Platte River Power Authority

Estes Park • Fort Collins • Longmont • Loveland

Resource planning update

Oct. 10, 2023

Energy leaders since 1973

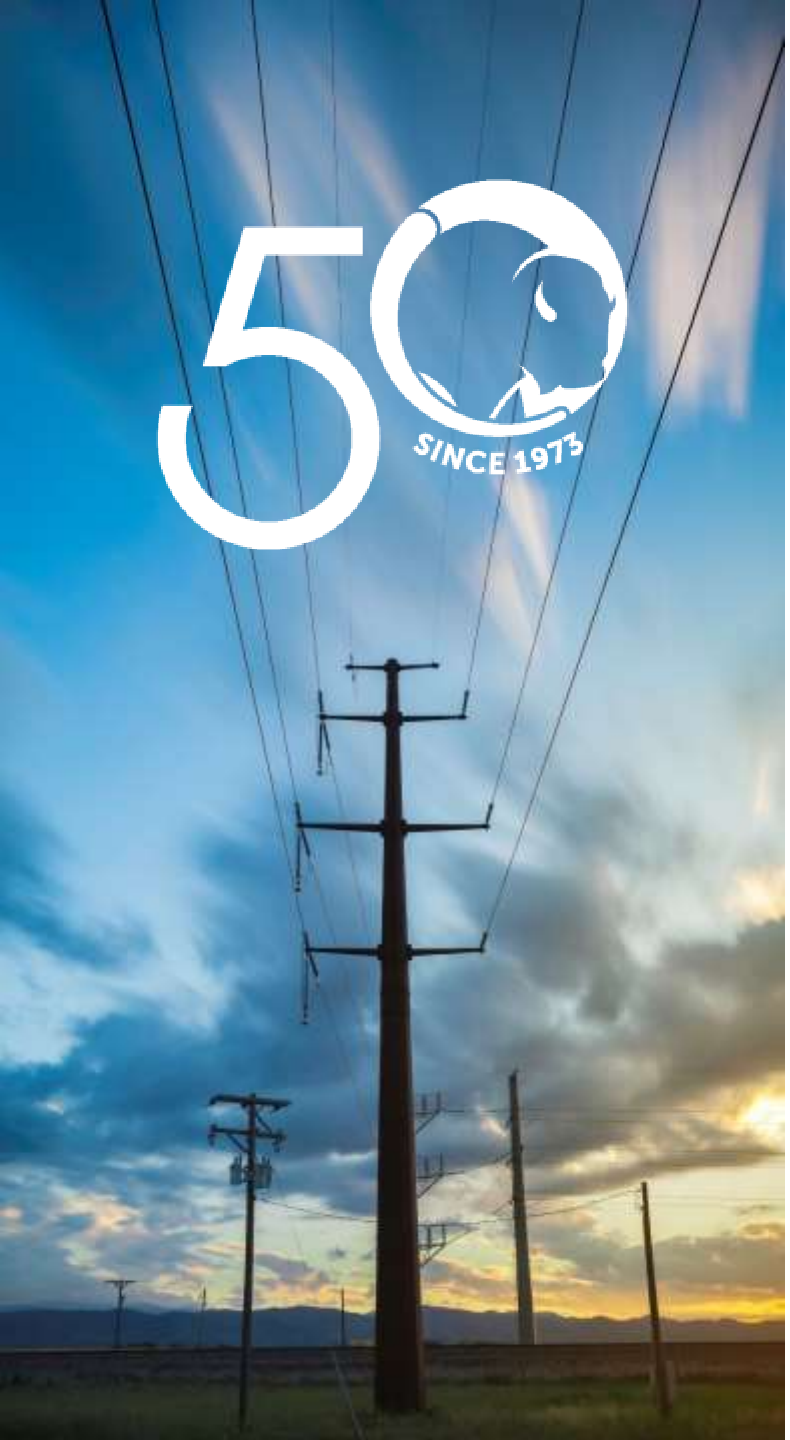
Agenda

- Introduction | **Kendall Minor**
- About Platte River Power Authority | **Jason Frisbie**
- 2024 Integrated Resource Plan | **Raj Singam Setti**


City of Fort Collins
ESTES PARK COLORADO
Platte River Power Authority
CITY OF LONGMONT COLORADO
City of Loveland
Owners
Owners
Owners
Owners

About Platte River

Jason Frisbie, general manager and CEO



About Platte River Power Authority

Platte River Power Authority is a not-for-profit, community-owned public power utility that generates and delivers safe, reliable, environmentally responsible and financially sustainable energy and services to Estes Park, Fort Collins, Longmont and Loveland, Colorado, for delivery to their utility customers.

At a glance

Headquarters
Fort Collins, Colorado

General manager/CEO
Jason Frisbie

Began operations
1973

Employees
297

Peak demand
707 MW on July 28, 2021

2023 projected deliveries of energy
5,174,234 MWh

2023 projected deliveries of energy to owner communities
3,301,376 MWh (~33% renewable)

Transmission system
Equipment in 27 substations, 263 miles of wholly owned and operated high-voltage lines and 522 miles of high-voltage lines jointly owned with other utilities.

Resource Diversification Policy

Passed by Platte River's Board of Directors in 2018

Purpose

To provide guidance for resource planning, portfolio diversification and carbon reduction.

Goal

To support owner community clean energy goals, we will proactively work towards a 100% noncarbon resource mix by 2030 while maintaining our foundational pillars of providing reliable, environmentally responsible and financially sustainable energy and services.

Accomplished

- An organized regional market must exist with Platte River as an active participant

In progress

- Transmission and distribution infrastructure investment must be increased
- Transmission and distribution delivery systems must be more fully integrated
- Improved distributed generation resource performance
- Technology and capabilities of grid management systems must advance and improve
- Advanced capabilities and use of active end user management systems
- Generation, transmission and distribution rate structures must facilitate systems integration

Awaiting technology

- Battery storage performance must mature and the costs must decline
- Utilization of storage solutions to include thermal, heat, water and end user available storage

Foundational pillars

Platte River is committed to decarbonizing our resource portfolio without compromising our three pillars:

- Reliability
- Environmental responsibility
- Financial sustainability

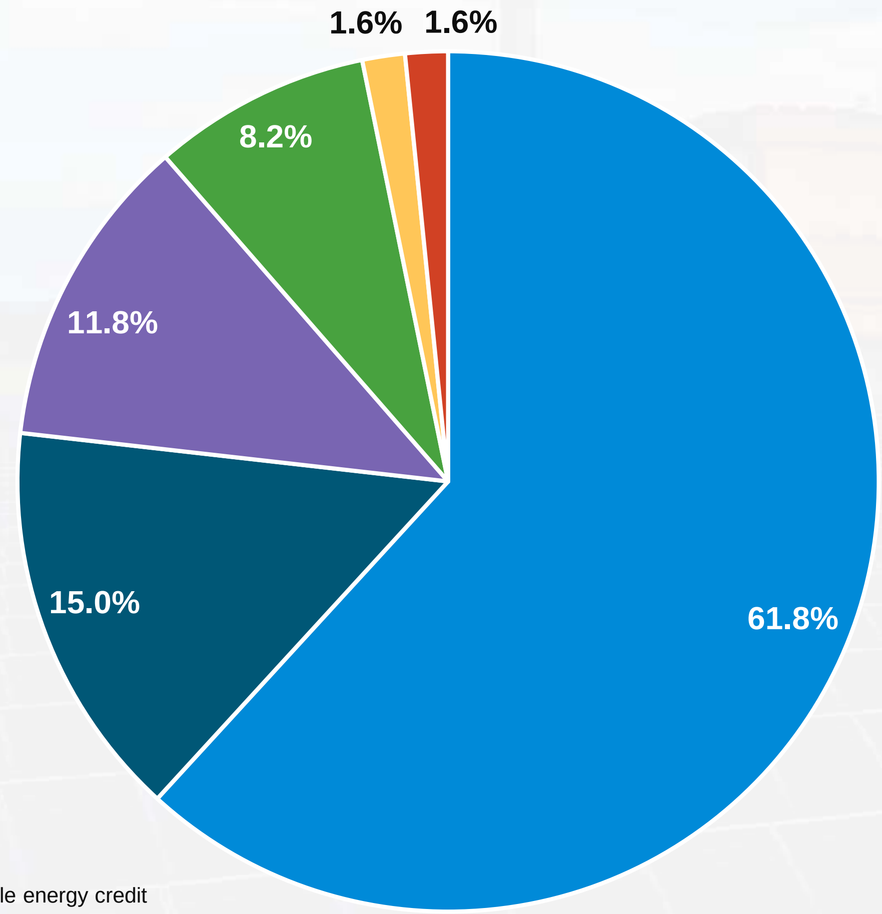
Progress since 2018

The 2024 IRP builds on the 2020 IRP and resource planning and modeling that occurred in 2021 and 2022

- 225 MW of Roundhouse wind
- Announcement to decommission coal resources
- Developed a distributed energy resources strategy
- Filed 2020 IRP
- 22 MW Rawhide Prairie Solar with 2 MWh battery
- 150 MW Black Hollow Solar power purchase agreement
- Additional solar and energy storage RFPs
- Filed Clean Energy Plan with the state of Colorado, which requires all electric utilities to achieve 80% carbon reduction by 2030
- Entry into Southwest Power Pool Western Energy Imbalance Service market

