Platte River Power Authority

Estes Park • Fort Collins • Longmont • Loveland

Welcome

2024 Integrated Resource Plan

Community engagement meeting

Meeting logistics

What is available to you

- Spanish translation services (available via Zoom)
- Hearing-impaired headsets

Q&A portion of the meeting

- The Q&A portion will follow the presentations
  - Virtual: submit questions via PollEv.com/prpa (link available in Zoom chat)
  - In person: cards are available to submit written questions
- Limited to **one minute per person** to allow for more participation

Stay up to date:

prpa.org/2024IRP

Submit questions throughout the IRP process and request community meetings:

2024IRP@prpa.org

Join Zoom for Spanish translation

Traducción en español está disponible. En su computadora, haga clic en el ícono del mundo etiquetado como "Interpretación" y seleccione "Español." Si está en una tableta o teléfono inteligente, haga clic en los tres puntos que dicen "más" y seleccione "Interpretación de idioma" y luego "Español."

Puede encontrar instrucciones adicionales aquí:
prpa.org/spanish.pdf

Audifonos con un adaptador para iPhone o Android están disponibles para su conveniencia.

Para llamar por teléfono:
US: 1 720 707 2699
Webinar ID: 837 2543 7643

Agenda

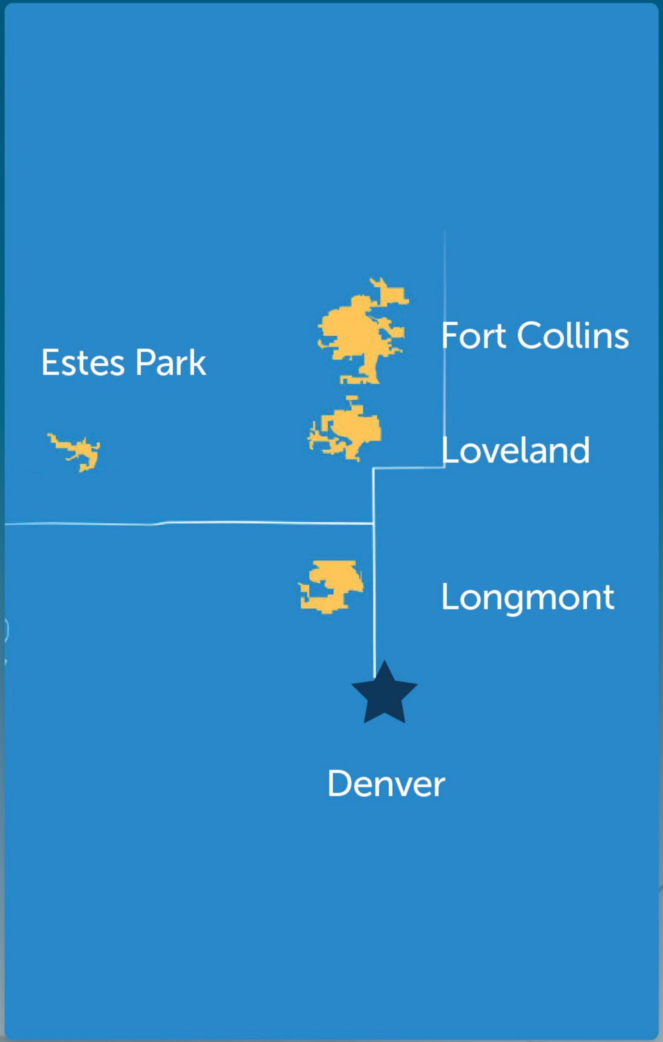
- Integrated resource plan, second community engagement meeting
  - Raj Singam Setti, chief transition and integration officer
  - Masood Ahmad, PhD, resource planning manager
  - Paul Davis, distributed energy resources manager
- 10-minute break
- Q&A

50 YEARS

Reliability

Environmental responsibility

Financial sustainability



4 municipalities
350K+ residents

Community owned, public power utility

~300 employees

Timeline

June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June

Community engagement

Listening session (June)

Listening session (Nov)

Listening session (April–May)

Ongoing public engagement in collaboration with owner communities

Resource planning

- Pre-IRP studies
- Load forecasting
- Other inputs, assumptions

IRP modeling (June–Aug)

Portfolio development (Sept–Dec)

Reliability assessment with renewables and DER integration (Aug–Nov)

Review results (Jan–Feb)

Board presentation (Mar–April)

IRP document development (May–June)

Where we are in the community engagement process

Strategic community engagement efforts

- Presented to owner community city councils
- Conducted 17 community meetings in partnership with owner communities
- Engaged with industry partners and nonprofit organizations
- Launched public education campaign

What we’ve heard from you

Dark calm events – what is the past, present and future of these by percentage? Are they increasing?

I’m interested in how Platte River is going to move to 100% renewable energy. If not 2030, then when?

How does joining an organized power market help renewable integration?

If you had to put the three pillars in order, what is the most important?

How will Platte River manage residential and commercial customers who want to put energy back into the grid? Will they need to store it?

Have you all considered geothermal and/or micro-nuclear? They seem to be gaining traction.

Why can’t the PRPA’s existing methane turbines be used to meet the demand for electricity when wind, solar, and hydropower resources aren’t sufficient to meet that demand?

How can a distributed power system save rate payers money?

With this new effort, how will we remain competitive in cost for electricity?

Has there been any consideration to the conversation of turning Rawhide into a thermal plant with solar thermal capability?

Your website and published guide states 100% by 2030 but the presentation states you’re 88% renewable.

When we receive calls for emergency financial support, electricity/utility bills are second only to housing.

California’s average electrical rate is approximately 65% more expensive than the rest of the country. Will Platte River be charging me 65% more for my electricity in 2028?

Key highlights from engagement

- Extreme weather modeling and climate change
- What is a dispatchable resource?
- Energy market and resource planning
    - Source of "other purchases"
- Electrification efforts and growth in demand/load
- Equity and affordability
- Behavioral change vs. adding more resources

Resource Diversification Policy and progress since 2018

Raj Singam Setti, chief transition and integration officer

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.

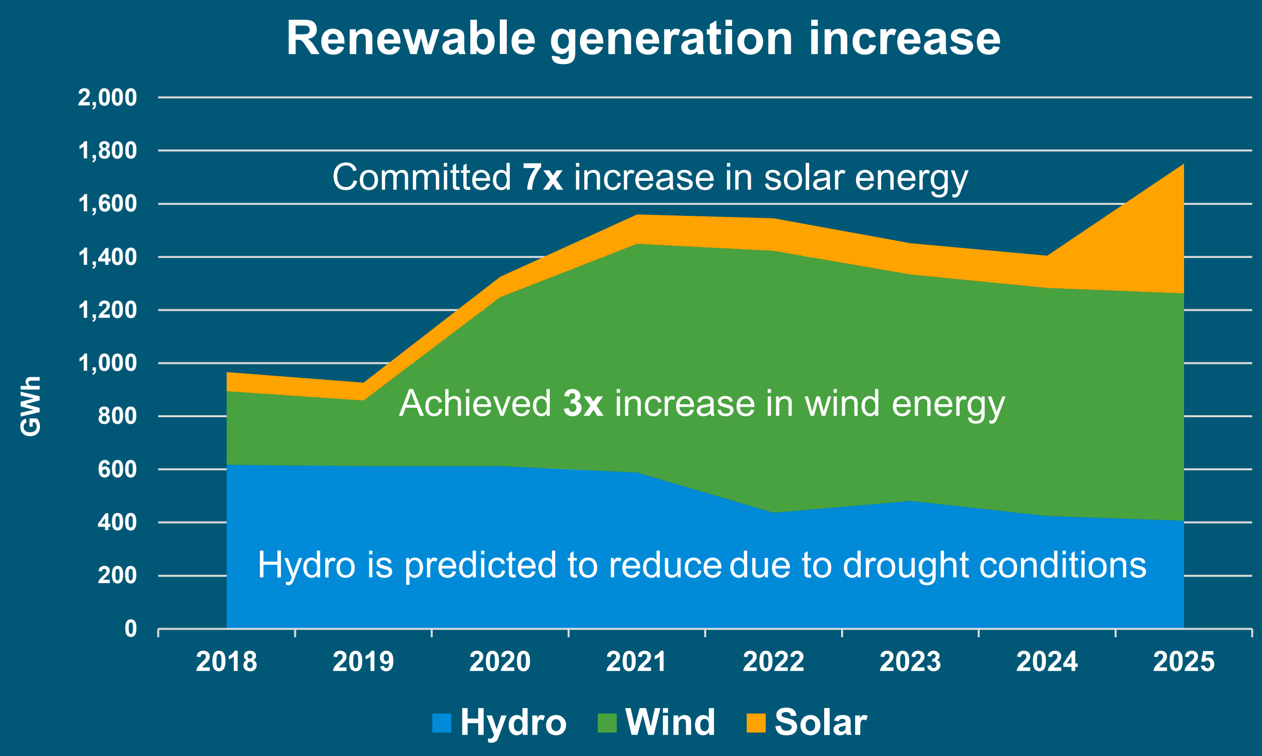
Goal

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.

