2022 Power Strategic Long-Term Resource Plan (SLTRP)
Roadmap to 100% Carbon Free by 2035

SLTRP Advisory Group Meeting #9
Preliminary Results on Reliability, Resiliency, and Sensitivities
June 30, 2022

Meeting Agenda

Joan Isaacson, Kearns & West

- Welcome & Introductions
- Meeting Purpose and Agenda Overview
- 2022 SLTRP Modeling Refinements
- 2022 SLTRP Reliability, Resiliency, and Sensitivities Results
- Discussion, Q&A, and Polling
- Wrap Up

Website: www.ladwp.com/SLTRP
Email: powerSLTRP@ladwp.com

Guides for Productive Virtual Meetings

- Use Chat for input OR Raise Hand to join the conversation
- Help to make sure everyone gets equal time to give input
- Keep input concise so others have time to participate
- Actively listen to others, seek to understand perspectives
- Offer ideas to address questions and concerns raised by others

Advisory Group Role in 2022 SLTRP

The Advisory Group will provide input and feedback based on their expertise, knowledge, and resources of the organizations, institutions, and constituent groups represented by Advisory Group members.

Advisory Group Meeting Plan

<table>
<tr>
<th>Phase 1 | Q3 2021
Launch & Laying Foundation</th>
<th>Phase 2 | Q3 2021
Scenario Development</th>
<th>Phase 3 | Q4 2021
Modeling</th>
<th>Phase 4 | Q1-2 2022
Results</th>
<th>Phase 5 | Q2-3 2022
Outreach</th>
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<tr>
<td>#1 September 23
• Advisory Group Launch
• LADWP Overview
• LA100 (Achieving 100% Renewable Energy)
• 2022 SLTRP Orientation
• Advisory Group Protocols & Operating Principles</td>
<td>#4 October 22
• Customer Focused Programs
- Energy Efficiency & Building - Electrification
- Transportation Electrification
- Demand Response
• Draft Scenario Matrix</td>
<td>#7 December 17
• LA100 Equity Strategies Overview
• Energy Storage Presentation
• 2022 SLTRP What-If Sensitivities Discussion
• Final Scenario Matrix</td>
<td>February
(Email Update)
• Modeling Progress Check-in,
• Upcoming Board Meetings</td>
<td>#9 June 30
• Preliminary Results on Reliability, resiliency, and Sensitivities</td>
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<tr>
<td>#2 September 30
• LA100 Study Review (NREL) at 9 am
• LA100 Rates Analysis (OPA) at 10 am
• LA100 Next Steps (LADWP)
• LA100 Assumptions (PSRP)
• Consider Topics for October 22
• Consideration of Scenario Definition</td>
<td>#5 November 10
• LA100 “No Combustion” Scenario
• 2022 SLTRP Assumptions
• Metrics & Evaluation Process
• Scenario Considerations
• Refine Scenario Matrix</td>
<td>November – May
• Internal Modeling
• Analysis of Scenarios</td>
<td>#8 April 28
• Preliminary Results on Core Scenarios
• (Capacity Expansion, LOLP and Production Cost Model)</td>
<td>#10 August 5 (TBD)
• Final Sensitivities

August
• Community Outreach Meetings
• Review Draft 2022 SLTRP</td>
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<td>#3 October 08
• SLTRP Deep Dive
• SB100 Review (LADWP)
• 100% Carbon-Free by 2035 Requirements (NREL)
• Green Hydrogen in LA (LADWP)
• 2022 SLTRP Key Considerations and Potential Scenarios</td>
<td>#6 November 19
• Distribution Automation
• 2022 SLTRP Advisory Group Feedback and Refined Draft Scenario Matrix
• 2022 SLTRP What-If Sensitivities Discussion</td>
<td>Modeling Underway</td>
<td>TBD
Potential field trip</td>
<td>#11 September (TBD)
Public Outreach Results

September
Submit Final 2022 SLTRP for approval</td>
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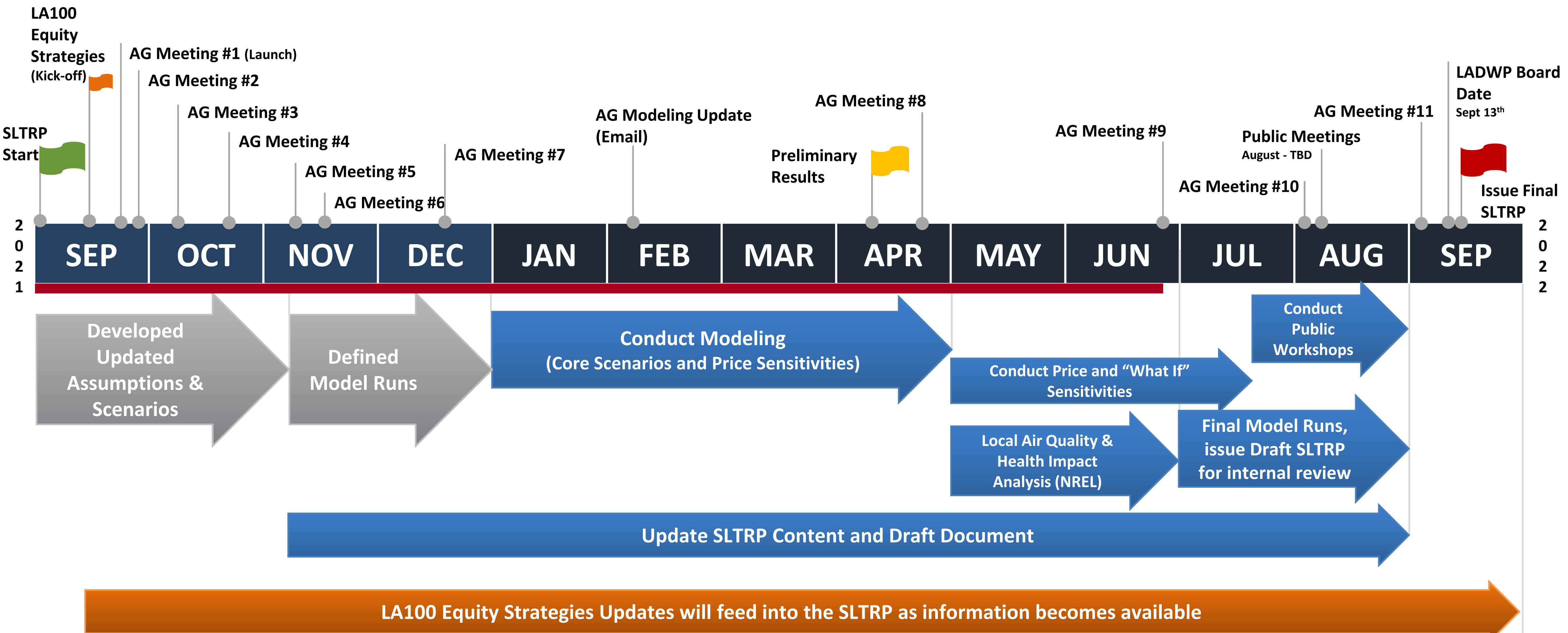
2022 SLTRP Overview - Timeline



2022 SLTRP Modeling Refinements

Jay Lim, LADWP Manager of Resource Planning





2022 SLTRP Overview – Core Scenarios

Los Angeles Department of Water & Power

SCENARIOS (100% Carbon Free by 2035)

**Note: SB100 achieves 100% clean energy by 2045 based on retail sales; however, figures are shown in terms of generation for benchmarking purposes*

CLEAN ENERGY TARGETS

	SB 100 Reference Case	Case #1	Case #2	Case #3
Total Renewable Portfolio Standard 2030	60%	80%	90%	90%
Total Clean Energy (Renewable, Hydro and Nuclear) Penetration Achieved 2035 vs. 2045	2035: 80% 2045: 90%*	2035: 100% 2045: 100%	2035: 100% 2045: 100%	2035: 100% 2045: 100%
Distributed Energy Resource Deployments	Reference Levels	High Levels	High Levels	Highest Levels

2022 SLTRP Overview - Sensitivities

Commodity Prices	Examples	Price Sensitivity	Scenario to Apply
Fuel Prices*	Natural Gas, Green Hydrogen, etc.	High/low sensitivities	SB100, Case 2, Tentative Recommended Case
GHG Prices*	GHG Allowance Prices	High/low sensitivities	SB100, Case 2, Tentative Recommended Case
Renewables and Energy Storage Prices*	Solar, Wind, Geothermal, Li-Ion, flow, etc.	High/low sensitivities	SB100, Case 2, Tentative Recommended Case

**bookend scenarios to evaluate price sensitivities by matching low and high commodity prices:*

- ***Low Bookend:** Low natural gas prices, low hydrogen prices, low GHG prices, low renewable and energy storage prices*
- ***High Bookend:** High natural gas prices, high hydrogen prices, high GHG prices, high renewable and energy storage prices*

Implementation Risk	Description	"What-if" Sensitivities	Scenario to Apply
Emerging Technologies	No In-Basin Combustion Alternatives	Long duration capacity (e.g. Hydrogen Fuel Cells)	Case 1, Case 2, Case 3
Demand Side Resources	Demand Response	Reaching only half of the 576/633 MW of DR by 2035	Case 1, Case 2, Case 3
Transmission	Transmission Upgrades (over 10 projects by 2030)	More difficult in-basin upgrades not completed by 2030	Tentative Recommended Case
Load	Transportation/Building Electrification	Low Load and High Load	Tentative Recommended Case

2022 SLTRP Modeling Refinements

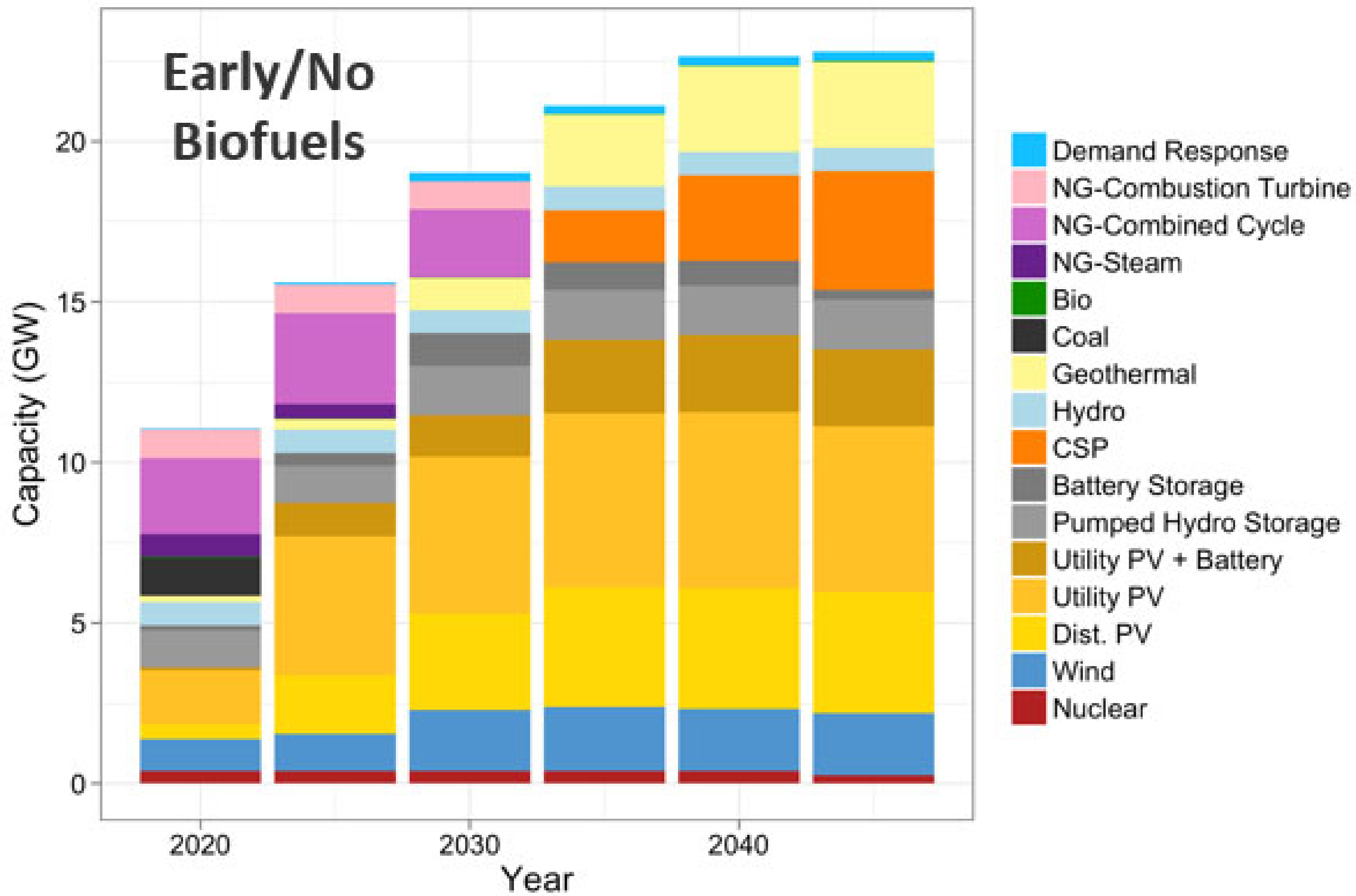
<u>Modeling Refinements on 2022 SLTRP Core Case Scenarios</u>

1) Natural Gas Capacity Phase Out Schedule
2) Loss of Load Probability Analysis
3) Resiliency Analysis
4) Price Sensitivities
5) No In-Basin Combustion Sensitivity
6) Demand Response Sensitivity

Recap of LA100 “No Combustion” Results

Restricting the eligibility of natural gas and biomass requires reliance on storage and other dispatchable renewable generation

EARLY RESULTS, NOT PART OF FINAL LA100 ANALYSIS

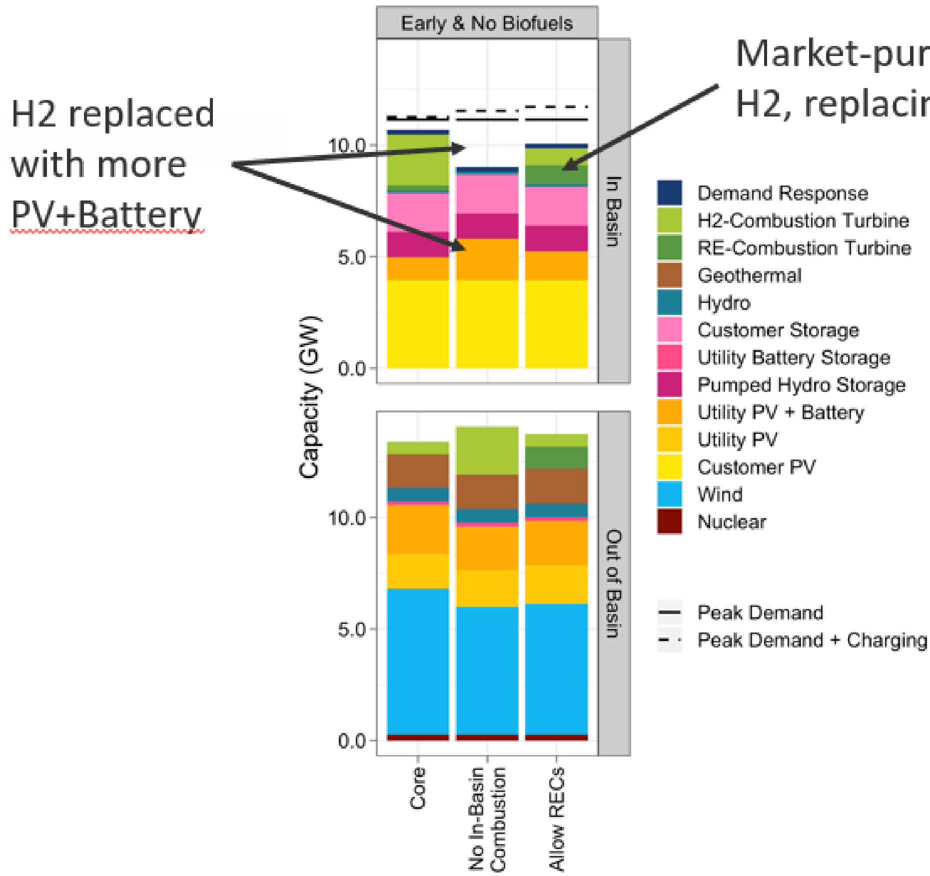


Initial Results

Initial Run – For Discussion Purposes Only; Subject to Change

Recap of LA100 "No Combustion" Results

Early/No Biofuels Sensitivities: Disallowing combustion shifts capacity outside the basin



Final Sensitivity

Greater reliance on out-of-basin resources requires more out- and in-basin transmission

Location	Core	No In Basin Combustion	Allow RECs
In Basin	468 MW 3 lines 24.8 km	1,457 MW 8 lines 90 km	143 MW 3 lines 38 km
Out of Basin	2,354 MW 3 lines 379 km	2,032 MW 2 lines 107 km	

Recap of LA100 "No Combustion" Results

Key Takeaways

- In-basin long-term dispatchable resources are used infrequently under *normal* grid conditions, but may be heavily relied upon during *stressed* grid conditions
- Lack of in-basin long-term dispatchable resources leads to increased reliance on the transmission system, which creates vulnerability to transmission outages
- Unexpected or low probability events (e.g. wildfires) can be very disruptive in systems with heavy reliance on transmission

