Omaha Public Power District

Pathways to Decarbonization: Energy Portfolio Final Results

Thursday, December 9th, 2021 (4-6 p.m.)

Thank you for joining us for today.
The workshop will begin soon, and we look forward to the discussion.

Today's content and a recording of today's workshop can be found online at OPPDCommunityConnect.com.

OPPD Safety Briefing

Stay safe on winter roads

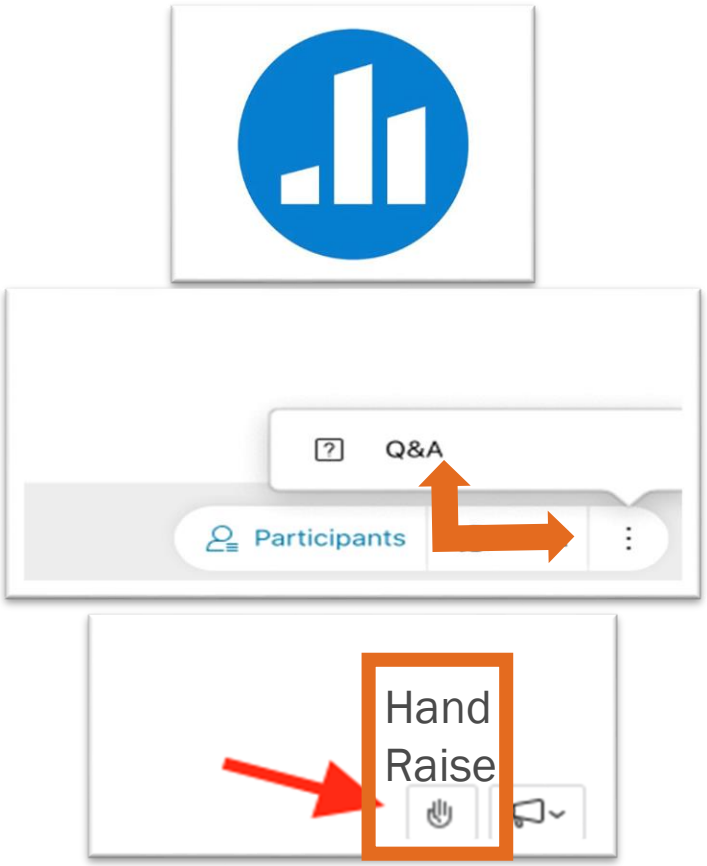
- In extreme weather, stay home if possible
- Slow down and plan for more time to get to your destination
- Check the condition of your tires and wiper blades
- Maintain a safe distance behind snow plows, be aware of blind spots and be careful if passing
- Make sure you can see, keep lights on and windshield clean, defrosted and defogged

Opening Statement

- Reminder to OPPD & E3 staff to mute microphones when not speaking
- Please silence all electronic devices
- This meeting is being recorded
- Public attendees on Webex are in listen only mode

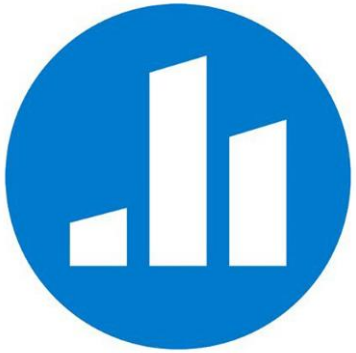
We will take comments and questions via the following channels. When prompted:

1. **Poll Everywhere** – participate in the check-in questions via by using your phone or computer
2. **Webex Q&A** – use throughout to ask a clarifying question of the content being covered
3. **Hand Raise** – use <u>when indicated throughout and end of the presentation</u> to ask additional questions



Question:

In 2021, OPPD has hosted 5 energy portfolio workshops and an Interim Modeling Update.
Have you attended prior events or watched our summary video?

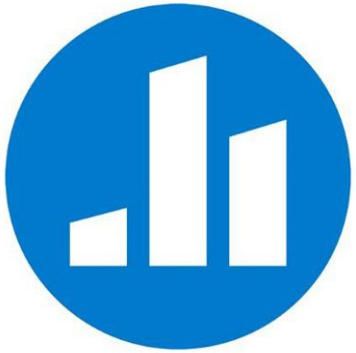


When poll is active, respond at **PollEv.com/oppd1**

Text **OPPD1** to **22333** once to join

Question:

Do you represent any organization or yourself as a customer? If you would like to share, what is your name and who do you represent?



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OPPD
Omaha Public Power District

Pathways to Decarbonization: Energy Portfolio Final Results

December 9th, 2021

Energy Portfolio

- The Energy Portfolio Project will study actionable pathways to eliminate or significantly reduce greenhouse gas (GHG) emissions from OPPD's energy portfolio, while balancing impacts on reliability, resiliency, and affordability

Photo by C. Kennedy

Objectives

Share and discuss final pathway results and next steps with stakeholders

Agenda

- Context of Workshop within Project
- Stakeholder Engagement & Feedback Summary
- Study Background
- Workshop #6: Final Results & Next Steps
  - Summary Across Scenarios
  - Portfolio Risk Analysis
  - Resiliency Analysis
  - Open Comment Period
- Key Findings
- Next Steps
- Open Comment Period

Energy Portfolio: Stakeholder Workshops

Today's Focus

1	2	3	4	Interim Modeling Update	5	6	
Pathways Planning 101	Multi-Sector Modeling	Key Assumptions & Scenarios	Modeling Approach		Initial Results	Final Results	
April 7 4:00-6:00 p.m.	April 28 4:00-6:00 p.m.	May 12 4:00-6:00 p.m.	May 26 4:00-6:00 p.m.	8/4	Oct 27 4:00-6:00 p.m.	Dec 9 4:00-6:00 p.m.	Feb 3 4:00-6:00 p.m.

Workshop #1

Pathways Planning 101

Duration: **2 hours**

IAP2 Level: **Inform**

Provides an overview of the Energy Portfolio study, its objectives, approach and stakeholder engagement plan.

- Coordination with OPPD's 2021 IRP
- Introduce study team members

Recording Available Online

Workshop #2

Multi-Sector Modeling

Duration: **2 hours**

IAP2 Level: **Inform/Consult**

Review of results for modeling Net Zero carbon across all energy uses in OPPD's service territory.

- Emissions across sectors
- Impact on future electric system demand

Recording Available Online

Workshop #3

Key Assumptions & Scenarios

Duration: **2 hours**

IAP2 Level: **Involve**

Review technologies, assumptions, and scenarios that will be used and analyzed in the Energy Portfolio modeling.

- Technology performance, fuel, and cost forecasts
- Scenarios for modeling

Recording Available Online

Workshop #4

Modeling Approach

Duration: **2 hours**

IAP2 Level: **Consult**

Review in-depth look at the technical modeling considerations and approach that will be used to develop pathways.

- Resource adequacy modeling
- Resource optimization modeling

Recording Available Online

Workshop #5

Initial Results

Duration: **2 hours**

IAP2 Level: **Consult**

Review initial modeling results for Energy Portfolio decarbonization pathways.

- Initial energy portfolio pathways to achieve Net Zero Carbon by 2050

Recording Available Online

Workshop #6

Final Results

Duration: **2 hours**

IAP2 Level: **Inform**

Review final results of modeling with consideration of feedback received on initial results.

- Final energy portfolio pathways to achieve Net Zero Carbon by 2050.

IRP Presentation

Integrated Resource Plan

Duration: **2 hours**

IAP2 Level: **Inform**

Review IRP filing and listen to stakeholder feedback.

iap2 international association for public participation

OPPD

Energy Portfolio Workshops

April – December 2021

Stakeholder Engagement:

- Workshop material presented to OPPD employees, as well as external stakeholders
- More than 100 external stakeholders attended at least one decarbonization workshop.
- Many attended multiple workshops within the series
- Recorded workshop material have more than 450 views

Objective:

- Provide a deeper dive on the decarbonization planning process and how it will support OPPD's Integrated Resource Plan (IRP)
- Seek and address feedback along the way through a variety of platforms

Outcome:

- Satisfaction with process

Study Scope

- The Energy Portfolio Study is a broad, and far looking study, evaluating many technologies and timelines over an extended horizon
- The study is intended to directionally inform OPPD stakeholders and decision makers
- Additional work is required to fully understand detailed impacts of pathways

From Workshop #1: Pathways Planning 101

The Energy Portfolio Project *IS*:

- A study to develop a range of 'Pathways' that achieve Net Zero Carbon by 2050
- An evaluation of existing and emerging energy technologies to effectively meet the Net Zero goal while meeting reliability needs and minimizing financial impact
- A scenario analysis to understand the impacts of implementation timelines
- A report on findings and commonalities of successful portfolios

The Energy Portfolio Project *IS Not*:

- A recommendation for a singular future energy portfolio
- A decision to add or retire specific assets
- A siting study to determine where new assets will be located
- A detailed transmission analysis required to understand full impacts of specific pathways

Spectrum of Zero Carbon Goals

more stringent — *less stringent*

100% Renewables	Zero Carbon	Net Zero Carbon	*Near-zero Carbon*
• *100% of generation from wind, solar, hydro, and battery storage* • *No combustion or nuclear*	• 100% of generation from zero-emitting resources • Leaves room for hydrogen, renewable natural gas, nuclear, and/or CCS	• Leaves room for some continued fossil generation with offsets from GHG reductions in other jurisdictions or through direct air capture	• *Allows for minimal electricity emissions (e.g. 1-5% of generation)*
	Modeled	*Modeled*	

Net Zero Credit Categories

Intersectoral Credit

Description: claiming credit for emissions reductions achieved through electrifying other sectors.
Pros: low to zero cost; supports utility action on electrification.
Cons: incompatible with an economy-wide net zero target, which is needed to meet climate goals; challenging to confirm “incrementality” of utility actions.

Not Included

GHG Offsets

Description: involves the purchase of traditional GHG offsets, which can include projects such as tree planting or carbon/methane capture.
Pros: low cost.
Cons: difficult to prove ”additionality” of GHG offsets (would they have been pursued anyway?); not necessarily compatible with an economy-wide net zero target.

Not Included

Negative Emissions

Description: offsetting remaining emissions through negative emissions technologies such as Direct Air Capture.
Pros: compatible with an economy-wide net zero target; possibly lower cost than 100% zero-carbon electricity.
Cons: high cost uncertainty due to lack of commercialized technologies.

Included

Electricity Exports

Description: net-zero is defined on an annual basis, allowing emitting generation or imports to be offset by zero-emitting exports.
Pros: low cost; encourages regional coordination.
Cons: becomes more challenging to displace fossil generation as the system achieves higher percentages of decarbonization

Included

Energy+Environmental Economics

OPPD Pathways to Decarbonization Workshop #6

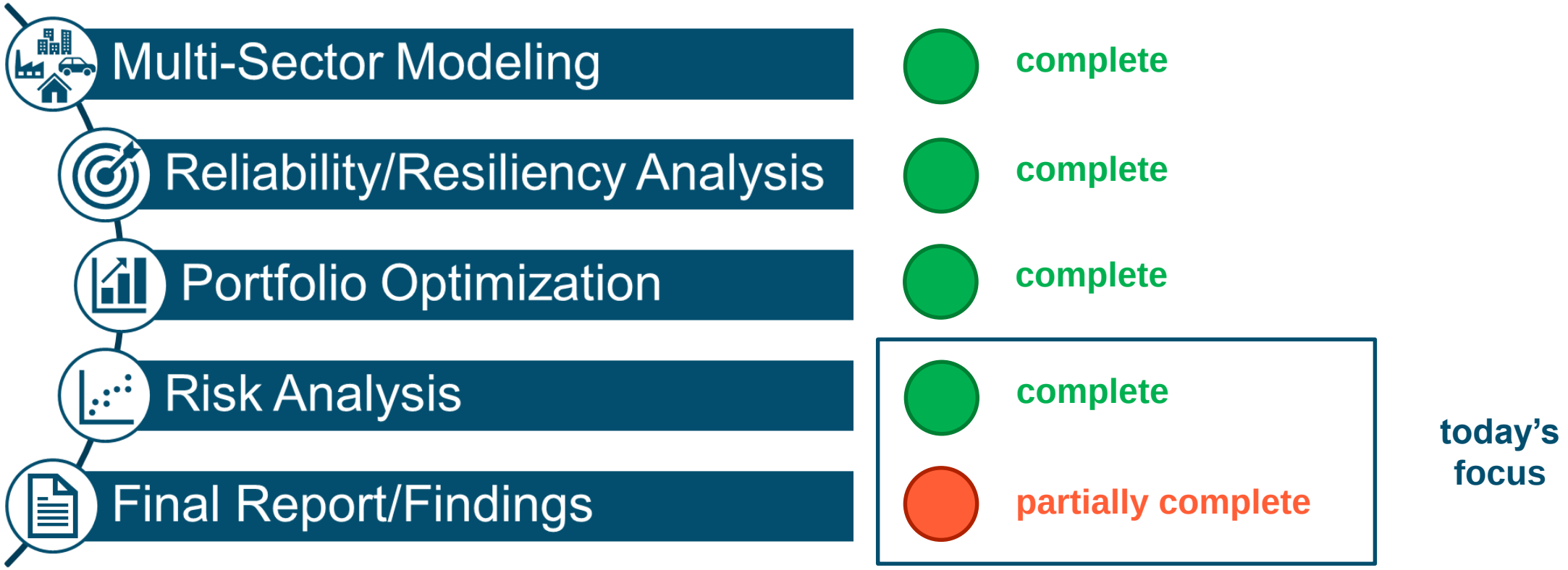
Final Results, Risk + Resiliency Analysis