Advancements needed

- An organized regional market must exist with Platte River as an active participant
- 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
- Battery storage performance must mature and the costs must decline
- Utilization of storage solutions to include thermal, heat, water and end user available storage

Progress since RDP passage in 2018



- Filed 2020 IRP, filed Clean Energy Plan with the state (80%+ carbon reduction by 2030), announcement to retire coal resources
- 225 MW Roundhouse Wind Energy Center
- Added 22 MW Rawhide Prairie Solar with 2 MWh battery
- Signed 150 MW Black Hollow Solar power purchase agreement
- Finalizing winning proposals from 2022 solar and battery storage RFPs
- Recently issued 150-250 MW wind RFP
- Implementing a distributed energy resources strategy
- Entered Southwest Power Pool Western Energy Imbalance Service market

2024 Integrated Resource Plan – progress to date

Masood Ahmad, PhD

Resource planning manager

Timeline

June | July | Aug | Sept | Oct | Nov | Dec | Jan | Feb | Mar | April | May | June

Community engagement

- Listening session (June)
- Listening session (Nov)
- Listening session (April–May)

Ongoing public engagement in collaboration with owner communities

Resource planning

- Pre-IRP studies
- Load forecasting
- Other inputs, assumptions

IRP modeling

Portfolio development

Review results

Reliability assessment with renewables and DER integration

Board presentation

IRP document development

Progress since June 1 engagement session

- Completed nine (9) of eleven (11) external studies
- Developed and tested about 25 portfolios
- Evaluated several options for dispatchable capacity

What is dispatchable capacity

- **Dispatchable thermal resource**
  - Enables deeper level of renewable penetration
  - Supports the integrity of the grid
  - Ensures reliability through dark calms
  - Hydrogen capable
- **Long duration energy storage**
  - Emerging technology
  - In discussions with two potential suppliers
- **Virtual power plant (VPP)**
  - Supports grid reliability and financial sustainability by engaging customers' flexible DERs

Resource planning process

Resource plan development process

- External studies
- Load forecasts
- Market price forecast
- Resource costs
- Customer input
- DERs

Portfolio development

- Objective - lowest cost and CO_2
- Constraint - must meet PRM

When, how much and what technology?

Reliability testing

- Resource portfolio testing with:
  - Dark calms
  - Extreme weather
  - Different wind/solar profiles

Plexos model

Complex optimization for portfolio development

Portfolio development

- Mixed integer linear program (MILP)
- Model 60 units at hourly granularity (both demand-side and supply side)
- 1 year capacity expansion optimization – 4.3 million variables
- 2030-2043 expansion plan – 28.5 million variables takes ~ 4 days

Reliability testing

- Each portfolio is simulated through 504 iterations (full 8760 commitment and dispatch model)
- 24 years of hourly historical wind and solar patterns each simulated 21 times
- 504 stochastic draws for
  - Dark calms
  - Near-term load forecast error
  - Unit forced outages

Complex optimization for portfolio development

Portfolio development

- Plexos model simultaneously optimizes the capacity expansion plan, unit commitment and unit dispatch across the entire modeled horizon.
- All aspects of the system are optimized including storage charging and discharging, electric vehicle charging and demand response usage.
- Expansion plan candidates include two versions of wind generators, two versions of solar generators, three types of batteries and one type of dispatchable thermal generation.

Reliability testing

- Each of the 504 iterations is a full 8,760 hour unit commitment and dispatch problem.
- Unit commitment and dispatch is solved in rolling one day steps with two days of imperfect foresight to simulate real world conditions.
- Each iteration reports the frequency and volume of unserved energy.