LA100 Study – Need for Firm Capacity

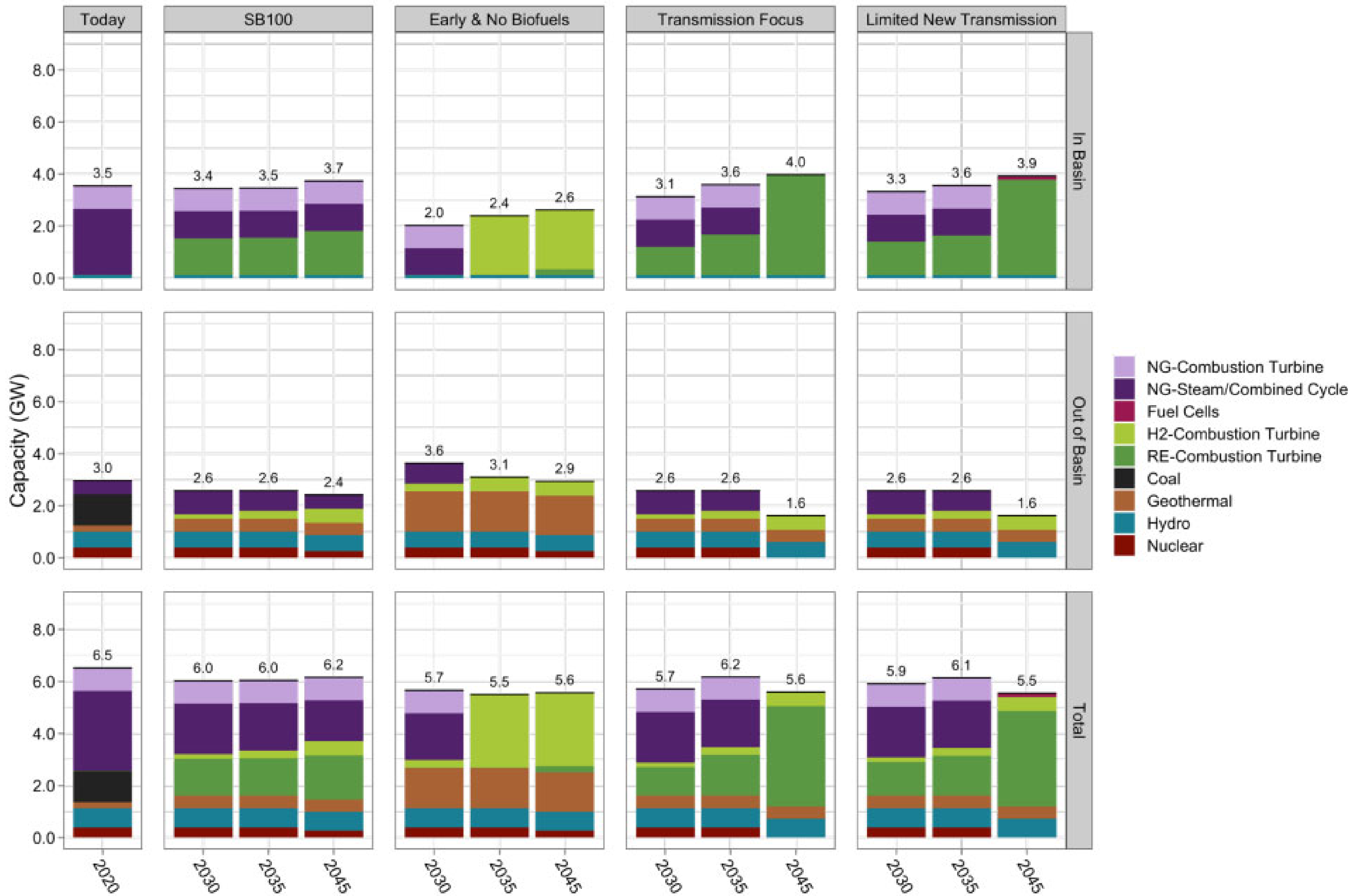
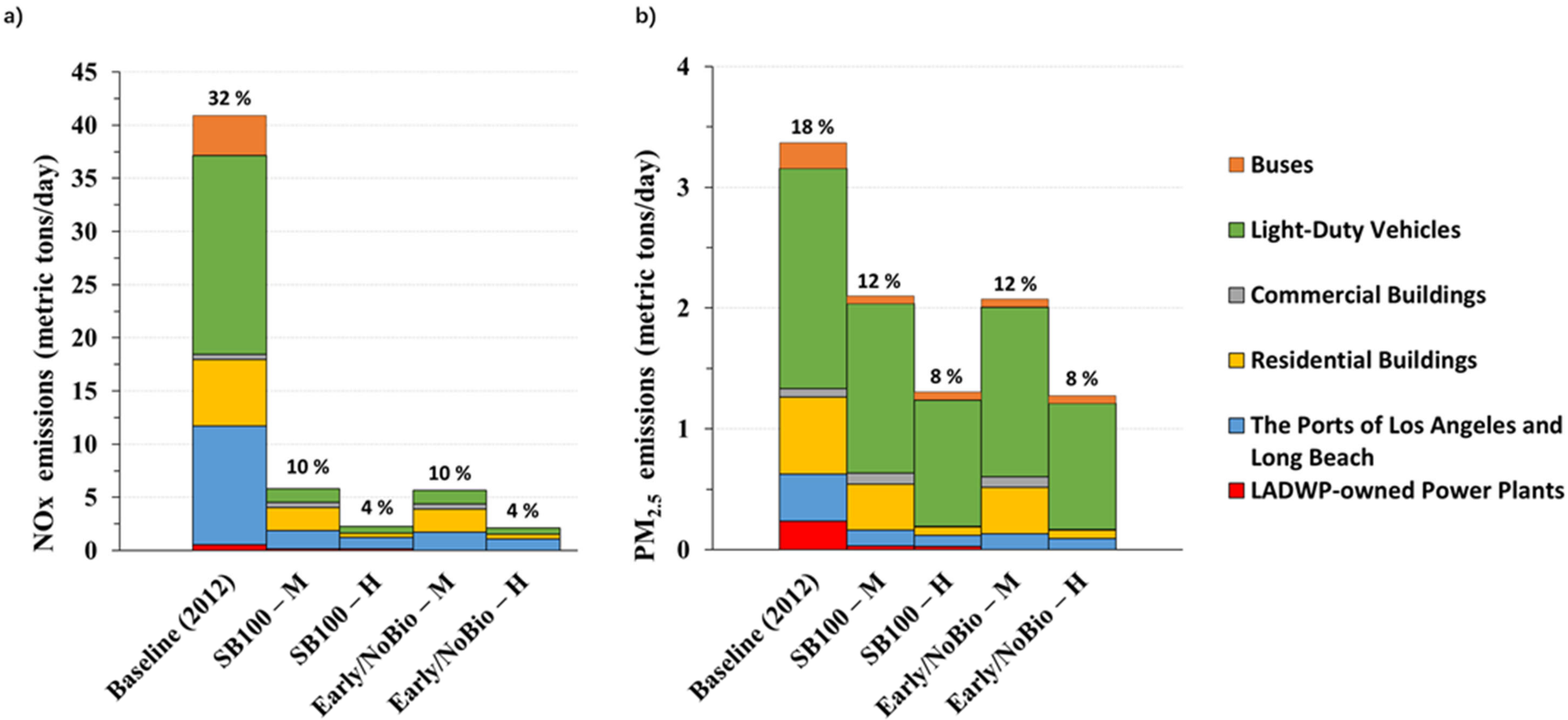


Figure 29. Nominal capacity of firm capacity resources, High scenarios, 2030–2045

Electrification Drives Air Quality and Health Benefits



Discussion and Q&A

2022 SLTRP: Reliability, Resiliency & Sensitivity Results

Zach Brode, Ascend Analytics
Jay Lim, LADWP Manager of Resource Planning



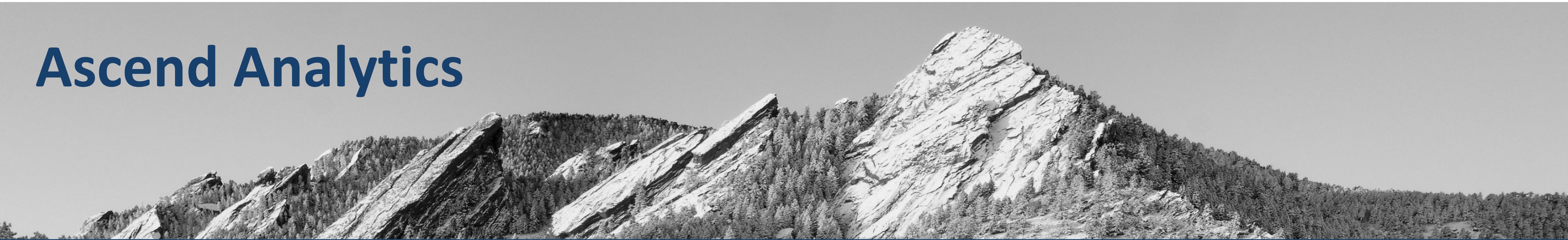


Ascend Analytics
Better models. Better decisions.

2022 SLTRP June Advisory Group Meeting

June 30th, 2022

Ascend Analytics



- Founded in 2002 with 50 employees in Boulder, Oakland and Bozeman
- Seven integrated software products for operations, portfolio analytics, and planning
- Consulting and custom analytical solutions

Proven and Broadly Adopted

New York Power Authority; nrg; Duke Energy; American Electric Power; Silicon Valley Clean Energy; Austin Energy; CPA; ipl an AES company; REU Redding Electric Utility; TID Water & Power; Ameren; Lansing BWL; NorthWestern Energy; LA DWP Los Angeles Department of Water & Power; City of Glendale Water & Power GWP; 8minute Solar Energy; ISO new england; East Bay Community Energy; Nebraska Public Power District; Shell; Terra-Gen; NextEra Energy

Differentiated Value for Enhanced Decision Analysis

PowerSimm OPS
OPERATIONAL STRATEGY

- Optimal short-term dispatch
- Determine operating strategies from position and financial exposure
- Track realized customer revenue and costs to settled day ahead and real time price
- Optimize financial exposure between day ahead and real time prices

PowerSimm Portfolio Manager
PORTFOLIO MANAGEMENT

- Portfolio management
- Generation asset management
- Hydro and renewable asset modeling
- Retail management & pricing
- Energy purchases and sales
- CFaR, GMaR, EaR

PowerSimm Planner
VALUATION & PLANNING

- Asset valuation
- Resource Planning
- Capacity Expansion Planning
- Reliability Analysis
- Renewable Integration
- Long-term Price Forecasting

Smart Bidder
STORAGE OPTIMIZATION

- Optimal offers to ISO
- Continuous adjust ISO offers
- Forecast probabilities of price spikes
- Renewables plus storage

BatterySimm Valuation
STORAGE VALUATION

- Optimal siting and sizing
- Captures realistic revenues given imperfect foresight
- Battery cycle analysis

Ascend Market Intelligence

- Power, ancillary, and capacity price forecasts, including subhourly and geographic evolution
- Market reports and analysis
- Hourly and subhourly nodal and hub price simulations

Modeling Plan

Item	Status
Model inputs for existing and new resources	Complete
Scenario build out	Complete
Model Validation	Complete
Capacity Expansion Modeling	Complete
Production Cost Modeling	Complete
Resource Adequacy	**Preliminary Results Shown Today**
Resiliency Study	**Preliminary Results Shown Today**
Sensitivities (what ifs, high/low commodity prices, load)	Based on preferred case
Hydrogen Buildout	Based on preferred case

Modeling Approach

Ascend Analytics
Better models. Better decisions.

Modeling Scenarios

SB100 — Reference Case

- 60% RPS by 2030
- 100 Clean by 2045 (based on retail sales)
- Reference level of local solar (1500 MW by 2035)
- Moderate DR (576 MW by 2035)
- Moderate EE (3210 GWh by 2035)
- Moderate Transmission Upgrades

Case 1 — Carbon Free by 2035 – Moderate

- 80% RPS by 2030 (based on sales)
- 100% carbon free by 2035 (based on generation)
- High level of local solar (2240 MW by 2035)
- Moderate DR (576 MW by 2035)
- High EE (4350 GWh by 2035)
- High Transmission Upgrades

Case 2 — Carbon Free by 2035 – Aggressive

- 90% RPS by 2030 (based on sales)
- 100% carbon free by 2035 (based on generation)
- High level of local solar (2240 MW by 2035)
- Moderate DR (576 MW by 2035)
- High EE (4350 GWh by 2035)
- High Transmission Upgrades

Case 3 — Carbon Free by 2035 – Aggressive with High DERs

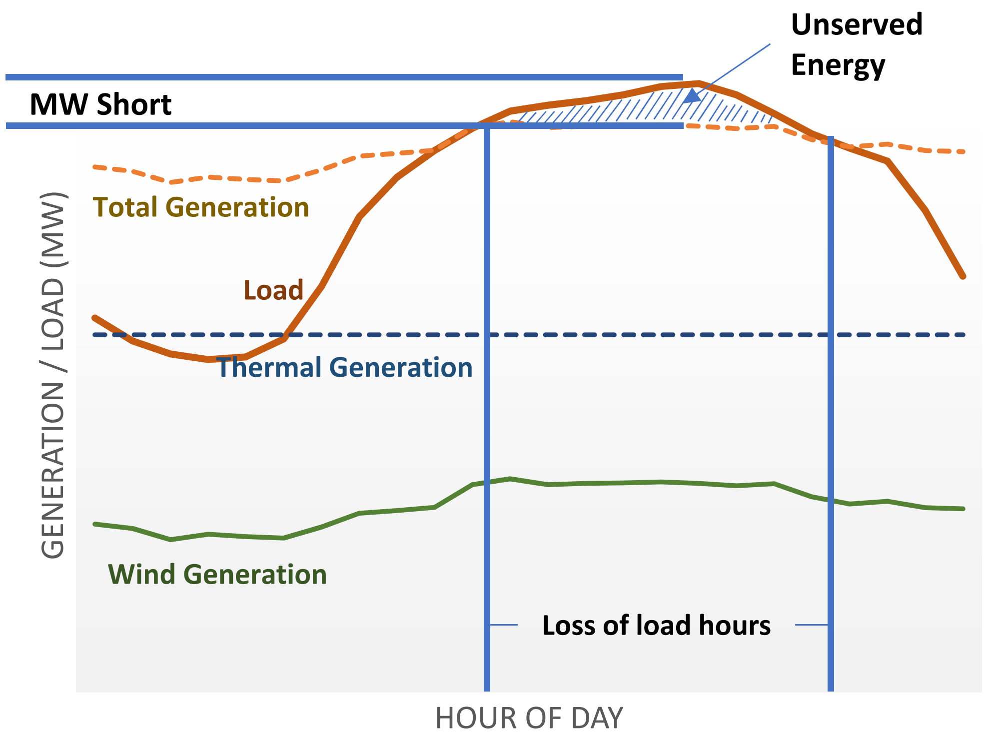
- 90% RPS by 2030 (based on sales)
- 100% carbon free by 2035 (based on generation)
- Highest level of local solar (2400 MW by 2035)
- High DR (633 MW by 2035)
- Highest EE (4770 GWh by 2035)
- High Transmission Upgrades

Overview of Resource Adequacy

Given system uncertainty, how likely will resources supply customer load all hours of the year?

