APS RPAC Meeting

05/17/2023

MEETING AGENDA

Welcome & Meeting Agenda
Matt Lind
1898 & Co.

Regulatory Updates
Todd Komaromy
APS

2023 All-Source RFP Update
Jill Freret
APS

Break

Planning Reserve Margin Trends in the West
Nick Schlag
E3

IRP Sensitivities
Michael Eugenis
APS

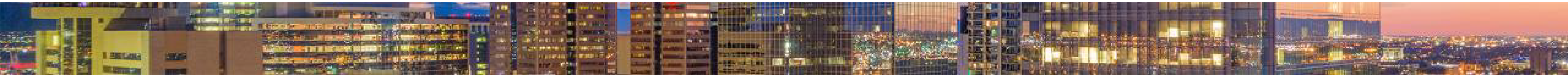
Next Steps & Open Discussion
Matt Lind
1898 & Co.

Meeting Guidelines

- 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.
- We will keep a parking lot for items to be addressed at later meetings.
- 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.
- Consistent member attendance encouraged; identify proxy attendee for scheduling conflicts.
- Meetings and content are preliminary in nature, and prepared for RPAC discussion purposes. Litigating attorneys are not expected to participate.

April Meeting Recap

- APS presented a preview on its 2023 Summer Preparedness. Updates included that it is prepared to serve its projected peak demand plus reserve margin of 9,385 MW.
- 1898 & Co. explained some of the key themes and takeaways from the first IRP public stakeholder meeting.
- APS discussed its progress on the 2022 RFP negotiations and the 2023 RFP development. APS emphasized its commitment to maintaining a diverse portfolio of resources.
- APS provided updates on the Aurora training and details on its Resource Technology Assessment that will be utilized in the IRP
- APS summarized adoptions forecasts for solar, storage, and EV adoption that have been developed by Guidehouse.



Following Up

- Action Items from Previous Meetings:
  - Distribute 2022 ASRFP
- Ongoing Commitments:
  - Distribute meeting materials in a timely fashion (3 business days prior)
  - Transparency and dialogue

Regulatory Updates

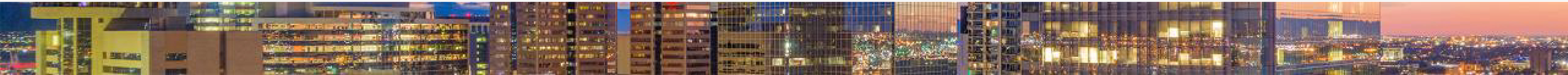
Regulatory Updates

APS and TEP filed for an extension of the IRP filing deadline on May 1st

- **Requested new deadline of November 1st**
- **Stakeholder support included SWEEP, Sierra Club, Arizona PIRG, AriSEIA, and more**

Market report workshop was held on May 4th

- **Agenda included market updates from TEP, UNSE, and APS**
- **Open discussion with meeting participants immediately followed**



Discussion & Questions

2023 ASRFP Update

2022 All-Source RFP Results

Contracts Signed since May RPAC

70 MW PVS – Final Review

Battery Storage Project Approval

ACC has approved all battery storage projects for including in PSA thus far

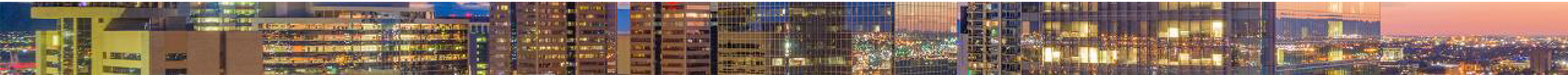
Negotiations Still Underway

Potential to sign 1,081 MW

Expected to finish negotiations by early June

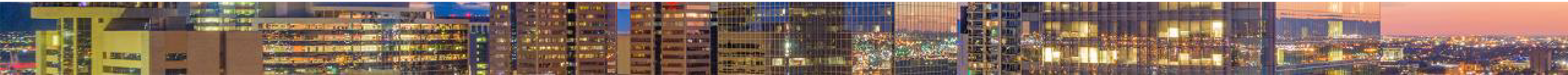
Remaining Projects Rebid

APS expects to see some of the remaining projects rebid into the next ASRFP.



Important Concepts from the 2022 ASRFP

- All resource except coal were allowed to bid into the 2022 ASRFP.
- Demand side resources were allowed to bid into ASRFP.
- Scoring process remained broad with quantitative & qualitative analysis. ASRFP prioritized low cost and low project delivery risk.
- Minimum size requirement was 5MW; Lower bid fee for projects smaller than 25MW.



2023 All Source RFP Key Features

Agave

- 150 – 400 MW ESS
- 4-hr Duration
- Must meet APS Safety Standards
- COD: 2026/2027

Ironwood

- 168 MW Solar + 168 MWs ESS
- Selected through Green Power Partners
- COD: 2026/2027

CCT

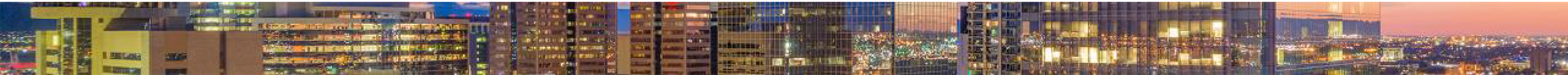
- Up to 250 MW
- Competitive renewable generation located on Navajo Nation
- Third party-owned (PPA)
- COD: May 2027 or 2028

Cholla

- Up to 115 MW
- New generation on existing site of Cholla Generating Station
- APS owned or third-party owned (PPA)
- COD: ASAP following Cholla retirement.