Our modeling platform – Plexos

TESTED
2,000+ Unique Users

CHOSEN
450+ Clients globally

SHARED
72 Countries

SKILLED
>375 Industry experts

Energy Exemplar

ELECTRIC & GAS UTILITIES

IPP, TRADERS & RENEWABLES

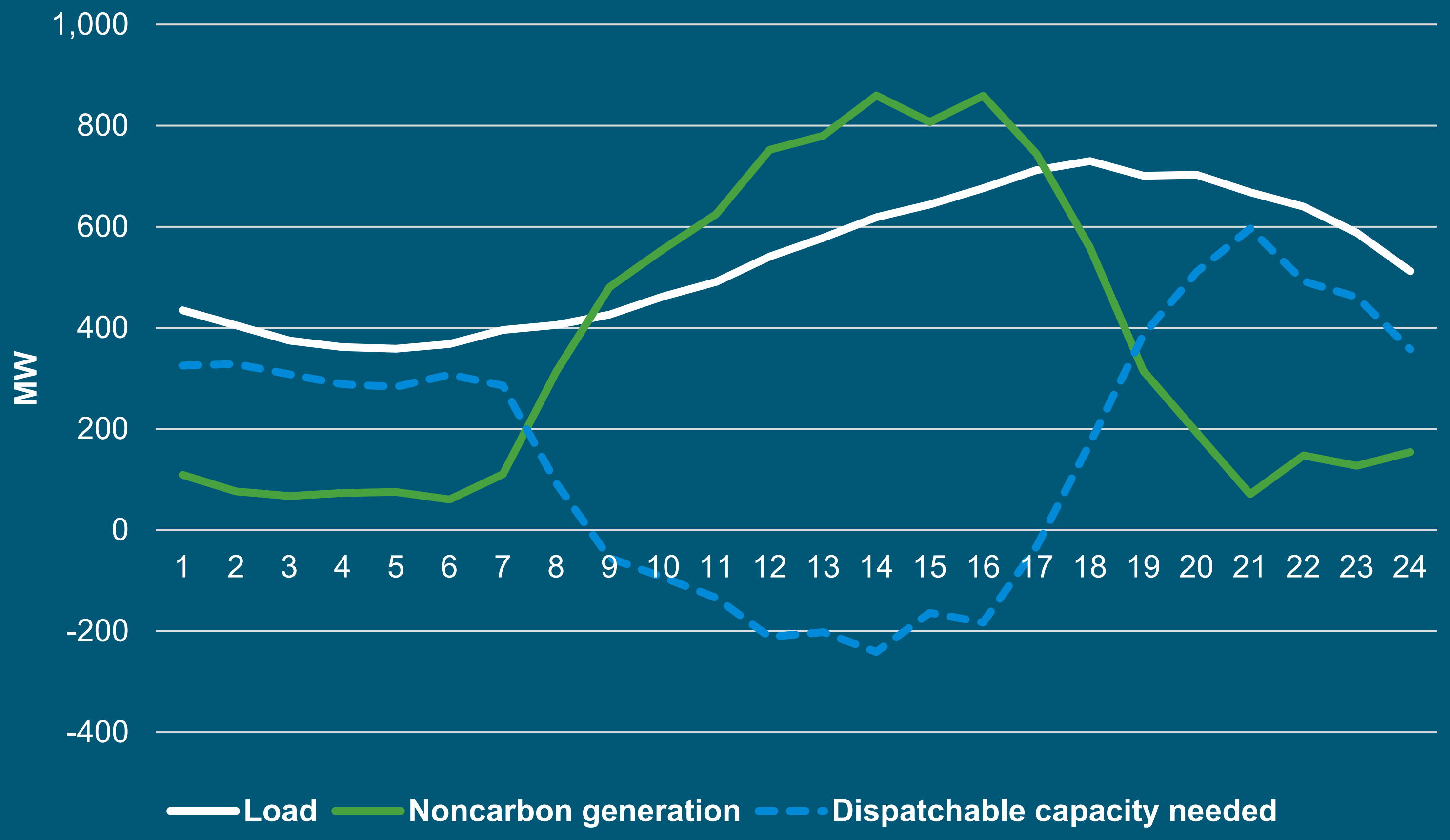
ISO, RTO & REGULATORS

CONSULTING, ANALYSTS AND RESEARCH LABS

Challenges

Renewable integration challenges

Daily

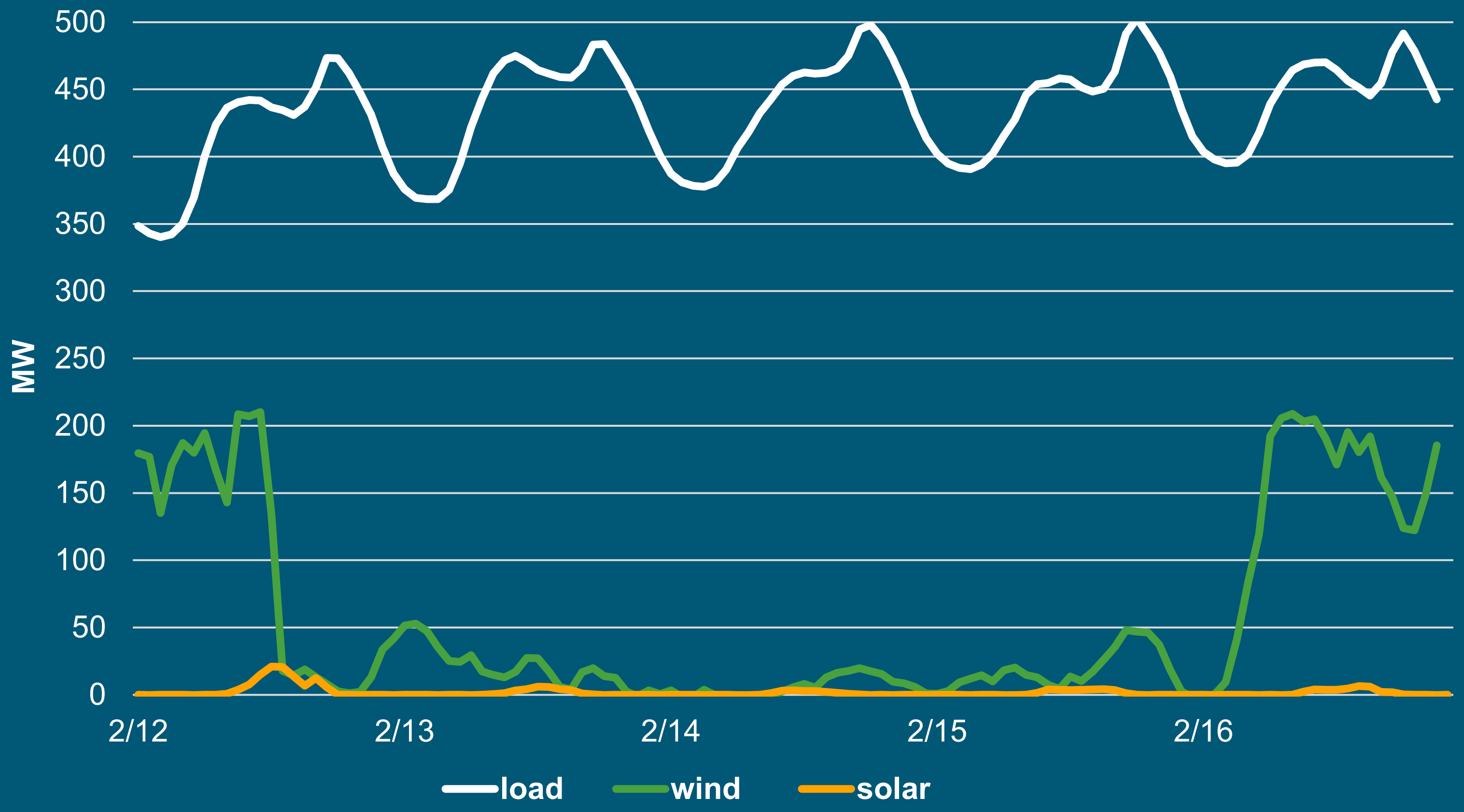


Key points

- Dispatchable capacity needed during many hours (VPP, storage, thermal)
- This shows that on a peak summer day, 300 to 600 MW is needed over a period of 16 hours

Renewable integration challenges

During extreme weather or dark calms like Feb 2021

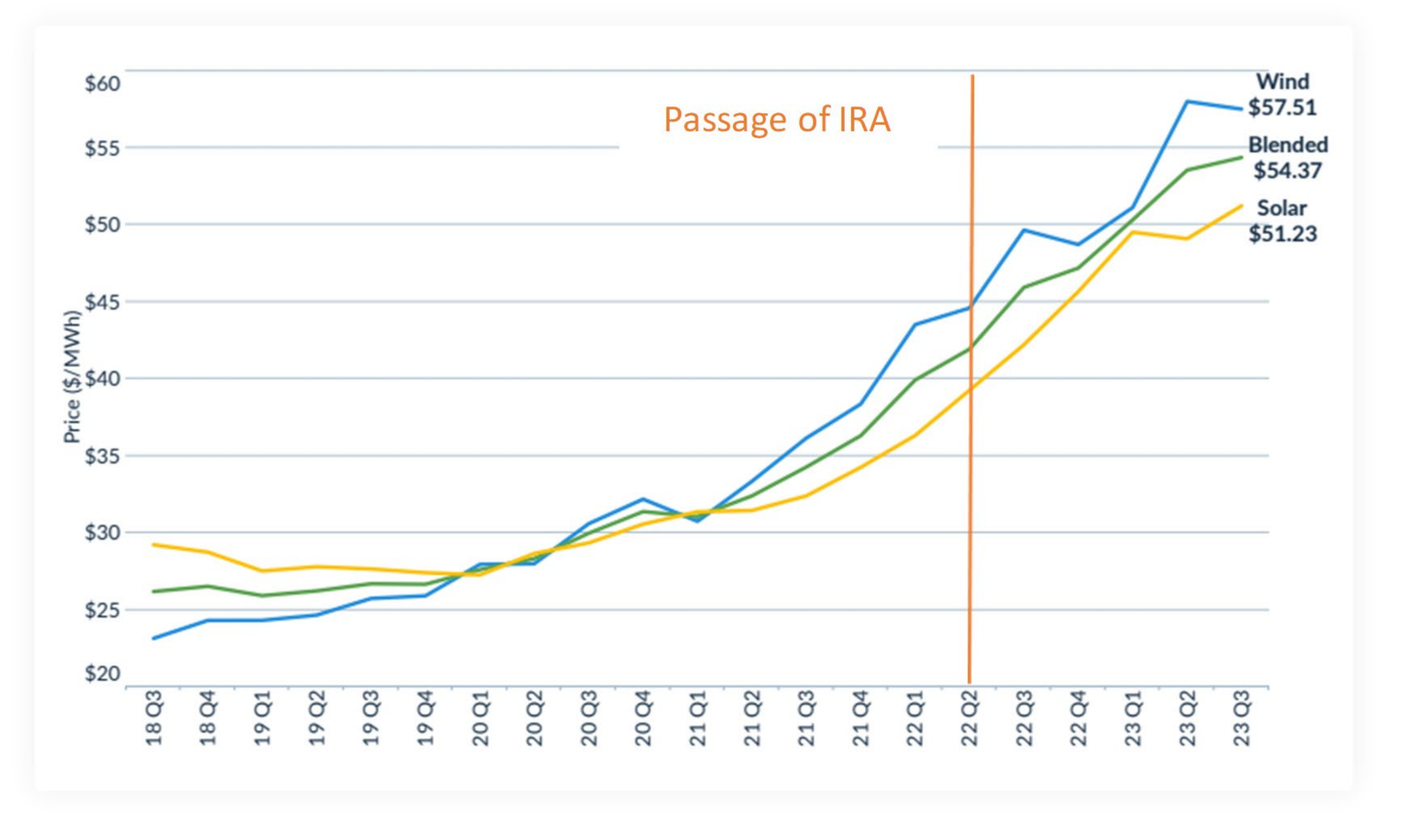


Key points

- Almost no wind and solar generation for about 80 hours
- Load continues to increase as cold weather persists
- Will need dispatchable resources, including long duration storage, to meet load during dark calms

