



# APS RPAC Meeting

4/15/2026



# MEETING AGENDA



Welcome & Meeting Agenda  
Adam Constable  
APS



Resource Adequacy Follow-Up  
Nick Schlag  
E3



ASRFP Update  
Colton King  
APS



2026 IRP Scenarios  
Mike Eugenis  
APS



2026 IRP Market Prices  
Akhil Mandadi / Nick Schlag  
APS / E3



Next Steps & Closing Remarks  
Adam Constable  
APS



Break

# Meeting Guidelines



## Member Engagement

RPAC Member engagement is critical. Clarifying questions are welcome at any time. There will be discussion time allotted to each presentation/agenda item, as well as at the end of each meeting.



## Action Items

We will keep a parking lot for items to be addressed at later meetings.



## Meeting Minutes

Meeting minutes will be posted to the public website along with pending questions and items needing follow up. We will monitor and address questions in a timely fashion.



## Preliminary Content

Meetings and content are preliminary in nature and prepared for RPAC discussion purposes.



## February Meeting Recap

- APS kicked the meeting off by sharing an overview of its resource adequacy study work that will inform the 2026 IRP.
- E3 followed up on APS's resource cost presentation during the November 2025 RPAC meeting with a comparison between APS's resource cost assumptions and other industry sources.
- APS shared the timeline for when it plans to address 2026 IRP planning items in the RPAC.



# Following Up

- Action Items from Previous Meetings:
  - N/A
- Ongoing Commitments:
  - Distribute meeting materials in a timely fashion
  - Transparency and dialogue
  - Respectful participation by all participants





# All-Source RFP Update

Colton King, APS



# 2024 All-Source RFP (ASRFP) – Signed Resources

## Signed Gas Resources are Least-Cost Best-Fit, and Supportive of Existing Renewable Procurement

- Target commercial operation dates
  - June 1, 2026 – June 1, 2030
- The Company focused on retaining previously acquired natural gas resources through this ASRFP to complement long-term renewable procurement from the 2023 ASRFP
  - Combined cycle facility for 600 MWs
  - Combined cycle facility for 575 MWs, which will increase to 600 MWs in 2027

## Core Principles

Reliable

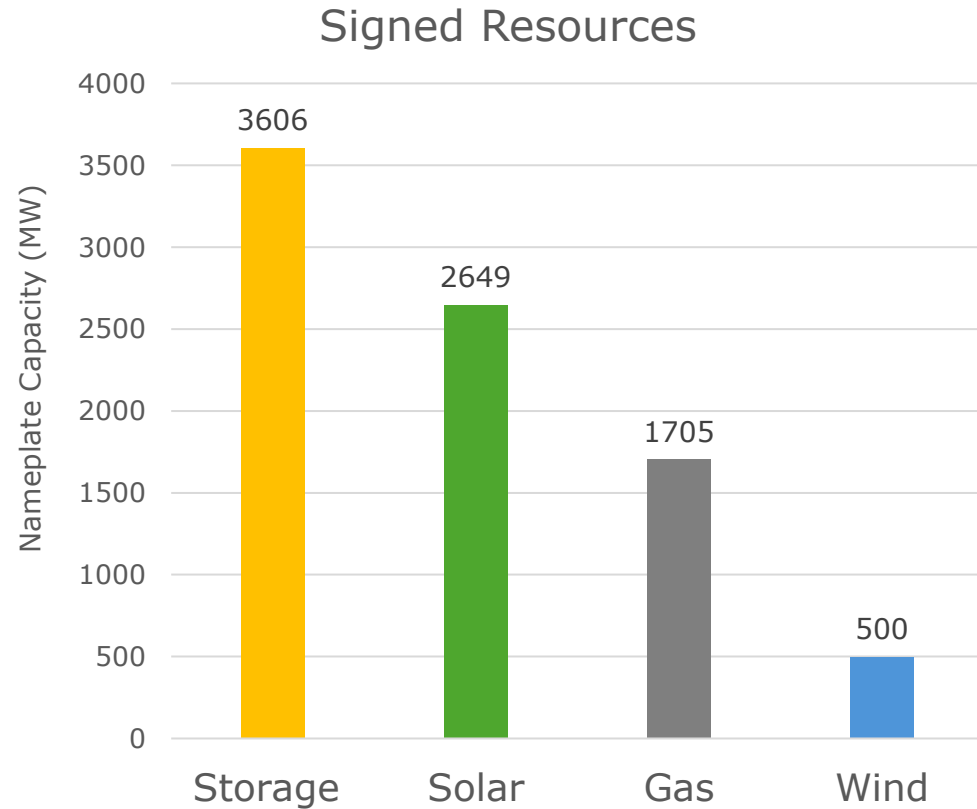
Affordable

Safe

Customer Focused



# 2023 & 2024 ASRFP – Signed Resources (Combined)



## Maintaining a Balanced Resource Procurement

- Sought capacity to meet both near-term and longer-term reliability needs
- Target CODs spanning 2026-2030
- Contracted 37% renewable; 80% clean
- 8,460 MW signed total
- 8,600 MW summer 2025 peak demand





# 2025 ASRFP

## Proposal Overview

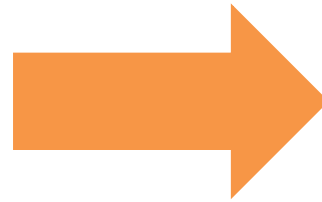
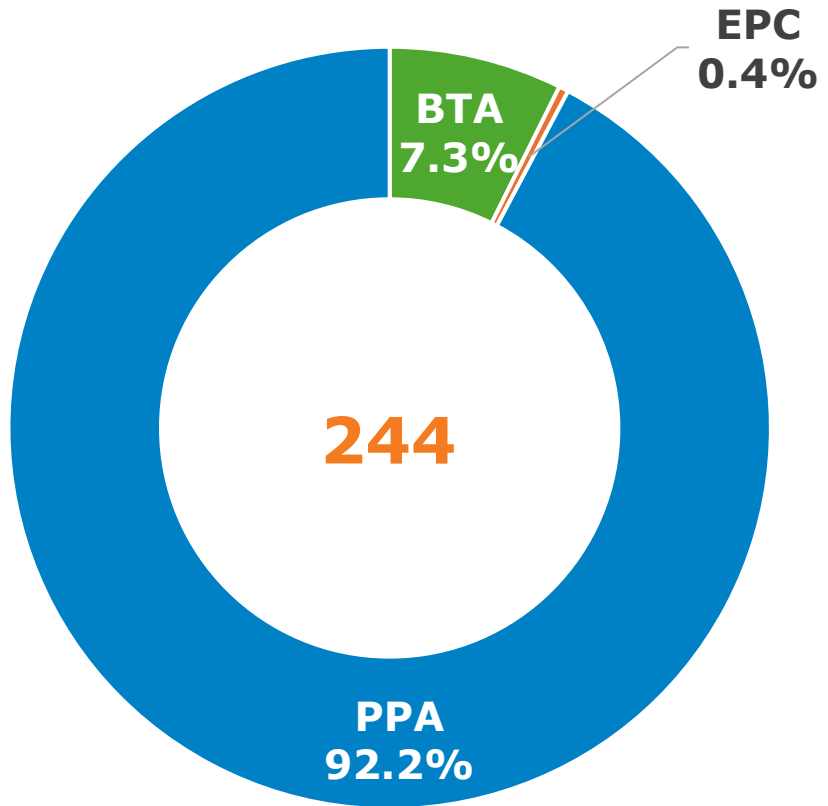
- APS is seeking at least 1 GW of resources to reliably meet summer peak, overnight energy, reserve margins, and growing XHLF demand
- Seeking resources in:
  - Near term (2028 – 2031)
  - Mid to long-term (2031+)
- Opportunities for both APS and third-party ownership

Event	2025 ASRFP Important Dates
RFP Release	Complete
Bidder's Conference	Complete
Proposal(s) Submitted	Complete
Shortlist Respondents Notified	May – August 2026
Anticipated Contract Execution	July – December 2026



# 2025 ASRFP Total Bids Received

## Total Proposals/Structures Received



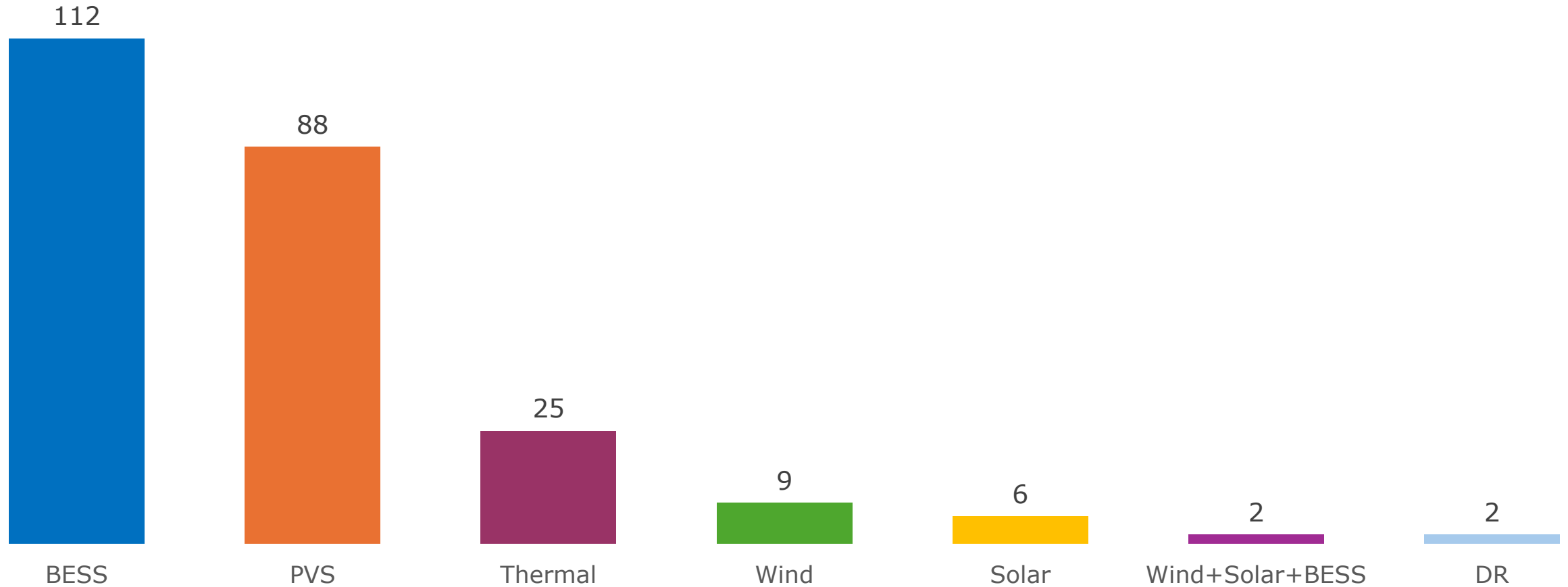
## 244 Total Proposals/Structures Received

- 225 PPA structures
- 18 BTA structures
- 1 EPC structure
- 137 unique projects received
- 62 unique bidders



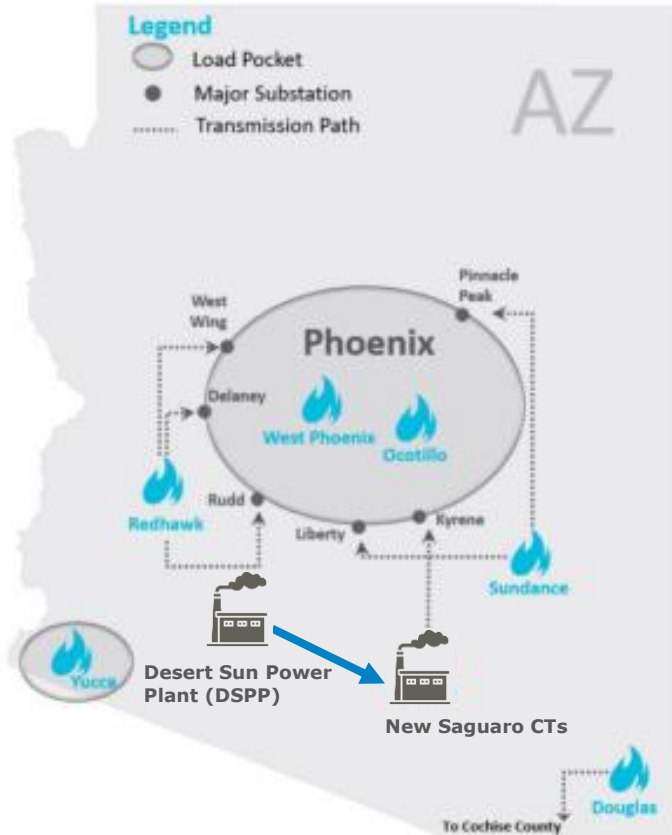
# 2025 ASRFP Bid Type Received

Number of Proposals by Resource Type





# CT Placement at Existing Saguaro Facility



APS has offered opportunities to bid for Desert Sun Power Plant (DSPP) combustion turbines at the existing Saguaro Power Plant in Pinal County, Arizona, rather than at the previously offered Gila Bend location:

- Uses existing site infrastructure and transmission interconnections at Saguaro
- 700 MW of total installed capacity (relocated, **not incremental**)
- Targeted COD in 2031

Location for part of the DSPP opportunity has changed. Volume of proposed natural gas procurement remains the same.



