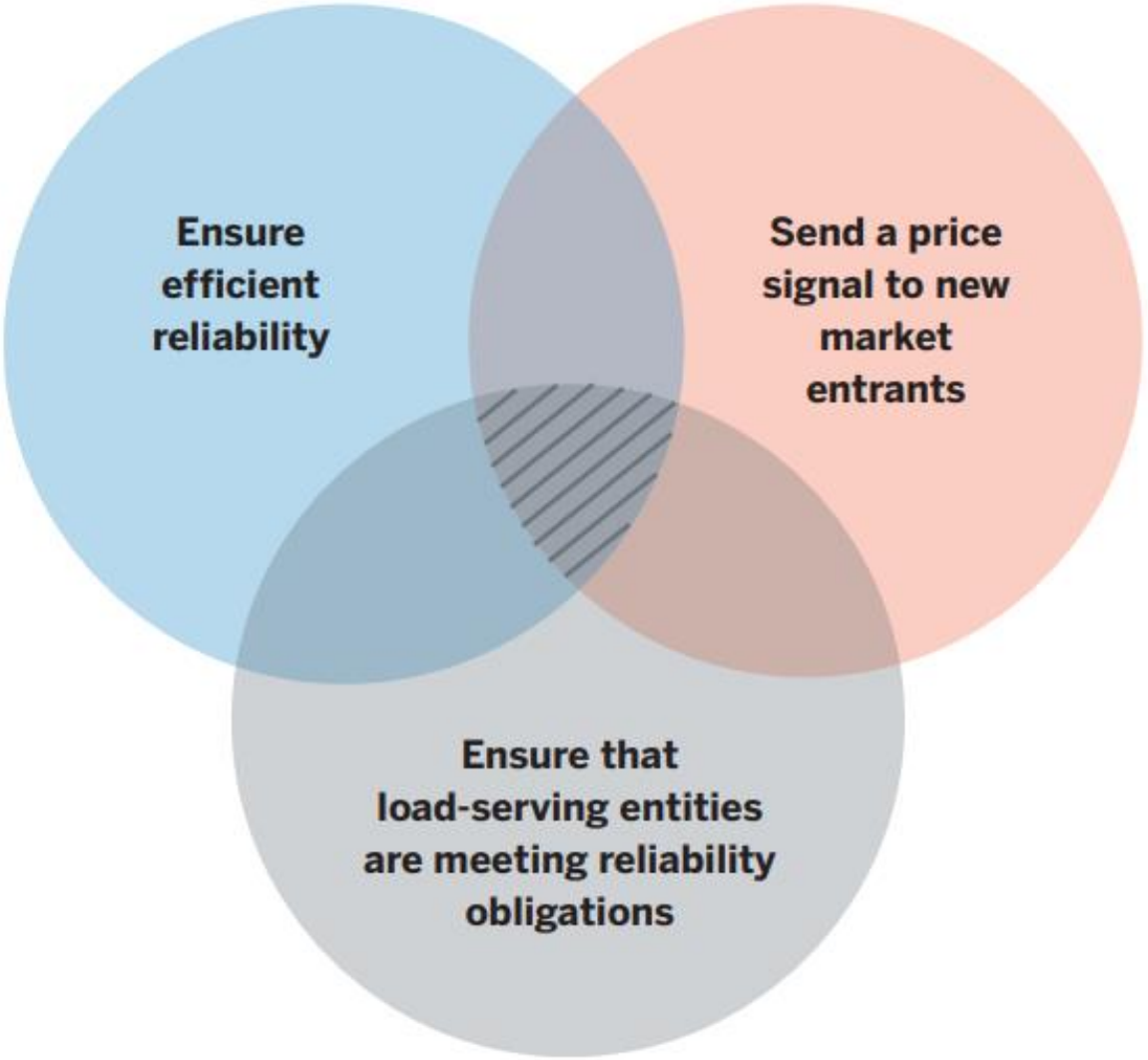
"The goal of capacity accreditation is to measure effective capacity contributions, in a technology-agnostic manner, and create a reliability-neutral way to allow for exchanging capacity between resources types while meeting resource adequacy needs."

-ESIG, Ensuring Efficient Reliability, New Design Principles for Capacity Accreditation, 2023