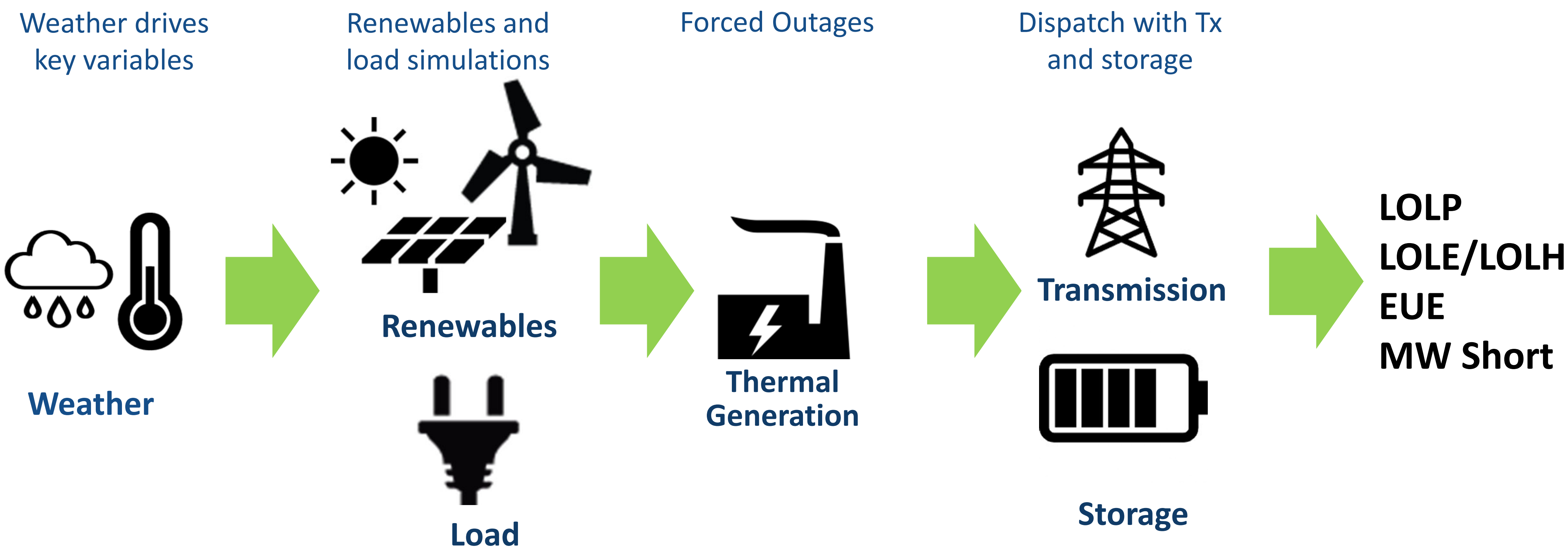
- Large sources of uncertainty include renewable generation, forced outages and load
- Probabilistic models provide metrics on loss of load events to fully understand potential harm/constraints

Metric	Description
LOLP	**Loss of load probability** – The probability of an event where load exceeds available generation resources
LOLH/LOLE	**Loss of load hours / expectation** – The expected number of hours (LOLH) or days (LOLE) where load cannot be met with available generation resources
EUE	**Expected energy unserved** – The expected amount of load, in MWh, that cannot be met with available generation
MW Short	The largest shortfall from inadequate generation resources
ELCC	**Effective load carrying capability** – The expected capacity contribution from variable renewable resources, usually as a function of the penetration of a renewable technology in a power system



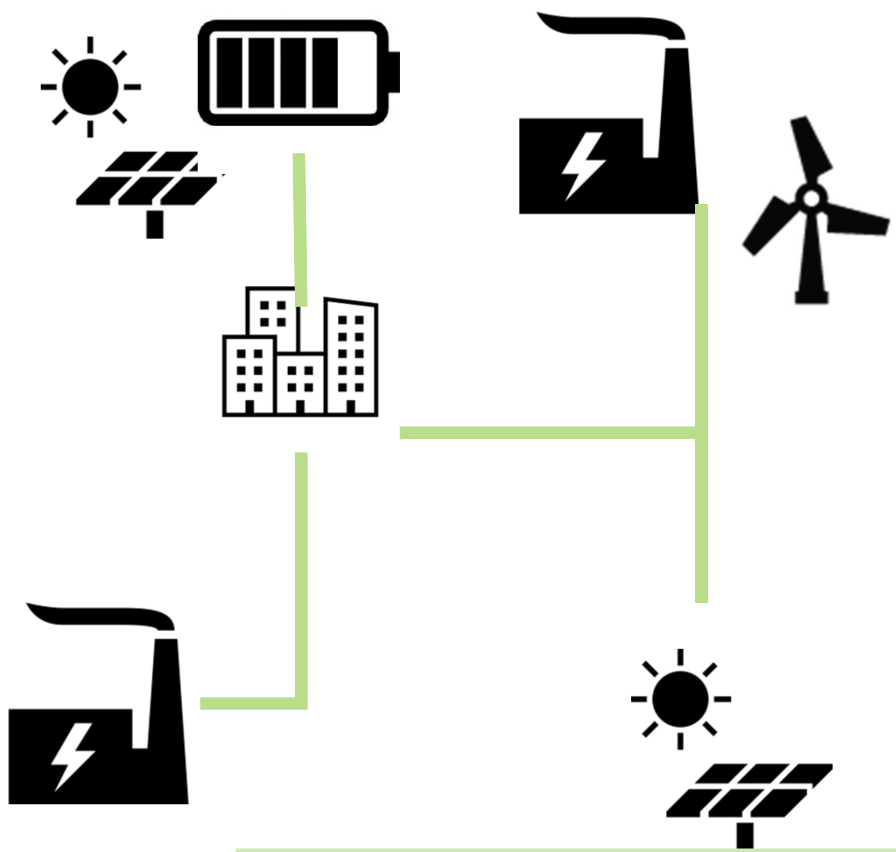
Resource Adequacy Modeling

Simulate and Dispatch LADWP's system on an hourly basis to **minimize unserved energy**

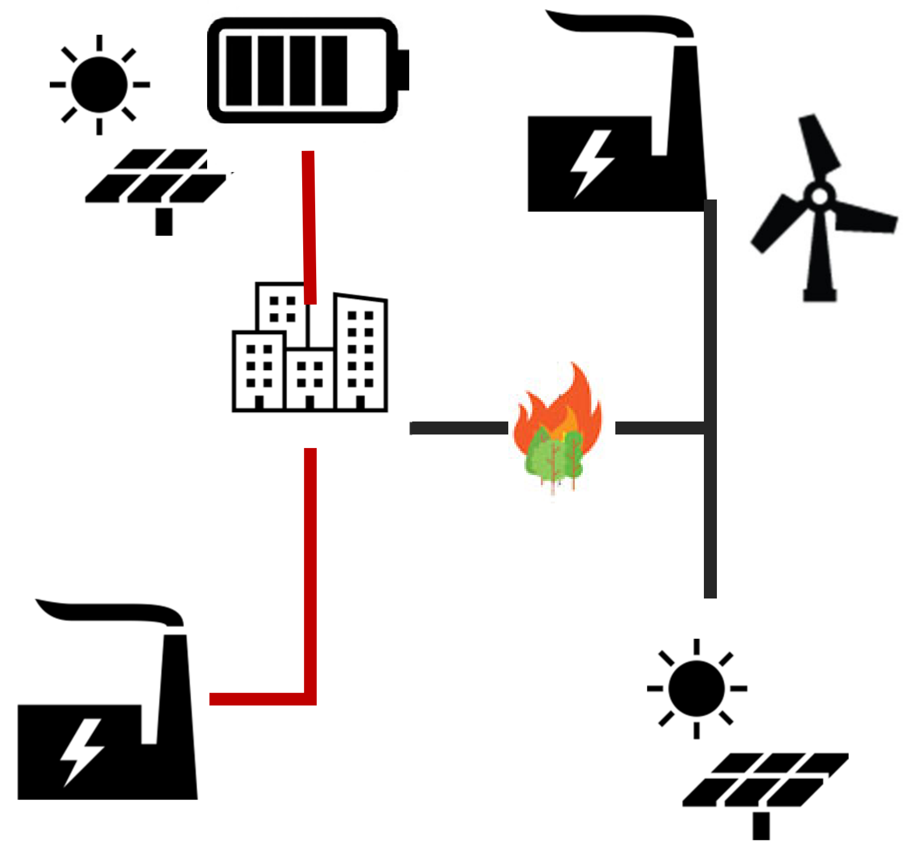


Resiliency Modeling

Simulate and Dispatch LADWP's system on an hourly basis to understand how the portfolio meets customer load with contingencies in the system



Normal Operations



Emergency Operations

Resiliency Scenarios

Ascend Analytics

No Barren Ridge

- Remove Barren Ridge Transmission Line
- Restricts DWP's ability to import renewable generation from Haskell

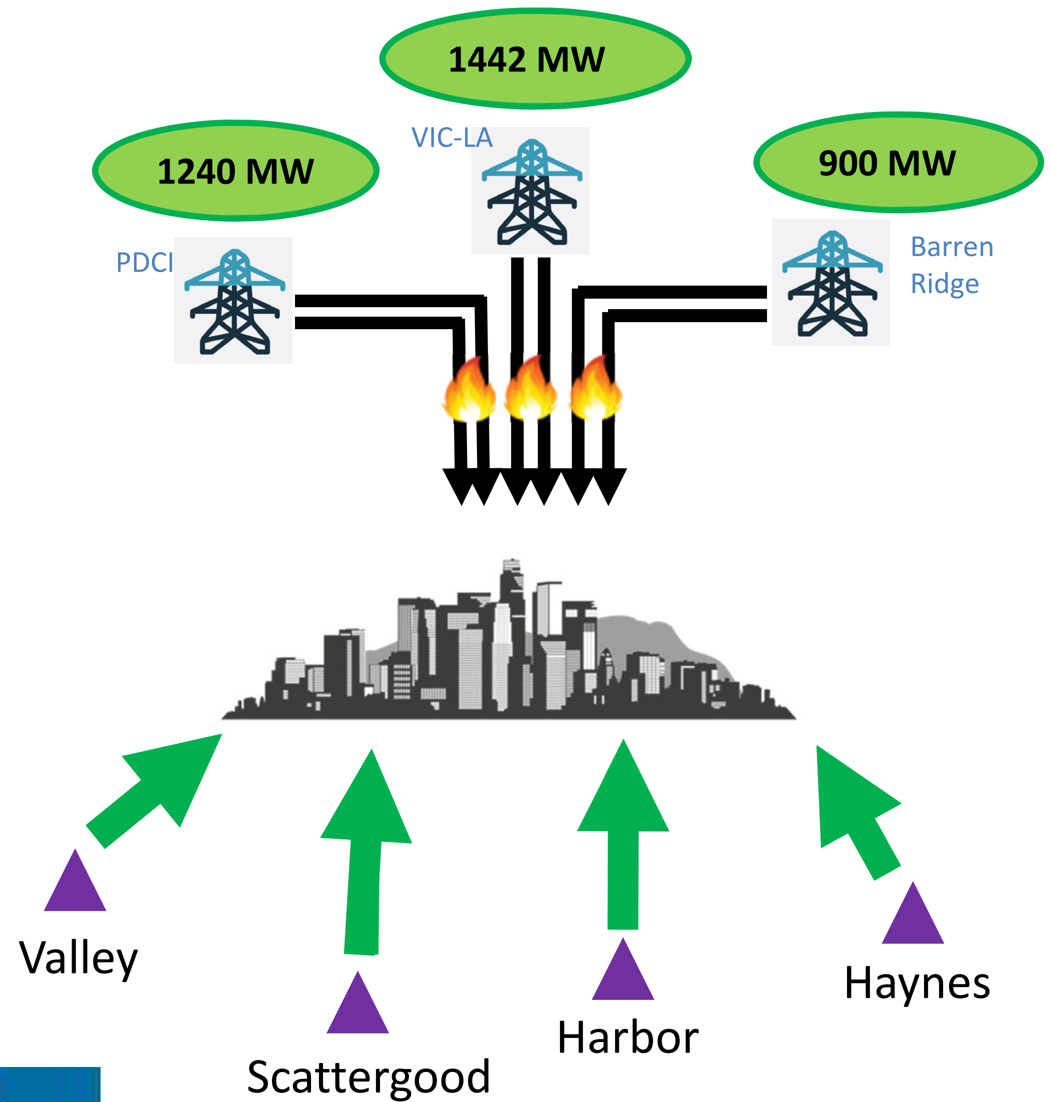
No STS

- Remove the Southern Transmission System (STS) which connects IPP to California
- DWP must curtail or sell all generation from IPP Renewed and renewables

Saddle Ridge Fire

- Remove Barren Ridge Barren Ridge, PCDI, and derate Vic-LA Transmission Lines
- The Saddle Ridge fire is the most severe case, impacting generation across the DWP system

Saddle Ridge Fire - Import Capacity Lost



- Complete loss of Pacific DC Intertie
- Complete loss of south of Barren Ridge Lines (3 lines)
- 2 of 5 lines lost on the VIC-LA path

Import = 1442 MW

In-Basin Generation + (938+951) MW

Net Capacity = 3331 MW

Total Load = 3331 MW

Reliability

Case 1 MWh Short

Year	Month	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
2025	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	363	587	622	438	397	267	18	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2035	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150	131	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	144	951	722	856	816	598	859	358	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The DWP system is short in the afternoon and evening in August and September

Case 2 MWh Short

Year	Month	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
2025	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	686	601	729	411	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	520	640	662	496	166	0	0	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0
	Sep	0	0	0	0	0	0							0	0	0	2	25	47	37	31	20	11	0	0
	Oct	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0							0	0	0	0	0	0	0	0	0	0	0	0
2035	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	101	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	483	453	983	1458	1027	859	358	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The DWP system is short in the afternoon and evening in August and September

Case 3 MWh Short

Year	Month	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
2025	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	218	369	383	180	343	171	3	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	685	601	642	411	0	0	0	0	0
	Sep	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	14	520	640	542	180	0	0	0	0	0
	Oct	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	101	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	483	453	984	1458	1027	859	358	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The DWP system is short in the afternoon and evening in August and September

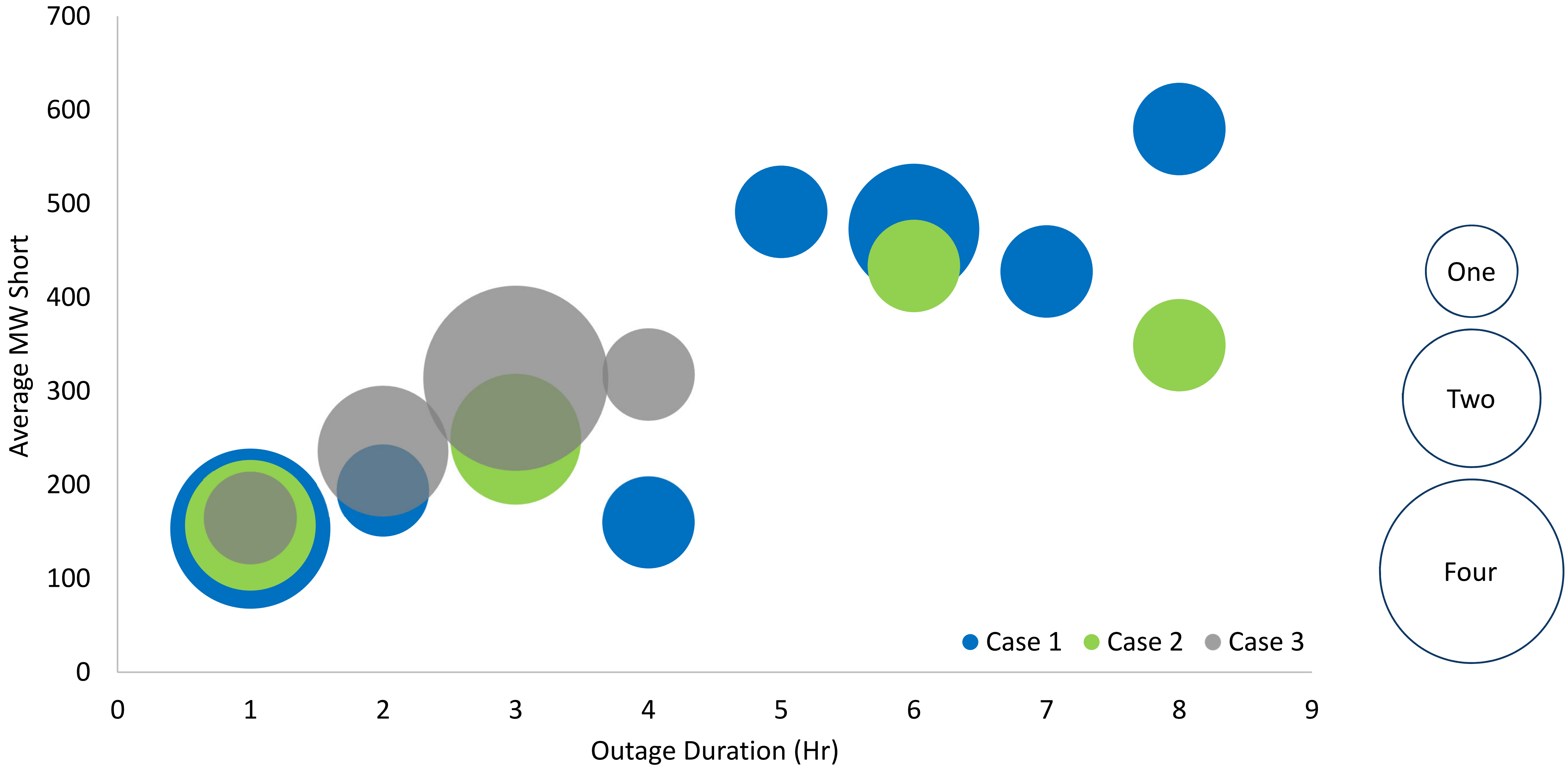
2025 MWh Short

Case	Month	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
Case 1	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	363	587	622	438	397	267	18	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Case 2	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	686	601	729	411	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	520	640	662	496	166	0	0	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Case 3	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	218	369	383	180	343	171	3	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