# Remaining Steps

March – April\*

April – July\*

July – December\*

## CONFORMING/INITIAL SCREENING

- Verify eligible resource
- Verify completion of datasheets
- Verify completion of requested documents

IM  
Review

## QUALITATIVE EVALUATION

- Verify Experience
- Verify Site Control, Interconnection
- Safety ratings
- Financial risk review

## QUANTITATIVE EVALUATION

- Review pricing
- Review technical details for compliance

## SHORTLIST

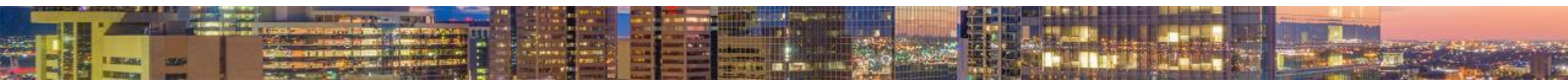
- Review scoring
- Portfolio Evaluation
- Identify bids for presentations

## NEGOTIATIONS

- Begin negotiations with selected bids

- Bids will be screened in batches, with earlier in-service dates screened first

\*Timelines are estimates and will be adjusted as needed to support customer reliability and affordability





# 2026 IRP Market Prices

Akhil Mandadi, APS / Nick Schlag, E3

# Capturing External Market Conditions in IRP Modeling

## Role of Market Price Forecast

- **Independent** market price forecast as external representation
- Opportunity to represent external world without performing external resource expansion
- Enabling representation of evolving regional market structure, two day-ahead markets, (inherently speculative, benefitting from third party market expertise)

## Modeling Specifics

- Key input during both capacity expansion and production costing
- Hourly price and depth forecast included
- Given the speculative nature of the forecast, the following assumptions are made:
  - Considered a non firm resource in the model
  - No market sales revenue assumed

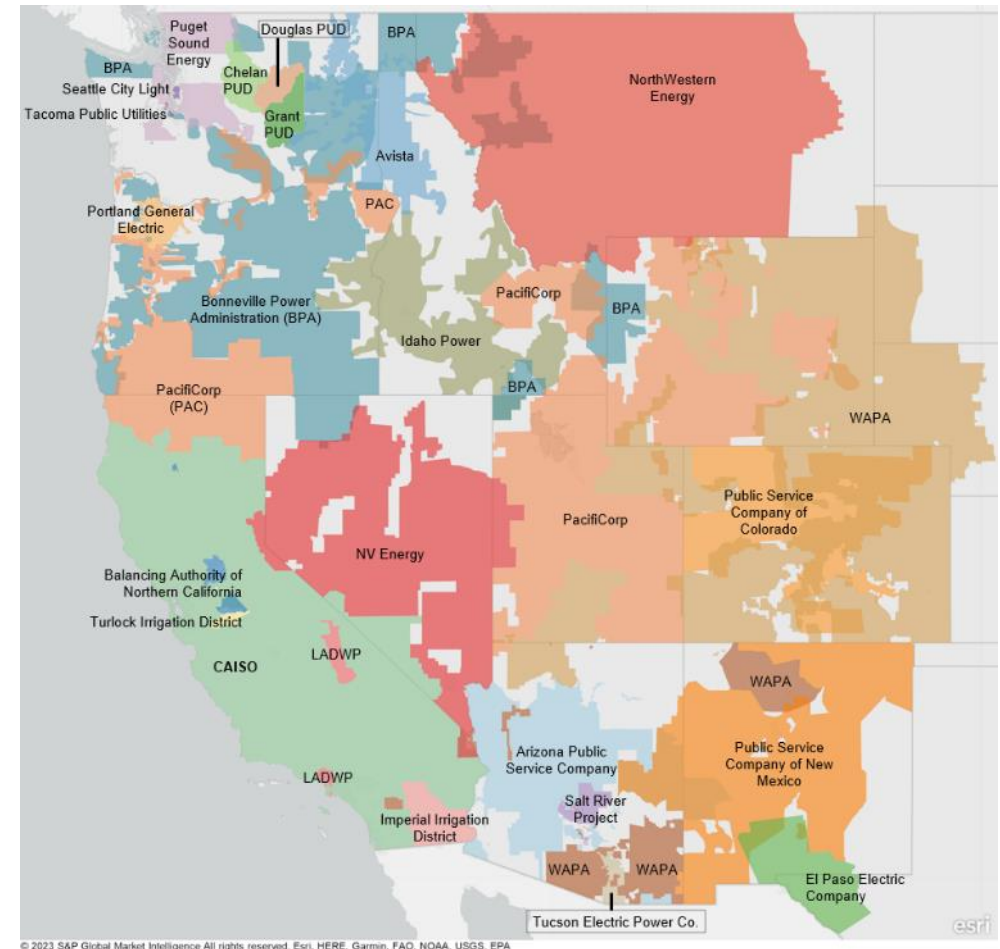
Market prices are used as a planning input and do not represent a market decision



# Wholesale Energy Markets in the Western Interconnection

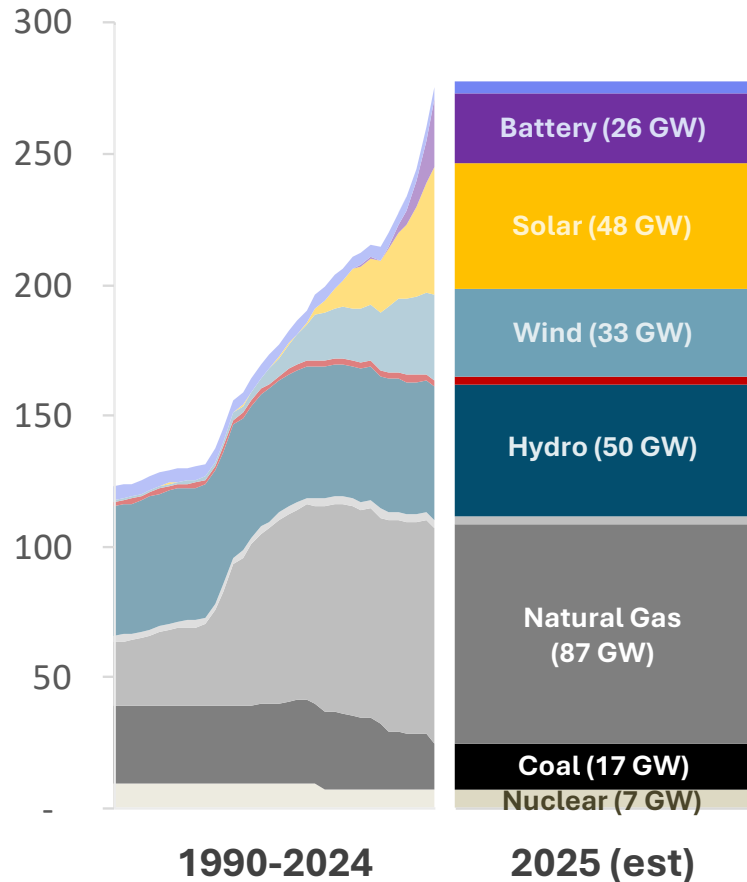
- + The Western system includes thirty-seven balancing authority areas, independently responsible for balancing loads and resources within their footprints
- + Today, a patchwork of organized and bilateral structures allows utilities and third parties to buy and sell power:
  - A single day-ahead market operated by California ISO
  - Bilateral wholesale markets with trading hubs throughout the West (e.g. Mid C, Palo Verde)
  - A real-time energy imbalance market (EIM) with a broader Western footprint, also operated by CAISO
- + Over the next several years, movement towards organized day-ahead markets is expected
  - Most large utilities have signaled intent to join either SPP Markets+ or California ISO's Enhanced Day Ahead Market

Thirty-Seven Balancing Authority Areas (BAAs) in the WECC



# State of the Western Interconnection Today

Installed Capacity of Generation Resources, WECC-US (GW)

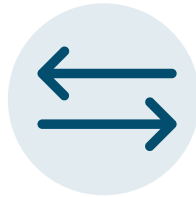


The electricity system in the West is currently in a period of transformational change:



## Accelerated growth due to large loads

*New industrial and data center loads – on top of other sources of load growth – will require significant investments in new resources*



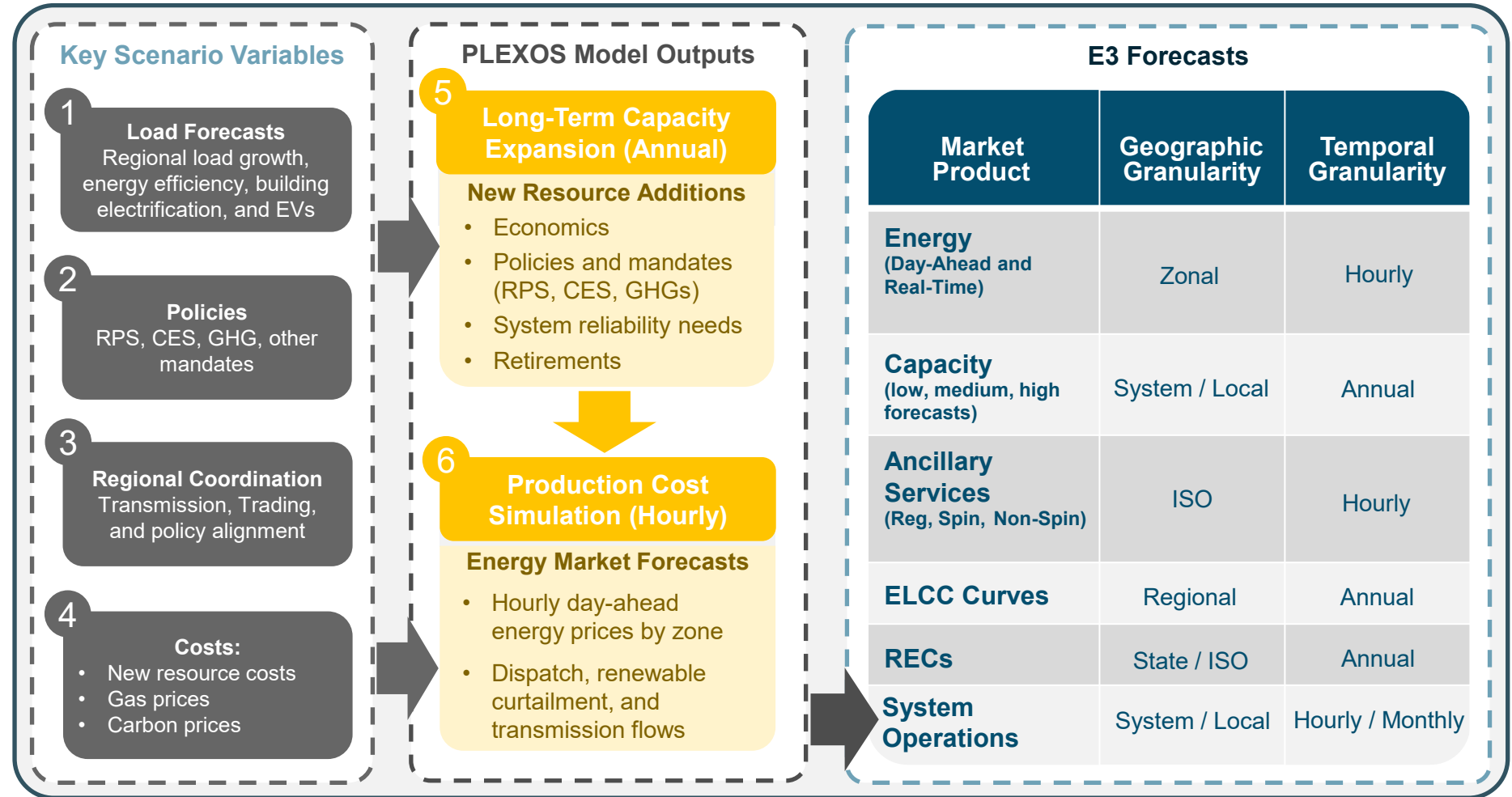
## Transitioning generation mix

*Penetrations of renewables and storage are increasing rapidly due to state policy, utility and corporate goals, and economics, while many aging fossil plants are approaching end of useful lives*

How these changes play out over the next several decades will shape the dynamics of wholesale electricity markets across the West