Renewable supply chain and cost challenges

- Costs approx. doubled – even with IRA subsidies
- Significant demand increase
  - Domestically - IRA
  - Globally
- Interest rate increases
- Delays and supply chain issues



Source : Level Ten Q3 PPA Price Index

Studies and assessments

Studies conducted by external consultants/advisors

Complex modeling

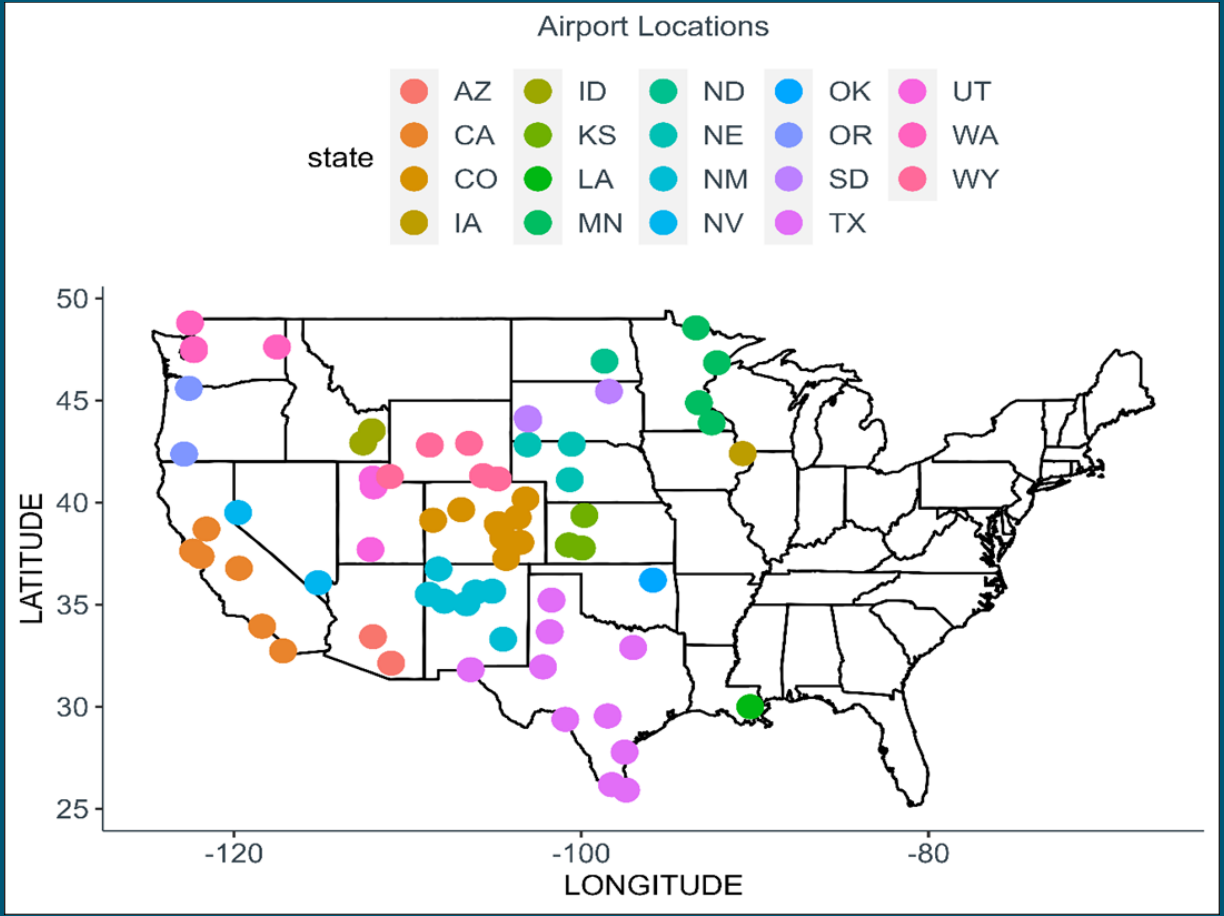
- Extreme weather and dark calms modeling
- Required reserve margin and effective load carrying capability (ELCC)
- Beneficial electrification assessment
- DER forecast and potential
- Load forecast, market prices, volatility and congestion

Technology evaluation

- Emerging technology screening
  - Cost curves
  - Time to maturity
- Dispatchable technology evaluation
  - High flexibility
  - Low carbon
  - Proven technology

Extreme weather and dark calm study scope

- 70 weather stations west of Mississippi
- 27 in and around Colorado
- Last 50 years of hourly weather (temperature, insolation and wind speed, etc.)



Dark calm study results

- Data suggests that we can expect 1.0 to 5.6 events per year in which wind and solar provides 10% or less of their rated capacity for 72 hours (3 days)
- Five-day events are relatively common, from twice per year to once every five years

Dark Calm Events by Location

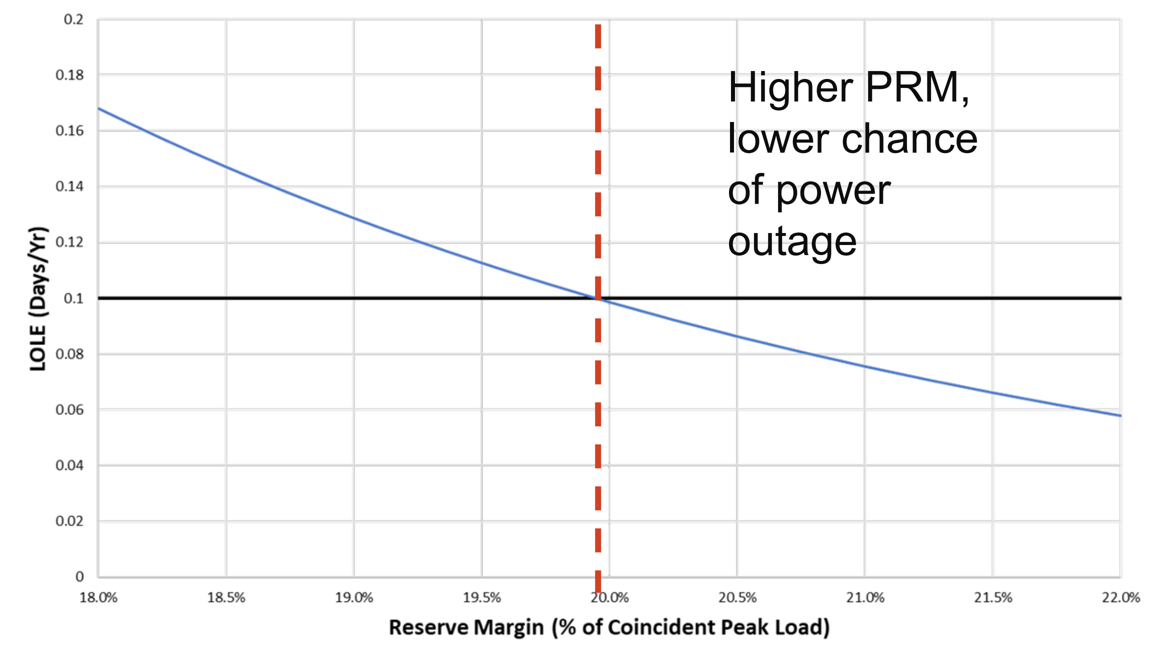
Breakdown of Events/Year by Renewable Output & Duration