The Nexus of Capacity Accreditation

Changing the way we think about capacity accreditation

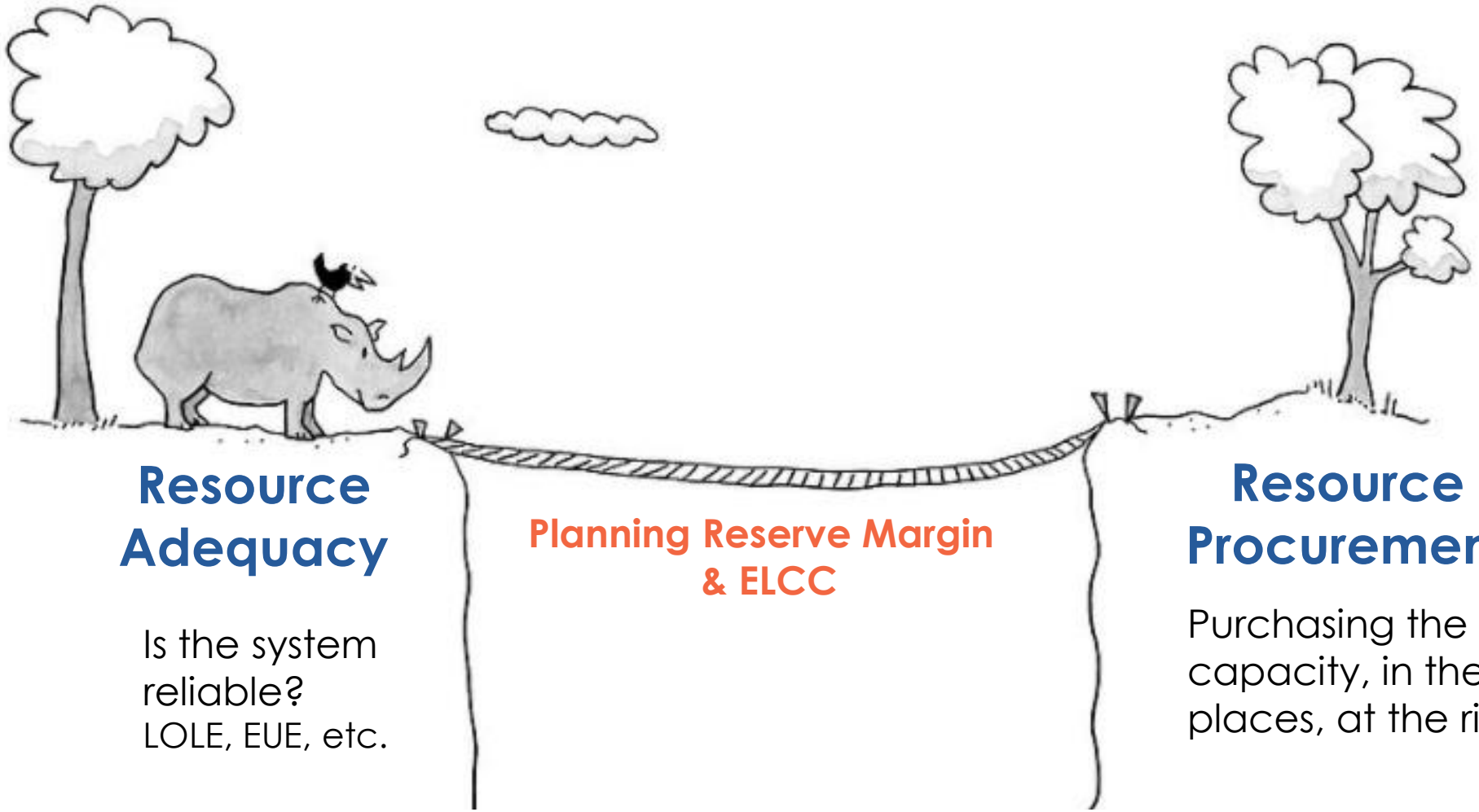


Accreditation ≠ Reliable System

Resource accreditation does not necessarily ensure a reliable system.

Capacity accreditation should be used for planning new entrants, compensating resources for reliability service, and for allocating responsibility to loads… not for ensuring resource adequacy

How does capacity accreditation get used?



Resource Adequacy

Is the system reliable?
LOLE, EUE, etc.