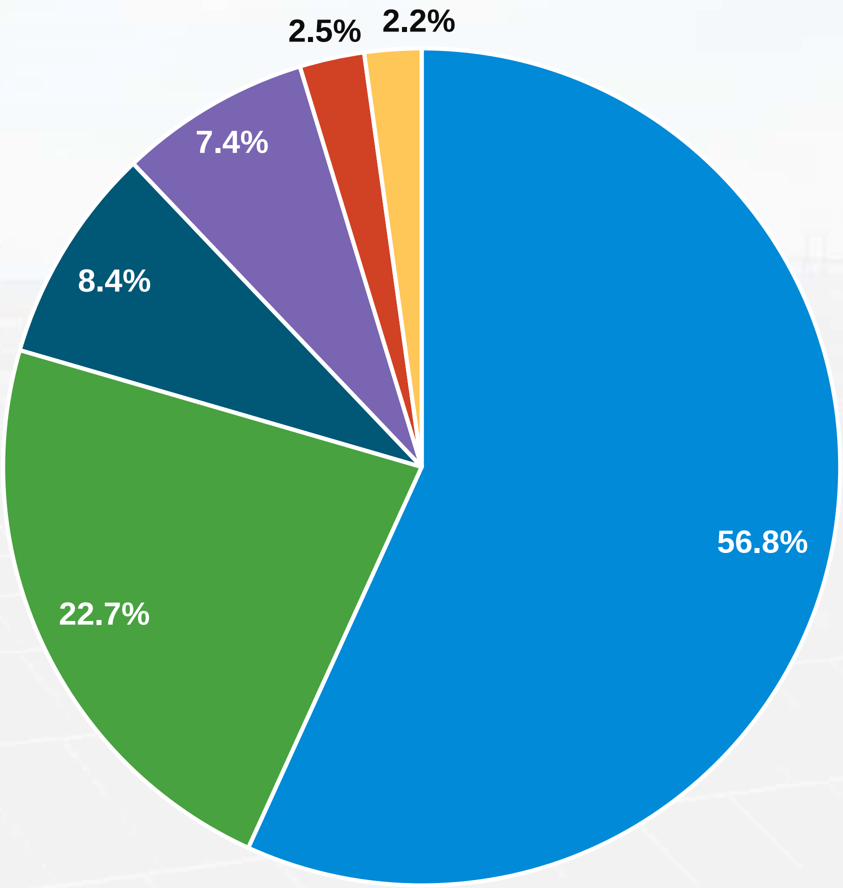
2018 system total

24.8% noncarbon resources



2023 budget system total

33.3% noncarbon resources

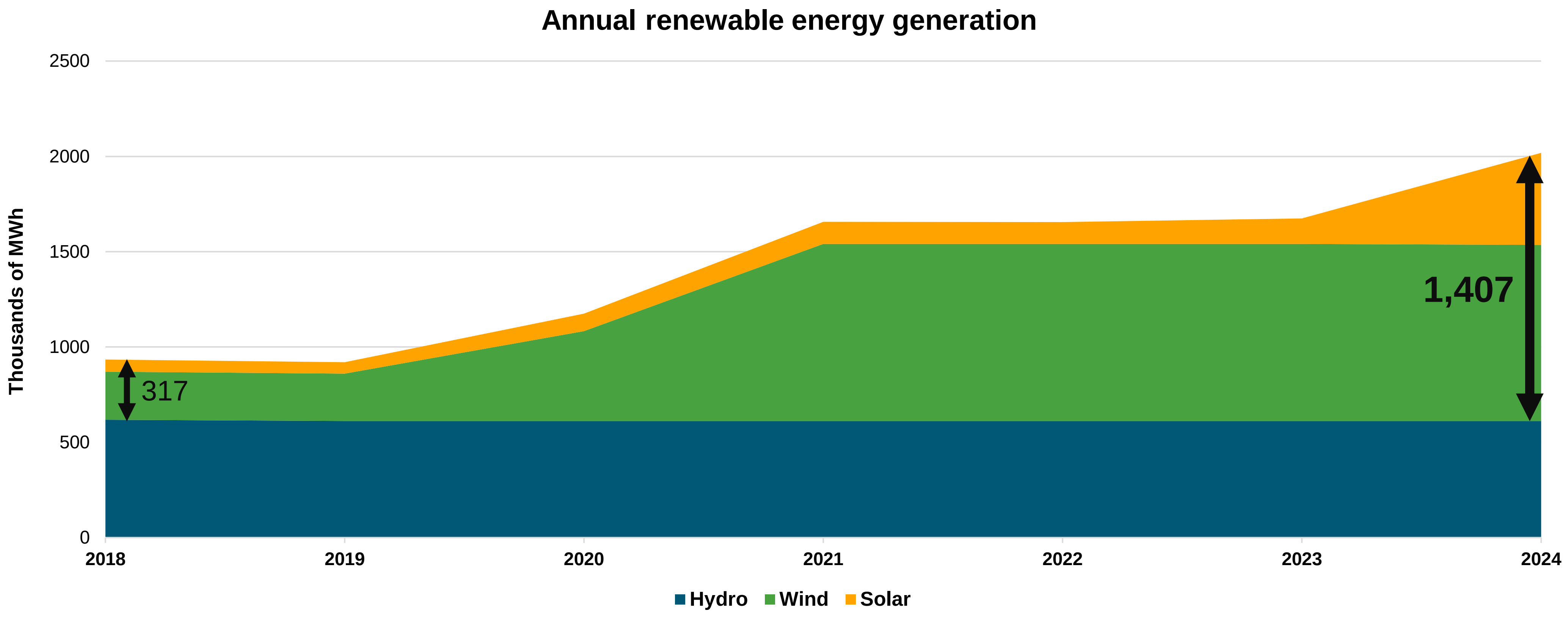


Includes renewable energy credit allocations to carbon resources

Due to drought conditions, not all hydropower may be considered noncarbon

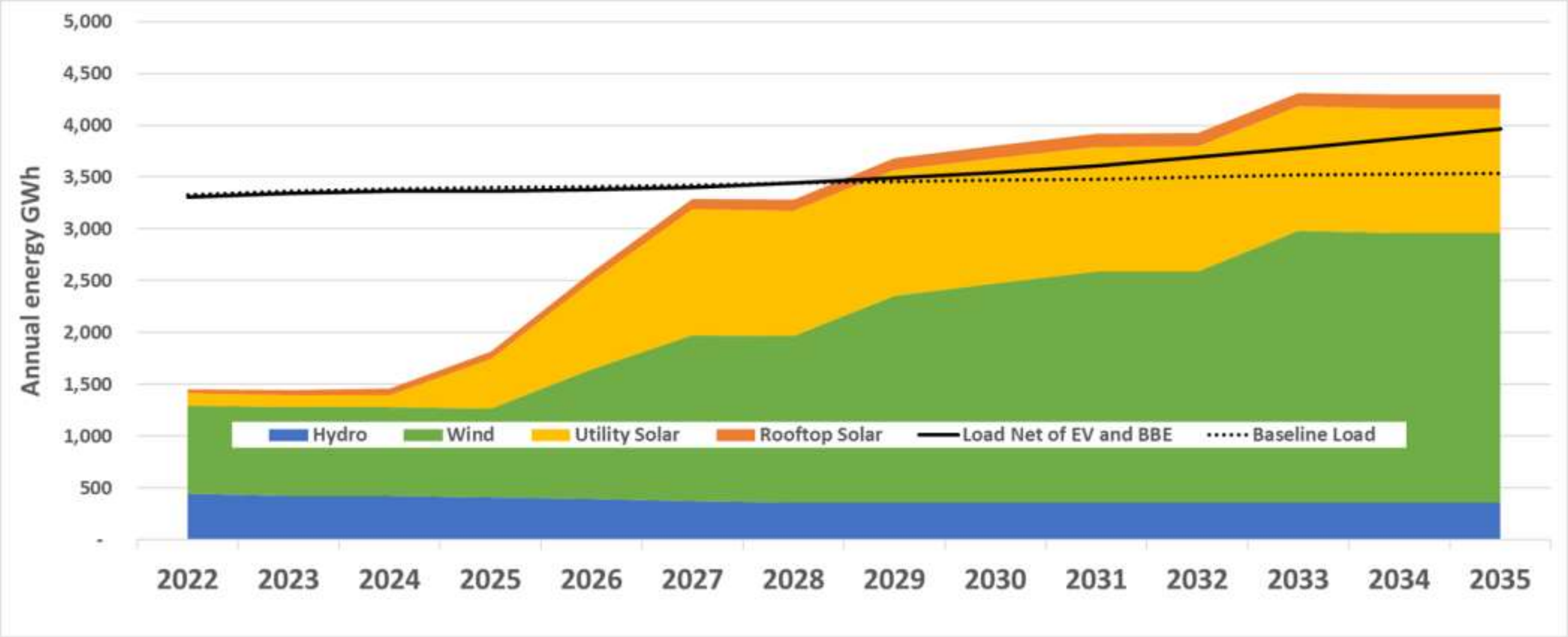
Coal | Wind | Hydropower | Solar | Other purchases | Natural gas