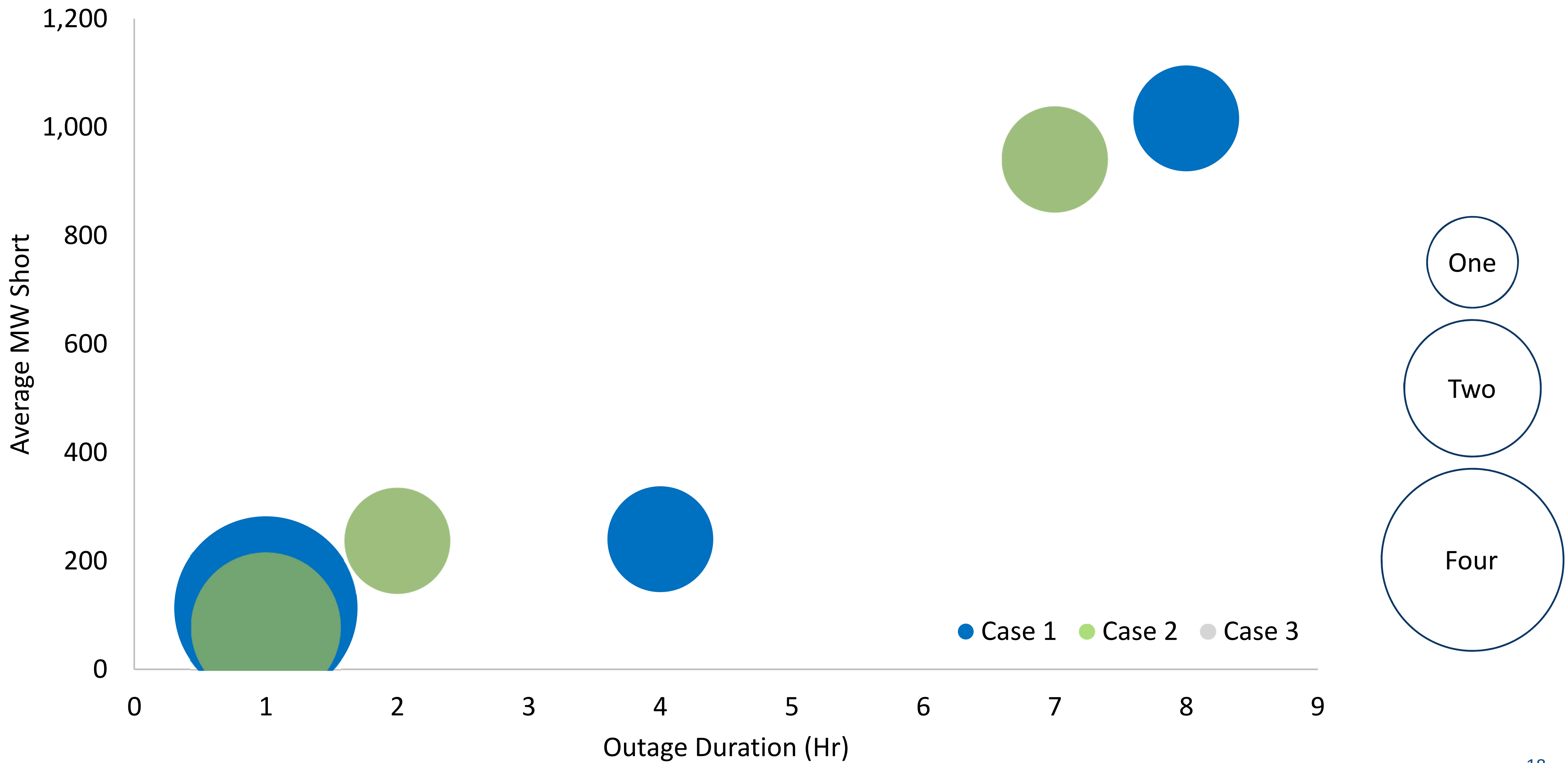
2035 MWh Short

Case	Month	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
Case 1	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150	131	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	144	951	722	856	816	598	859	358	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Case 2	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	101	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	483	453	983	1458	1027	859	358	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Case 3	Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	101	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	483	453	984	1458	1027	859	358	0	0
	Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2025 Core Scenario Reliability



2035 Core Scenario Reliability

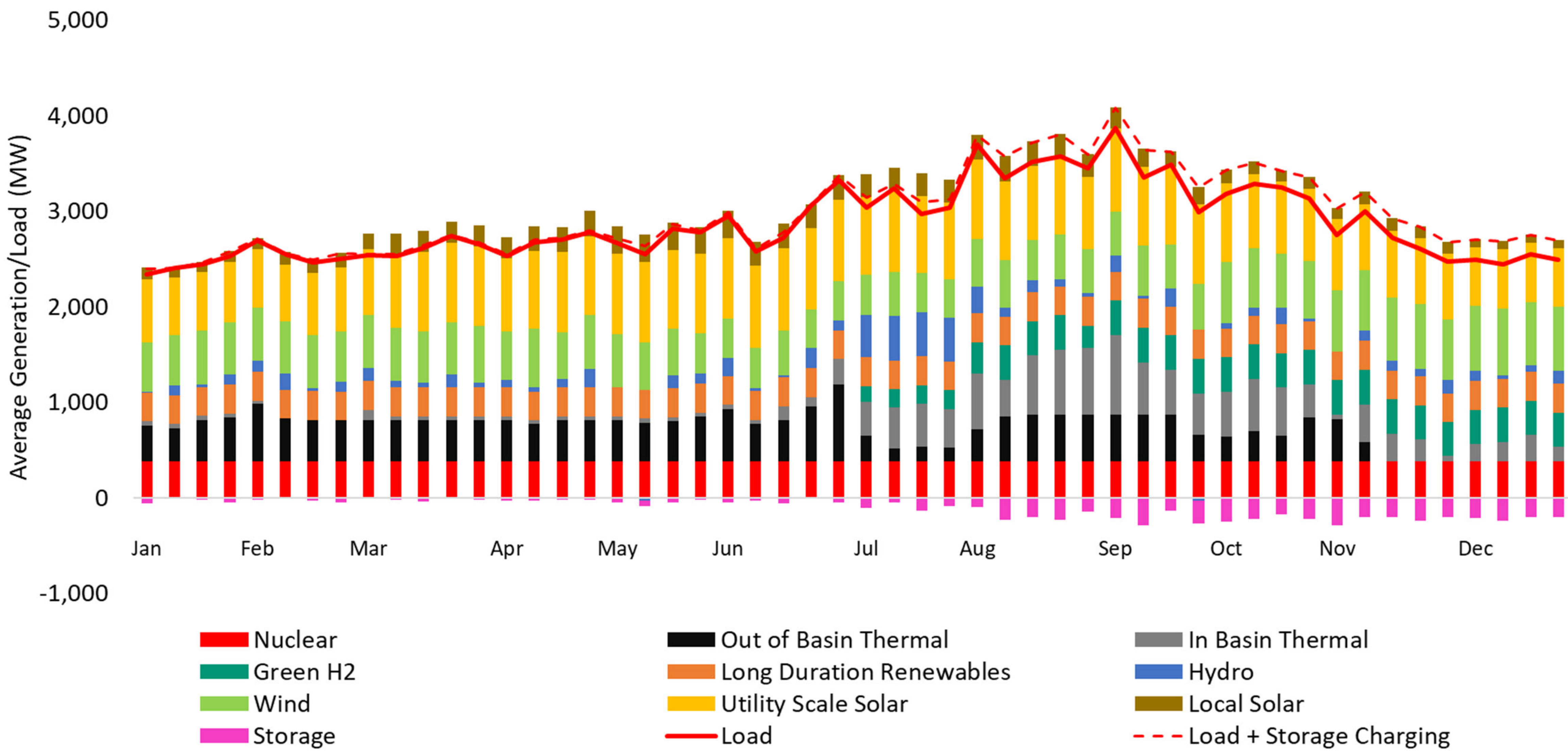


Resiliency

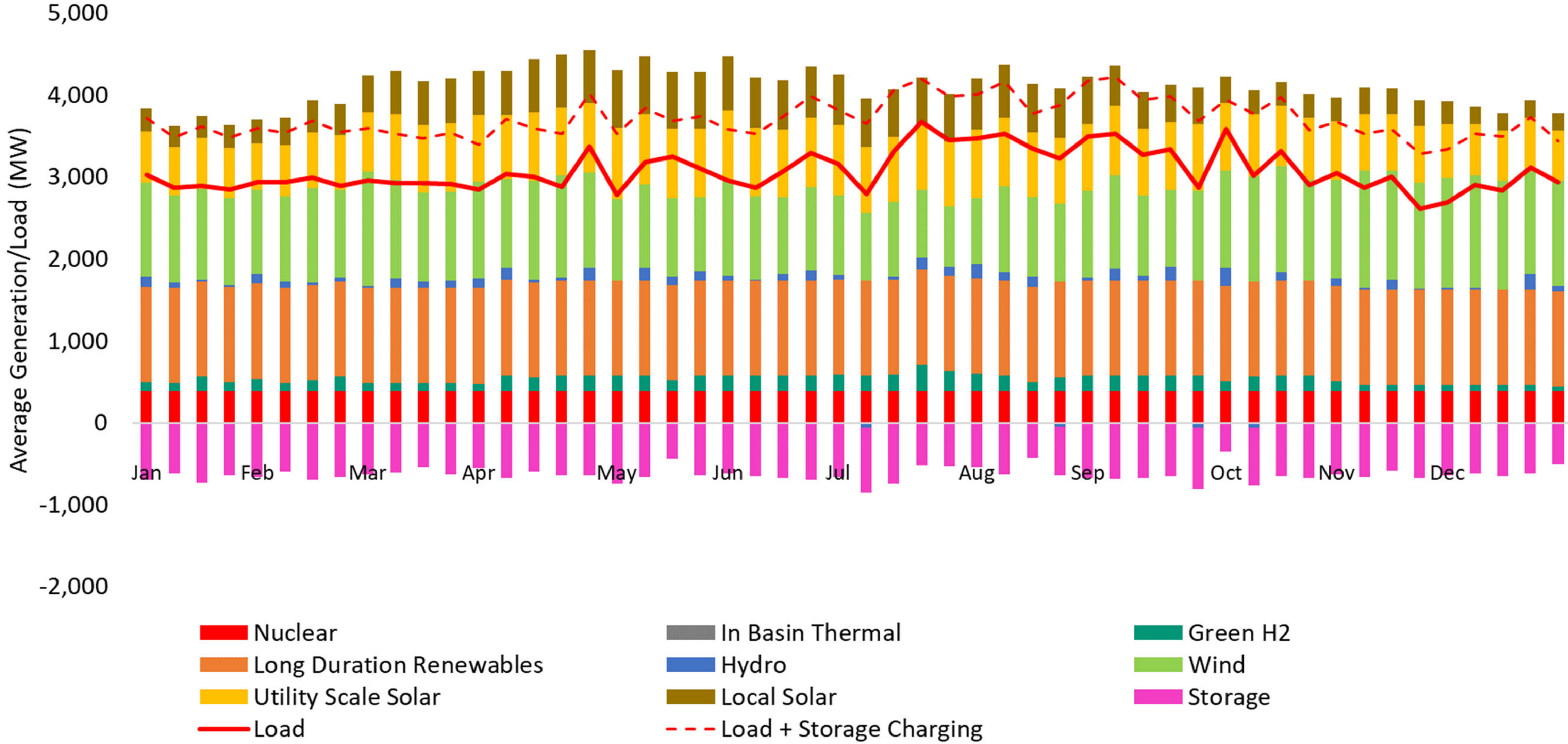
Ascend Analytics

Better models. Better decisions.