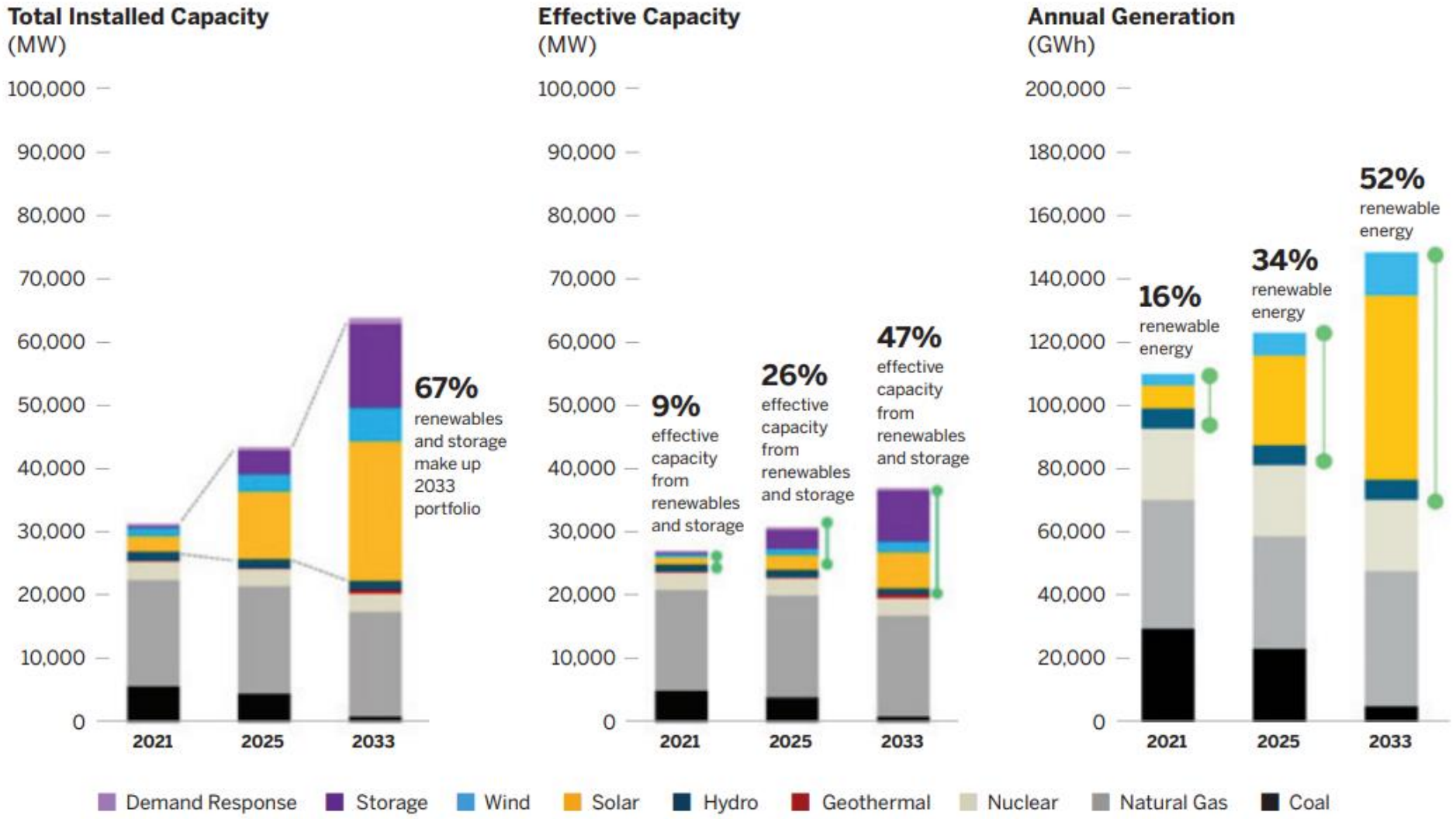
Planning Reserve Margin & ELCC

Resource Procurement

Purchasing the right capacity, in the right places, at the right time

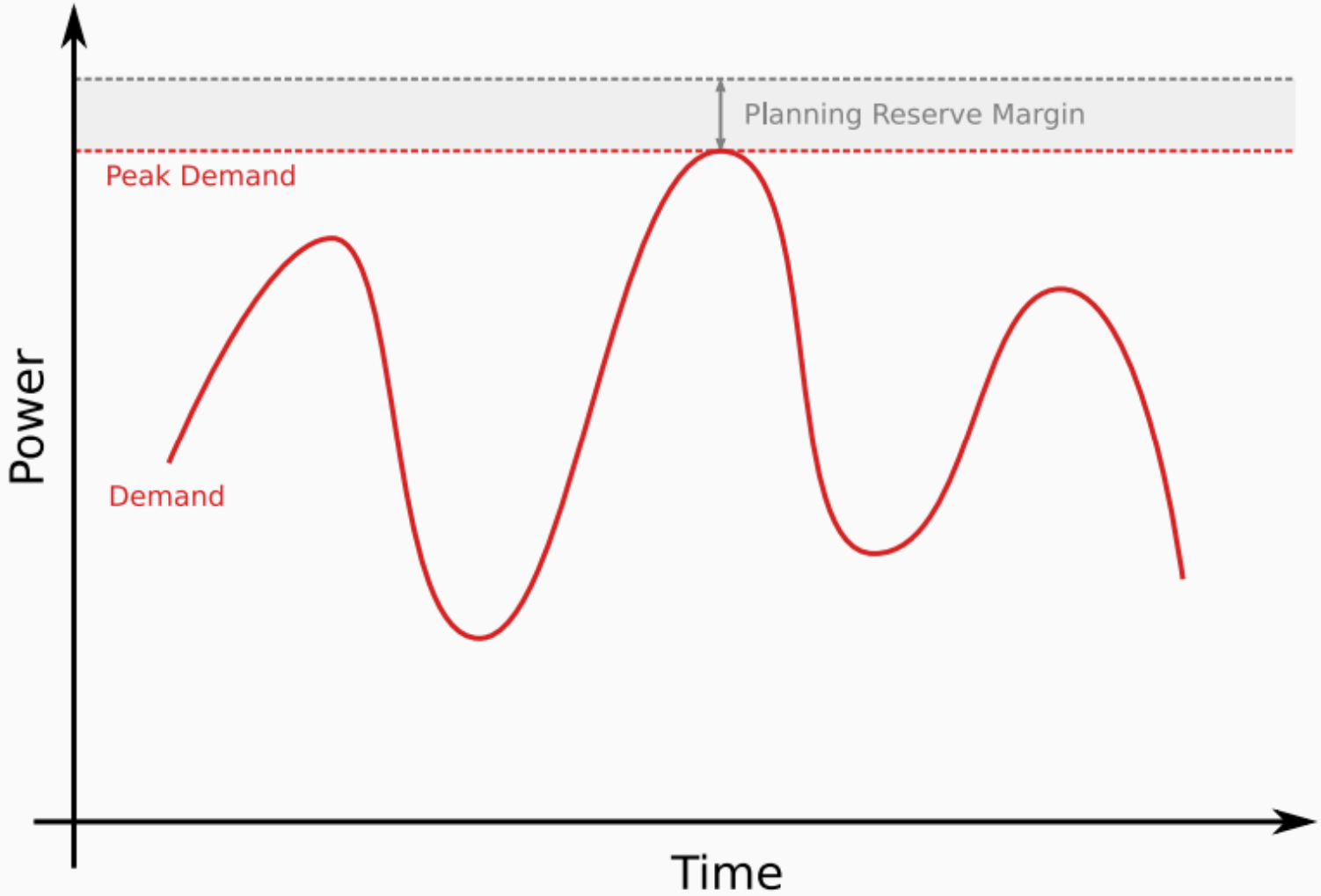
"Go ahead. Nothing to worry about."