Progress on adding renewable generation



Over 1 million MWh of renewables added since 2018

Currently planned renewable supplies



2023 budget system total

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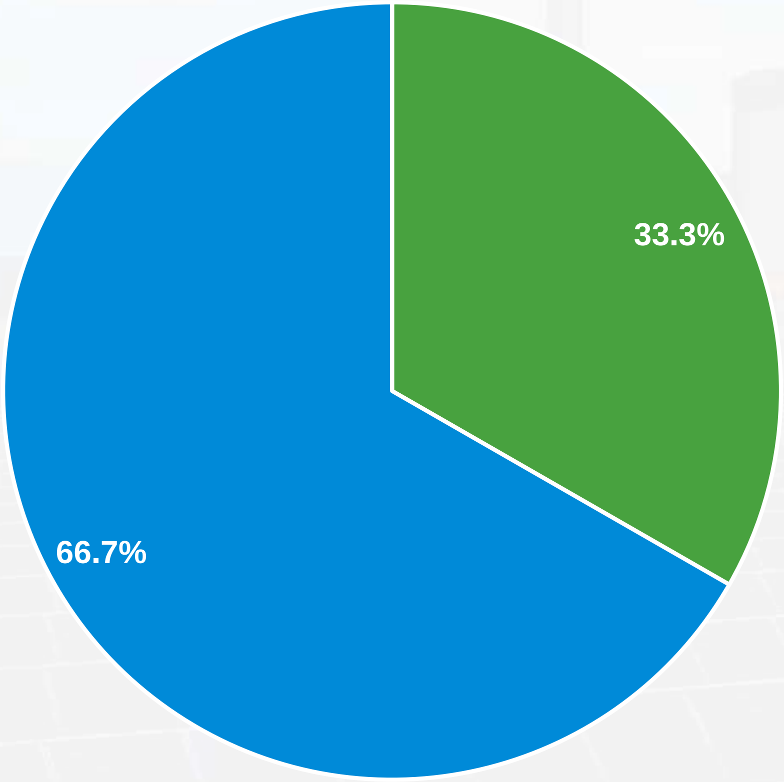
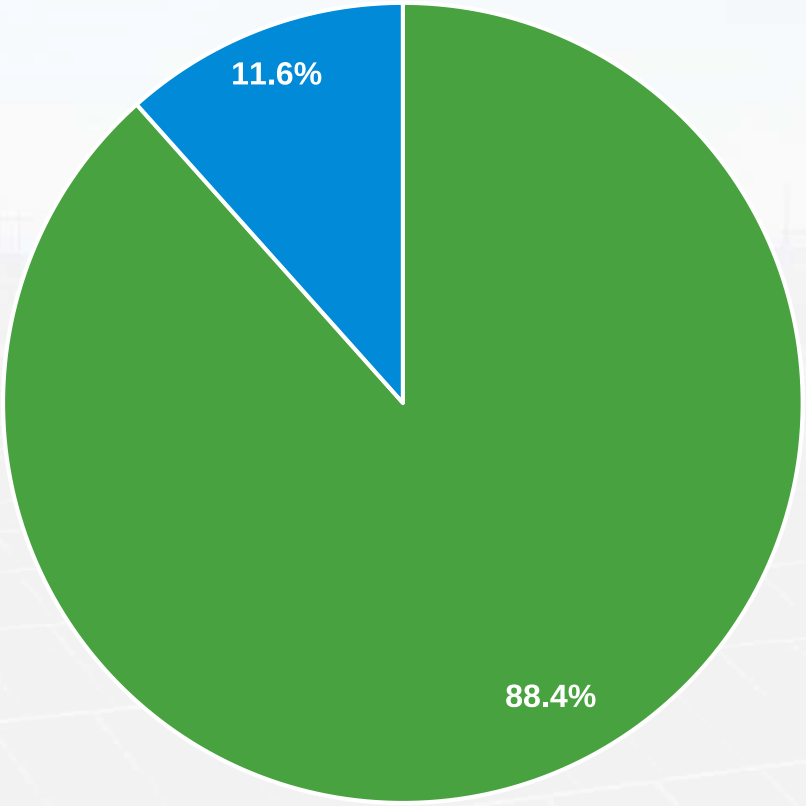


2030 projected system total

88.4% noncarbon resources



Includes renewable energy credit allocations to carbon resources

Due to drought conditions, not all hydropower may be considered noncarbon

■ Renewable resources ■ Dispatchable resources (includes purchases)

Our shared energy transition and future

2030 projected system total

88.4% noncarbon energy

- More wind
- More solar
- Hydro
- 4-hr battery storage

11.6 % dispatchable capacity

- Virtual power plant
- Long-duration storage
- Dispatchable thermal capacity

2024 Integrated Resource Plan

Raj Singam Setti, chief transition and integration officer

What is an IRP

- An IRP is a planning process which integrates customer demand and distributed energy resources (DERs) with utility resources to provide reliable, economical and environmentally desirable electricity to customers
- Typically developed for the next 10-20 years and updated every few years
- IRP assists with preparing for industry changes including:
  - Technological progress
  - Consumer preferences
  - Regulatory mandates
- Required by Western Area Power Administration (WAPA) every five years
- WAPA requires a short-term action plan and an annual follow up on plan execution
  - Last IRP was submitted in 2020

IRP modeling process

Input assumptions

- Load forecast
- DER potential
- Power price forecast
- Resource cost forecast
- Extreme weather models
- Renewable profiles

Portfolio development

- Resource mix
  - Renewable
  - New technology
- Least cost
- Carbon reduction
- Reserve margins

Reliability testing

- Portfolio testing with
  - Dark calms (low supply)
  - Extreme weather (high demand)
  - Different wind/solar profiles

Plexos model

Summary

Study	Advisor	Status
Extreme weather event and dark calm analysis	ACES	Completed
Planning reserve margin requirements and effective load carrying capability	Astrape consulting	Completed
Building electrification forecast	Apex Analytics	Completed
DER potential study	Dunsky	Draft report
Price volatility, congestion, and curtailment	ACES	Completed
Emerging technologies review. Assess state of the art and future cost/availability of dispatchable technologies, hydrogen, ammonia, energy storage and carbon capture	B&V consulting	Expected by Q3
Dispatchable technology selection. Techno-economic assessment of available options and recommendation of the best fit	B&V consulting	Expected by Q3

Extreme weather events and dark calms

Extreme weather events summary

- 4-8 heat and cold waves lasting about a week experienced every year
- Noticeable increase in frequency, duration and intensity of heat waves
- Noticeable decrease in frequency, duration and intensity of cold waves

Heat waves:

Heat Wave Summary – West Region						
	48 Hours	72 Hours	96 hours	120 hours	144 hours	168 hours
Events per year	0.47	0.02	0.09	0.04	0.021	0.043

Cold waves:

Cold Wave Summary – West Region													
Number of Hours	48	72	96	120	144	168	192	216	240	264	288	312	336
Events per year	4.9	1.7	0.9	0.4	0.17	0.08	0	0	0	0	0	0	0

Cold Wave Summary – Colorado Region										
Number of Hours	48	72	96	120	144	168	192	216	240	264
Events per year	2.36	0.9	0.3	0.17	0.02	0.04	0	0	0	0

Dark calm events summary

- Meeting reliability requirements for a 3-day event (72 hours)
  - Ensuring uninterrupted power supply for the full duration

- Managing renewable output
  - Addressing losses of Up to 15% in renewable output

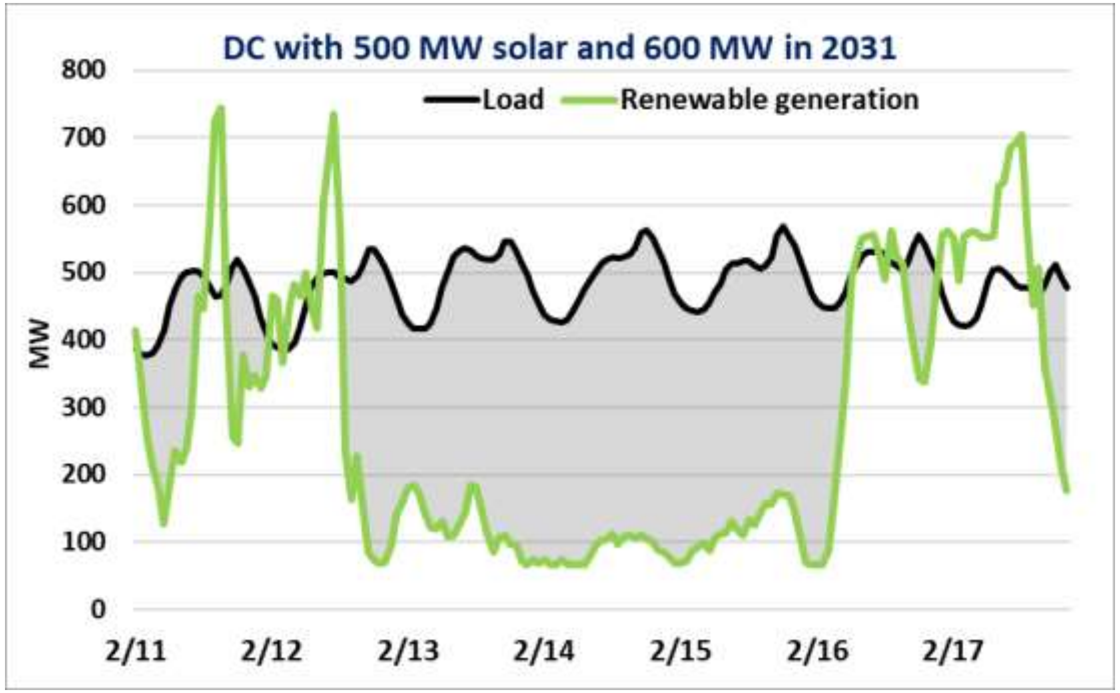
Dark Calm Events by Location

Breakdown of Events/Year by Renewable Output & Duration

% of Full Output	48 hrs	72 hrs	96 hrs	120 hrs
MISO Central				
5%	3.00	1.25	0.50	0.25
10%	11.20	5.60	2.40	2.00
15%	6.20	11.40	3.80	4.80
MISO North				
5%	1.00	1.00	0.67	0.00
10%	5.00	1.75	0.50	1.00
15%	2.20	3.00	1.20	2.00
Northwest ERCOT				
10%	3.80	1.00	0.20	0.20
15%	3.20	3.40	3.00	1.20