December 9, 2021

Arne Olson, Sr. Partner
Zach Ming, Director
Aaron Burdick, Associate Director
Sumin Wang, Consultant
Chen Zhang, Consultant

Project Phases

+ E3 has completed its risk analysis, resiliency case studies, and is drafting its final written report



Energy+Environmental Economics

Summary of Project Results

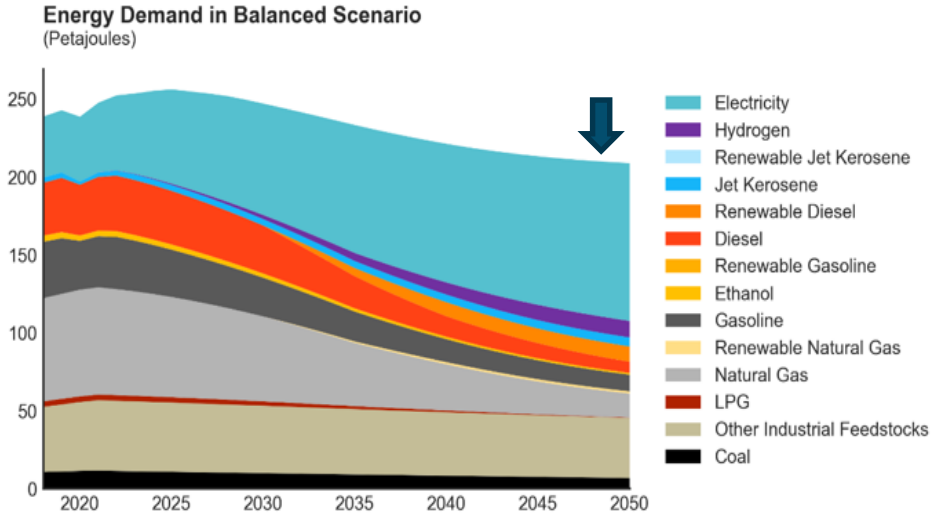
Energy Efficiency is a Critical Pillar for Decarbonization

+ Reaching net-zero carbon efficiently *requires significant economy-wide efficiency gains*, resulting in lower total energy usage despite economic and population growth

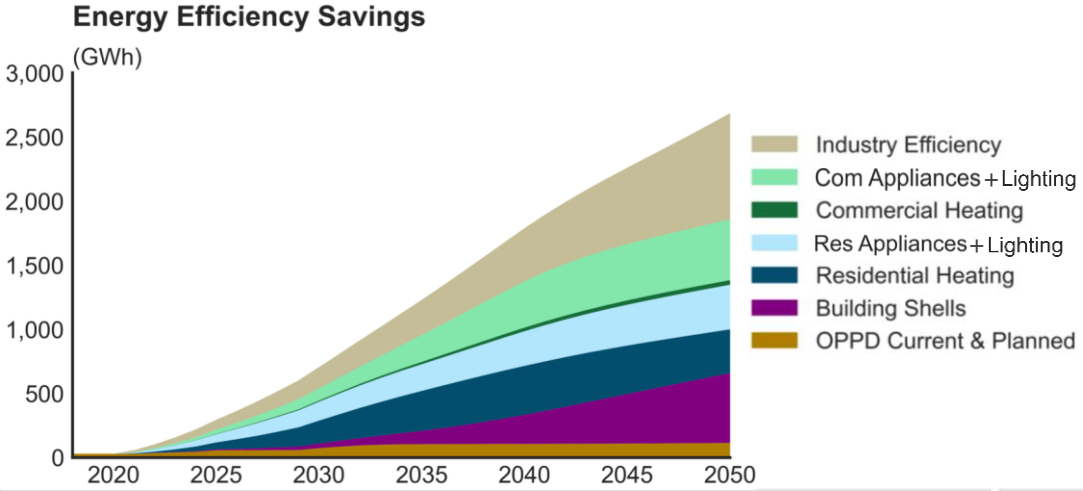
+ *Electrification promotes significant energy efficiency*, especially in transportation and building primary energy consumption, *but adds considerable electric load growth*

+ *Electric load growth is partially offset by significant embedded energy efficiency gains*

OPPD *Economy-Wide* Energy Efficiency



OPPD *Electric* Energy Efficiency

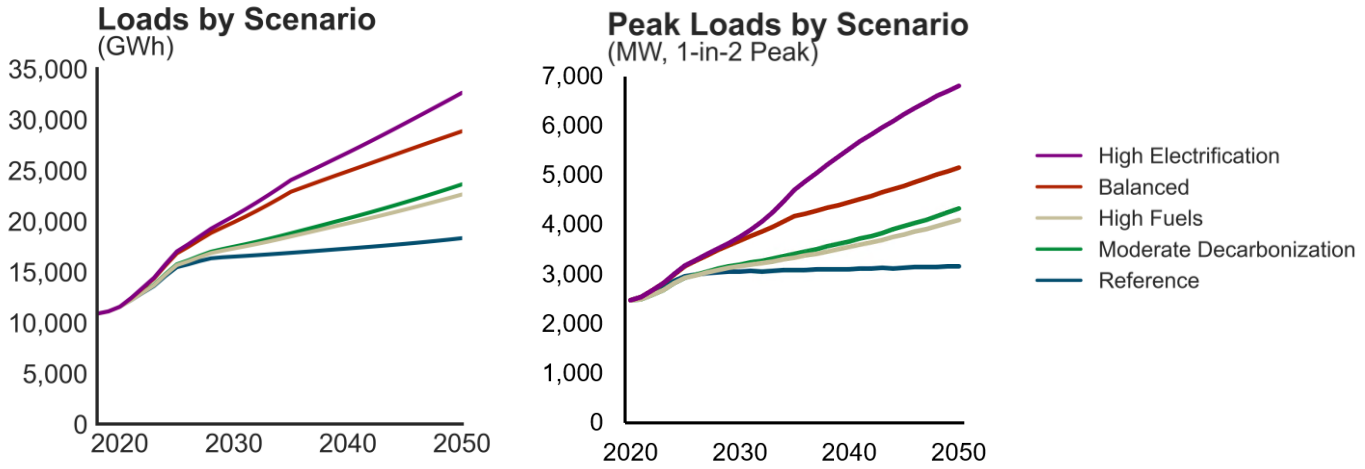


Based on updated E3 PATHWAYS modeling to break out EE assumptions by sector and end use. Could be achieved through a mix of customer behavior, OPPD programs, and codes + standards.

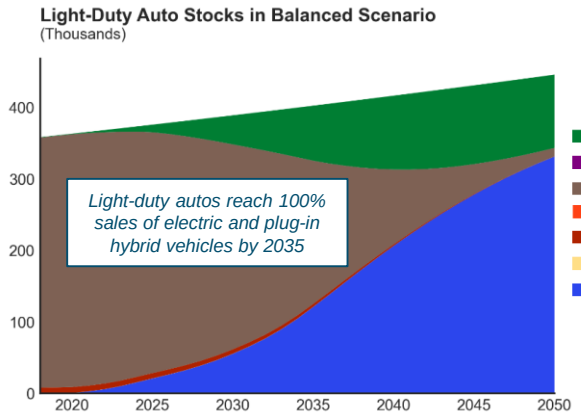
Electrification is Central to Economy-wide Decarbonization and Impacts Electric Resource Needs

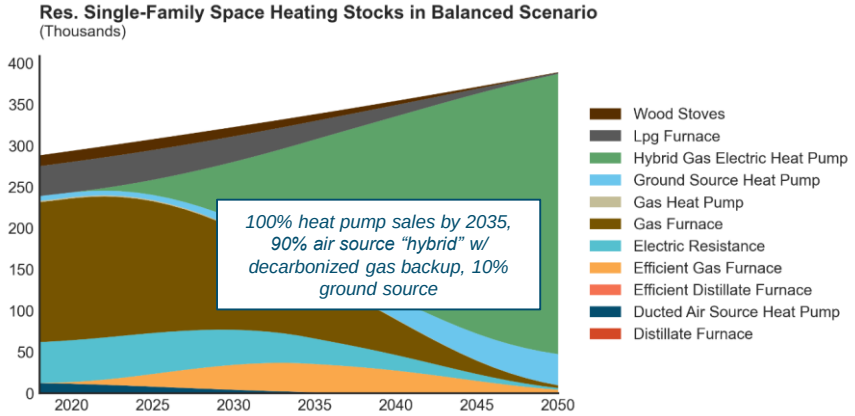
+ **All decarbonized economy-wide scenarios feature *significant OPPD electric load and peak demand growth from electrification***
+ **This depends on:**
  - Electric vehicle adoption across all vehicle types
  - Adoption of electric heat pumps for space and water heating
  - Fuel switching in industrial uses from gas to electricity and hydrogen

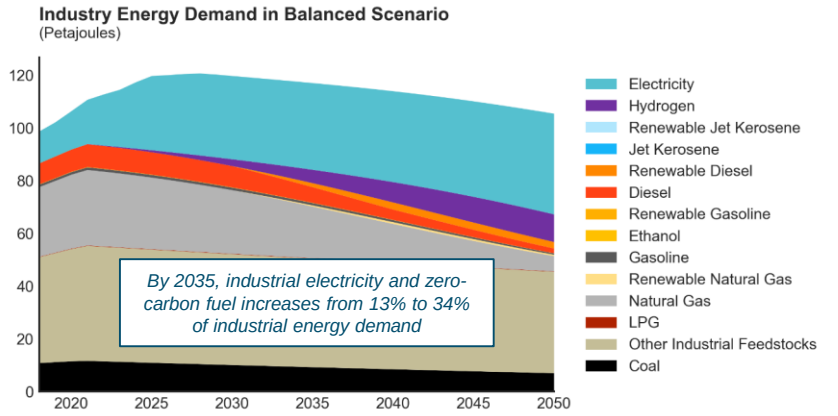
OPPD Electric Load Impacts



Transformation of Transportation, Building, and Industrial Energy Use



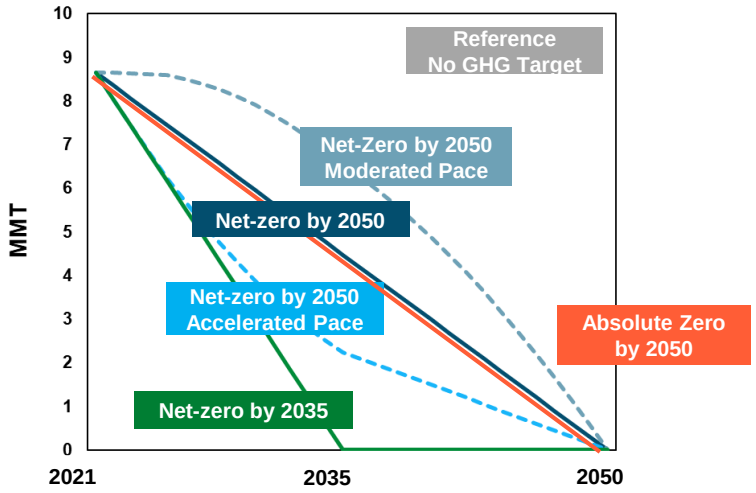




OPPD Energy Portfolio Scenarios

OPPD Framing Scenarios

Pace of Decarbonization



Technology Availability

Scenario	Technologies Available
Mature Only	Only mature (solar, wind, gas, li-ion, flow batteries, etc.)
Mature + H2	+ Hydrogen enabled gas
Mature + Emerging	+ Advanced nuclear, gas w/ carbon capture and storage, ultra-long duration seasonal storage
Mature + Emerging, No H2	- Hydrogen enabled gas

Framing scenarios consider various paces of decarbonization under multiple technology availability scenarios

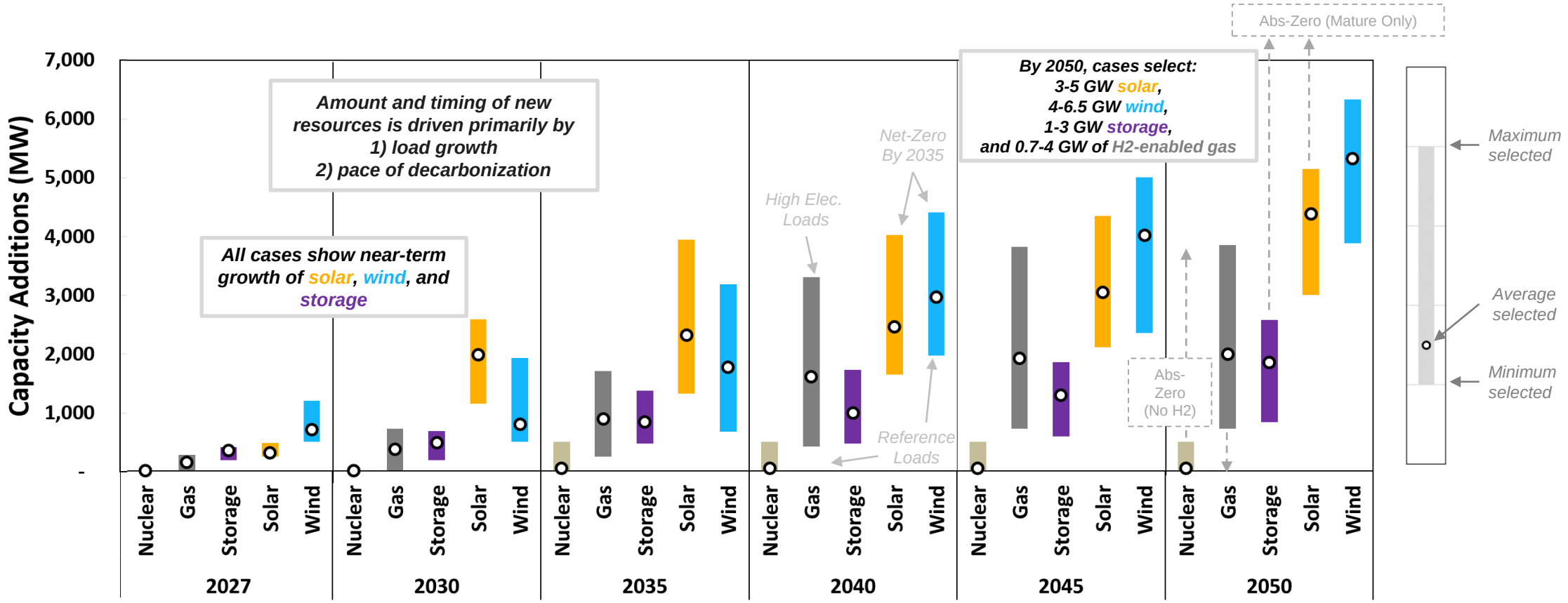
Sensitivity Scenarios

Assumption	Sensitivities
Multi-Sector Electrification Loads	High Electrification, Moderate Decarbonization, Reference
SPP Resource Mix	Reference
Carbon pricing	Carbon price
Technology costs	Breakthrough costs
Flexible Loads	High