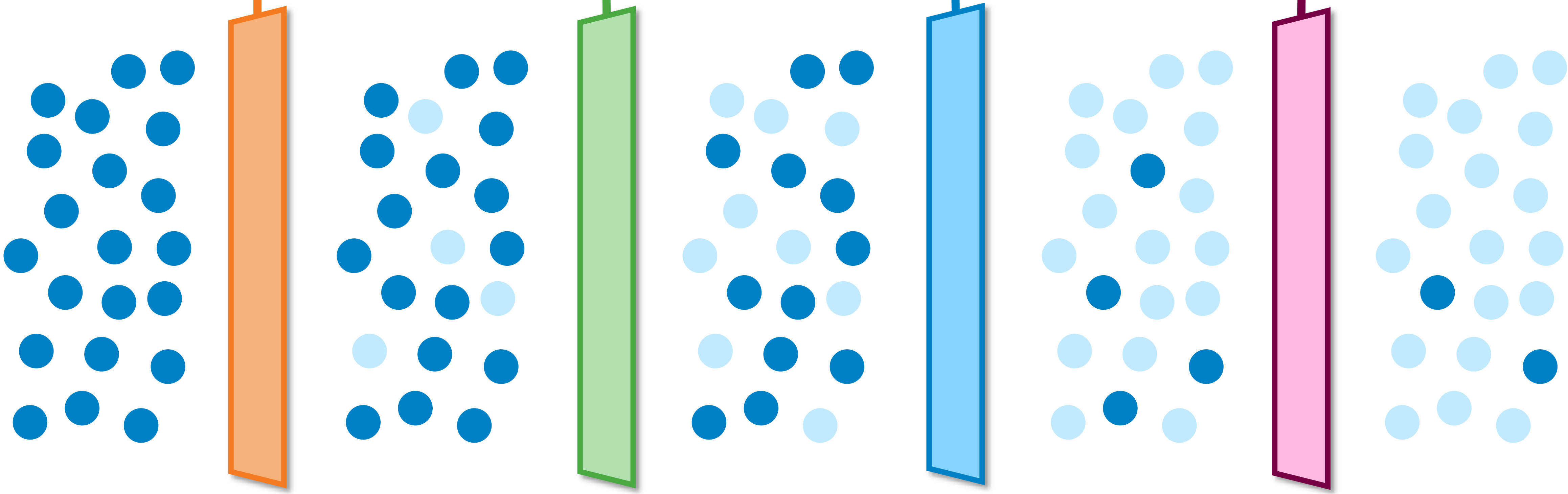
Incremental Gas Generation

- Up to 400 MW
- APS-owned and third party-owned (PPA)
- COD: ASAP, but no later than March 2027

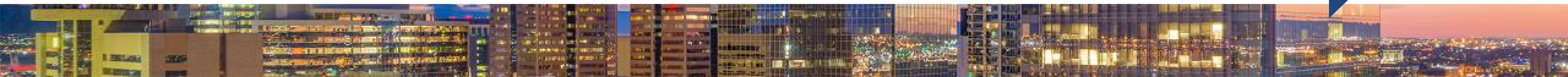


Request For Proposal (RFP) Process

1. Review bids for minimum participation criteria
2. Screen bids using cost and non-cost criteria to create a “shortlist”
3. Evaluate short list of bids using portfolio analysis
4. Negotiate and execute contracts with one or more resources



Evaluation process narrows the pool of prospective bidders through several steps, culminating with contract negotiations and execution



Key Attributes for Evaluation

Transparent

Open process providing broad participation and ensuring competitive proposals

Flexible

Flexible to accommodate different technologies

Well Documented

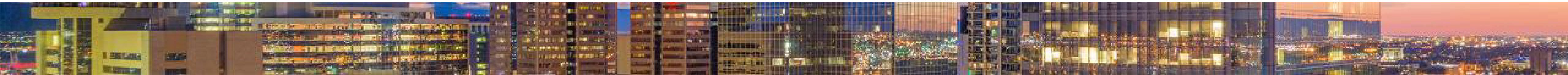
Well documented for clear understanding of the evaluation

Aligned

Procurement aligned with IRP

Recommendations

- Early stakeholder involvement
- Clear definition of acceptable technologies
- Clear identification of information needed
- Consistent assumptions established early and “locked down”
- Evaluation process and criteria needs to be established early



2023 All Source RFP Timeline

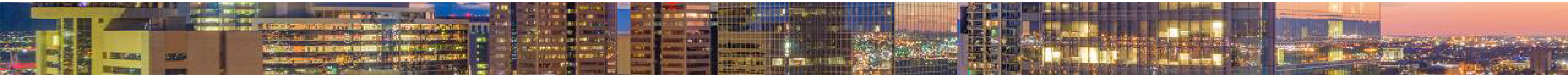
May RPAC Meeting
Wednesday, May 17th

Breakout Session #1
Friday, June 2nd

Breakout Session #2
Thursday, June 15th

June RPAC Meeting
Friday, June 23rd

RFP Release
Friday, June 30th



2023 ASRFP Design: Building on Market Factors

Project Deliverability

- In-service dates
  - Target earlier in-service dates to mitigate potential delays
- Transmission deliverability
  - Provide directional guidance to bidders

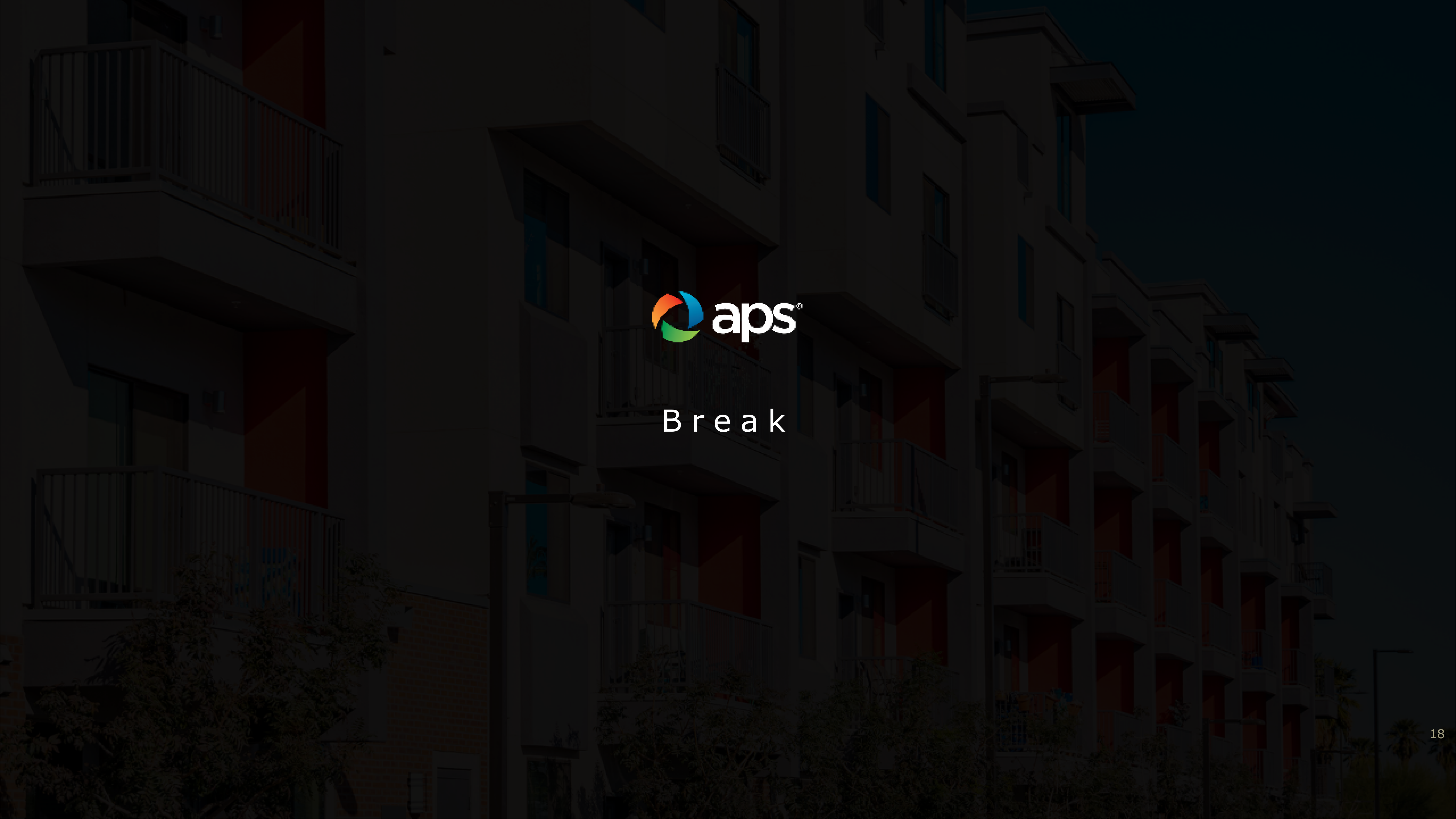
Customer Affordability

- Fixed vs Open Book pricing
- Tax credit strategy and utilization of the IRA
- Interconnection network upgrades

