Initial Modeling Results

Austin Energy's Resource, Generation and Climate Protection Plan to 2035

The following pages show data results associated with preliminary modeling efforts for the Resource, Generation and Climate Protection Plan to 2035. ***These results do not reflect a recommendation, and they do not reflect a plan.*** *These results are for informational purposes only.*

All modeling reflects the input assumptions coordinated with the Electric Utility Commission earlier this year.

Customer Driven.
Community Focused.℠

AUSTIN ENERGY'S RESOURCE, GENERATION AND CLIMATE PROTECTION PLAN TO 2035

WHAT DID YOU OBSERVE?

WHAT SURPRISED YOU?

WHAT QUESTIONS DO YOU HAVE?

IF YOU COULD CHANGE SOMETHING AND THEN RE-RUN THE MODEL, WHAT WOULD IT BE?

Reference Guide to Numbered Portfolios

REF #	PORTFOLIO	DESCRIPTION
1	No New Commitments	Existing DSM commitments, no new generation
2	2030 Current Plan	100% Carbon-Free by 2035, 65% Renewables by 2027, existing DSM commitments, REACH on gas
3	Local Gen/Storage + Margin	**575 MW new local peakers and combined cycle starting 2027, 275 MW local storage,** 100% DNV projections*, replace PPAs, Decker/SHEC run through 2035
4	Local Dispatchable + Margin	**1,100 MW new local peakers & combined cycle starting 2027**, 50% DNV projections, REACH on FPP, Decker/SHEC run through 2035
5	Meet Env Goals + Expand DSM	**Retire Decker in 2027**, 100% DNV projections, 100% CF, 65% RE, REACH on gas, retire SHEC 2034
6	Aggressive DSM + Storage + Keep PPAs	**Aggressive DNV projections**, **replace PPAs**,100% CF, REACH on gas, retire Decker/SHEC 2034
7	Aggressive DSM + Storage + 65% RE Goal	**Aggressive DNV projections, 65% RE**, 100% CF, REACH on gas, retire Decker/SHEC 2034
8	Hydrogen-Capable Local Plant	**1,100 MW local hydrogen-capable peakers starting in 2030**, 100% DNV projections, 100% CF, 65% RE, REACH on gas, retire Decker/SHEC 2034
9	Hydrogen + Local Storage	**550 MW local hydrogen peakers, 395 MW local storage**, 100% DNV projections, 100% CF, 65% RE, REACH on gas, retire Decker/SHEC 2034
10	Keep Existing Gas + Local Storage	**Decker/SHEC run past 2035**, **395 MW local storage**, 100% DNV projections, 65% RE, REACH on gas
11	Replace FPP in 2028 w/Gas	**FPP retire end of 2028, 575 MW new local peakers and combined cycle**, 100% DNV projections, 65% RE, REACH on FPP and gas
12	EUC – 1 (Working Group Recs)	**525 MW local storage, 700 MW local solar, 540 MW new EE, 300 MW DR**, **100% RE as % of load,** 100% CF, REACH on gas, retire Decker/SHEC 2034
13	EUC – 2	**925 MW local storage**, aggressive DNV projections,100% RE as % of load, 100% CF, REACH on gas, retire Decker/SHEC 2034

*DNV projections refers to the quantities of Demand-Side Management (Demand Response, Energy Efficiency, and Local Solar) resulting from the market potential study performed by DNV Energy Insights

Portfolio	Net Cost 20-yr NPV ($MM)	2035 Bill Impact ($/Month)	2035 Energy Burden (%)	Total Liquidity Need ($MM)	2035 Reliability Risk Events 4+ Hours (Count)	2035 Reliability Risk Hours (Hours)	Total CO_2 Emissions (Million Metric Tons)	Total NOx Emissions (Metric Tons)	Total SOx Emissions (Metric Tons)	Total PM Emissions (Metric Tons)
1	$9,771	$38	3.7%	$1,291	9	165	14	1596	49	389
2	$13,026	$67	4.5%	$1,685	17	2,204	6	589	8	152
3	$8,659	$33	3.5%	$424	0	0	27	3016	88	761
4	$7,336	$21	3.2%	$365	0	0	40	8978	1036	869
5	$13,029	$68	4.5%	$1,657	20	2,115	6	599	7	153
6	$12,913	$68	4.5%	$1,643	25	2,141	6	584	4	150
7	$13,053	$69	4.5%	$1,445	24	2,136	6	573	4	148
8	$10,629	$43	3.8%	$653	0	3	9	1730	20	259
9	$11,665	$55	4.1%	$961	20	438	8	1355	17	235
10	$12,155	$56	4.1%	$549	4	41	6	650	4	554
11	$9,273	$35	3.6%	$359	0	0	25	5267	562	167
12	$13,244	$75	4.7%	$1,111	55	1,369	4	440	0	114
13	$14,315	$81	4.9%	$1,313	56	2,449	4	457	1	118

Portfolio	Net Cost 20-yr NPV	2035 Bill Impact	2035 Energy Burden	Total Liquidity Need	2035 Reliability Risk Events 4+ hours	2035 Reliability Risk Hours	Total CO_2 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM Emissions
1	4	4	4	8	6	6	10	9	10	10
2	9	8	8	13	7	12	5	5	7	5
3	2	2	2	3	1	1	12	11	11	12
4	1	1	1	2	1	1	13	13	13	13
5	10	10	10	12	8	9	6	6	6	6
6	8	9	9	11	11	11	4	4	3	4
7	11	11	11	10	10	10	3	3	3	3
8	5	5	5	5	1	4	9	10	9	9
9	6	6	6	6	8	7	8	8	8	8
10	7	7	7	4	5	5	7	7	3	11
11	3	3	3	1	1	1	11	12	12	7
12	12	12	12	7	12	8	1	1	1	1
13	13	13	13	9	13	13	2	2	2	2

Ranks each portfolio 1-13 (1 = best, 13 = worst) within each output metric column

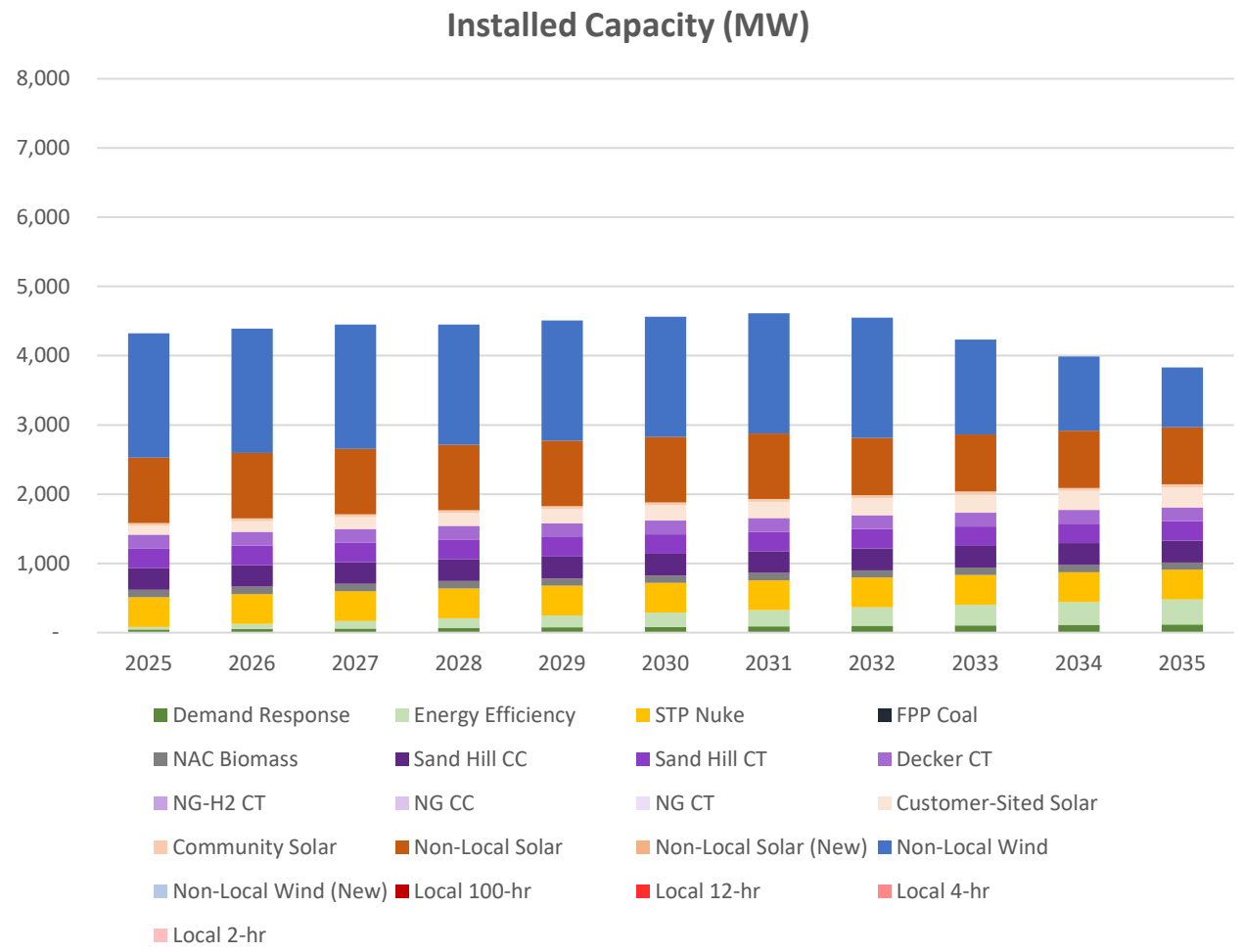
Portfolio	1 - No New Commit-ments	2 - 2030 Current Plan	3 - Local Gen/ Storage + Margin	4 - Local Dispatch-able + Margin	5 - Meet Env Goals + Expand DSM	6 - Aggressive DSM + Local Storage and Maintain Current RE Levels	7 - Aggressive DSM + Local Storage and Meet 65% RE Goal	8 - Hydrogen	9 - Hydrogen + Storage	10 - Keep Existing Gas + Storage	11 - Replace FPP in 2028 w/ Gas	12 - EUC-Workgroup Recs	13 - EUC-Increase Batteries
RESOURCES													
Non-Local Solar (New)		700	118		700	118	700	700	700	700	700	1000	1000
Non-Local Wind (New)		1100	932		1100	932	1100	1100	1100	1100	1100	1500	1500
NG CC			225	600							225		
NG CT			350	500							350		
NG-H2 CT								1100	550				
Local 2-hr			25			25	25		25	25		25	25
Local 4-hr			100			100	100		100	100		200	360
Local 12-hr			150			150	150		150	150		300	540
Local 100-hr						120	120		120	120			
Decker CT	200		200	200						200	200		
Sand Hill CC	315		315	315						315	315		
Sand Hill CT	280		280	280						280	280		
FPP Coal													
STP Nuke	430	430	430	430	430	430	430	430	430	430	430	430	430
NAC Biomass	105	105	105	105	105	105	105	105	105	105	105	105	105
Non-Local Wind	864	864	864	864	864	864	864	864	864	864	864	864	864
Non-Local Solar	826	826	826	826	826	826	826	826	826	826	826	826	826
Customer-Sited Solar	290	290	371	330	371	439	439	371	371	371	371	640	371
Community Solar	42	42	60	51	60	60	60	60	60	60	60	60	60
Demand Response	120	120	270	195	270	325	325	270	270	270	270	300	270
Energy Efficiency	360	360	360	360	360	360	360	360	360	360	360	540	360

Portfolio #1 – No New Commitments

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$7,934/ $9,771	4
2035 Bill Increase ($/Month)	$38	4
Liquidity Risk	$1.3B	8
Reliability Risk Hours (2035)	165	6
Total CO_2 (Million Metric Tons)	14.3	10
Total NOx (Metric Tons)	1,596	9

- FPP Retires: 2024
- Decker/SHEC Retire: Past 2035
- New Local Solar* (MW): 332
- New Local Storage (MW): 0
- New Local Gas (MW): 0
- DSM Projection: Existing commitments
- RE Goal: Not included
- 100% Carbon-Free Goal : No

*includes existing commitments

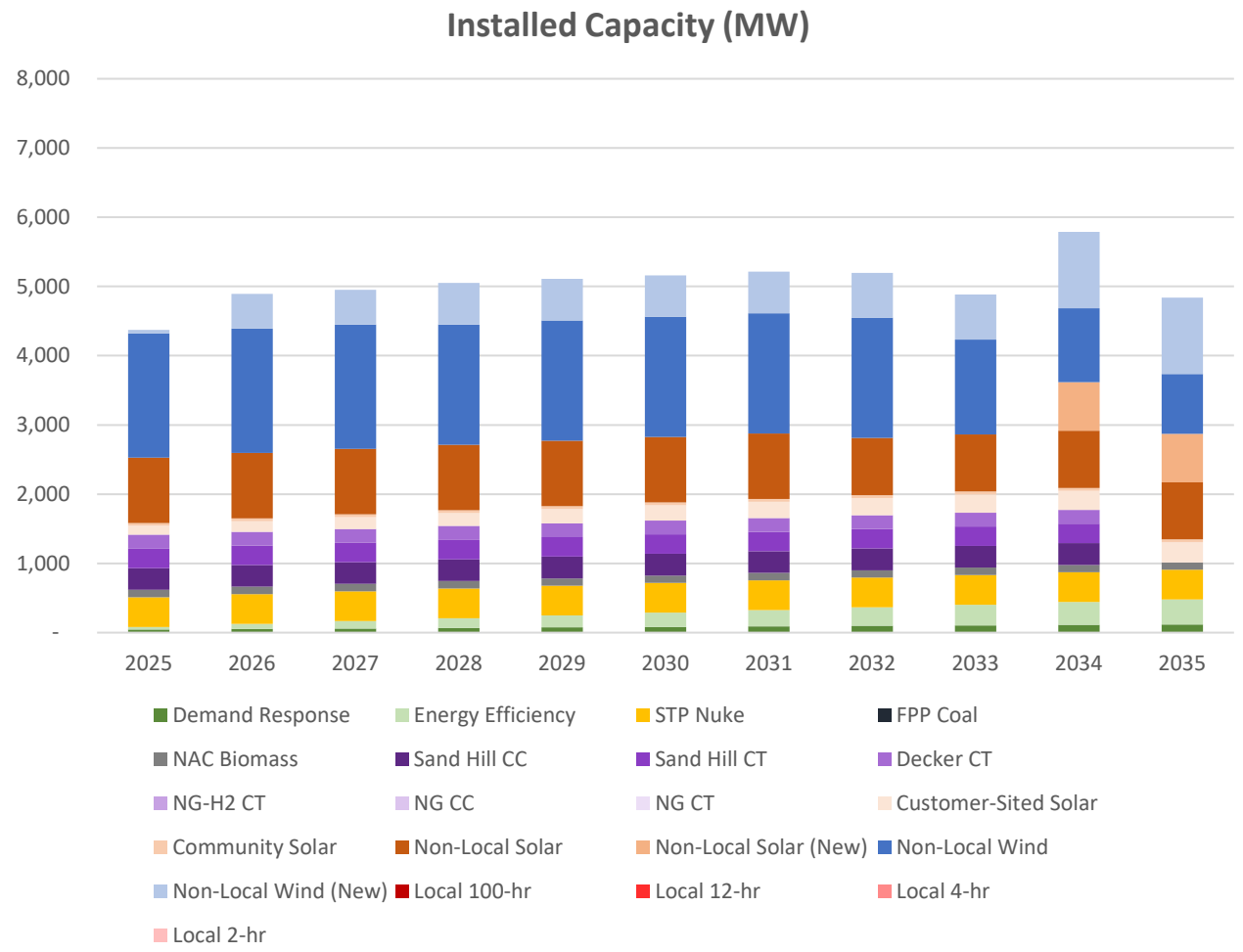


Portfolio #2 – Meet 2030 Plan

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$10,509/ $13,026	9
2035 Bill Increase ($/Month)	$67	8
Liquidity Risk	$1.69B	13
Reliability Risk Hours (2035)	2,204	12
Total CO_2 (Million Metric Tons)	5.8	5
Total NOx (Metric Tons)	589	5