How do we measure a portfolio of resources?



The evolving challenge of the PRM

- Risk is shifting to non-peak periods
- Relies on ELCC to remain credible (saturation and portfolio effects are increasingly difficult)
- Storage makes the system *energy* limited, not capacity limited
- Thermal units have correlated outages (UCAP based on FOR is not applicable)



More info: Gord Stephen, "Getting Past Capacity Credits, Better Deterministic Adequacy Analysis via Energy Reserve Margins," NERC Probabilistic Assessment Forum, Oct 6, 2021.

Transition of Capacity Accreditation Methods

Increasing shares of variable renewables and energy-limited resources

1. Nameplate capacity of resources
2. Expected capacity available at the time of peak load
3. Expected capacity available at the time of peak net load
4. Expected capacity available at the time of high risk
5. Expected capacity and energy available from resources during periods of high risk

Accreditation redesign considerations

- Deterministic or probabilistic?
- Prospective or retrospective?
- Average or marginal?

Deterministic vs. Probabilistic

There are a range of accreditation options used in the industry.

ELCC is the most commonly adopted today

But there are tradeoffs for different approaches.

Deterministic Approaches	Probabilistic Approaches
Variations	**Variations**
• Capacity factor during pre-defined number of peak load hours or static risk window (i.e., afternon hours during summer months) • Exceedance (i.e., capacity available more than 70% of the time)	• Effective load-carrying capability (ELCC) • Equivalent firm capacity (EFC) • Marginal reliability improvement (MRI)
Advantages	**Advantages**
• Simple, transparent, and easy to understand • Does not require modeling to calculate • Provides certainty for generation owners	• Evaluates resource performance during periods of scarcity, not just peak demand • Considers correlation of resources and load • Accounts for weather-driven resource performance
Challenges	**Challenges**
• May not align with scarcity periods • Requires regular updates to the pre-defined risk windows to stay relevant, especially with high penetrations of renewables and storage	• Computationally intensive • Sensitive to inputs and assumptions • Opaque for market participants • Difficult to apply to all resources and capture plant-specific configurations