Additional Project Risks

- Increased demand from IRA outpacing supply
- Tariff and UFPLA risk still remains
- Equipment timelines remain long

Discussion & Questions



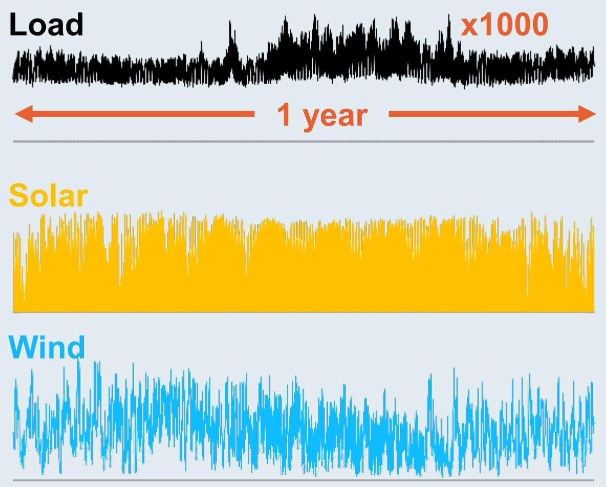
Break

Planning Reserve Margin Trends in the West

Refresher: Best Practices in Resource Adequacy Analysis

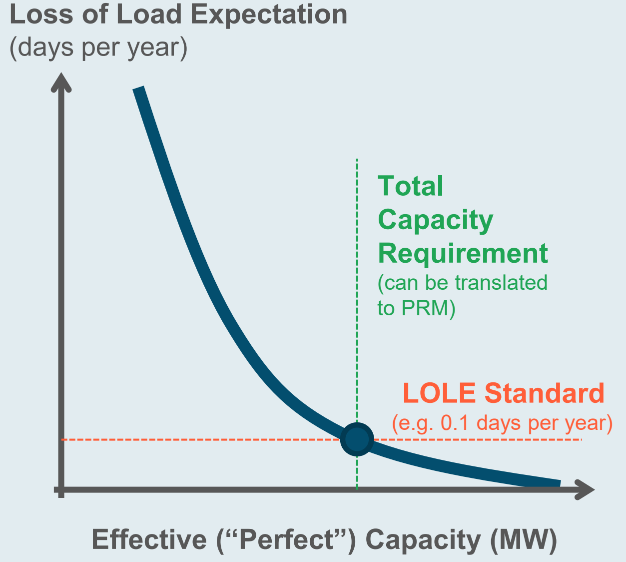
Develop a representation of the loads and resources of an electric system in a loss of load probability model

LOLP modeling allows a utility to evaluate resource adequacy across all hours of the year under a broad range of weather conditions, producing statistical measures of the risk of loss of load



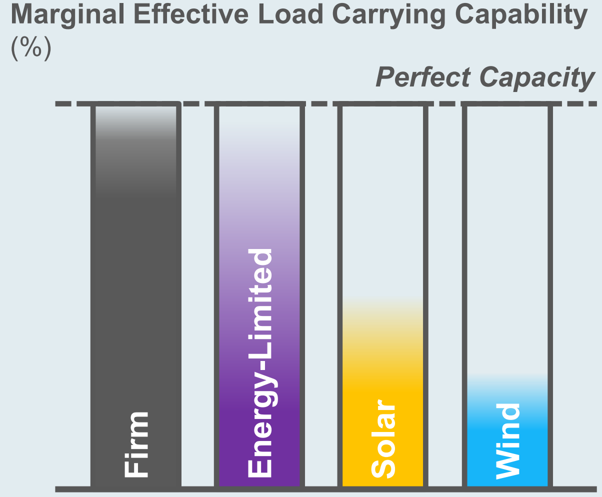
Identify the amount of perfect capacity needed to achieve the desired level of reliability

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



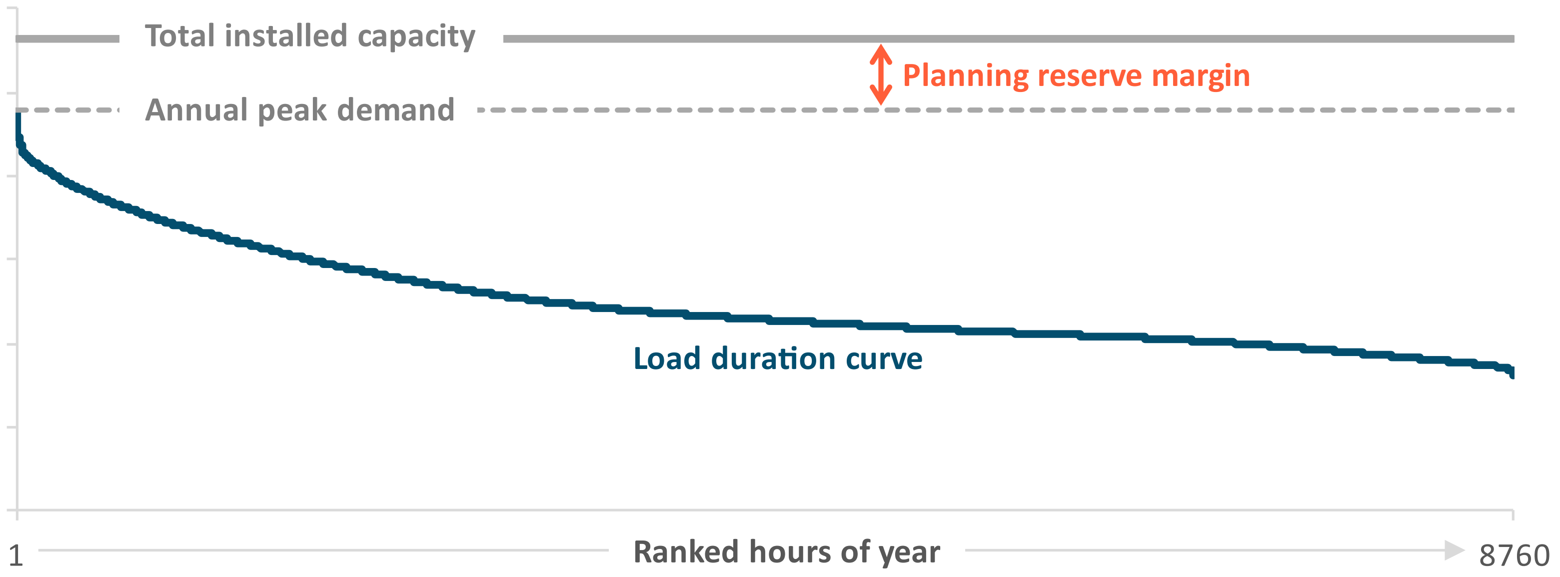
Calculate capacity contributions of different resources using effective load carrying capability