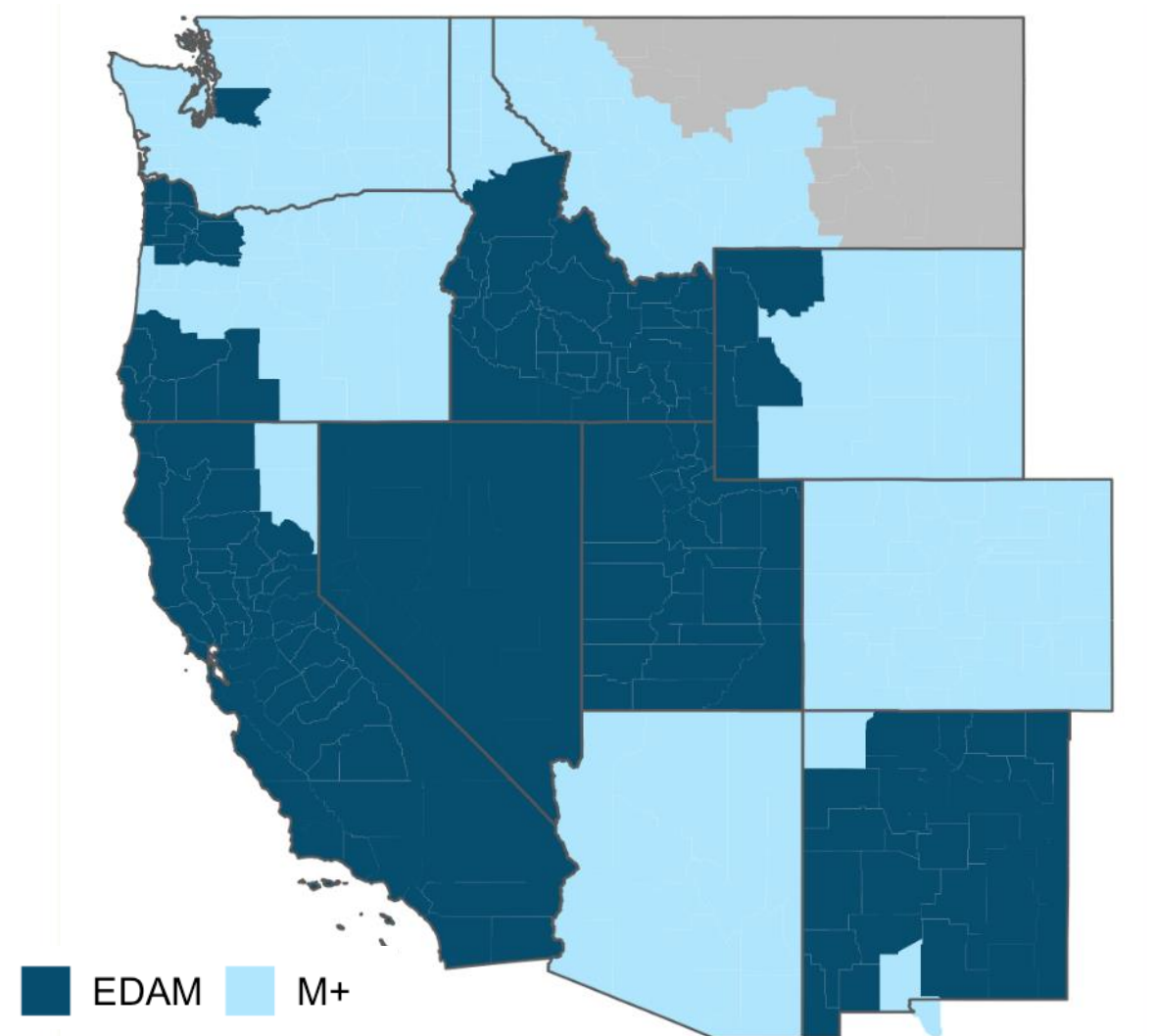
# A Fundamentals-Based Approach to Market Price Forecasting

E3 uses a “fundamentals-based” approach to develop market price forecasts derived from a view of how loads and resources across the region are likely to evolve over the next several decades



# EDAM and Markets+ Footprints in E3 WECC Model

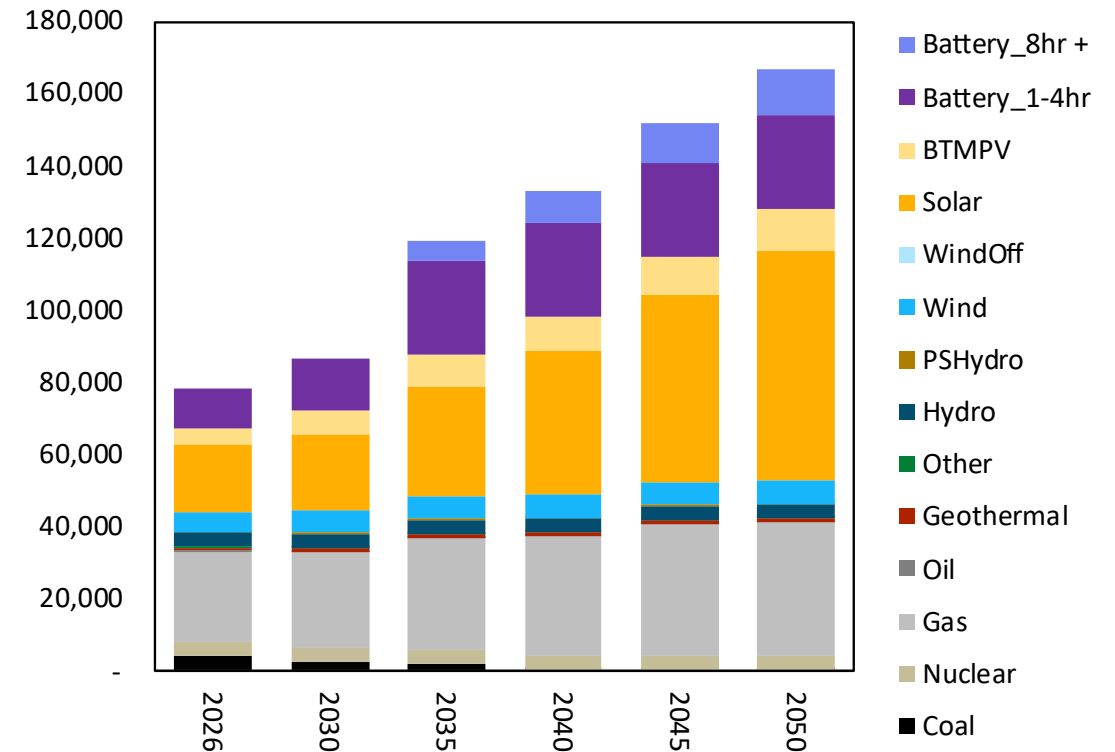
- + E3's Core Case models EDAM and Markets+ going live in 2027 in accordance with current targets
- + Market participation footprints follow public announcements and “leanings” of balancing authorities
- + Transfer costs increase between market seams and decrease within market groups
  - Physical transmission capabilities still limit power flow between all balancing authorities
  - Wheeling rates are removed between zones **within market groups**
  - Wheeling charges **between market groups** are maintained and based on balancing authority OATT rates
  - An additional “risk factor” is added to hurdle rates **between market groups** to reflect price uncertainty from scheduled generation crossing market footprints



# Outlook for Capacity and Generation in the Southwest

- + Significant quantities of new generation added across the region to meet growing energy and capacity needs
- + Changes to resource mix reflect technology-specific considerations:
  - Solar and storage capacity increases significantly, supporting summer peak needs
  - New natural gas capacity added as a firm resource to ensure resource adequacy
  - Limited development of wind resources – despite high quality resources in New Mexico, transmission is a bottleneck
  - Remaining coal resources phase out of system by mid 2030s, with multiple plants converting to natural gas
- + Emerging system dynamic: relative energy abundance during daytime (solar) hours, relative scarcity during overnight periods where storage and gas are needed

Southwest Installed Capacity (MW)



# Future Pricing Patterns Reflect Increasing Penetrations of Renewables and Storage

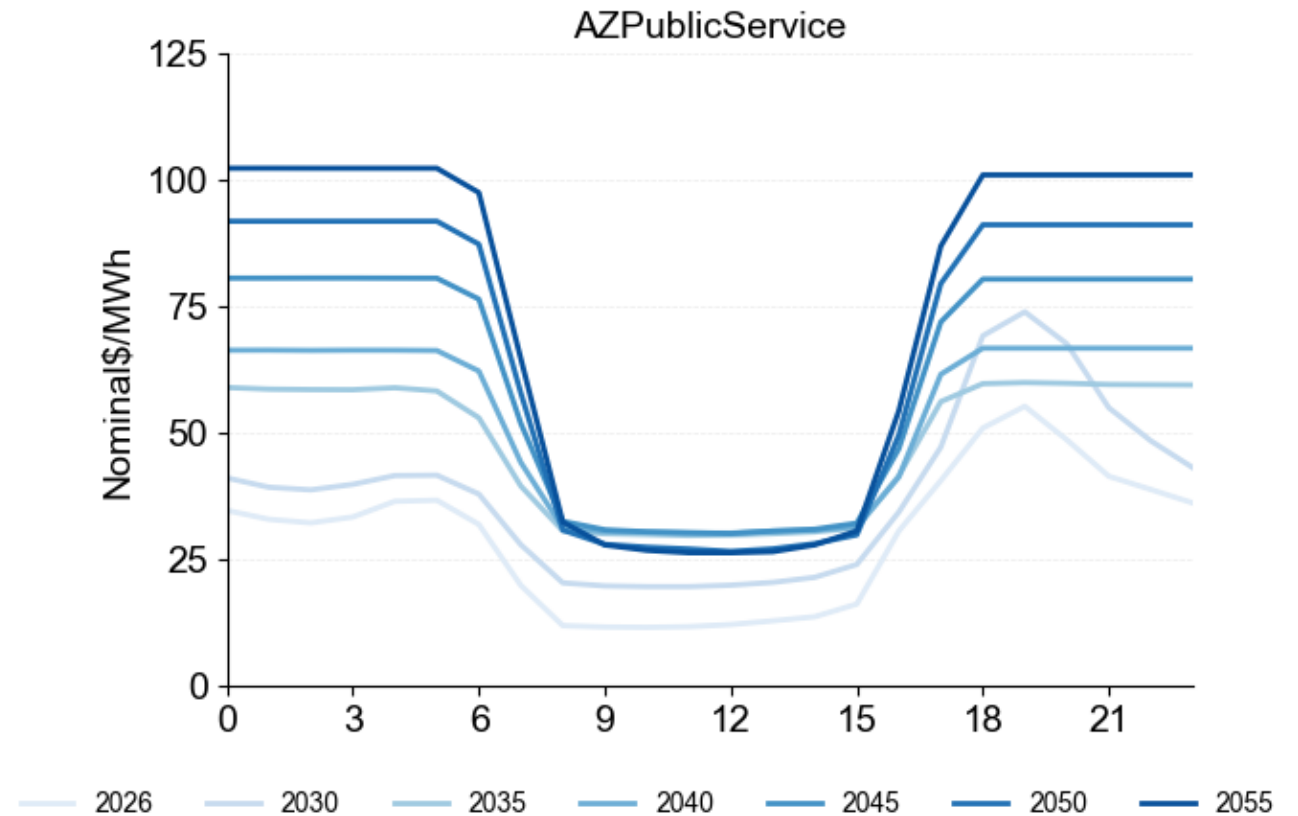
+ The duck curve persists through the full forecast period, and peak pricing continues to occur in sundown hours

- Peak pricing continues to occur in sundown hours while battery discharge helps to flatten overnight prices
- Excess solar generation keeps daytime prices low and supports mid-day battery charging
- Overnight prices rise driven by load growth and increasing gas prices, even with mitigation from evening storage discharge

+ While average prices in all hours grow over time, the increase in overnight prices is much more obvious than in mid-day hours because of the region's solar-heavy portfolio

+ Relative changes year to year in the trough and the peaks of the duck curve are driven primarily by the balance of solar to storage

Average Day-Ahead Energy Prices by Hour (Nominal \$/MWh)

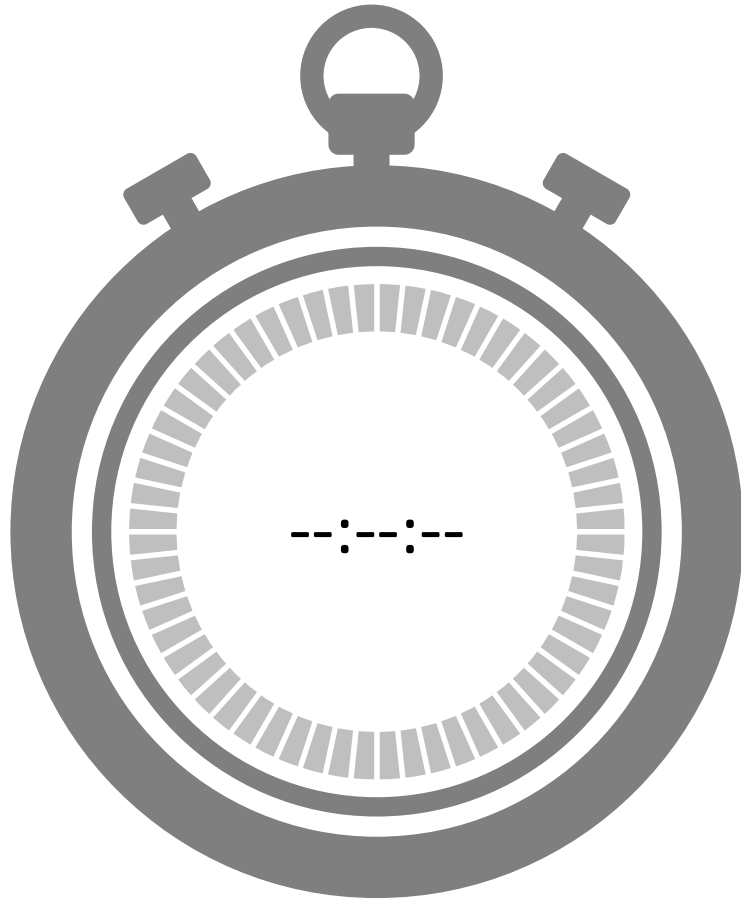




Break



# Time for a Break



Break Duration 5 min.

Meeting will resume at

hh:mm





# Resource Adequacy Follow-Up

Nick Schlag, E3

# Resource Adequacy Education: Three Questions

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**1**  
What is the difference between an “ICAP” and a “PCAP” planning reserve margin?