- FPP Retires: 2024
- Decker/SHEC Retire: 2034
- New Local Solar* (MW): 332
- New Local Storage (MW): 0
- New Local Gas (MW): 0
- DSM Projection: Existing commitments
- RE Goal: 65%
- 100% Carbon-Free Goal: Yes

*includes existing commitments

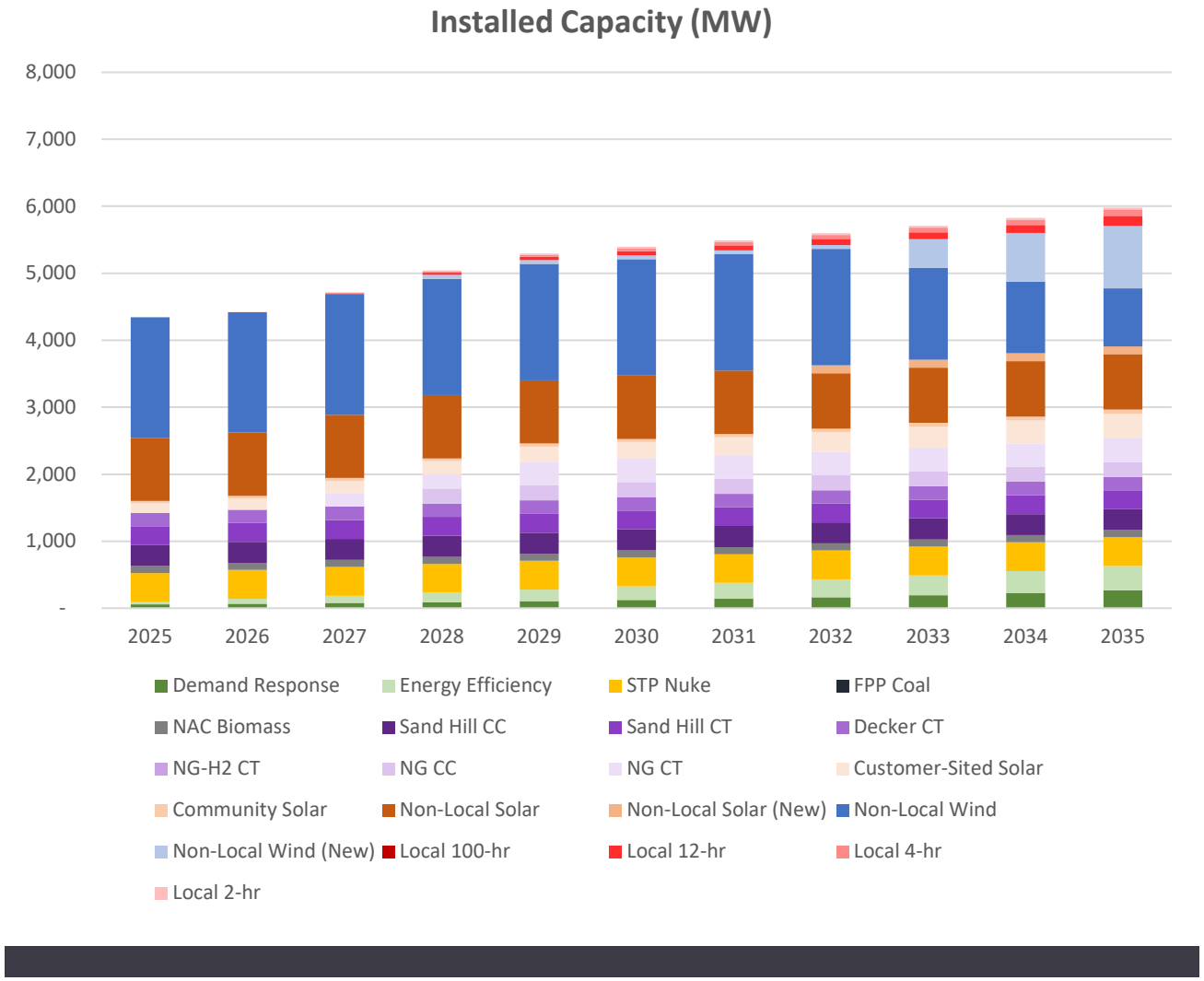


Portfolio #3 – Local Gen/Storage + Margin

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$7,628/ $8,659	2
2035 Bill Increase ($/Month)	$33	2
Liquidity Risk	$424M	3
Reliability Risk Hours (2035)	0	1
Total CO_2 (Million Metric Tons)	26.6	12
Total NOx (Metric Tons)	3,016	11

- FPP Retires: 2024
- Decker/SHEC Retire: Past 2035
- New Local Solar* (MW): 431
- New Local Storage (MW): 275
- New Local Gas (MW): 575
- DSM Projection: DNV Study
- RE Goal: Replace PPAs
- 100% Carbon-Free Goal: No

*includes existing commitments

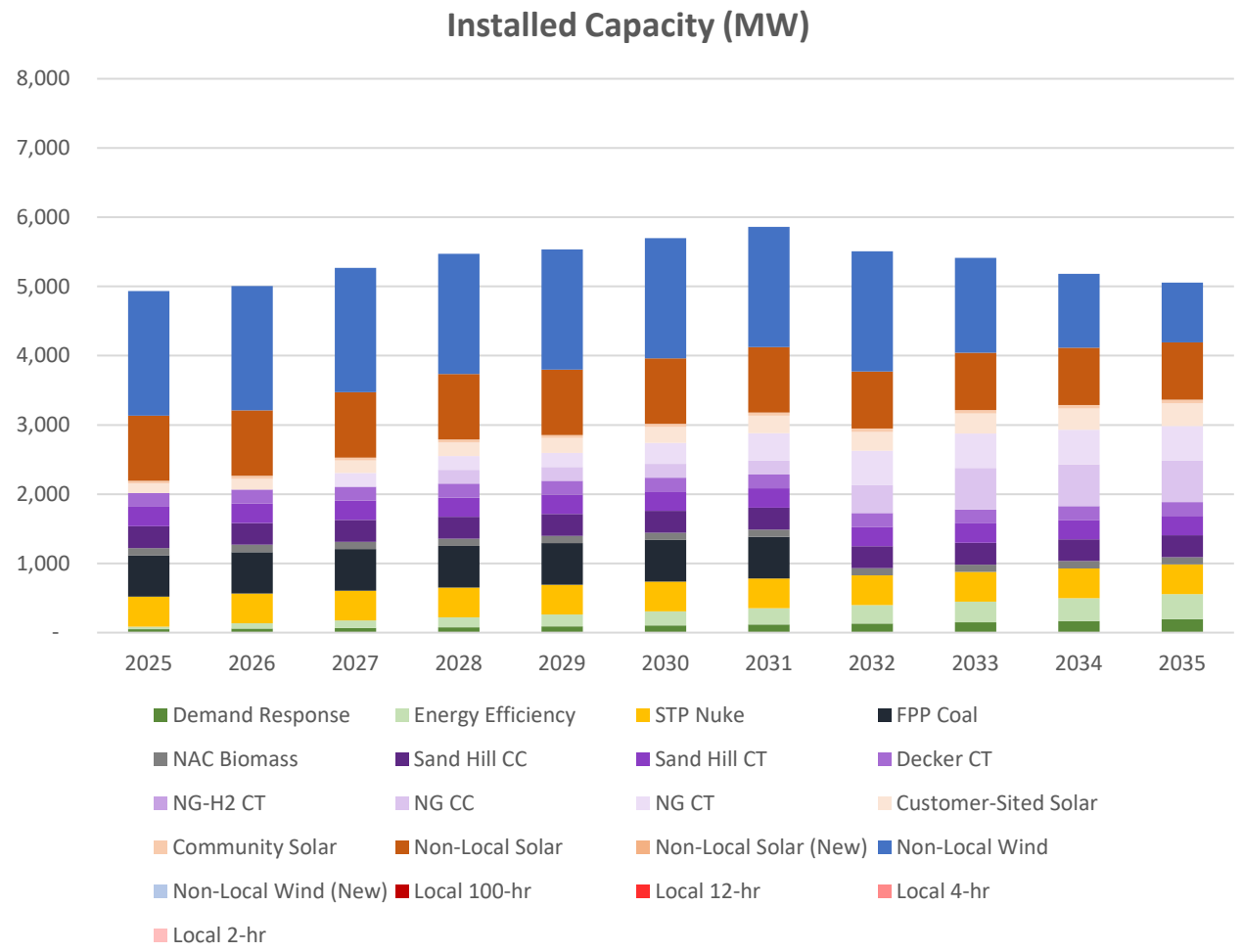


Portfolio #4 – Local Dispatchable + Margin

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$6,696/ $7,336	1
2035 Bill Increase ($/Month)	$21	1
Liquidity Risk	$365M	2
Reliability Risk Hours (2035)	0	1
Total CO_2 (Million Metric Tons)	40.4	13
Total NOx (Metric Tons)	8,978	13

- FPP Retires: 2031
- Decker/SHEC Retire: Past 2035
- New Local Solar* (MW): 381
- New Local Storage (MW): 0
- New Local Gas (MW): 1,100
- DSM Projection: 50% DNV Study
- RE Goal: Not included
- 100% Carbon-Free Goal: No

*includes existing commitments

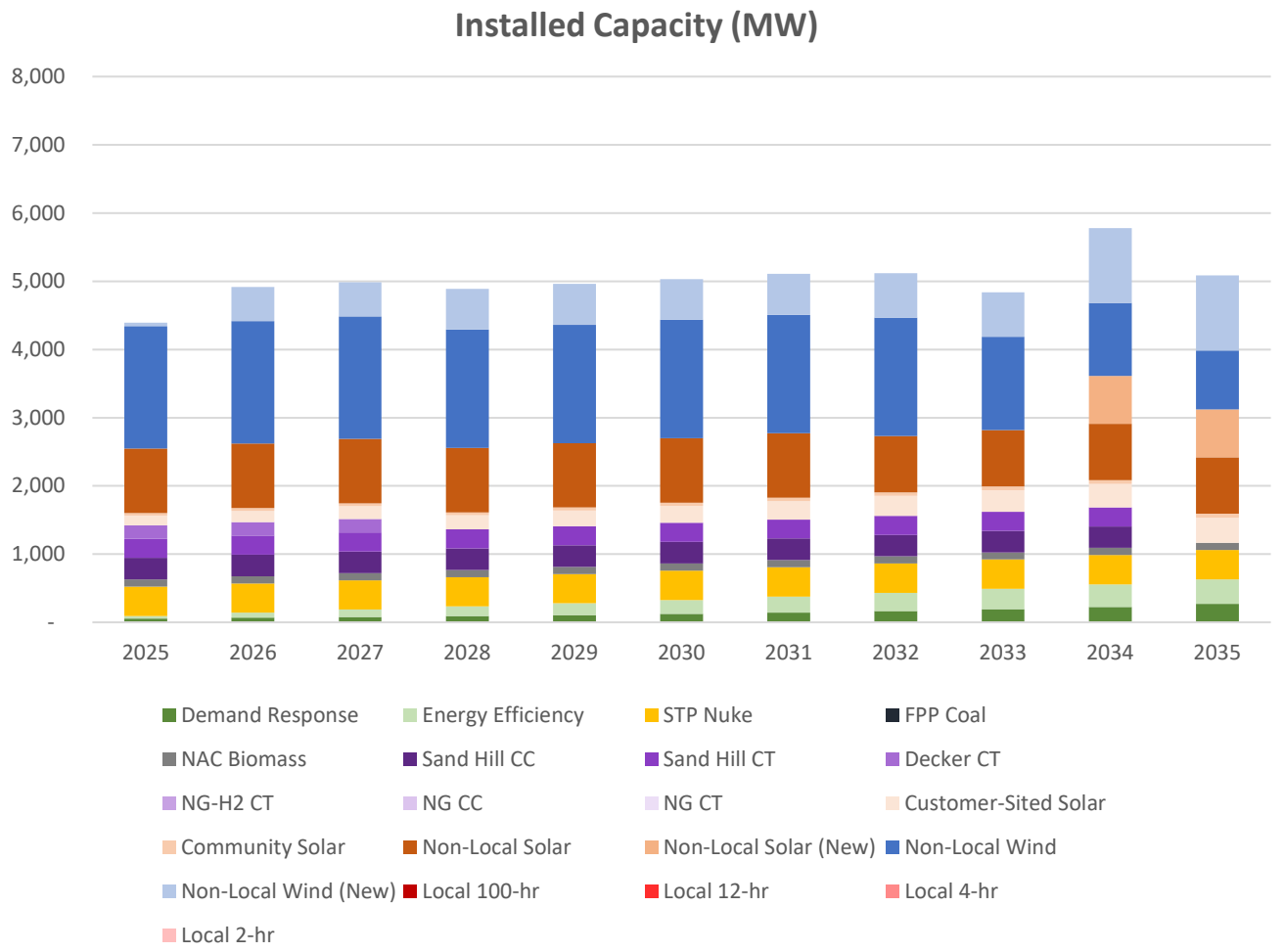


Portfolio #5 – Meet Env Goals + Expand DSM

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$10,480/ $13,029	10
2035 Bill Increase ($/Month)	$68	10
Liquidity Risk	$1.66B	12
Reliability Risk Hours (2035)	2115	9
Total CO_2 (Million Metric Tons)	5.8	6
Total NOx (Metric Tons)	599	6

- FPP Retires: 2024
- Decker/SHEC Retire: 2027/2034
- New Local Solar* (MW): 431
- New Local Storage (MW): 0
- New Local Gas (MW): 0
- DSM Projection: DNV Study
- RE Goal: 65%
- 100% Carbon-Free Goal: Yes

*includes existing commitments

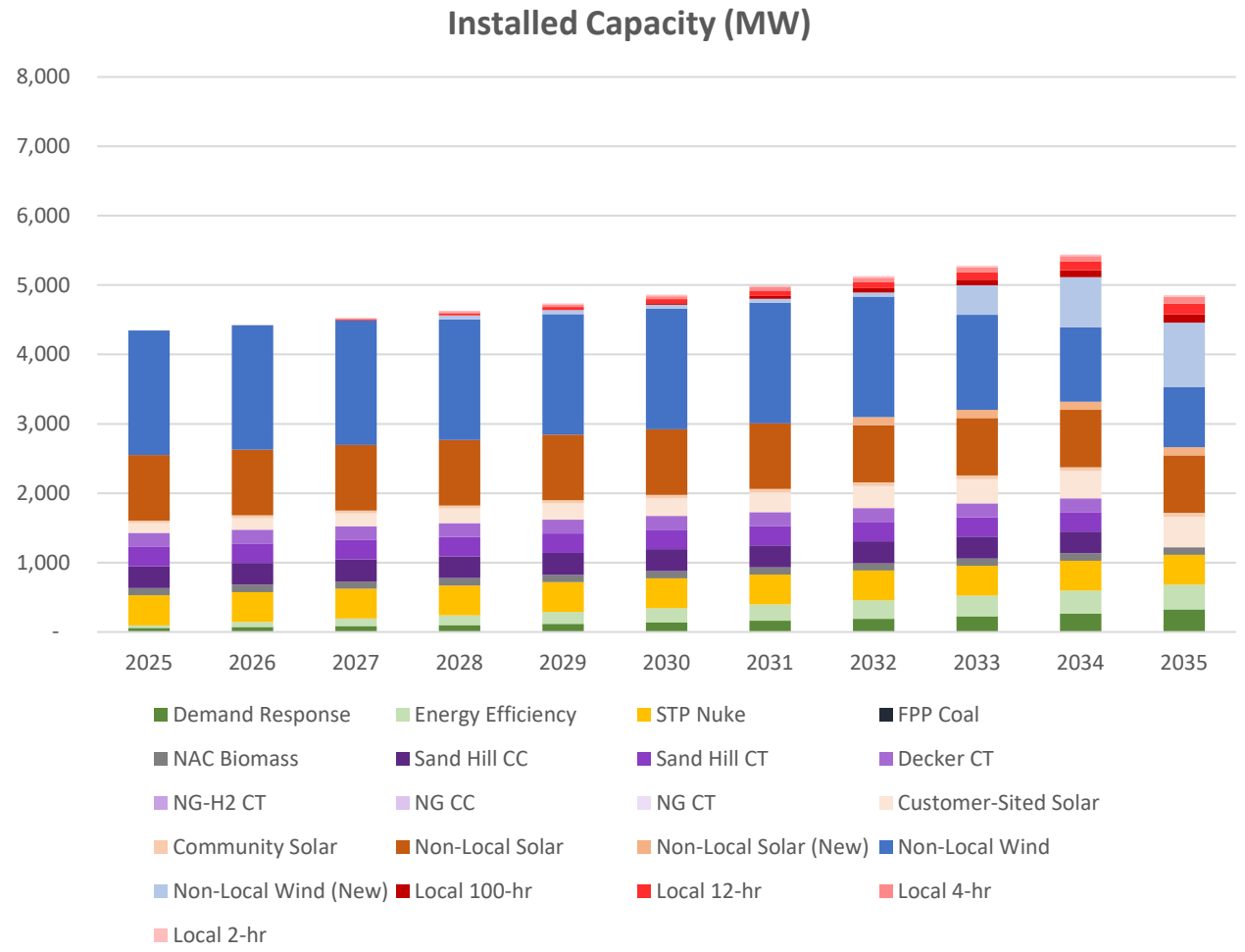


Portfolio #6 - Aggressive DSM + Storage + Keep PPAs

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$10,355/ $12,913	8
2035 Bill Increase ($/Month)	$68	9
Liquidity Risk	$1.64B	11
Reliability Risk Hours (2035)	2141	11
Total CO_2 (Million Metric Tons)	5.7	4
Total NOx (Metric Tons)	584	4