Reliability during dark calms (DC) and extreme weather events (EWE)

- This is DC experienced during winter storm Uri in 2021. We scaled up the load and generation to 2031.
- The only way to supply noncarbon energy during DC is to rely:
  - Long duration energy storage (LDES), that once charged will last many days
  - Traditional generation burning noncarbon fuel like hydrogen
- Currently available 4-hour Li Ion battery will not be sufficient. Even if we build 3000 MW (cost $4.5 billion), that will not be sufficient.
- Based on our analysis, we will need about 13,000 MW of 4-hour storage – which is not practical
- Can the market help? Maybe, but we cannot plan on it.
  - Usually severe weather patterns cover large areas. Most likely, all the neighboring utilities will be having similar shortages as we saw during Uri
  - Even if we can find power, it will be very expensive. Our quick analysis showed it will cost almost 40% of our annual power supply cost. This was observed for many small utilities after Uri.
- During winter severe weather, there are challenges of getting fuel as well, which means on-site storage will be required

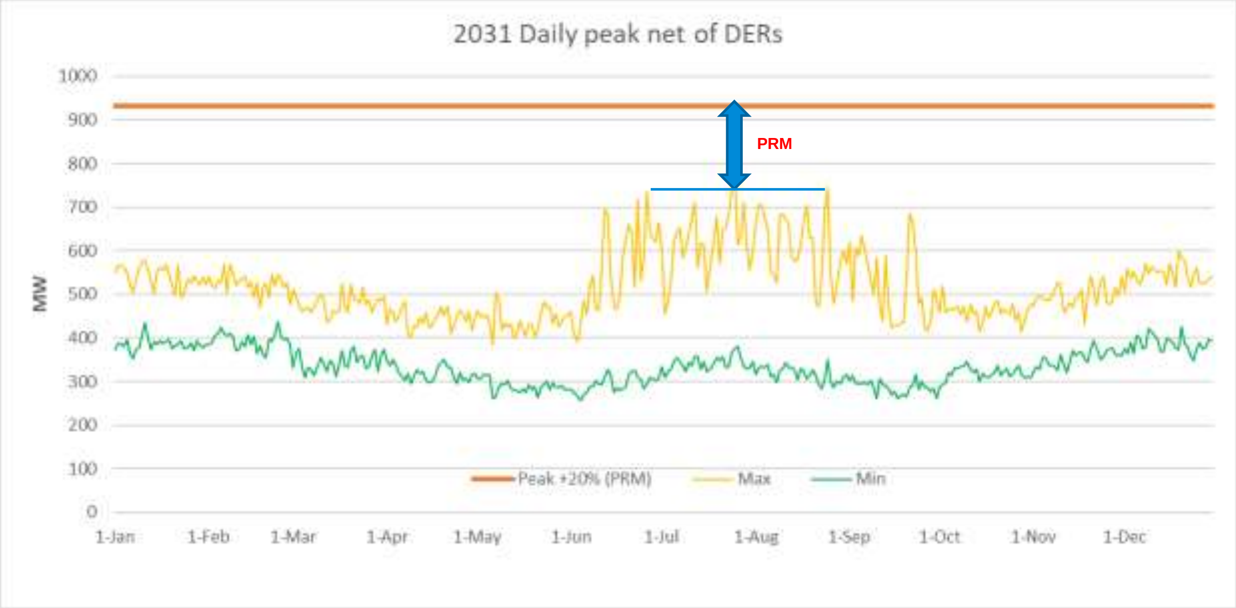


A 3 GW battery will last a day. 10 GW battery will cover this DC but we would need 13 GW to cover an expected DC lasting up to 5 days.

Planning reserve margin (PRM) and effective load carrying capability (ELCC) study

Planning reserve margin (PRM) requirement

- Each utility must carry a spare capacity. Market can help in emergencies but does not guarantee
- Historically, PRM was 15% but with the addition of intermittent renewables it is going up
- Independent assessment from external advisors suggested we will need 20-25%
- WECC study recommends 22-25% for our area
- Texas increased the requirement from 13% to 18%



Renewable generation, DERs and 4-hour battery storage can provide PRM but, their ELCC drops significantly as you add more resources, due to intermittency and energy limitations. Long duration energy storage (when developed) or traditional thermal generation are better suited to provide PRM. A 100 MW wind or solar can only 5-10 MW of PRM, while 100 MW of LDES or thermal generation can provide 90 MW of firm capacity.

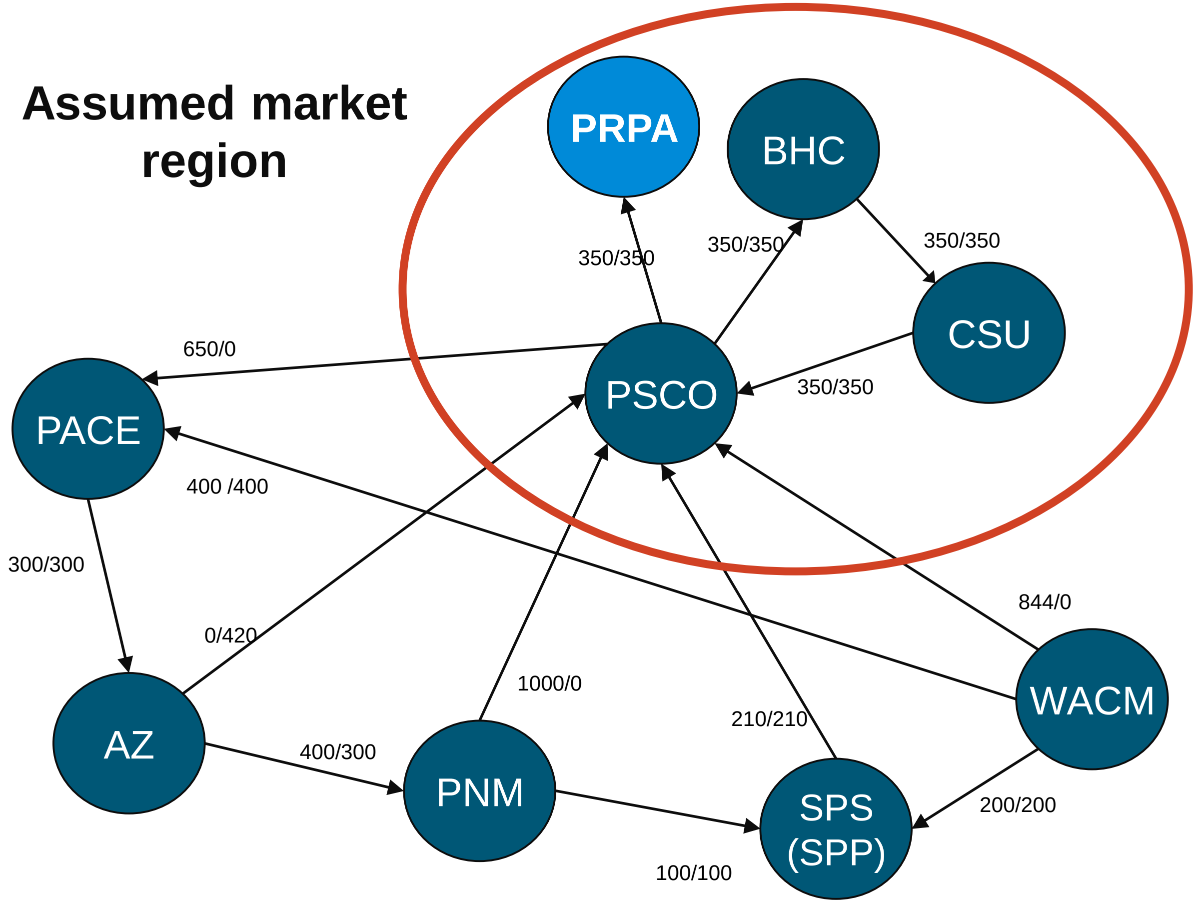
Modeling basis

Modeling year 2030. Assumed a regional market to realize diversity benefits.