Sensitivities consider additional scenarios for load, cost, technology, and policy

New Resource Needs

Range of Resources Added in Net-Zero Carbon Scenarios



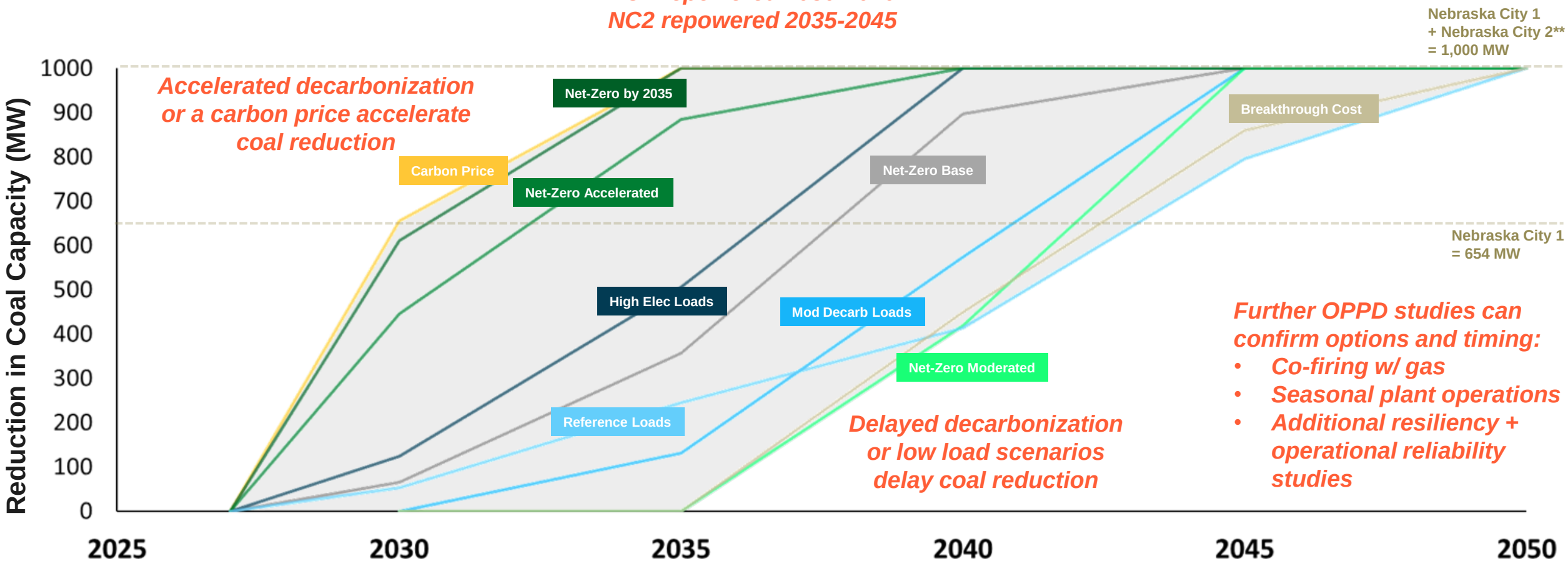
- Graph shows the range (and average) of resources selected by RESOLVE across all decarbonized scenarios
- These additions are on top of planned Power with Purpose solar and gas additions
- Gas includes both new H2-enabled gas and NC coal-to-gas repowering
- Near-term buildout subject to execution feasibility (SPP interconnection, permitting, supply chain, etc.)

***Advanced nuclear* or hydrogen fuels needed to reach absolute-zero… *nuclear* may be economic (by 2035) for net-zero under breakthrough technology costs**

Coal Transition

Nebraska City (NC) Coal Capacity Reduction Across Net-Zero Carbon Scenarios

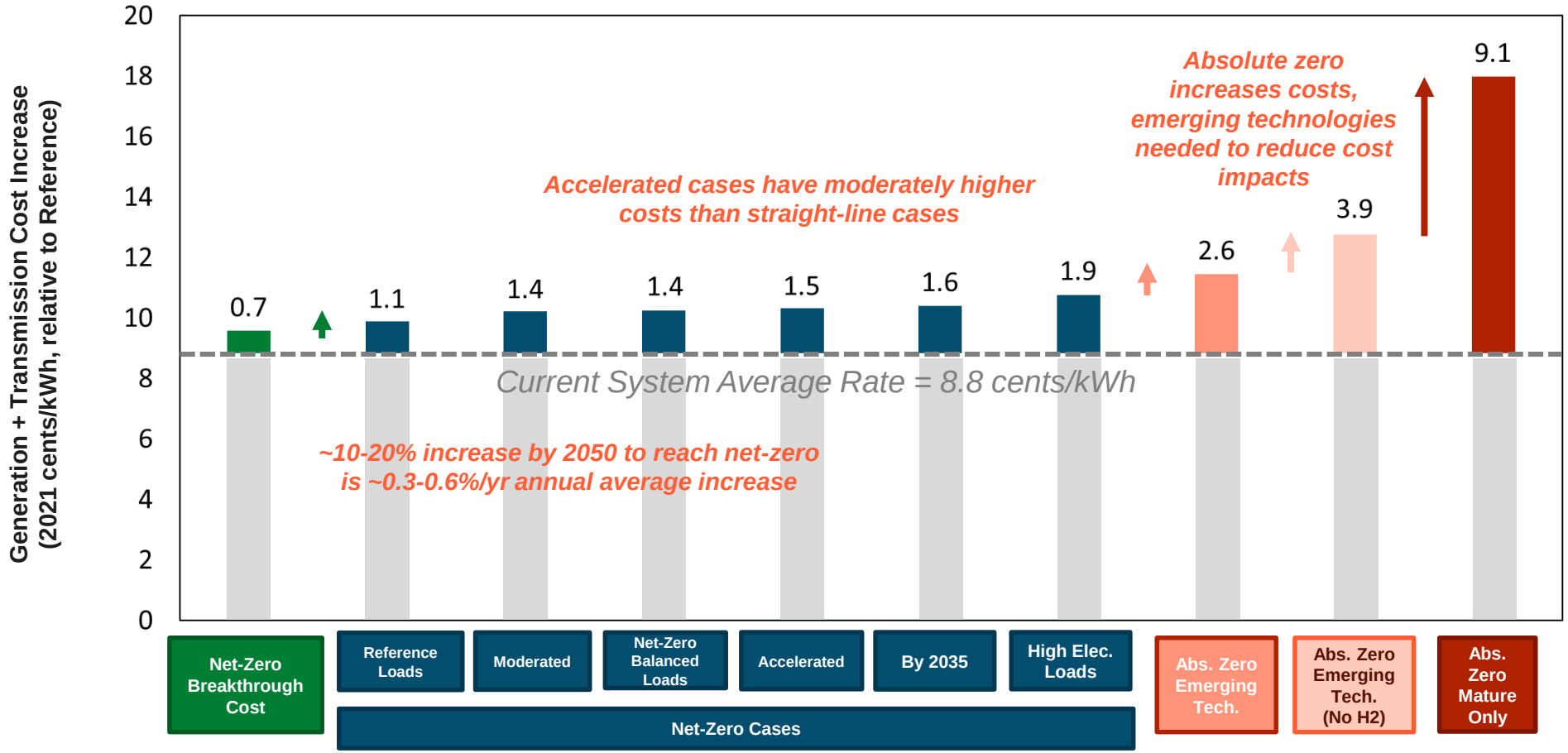
All net-zero scenarios repower NC1 and NC2 to gas
NC1 repowered 2030-2040
NC2 repowered 2035-2045



** RESOLVE is a linear optimization model, hence may repower/retire partial units*
*** OPPD's NC2 portion only (346 MW)*

Cost Impacts

2050 Generation + Transmission Costs ($/MWh) Incremental to Reference Scenario



- *Costs include generation cost impacts and transmission costs (transmission for new generation, i.e. interconnection, deliverability)*
- *Costs are directional in nature, are not representative of detailed financial modeling, and do not include all costs that may be required to support grid transformation*
- *Full rate impact analysis should also include distribution + transmission cost impacts due to electrification, grid modernization, regional congestion, etc.*
- *Total customer cost impacts should also include holistic impact of higher electricity costs with gasoline and natural gas savings due to electrification*

Energy+Environmental Economics

Portfolio Risk Analysis

Overview of Portfolio Risk Analysis Approach

+ **A decarbonized electricity system with predominantly fixed costs presents a very different risk profile than traditional electricity systems**

Carbon-emitting electricity system

- Mix of fixed and variable fuel costs
- Subject to further environmental regulation

More Relevant risks

- × Carbon prices/regulations
- × Fuel prices

Decarbonized electricity system

- Costs almost entirely fixed costs from long-term asset investments or PPAs (with very little fuel consumption)

More relevant risks

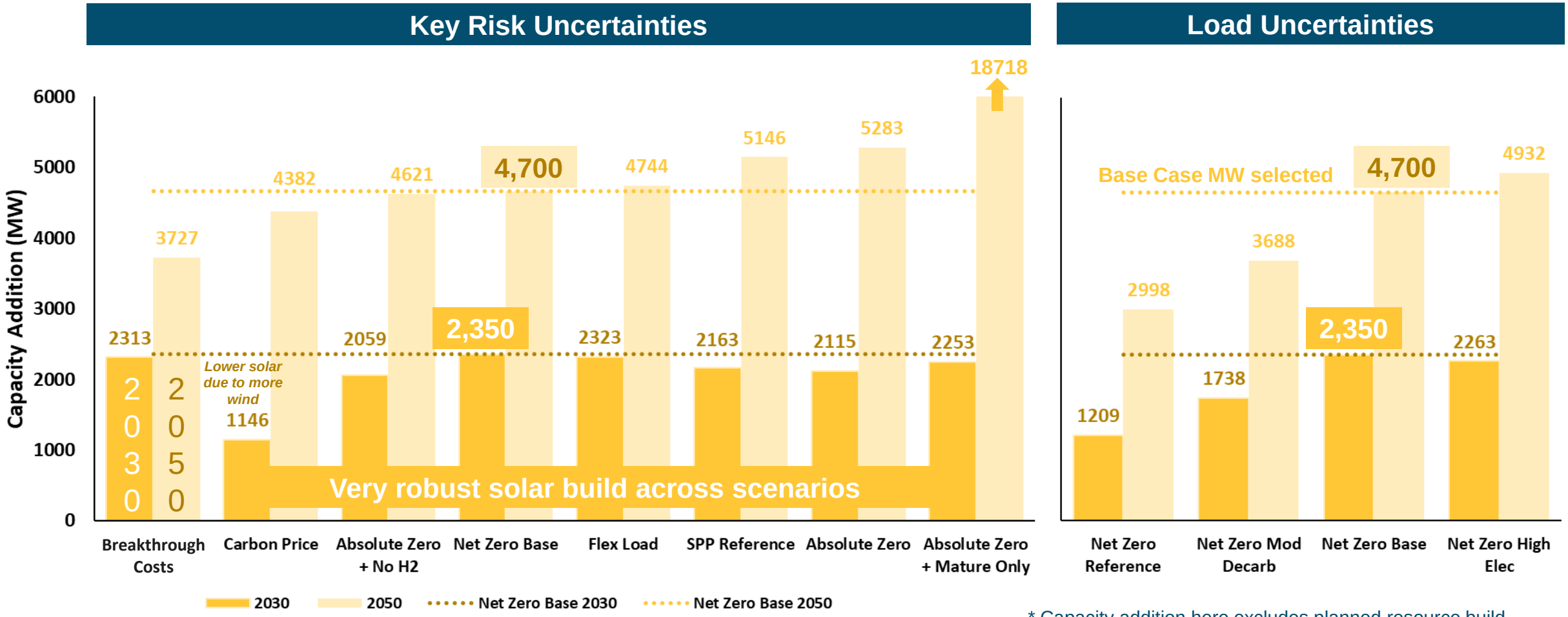
- ✓ Technology evolution
- ✓ Stranded costs

+ **Key risk questions**
  - What risks would cause a change to the optimal pathways to decarbonization portfolio selected?
  - What investments can be considered “least-regrets”?
  - What risk mitigation strategies should OPPD consider?