- FPP Retires: 2024
- Decker/SHEC Retire: 2034
- New Local Solar* (MW): 499
- New Local Storage (MW): 395
- New Local Gas (MW): 0
- DSM Projection: DNV Study+
- RE Goal: Replace PPAs
- 100% Carbon-Free Goal: Yes

*includes existing commitments

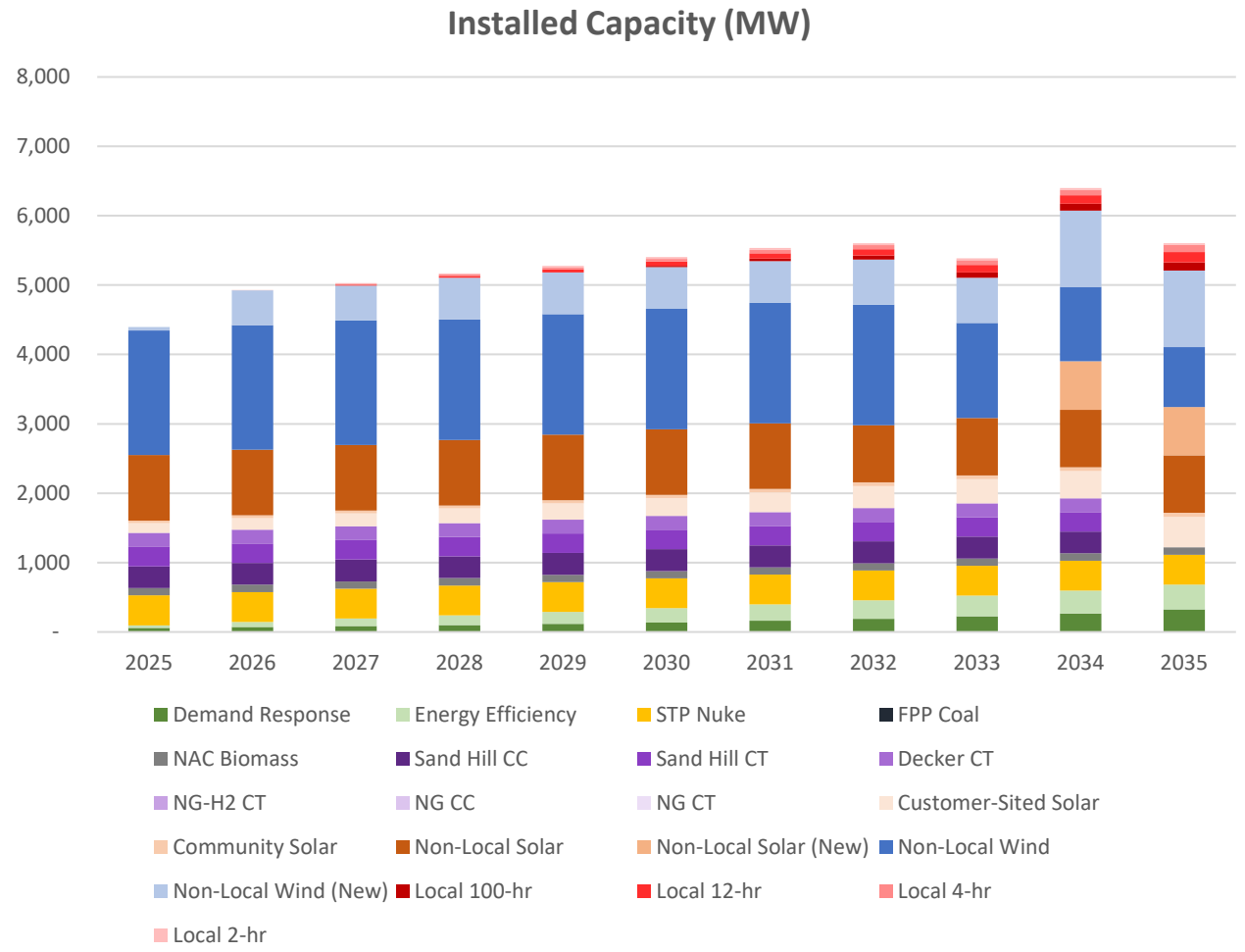


Portfolio #7 – Aggressive DSM + Storage + 65% RE

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$10,552/ $13,053	11
2035 Bill Increase ($/Month)	$69	11
Liquidity Risk	$1.45B	10
Reliability Risk Hours (2035)	2136	10
Total CO_2 (Million Metric Tons)	5.6	3
Total NOx (Metric Tons)	573	3

- FPP Retires: 2024
- Decker/SHEC Retire: 2034
- New Local Solar* (MW): 499
- New Local Storage (MW): 395
- New Local Gas (MW): 0
- DSM Projection: DNV Study+
- RE Goal: 65%
- 100% Carbon-Free Goal: Yes

*includes existing commitments

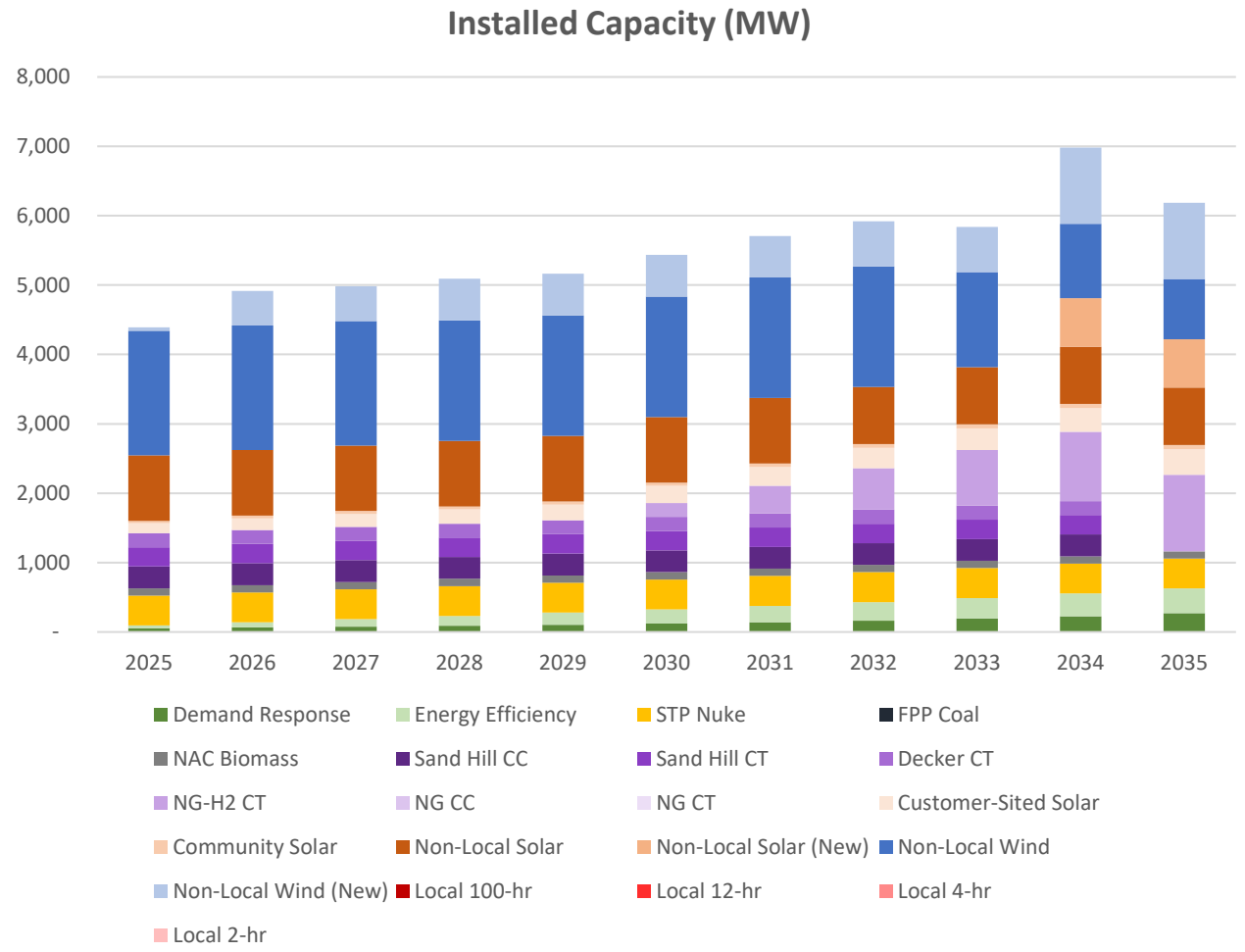


Portfolio #8 – Hydrogen-Capable Local Plant

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$8,874/ $10,629	5
2035 Bill Increase ($/Month)	$43	5
Liquidity Risk	$653M	5
Reliability Risk Hours (2035)	3	4
Total CO_2 (Metric Tons)	9.0	9
Total NOx (Metric Tons)	1,730	10

- FPP Retires: 2024
- Decker/SHEC Retire: 2034
- New Local Solar* (MW): 431
- New Local Storage (MW): 0
- New Local Gas (MW): 0
- DSM Projection: 100% DNV Study
- RE Goal: 65%
- 100% Carbon-Free Goal: Yes

*includes existing commitments

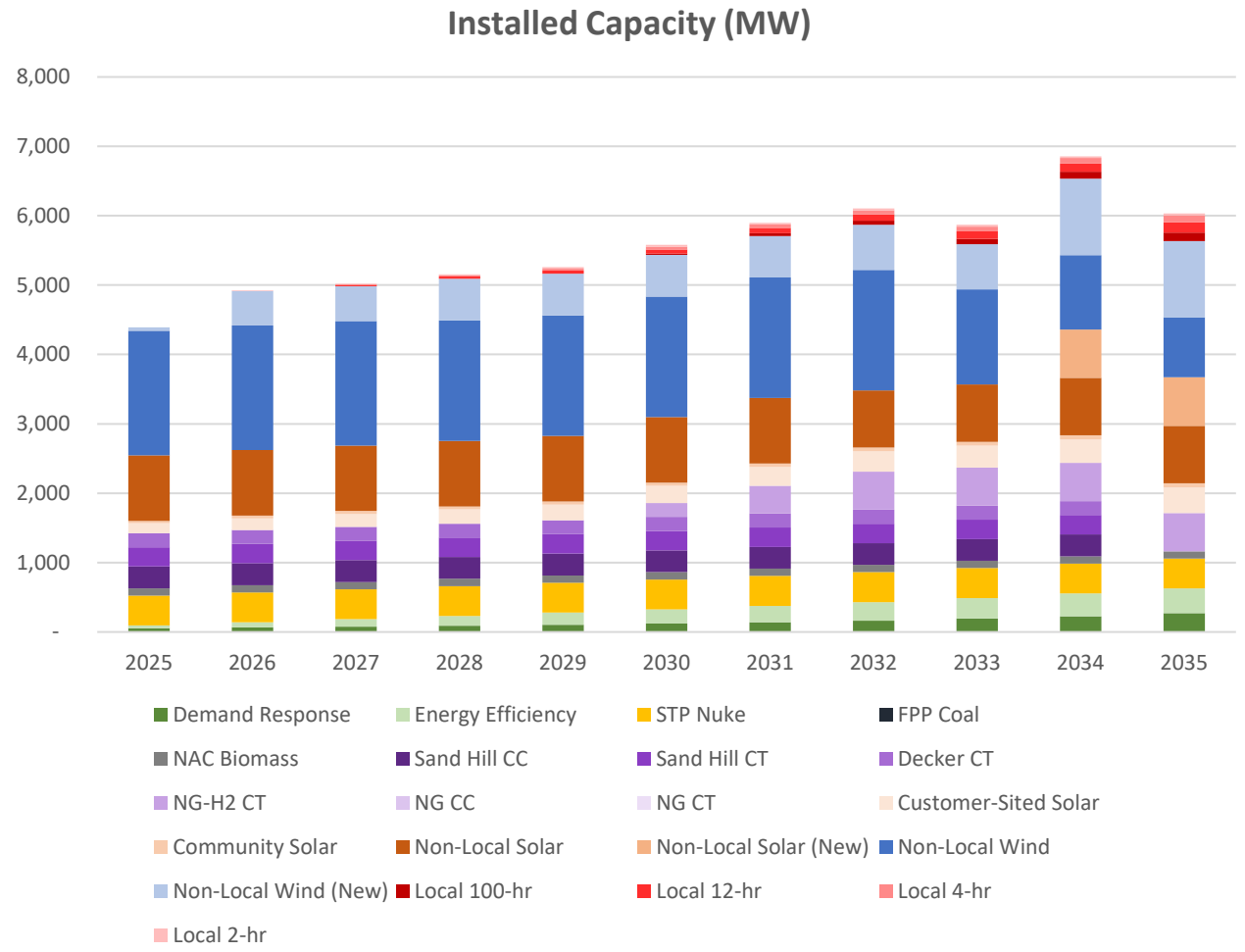


Portfolio #9 – Hydrogen + Local Storage

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$9,595/ $11,665	6
2035 Bill Increase ($/Month)	$55	6
Liquidity Risk	$961M	6
Reliability Risk Hours (2035)	438	7
Total CO_2 (Metric Tons)	8.2	8
Total NOx (Metric Tons)	1,355	8

- FPP Retires: 2024
- Decker/SHEC Retire: 2034
- New Local Solar* (MW): 431
- New Local Storage (MW): 395
- New Local Gas (MW): 0
- DSM Projection: 100% DNV Study
- RE Goal: 65%
- 100% Carbon-Free Goal: Yes