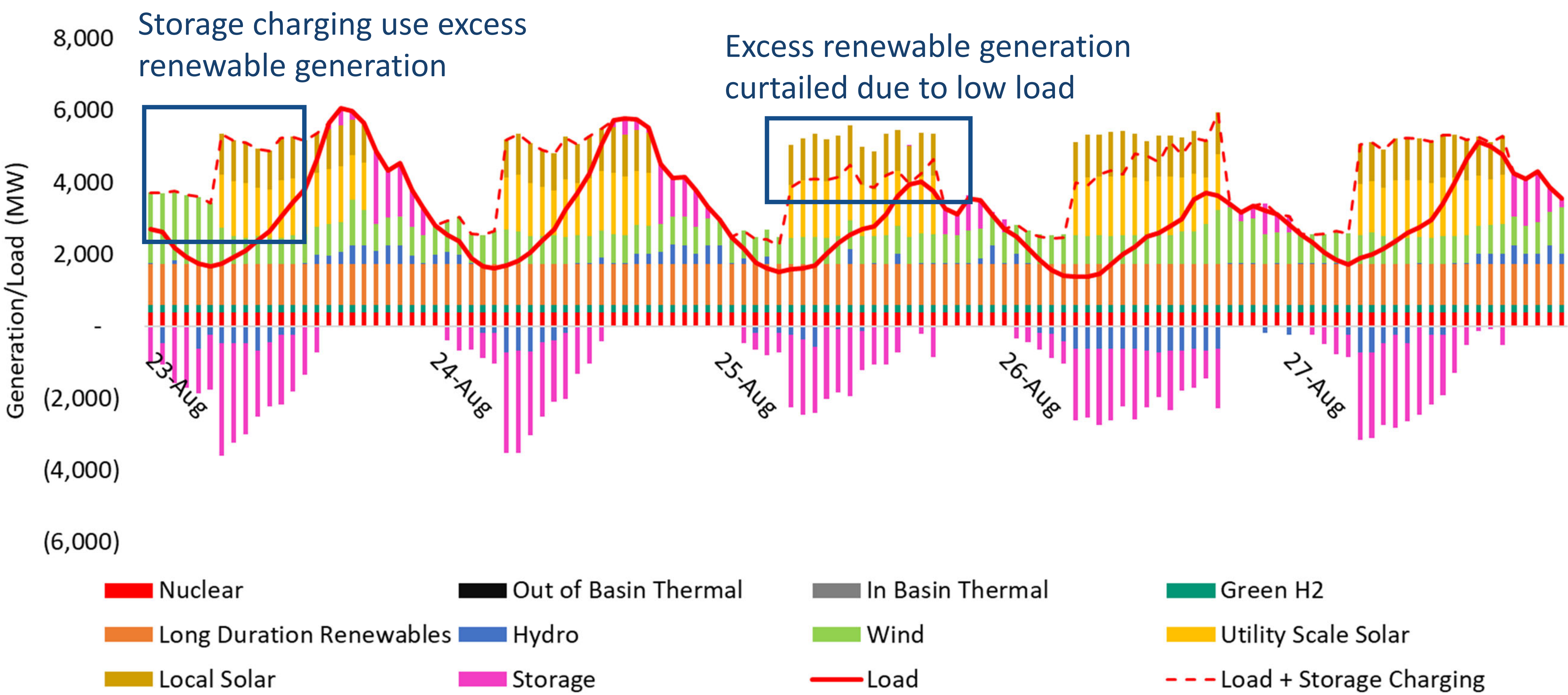
2025 Case 1 Weekly Dispatch



2035 Case 1 Weekly Dispatch



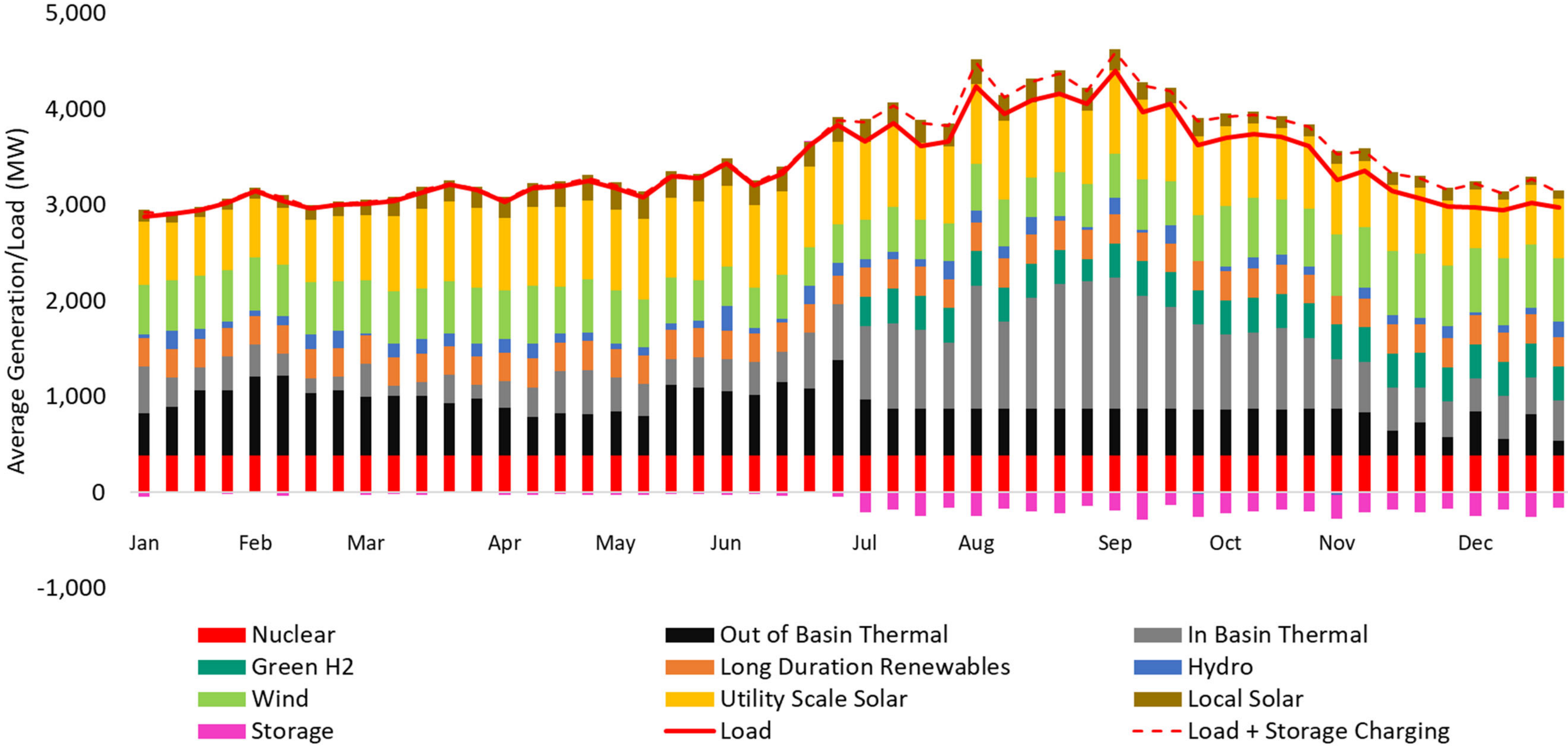
Case 1 2035



Ascend Analytics

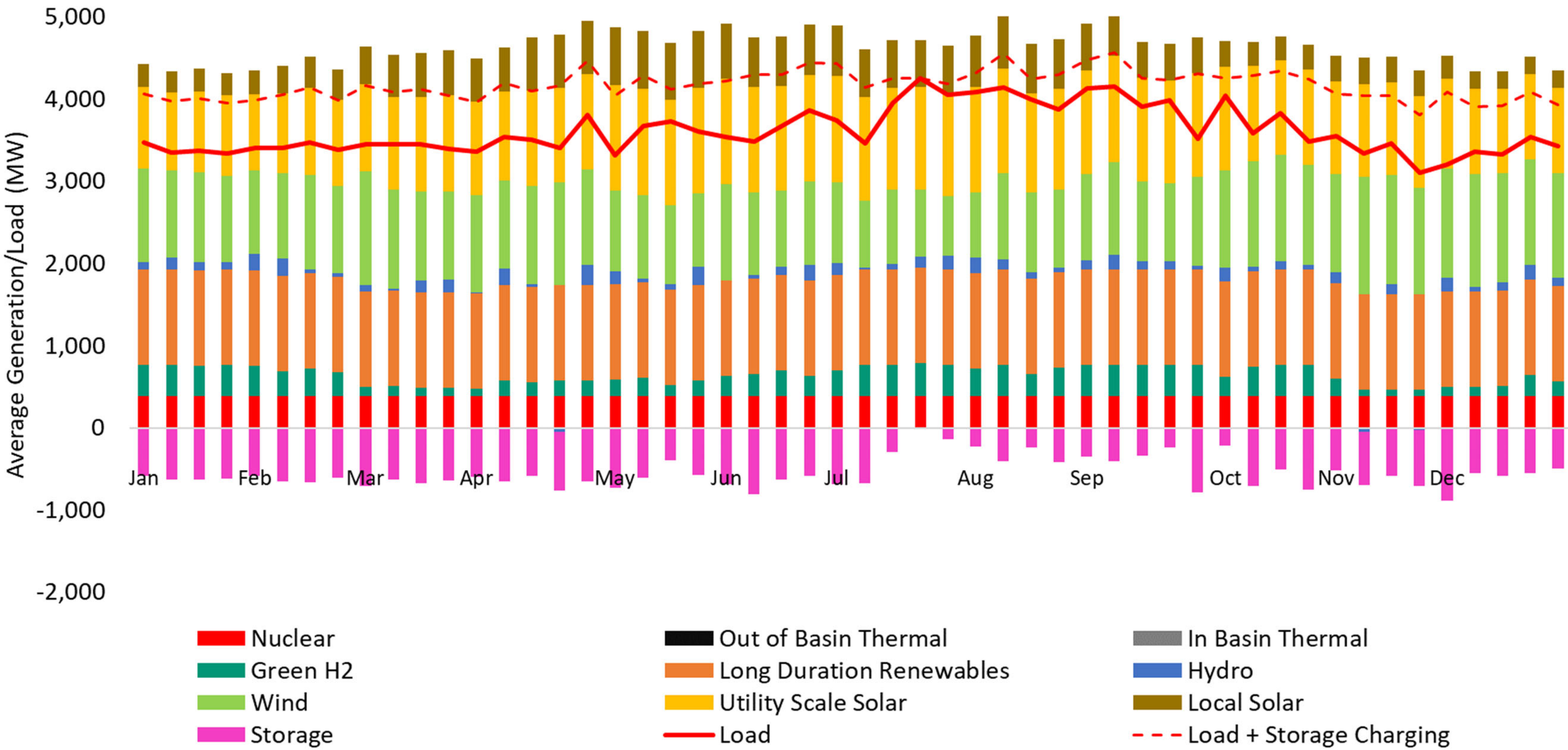
2025 Case 2 Weekly Dispatch

Ascend Analytics

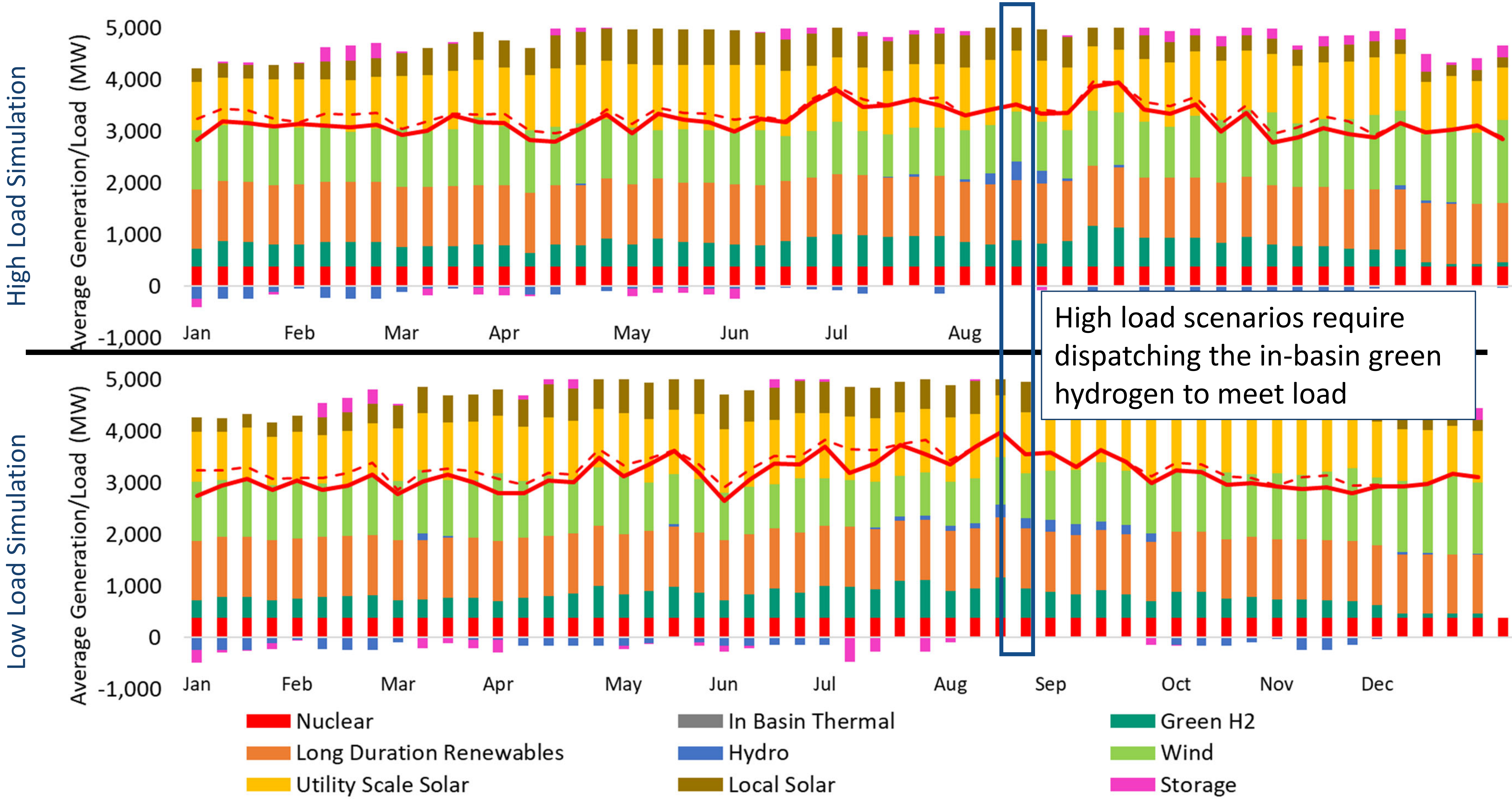


2035 Case 2 Weekly Dispatch

Ascend Analytics



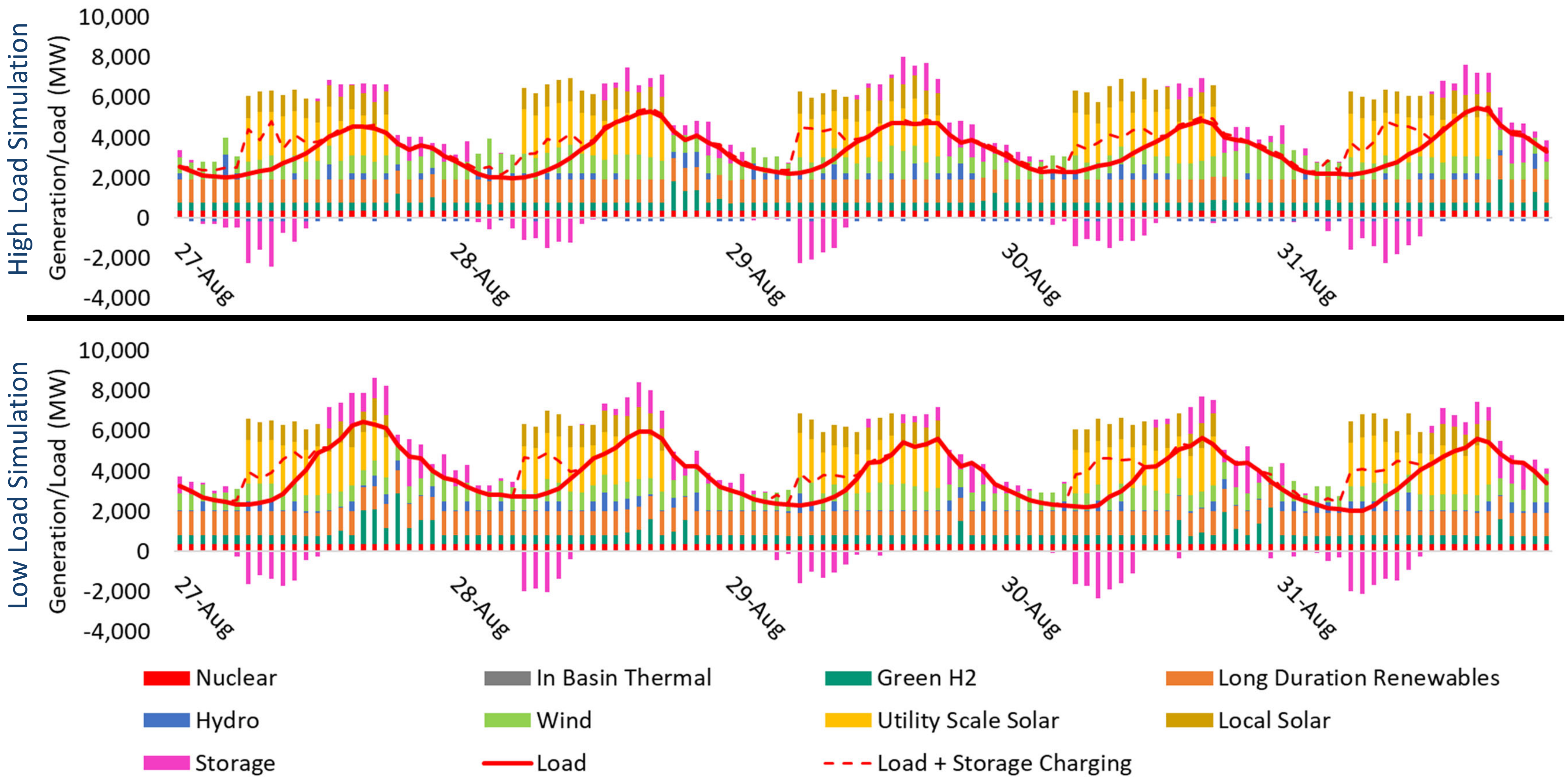
Case 2 – No Barren Ridge 2035



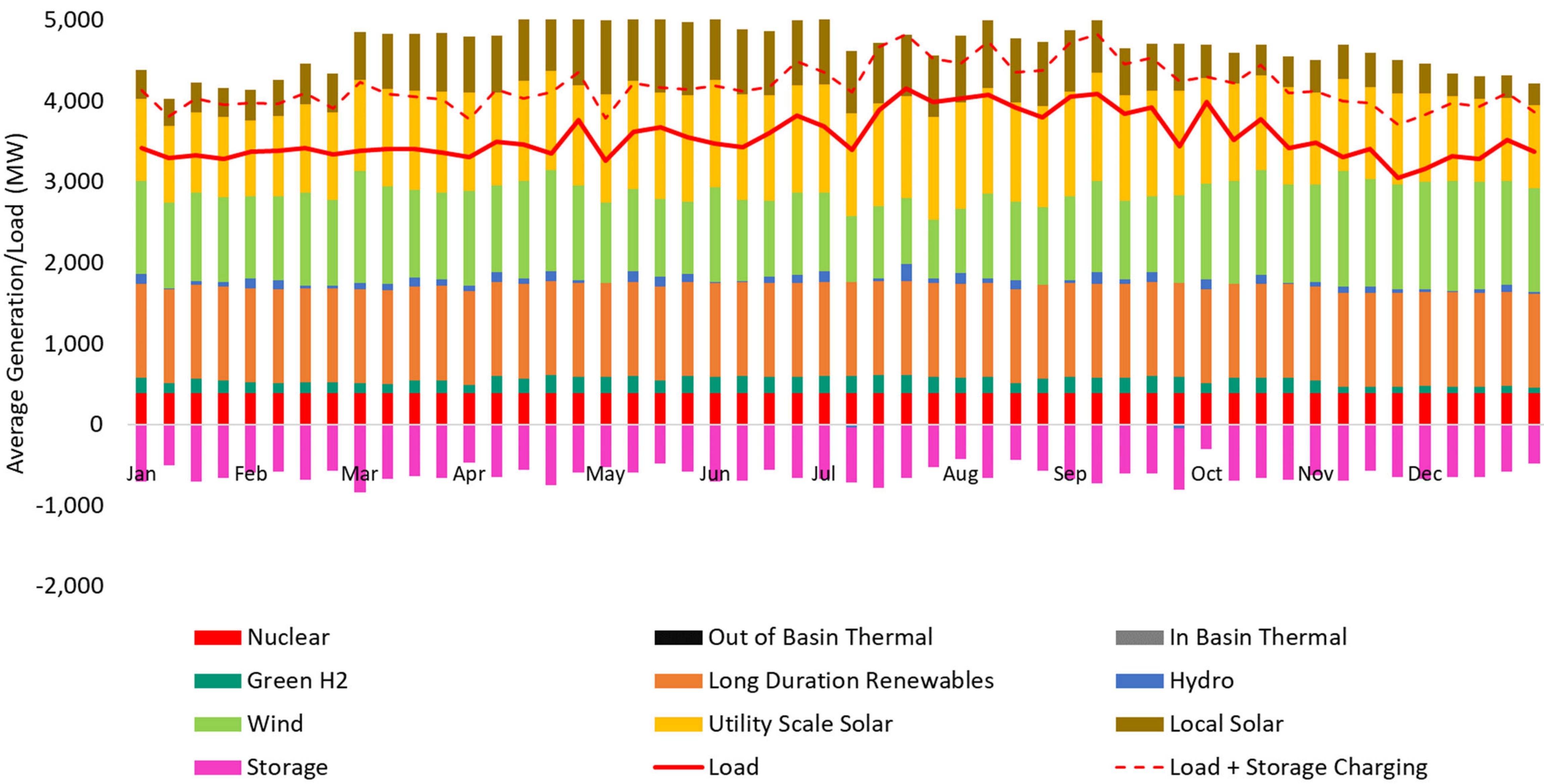
High load scenarios require dispatching the in-basin green hydrogen to meet load