+ **Portfolio risk analysis focuses on the financial risk that the portfolio diverges from the least-cost outcome**
  - Other project tasks focus on reliability and resiliency risk

Solar Risk Analysis

+ Across all key risk uncertainties, quantity of solar is very robust - key takeaway is it is low risk to build significant quantities of solar
+ Load is uncertain but OPPD can adapt by increasing/decreasing pace of additions over time as load evolves

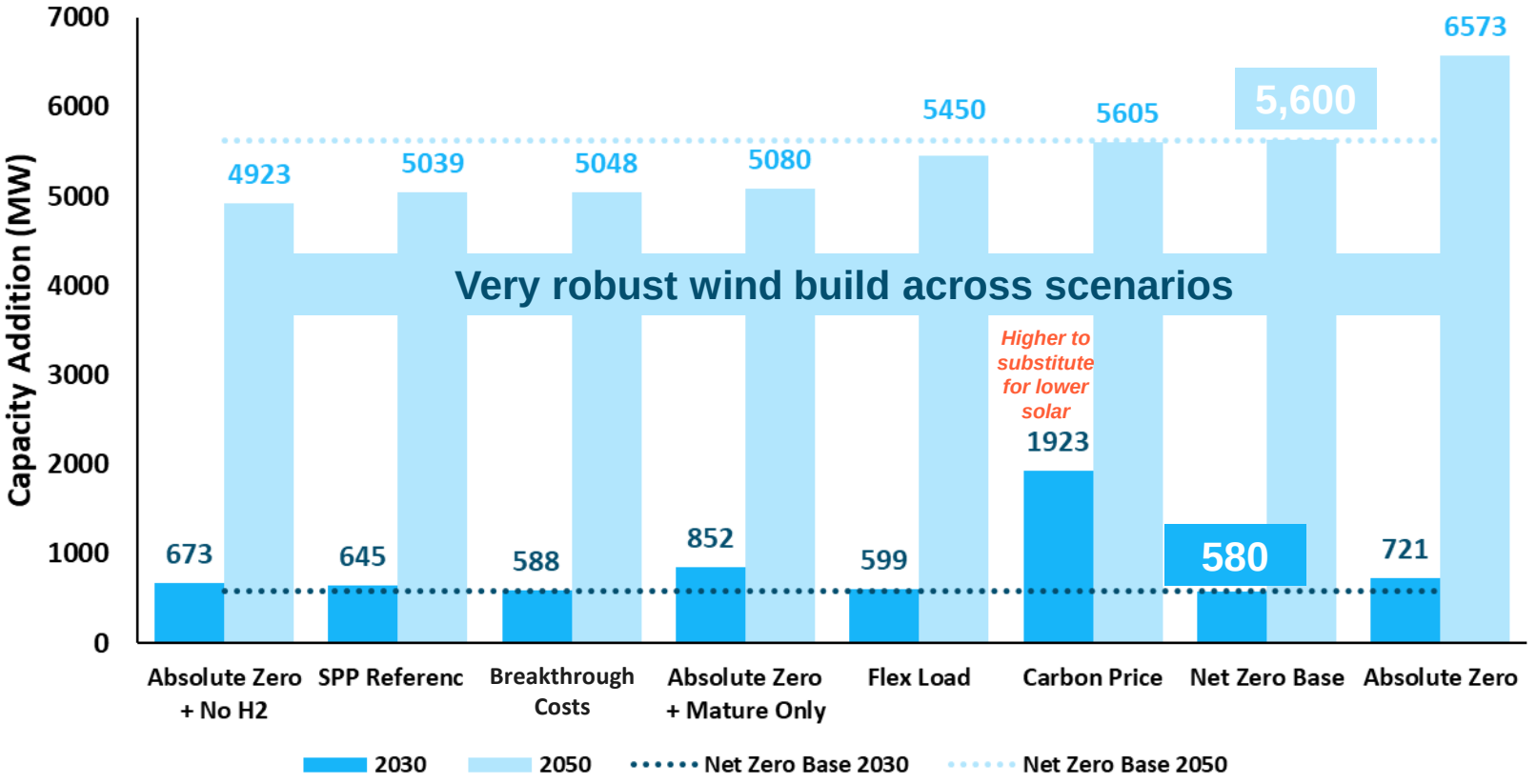


* Capacity addition here excludes planned resource build

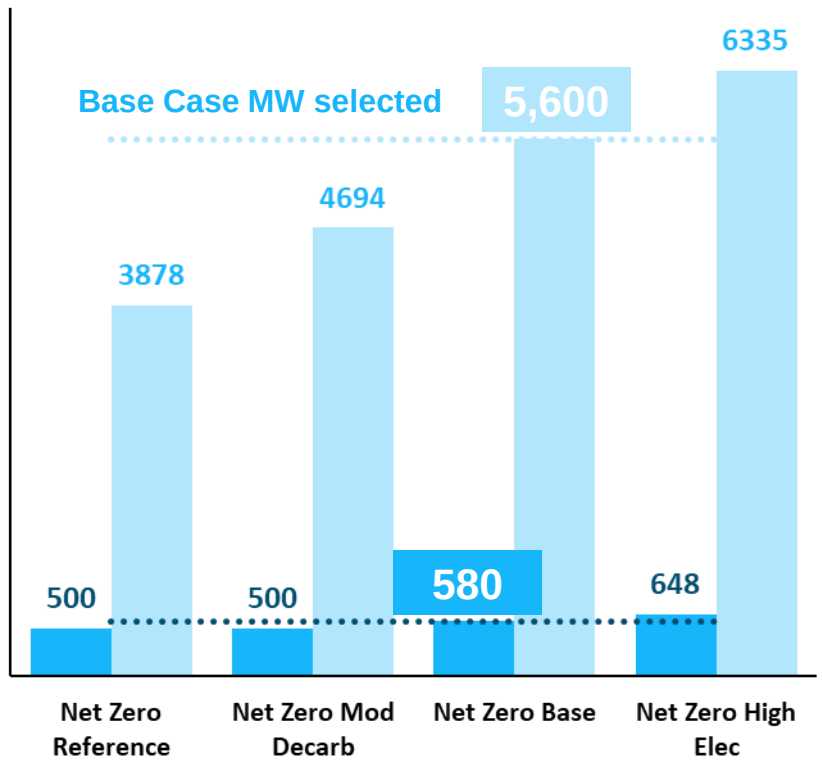
Wind Risk Analysis

- Across all key risk uncertainties, quantity of wind is very robust - key takeaway is it is low risk to build significant quantities of wind
- Load is uncertain but OPPD can adapt by increasing/decreasing pace of additions over time as load evolves

Key Risk Uncertainties



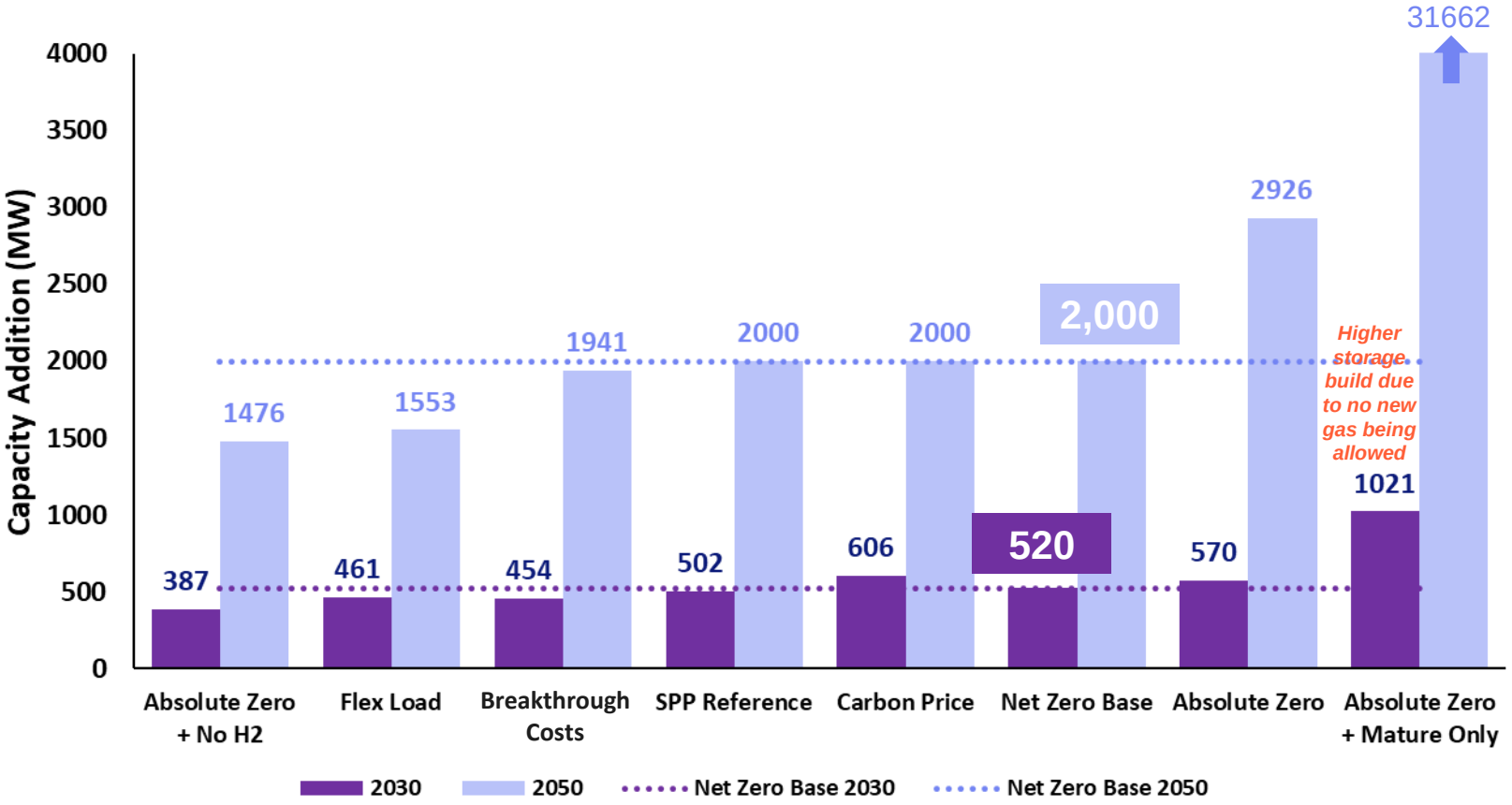
Load Uncertainties



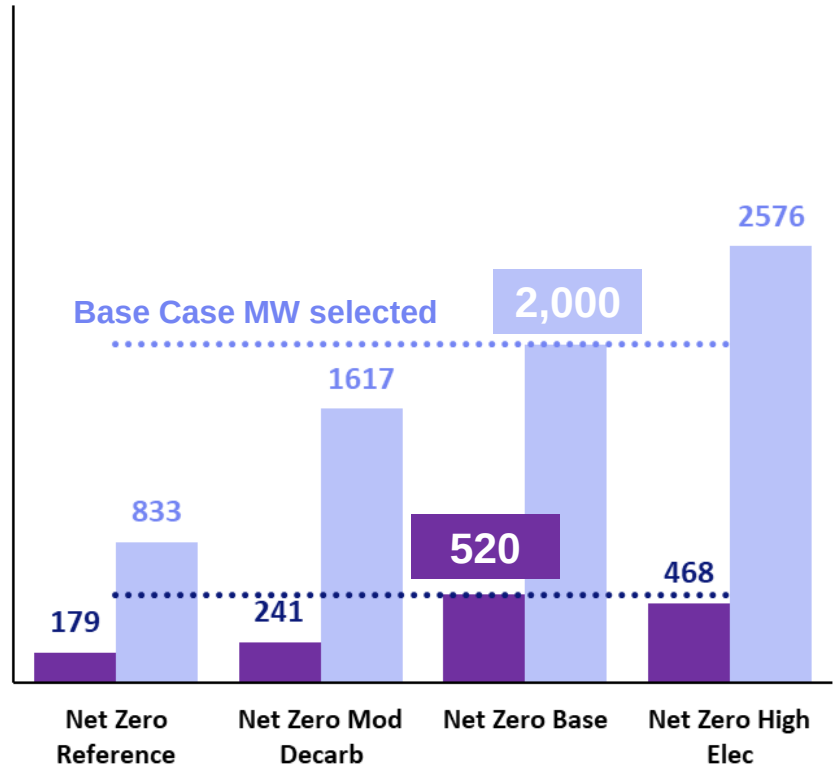
Storage Risk Analysis

- Across all key risk uncertainties, quantity of storage is very robust - key takeaway is it is low risk to build significant quantities of storage
- Load is uncertain but OPPD can adapt by increasing/decreasing pace of additions over time as load evolves