*includes existing commitments

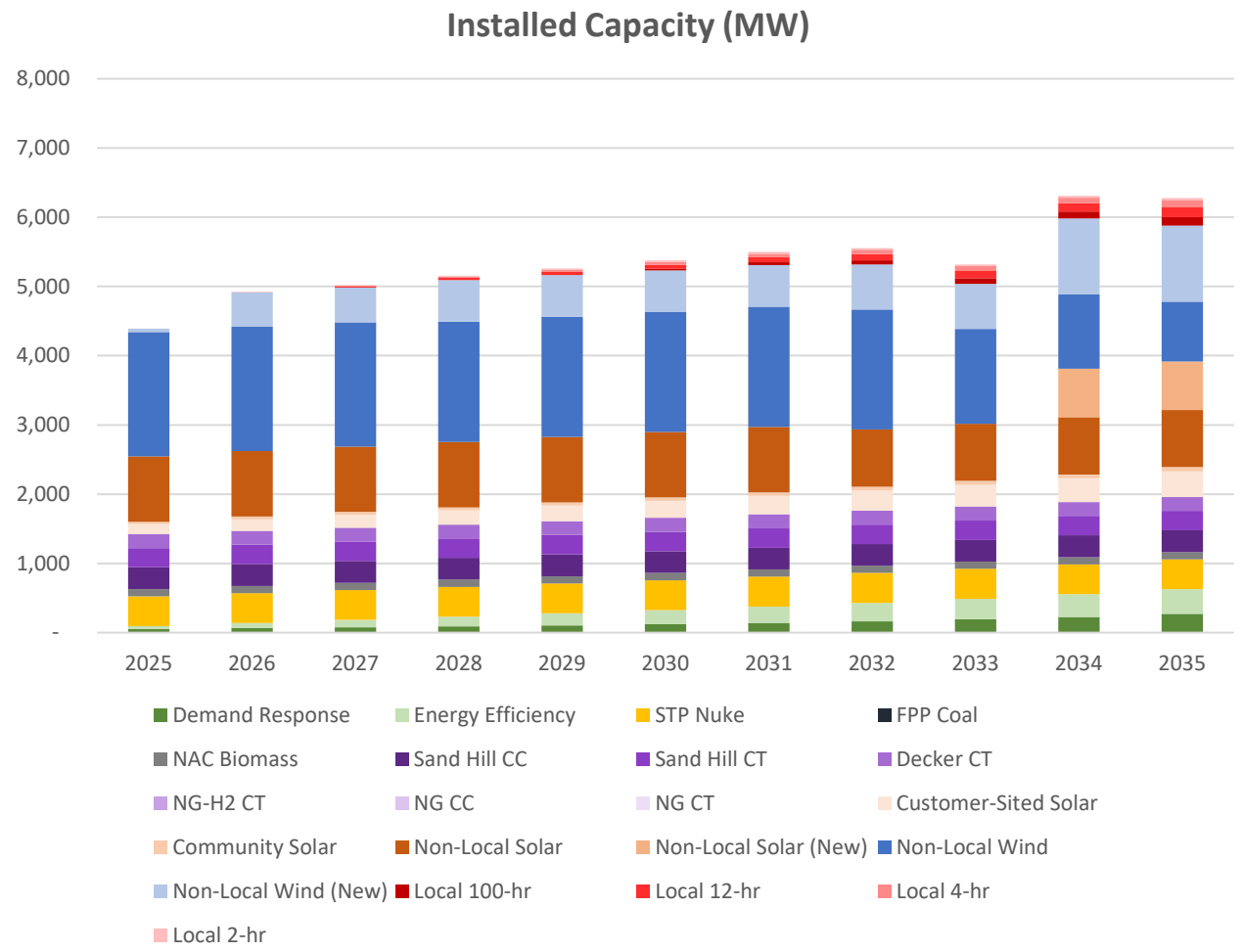


Portfolio #10 – Keep Existing Gas + Local Storage

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$9,823/ $12,155	7
2035 Bill Increase ($/Month)	$56	7
Liquidity Risk	$549M	4
Reliability Risk Hours (2035)	41	5
Total CO_2 (Metric Tons)	6.3	7
Total NOx (Metric Tons)	650	7

- FPP Retires: 2024
- Decker/SHEC Retire: After 2035
- New Local Solar* (MW): 431
- New Local Storage (MW): 395
- New Local Gas (MW): 0
- DSM Projection: 100% DNV Study
- RE Goal: 65%
- 100% Carbon-Free Goal: No

*includes existing commitments

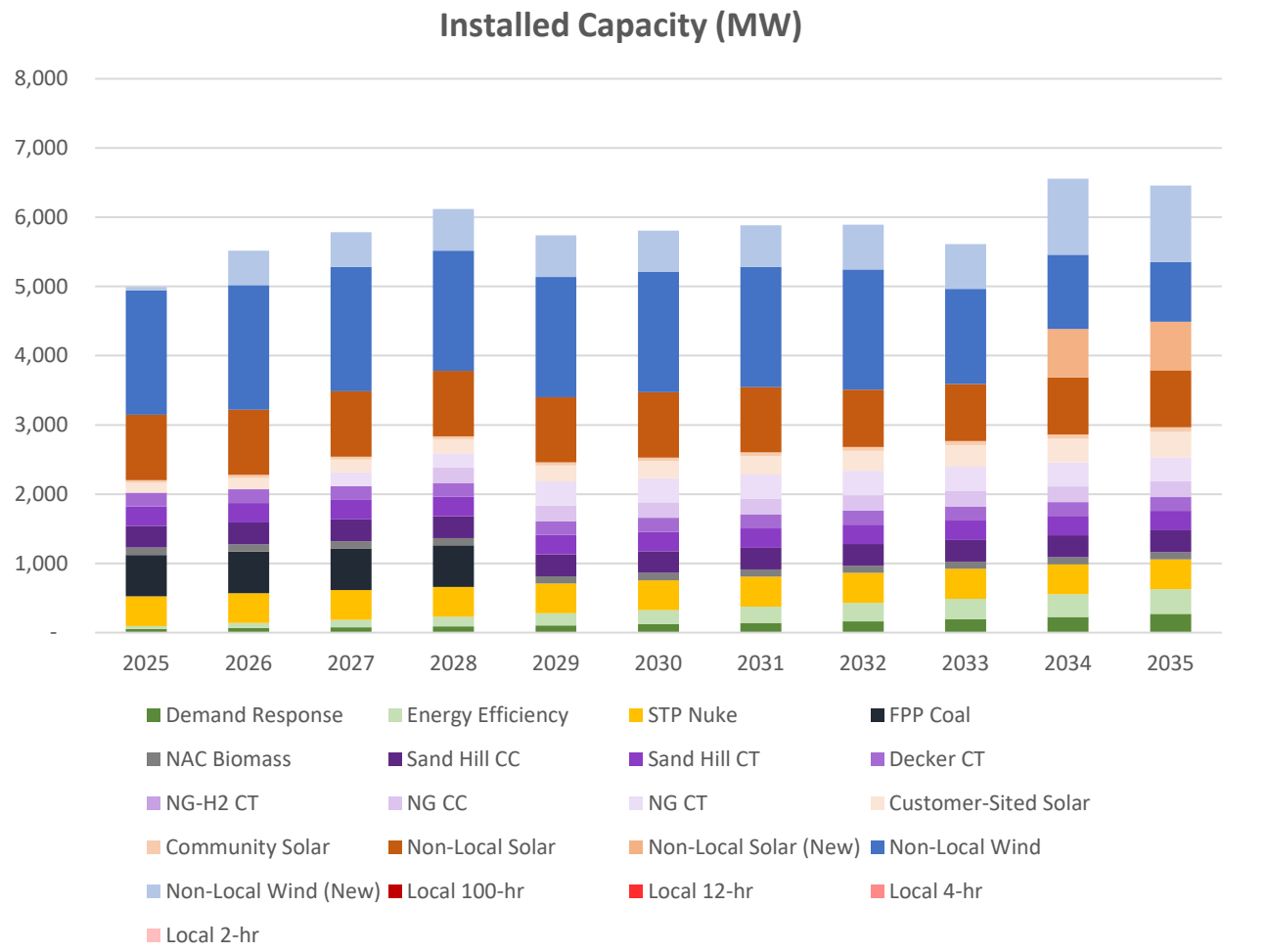


Portfolio #11 – Replace FPP in 2028 w/ Gas

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$8,033/ $9,273	3
2035 Bill Increase ($/Month)	$35	3
Liquidity Risk	$359M	1
Reliability Risk Hours (2035)	0	1
Total CO_2 (Metric Tons)	24.5	11
Total NOx (Metric Tons)	5,267	12

- FPP Retires: 2028
- Decker/SHEC Retire: Past 2035
- New Local Solar* (MW): 431
- New Local Storage (MW): 0
- New Local Gas (MW): 575
- DSM Projection: 100% DNV Study
- RE Goal: 65%
- 100% Carbon-Free Goal: No

*includes existing commitments

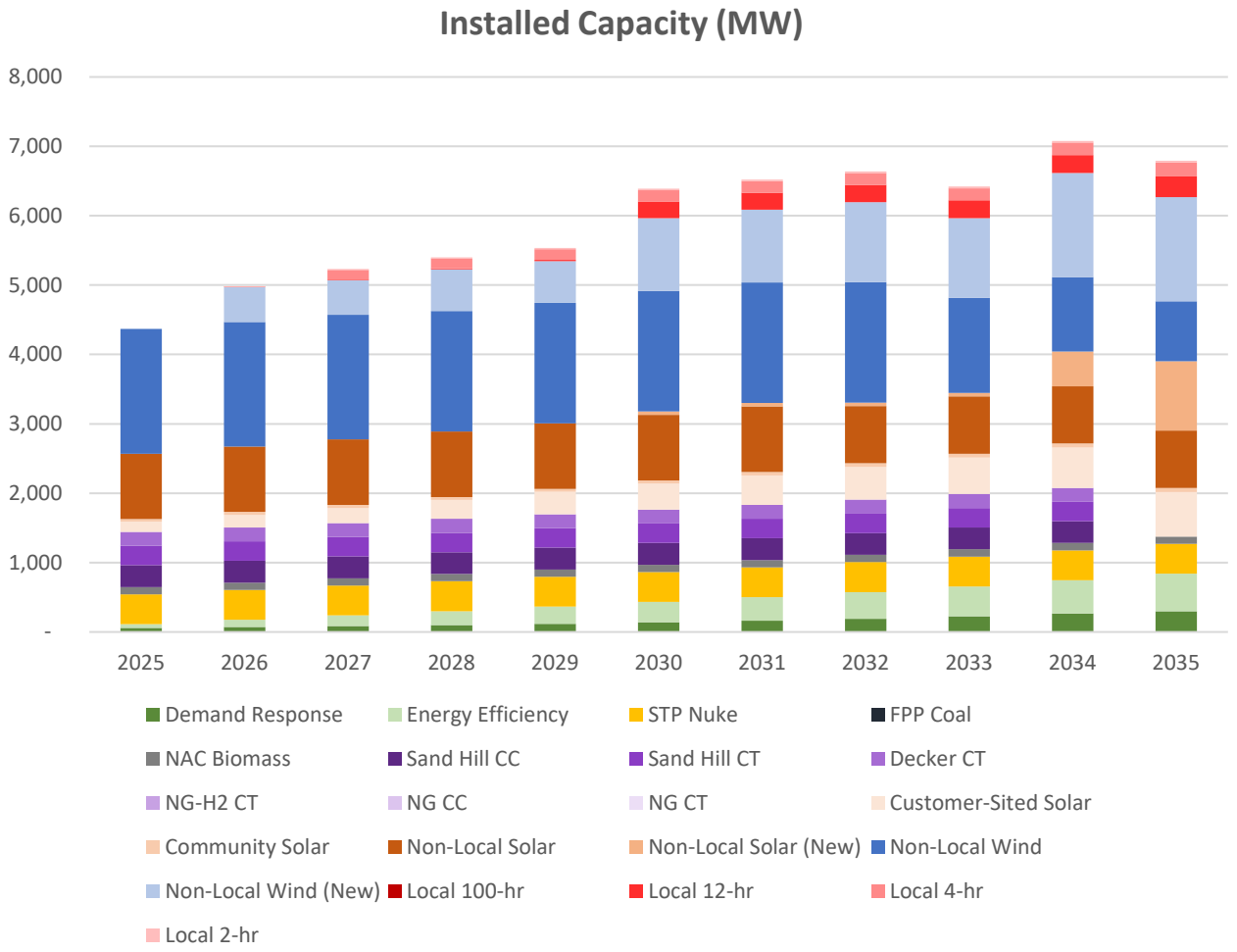


Portfolio #12 – EUC Working Group

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$10,858/ $13,244	12
2035 Bill Increase ($/Month)	$75	12
Liquidity Risk	$1.11B	7
Reliability Risk Hours (2035)	1,369	8
Total CO_2 (Metric Tons)	4.3	1
Total NOx (Metric Tons)	440	1

- FPP Retires: 2024
- Decker/SHEC Retire: 2034
- New Local Solar* (MW): 700 [1]
- New Local Storage (MW): 525
- New Local Gas (MW): 0
- DSM Projection: DNV Study+ [1]
- RE Goal: 100% of load
- 100% Carbon-Free Goal: Yes

*includes existing commitments



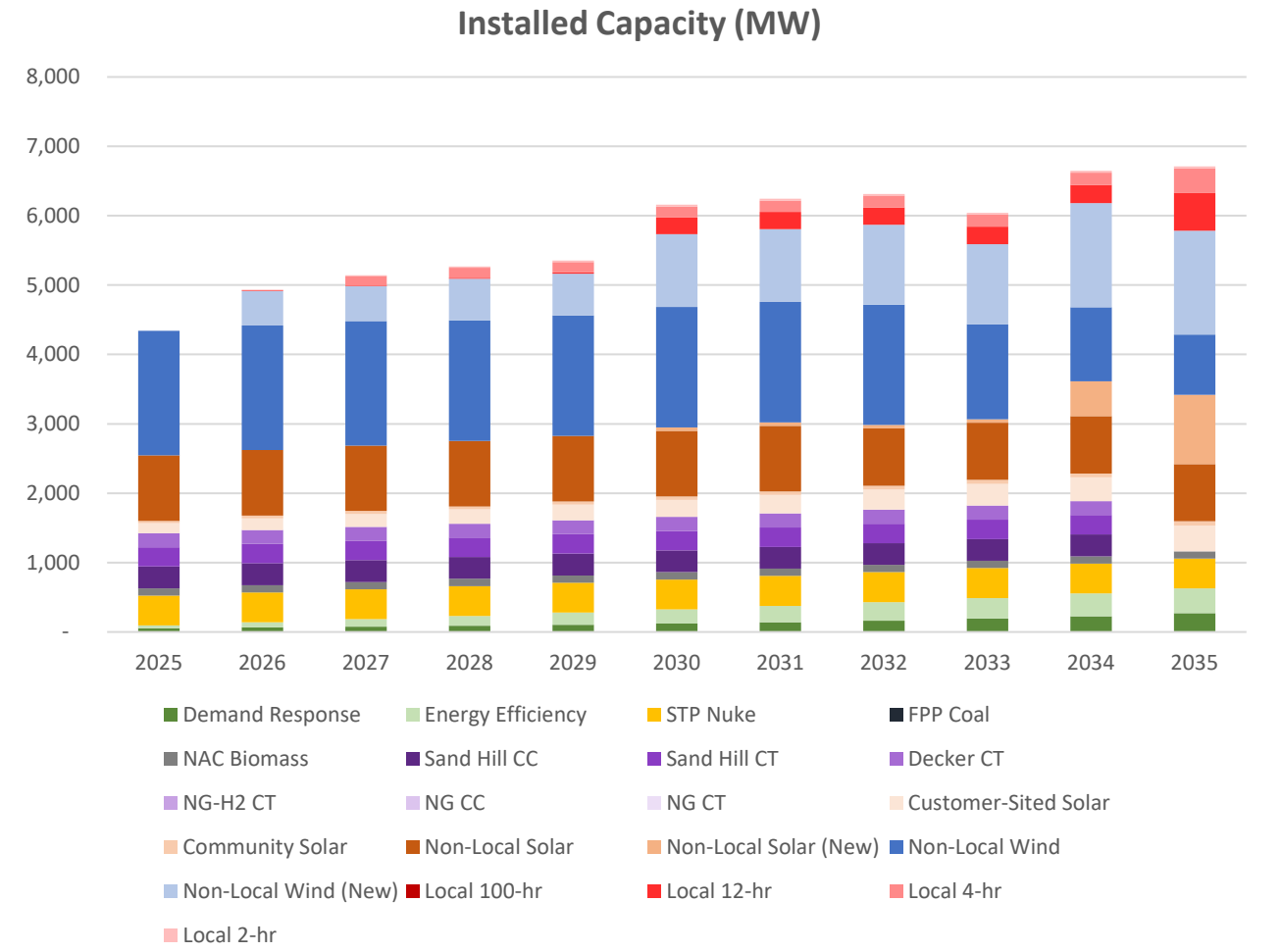
[1] Outside upper bound of DNV Market Potential Study