Case 2 – No Barren Ridge 2035

Ascend Analytics

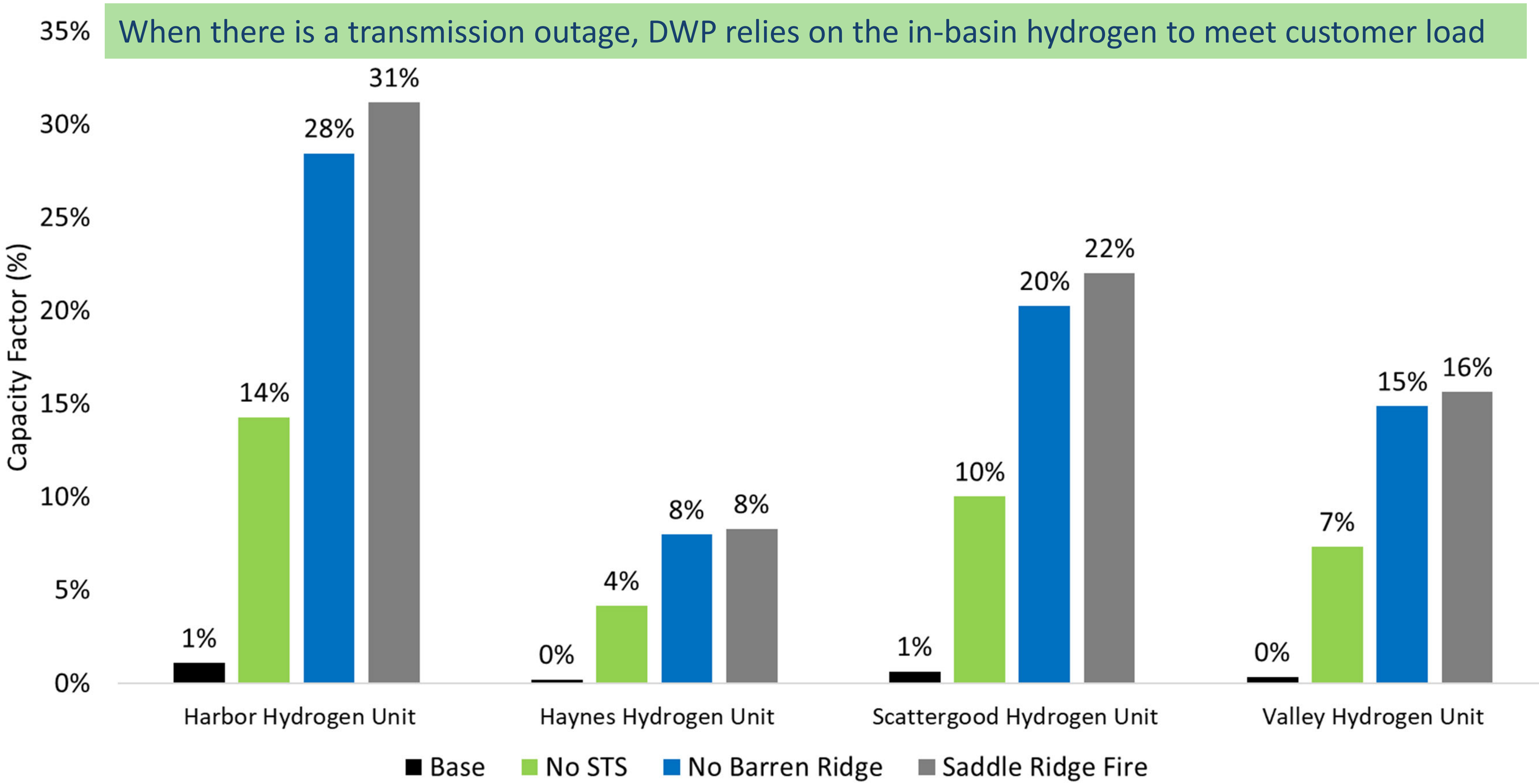


2035 Case 3 Weekly Dispatch



2035 In Basin Green H2 Capacity Factors

Ascend Analytics



Note: Increased capacity factors for extreme events was modeled for an entire year's transmission outage; actual capacity factors would likely be dramatically less based on the duration of the outage (typically consecutive days to weeks), decreasing overall capacity factors

Key Take Aways

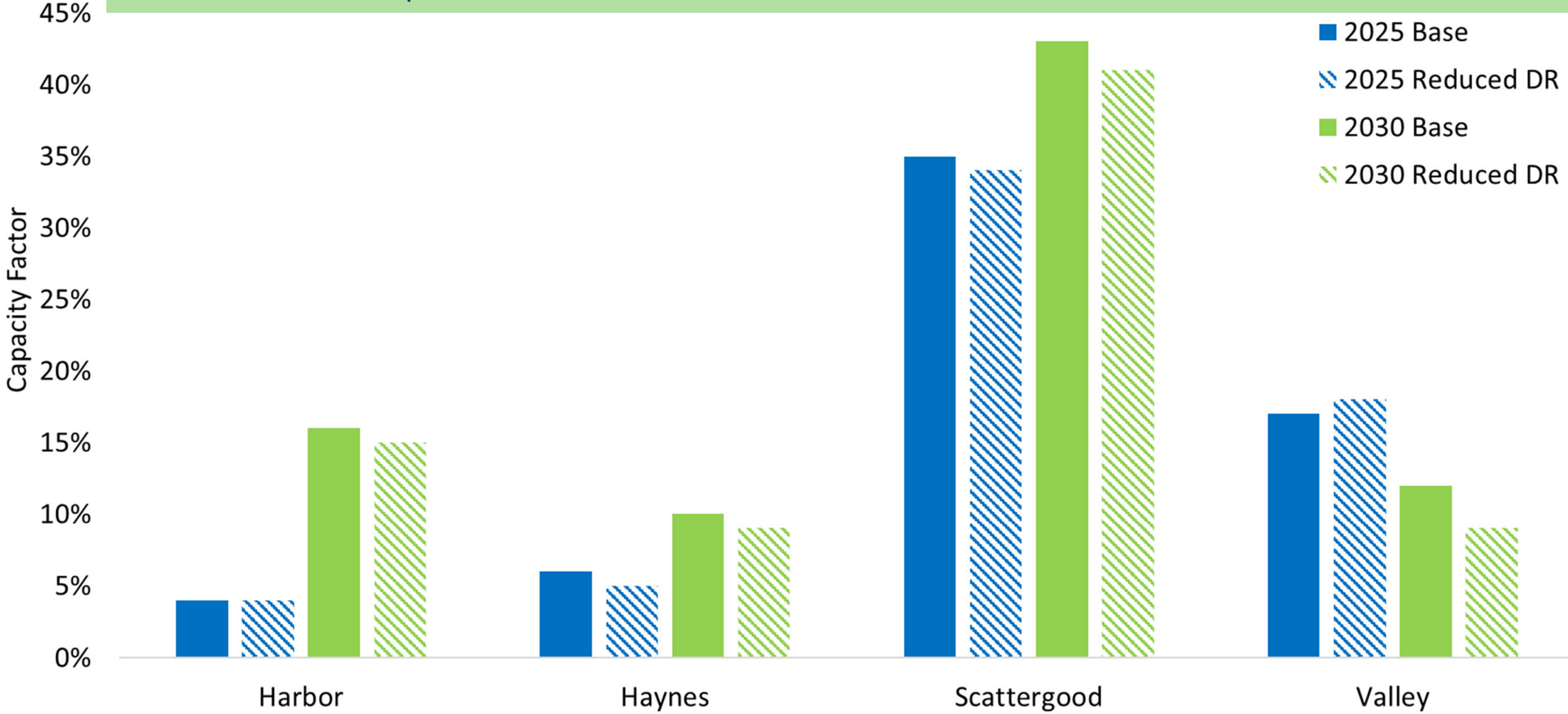
- Dispatchable in-basin capacity plays a key role in meeting customer demand under resiliency scenarios
- To meet the zero carbon goal, DWP will long in energy and will have to curtail during sun up hours
- Seasonal storage of energy will play a key role in effectively utilizing over generation from renewables in the shoulder months

Demand Response Sensitivities

Ascend Analytics
Better models. Better decisions.

Case 1 Demand Response Sensitivity

Additional demand response has a minimal impact on the need for dispatchable generation in 2025 and 2030 and no impact in 2035



Price Sensitivities

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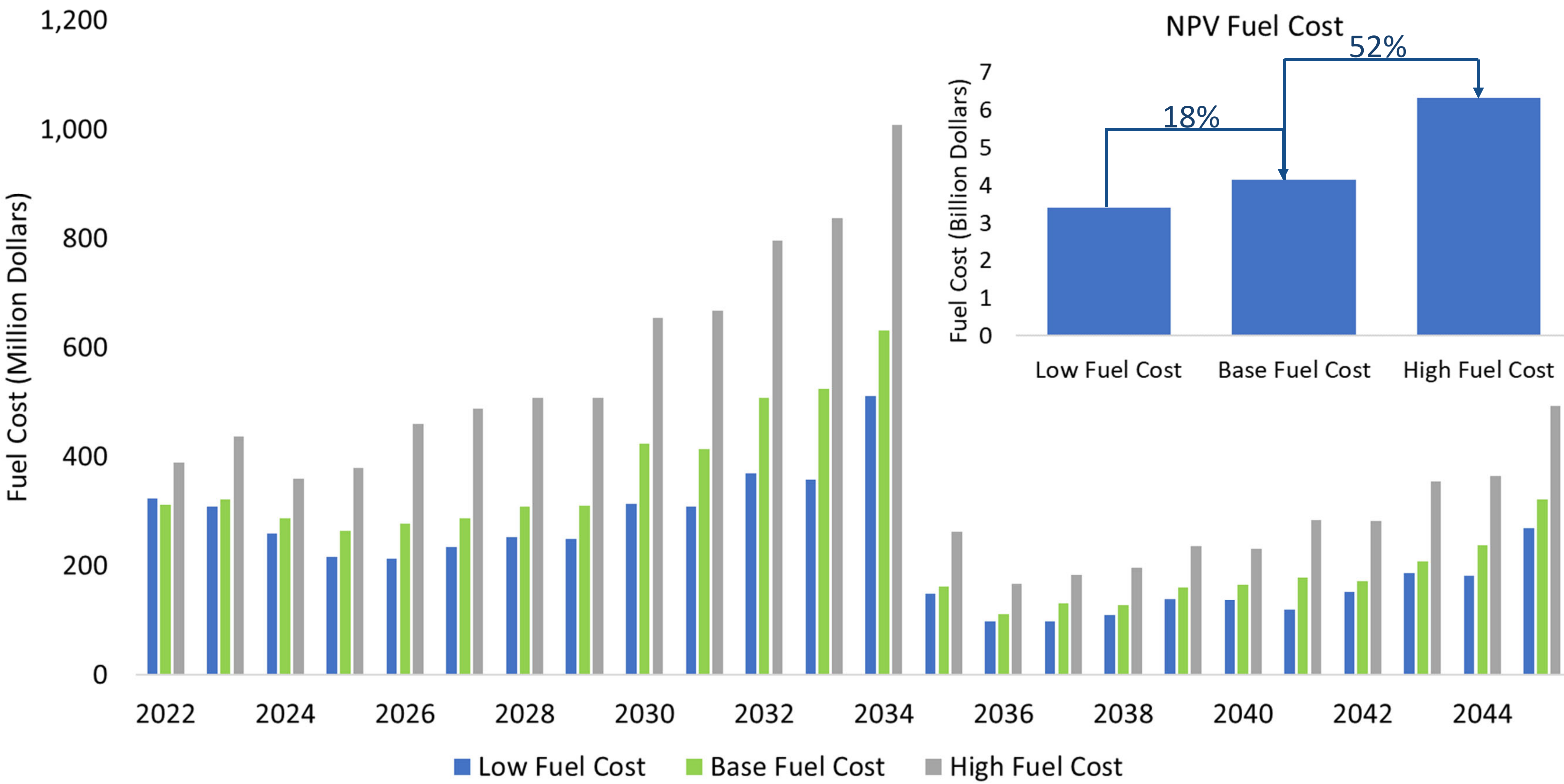
Better models. Better decisions.

Case 2 Fuel Cost Sensitivities



No In-Basin Combustion

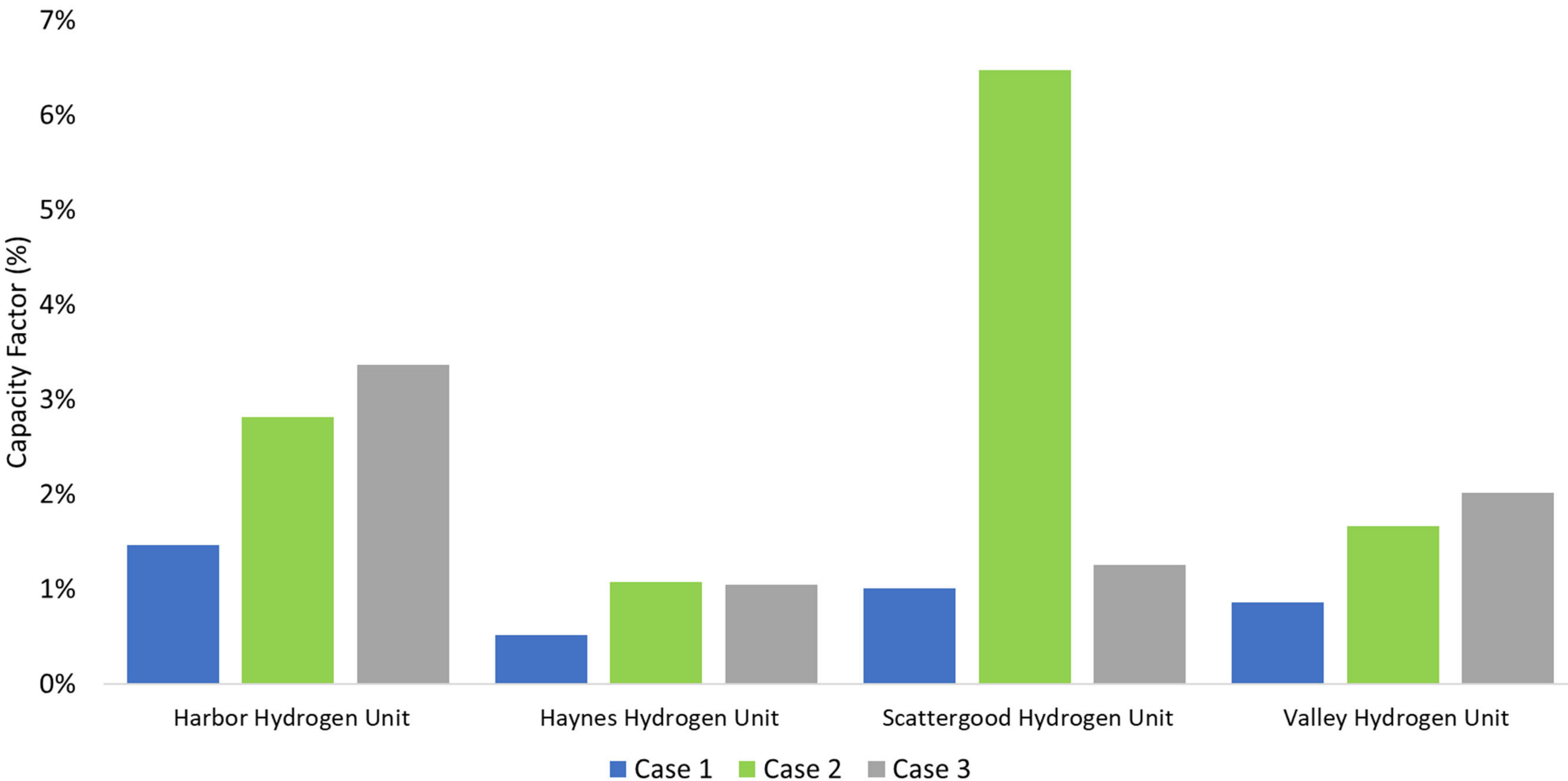
Ascend Analytics
Better models. Better decisions.

No In-Basin Combustion

- The no in-basin combustion cases replace the green hydrogen turbines with hydrogen fuel cells
- Hydrogen fuel cells cost significantly more to build than the turbines
    - Fuel cells are more efficient compared to combustion turbines and therefore reduce fuel costs
- NOx emissions from DWP under the zero carbon scenarios are low in the 2030s and 2040s

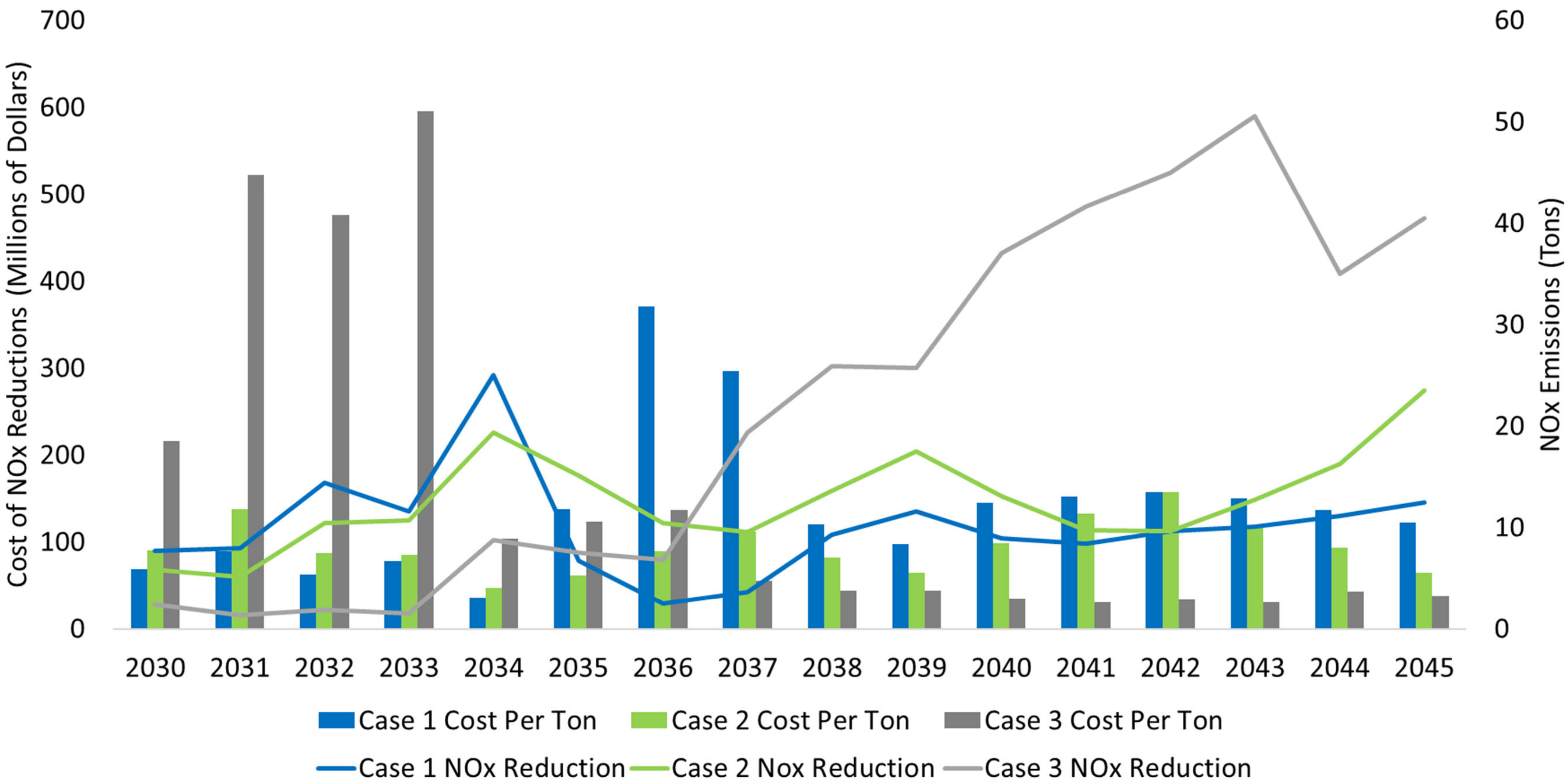
2035 In-Basin Green Hydrogen Capacity Factors

Ascend Analytics



Cost of NOx Reduction

Ascend Analytics



Discussion and Q&A

2022 SLTRP: Breakout Sessions

Joan Isaacson, Kearns & West





2022 SLTRP Core Scenario & Sensitivity Results

Breakout Session Question #1: What are your thoughts on the tradeoffs (cost, reliability, carbon emissions) between Cases 1, 2, and 3 relative to one another or the reference SB100 Case?