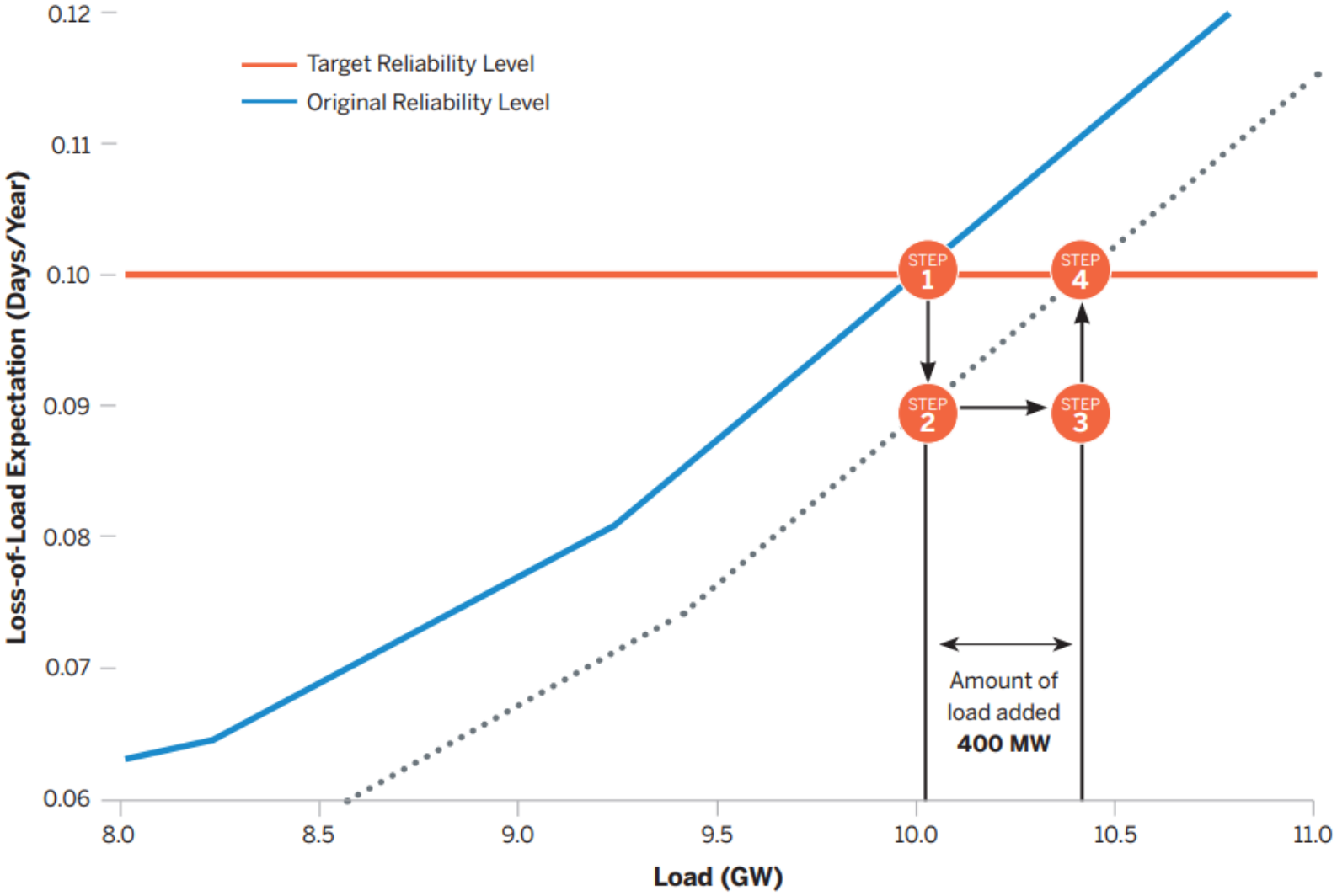
Prospective vs. Retrospective

Operational/Tight Margin Hours — **Planning/Probabilistic Analysis**

Risk Hours Methods	Blended Method	ELCC Method
Identifies risk hours ("RA Hours"), then calculates capacity accreditation based on historical performance during risk hour events	**Blending both simulated capability and actual performance metrics captures different risks**	Accredits resources based on their simulated ability to reduce loss-of-load events in a probabilistic resource adequacy model

Source: adapted from Midcontinent Independent System Operator (2022b).