2030 resource mix

Conventional resources ~8,900 MW Storage and renewable resources	
Battery storage	867
Distributed solar	1,820
DR	670
PSH	301
Solar	3,880
Wind	6,280

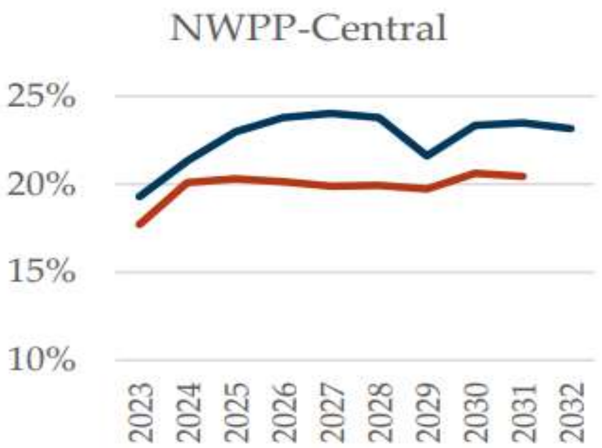
- Assessed regional PRM for one outage in 10 years or annual Loss of Load Expectation (LOLE) of .1
- Ran 63,000 simulations (42 years of historical weather X five load forecast errors X 300 outage patterns)

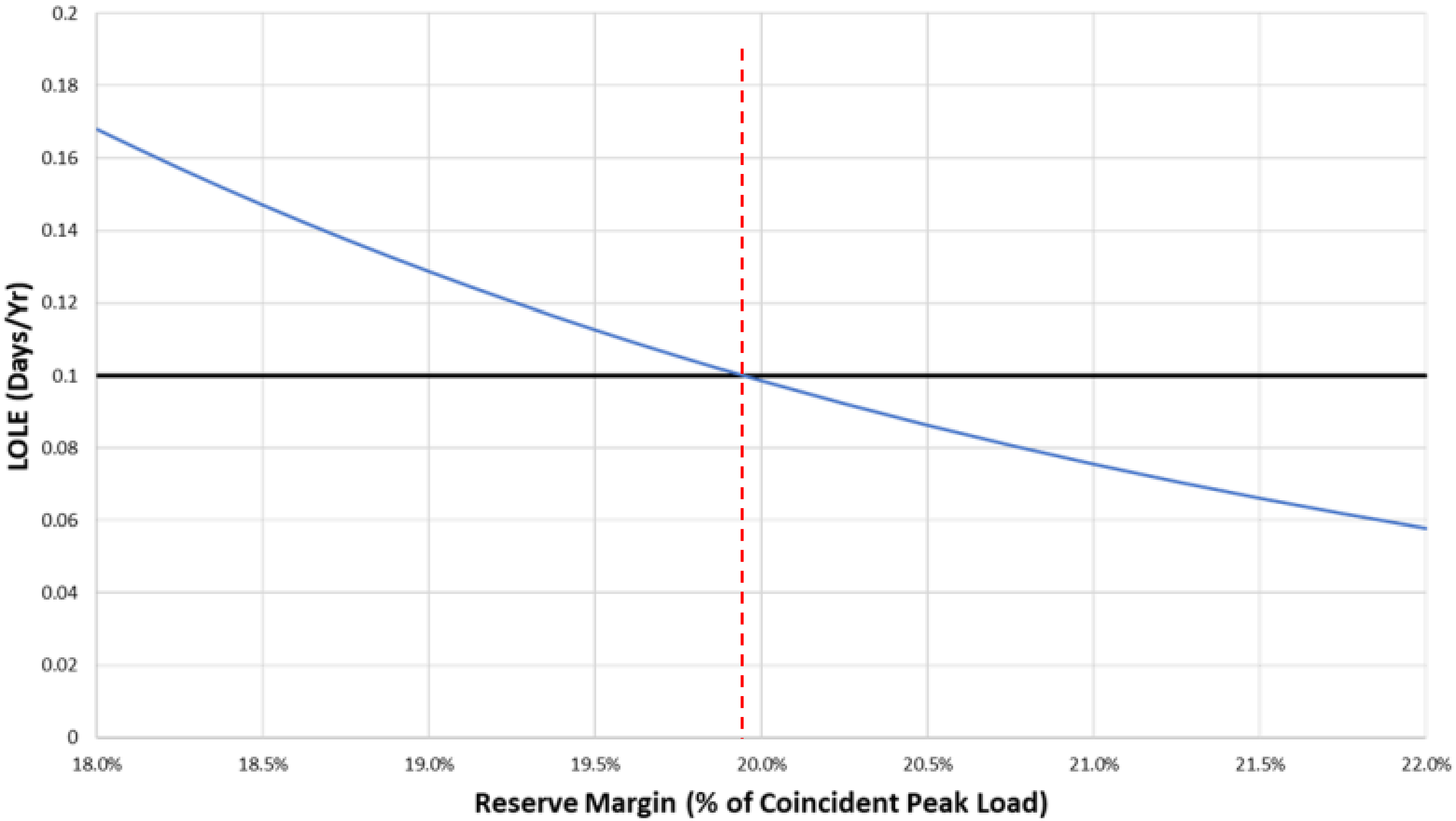


2030 PRM curve

Study recommends a PRM of 19.9% which includes a diversity benefit of 2.2%

Results are somewhat in line with proposed PRM requirements for our region.





https://www.wecc.org/Reliability/2022%20Western%20Assessment%20of%20Resource%20Adequacy.pdf

Building electrification

Key findings

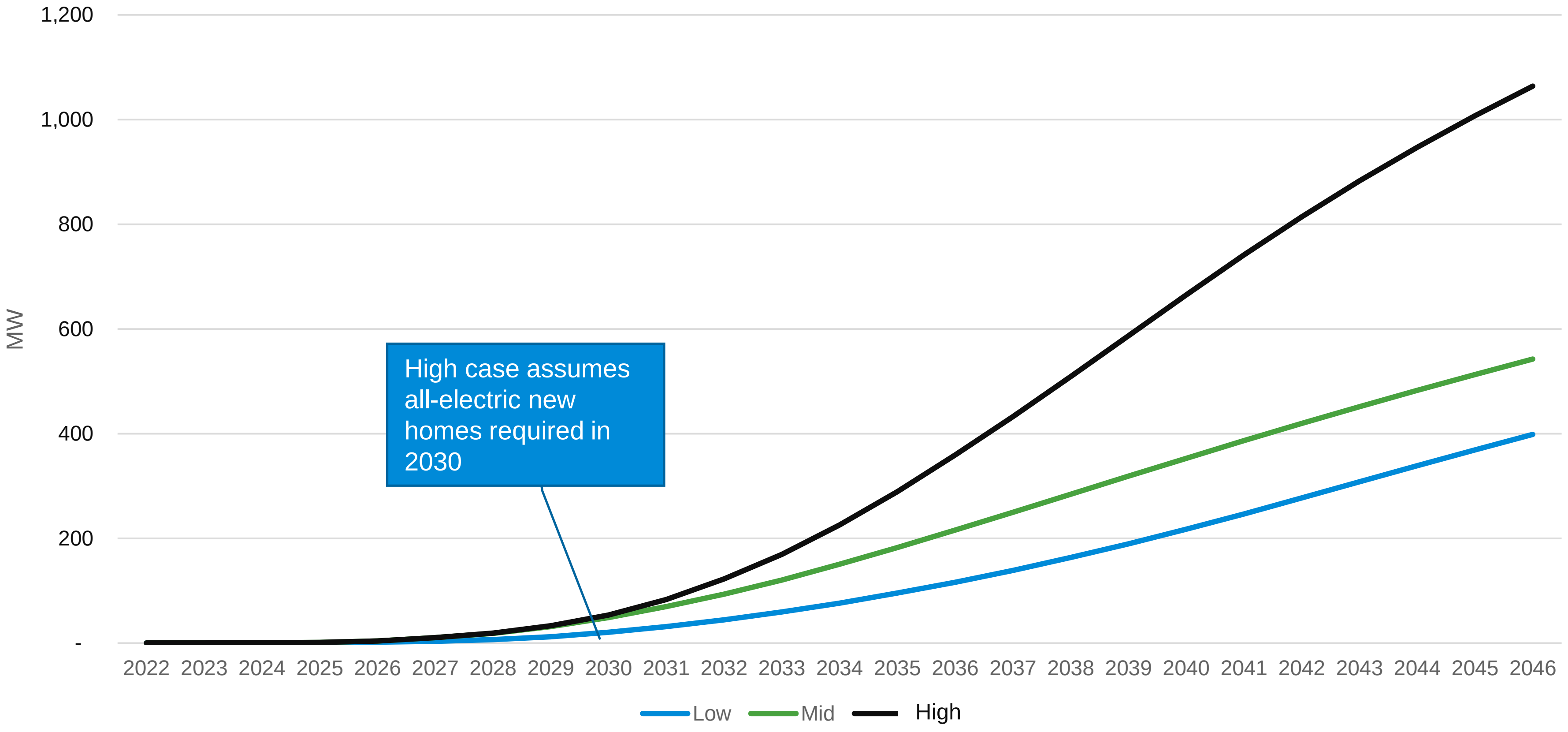
- Space heating has the biggest impact, especially after 2030
- Partial electrification of heat with gas back up improves load factor
- Full electrification causes significant impact on winter peak

Components of electrification load

Sector	End use	Percent of 2040 fossil fuel GHG emissions	Included in PRPA forecast
Residential	**Space heating**	**51.8%**	**Yes**
Residential	Water heating	12.5%	Yes
Residential	Cooking	1.7%	Yes
Residential	Lawn and garden	0.9%	No
Residential	Clothes Dryer	0.5%	No
Commercial	**Space Heating**	**23.6%**	**Yes**
Commercial	Cooking	4.7%	Yes
Commercial	Water Heating	2.9%	Yes
Commercial	Fork Lifts	0.8%	No
Commercial	Lawn and Garden	0.6%	No

Building electrification winter peak projection

- Platte River may become winter peaking sometime after 2040
- Winter peaking starts roughly 5-7 years after all electric new building code goes into effect