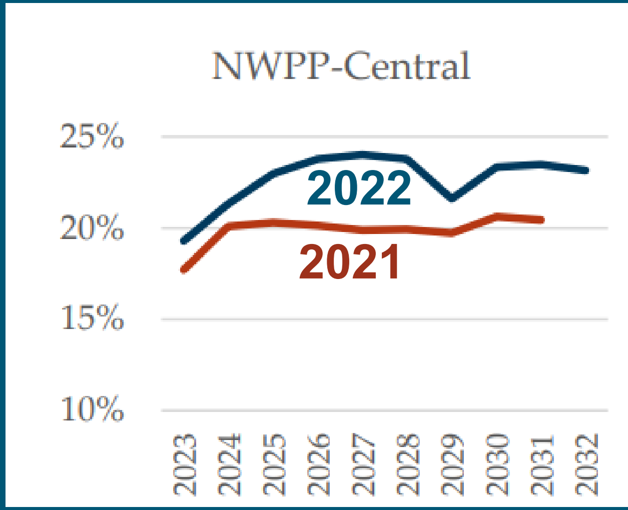
% of Full Output	48 hrs	72 hrs	96 hrs	120 hrs
MISO Central				
5%	3.00	1.25	0.50	0.25
10%	11.20	5.60	2.40	2.00
15%	6.20	11.40	3.80	4.80
MISO North				
5%	1.00	1.00	0.67	0.00
10%	5.00	1.75	0.50	1.00
15%	2.20	3.00	1.20	2.00
Northwest ERCOT				
10%	3.80	1.00	0.20	0.20
15%	3.20	3.40	3.00	1.20

PRM study

Planning reserve margin (PRM) is the required excess energy needed above peak load for maintaining reliability

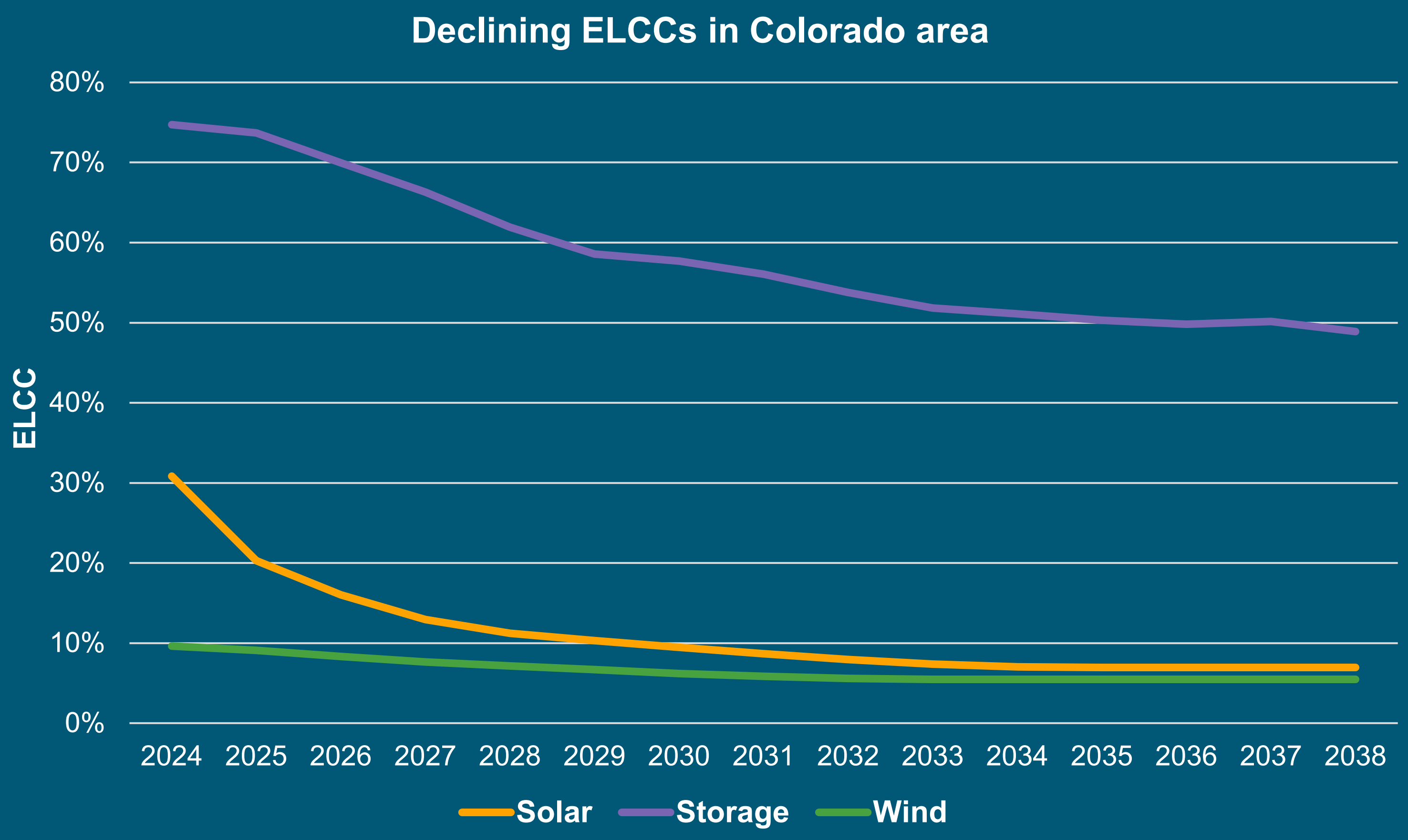
- With more and more renewables on the system, we need to provide more capacity than load to minimize the chance of systemwide outages
- Study recommends a PRM of 19.9% in a market and 22.1% without a market





WECC Results are in line with proposed PRM requirements for our region

Effective load carrying capability (ELCC)



As you add more renewables or storage, their contribution to firm capacity declines

Status of noncarbon technology options

Independent assessment by Black & Veatch

Technology	Findings – cost, suitability, availability, timings
Long duration energy storage	Will likely be an option during the next decade
Hydrogen	Will likely be an option during the next decade
Small modular nuclear reactor	May be available in the middle of next decade, but not suitable to follow load and renewables
Pump storage	Possible option for a few hours of storage – no identified sites nearby
Carbon sequestration	Possible by next decade, but cost will be very high for our low capacity factor, dispatchable generation needs

Black & Veatch recommendation:
Build dispatchable thermal generation for 2030 needs and progressively convert to green hydrogen fuel when available

Power supply portfolios

Portfolio selection criteria

Requirements

Three foundational pillars:

- **Reliability** – PRM and loss of load hours (LOLH)
- **Environmental responsibility** – CO_2 emissions (tons emitted)
- **Financial sustainability** – capital and operating costs

Regulatory requirements:

- State Clean Energy Plan (requires 80% CO_2 reduction by 2030 from 2005 actual emissions)

Considerations

Technology:

- Proven and cost effective
- Diversification – balanced combination of all
- Optimal longevity of power purchase agreements
- Avoiding stranded investments

Other:

- How much energy we will export and import?

Dispatchable capacity is required in all portfolios that meet the reliability criteria.