ELCC Refresher

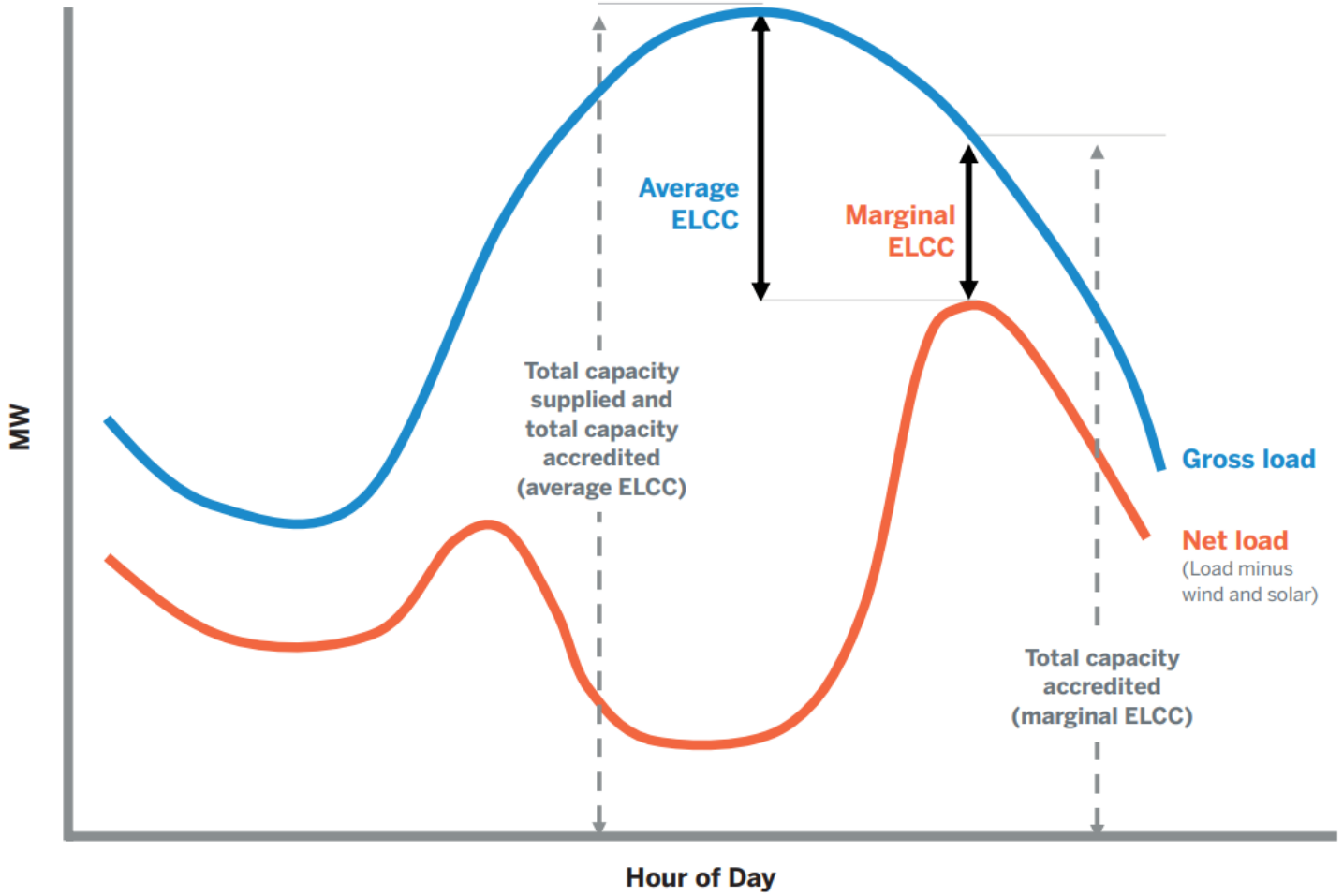


Effective Load Carrying Capability measures the contribution of a resource to reducing loss of load, compared to a constantly available generator (or load)

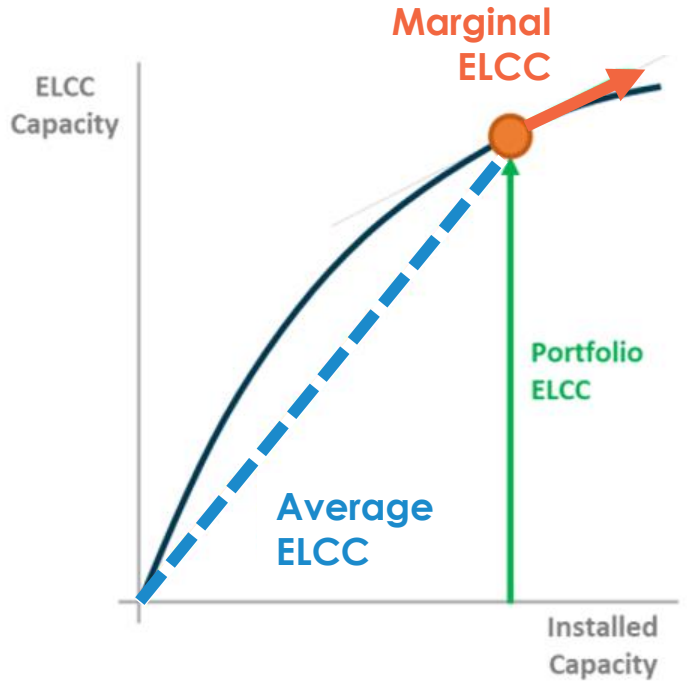
ELCC can be applied to ***all resource types***

Source: Ibanez & Milligan (2014) National Renewable Energy Laboratory.

Average vs. Marginal



Note: The figure is for illustrative purposes only. Output during net load peak is a reasonable proxy for marginal ELCC for variable renewable resources but not for dispatchable resources with energy limitations. Risk periods and loss-of-load events can occur outside of the peak and net peak demand periods.
Source: Carden, Bellon, and Dombrowsky (2022)/Astrapé Consulting.



Both marginal and average methodologies assign every resource in a class the same capacity credit, but they differ according to whether the class of resources is measured by a small change of the capacity of the class or by measuring the contributions of the class in its entirety.

Five Pillars of Accreditation

What are the foundational elements that should be considered for any accreditation technique?