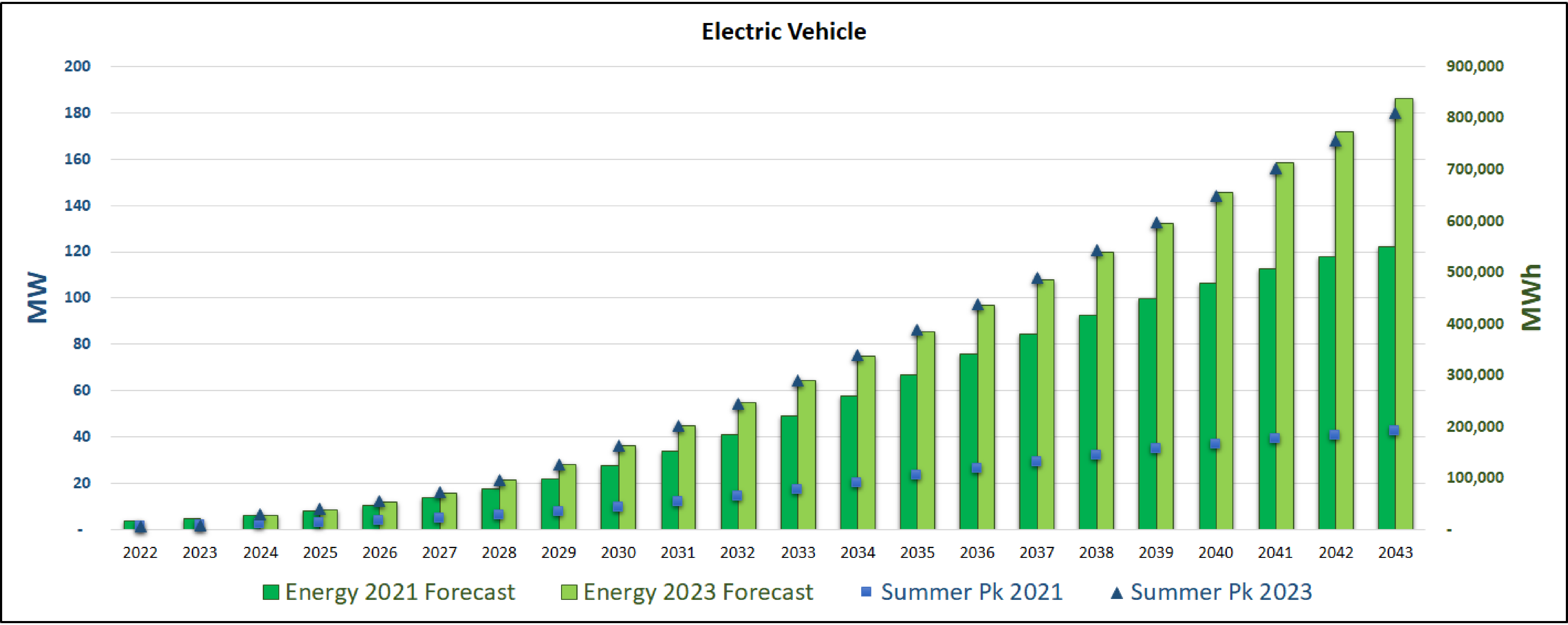


DER potential study

DER potential study scope

- **Technologies:** transportation electrification, distributed generation + storage and demand response
- **Scenarios:** three market potential scenarios that consider market/technology factors and program/utility levers (incentives, rates, policy, etc.)
- **Sectors:** residential single family, residential multi-family, small commercial, large commercial
- **Outputs:** technology adoption (number of units), annual energy impacts (MWh), hourly demand impacts (MW), program metrics (budgets)

Transportation electrification *unmitigated* energy and demand summer medium growth



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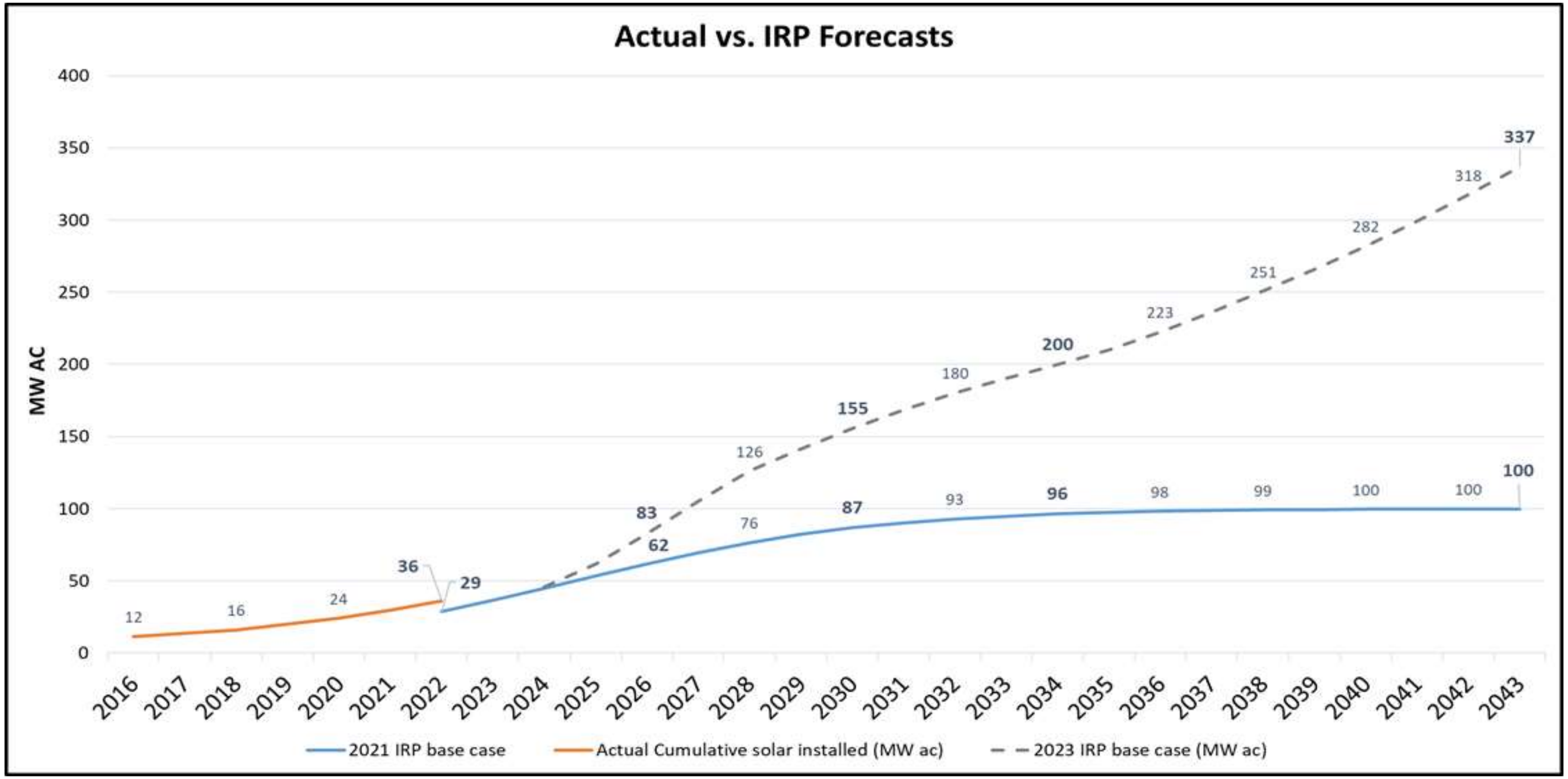
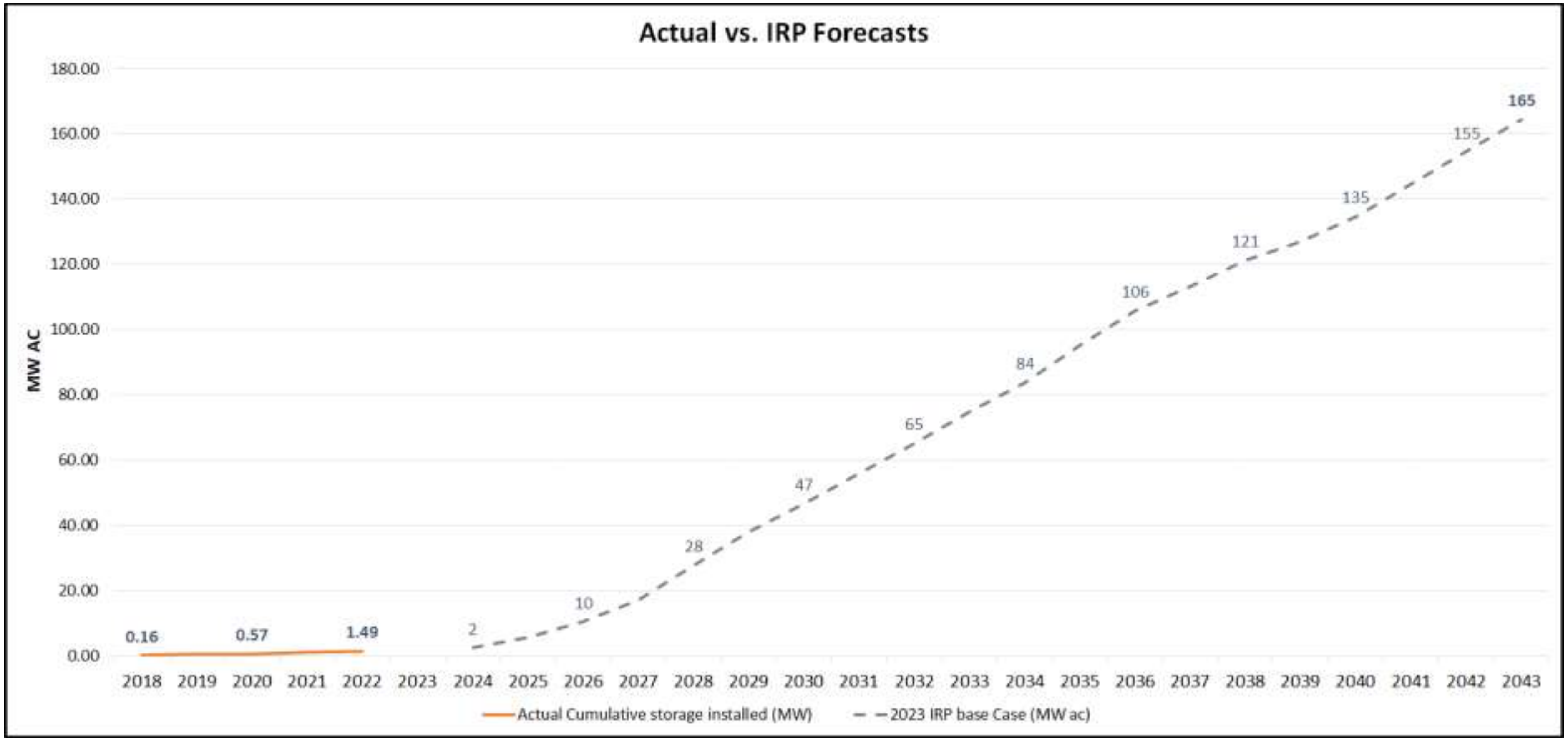
Behind the meter solar potential