ELCC measures a resource's contribution to the system's needs relative to perfect capacity, accounting for its limitations and constraints



Conceptual Origins of the Planning Reserve Margin

Illustrative Load Duration Curve & Planning Reserve Margin
(MW)



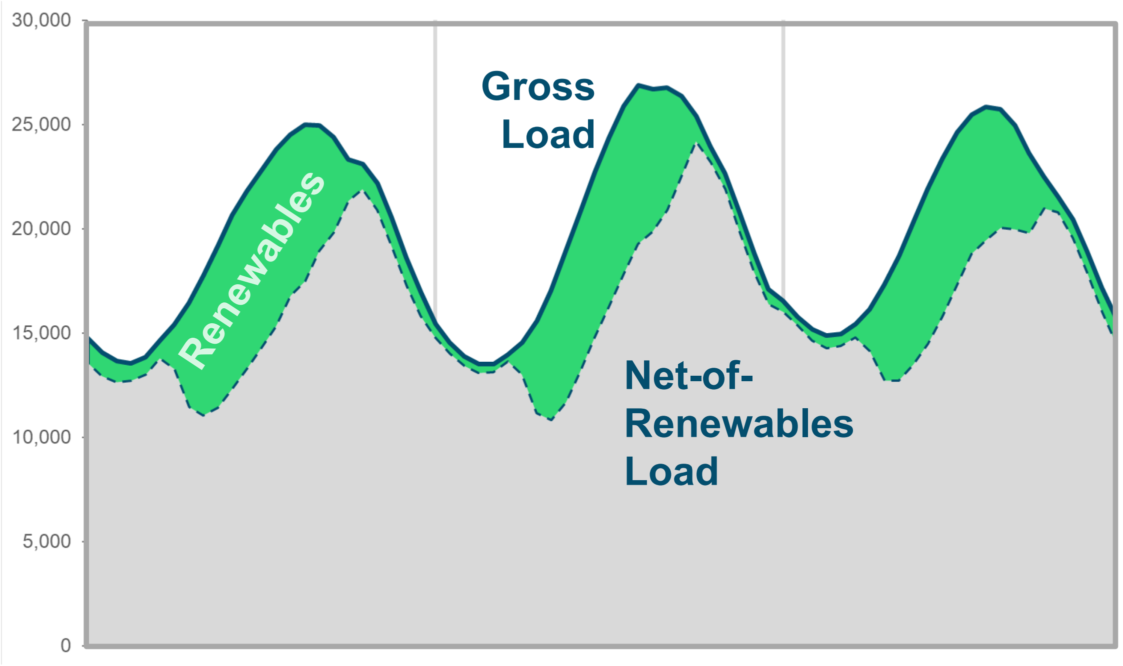
"Planning Reserve Margin" reflects the amount of capacity above expected peak demand needed to ensure reliability while accounting for:

1. **Extreme weather**
2. **Operating reserve needs**
3. **Plant outages**

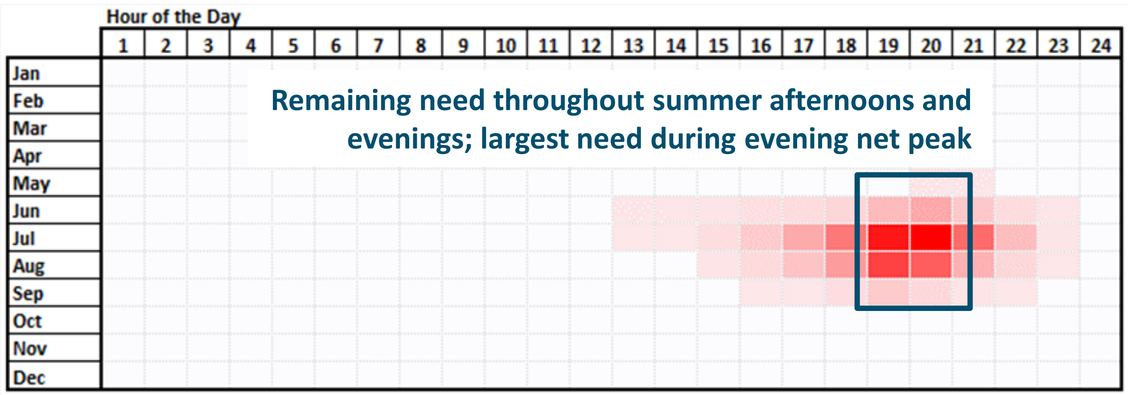
By 2025, the principal resource adequacy challenge in the Southwest is the evening "net peak"

- **With increasing penetration of solar resources, the highest "net peak" period occurs after sundown** *(i.e. the highest loss of load probability occurs when solar is not producing)*
- **This shift has direct implications for the relative capacity value of different types of resources**

2025 load & net load on representative summer peak days
(MW)