Portfolio #13 – Increase Local Storage

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$11,647/ $14,315	13
2035 Bill Increase ($/Month)	$81	13
Liquidity Risk	$1.31B	9
Reliability Risk Hours (2035)	2,449	13
Total CO_2 (Metric Tons)	4.4	2
Total NOx (Metric Tons)	457	2

- FPP Retires: 2028
- Decker/SHEC Retire: 2034
- New Local Solar* (MW): 431
- New Local Storage (MW): 925
- New Local Gas (MW): 0
- DSM Projection: 100% DNV Study
- RE Goal: 100% of load
- 100% Carbon-Free Goal: Yes

*includes existing commitments



Resource, Generation and Climate Protection Plan to 2035

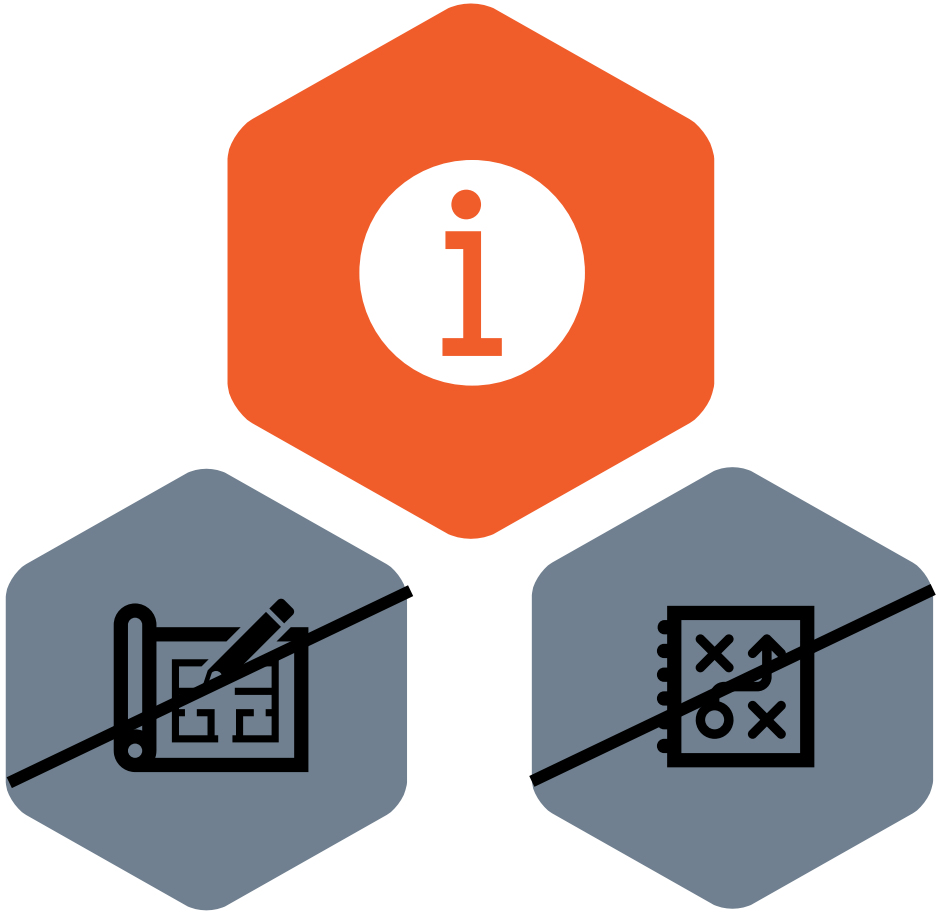
Briefing and Process Update

Lisa Martin

Deputy General Manager and Chief Operating Officer

September 30, 2024

Important Context for this Discussion

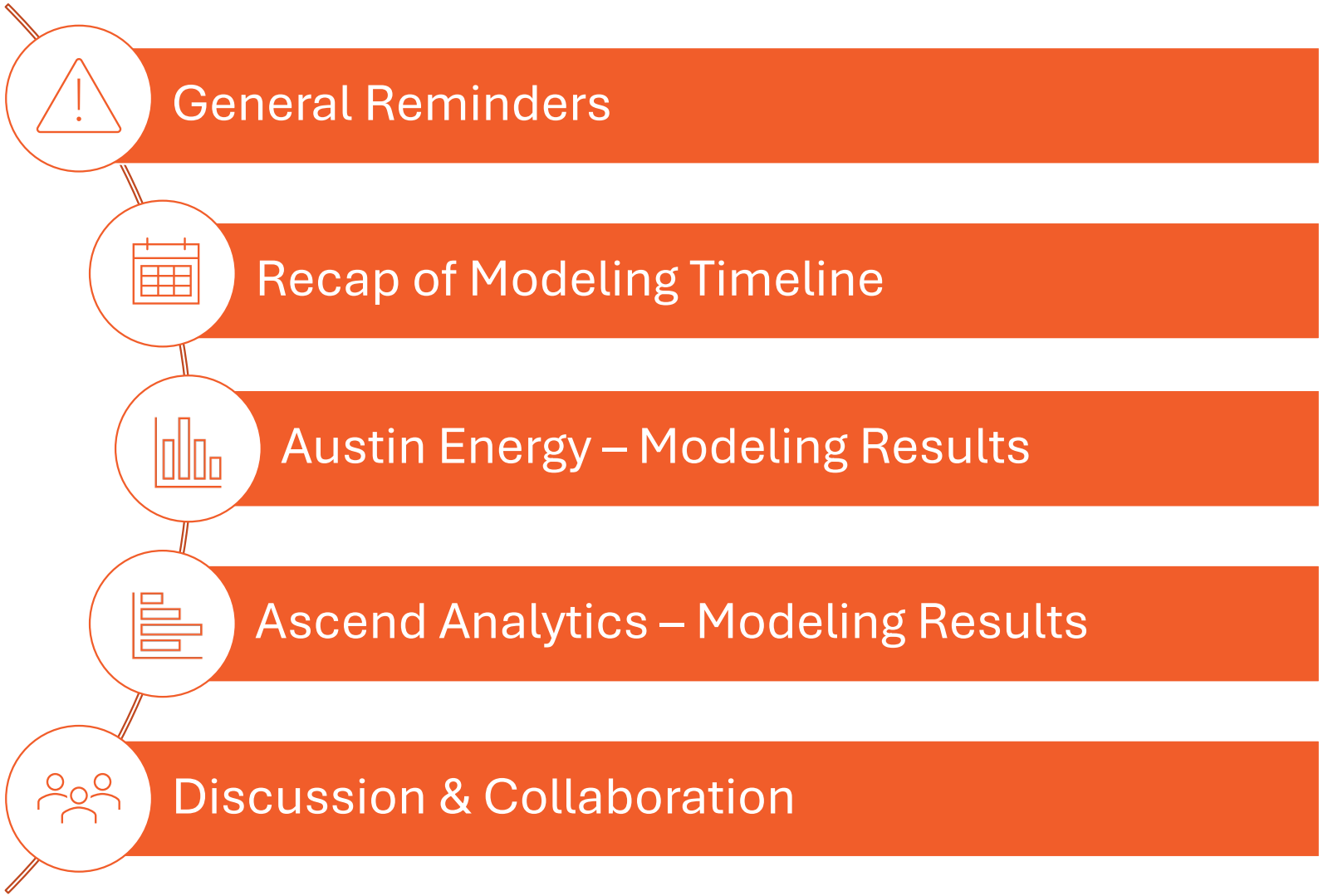


Models provide information

not a specific plan or recommendation

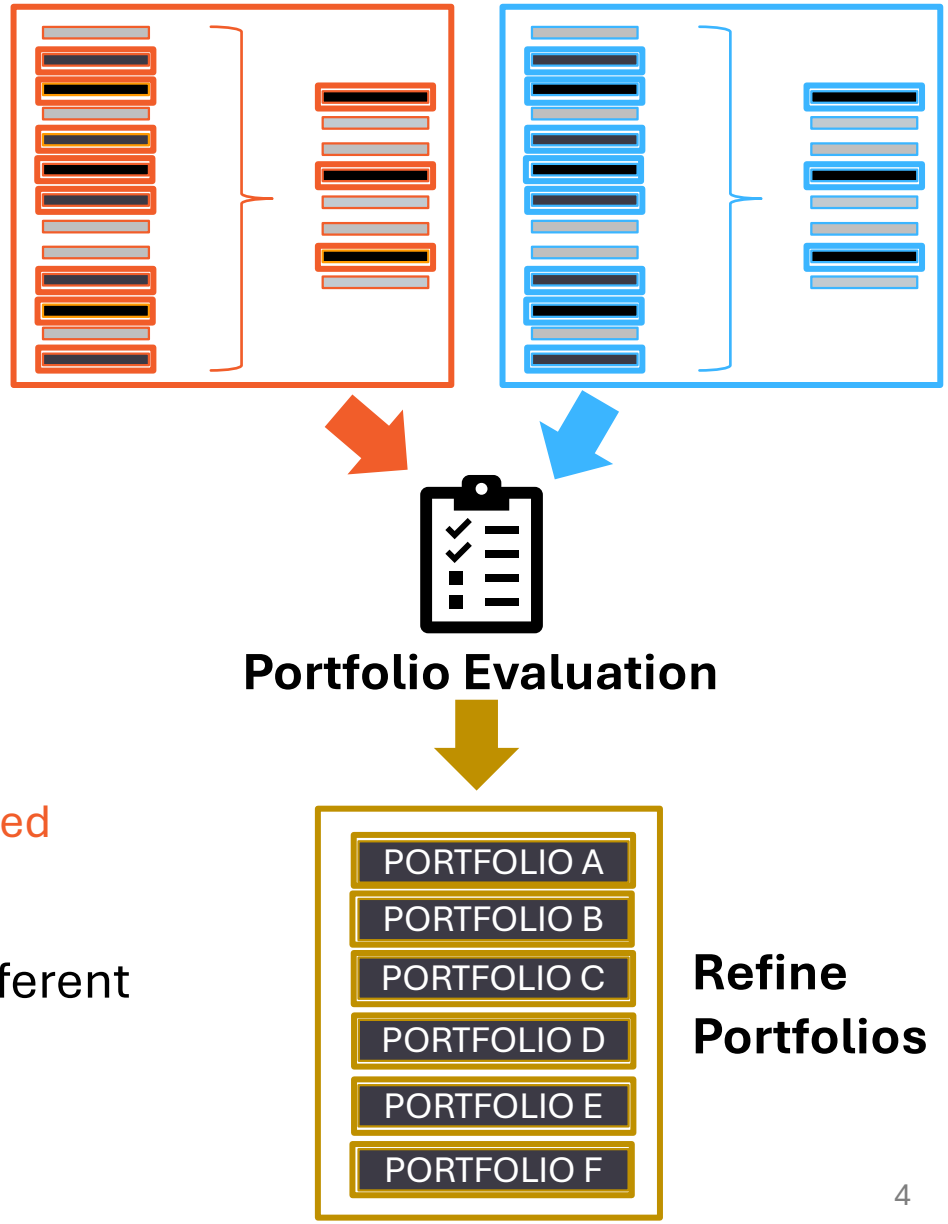
The following slides show data results associated with preliminary modeling efforts for the Resource, Generation and Climate Protection Plan to 2035. **These results do not reflect a recommendation, and they do not reflect a plan.** These results are for informational purposes only. All modeling reflects the input assumptions coordinated with the Electric Utility Commission earlier this year.

Agenda


General Reminders
Recap of Modeling Timeline
Austin Energy – Modeling Results
Ascend Analytics – Modeling Results
Discussion & Collaboration

General Reminders

- 17 portfolios studied to date
  - 13 Austin Energy & EUC-defined portfolios
  - 4 Ascend Analytics (software-optimized) portfolios
- Several portfolios included for reference only
  - Edge cases, purposefully defined to help understand the boundaries
- Slides show raw data for comparison across portfolios
- We're not drawing conclusions
  - With these portfolios, tradeoffs are significant
  - With the information gained from these portfolios, we will need to refine
- Next step: Ask "what if?" and refine portfolios by mixing different technologies, seeking a more acceptable set of tradeoffs



EUC Office Hours

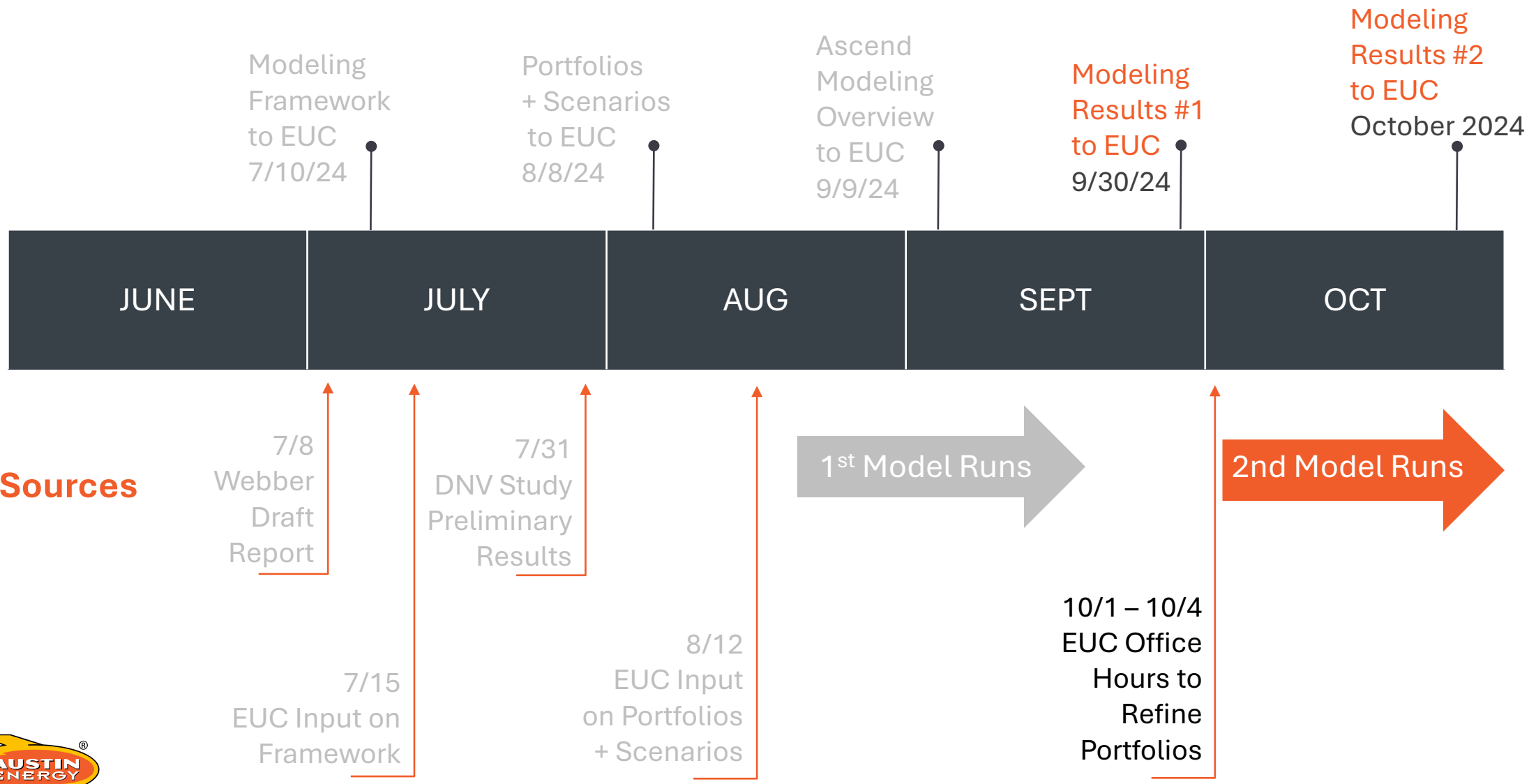
- Tuesday, Oct. 1 1 p.m. – 3 p.m.
- Wednesday, Oct. 2 11 a.m. – 1 p.m.
- Thursday, Oct. 3 2:30 p.m. – 4 p.m.
- Friday, Oct. 4 10 a.m. – 12 p.m.