**2**  
What is “ELCC,” and why is it the preferred method for counting capacity?

**3**  
What are the advantages of using the PCAP convention in the planning reserve margin?



# Resource Adequacy Basics



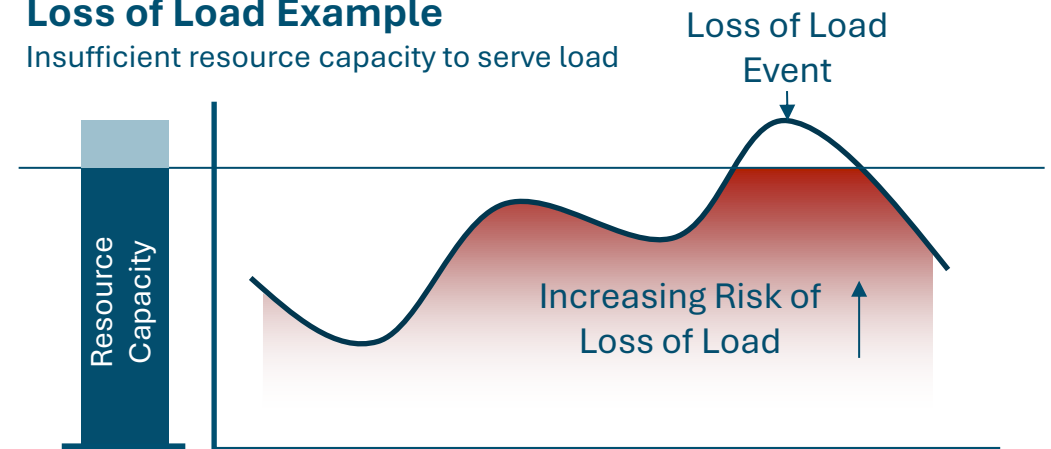
Energy+Environmental Economics

# What is “Resource Adequacy?”

- + **Resource adequacy** is a measure of the ability of a portfolio of generation resources to meet load across a wide range of system conditions, accounting for supply & demand variability
- + The resource adequacy of an electricity system is typically measured against a standard that usually allows for small or infrequent reliability events
  - Most common standard: “one day in ten years”, or LOLE = 0.1 days per year
  - No system is planned to achieve perfect reliability
- + For simplicity, resource adequacy is often expressed in terms of a capacity balance relative to peak demand

## Loss of Load Example

Insufficient resource capacity to serve load



### **NERC Definition of Resource Adequacy:**

*“The ability of supply-side and demand-side resources to meet the aggregate electrical demand (including losses)”*

Source: [NERC Glossary of Terms](#)

# Resource Adequacy is Increasing in Complexity – and Importance

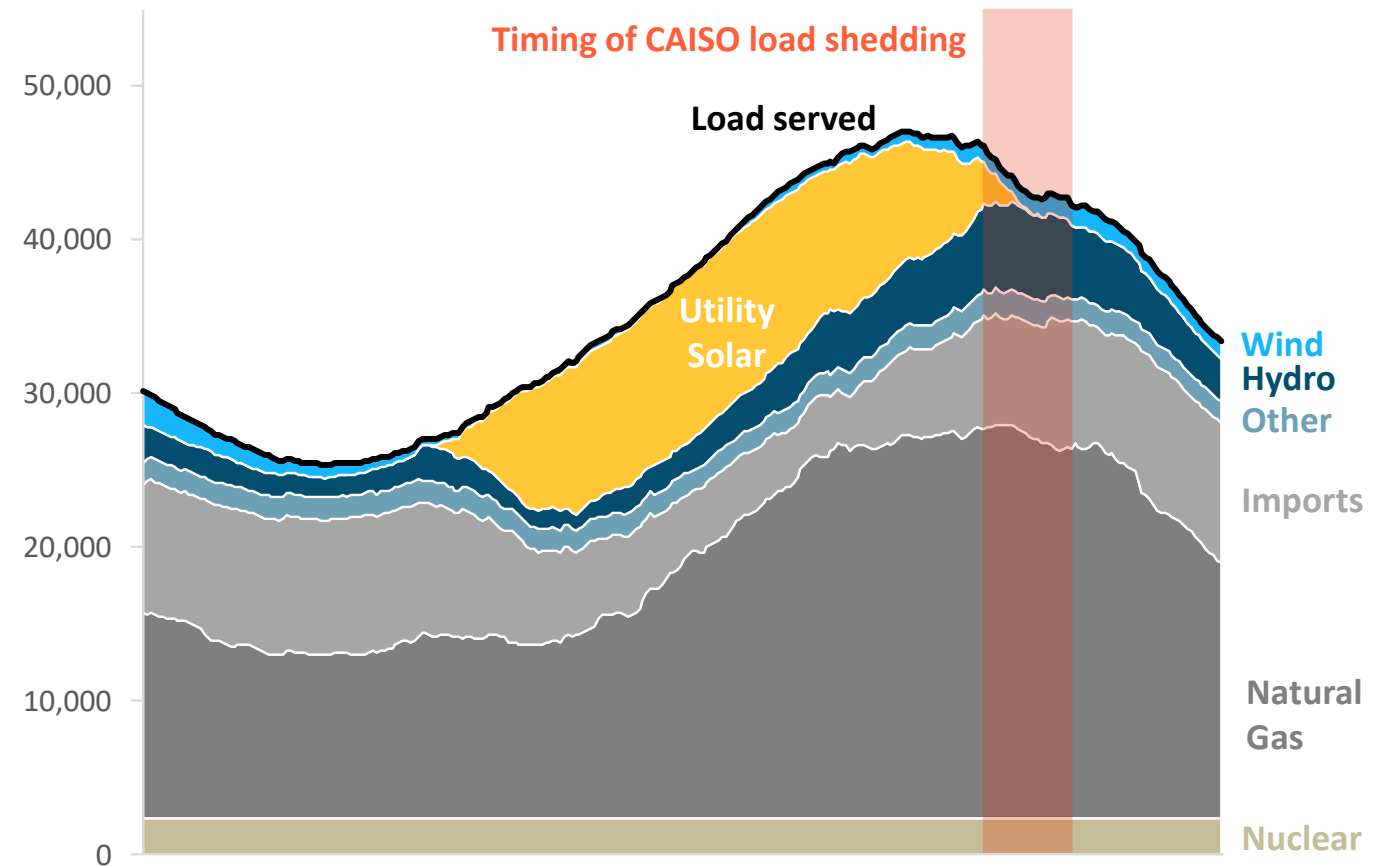
## + Transition towards renewables and storage introduces new sources of complexity in resource adequacy planning

- The concept of planning exclusively for peak demand becoming obsolete
- Risk is shifting to periods outside of the traditional peak (e.g. California’s rotating outages during August 2020 “net peak” period)

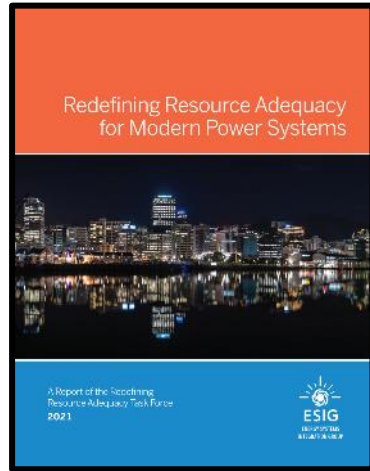
## + Reliable electricity supply is becoming increasingly important to society:

- Space heating and air conditioning under extreme weather conditions can be a matter of life or death
- New electric loads – from data centers to electric vehicles – make electricity even more central to day-to-day life and economic development

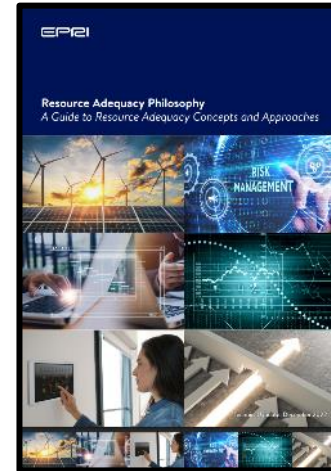
CAISO System Operations on August 14, 2020  
(MW of generation & load served)



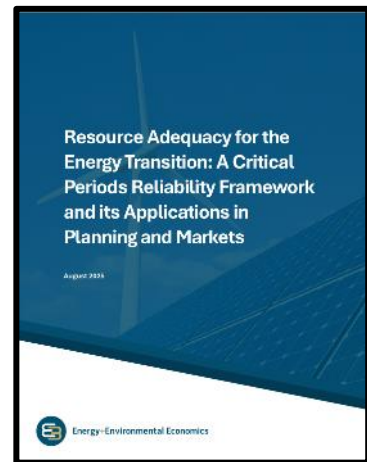
# Experts Agree: Effectively Planning for Resource Adequacy Must Consider All Hours of the Year



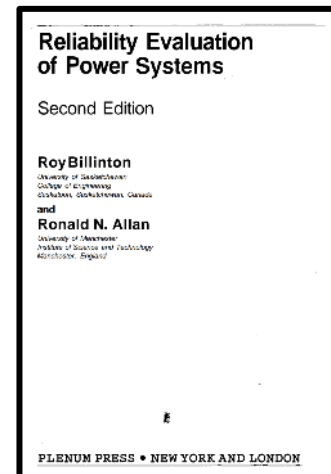
*“The conventional assumption that peak risk is aligned with peak load is no longer true, requiring a **chronological evaluation of all hours of the year** so that the times of risk of shortfall can be accurately identified.”*



*“...**modeling year-long chronological operations** that reflects net load variability and that captures the size, frequency, and duration of shortfall events is increasingly becoming **standard practice.**”*



*“...in the future, **critical periods will increasingly occur at different times of day and year** due to combinations of high load and low resource availability.”*



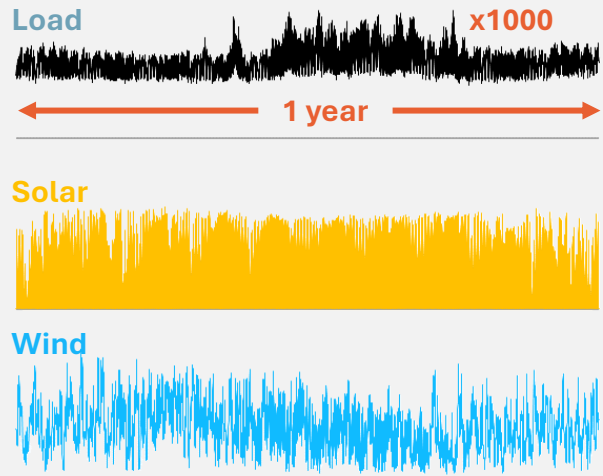
*“...the **sequential approach is required if the past history affects the present conditions.** This is the case in a power system containing hydroplant in which the past use of energy resources (e.g., water) affects the ability to generate energy in subsequent time intervals.”*

# Key Steps for Any Resource Adequacy Framework

## Step 1: Model + Data Development

Develop a robust dataset of the loads and resources, typically in a loss of load probability (LOLP) model

LOLP modeling evaluates resource adequacy across all hours of the year under a broad range of weather conditions

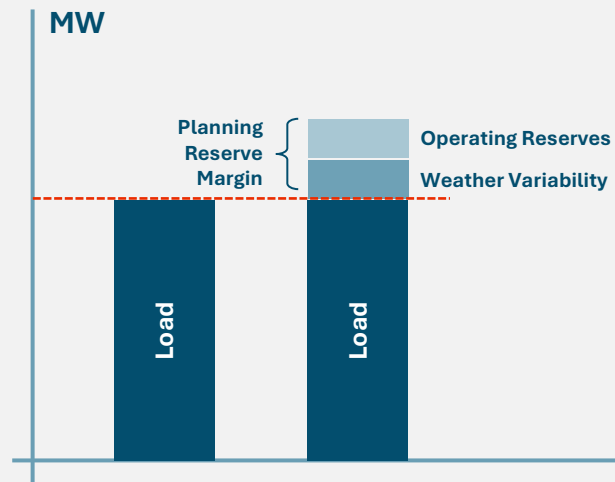


*Robust probabilistic models + datasets are the foundation of any resource adequacy analysis*

## Step 2: Need Determination and Allocation

Identify the total need to achieve the desired level of reliability

Factors that impact the amount of effective capacity needed include load & weather variability, operating reserve needs

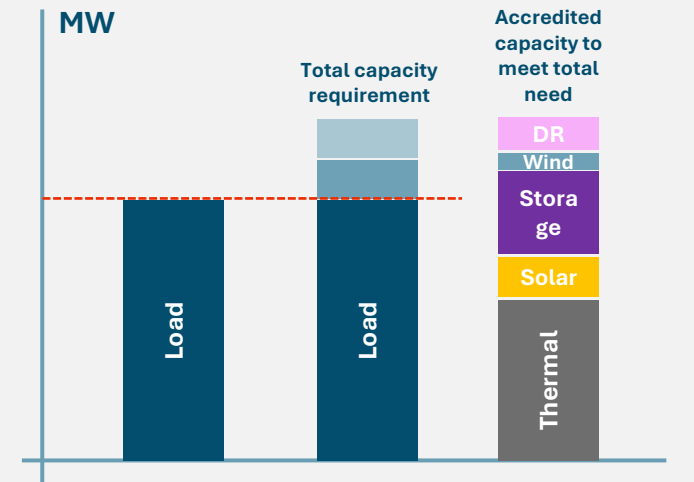


*A need determination sets the total requirements for reliability resource procurement to meet a target level of reliability (e.g. 0.1 LOLE)*

## Step 3: Resource Accreditation

Assign capacity credits to resources

Measures a resource's contribution to reliability needs relative to target reliability, accounting for performance across all hours