Key Risk Uncertainties



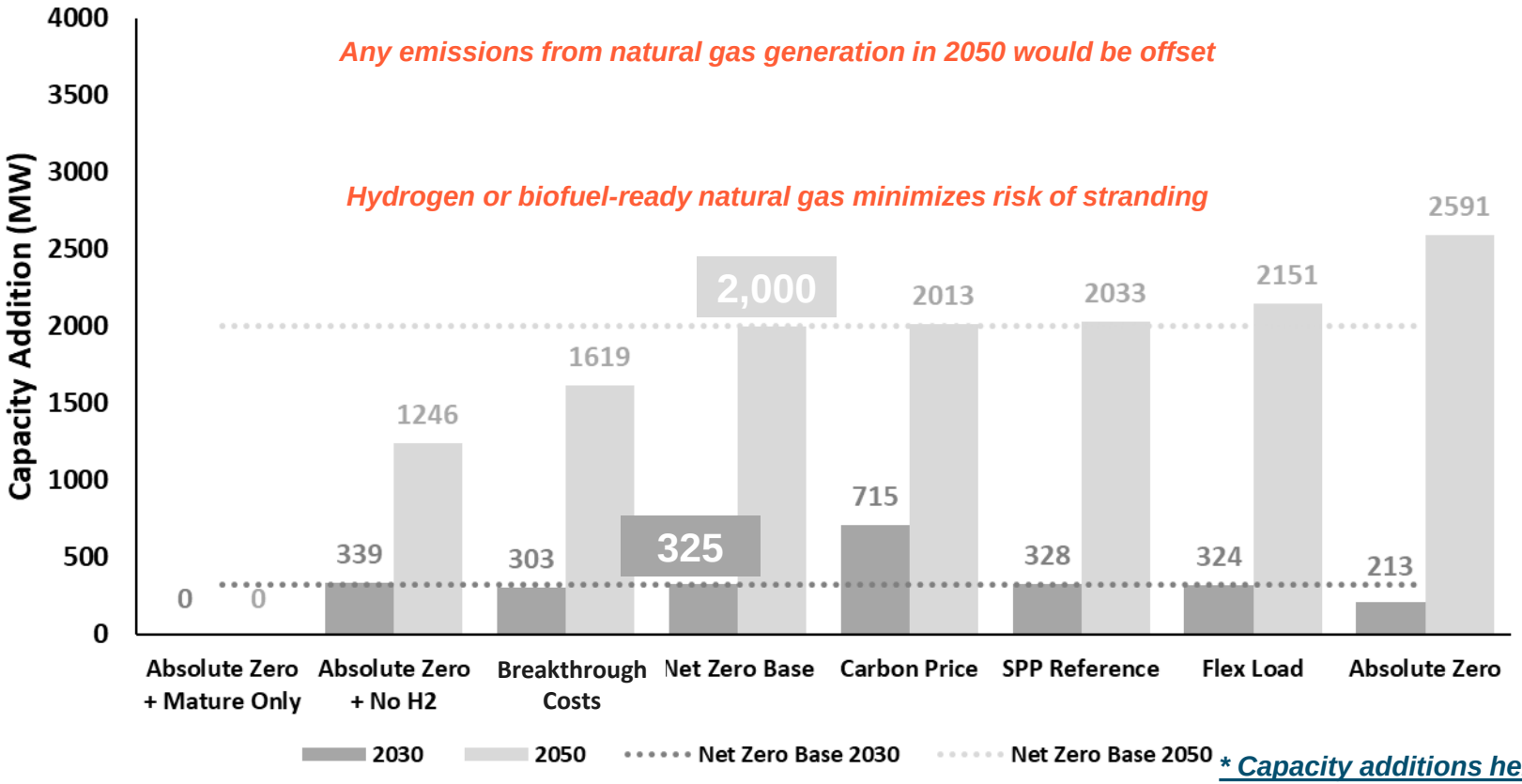
Load Uncertainties



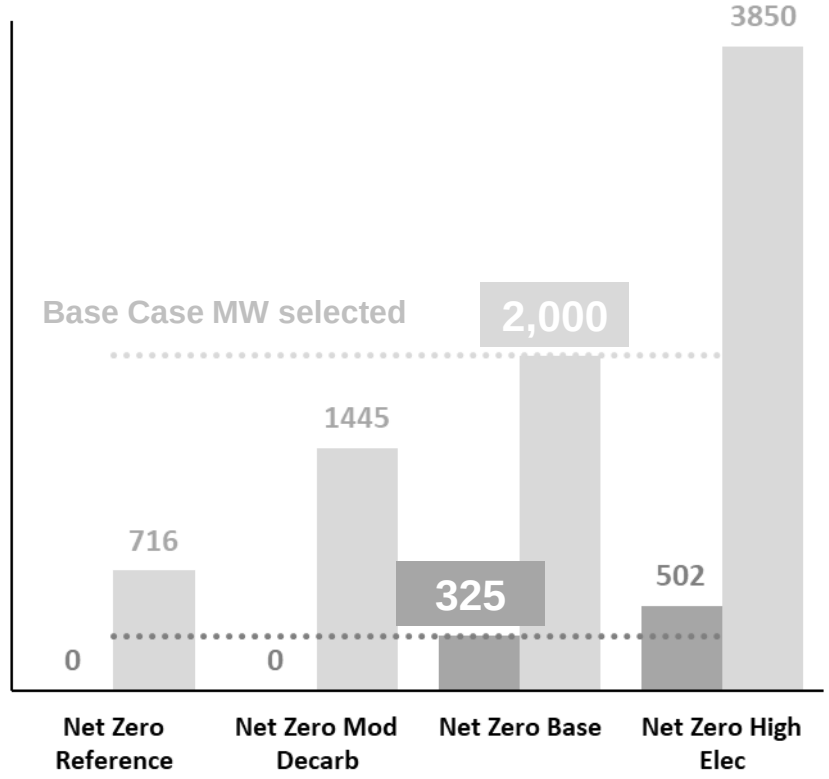
New Firm Capacity Risk Analysis

+ **New firm capacity additions (that can utilize natural gas, biogas, or green hydrogen) is consistent with and an optimal component of a net zero portfolio**
  - All scenarios and sensitivities contain new firm capacity except when it is explicitly excluded as an option

Key Risk Uncertainties



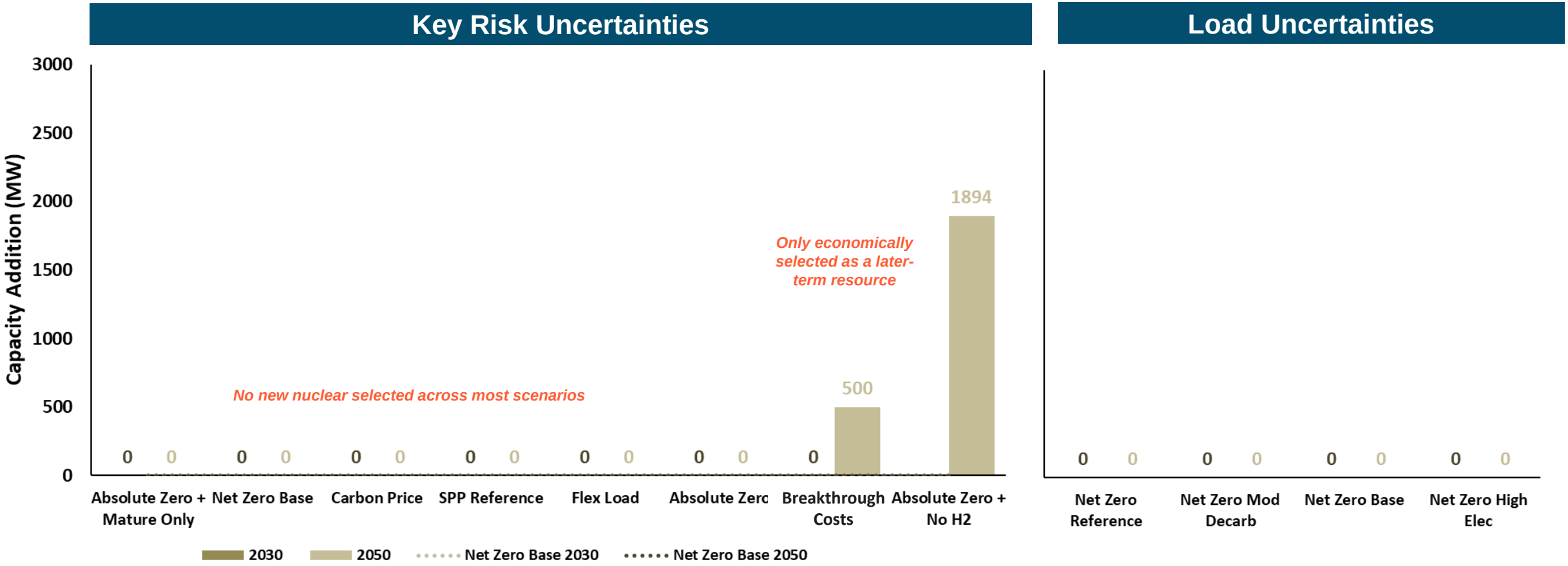
Load Uncertainties



** Capacity additions here are incremental to planned Power with Purpose additions*

Nuclear Risk Analysis

+ **Nuclear is an available option in all scenarios but is not economic except:**
  - In the event of extreme cost reductions (low cost sensitivity) OR absolute zero (e.g. carbon netting is not allowed) *when* hydrogen generation is unavailable
+ **OPPD has time to re-assess nuclear cost-effectiveness as technology evolves**



Risk Analysis Summary

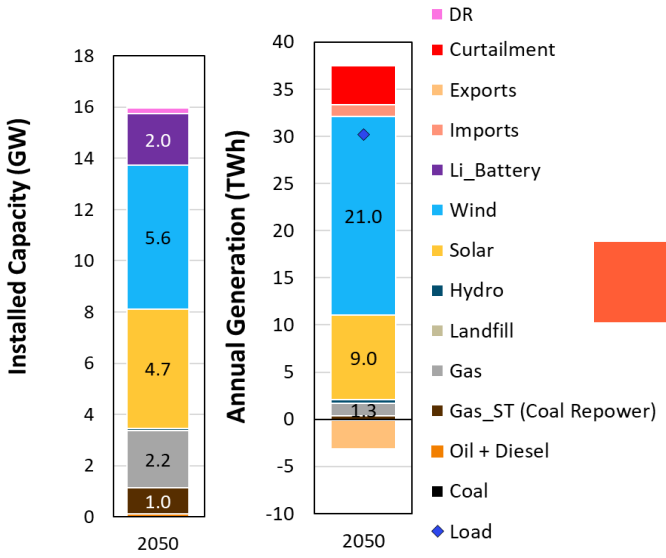
- **Investing in significant quantities of wind, solar, and battery storage is a robust and low-risk action for OPPD to achieve net zero targets**
  - **Minimum** 2030 volumes selected = **~1,100 MW solar**, **~500 MW wind**, and **~150 MW of battery storage**
    - *These builds are incremental to planned Power with Purpose solar*
  - Investments made over the minimum should be considered low regret since it moves forward necessary 2035-2050 capacity additions and provides additional GHG savings
  - However, the minimum may not be lowest risk since it under-procures under many scenarios
- **OPPD should continue to monitor long-term uncertainties (particularly load) and adjust procurement plans over time**
- **New firm capacity additions (that can utilize natural gas, biogas, or green hydrogen) are consistent with and an optimal component of a net zero portfolio across a robust range of key risk uncertainties**
- **Nuclear is only a cost-effective resource if costs drop dramatically or OPPD cannot develop hydrogen-ready natural gas generation**
  - OPPD has time to re-assess nuclear as new nuclear technologies develop

Energy+Environmental Economics

Resiliency Analysis

Resiliency Case Studies

OPPD 2050 Net-Zero Carbon Portfolio



Case studies focused on a single portfolio, the RESOLVE's 2050 net-zero carbon portfolio

This portfolio meets 1-day-10-year reliability standard modeled under historical conditions

Resiliency Case Studies Considered

1. Extended Low Wind and Solar Output

Limits ability of these resources to serve load while depleting charge of duration-limited battery storage – requires firm backup resources

2. Extreme Summer Heat

Record hot temperatures lead to above normal peak load conditions and reduce capability of generators

3. Extreme Winter Cold (Polar Vortex)

Record cold temperatures lead to above normal peak load conditions, reduce capability of generators, and reduce availability of fuel supply to due to competing use with other sectors such as building heat

4. Extreme Localized Events (tornadoes, floods)

Can damage or destroy generators in a specific area for long periods of time

Case studies included a mix of quantitative and qualitative analysis

Studies 2+3+4 include specific extreme events that go beyond those captured in traditional resource adequacy modeling

Critical Reliability Periods Shift to Low Wind and Solar Periods, Requiring Firm Capacity Resources

All years are equally reliable (0.1 LOLE), but the timing of the reliability challenge changes from high loads to low renewables

By 2050, OPPD faces:

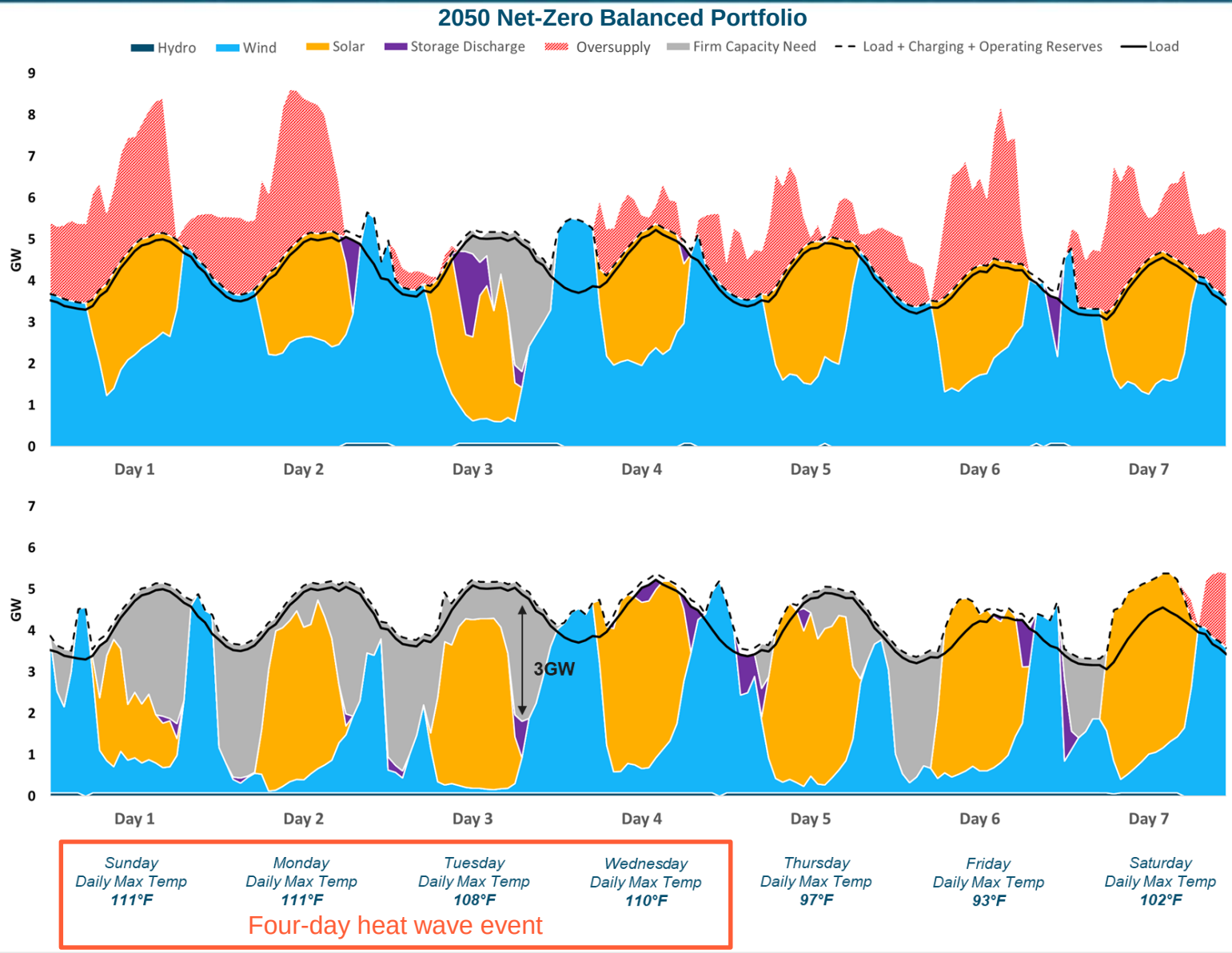
- *Winter challenge under extended low wind + solar*
- *Summer challenge at night under low wind + high loads*

Both require firm capacity that can operate on-demand with fuel security

Extreme Summer Heat: Before Resiliency Stress

High Renewable Week

Low Renewable Week



Some summer weeks will have very high levels of wind and solar

Some summer weeks will have low wind output…

…these weeks rely on firm capacity to reliably serve load

Load and resources from RECAP modeling based on historical OPPD load, weather, and wind + solar output using NREL datasets

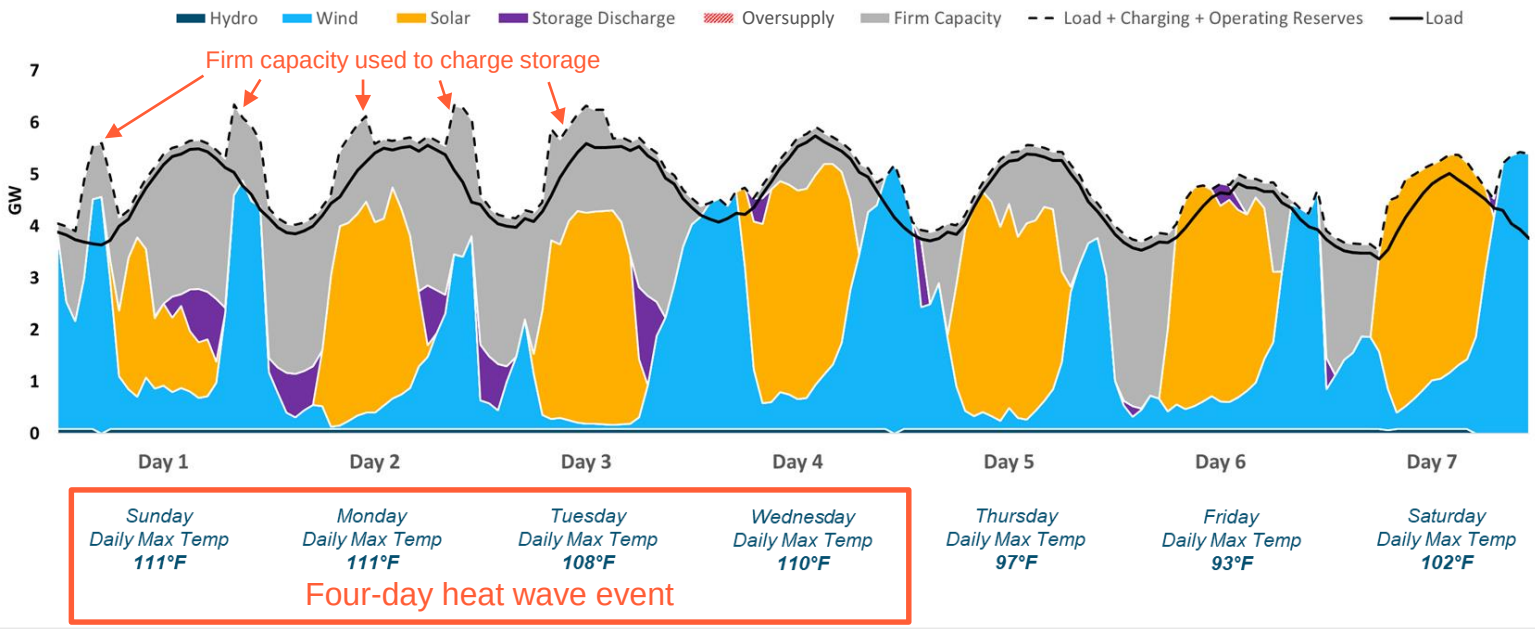
Extreme Summer Heat: With Resiliency Stress

2050 Net-Zero Balanced Portfolio

Resiliency Stress Parameters

Parameter	Assumption	Source
Load	**10% increase** under 5°F temperature increase by Mid-Century	Based on U.S. Climate Resilience Toolkit Climate Explorer and E3 working assumption
Firm capacity	**11% de-rate** due to extreme heat	OPPD
Energy storage	**5% outage rate**	California Energy Storage Association

Low Renewable Week With Resiliency Stress



Increased loads and decreased thermal + storage output did not trigger a reliability event…

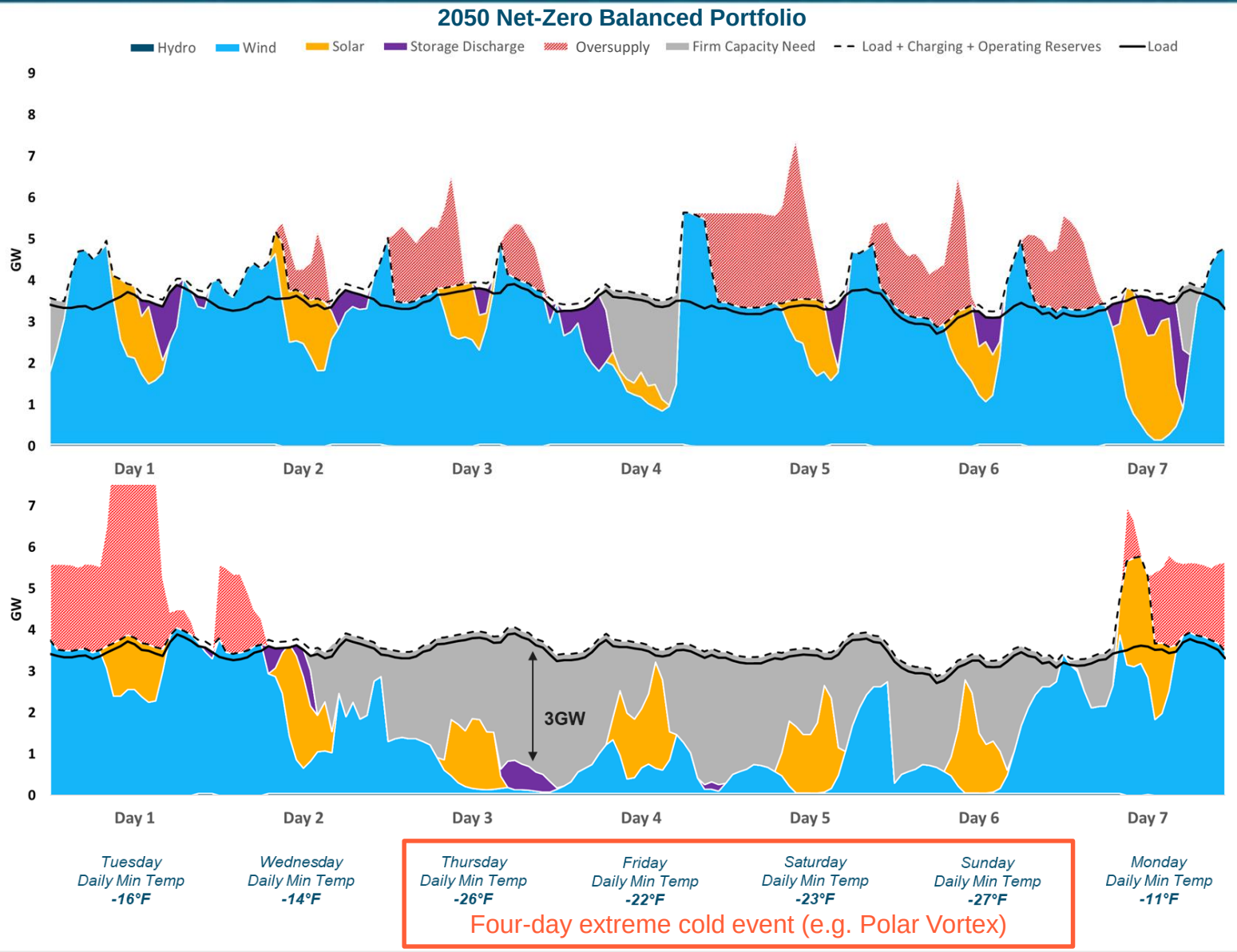
…but did require using firm capacity to charge storage during low wind periods

Load and resources from RECAP modeling based on historical OPPD load, weather, and wind + solar output using NREL datasets

Extreme Winter Cold: Before Resiliency Stress

High Renewable Week

Low Renewable Week



Some winter weeks will have very high levels of wind + solar

Some winter weeks will have low wind + solar output…

…these weeks rely on firm capacity to reliably serve load

Extreme Winter Cold: With Resiliency Stress

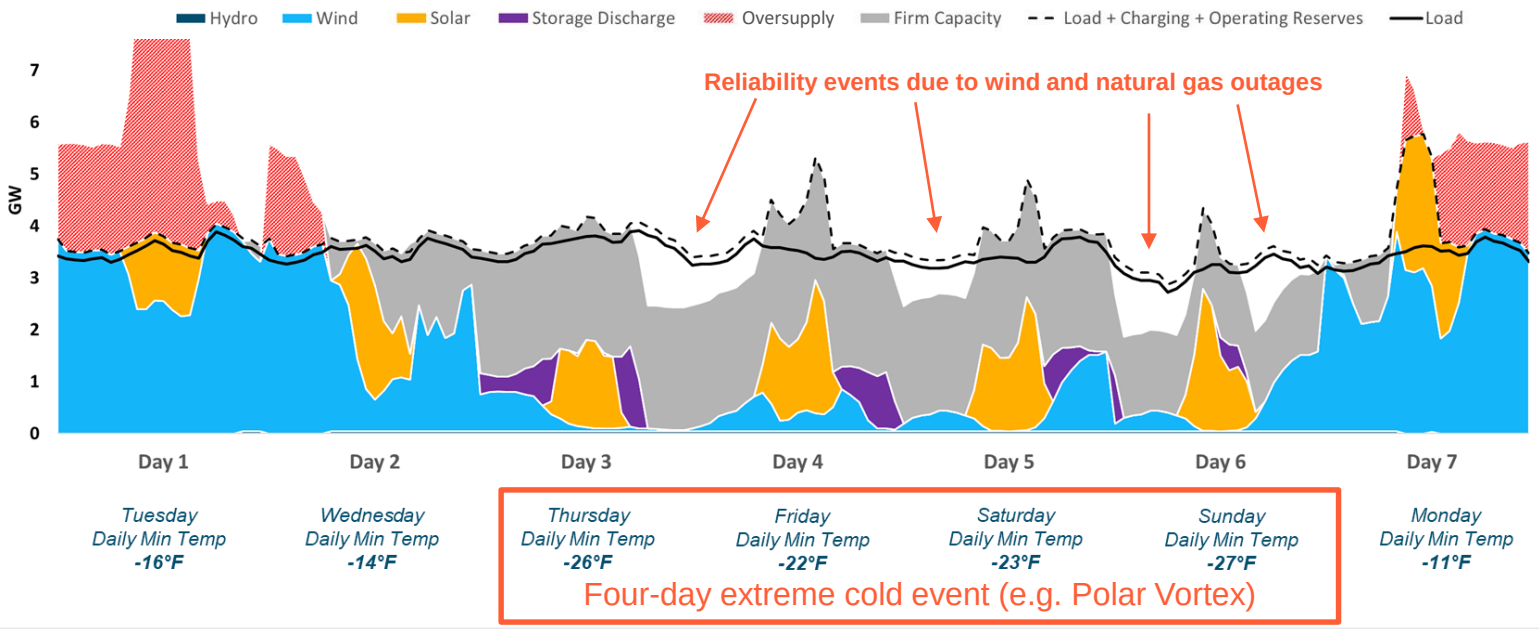
2050 Net-Zero Balanced Portfolio

Resiliency Stress Parameters

Parameter	Assumption	Source
Fuel availability	Start up failures + fuel supply disruption **reduce firm capacity ~40-50%** Units with on-site fuel tanks can operate for 2-3 days	SPP Feb. 2021 Polar Vortex conditions
Wind	**43% unavailable** due to turbine icing	SPP Feb. 2021 Polar Vortex conditions
Energy storage	**5% outage rate**	California Energy Storage Association