Which metrics (tradeoffs) are most important to you and why?

Breakout Session Question #2: What are your initial reaction or impressions from the price, no in-basin combustion (cost and NOx), and demand response sensitivities so far?

Los Angeles Department of Water & Power

2022 SLTRP June Advisory Group Meeting—Breakout Sessions

June 30th, 2022

Breakout Session

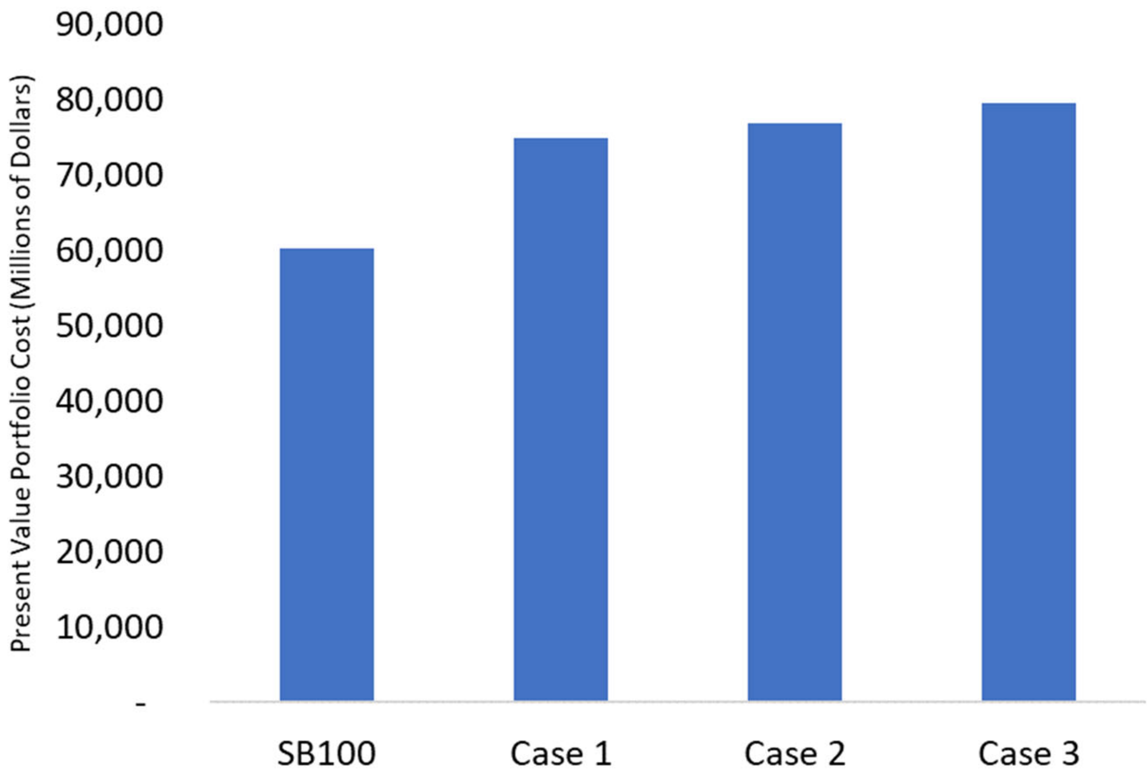
Question 1: What are your thoughts on the trade-offs between Cases 1, 2, and 3 relative to one another or the SB 100 case?

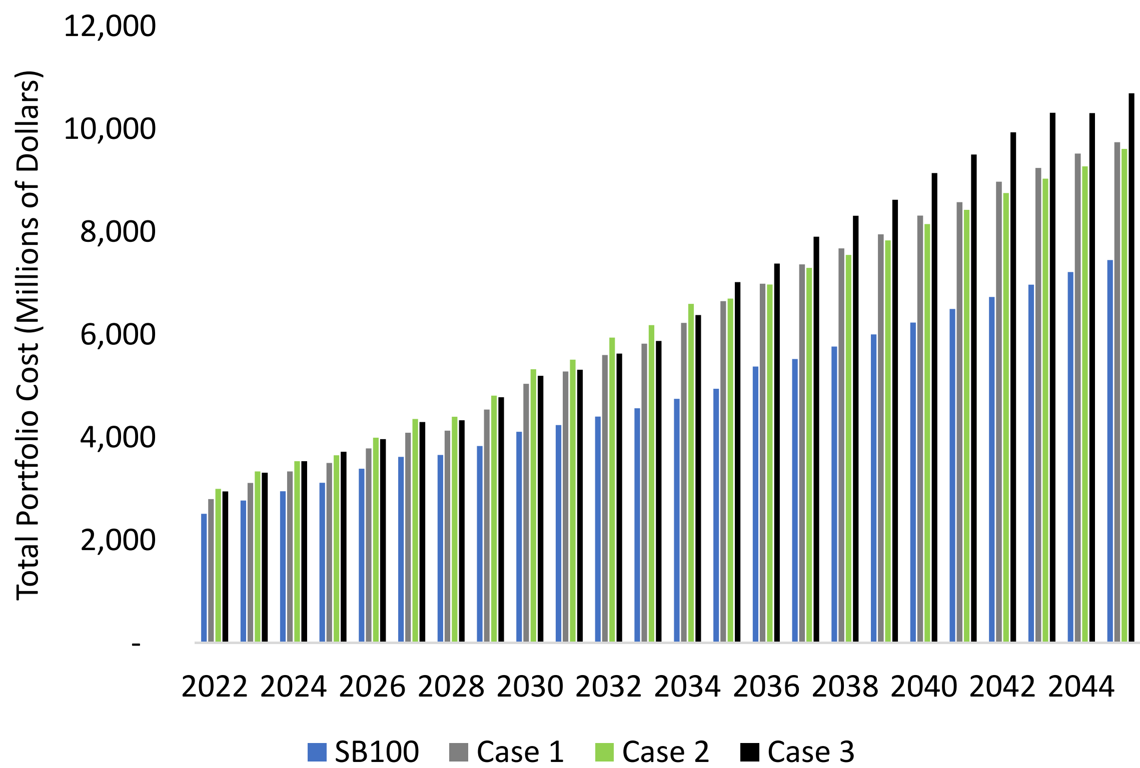
- **System Cost**
- **Carbon Emissions**
- **Reliability**

Question 2: What are your initial reactions or impressions regarding the "Price", "No In-Basin Combustion", and "Demand Response" sensitivities so far?

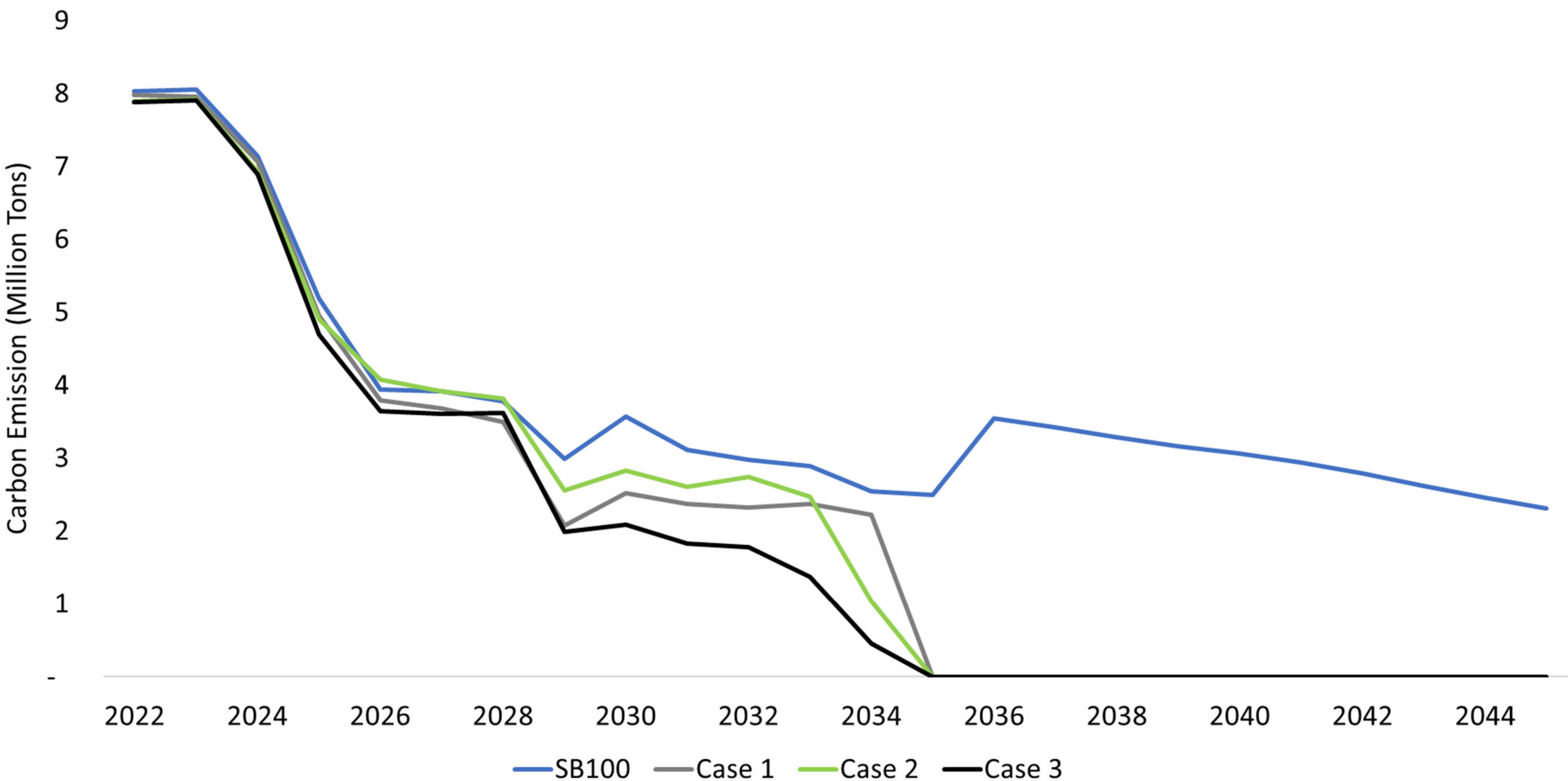
- Price Sensivities
- In-Basin Green Hydrogen Capacity Factors
- NOx Reductions with no in-basin combustion

Power System Cost



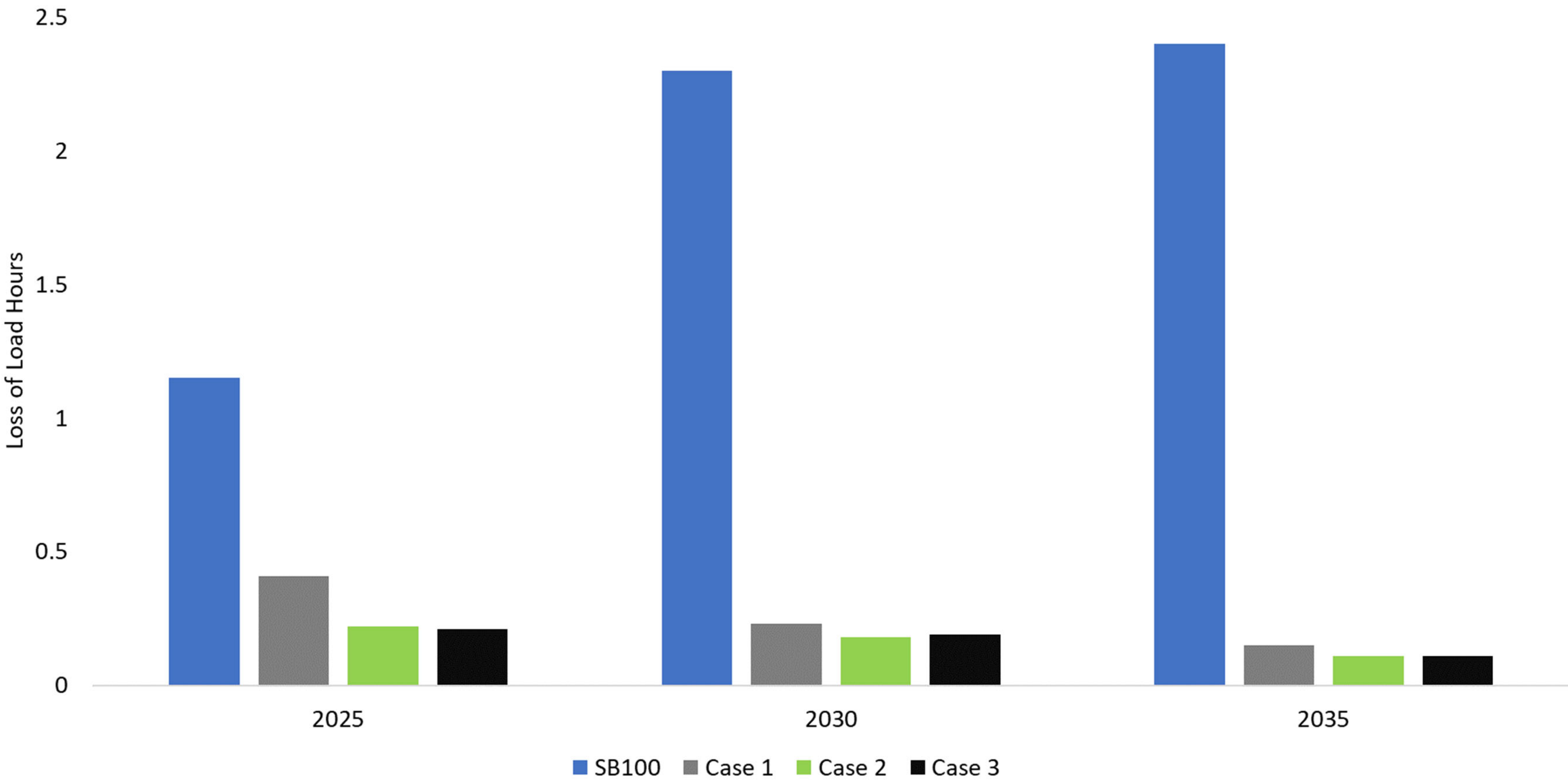


Carbon Emissions



2035 Core Scenario Reliability

Ascend Analytics



Breakout Session

Question 1: What are your thoughts on the trade-offs between Cases 1, 2, and 3 relative to one another or the SB 100 case?