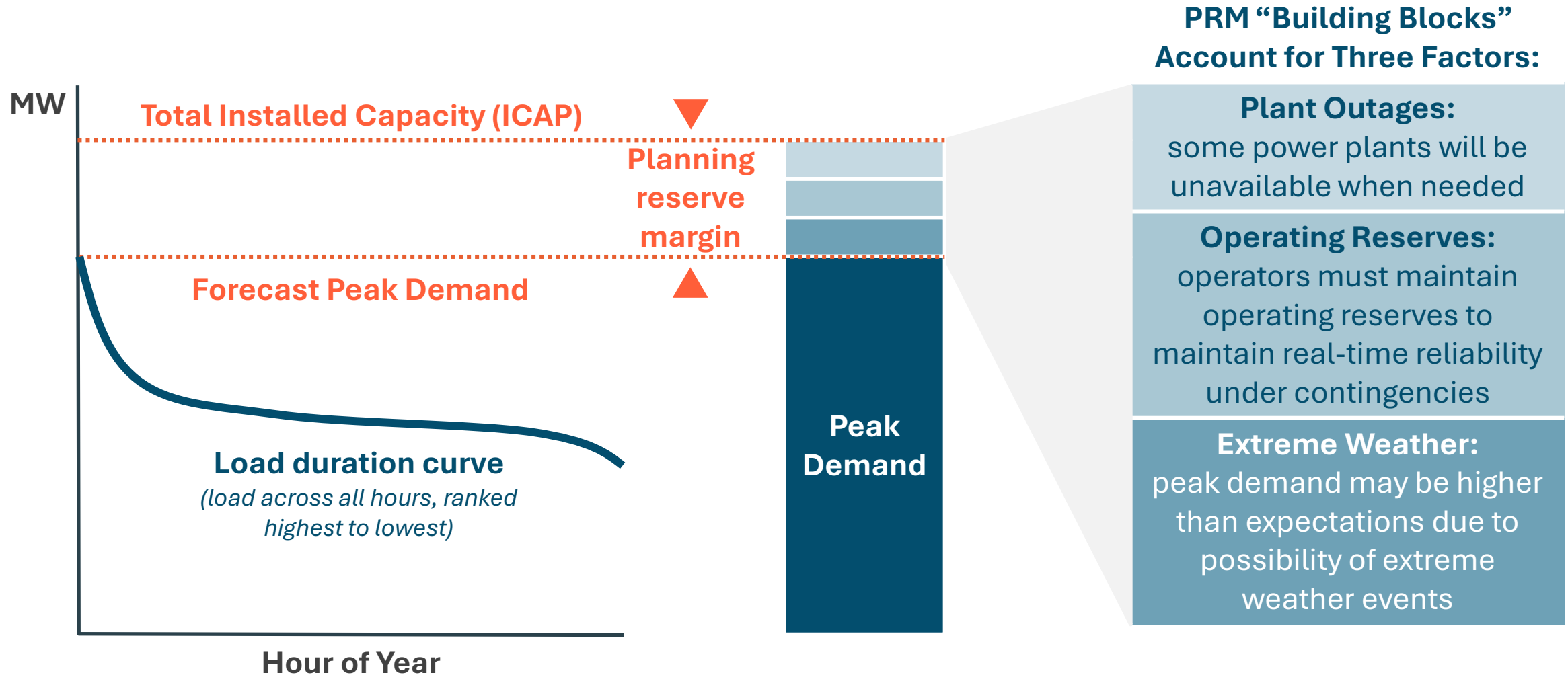
*Resource accreditation determines how much each resource counts towards the total reliability need*

# **Deep Dive into Reserve Margins & Capacity Accreditation**



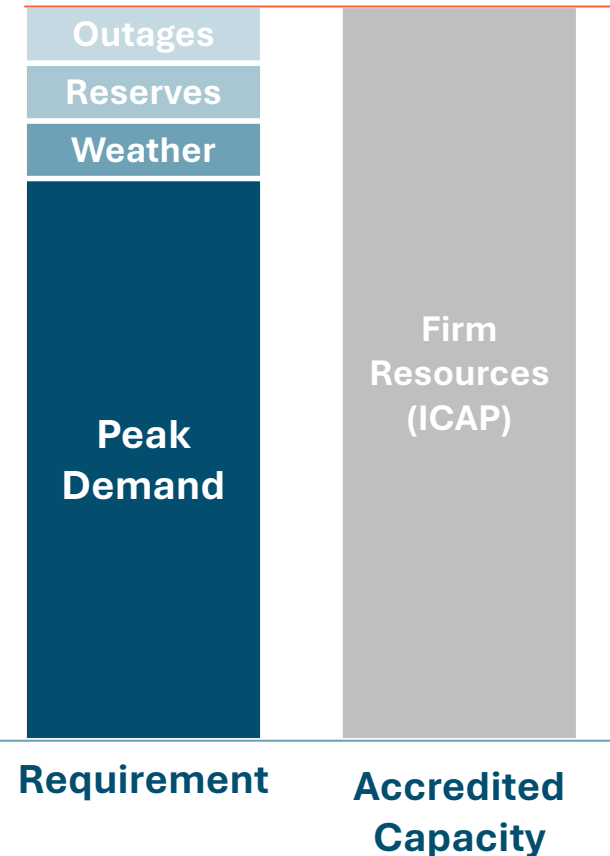
Energy+Environmental Economics

# The “Classical” Model for Resource Adequacy

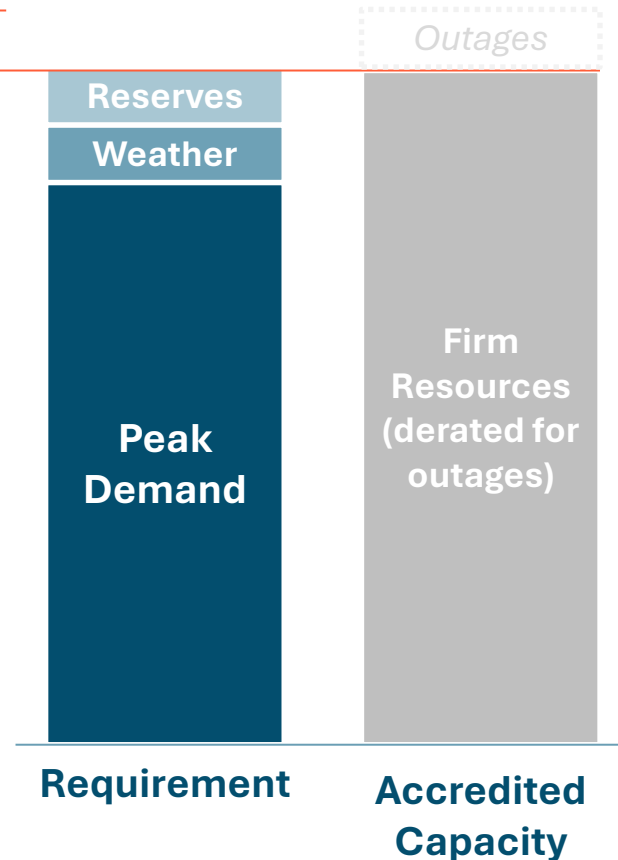


# Classical “ICAP” Accounting is Not the Only Option

## Installed Capacity (“ICAP”) PRM Accounting



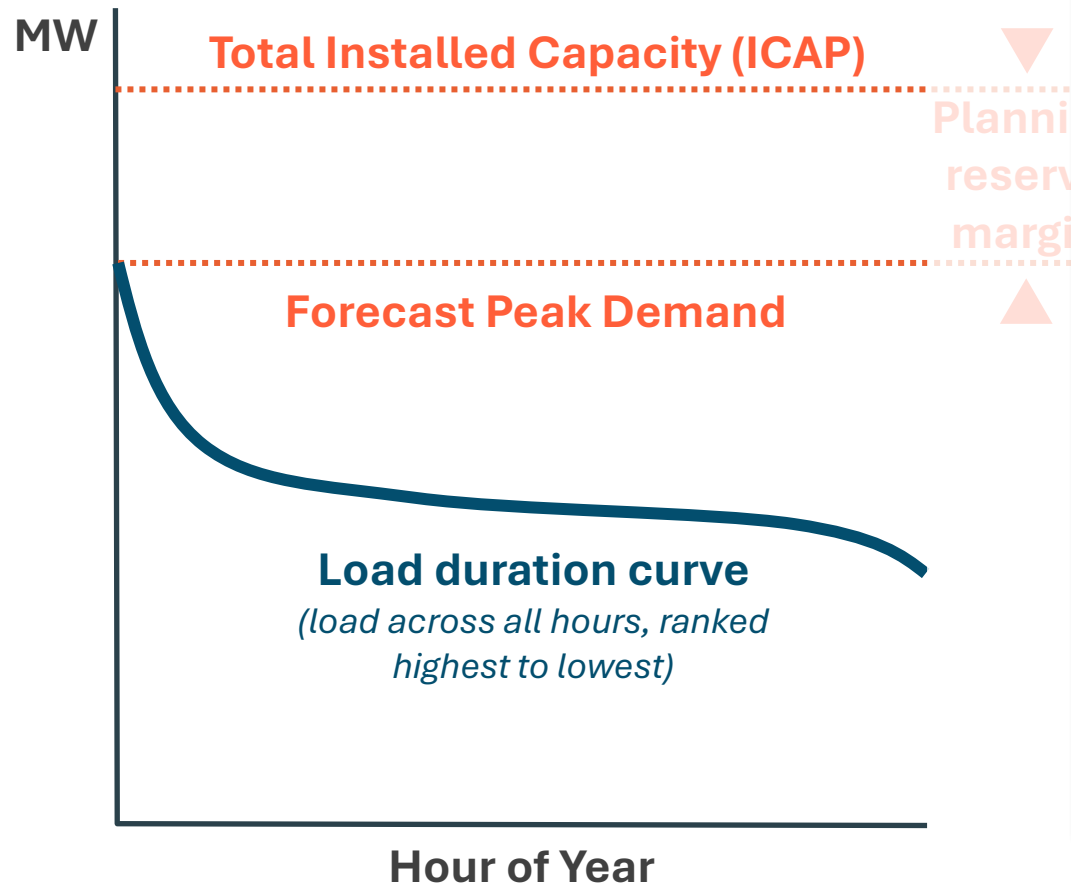
## Perfect Capacity (“PCAP”) PRM Accounting



Planning reserve margin requirement and firm resource accreditation are each reduced by the same amount – preserving the same underlying load-resource balance

Both accounting methods describe the same underlying physical system

# The “Classical” Model for Resource Adequacy



PRM “Building Blocks”

## Why did this work well?

Historically, most resources were capable of operating at full capacity when needed (“firm” resources)

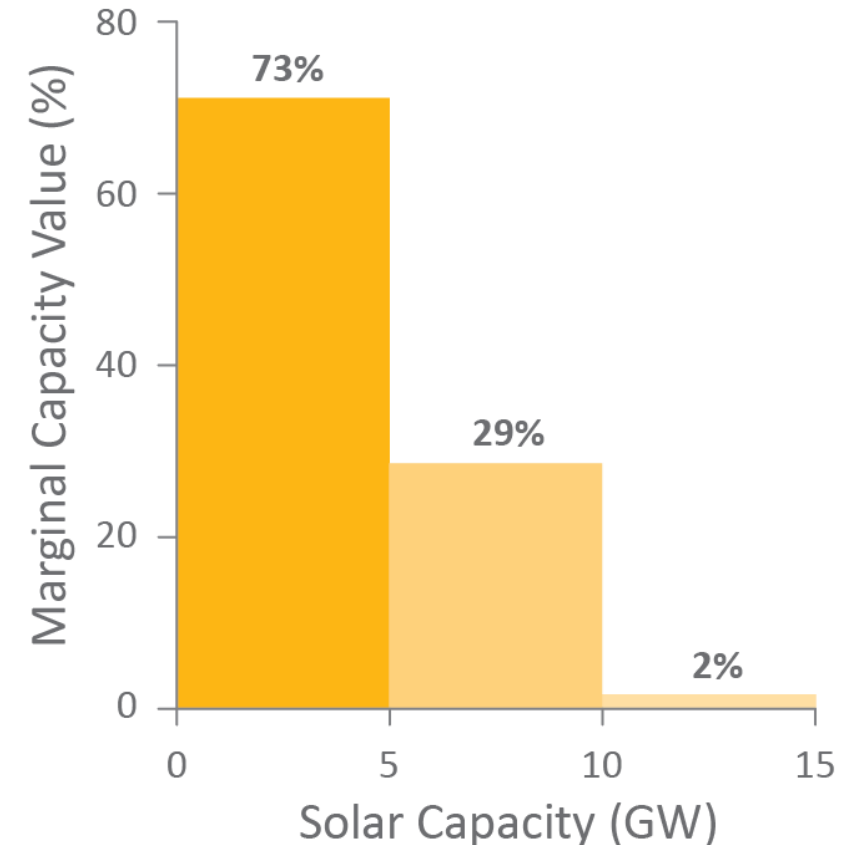
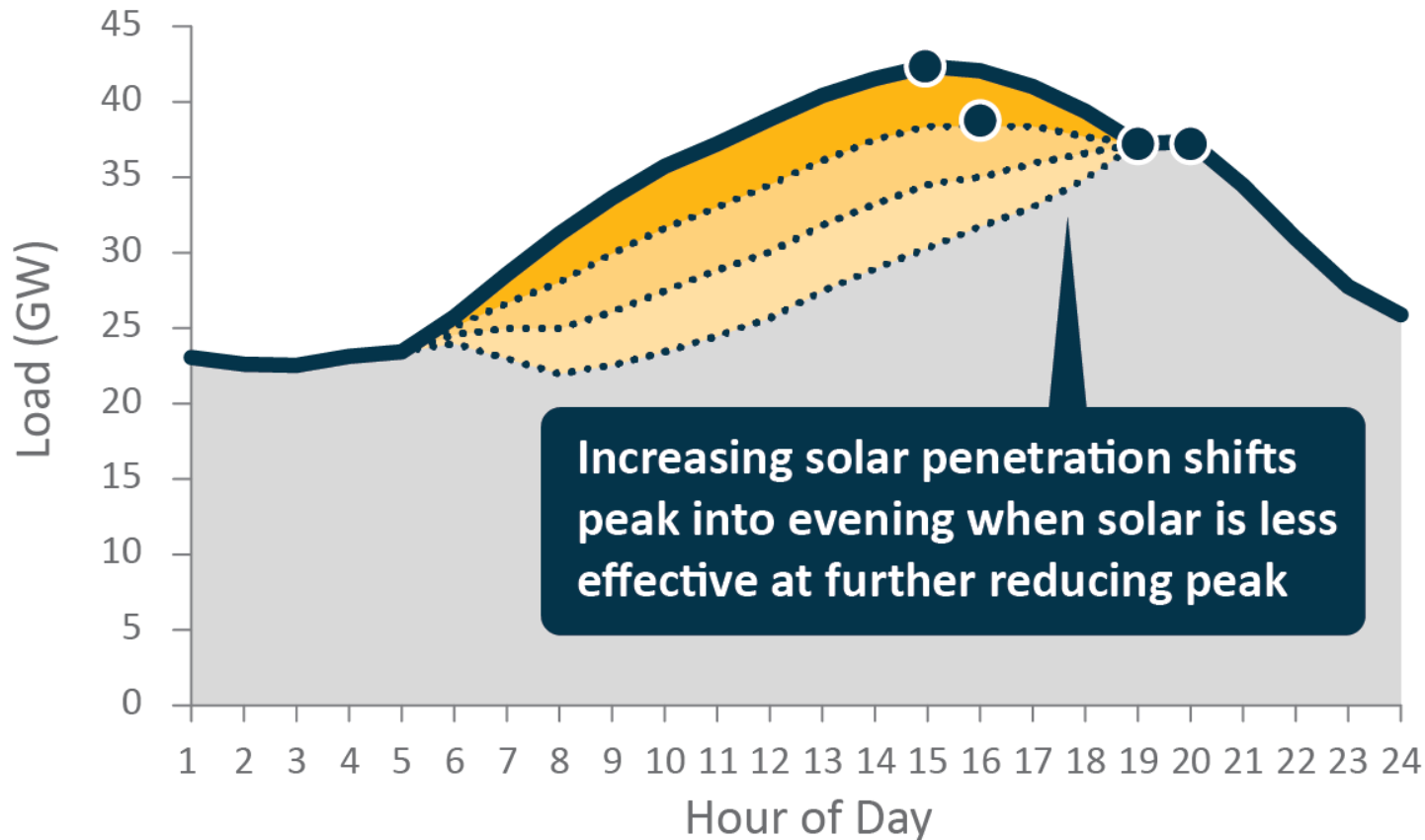
As long as a utility could meet peak demand, they would also have enough capacity available the rest of the year