Assumptions match the resiliency challenge faced in February 2021, however efforts are already underway at SPP to address fuel security

Low Renewable Week With Resiliency Stress



Reliability events triggered by multi-hour nighttime shortfalls under fuel supply disruption

Mitigation Options to Avoid Reliability Event:

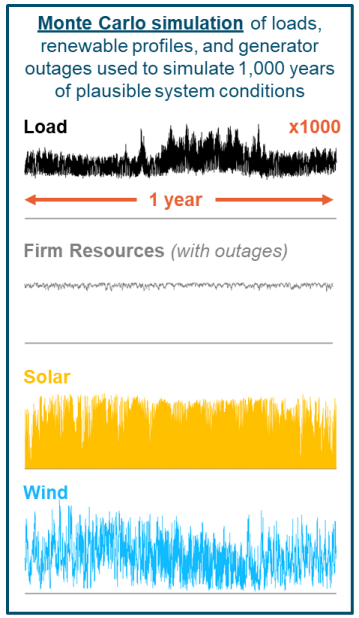
- Additional on-site backup fuel
- Winterize fuel delivery infrastructure
- Add wind turbine de-icing

Load and resources from RECAP modeling based on historical OPPD load, weather, and wind + solar output using NREL datasets

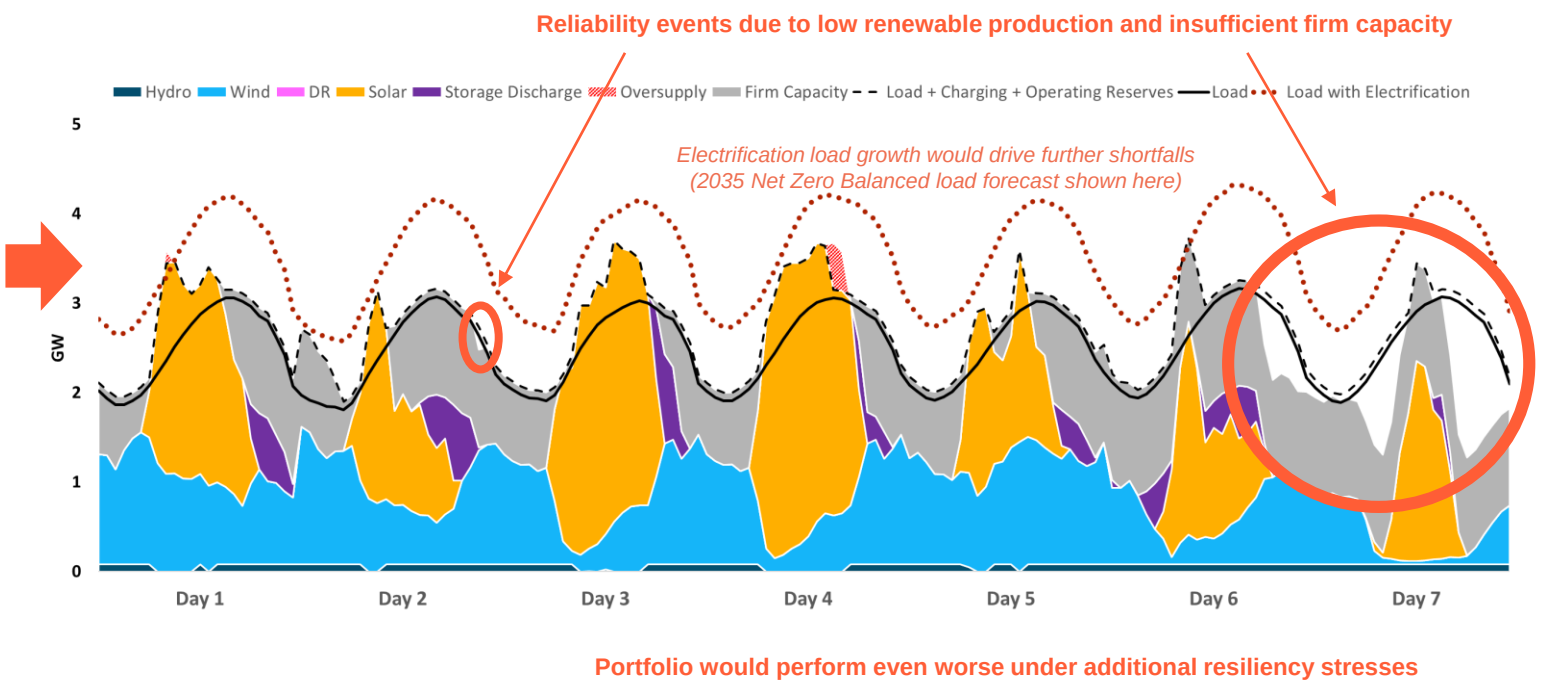
Portfolios Without Any New Firm Capacity Face Reliability Challenges

+ **E3 used RECAP to model a stakeholder's recommended 2035 portfolio with no coal generation and no new firm capacity above today's OPPD fleet (including no Power with Purpose assets)**
  - This portfolio was not sufficiently reliable

RECAP Model



Critical Summer Week: 2035 Scenario with Coal Retirements but No Firm Resource Additions



Portfolio would perform even worse under additional resiliency stresses

Reliability Metrics

Metric	Stakeholder Portfolio w/o Firm Capacity Additions	E3 RESOLVE Portfolio*
Loss of load expectation	65 days/yr ✗ *(vs. 0.1 days/yr)*	0.1 days/yr ✓ *(vs. 0.1 days/yr)*
Loss of load hours	365 hours/yr	0.1 hours/yr
Expected unserved energy	144,000 MWh/yr	10 MWh/yr
Capacity Shortfall vs. 1-day-in-10-yr LOLE	670 MW	- 28 MW

* Net-zero balanced straight-line portfolio shown (based on 2030 RECAP results)

Conclusions from Resiliency Case Studies

1. Extended Low Wind and Solar Output

- By 2050, *reliability challenges shift from peak demand to low renewable periods*
- *Firm capacity is required to maintain reliability* during extended low wind and solar events

2. Extreme Summer Heat

- Extreme heat may threaten reliability during periods of low wind and high loads
- However, *event can be withstood* with sufficient firm capacity

3. Extreme Winter Cold

- Extreme cold may threaten reliability through fuel availability challenges and *this event may cause major customer outages if not mitigated*
- *However, the impact can be mitigated* via 1) winterizing fuel infrastructure, 2) additional on-site backup fuel, and 3) wind turbine de-icing technologies

4. Extreme Localized Event

- Ability the withstand and recover from localized events *depends on OPPD's interconnection to the broader regional SPP market to secure necessary essential reliability services*
- Mitigation recommendations include 1) operational reliability studies on key asset contingencies, 2) on-system reliability investments (e.g. synchronous condensers), and 3) SPP reserve products to incentivize system flexibility

Public Comment Portion: Webex Hand Raise

Step 1: Click the Participant icon to open the Attendee list

Step 2: Scroll to the bottom of the Attendee list and click the “Hand Raise” button

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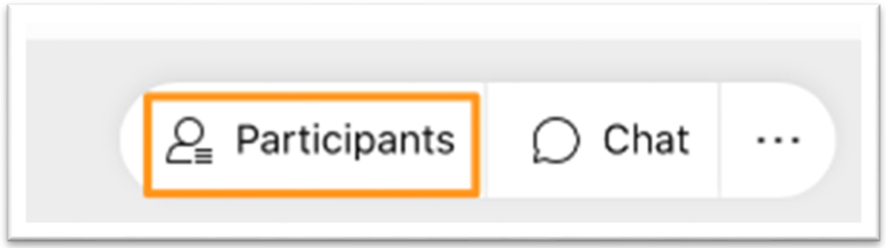

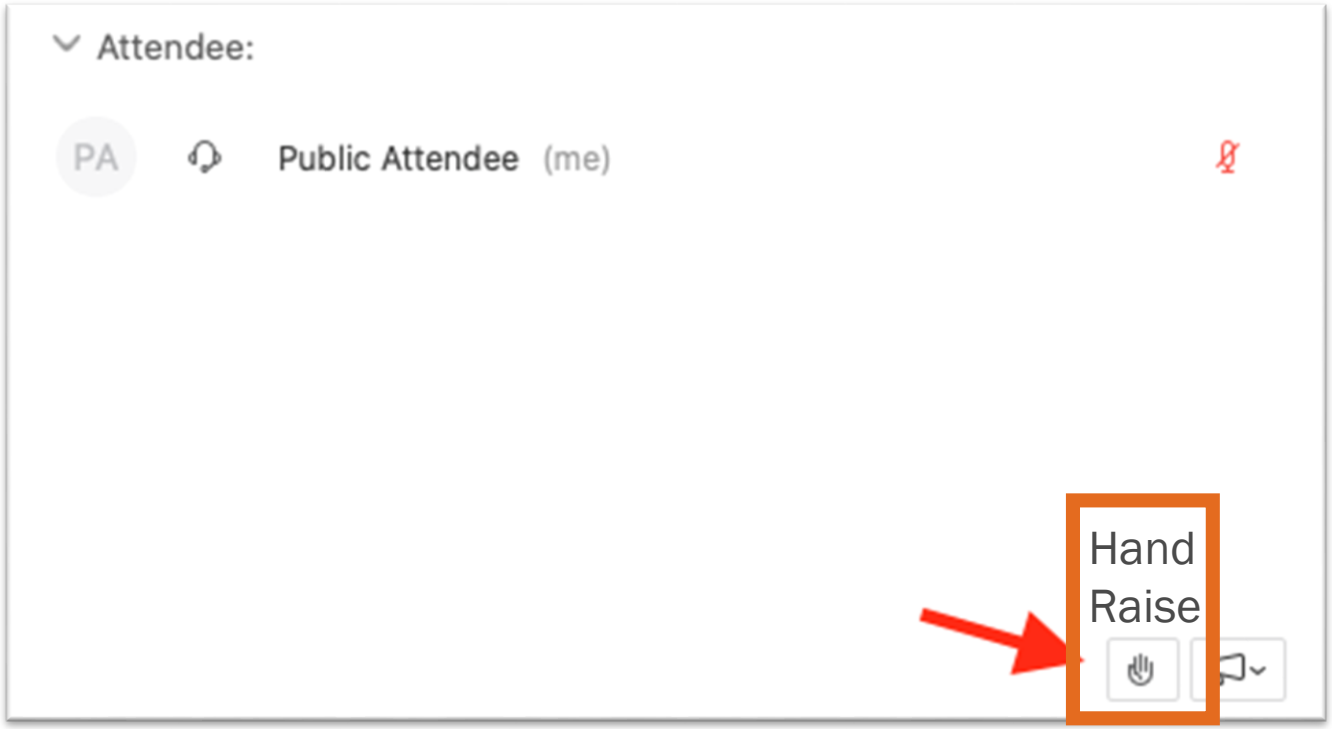

*(Note: Telephone users should press *3 to raise (and lower) hand.)*

Key Findings

Key Findings

1. *OPPD can achieve Net Zero while balancing affordability and reliability*

Net-zero is achievable with projected generation and transmission cost impacts of approximately 10-20% over time by 2050 while maintaining resource adequacy levels.

2. *Cessation of coal generation and reduced use of fossil generation*

Generation from fossil resources is reduced in all Net Zero scenarios as it is increasingly displaced by low-carbon resources. All scenarios ultimately repower or retire OPPD's coal generation by 2050 and maintain firm resources with minimum capacity factors.

3. *A mix of new low-carbon resources including renewable energy, energy storage, and community-wide energy efficiency will be required*

Large quantities of low carbon resources are required to displace fossil generation and reduce emissions across OPPD's system.

Key Findings

4. *Firm Generation is needed to maintain resource adequacy*

Wind, solar, energy storage, and demand-side resources support reliability but have limitations, especially during certain extreme weather events. Firm resources are required to support the system during these critical periods.

5. *Resources are consistent across a variety of pathways*

A core set of resources are common across a variety of scenarios. Pace of Decarbonization scenarios sets the speed of resource decisions. The solution scales proportionally with total load.

6. *Absolute Zero emissions scenarios are substantially higher cost and very dependent on future technology development*

Achieving Absolute Zero with current technology requires impractically high levels of new resources at significantly higher cost. However, emerging technologies such as hydrogen, long-duration storage, and small modular reactors have the potential to make this more feasible.

Key Findings

7. *Accelerating decarbonization reduces cumulative emissions at a relatively low incremental cost, but poses implementation and integration challenges*

Accelerating Net Zero decarbonization pathways results in relatively low incremental cost, but requires integrating higher levels of resources in the near-term, which may pose supply chain, financial, grid interconnection, and operational risks.

8. *The changing resource mix will pose new resiliency challenges that must be evaluated, understood, and mitigated*

Critical resource adequacy periods are expected to change from peak summer conditions to periods of extreme cold or extended periods of low renewable generation. Grid resiliency will depend on how utilities anticipate and prepare for these extreme events as the grid continues to evolve.