Our prior work and industry assessment validate the need for dispatchable thermal capacity

- **2020 Integrated Resource Plan:** 104 MW (using average weather)
- **Resource Plan update 2022:** 166 MW (using Feb. 2021 extreme weather)

- Independent assessment by Black & Veatch supports building new dispatchable thermal capacity

Other organizations are reaching the same conclusion

Xcel Energy PG&E SMUD Colorado Springs Utilities *It's how we're all connected* MISO pjm EPRI ELECTRIC POWER RESEARCH INSTITUTE NREL NATIONAL RENEWABLE ENERGY LABORATORY

2030 portfolio 1

No new dispatchable thermal resource

Noncarbon resources (MW)			Cost and risk	
Wind	600		**Annual cost, $M**	**598**
Solar	842		Renewable generation, % of load	122%
Hydro	70		Dumped renewable energy, % of load	2%
Total noncarbon resources	1512			
Dispatchable resources (MW)			**CO2**	
Storage 4 hr	3,149		CO2 emission, tons	39,035
Storage 100 hr	-		Thermal generation, % of load	1%
New dispatchable thermal capacity	**-**		State CEP compliance	Yes
Existing CTs	388		**Reliability**	
VPP	32		**Maximum hours of no power supply**	**28**
Total portfolio (MW)	**5,081**		Average hours of no power supply	0.3
Total new generation	3,999		Maximum lost power, MWh	1,218
Capital cost, $billion	**$4.6 - $6.9**			

- [ ] Reliability
- [x] Environmental responsibility
- [ ] Financial sustainability

2030 portfolio 2

Least cost

Noncarbon resources (MW)	
Wind	566
Solar	373
Hydro	70
Total noncarbon resources	1,009
Dispatchable resources (MW)	
Storage 4 hr	90
Storage 100 hr	-
New dispatchable thermal capacity	**240**
Existing CTs	388
VPP	32
Total portfolio (MW)	1,759
Total new generation	**677**
Capital cost, $billion	**$0.70 - $1.1**

Cost and risk	
Annual cost, $M	**208**
Renewable generation, % of load	91%
Dumped renewable energy, % of load	2%
CO2	
CO2 emission, tons	249,345
Thermal generation, % of load	13%
State CEP compliance	Yes
Reliability	
Maximum hours of no power supply	**7**
Average hours of no power supply	0.1
Maximum lost power, MWh	666

- [x] Reliability
- [ ] Environmental responsibility
- [x] Financial sustainability

2030 portfolio 3

200 MW of dispatchable thermal capacity

Noncarbon resources (MW)			Cost and risk	
Wind	568		**Annual cost, $M**	**209**
Solar	407		Renewable generation, % of load	93%
Hydro	70		Dumped renewable energy, % of load	2%
Total noncarbon resources	1,045			
Dispatchable resources (MW)			**CO2**	
Storage 4 hr	139		CO2 emission, tons	205,461
Storage 100 hr	10		Thermal generation, % of load	10%
New dispatchable thermal capacity	**200**		State CEP compliance	Yes
Existing CTs	388		**Reliability**	
VPP	32		**Maximum hours of no power supply**	**8**
Total portfolio (MW)	**1,814**		Average hours of no power supply	0.1
Total new generation	732		Maximum lost power, MWh	892
Capital cost, $billion	**$0.80 - $1.2**			

- ☑ **Reliability**
- ☑ **Environmental responsibility**
- ☑ **Financial sustainability**

Next steps in the IRP process

- Finalize portfolio development
  - Three portfolios shown earlier
  - Social cost of carbon
  - Faster technology evolution
- Conduct sensitivity analysis
- Publish consultant reports
- Present full IRP to the board in spring and file in summer

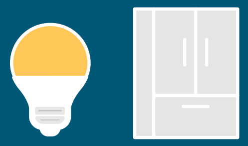
- What if gas prices change?
- What if renewable prices change?
- What if our load grows?
- What if we get more or less DER participation from our customers?

Distributed energy resources in IRP

Paul Davis, distributed energy resources manager

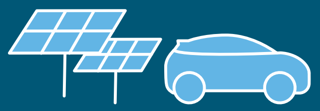
Distributed energy resources

Flexible DERs that can form a VPP



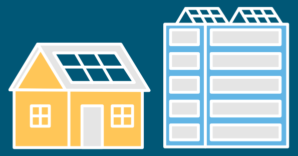
Energy efficiency

Save energy and save money by using energy more efficiently



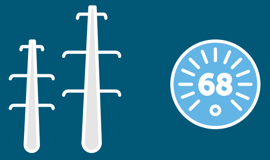
Electrification

Reduce greenhouse gases by replacing fossil fuel use with increasingly decarbonized electricity



Distributed generation

On site noncarbon generation provides customer benefits and reduces utility investments



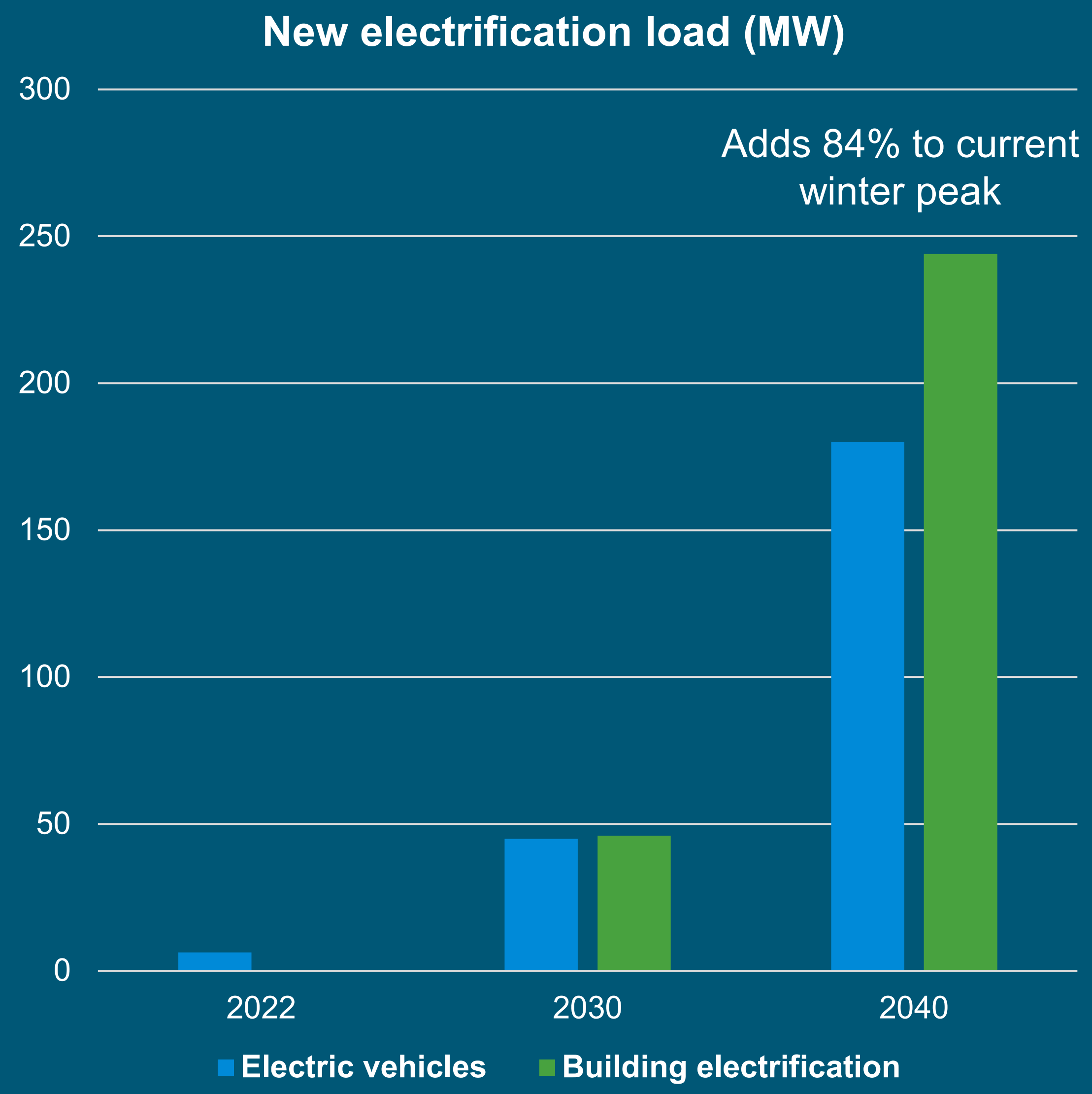
Demand response

Distributed energy storage

Shift energy to align electric use to renewable availability and to decarbonize the electric system in a cost effective and reliable manner