## Why did this start to break down?

Over past two decades, resource mix has shifted towards larger quantities of resources that are not always capable of producing power at full output levels (e.g. wind, solar, energy storage, demand response)

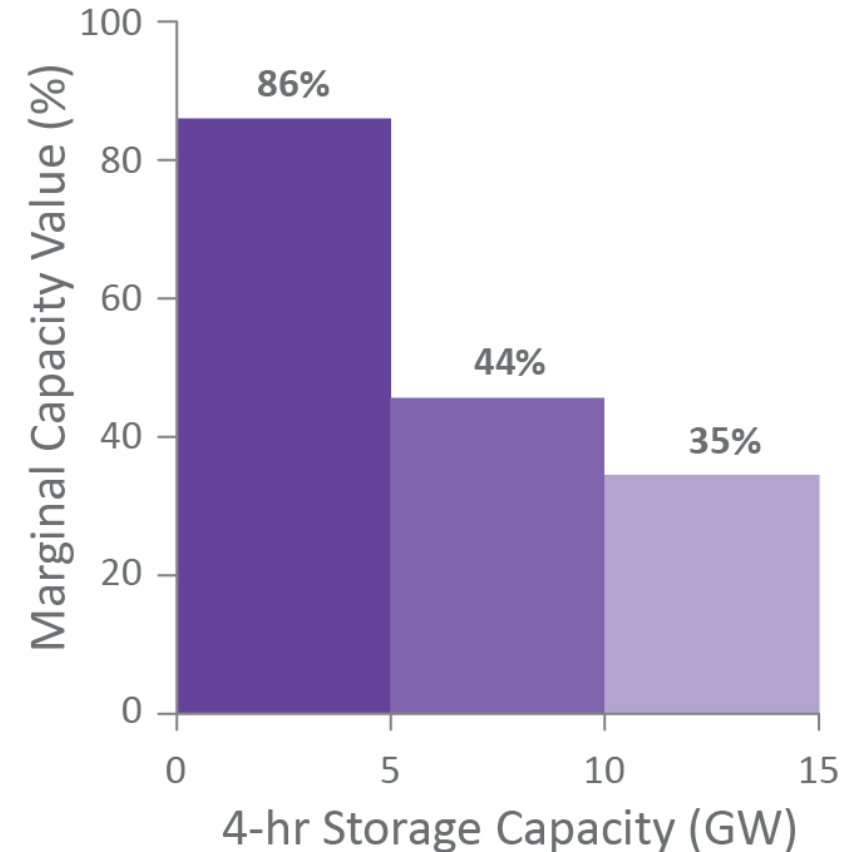
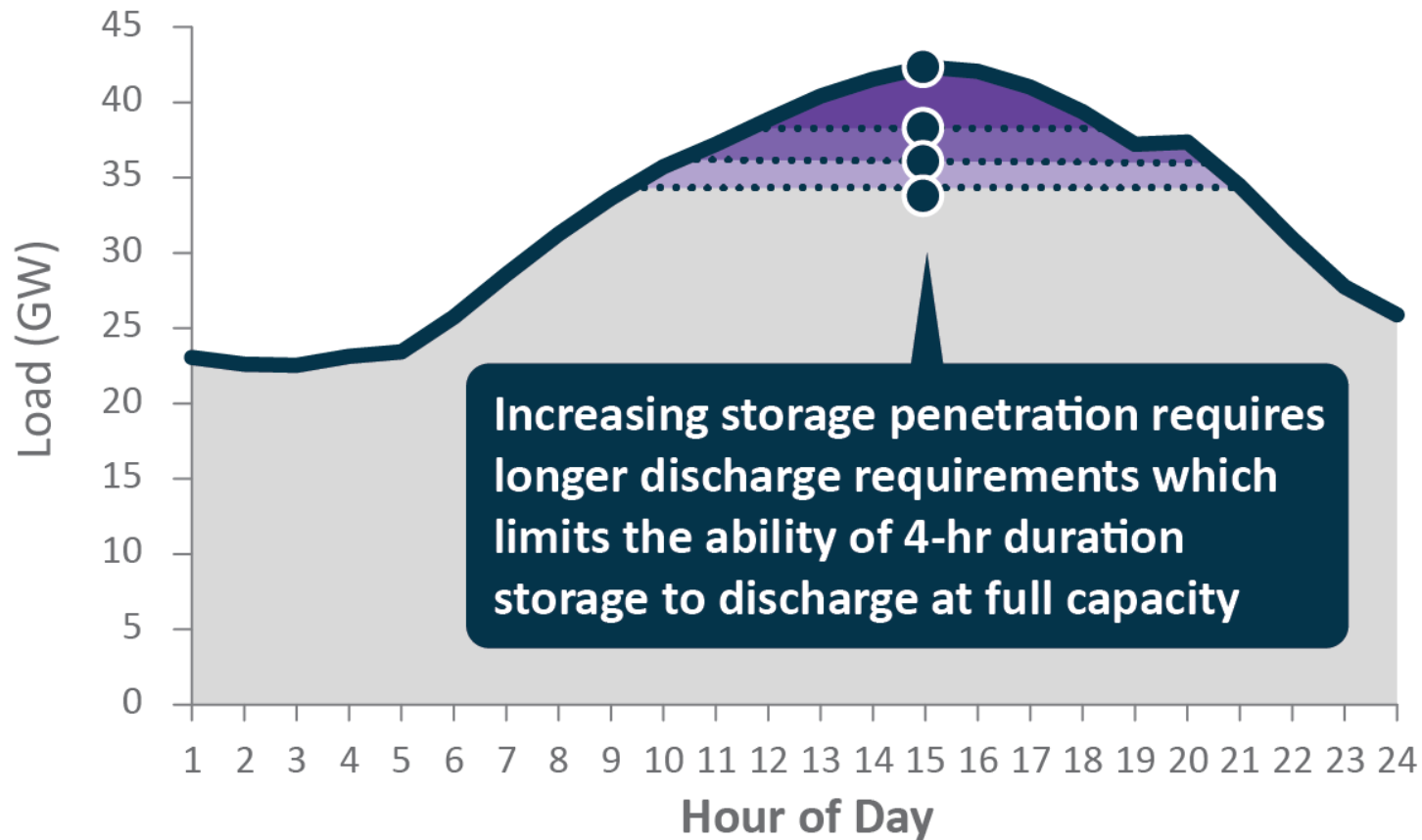
# Complication #1: Variable Resources (Solar, Wind)

## Diminishing Capacity Value of Solar

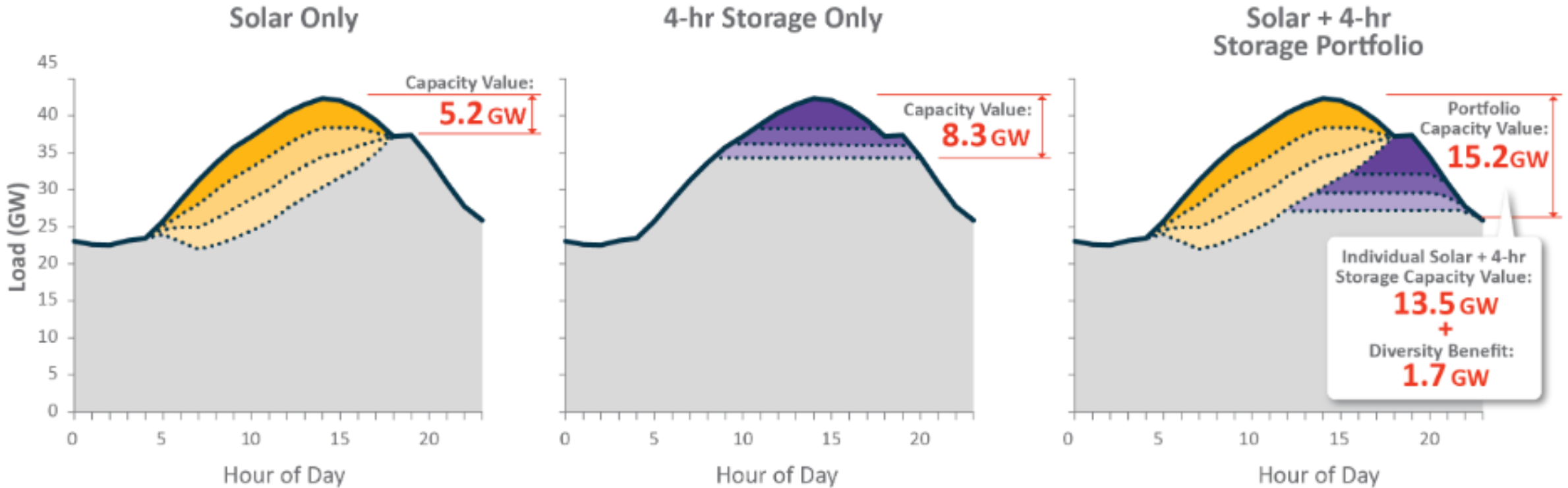


# Complication #2: Energy-Limited Resources (Storage, DR)

## Diminishing Value of 4-hr Storage ELCC



# Complication #3: Interactive Effects

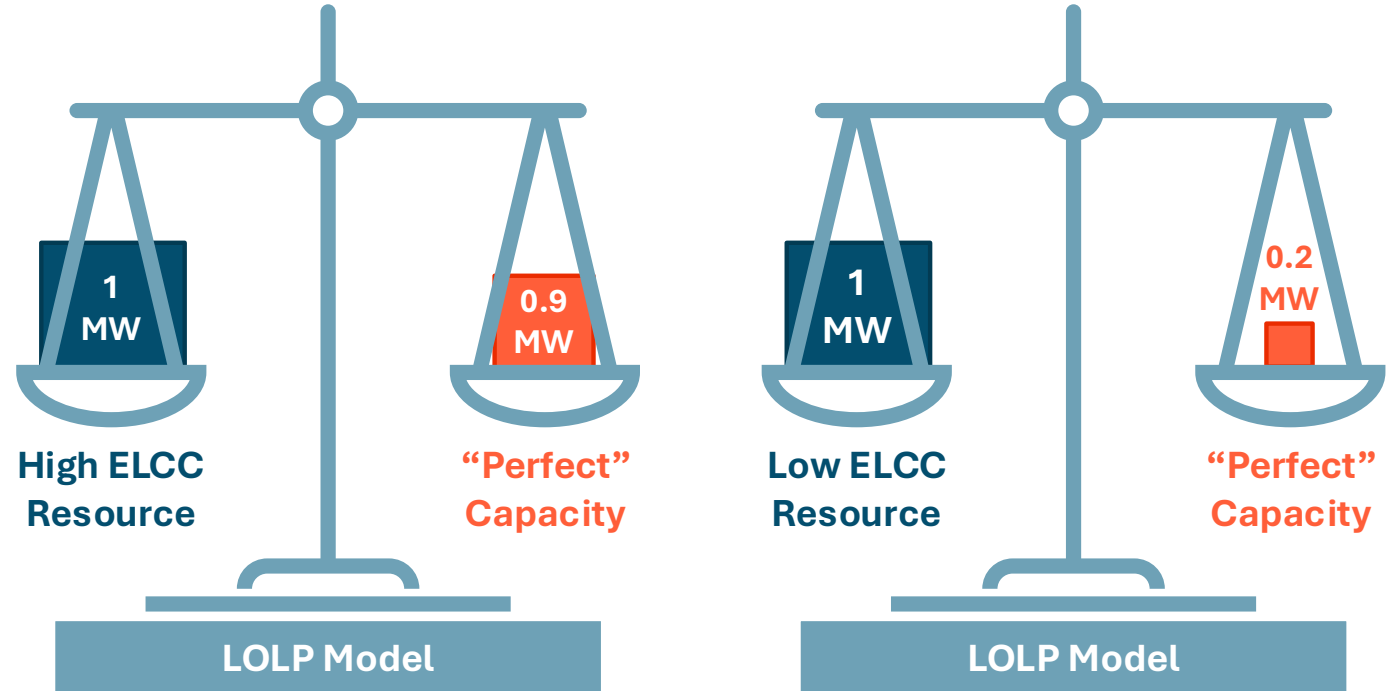


# Effective Load Carrying Capability (“ELCC”) for Accreditation

The ELCC of a resource (or portfolio of resources) is the quantity of perfect capacity (“PCAP”) that can be displaced or avoided while maintaining equivalent system reliability