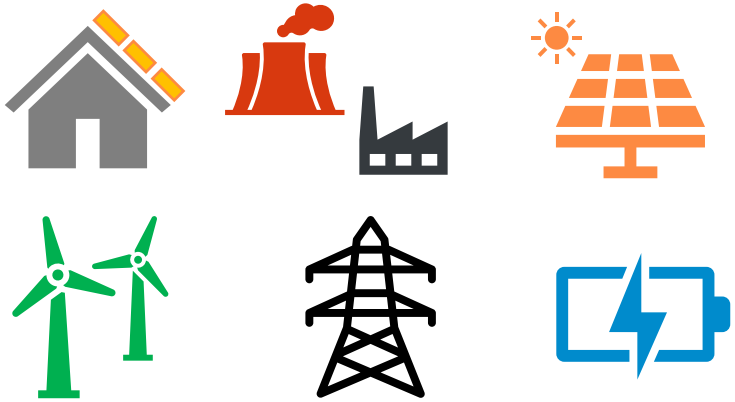
Non-Discriminatory	Robust	Transparent	Reliable	Predictable
Accreditation is applied to all resources using a similar methodology.	Accreditation continues to work as the resource mix, load patterns, and system risk change over time.	Accreditation can be effectively communicated to stakeholders, and data are readily available for decisionmaking.	Accrediation accurately measures performance during real scarcity events.	The process is repeatable and consistent. It does not yield volatile or unexplained changes year to year.

Capacity accreditation for all

- Create a level playing field
- Recognize benefits and limitations for each resource type
- Consider transmission & interregional coordination as a capacity resource

Top two recommendations for capacity accreditation redesign

#1 Capacity accreditation for all



- Non-discriminatory accreditation,
- Applied to all resources in a consistent manner
- Create a level playing field
- Can be broadened to **thermal resource**s, **transmission**, and **load flexibility**

#2 Linking accreditation to actual operations

Energy-only Market ⟷ **RA-modeled Accreditation**

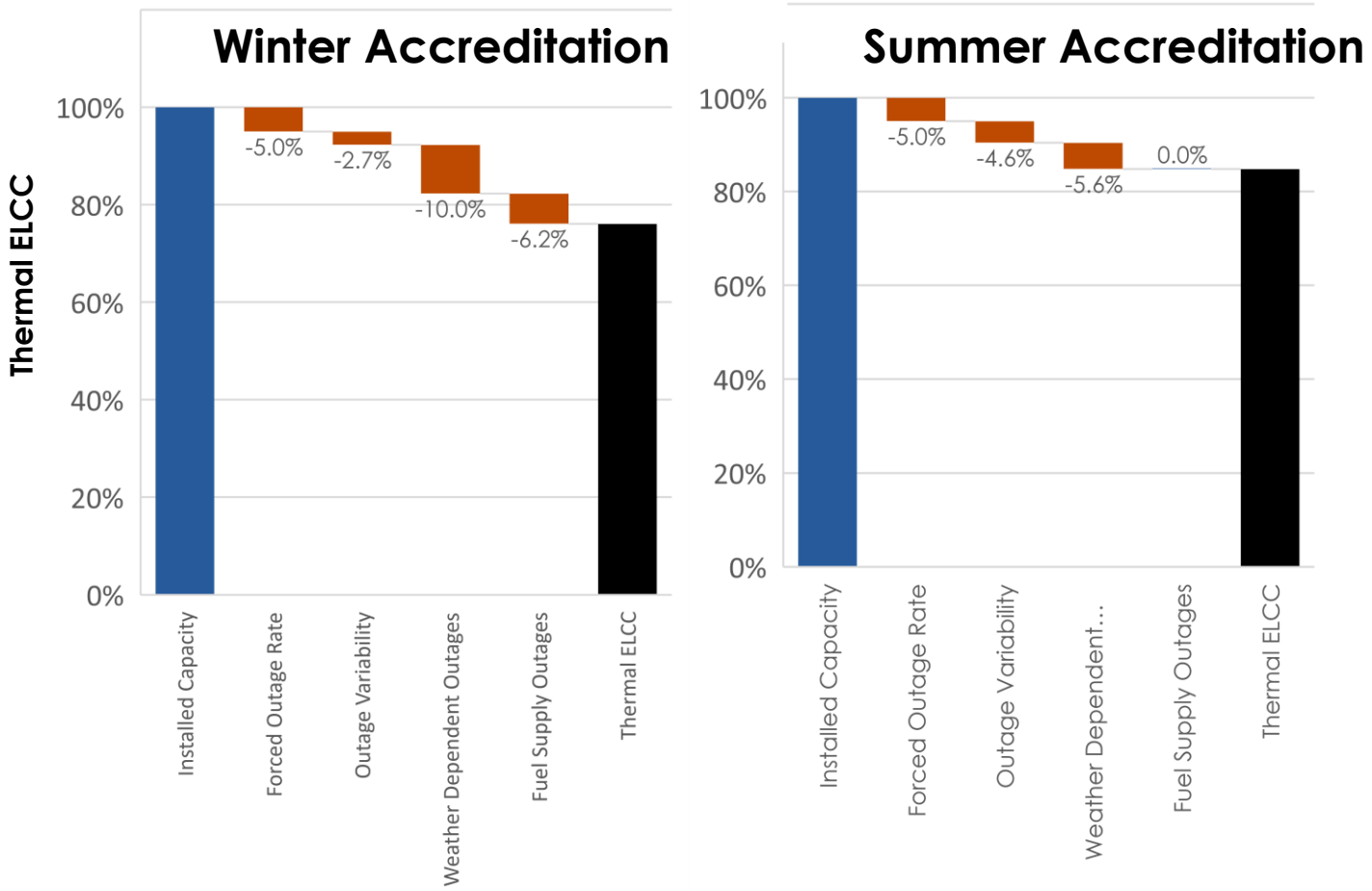
- Incorporate actual risk on the system,
- Measure actual unit performance to differentiate generation type
- Don't get paid for what you are, get paid for what you do.