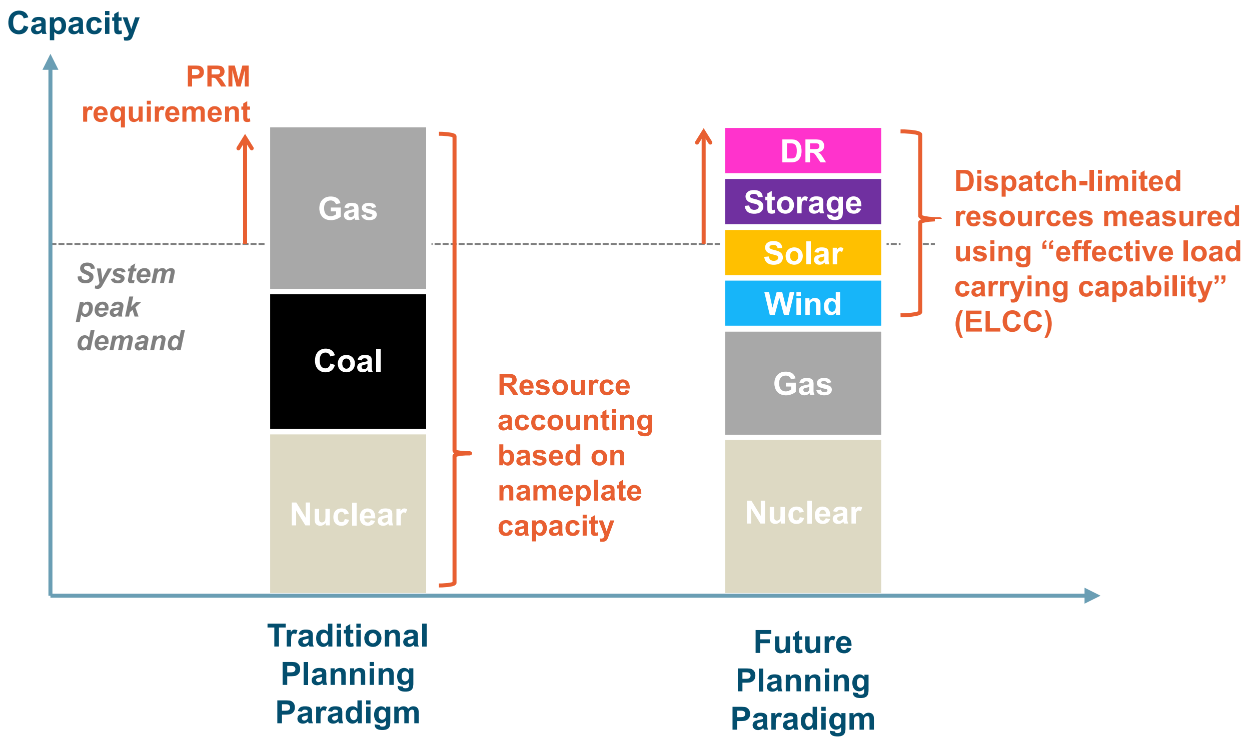


2025 Loss of Load Probability
Existing & Planned Resources



Adapting the PRM framework for a high renewable future

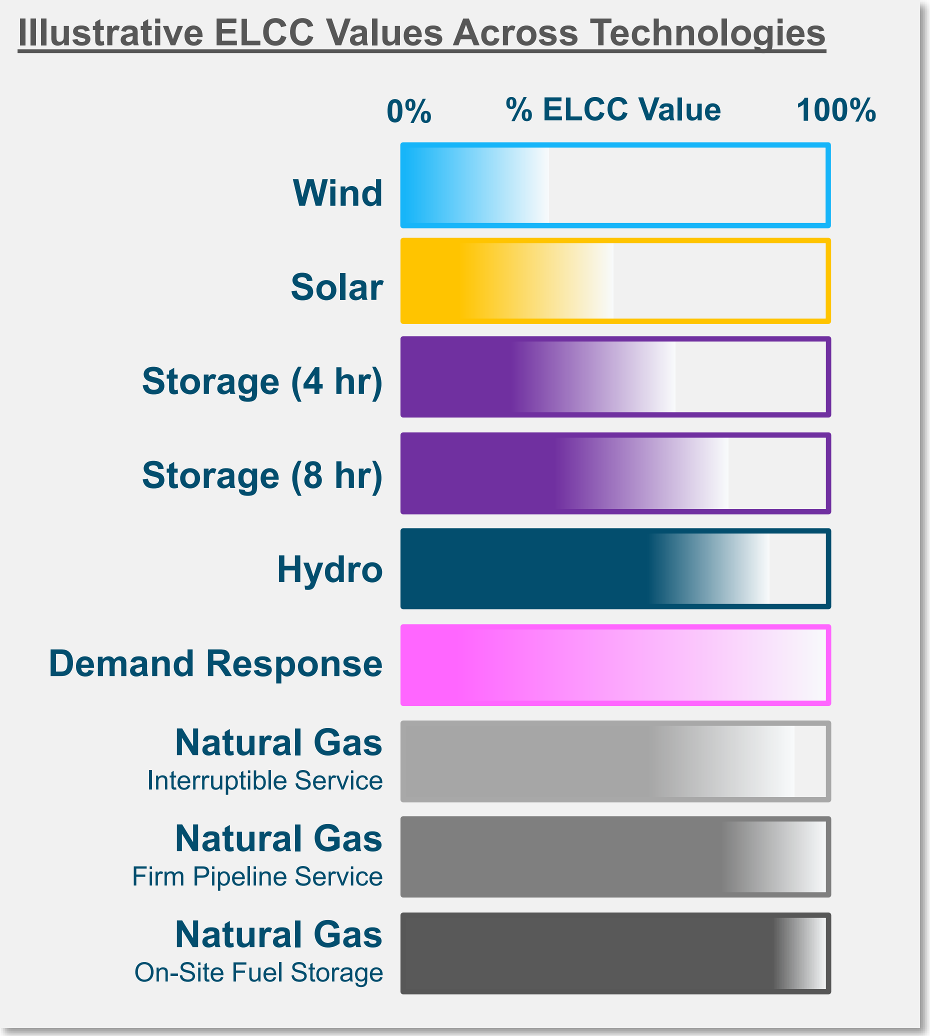
- **Historically, utilities have relied upon a "planning reserve margin" (PRM) to ensure enough supply is available during peak periods**
- **Introduction of significant quantities of wind, solar, and storage present significant challenges to this accounting framework because:**
  - Availability of these resources during peak periods is likely lower than nameplate capacity
  - Increasing penetrations of renewables & storage will cause reliability needs to shift to other times of day/year
- **To continue using a PRM, we must revisit how we count capacity to ensure resources are measured based on their contributions across all hours – not just during peak periods**
  - A resource's **effective load carrying capability (ELCC)** reflects its contribution to reliability considering all hours of the year, across multiple years of load + weather conditions



ELCC Appropriately Accounts for Each Resource's Capabilities and Imperfections

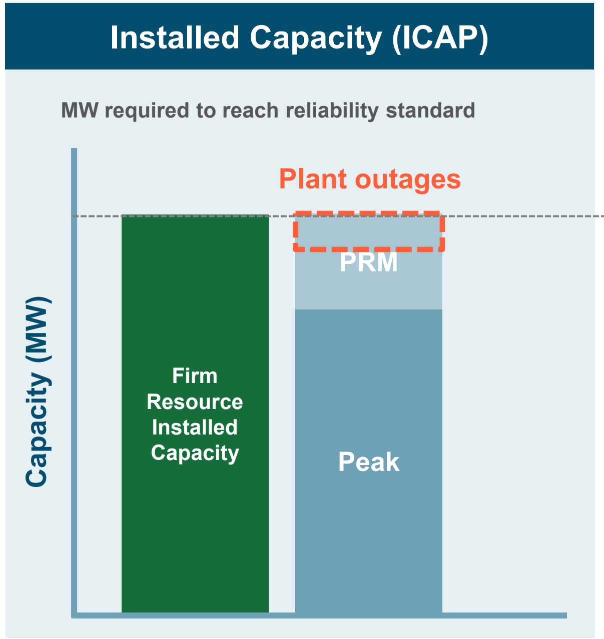
+ **Applying an ELCC methodology to count resources towards the PRM provides a robust framework for resource adequacy accounting**