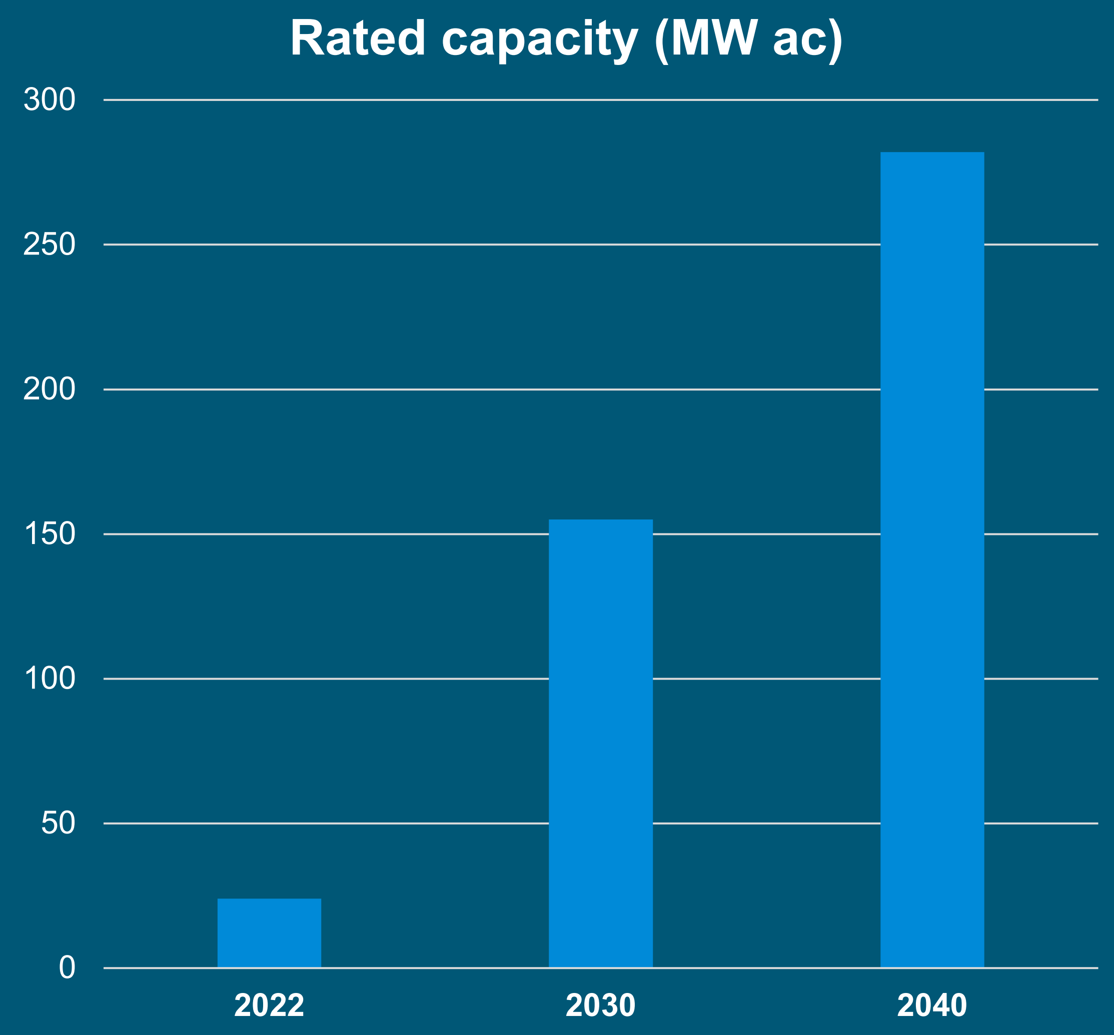
New load: electrification

- Increasingly decarbonized electric supply supports emissions reductions from vehicles and buildings
- Efficient electric technology replaces less-efficient fossil fuel technology
- New loads add to our energy and capacity requirements
- Provides dispatchable capacity when customers allow utility to manage their load as part of a VPP



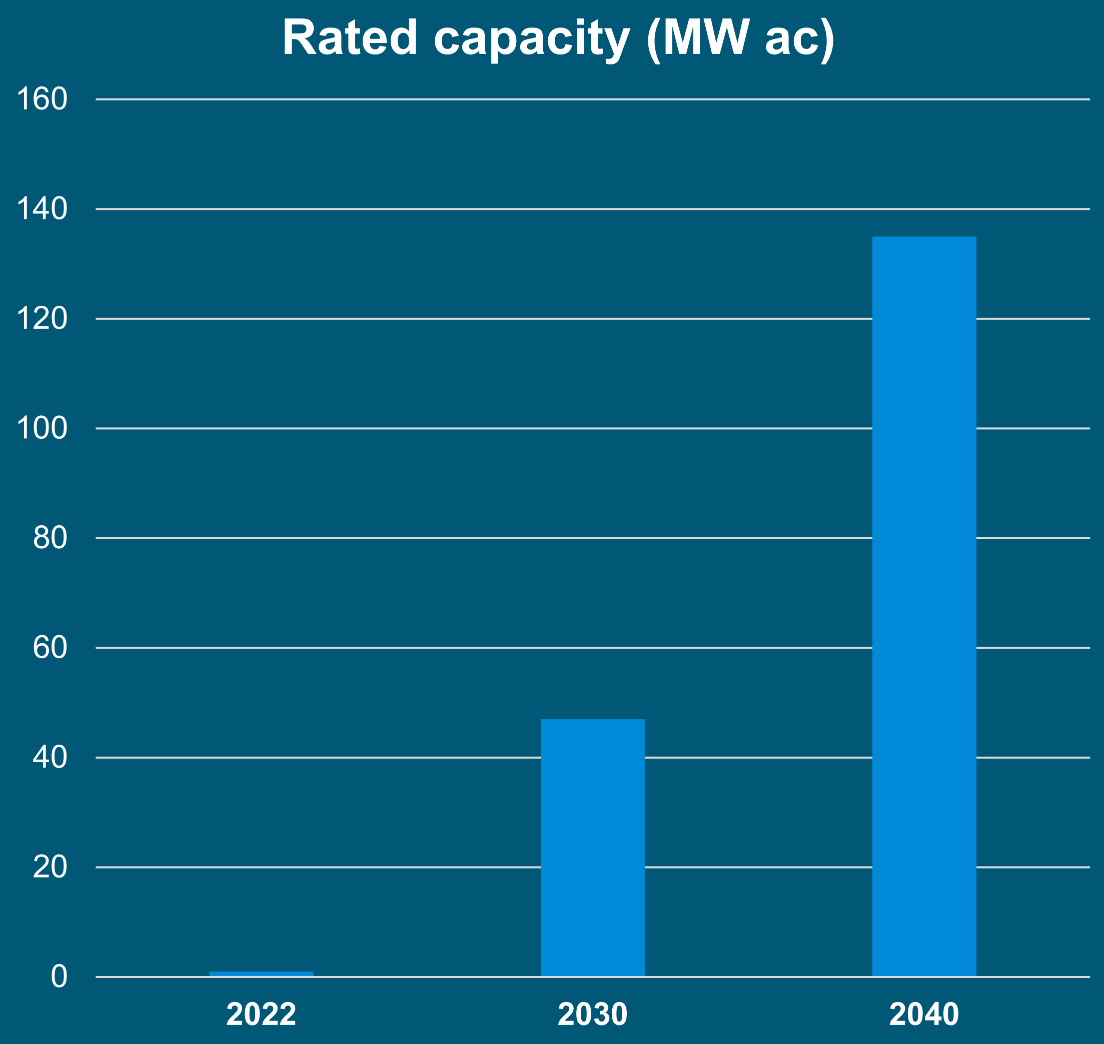
Distributed solar: forecasted customer adoption

- Provides energy to resource mix
- Reduces utility-scale solar needed
- Does not provide dispatchable capacity
- As solar adoption grows, we will see oversupply during peak solar hours and undersupply after the sun sets
- Need to improve utility operators’ ability to measure and forecast solar generation