Capacity accreditation for all

UCAP accreditation may not be a good proxy for perfectly available capacity when accounting for fleet wide interactions of thermal resources

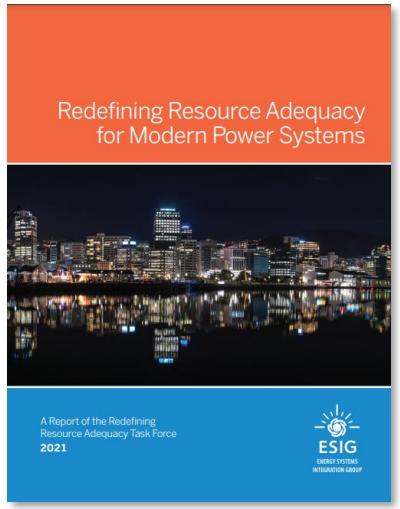
Fleet wide interactive outage effect categories include:

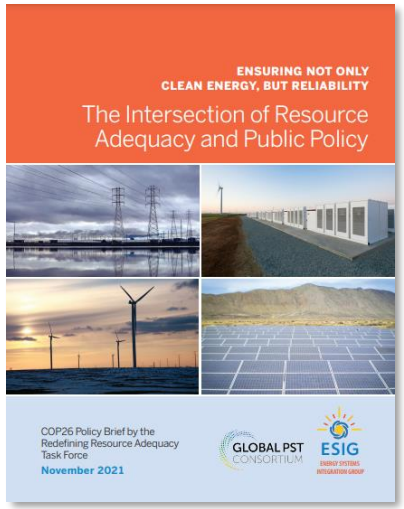
- Outage variability
- Common mode failures
- Weather dependent outages
- Fuel availability outages

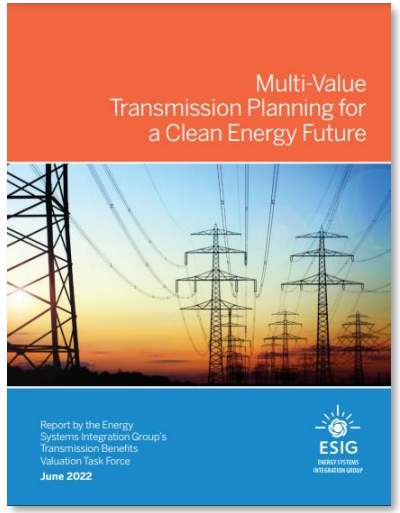


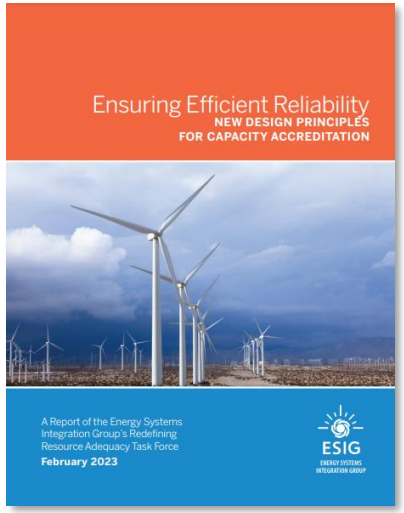
Data Source: Astrape, 2022 (Chart by Telos Energy)
Accrediting Resource Adequacy Value to Thermal Generation

ESIG Task Forces that work on Resource Adequacy









Redefining Resource Adequacy Task Force

- **Whitepaper:** Redefining Resource Adequacy for Modern Power Systems
- **Policy Brief:** The Intersection of Resource Adequacy and Public Policy
- **Blog:** Five Principles of Resource Adequacy for Modern Power Systems
- **Webinar 2020:** Redefining Resource Adequacy for Modern Power Systems (part 1)
- **Webinar 2021:** Redefining Resource Adequacy for Modern Power Systems (part 2)
- **Webinar 2022:** Best of 2022 Resource Adequacy Case Study Review
- **ESIG Fall Workshop 2022:** Redefining Capacity Accreditation
- **CIGRE Session 2022**: Stenclik, et al., Beyond Expected Values Evolving Metrics for Resource Adequacy Assessment
- **Whitepaper:** Ensuring Efficient Reliability: New Design Principles for Capacity Accreditation

Multi-value Benefits of Transmission Task Force

- **Report:** Multi-Value Transmission Planning for a Clean Energy Future

Aligning Retail Pricing with Grid Needs Task Force

Resilience and Transmission Task Force

THANK YOU

Derek Stenclik

derek.stenclik@telos.energy