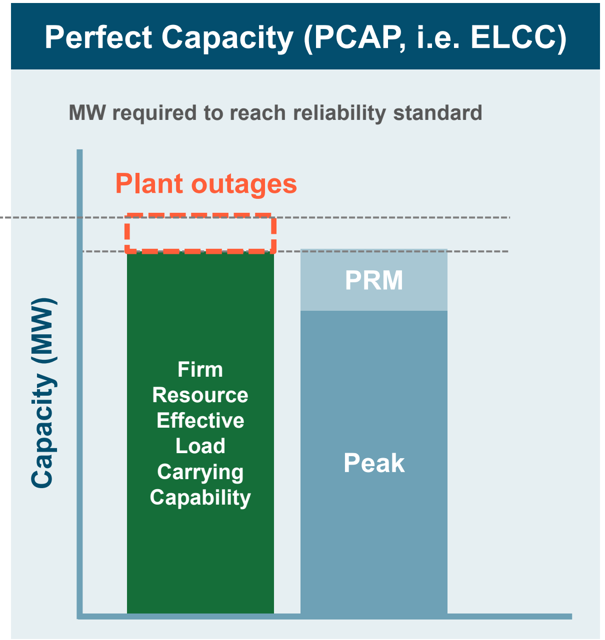
+ **ELCC can account for all factors that can limit availability:**
  - Hourly variability in output
  - Duration and/or use limitations
  - Seasonal temperature derates
  - Temperature-related outage rates
  - Forced outages
  - Energy availability
  - Fuel availability
  - Correlated outage risk, *especially under extreme conditions*



A Transition in PRM Accounting Conventions

- **Historically, it has been common practice for utilities to count firm resources towards the PRM at their full installed capacity**
  - Risk of outages is embedded in the PRM requirement itself
- **With application of ELCC to measure variable and energy-limited resources, utilities are increasingly opting to apply ELCC-style derates to firm resources**
  - Moves the risk of outages to the resource accounting side
- **This change in accounting will result in a lower apparent PRM, but does not reflect a change in the underlying system or its reliability needs**

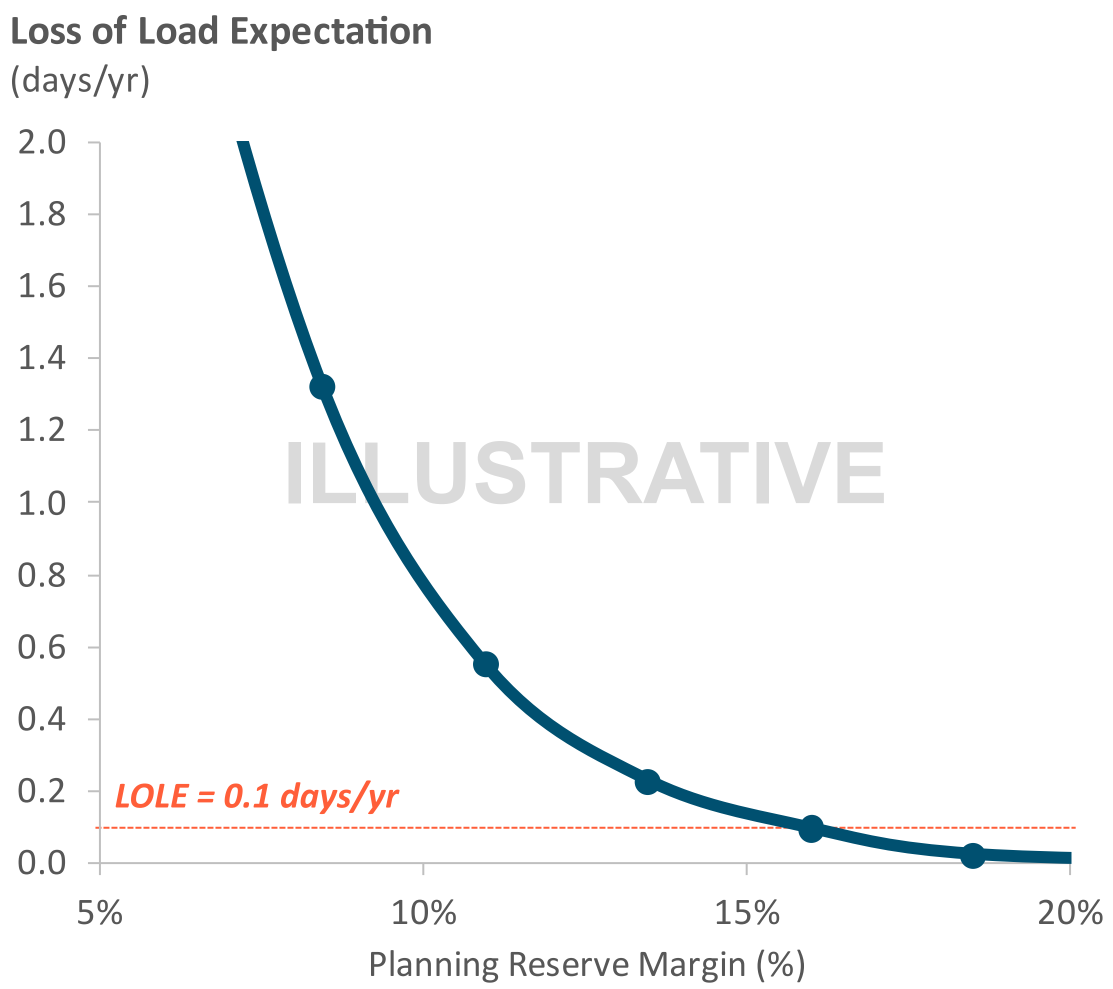




Calibrating a PRM requirement based on a statistical reliability standard

+ **Loss of load probability modeling can be used to calibrate a PRM requirement consistent with a "one day in ten years" standard**
  - Increasing PRM requirements result in increasingly reliable systems

+ **The relationship between PRM and LOLE is highly <u>nonlinear</u>**
  - Falling short of PRM target quickly leads to frequent reliability issues; exceeding a PRM target results in small improvements in reliability
  - Nonlinearity has implications for risk and interpretation of modeling error



Planning reserve margin targets vary considerably across Western utilities

- **Reserve margin requirements throughout the Western Interconnection generally vary between 13% and 20%**
- **Variations between utilities are driven by a number of factors:**
  - Different **system characteristics**
  - Different **accounting conventions**
  - Different **methodologies**
  - Different assumptions regarding **market support**
- **Most utilities rely on loss-of-load-probability modeling as the basis for establishing a PRM requirement, but some are stipulated based on rules of thumb**
  - Utilities that have recently adopted LOLP modeling have generally found that increases in PRM requirements have been needed