Next Steps

Next Steps

- The Energy Portfolio Project studied actionable pathways to eliminate or significantly reduce greenhouse gas (GHG) emissions from OPPD's energy portfolio, while balancing impacts on reliability, resiliency, and affordability
- The Energy Portfolio study surpasses all prior OPPD work to understand the directional changes required for OPPD to achieve Net Zero Carbon by 2050, informing OPPD's leadership and Board of Directors to support future decision making
- The findings will be incorporated into OPPD's IRP filing in February of 2022
- Advanced engineering financial studies are required to understand the impacts of specific decisions as well as additional questions arising from the Energy Portfolio work
- In 2022 OPPD will take the next step in its Net Zero planning by initiating Advanced Feasibility Studies for supply and demand side opportunities

OPPD Integrated Resource Plan

- The **first 5 years** will include OPPD's planned Power with Purpose actions, including the addition of 400-600MW of solar, 600MW of natural gas, retiring North Omaha Units 1-3 and repowering Units 4-5 resulting in substantial near-term emissions reductions
- The **long-term horizon** will incorporate the Pathways Decarbonization: Energy Portfolio findings
- Outreach Activities:
  - Public Release - January 14th, 2022
  - Stakeholder Meeting - *February 3rd, 2022*
  - Submission to WAPA - *February 28th, 2022*

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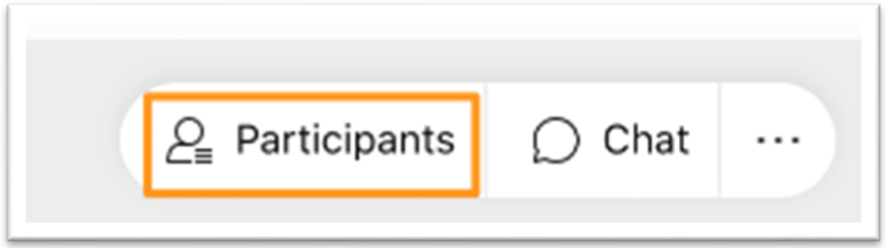

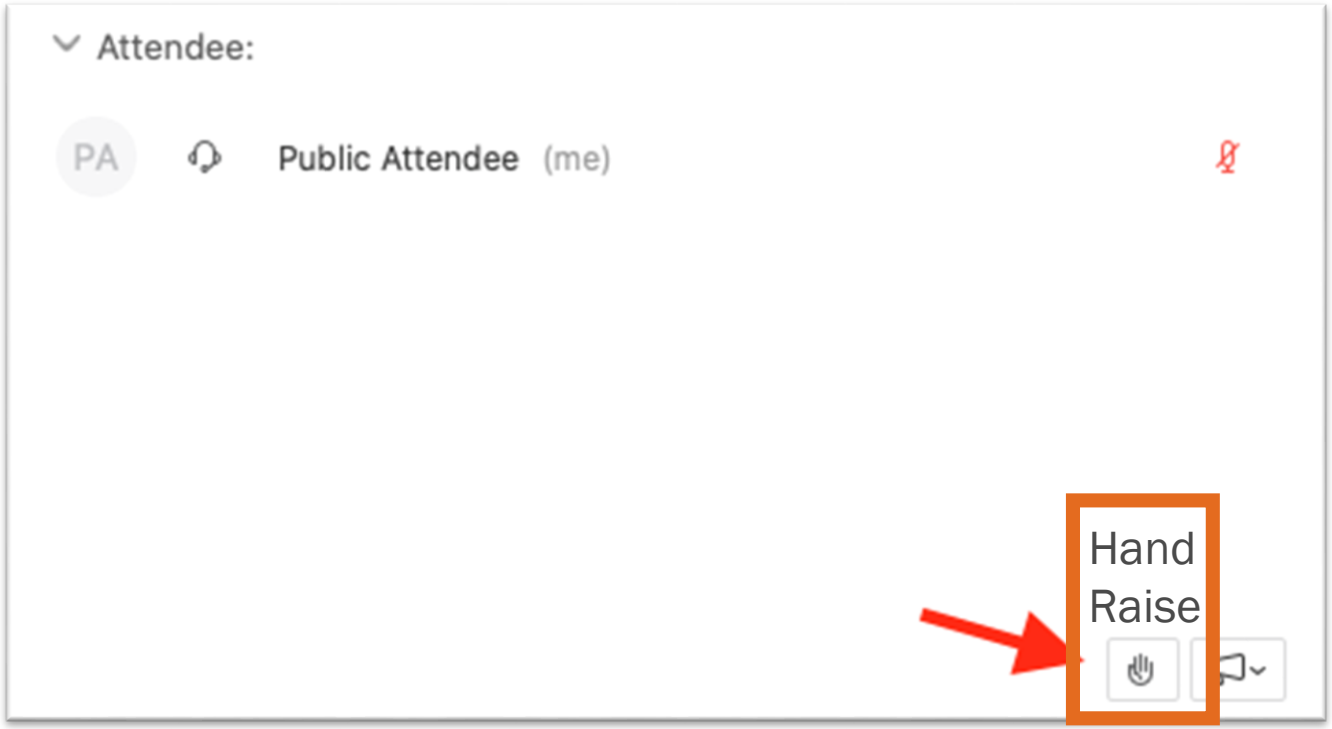

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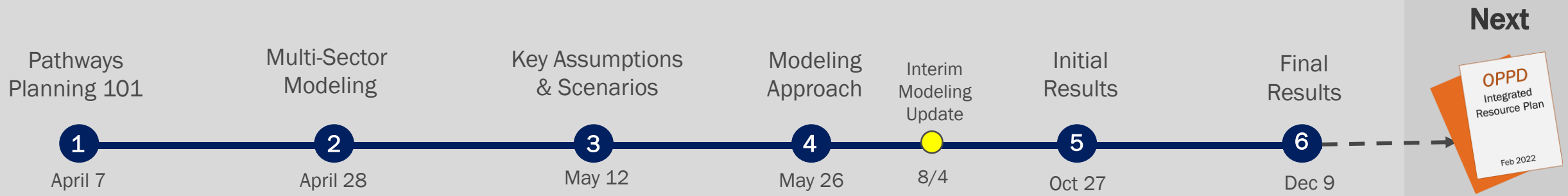
Energy Portfolio: Stakeholder Workshops



Workshop #1

Pathways Planning 101

Duration: **2 hours**

IAP2 Level: **Inform**

Provides an overview of the Energy Portfolio study, its objectives, approach and stakeholder engagement plan.

- Coordination with OPPD's 2021 IRP
- Introduce study team members

Recording Available Online

Workshop #2

Multi-Sector Modeling

Duration: **2 hours**

IAP2 Level: **Inform/Consult**

Review of results for modeling Net Zero carbon across all energy uses in OPPD's service territory.

- Emissions across sectors
- Impact on future electric system demand

Recording Available Online

Workshop #3

Key Assumptions & Scenarios

Duration: **2 hours**

IAP2 Level: **Involve**

Review technologies, assumptions, and scenarios that will be used and analyzed in the Energy Portfolio modeling.

- Technology performance, fuel, and cost forecasts
- Scenarios for modeling

Recording Available Online

Workshop #4

Modeling Approach

Duration: **2 hours**

IAP2 Level: **Consult**

Review in-depth look at the technical modeling considerations and approach that will be used to develop pathways.

- Resource adequacy modeling
- Resource optimization modeling

Recording Available Online

Workshop #5

Initial Results

Duration: **2 hours**

IAP2 Level: **Consult**

Review initial modeling results for Energy Portfolio decarbonization pathways.

- Initial energy portfolio pathways to achieve Net Zero Carbon by 2050

Recording Available Online

Workshop #6

Final Results

Duration: **2 hours**

IAP2 Level: **Inform**

Review final results of modeling with consideration of feedback received on initial results.

- Final energy portfolio pathways to achieve Net Zero Carbon by 2050.

IRP Presentation

Integrated Resource Plan

Duration: **2 hours**

IAP2 Level: **Inform**

Review IRP filing and listen to stakeholder feedback.

iap2 international association for public participation

OPPD

Next Steps

We are committed to continued stakeholder engagement and feedback.

Post-meeting survey (two options)

- Safe “pop-up” option as you leave meeting
- Watch your email – we'd love your input

Upcoming Engagement

- Integrated Resource Plan Meeting – February 3rd

OPPDCommunityConnect.com

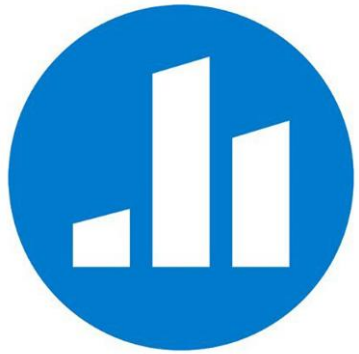
- Written comments on initial results due by 12/17
- Workshop recording to be posted
- Q&A available via the platform

Let’s Talk

- OPPD.com/speakersbureau

Question:

We know that we shared a lot of information and appreciate that you've stuck with us. What stood out to you personally?

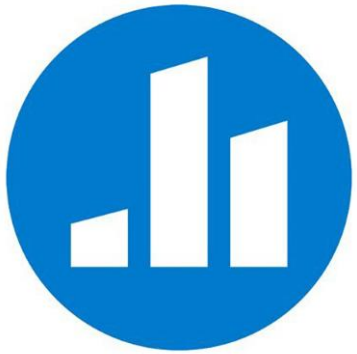


When poll is active, respond at **PollEv.com/oppd1**

Text **OPPD1** to **22333** once to join

Question:

What thoughts/questions do you have for OPPD to as we wrap-up this study and integrate results into our Integrated Resource Plan?



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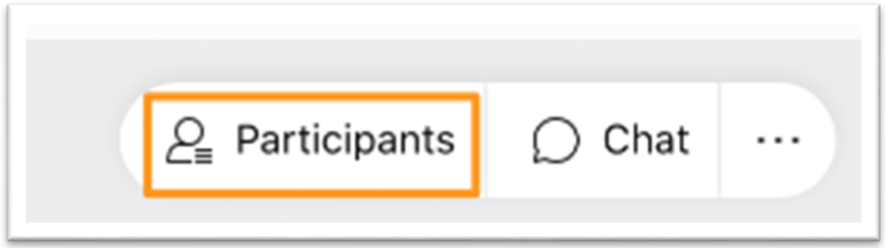

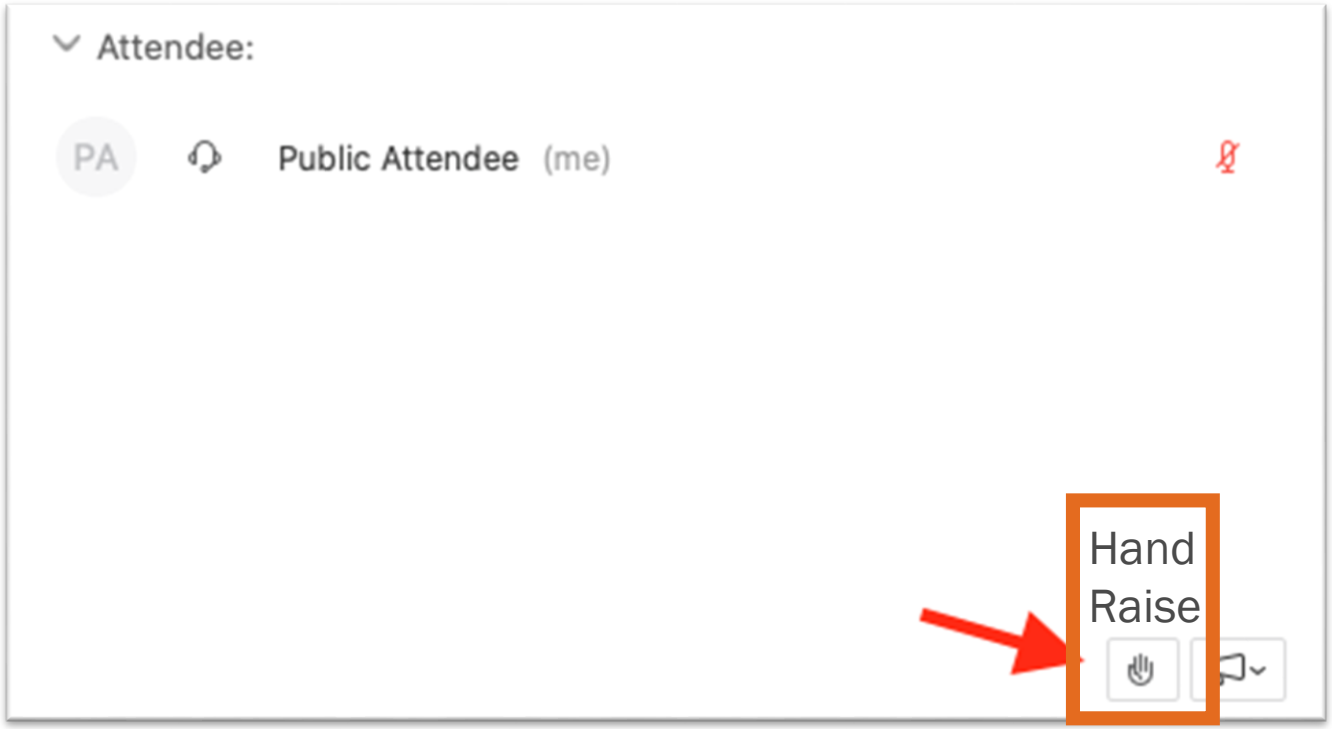

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Thank you for attending today!