If none of the above times work, please let us know so we can find a time to collaborate.

Office Hours Objectives:

- Review detailed results
- Ask questions
- Determine takeaways
- Refine portfolios

Modeling Timeline



Portfolio Modeling Results

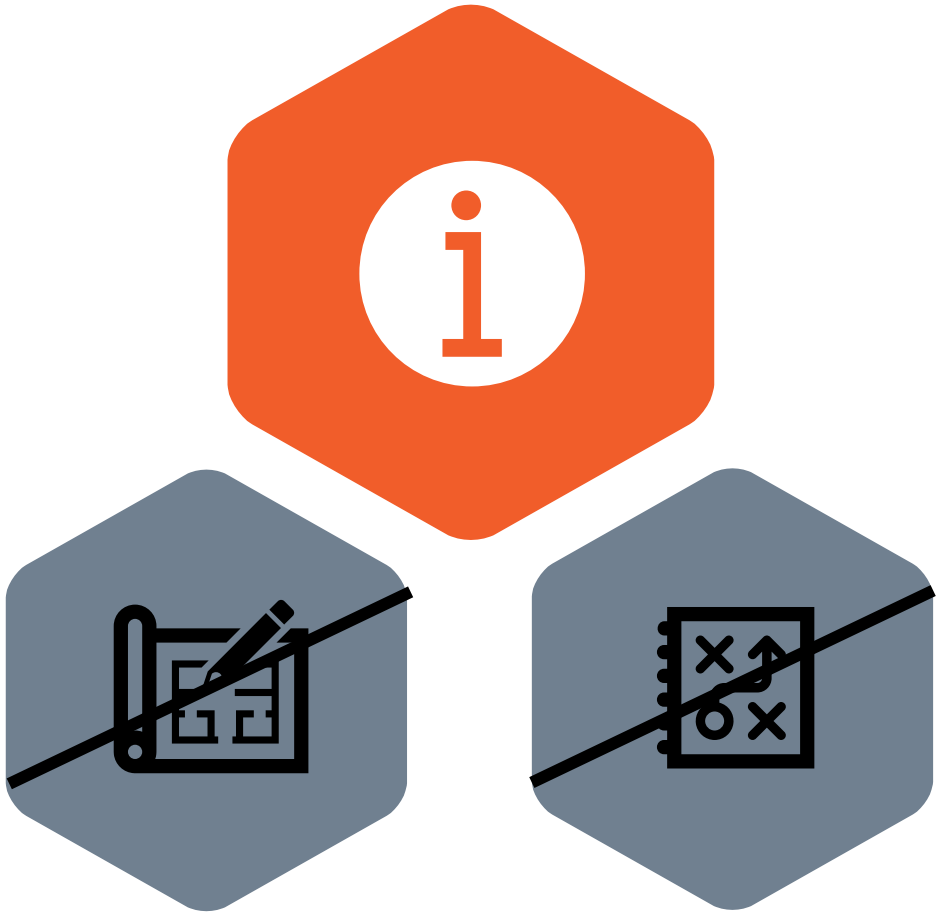
Austin Energy Resource, Generation and Climate Protection Plan to 2035

Michael Enger

Vice President, Energy Market Operations & Resource Planning

September 30, 2024

Important Context for this Discussion



Models provide information

not a specific plan or recommendation

The following slides show data results associated with preliminary modeling efforts for the Resource, Generation and Climate Protection Plan to 2035. **These results do not reflect a recommendation, and they do not reflect a plan.** These results are for informational purposes only. All modeling reflects the input assumptions coordinated with the Electric Utility Commission earlier this year.

Reference Guide to Numbered Portfolios

REF #	PORTFOLIO	DESCRIPTION
1	No New Commitments	Existing DSM commitments, no new generation
2	2030 Current Plan	100% Carbon-Free by 2035, 65% Renewables by 2027, existing DSM commitments, REACH on gas
3	Local Gen/Storage + Margin	**575 MW new local peakers and combined cycle starting 2027, 275 MW local storage,** 100% DNV projections*, replace PPAs, Decker/SHEC run through 2035
4	Local Dispatchable + Margin	**1,100 MW new local peakers & combined cycle starting 2027**, 50% DNV projections, REACH on FPP, Decker/SHEC run through 2035
5	Meet Env Goals + Expand DSM	**Retire Decker in 2027**, 100% DNV projections, 100% CF, 65% RE, REACH on gas, retire SHEC 2034
6	Aggressive DSM + Storage + Keep PPAs	**Aggressive DNV projections**, **replace PPAs**,100% CF, REACH on gas, retire Decker/SHEC 2034
7	Aggressive DSM + Storage + 65% RE Goal	**Aggressive DNV projections, 65% RE**, 100% CF, REACH on gas, retire Decker/SHEC 2034
8	Hydrogen-Capable Local Plant	**1,100 MW local hydrogen-capable peakers starting in 2030**, 100% DNV projections, 100% CF, 65% RE, REACH on gas, retire Decker/SHEC 2034
9	Hydrogen + Local Storage	**550 MW local hydrogen peakers, 395 MW local storage**, 100% DNV projections, 100% CF, 65% RE, REACH on gas, retire Decker/SHEC 2034
10	Keep Existing Gas + Local Storage	**Decker/SHEC run past 2035**, **395 MW local storage**, 100% DNV projections, 65% RE, REACH on gas
11	Replace FPP in 2028 w/Gas	**FPP retire end of 2028, 575 MW new local peakers and combined cycle**, 100% DNV projections, 65% RE, REACH on FPP and gas
12	EUC – 1 (Working Group Recs)	**525 MW local storage, 700 MW local solar, 540 MW new EE, 300 MW DR**, **100% RE as % of load,** 100% CF, REACH on gas, retire Decker/SHEC 2034
13	EUC – 2	**925 MW local storage**, aggressive DNV projections,100% RE as % of load, 100% CF, REACH on gas, retire Decker/SHEC 2034

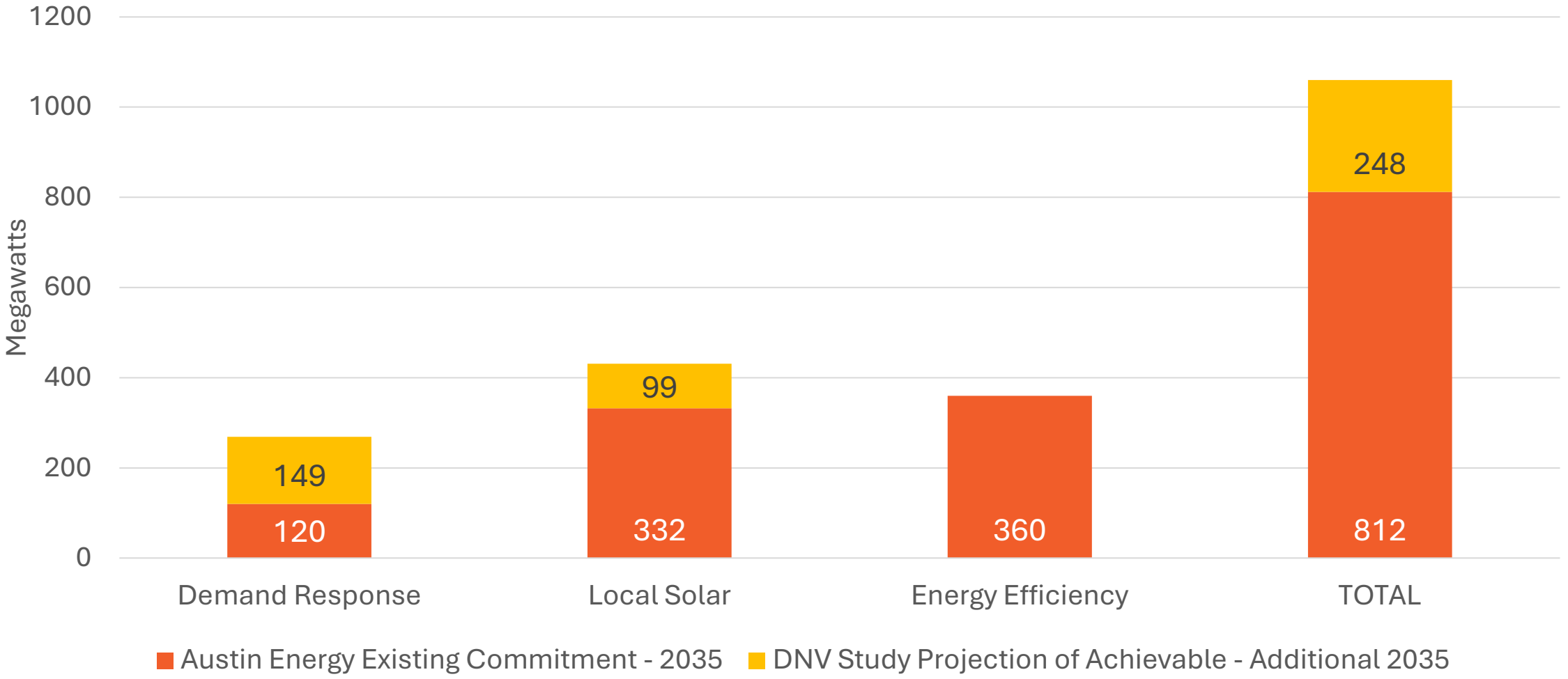
*DNV projections refers to the quantities of Demand-Side Management (Demand Response, Energy Efficiency, and Local Solar) resulting from the market potential study performed by DNV Energy Insights

Glossary of Terms

Term	Definition
Ascend Analytics	Consultant currently providing additional modeling support – Ascend's modeling uses the same set of inputs and assumptions as AE's UPLAN modeling, but the main difference in their approach is that their software designs optimized portfolios based on constraints and UPLAN relies on the modeling team to design the portfolios
DNV Study	DNV is a consultant that is currently working on a demand-side management market potential study for Austin Energy – preliminary data from DNV related to Austin's market potential for additional local solar, demand response and energy efficiency is included in the modeling – "100% of DNV study" indicates that a portfolio includes 100% of the additional DSM savings based on DNV's data
Local Congestion	When transmission lines that bring power into the Austin Energy service territory begin to reach their maximum carrying capacity, they experience "congestion" which can cause cost increases and potential reliability issues
Local vs. Non-Local Generation	An asset is considered "local" generation if it is physically located within the Austin Energy service territory – this is important in the context of relieving "local congestion" (see definition above)
Portfolios	A specific mix of electricity generation and demand-side management resources year by year over the modeling period of 2025-2035, provided in MW capacity
Scenarios	Different possible future worlds with different kinds of stressors (extreme events, local congestion, ERCOT market rule changes) that test each portfolio's performance in that future through modeling
UPLAN	Modeling software used by Austin Energy to simulate how a portfolio of resources will perform operationally and financially under projected normal conditions and in various future states (scenarios)

Demand-Side Management 2035

Austin Energy 2035 Commitments & Market Penetration Study Projections



Note: All new MW capacity figures provided in graph represent cumulative additions projected by 2035. Energy Efficiency figures do not include pre-2024 installations (~828 MW).

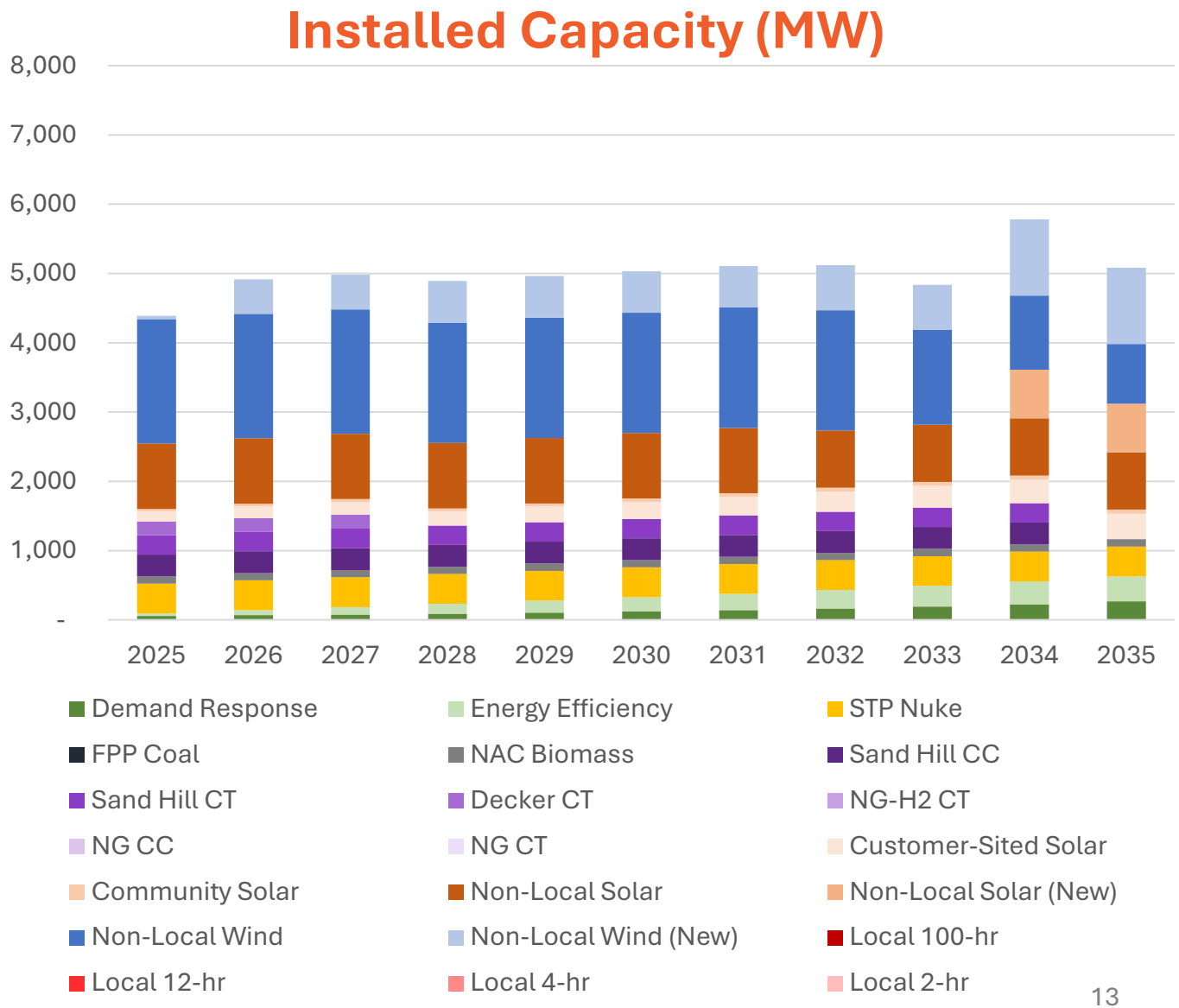
Portfolio Comparison – Financial Impacts