Medium + medium Net Energy Metering blended



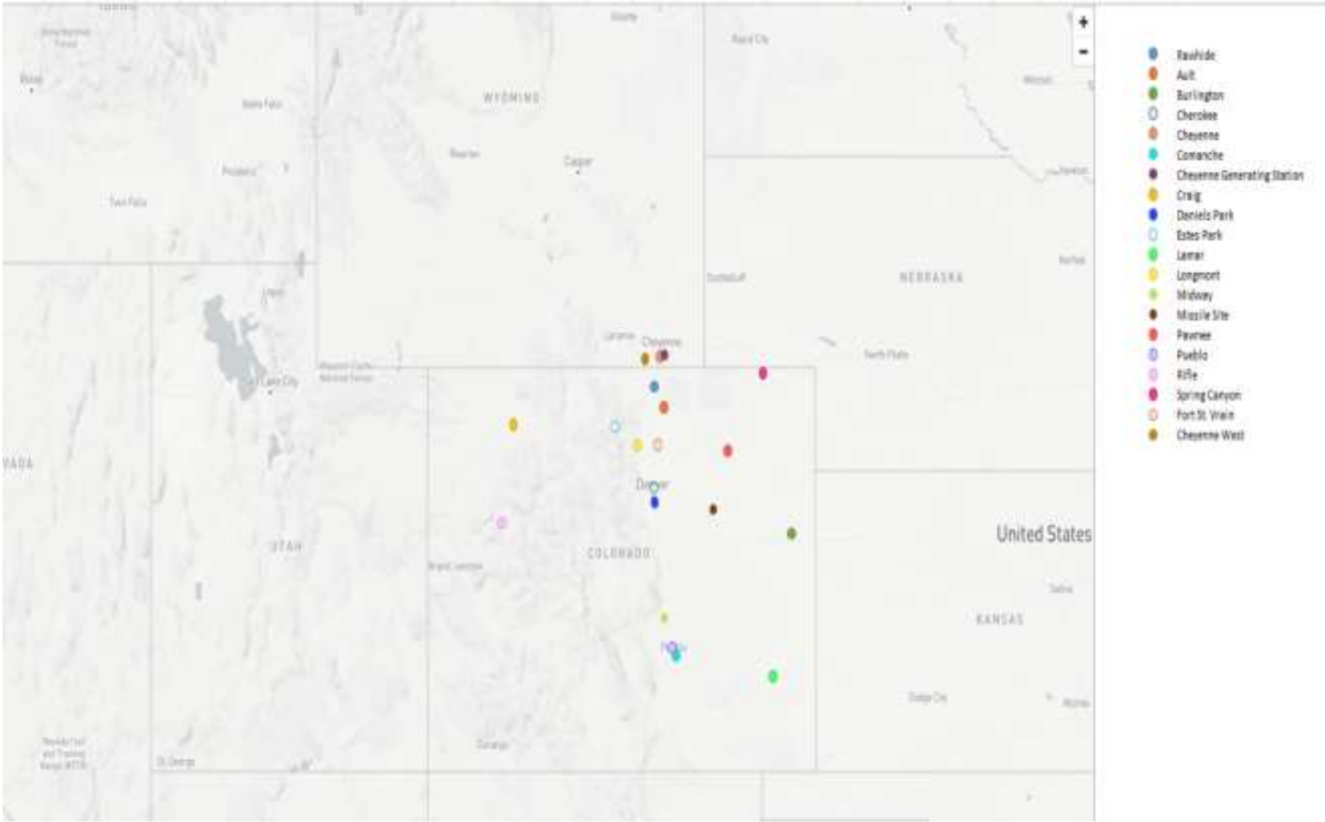
Behind the meter storage potential

Medium + medium Net Energy Metering blended



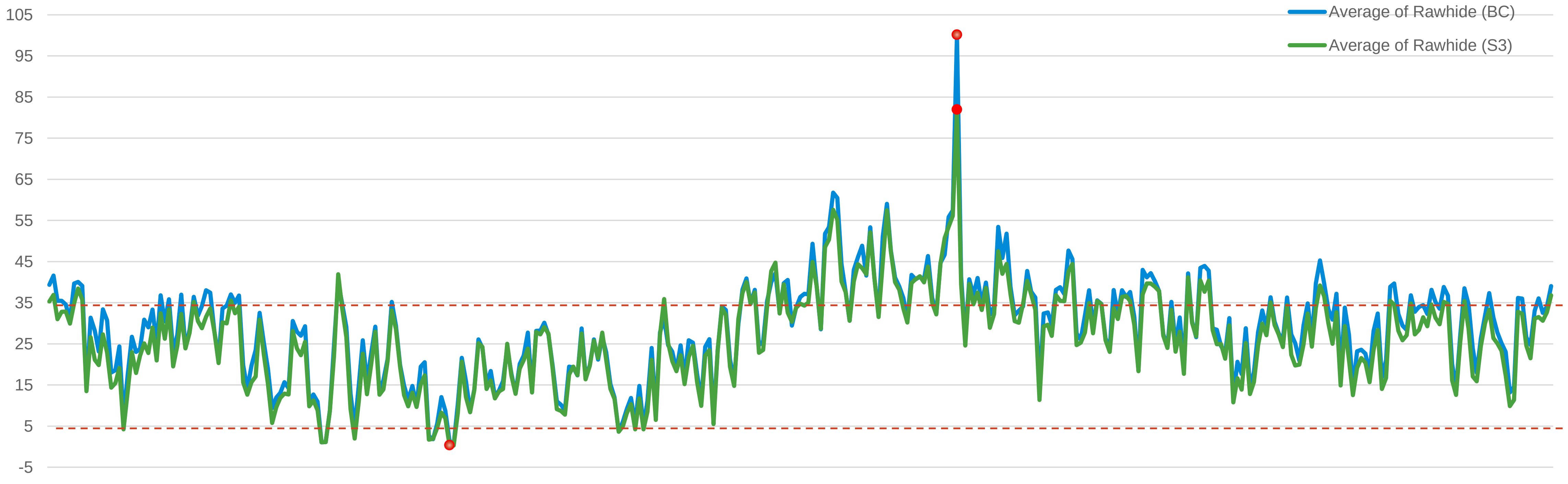
Market price volatility

Locational marginal price (LMP) forecast



030 Base case assumptions (20 locations)
500 MW wind at Rail Tie site in WY
1800 MW of Wind connecting to Gateway South in Western WY
3000 MW of Wind connecting to Colorado Power Pathway
500 MW of wind near Casper WY
500 MW of solar near Craig CO
2000 MW of Utility Scale Solar in the Denver-Pueblo Area
1000 MW of distributed solar in Denver-Pueblo Area
200 MW of peaking generation at Cheyenne Energy Station
1300 MW of peaking generation in Denver area
500 MW of batteries in Denver area
Retirement of all coal Units in CO