Utility	PRM	References
Arizona Public Service Co	15%	APS 2020 IRP
Avista Corporation	16%	Avista 2021 Electric IRP
California Public Utilities Commission[1]	20-24%	CPUC PSP
El Paso Electric Company[2]	13%	EPE 2021 IRP
Idaho Power Company	15.5%	IPC 2021 IRP
Northwestern Energy	16%	NWE 2020 Supply Plan
NV Energy	16%	NVE IRP
PacifiCorp	13%	PacifiCorp 2023 IRP
Portland General Electric[3]	N/A	PGE 2023 IRP
Public Service Company of New Mexico	18%	PNM 2020 IRP
Public Service Company of Colorado	18-20%	PSCo 2021 ERP
Puget Sound Energy	21-24%	PSE 2021 IRP
Sacramento Municipal Utilities District	15%	SMUD 2018 IRP
Salt River Project	16%	SRP 2023 ISP
Tucson Electric Power	15%	TEP 2020 IRP

Notes

1. The CPUC's requirement is expressed in ICAP terms and corresponds to a "PCAP" PRM of 13%; this requirement will inform LSE's obligations for procurement to meet near-term needs
2. EPE's 13% PRM requirement uses a "PCAP" accounting convention, which results in it being materially lower than requirements expressed using an "ICAP" convention
3. In its latest IRP, PGE does not rely on a PRM requirement, instead relying exclusively on an LOLH standard of 2.4 hrs/yr

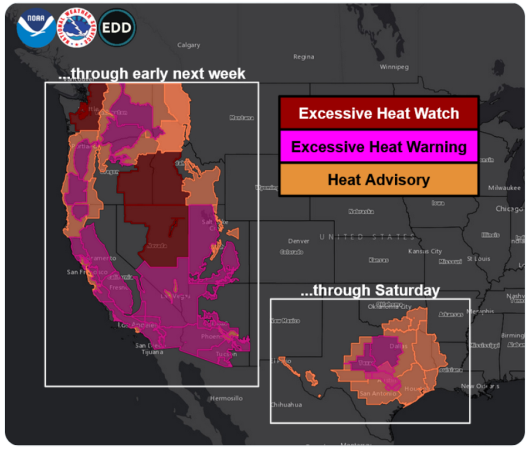
Multiple trends driving recent increases in capacity requirements

1. **Improvements in representation of extreme weather in reliability modeling – coupled with effects of climate change**
   - As extreme events become more frequent and more severe, utilities' capacity needs to preserve reliability will increase

1. **Tightening conditions across Western markets**
   - Load growth and resource retirements have led to tighter conditions in wholesale markets – a trend that, exacerbated by supply chain delays, is expected to continue
   - Utilities that have previously counted on "market support" to fulfill a portion of their needs have reduced their reliance on the market to meet reliability needs

NWS Weather Prediction Center
@NWSWPC

Over 80 million people are within an Excessive Heat Watch/Warning or Heat Advisory today. Extreme heat will significantly increase the potential for heat related illnesses, particularly for those working or participating in outdoor activities. Remember to stay hydrated!



4:00 AM · Aug 15, 2020

Image source: https://twitter.com/NWSWPC/status/1294589703254167557

DIVE BRIEF

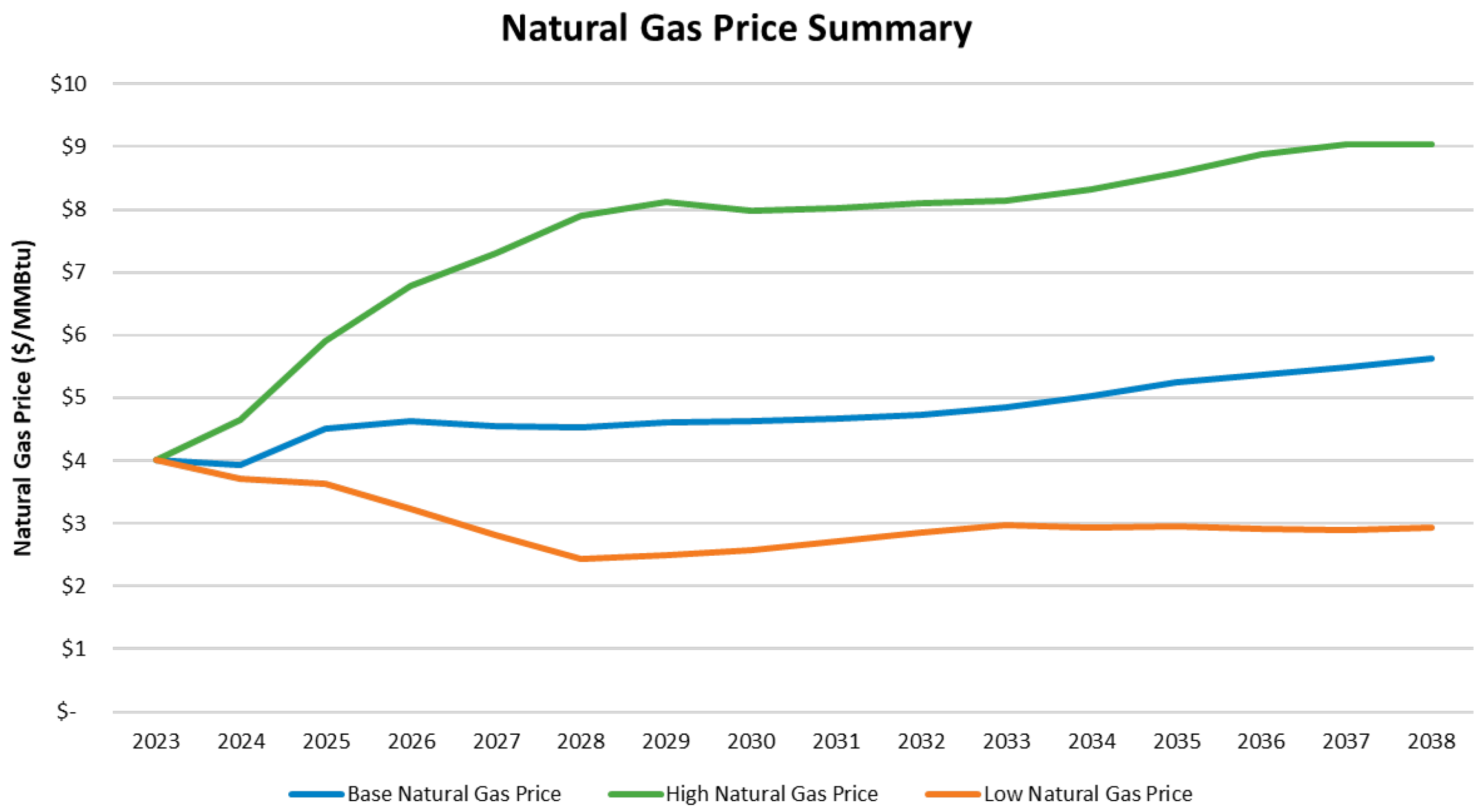
Most of US electric grid faces risk of resource shortfall through 2027, NERC finds

Published Dec. 16, 2022

Discussion & Questions

IRP Sensitivities

APS has developed natural gas sensitivities to evaluate in various IRP cases based on internal and public sources.