Features of the ELCC Approach:

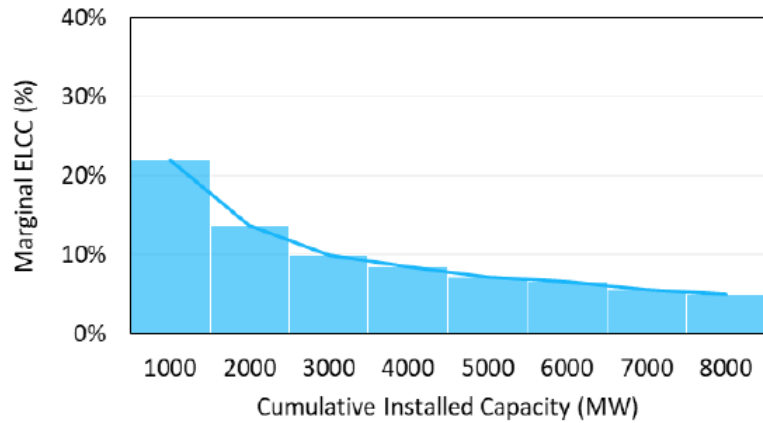
1. Calculated using loss-of-load-probability modeling
2. Accounts for supply-demand balance across all hours of the year
3. Captures saturation effects at increasing technology penetration
4. Captures interactive effects among diverse technologies



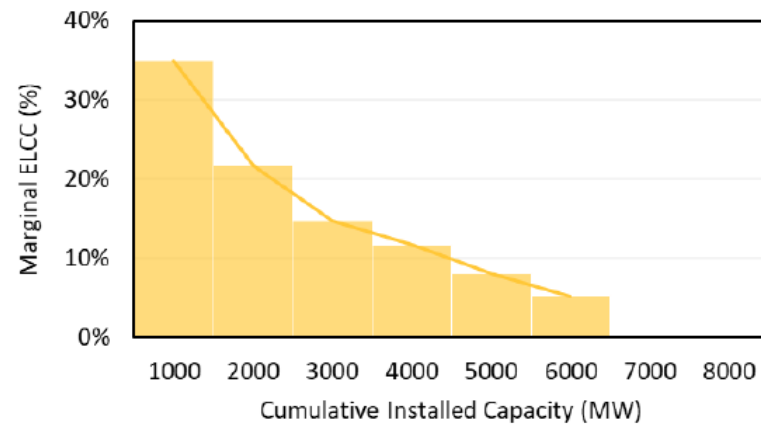
**“Perfect” Capacity (“PCAP”): a theoretical benchmark resource that is available at maximum capacity in all hours of the year**

# Example ELCC Curves for Individual Resources

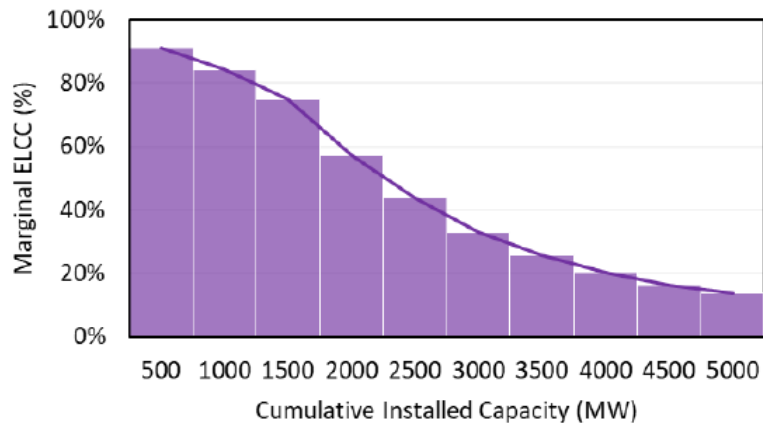
### Marginal ELCC (%) - Wind



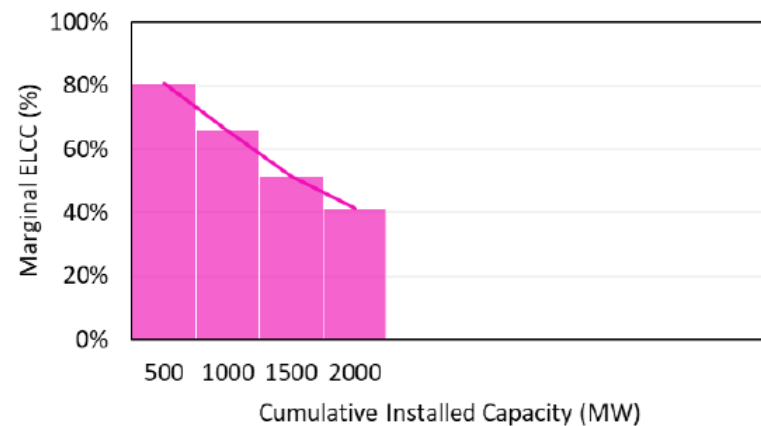
### Marginal ELCC (%) - Solar



### Marginal ELCC (%) - 4-hr Battery Storage



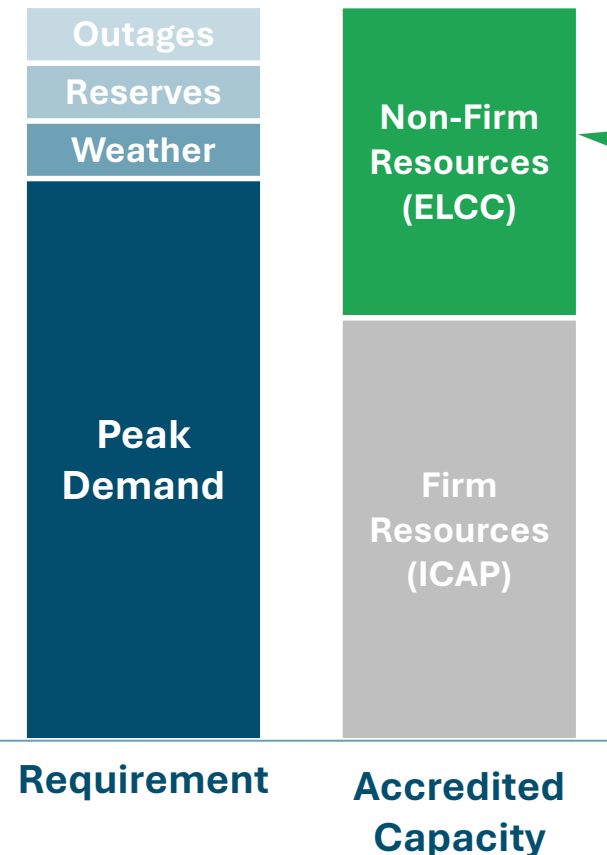
### Marginal ELCC (%) - 4-hr DR



*Example is illustrative – not based on APS system*

# Introduction of ELCC into Traditional “ICAP” Reserve Margin

## Installed Capacity (“ICAP”) PRRM Accounting



Adoption of ELCC for a wide range of “non-firm” resources (e.g. wind, solar, storage, demand response) was a major step forward for resource adequacy planning – but introduced a more subtle inconsistency...

### The Inconsistency

1 MW of ELCC from Non-Firm Resources

≠

1 MW of ICAP from Firm Resources

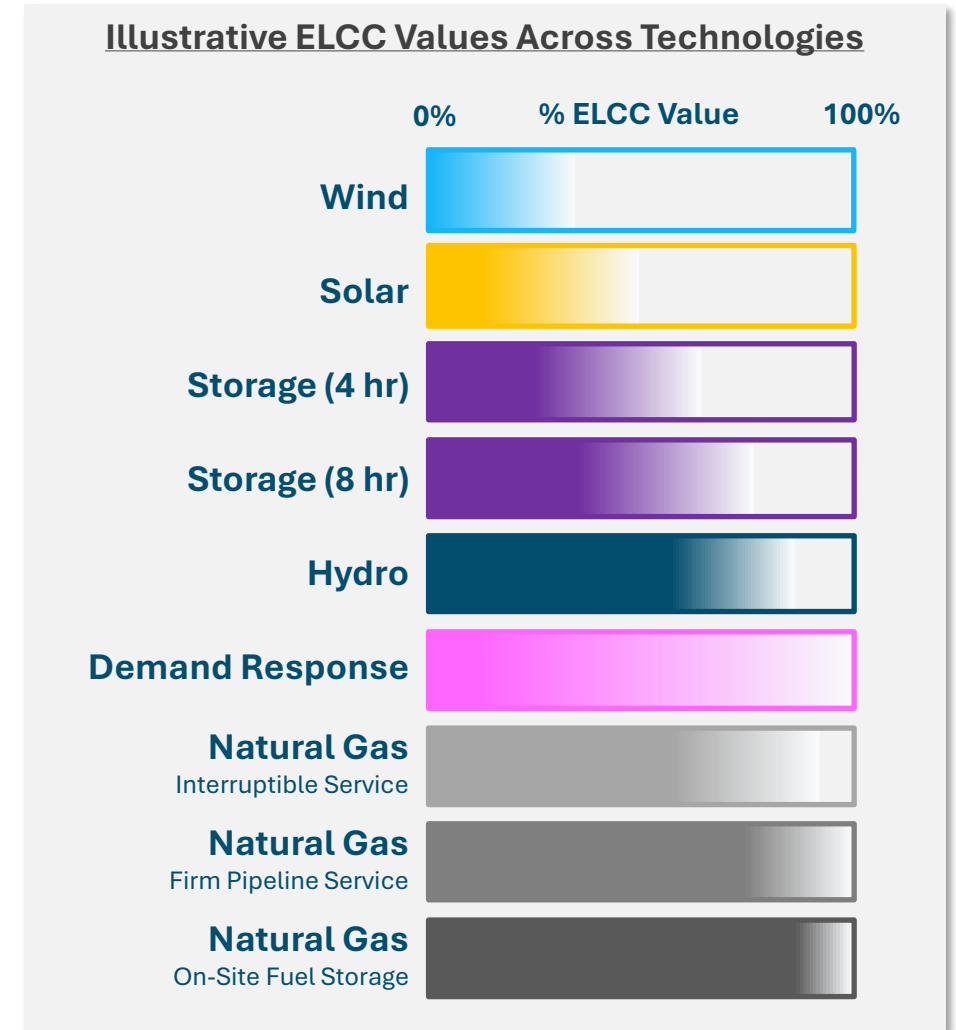
*Accredited capacity for renewables and storage accounts for factors that would limit their availability (variability and duration), but for thermal resources does not (outages)*

# No Resource is “Perfect” – ELCC Applies to All Resources

+ ELCC creates level playing field by measuring all resources against perfect capacity, accounting for all factors that can limit availability...

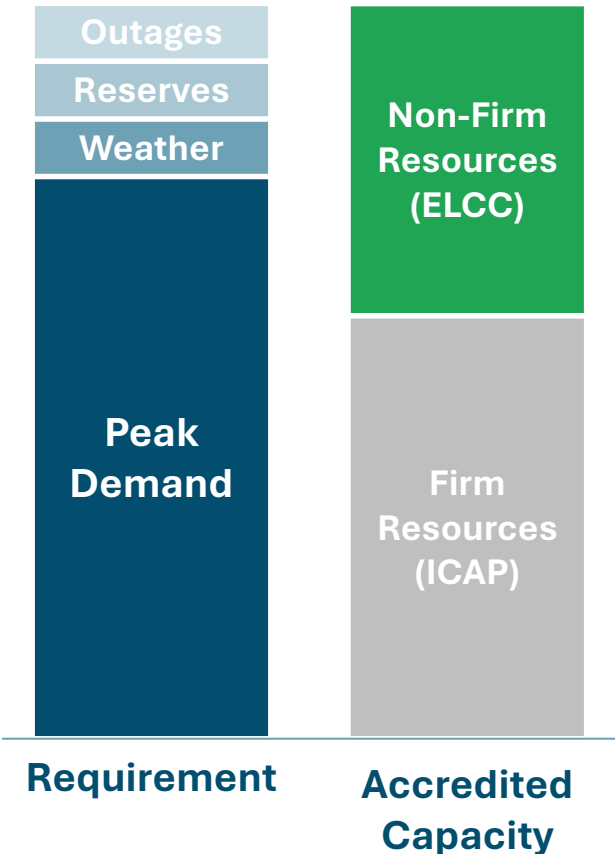
- ✓ Hourly variability in output
- ✓ Duration and/or use limitations
- ✓ Seasonal temperature derates
- ✓ Temperature-related outage rates
- ✓ Forced outages
- ✓ Energy availability
- ✓ Fuel availability
- ✓ Correlated outage risk, *especially under extreme conditions*

+ ...but requires a slight adjustment to how we calculate the reserve margin (ICAP vs. PCAP)