LMP forecast - 2030

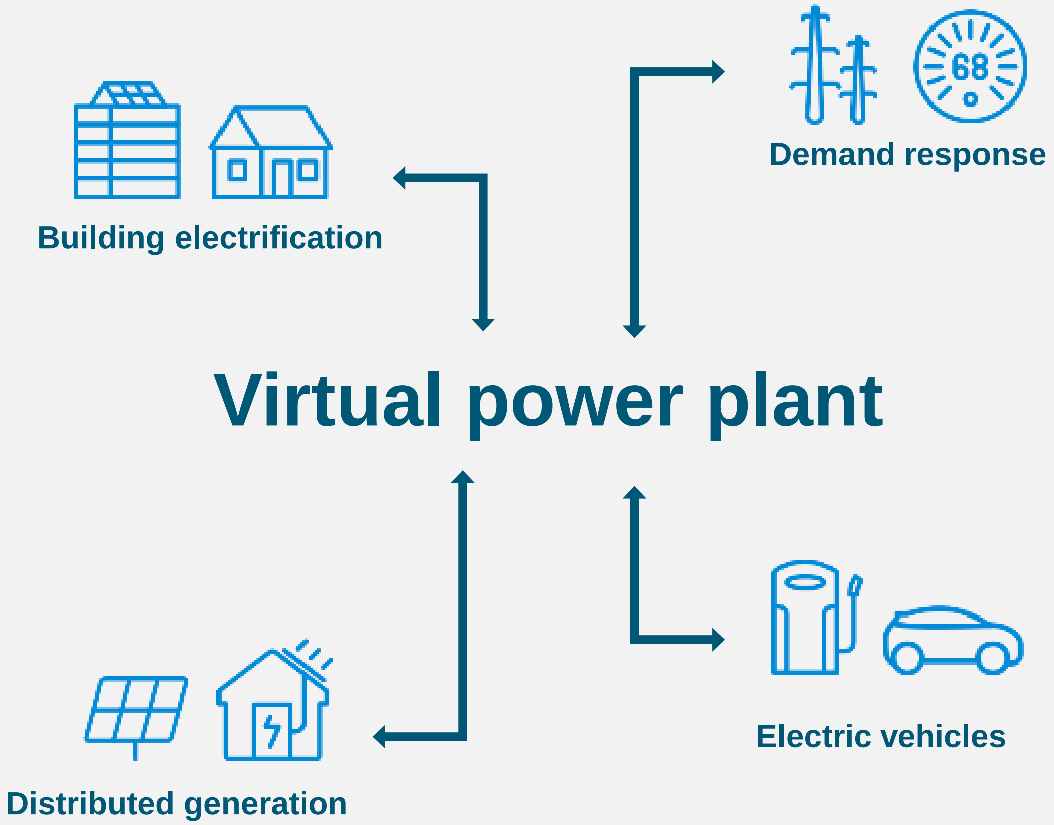


New dispatchable capacity

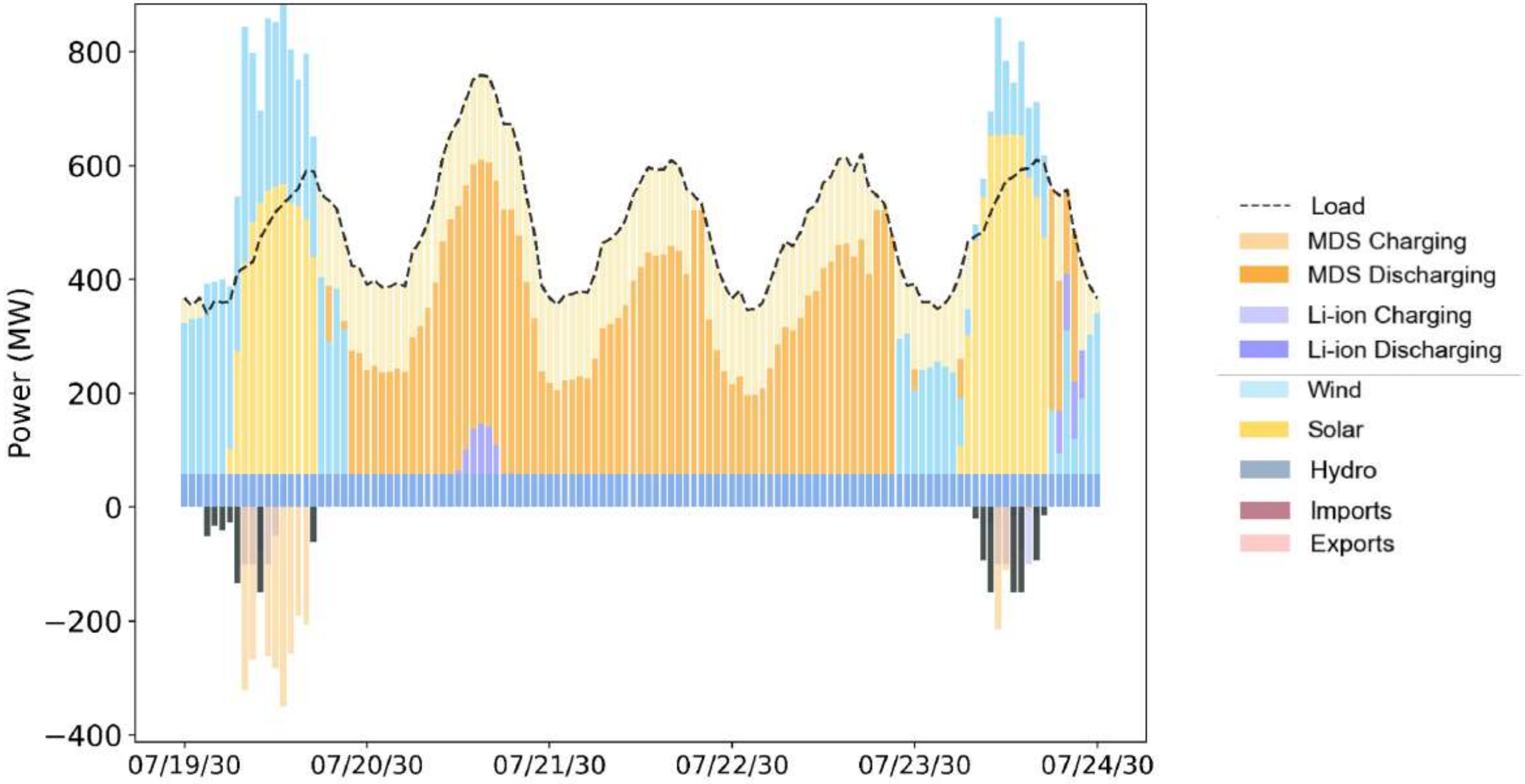
Virtual power plant – integration

Information needed from the owner communities

- Data is fuel for VPP
- Meter Data - AMI
- Distributed generation and DER availability/capability/derates
- Demand response status by program
- EV/devices aggregated status



Long duration storage



Dispatchable thermal capacity

Recommend the most suitable dispatchable technology to provide 170-240 MW by 2028 to complement renewable generation after coal retirement

Followed a multi-track process				
Internal team	**Vendor engagement**	**Site visits**	**B&V process**	**Decision matrix**
• Resource planning • Portfolio strategy • Operation • Engineering • Transmission • Environmental • Permitting	• GE • Mitsubishi • Mitsubishi Aero • Siemens • Wartsila • Pro Energy	• Cheyenne • Drake • Pueblo • Meetings with utilities	• Screening • Operational characteristics • LCOE • Operational flexibility • Reliability • Fuel versatility • Emissions • Constructability • Market performance	• More weights to the attributes related to three pillars • Multiple sub-categories • Qualitative and quantitative attributes evaluated

Dispatchable thermal capacity

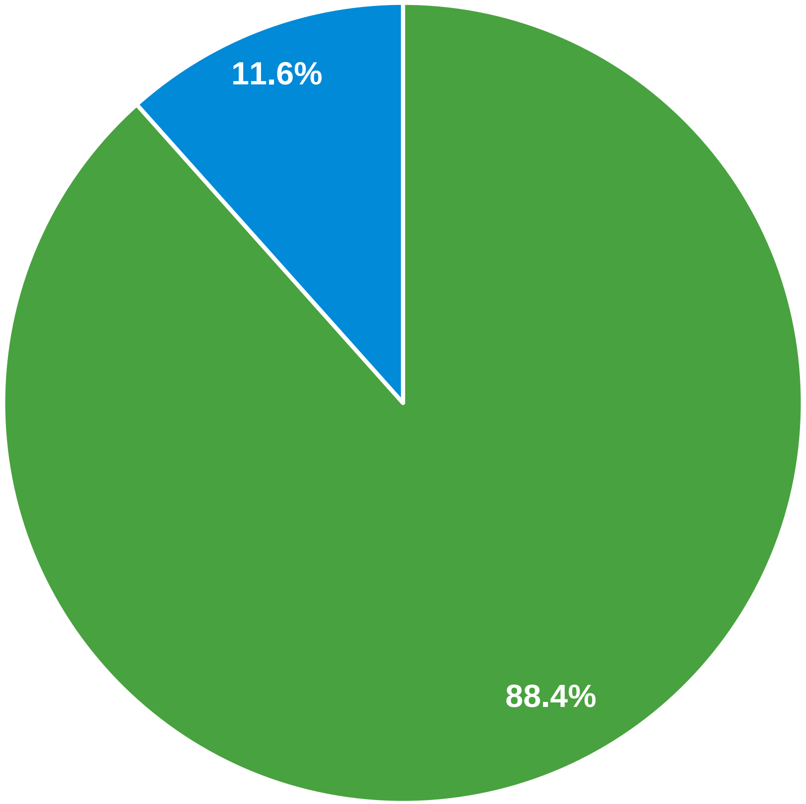
Decision matrix

Qualification	Weighting
Reliability	0.30
Emissions	0.25
Costs	0.20
Operational Flexibility	0.10
Fuel Versatility	0.05
Constructability	0.05
Market Performance	0.05
Total weighted score	**1.0**

Key takeaways

2030 projected 11.6% dispatchable capacity

- Long duration storage
  - Emerging technologies are promising
  - In discussions with two potential suppliers
- Virtual power plan integration
  - DER team established across owner communities working to accelerate the integration of DERs
- Dispatchable thermal capacity
  - Enables deeper level of renewable penetration
  - Supports the integrity of the grid
  - Ensures reliability through dark calms
  - Hydrogen capable



Stay informed

Stay informed

- Join us for the Nov. 2 community engagement meeting
- Visit prpa.org/2024IRP

Submit additional questions and request community presentations

- 2024IRP@prpa.org

Questions

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