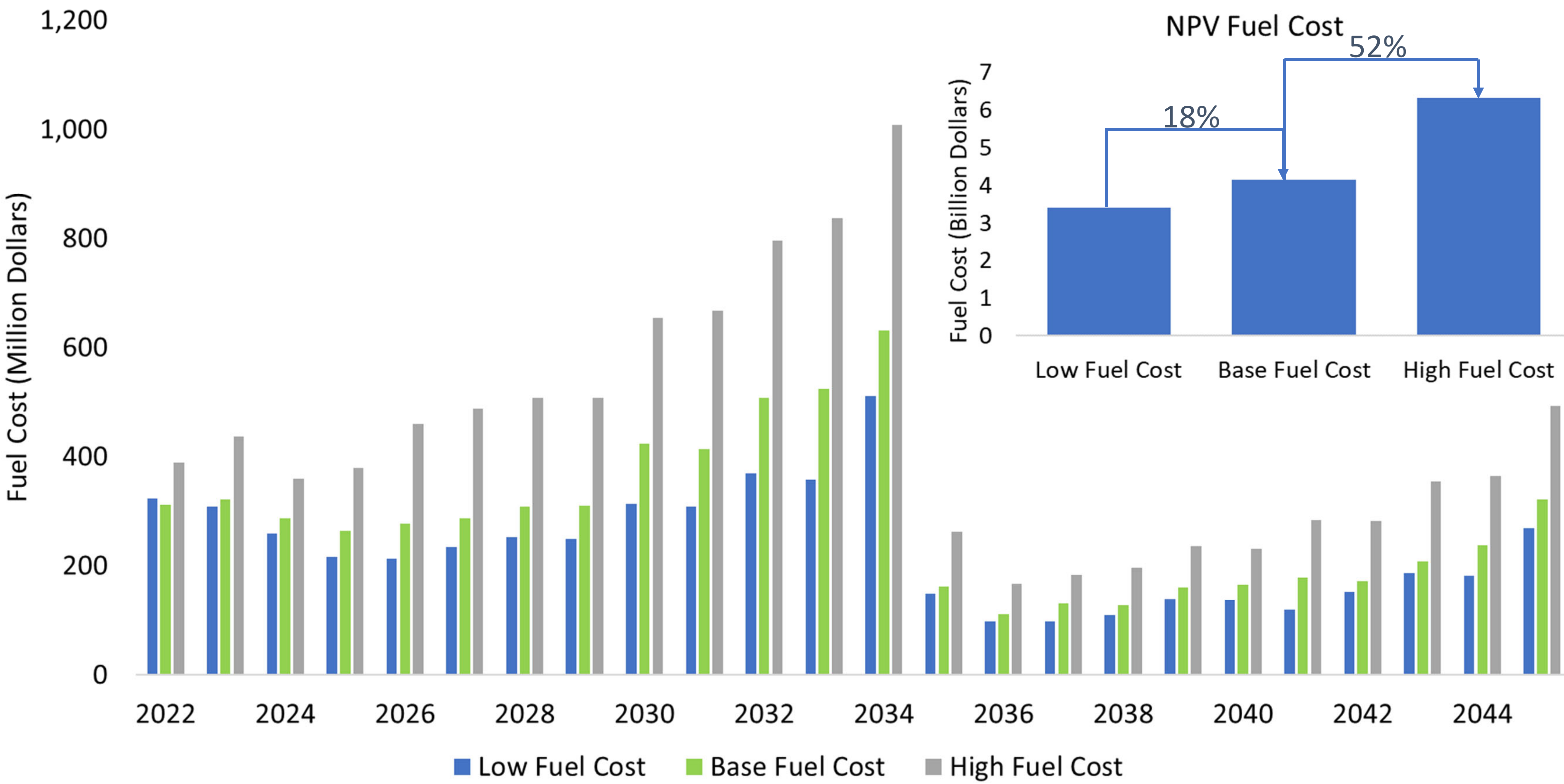
- System Cost
- Carbon Emissions
- Reliability

Question 2: What are your initial reactions or impressions regarding the "Price", "No In-Basin Combustion", and "Demand Response" sensitivities so far?

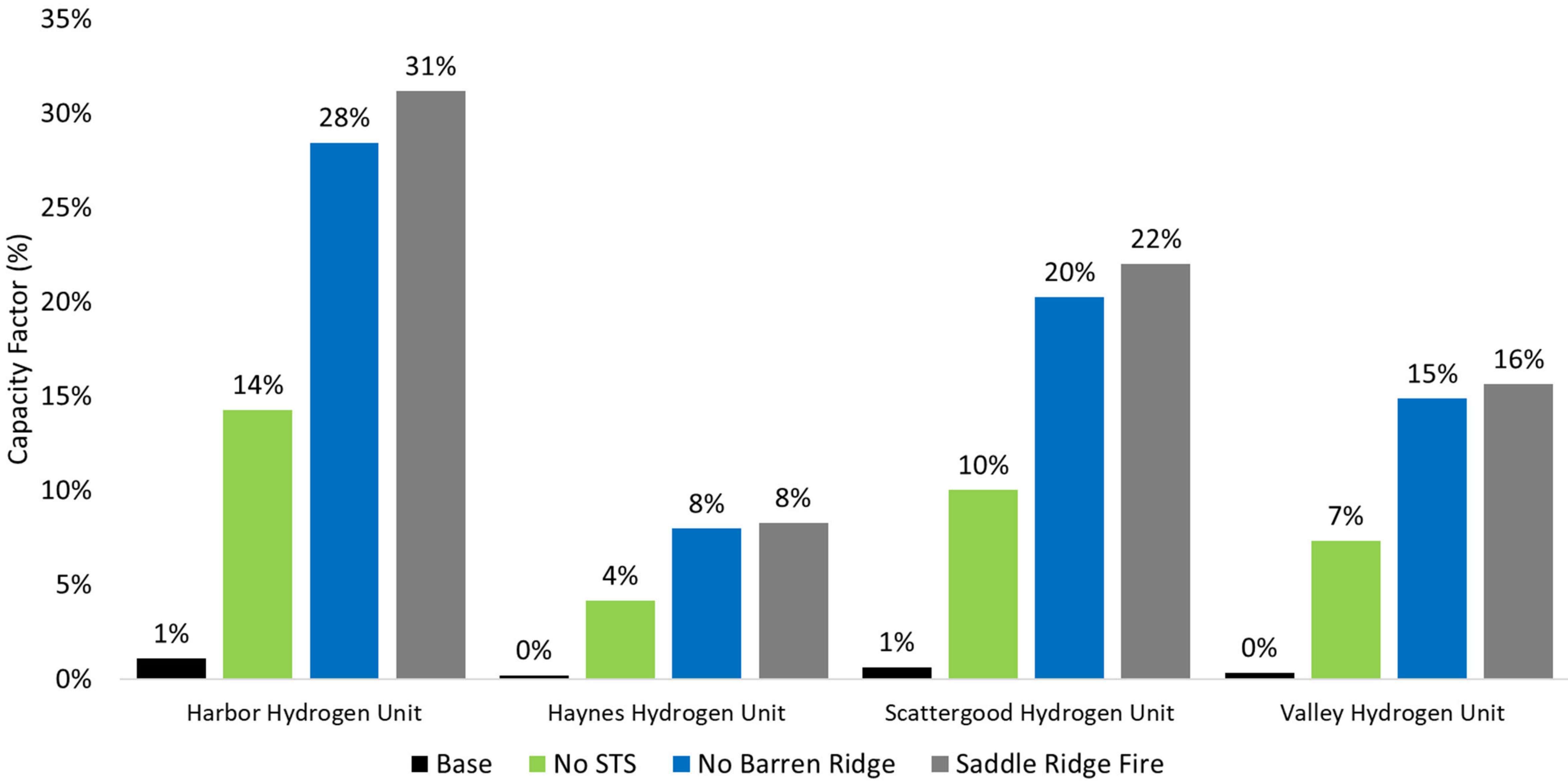
- **Price Sensitivities**
- **In-Basin Green Hydrogen Capacity Factors**
- **NOx Reductions with no in-basin combustion**

Case 2 Fuel Cost Sensitivities

Ascend Analytics

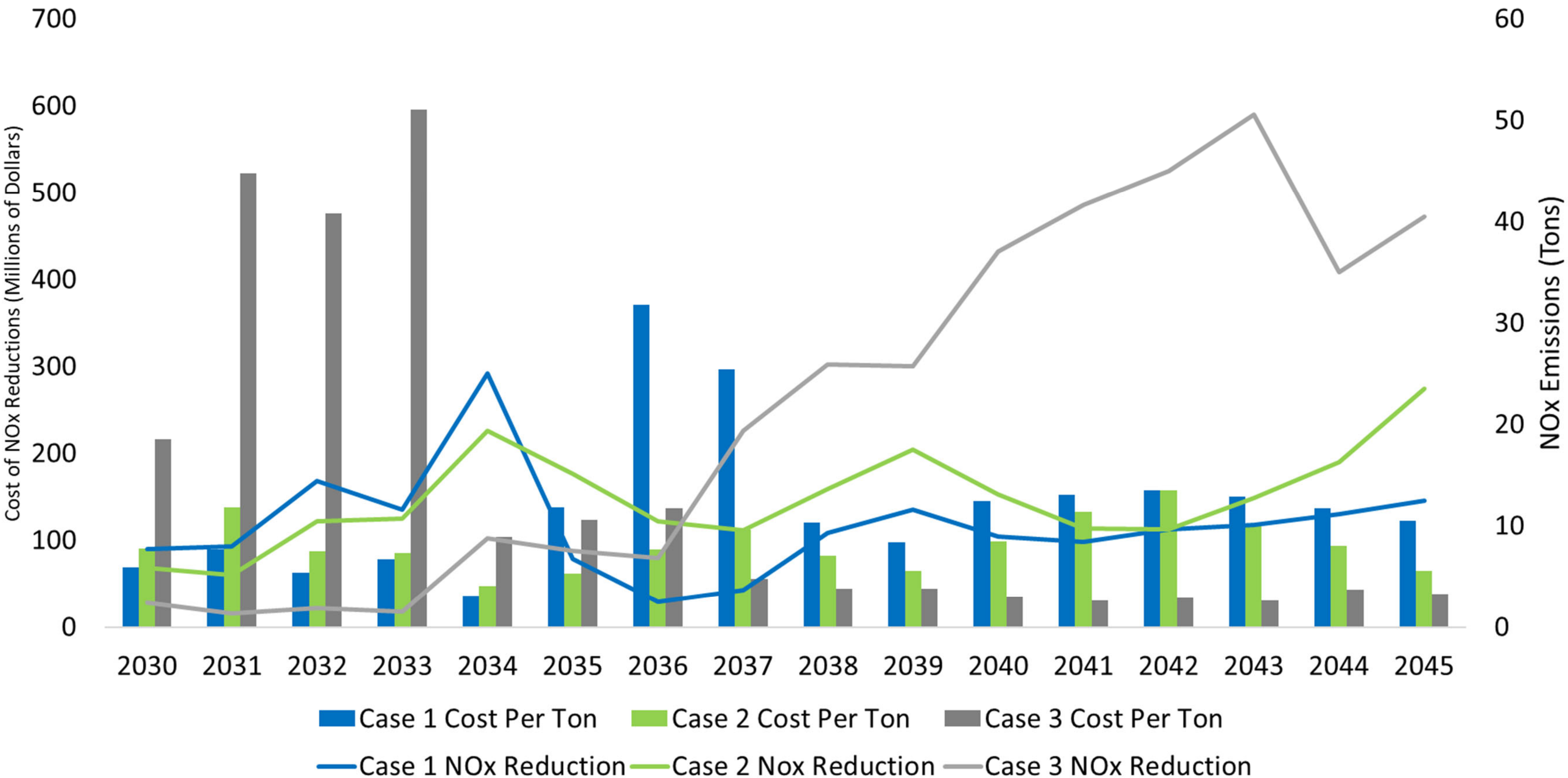


2035 In-Basin Green Hydrogen Capacity Factors



NOx Emissions from In-Basin Green Hydrogen

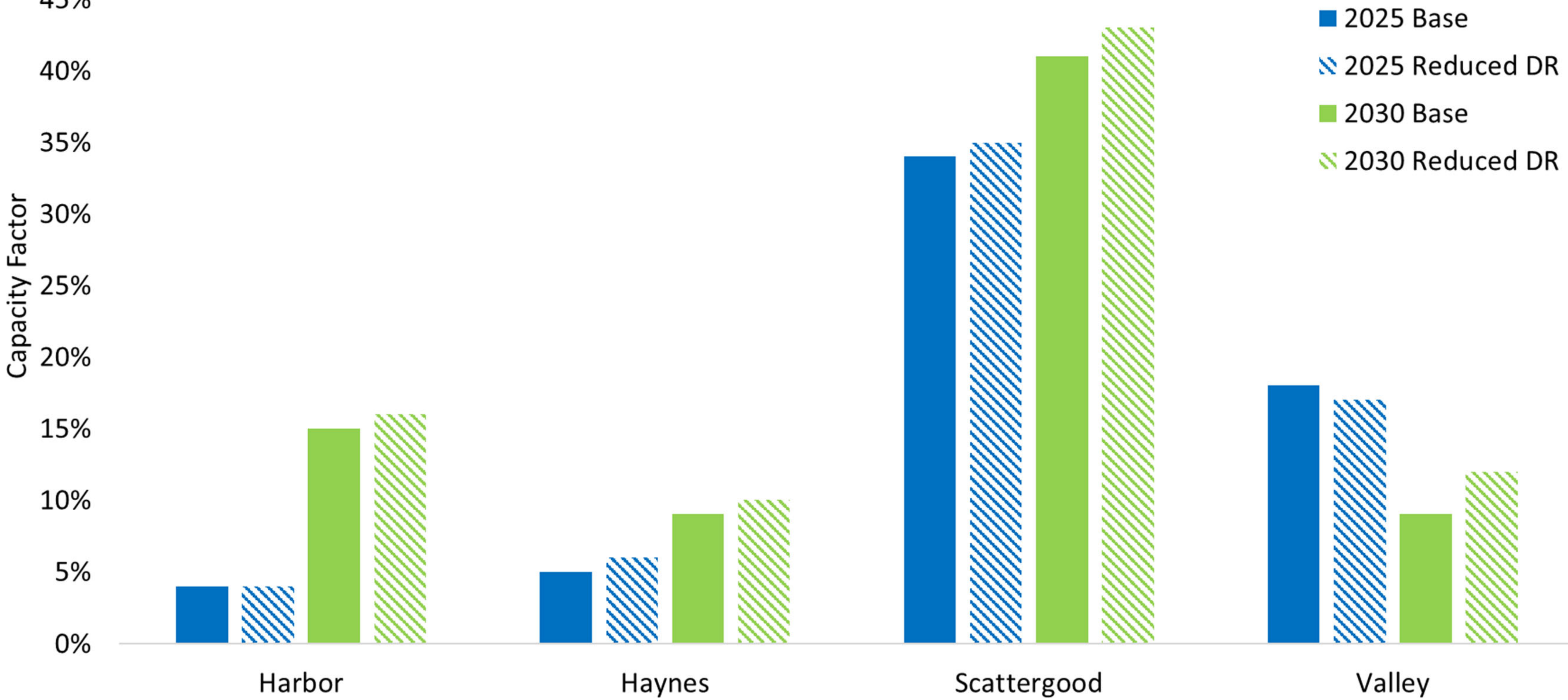
Ascend Analytics



Case 1 Demand Response Sensitivity

Ascend Analytics

Additional demand response has a minimal impact on the need for dispatchable generation in 2025 and 2030 and no impact in 2035



Communications & Public Affairs

- Website: ***ladwp.com/sltrp***
- Email address: ***powerSLTRP@ladwp.com***

LADWP > About Us > Power > Strategic Long-Term Resource Plan

Power

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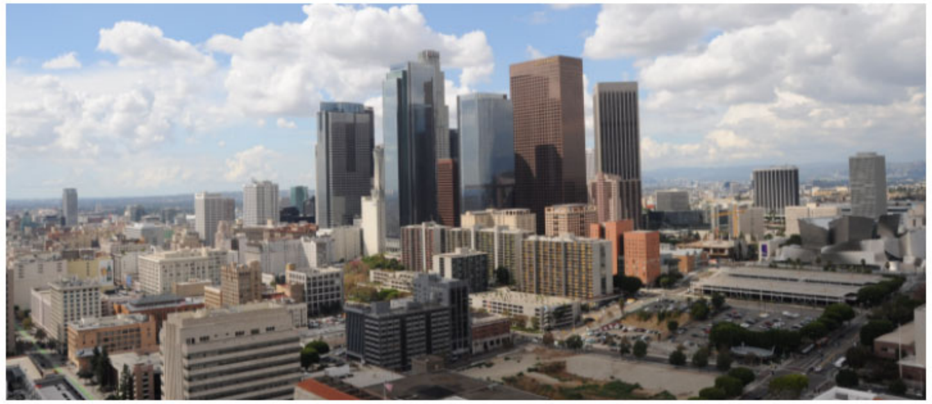
Strategic Long-Term Resource Plan



L.A.'s energy future is guided by the Power Strategic Long-Term Resource Plan (SLTRP), a roadmap for providing reliable and sustainable electricity to our customers with a 25-year planning horizon, while also transitioning to a 100% carbon-free power supply by 2035. The SLTRP is updated periodically and incorporates community input through robust outreach and engagement.

Overview

Developing a robust and actionable power plan is essential for LADWP to achieve a clean energy future for Los Angeles. The Power Integrated Resource Plan (IRP) was expanded into the SLTRP, which has a 25-year horizon that aligns with state goals for greenhouse gas (GHG) emissions reductions. LADWP continues to produce an IRP that is submitted to the California Energy Commission every five years.

Following the results of the LA100 study, the City Council established an accelerated goal for all of the city's electricity to come from zero-carbon energy by 2035, City Council Motion and a Hiring Plan City Council Motion.

\+ **Advisory Group**

− **AG Meetings and Presentations**

Advisory Group Meeting #8 (April 28, 2022)

- SLTRP Agenda Meeting #8
- SLTRP Presentation Meeting #8

Advisory Group Meeting #7 (December 17, 2021)

- SLTRP Meeting Summary AG #7
- SLTRP Agenda Meeting #7
- SLTRP Presentation Meeting #7
- SLTRP Energy Storage Update
- SLTRP LA100 Equity Strategies Overview

Advisory Group Meeting #6 (November 17, 2021)

- SLTRP Meeting Summary AG #6
- SLTRP Agenda Meeting #6
- LA100 Next Steps Scenario Matrix
- SLTRP Presentation Meeting #6
- SLTRP Distribution Automation Meeting #6

Advisory Group Meeting #5 (November 10, 2021)

- SLTRP Meeting Summary AG #5
- SLTRP Meeting #5 Agenda
- 2022 SLTRP Presentation
- LA100 SLTRP NREL Presentation

Wrap Up & Next Meeting

Next Meeting:

August 5 (TBD), 2022(10 am to 12 pm)

Public Outreach Meetings

August 2022

Website: www.ladwp.com/SLTRP

Email: powerSLTRP@ladwp.com