# Using a “PCAP” Reserve Margin to Harmonize Accreditation

## Installed Capacity (“ICAP”) PRM Accounting



### The Inconsistency

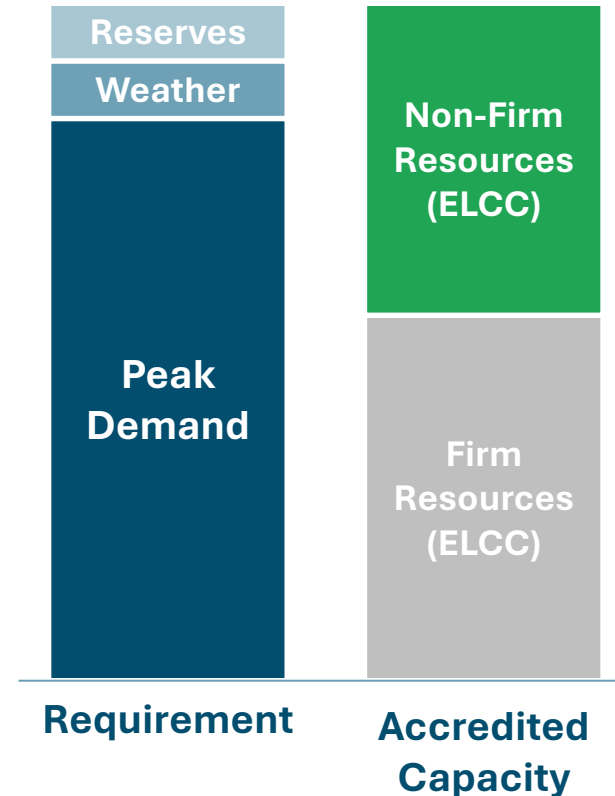
1 MW of ELCC from Non-Firm Resources

≠

1 MW of ICAP from Firm Resources

*Accredited capacity for renewables and storage accounts for factors that would limit their availability (variability and duration), but for thermal resources does not (outages)*

## Perfect Capacity (“PCAP”) PRM Accounting



### The Solution

1 MW of ELCC from Non-Firm Resources

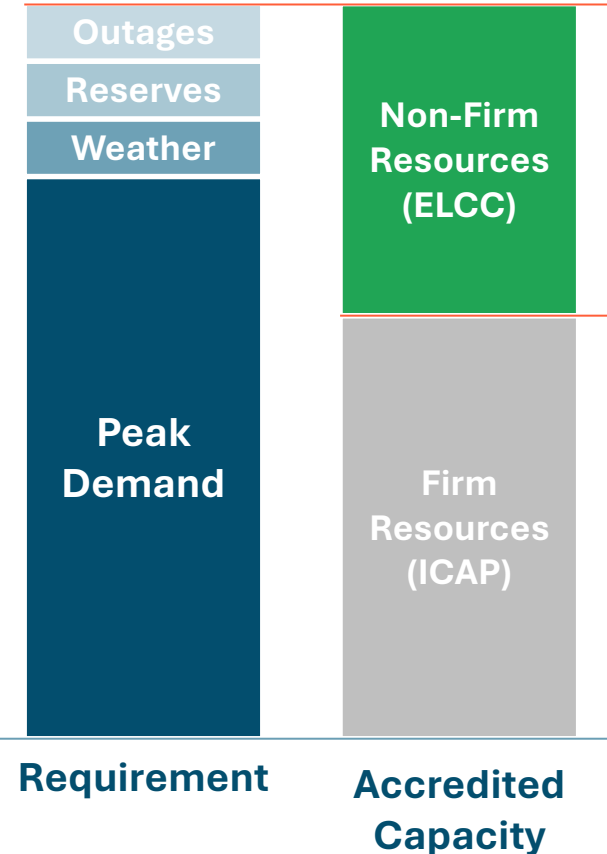
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1 MW of ICAP from Firm Resources

*All resources derated based on known factors that may limit their availability during periods of system risk*

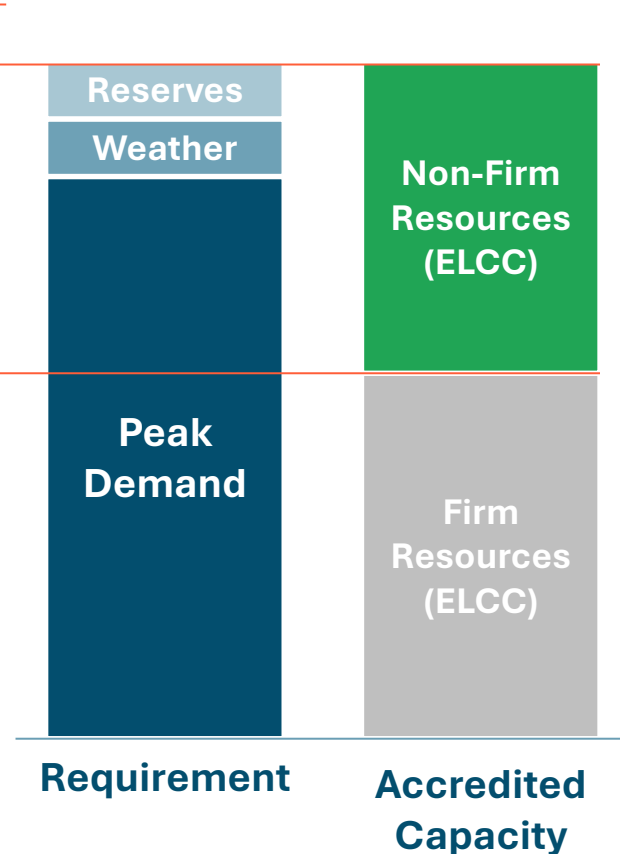
# Using a “PCAP” Reserve Margin to Harmonize Accreditation

## Installed Capacity (“ICAP”) PRM Accounting



Reduction in PRM requirement...

## Perfect Capacity (“PCAP”) PRM Accounting



...matches reduction in firm resource accredited capacity

Both accounting methods describe the same underlying physical system and show the same balance – so why is PCAP preferred?

# Advantages of Using a PCAP Reserve Margin for Planning

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## 1 Most uniform valuation of capacity across all technologies

*All resources evaluated on a level playing field (using ELCC), accounting for all quantifiable factors that could limit their ability or performance*

## 2 Greater stability of reserve margin requirement over time

*Requirement depends only on characteristics of loads, independent of resources (reduced need to recalibrate with changing portfolios)*

## 3 Closer alignment with most common market constructs

*Framework more directly comparable with accounting conventions commonly used in resource adequacy programs*

# Revisiting Our Key Questions

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**1** What is the difference between an “ICAP” and a “PCAP” planning reserve margin?

Two options for PRM accounting conventions that differ in where plant outages are accounted for (ICAP in reserve margin, PCAP as a resource derate)

**2** What is “ELCC,” and why is it the preferred method for counting capacity?

A resource’s capacity contribution measured against a “perfect” resource using loss-of-load-probability modeling, captures resource contributions in a technology-agnostic manner

**3** What are the advantages of using the PCAP convention in the planning reserve margin?

Enables use of ELCC for all resources in the system, allowing for uniform valuation across all potential resource options

# Upcoming Webinar: 2026 Southwest Resource Adequacy Study

## Resource Adequacy in the Desert Southwest

**Tuesday, April 28, 2026 1:00 PM - 2:00 PM**

(UTC-07:00) Pacific Time (US & Canada)

### Agenda

Join E3 for a webinar (plus live Q&A) presenting new findings from a recent study on resource adequacy across the entire Desert Southwest, commissioned by a group of major utilities across the region. The analysis looks at both the next decade and the longer-term trajectory through 2045, and in this session we'll walk through both parts of the study:

- Phase 1: Near-term outlook (2025-2035): are utilities' resource plans sufficient to meet near-term resource adequacy needs of the region?
- Phase 2: Long-term perspective (through 2045): what are the features and characteristics of resource portfolios capable of meeting long-term resource adequacy needs?

Attendees will come away with a clearer view of where the region may face reliability gaps and how planning decisions can help mitigate them.

### About the speakers:

Nick Schlag, Partner at E3, leads the firm's integrated system planning work and has over 15 years of experience advising utilities on resource adequacy, long-term planning, and reliability strategy.

Adrian Au, Associate Director at E3, focuses on resource adequacy and leads the development of E3's reliability modeling model, with experience leading studies on optimal resource planning, capacity needs, and reliability risks.

### Register for webinar

If you want to attend, register now. When your registration is approved, you'll receive an invitation to join the webinar.

Register

**Link to Register:**  
[Resource Adequacy in the Desert Southwest Registration - Webex](#)

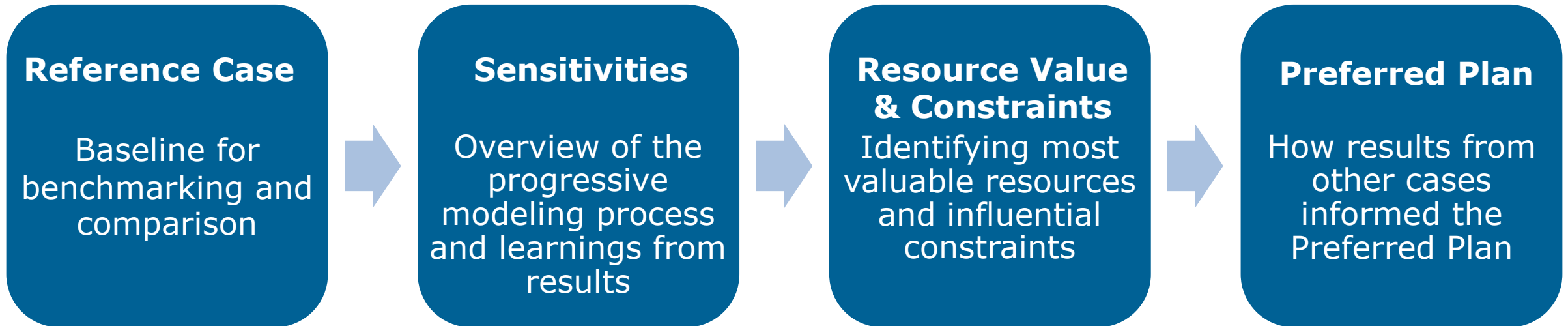


# 2026 IRP Scenarios

Mike Eugenis, APS



# The IRP Portfolio Process





# 2026 IRP Portfolios Will Evaluate Key Considerations



Technology Neutral



Four Corners Extension



Day-Ahead Market Participation



Load Growth



Fuel Pricing



Resource Capital Costs



= Commission Required





## Technology Neutral



- Will include an analysis of a technology-neutral resource portfolio, which is the least-cost method of safely and reliably meeting customers' energy needs without regard to emissions reduction goals or renewable or carbon emission standards
- Provides a reference point to compare APS's preferred portfolio against a least-cost outcome



## Four Corners Extension



- Scenarios evaluate alternative timing assumptions for continued operation of Four Corners to understand impacts on system reliability and cost
- Will evaluate the role of Four Corners as a reliability backstop during periods of infrastructure development and resource transition





## Day-Ahead Market Participation



- Scenarios will capture the benefits of joining a day-ahead market, provide market enrollment assumptions in the preferred portfolio, specifically identify those assumptions in the IRP, and support ongoing periodic reporting on activities, metrics, and decision-making



## Load Growth

- Scenarios evaluate a range of load growth trajectories
- Alternative cases test higher and lower load growth relative to the Reference Case forecast
- Sensitivities consider differences in the timing and shape of load growth, not just peak demand





## Fuel Pricing

- Scenarios include sensitivities to natural gas fuel price assumptions over the planning horizon
- Fuel price sensitivities will help evaluate durability of dispatchable resources under higher and lower fuel price environments relative to the Reference Case



## Resource Capital Costs

- Scenarios will evaluate alternative cost assumptions or renewable, storage, and thermal resources
- Assumptions reflect uncertainty in equipment pricing, labor availability, and policy conditions

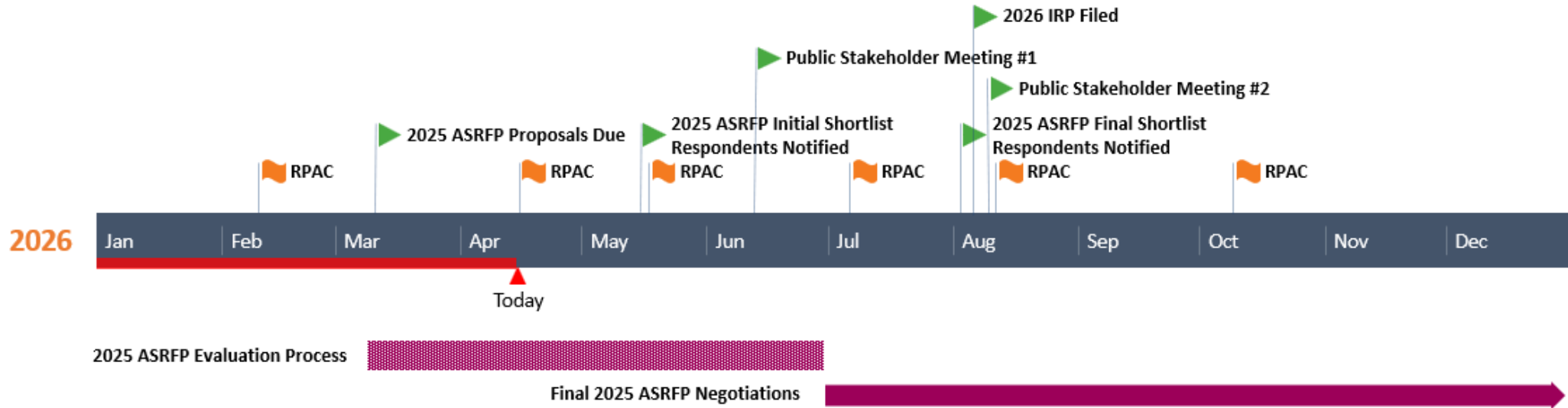




# Next Steps & Closing Remarks

Adam Constable, APS

# Forward Plans and Meetings



## Key Milestones

Next RPAC Meeting: TBD  
Time: TBD

LSEs Provide Base Case Information: May 5, 2026

Public Stakeholder Meeting #1: June 2026