Portfolio #5 – Meet Environment Goals + Expand DSM

Output Metric	Value	Rank
NPV Net Cost ($millions) (Normal/Avg of Scenarios)	$10,480/ $13,029	10
2035 Bill Increase ($/Month)	$68.30	10
Liquidity Risk	$1.66B	12
Reliability Risk Hours (2035)	2115	9
Total CO_2 (Million Metric Tons)	5.8	6
Total NOx (Metric Tons)	599	6

- FPP Retires: 2024
- Decker/SHEC Retire: 2027/2034
- New Local Solar* (MW): 431
- New Local Storage (MW): 0
- New Local Gas (MW): 0
- DSM Projection: DNV Study
- RE Goal: 65%
- 100% Carbon-Free Goal: Yes

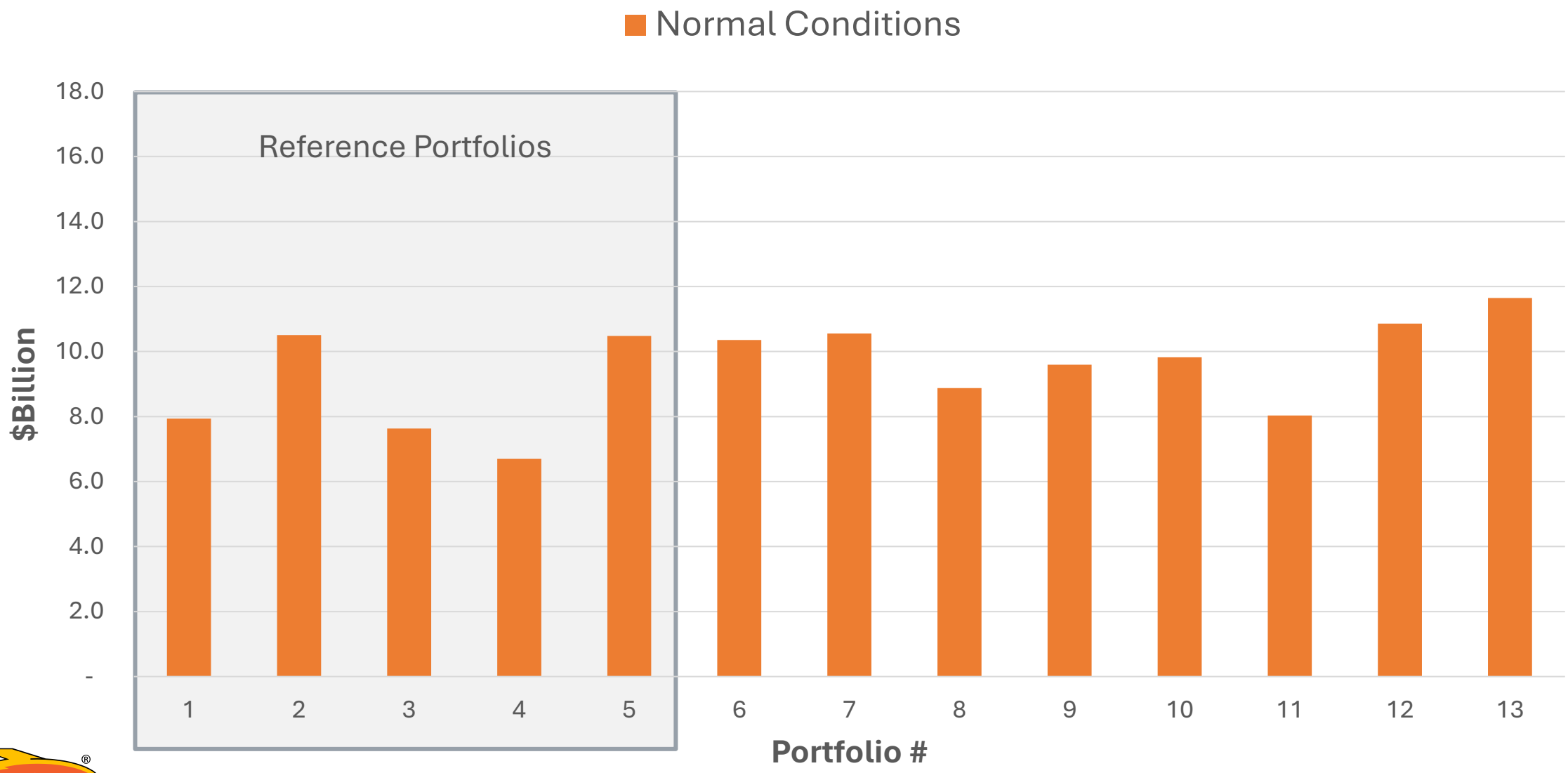
*includes existing commitments



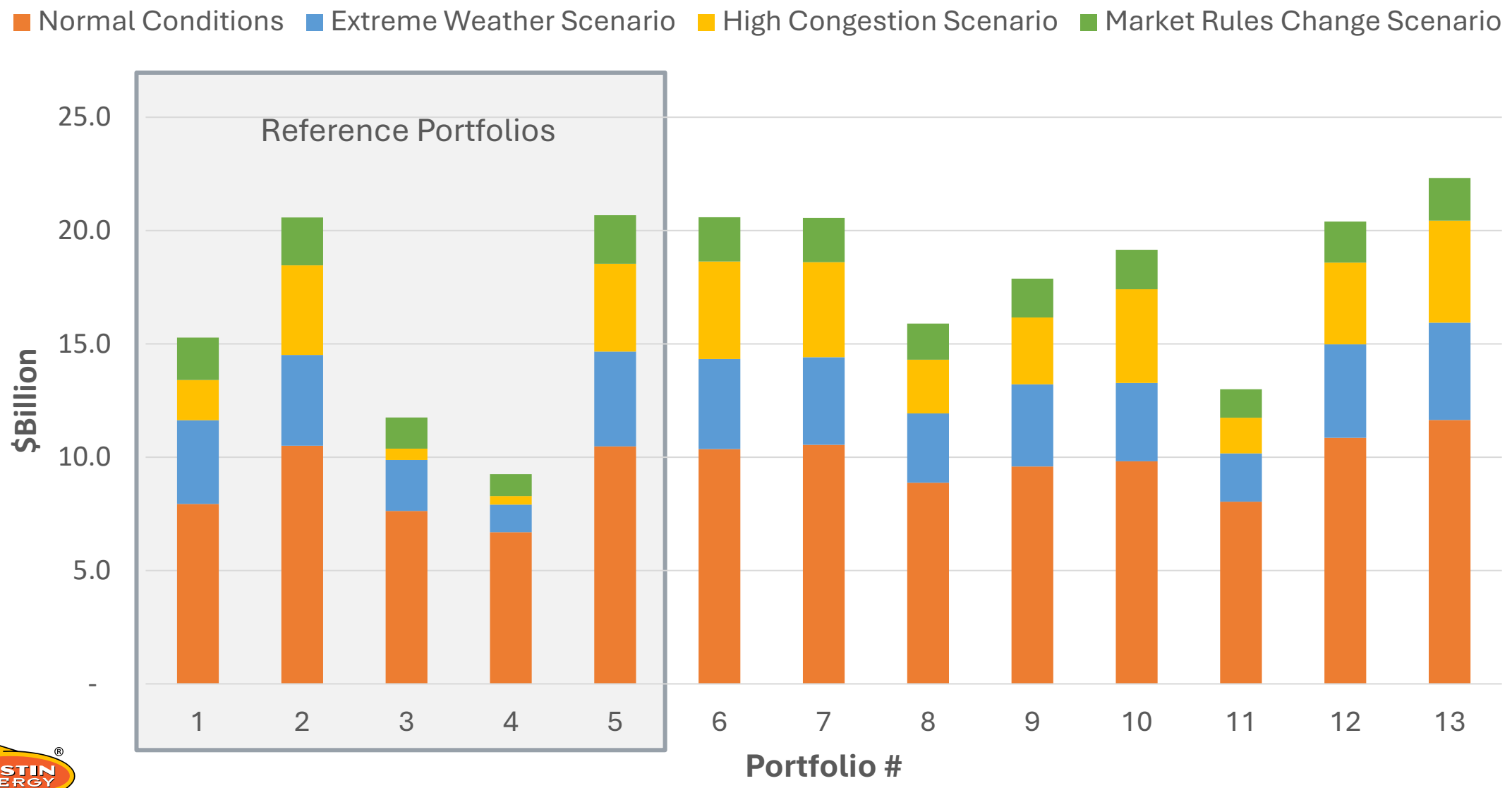
Net Cost

- “Net Cost” = Total capital + O&M costs to generate power – Total revenue from sale of power for a given portfolio mix.
- Capital costs for new assets amortized (spread out evenly) over expected life of asset.
- O&M costs include fuel, personnel, regular maintenance, etc.
- To compare a single “Net Cost” value across portfolios we use the Net Present Value (NPV) of the annual net costs for the 20-year period 2025-2045 using 7.8% discount rate.

Net Present Value of 20-Yr Annual Net Costs



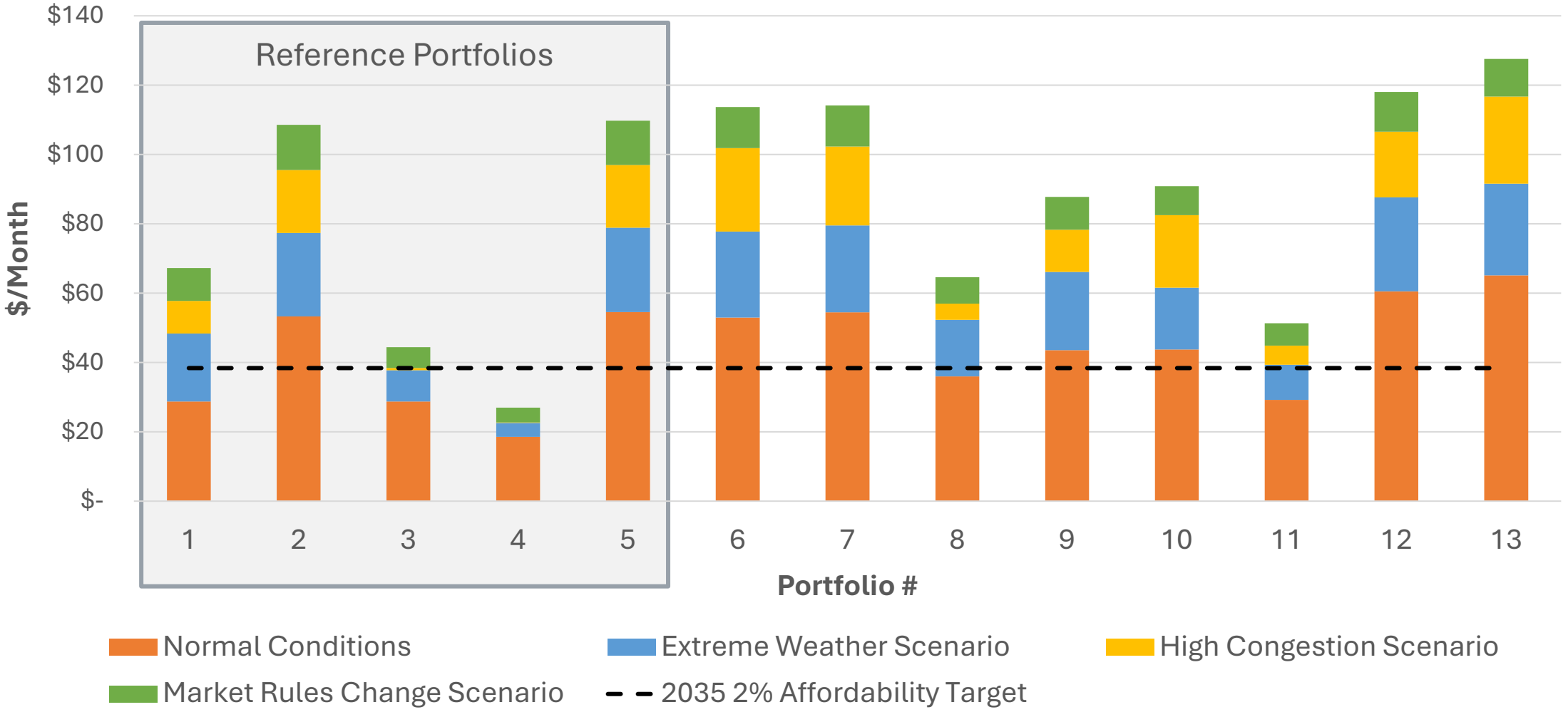
Net Present Value of 20-Yr Annual Net Costs



Bill Impact

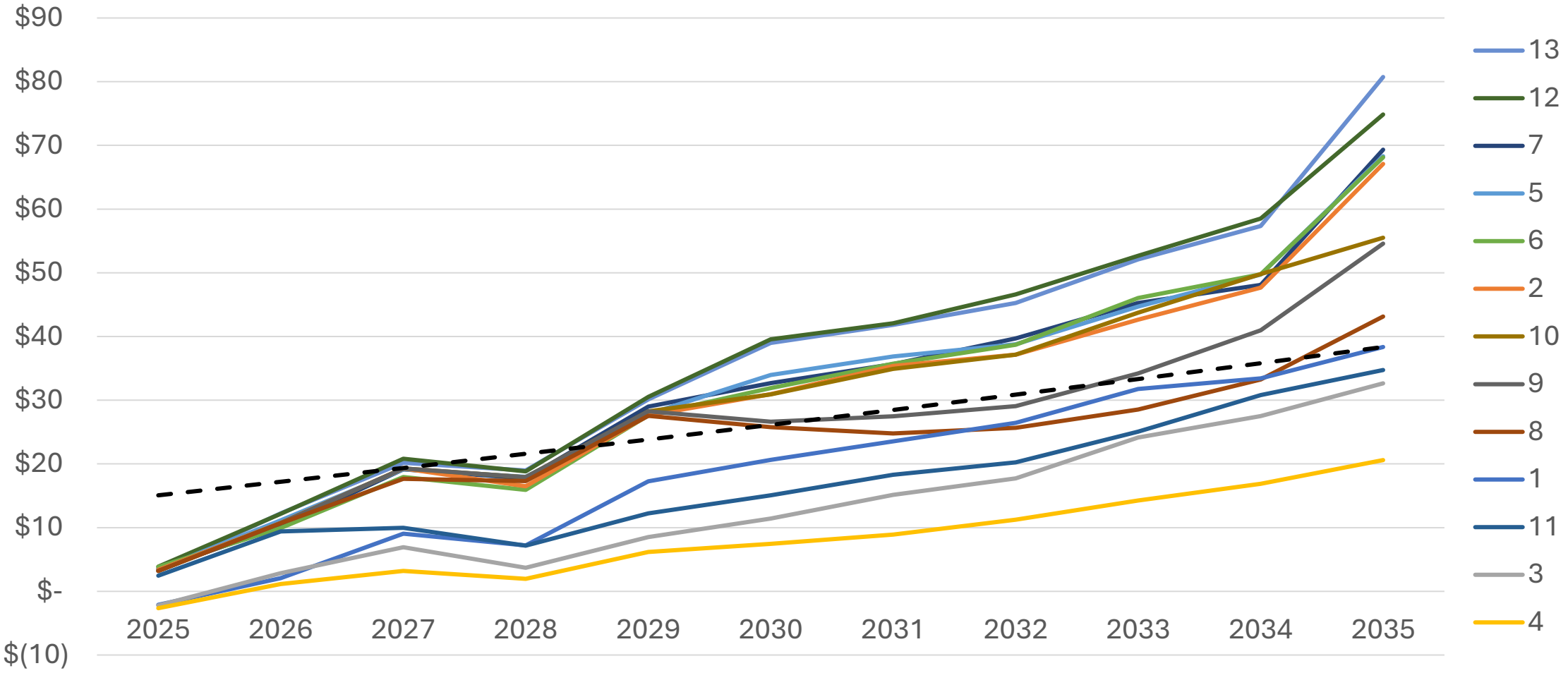
- "Average Monthly Residential Bill Increase" = expected increase in a typical Austin Energy residential customer's monthly electricity bill in 2035 compared with today due to the additional net costs associated with the generation portfolio only.
- Based on the "Net Cost" of each portfolio.
- Does not account for any other new or required AE capital or O&M costs in the future.