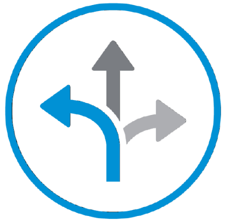


Note:
1) Base forecast comes from APS annual average of monthly weighted delivered natural gas prices through 2035. Prices are escalated annually at 2.39% from 2036 on.
2) Low & High forecasts come from EIA's 2023 Annual Energy Outlook Henry Hub prices. Prices are adjusted to account for APS natural gas hedge

EPA Proposed Carbon Pollution Standards

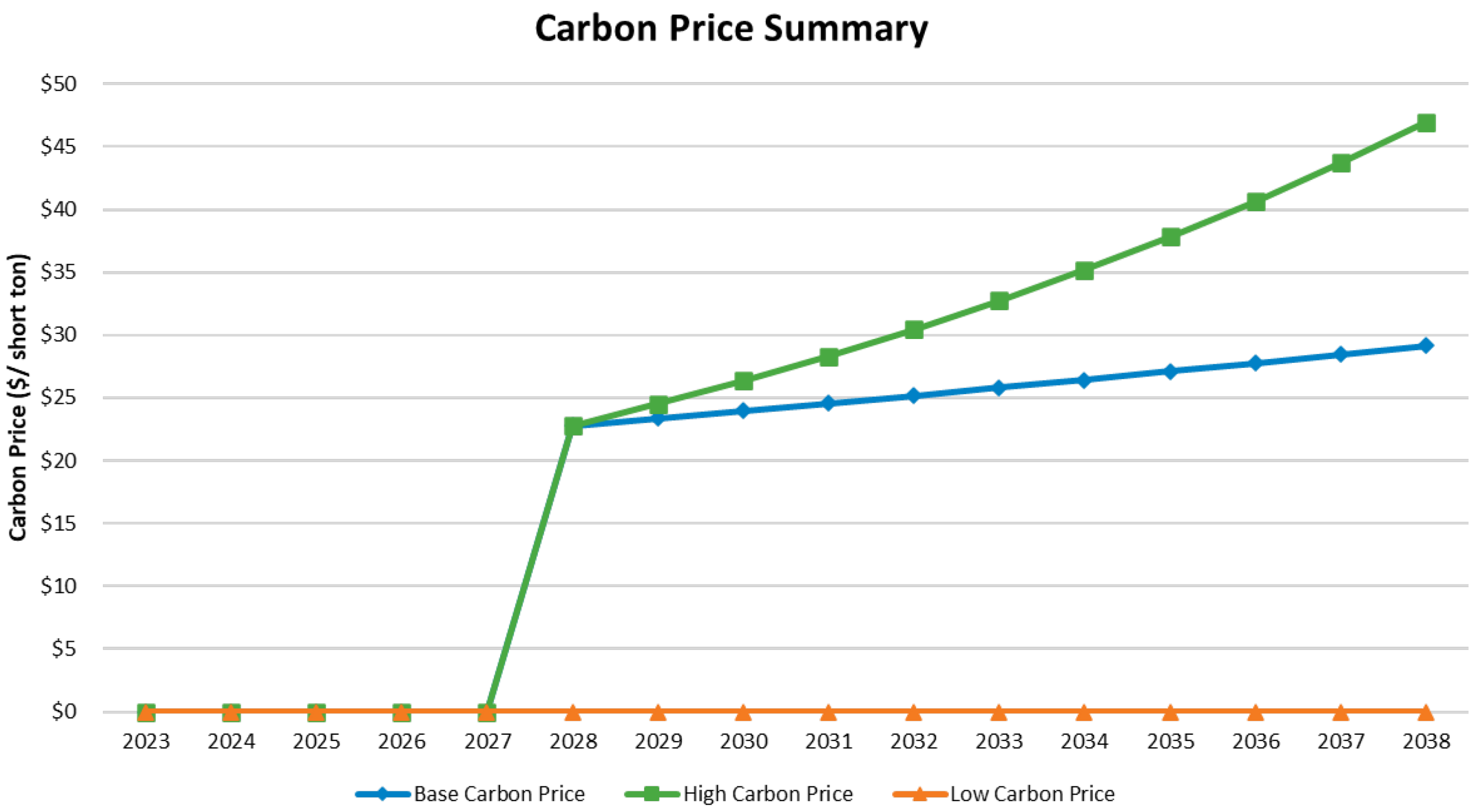
Existing Coal and
New/Existing Natural
Gas Impacted

Relies heavily on
developing
technologies



Continue to monitor
developments and
include in analysis
as more clarity
provided

APS has developed carbon price sensitivities based on programs active in neighboring regions.

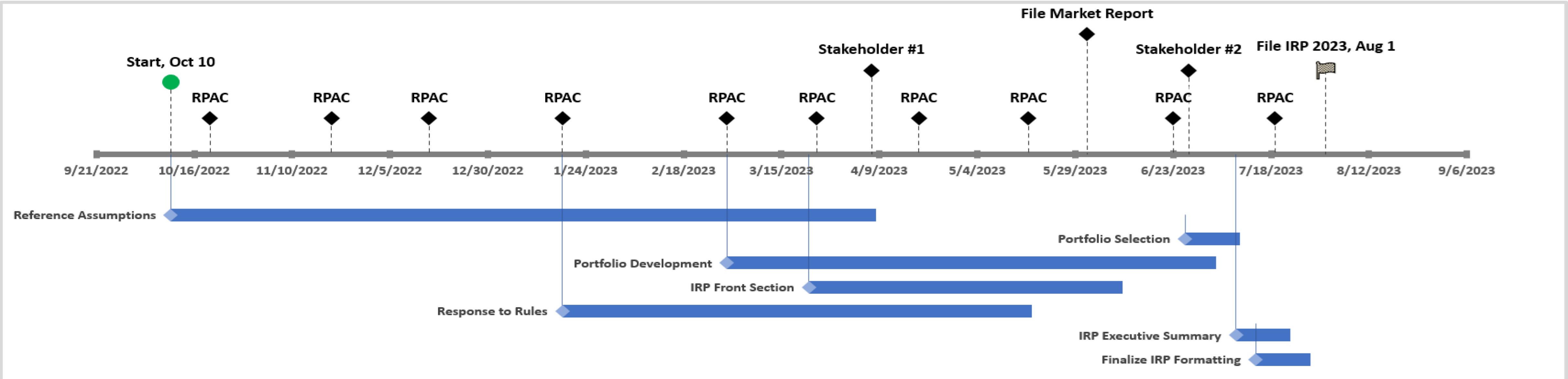


Note:
1) CO_2 emission costs are from California Cap-And-Trade Program
2) CO_2 is updated based on the May 2023 reserve price and escalated at 2.5% starting in 2028 for base price. Escalated at 7.5% annually for high price.

Discussion & Questions

Next Steps

IRP Timeline



Key Milestones

Market Report: Early June
June RPAC: 6/23/2023
Public Stakeholder Meeting #2*: 6/27/2023

July RPAC: 7/19/2023
IRP Filing*: 8/01/2023

*Dates are subject to change if IRP extension is approved by the ACC