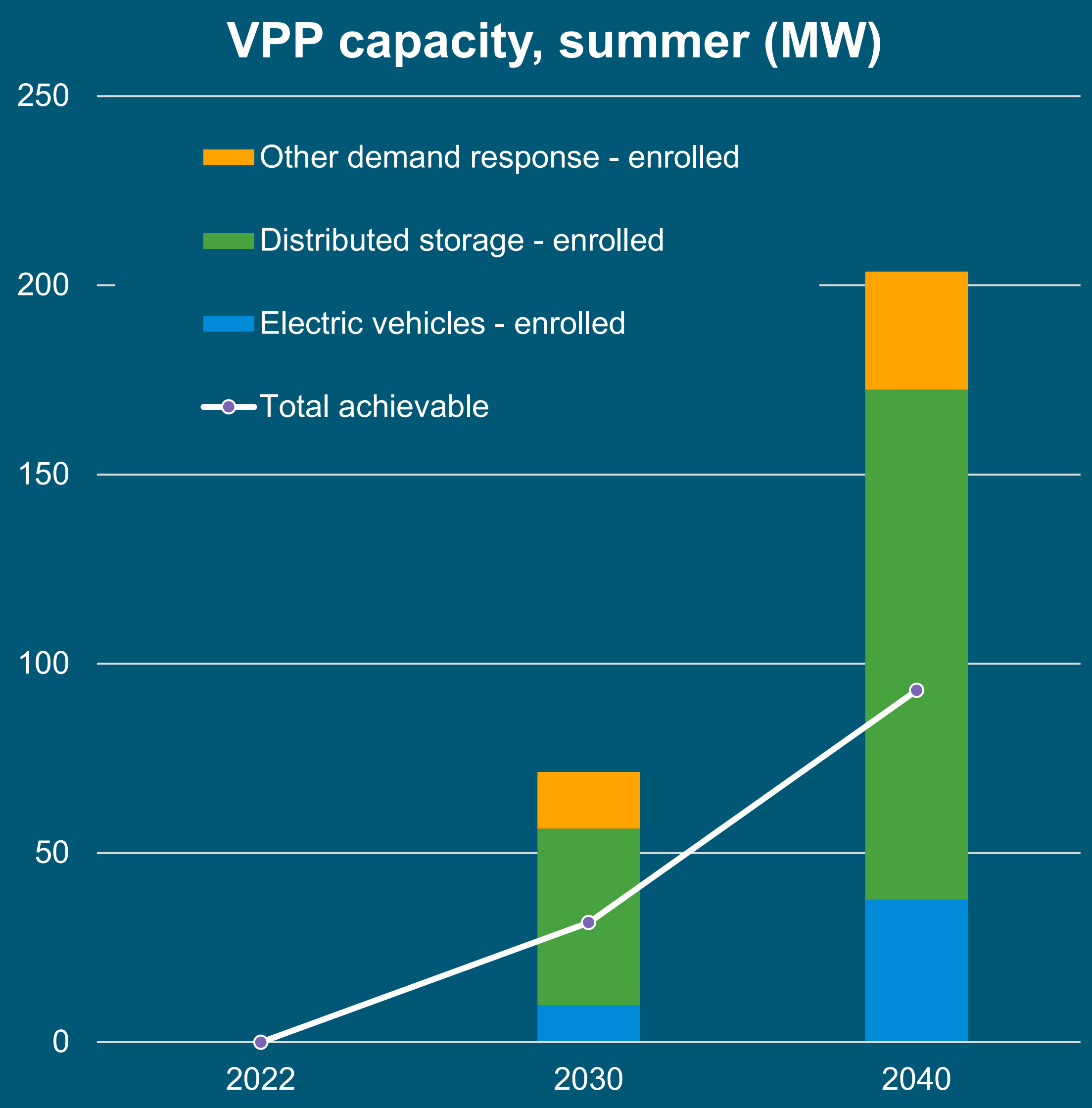
Distributed storage: forecasted customer adoption

- Growing flexible resource
- Improves benefits of customer solar when co-located
- Provides dispatchable capacity when customers allow utility to manage their storage as part of a VPP



VPP

- VPP provides dispatchable, noncarbon resource
- VPP improves alignment between electric consumption to available variable renewable generation
- Enrolled capacity is the diversified capacity available from DERs that participate in VPP programs
  - Projected to include 50,000 DERs in 2030
- Achievable capacity is the capacity that can consistently reduce evening peak load while respecting customer restrictions on utility use of their flexibility (e.g., due to customer comfort, convenience or reliability concerns)
- Electric vehicles and storage expected to be the most flexible DERs and have the fewest restrictions



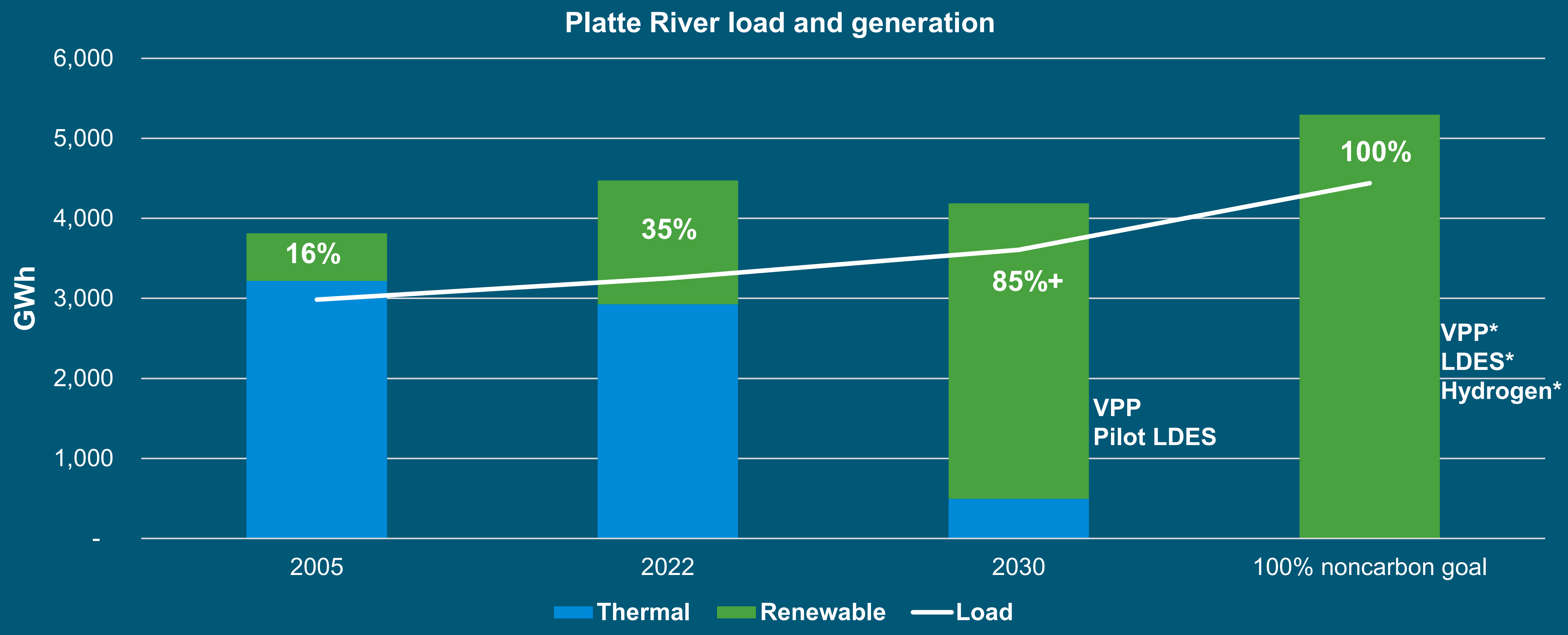
VPP will also include an additional 20 to 25 MW from distribution-scale storage currently in development.

Key takeaways

Raj Singam Setti, chief transition and integration officer

Journey to 100% noncarbon portfolio

We expect to provide 85%+ noncarbon energy by 2030 and will continue to work toward 100%



Key takeaways

- Resource planning and portfolio development is a complex optimization process
- Platte River is developing 2024 IRP in line with:
  - Three pillars of reliability, financial sustainability and environmental responsibility
  - Our customers' desires and directives
  - The best business practices of taking measured risks (financial and technological)
- Platte River will continue to engage with all the stakeholders during the IRP development process and plans to present the final results during spring 2024

Break

Q&A will follow this brief break

Questions

Please limit your question(s) to one (1) minute

State your name, city of residence and organization you represent (if applicable)