2035 Average Monthly Residential Bill Increase



DISCLAIMER: These are representative results based on modeling for the 2035 Resource Generation Plan and are not projections of Austin Energy's future prices. The results are not inclusive of factors beyond the scope of this Resource Generation Plan modeling.

Avg. Monthly Bill Impact by Year – Avg. of All Scenarios

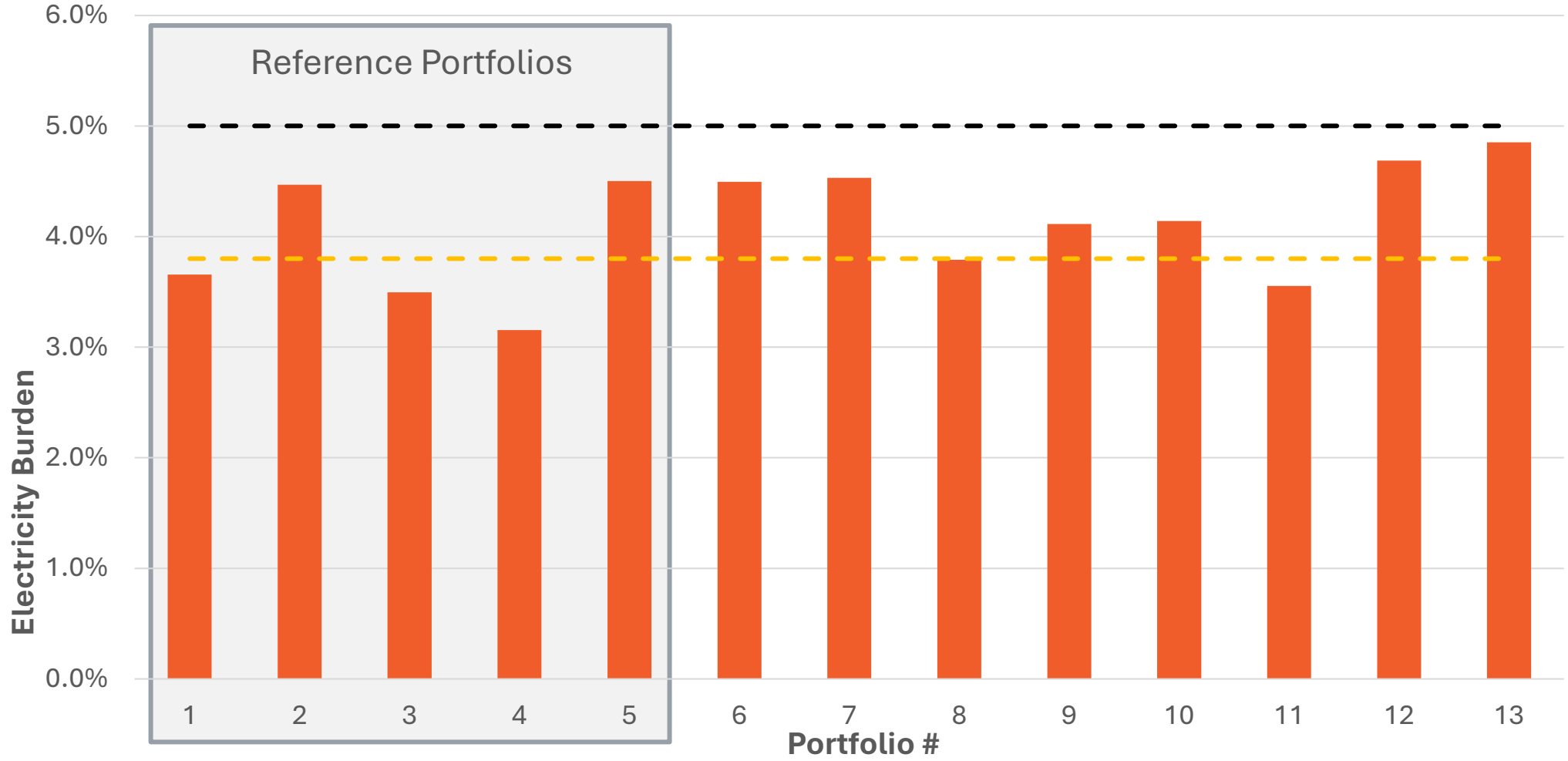


DISCLAIMER: These are representative results based on modeling for the 2035 Resource Generation Plan and are not projections of Austin Energy's future prices. The results are not inclusive of factors beyond the scope of this Resource Generation Plan modeling.

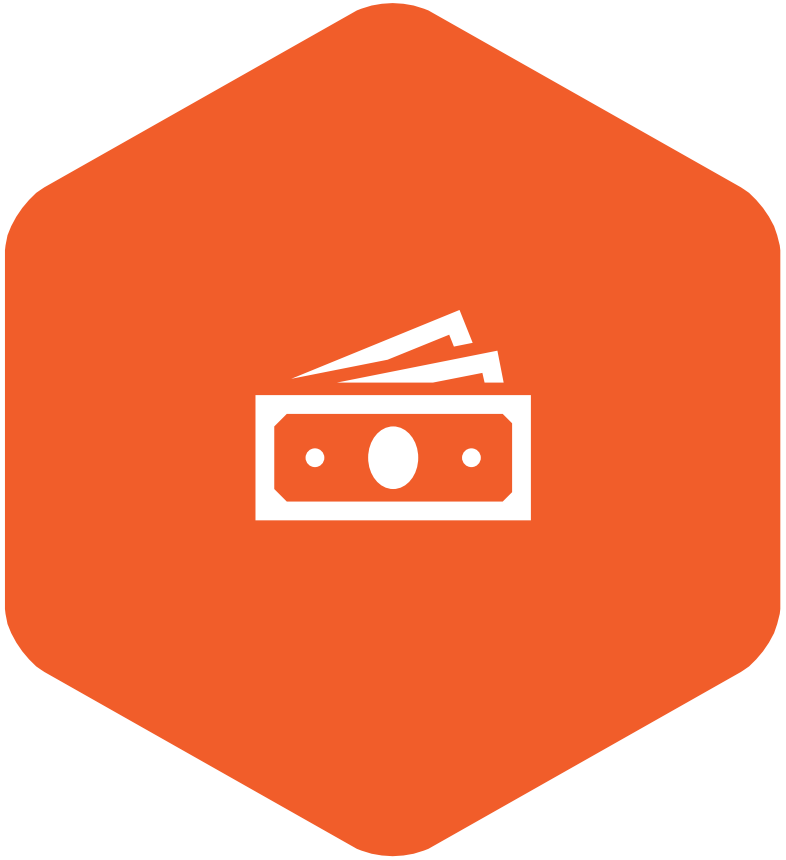
Electricity Burden

- “Electricity Burden” is the percentage of a household’s monthly income that goes toward their electricity bill
- A higher percentage of income dedicated to electricity costs indicates a higher “electricity burden” for that household
- For this analysis AE estimates the electricity burden for a typical customer in its Customer Assistance Program (CAP) using the 2023 Federal Poverty Income guidelines as a reference for estimated annual income

2035 Estimated Customer Assistance Program (CAP) Customer Electricity Burden (Avg of Scenarios)



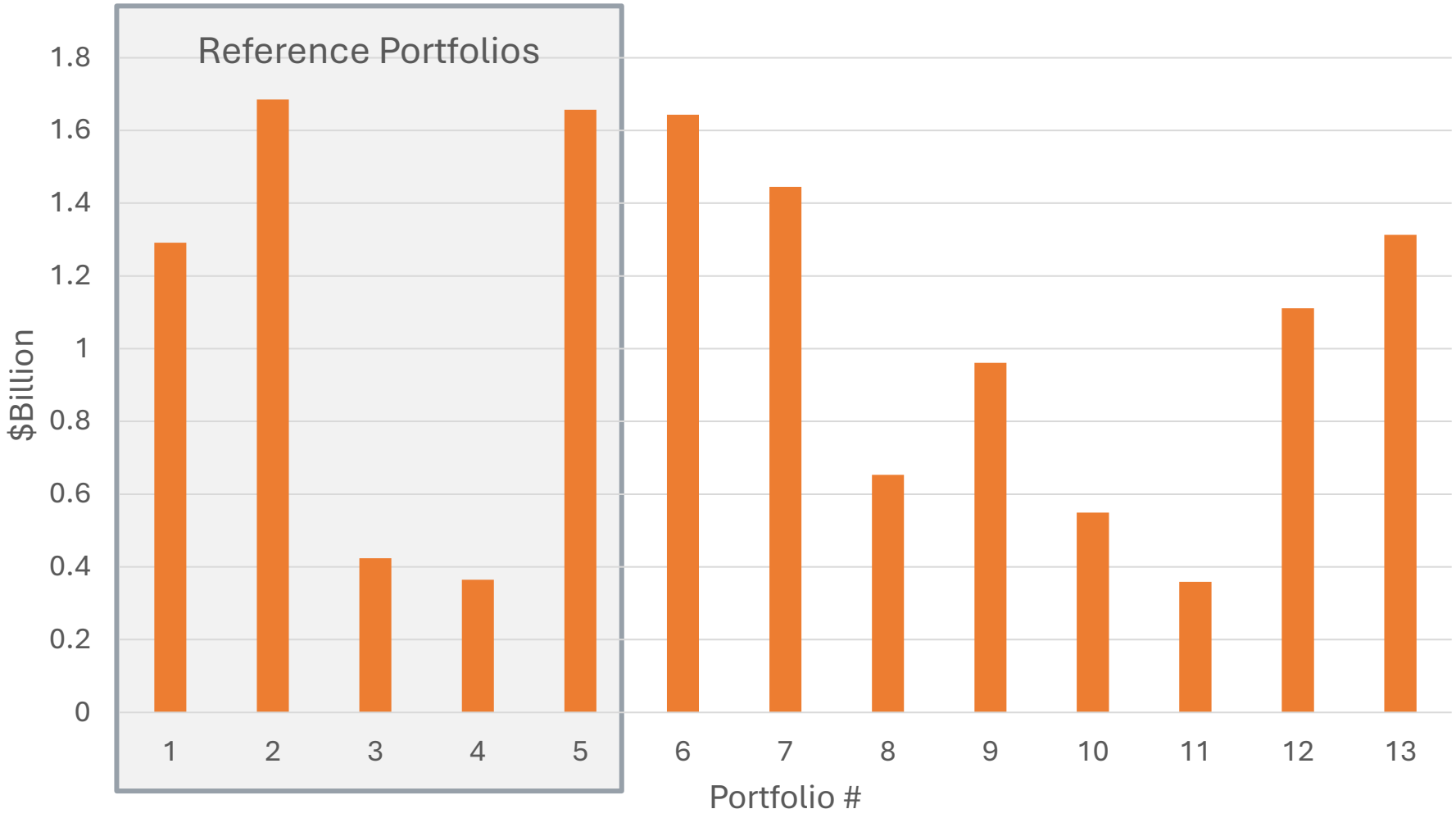
Liquidity Risk



- “Liquidity Risk” = Risk to Austin Energy of not having enough cash on-hand to settle financial account with ERCOT after an extreme event.
- Uses a modeling technique called “backcasting” to estimate how a portfolio of resources would have performed financially during an event similar to Winter Storm Uri.
- During an extreme event, ERCOT prices can spike – Austin Energy must purchase power from ERCOT to cover local load – if Austin Energy does not sell enough electricity at the same prices to cover expense, it must pay the difference to ERCOT immediately.
- Based on portfolio mix in 2035.

Stress Test Results – Total Liquidity Risk

Based on 2035 portfolio mix



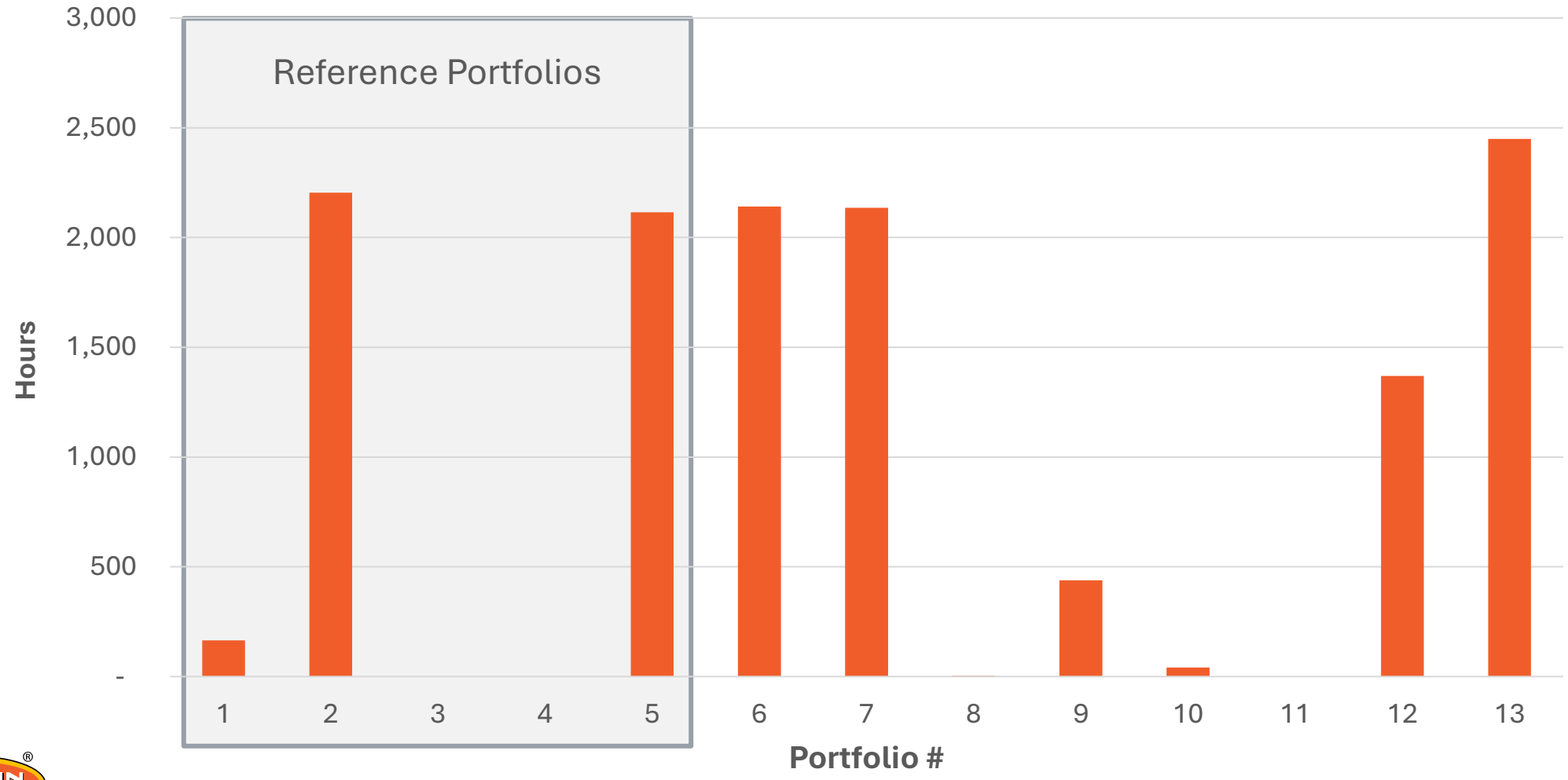
Portfolio Comparison - Reliability Impacts

Reliability Risk Hours

- “Reliability Risk Hours” = total number of hours in a given year that the model predicts there will be increased risk of local outages.
- Local outages in this case are a result of not enough electricity physically available to meet Austin’s load.
- Can be caused by high local load, decrease in local power generation, decrease in import capacity, or a combination of these factors.

2035 Reliability Risk Hours

One year = 8,760 hours

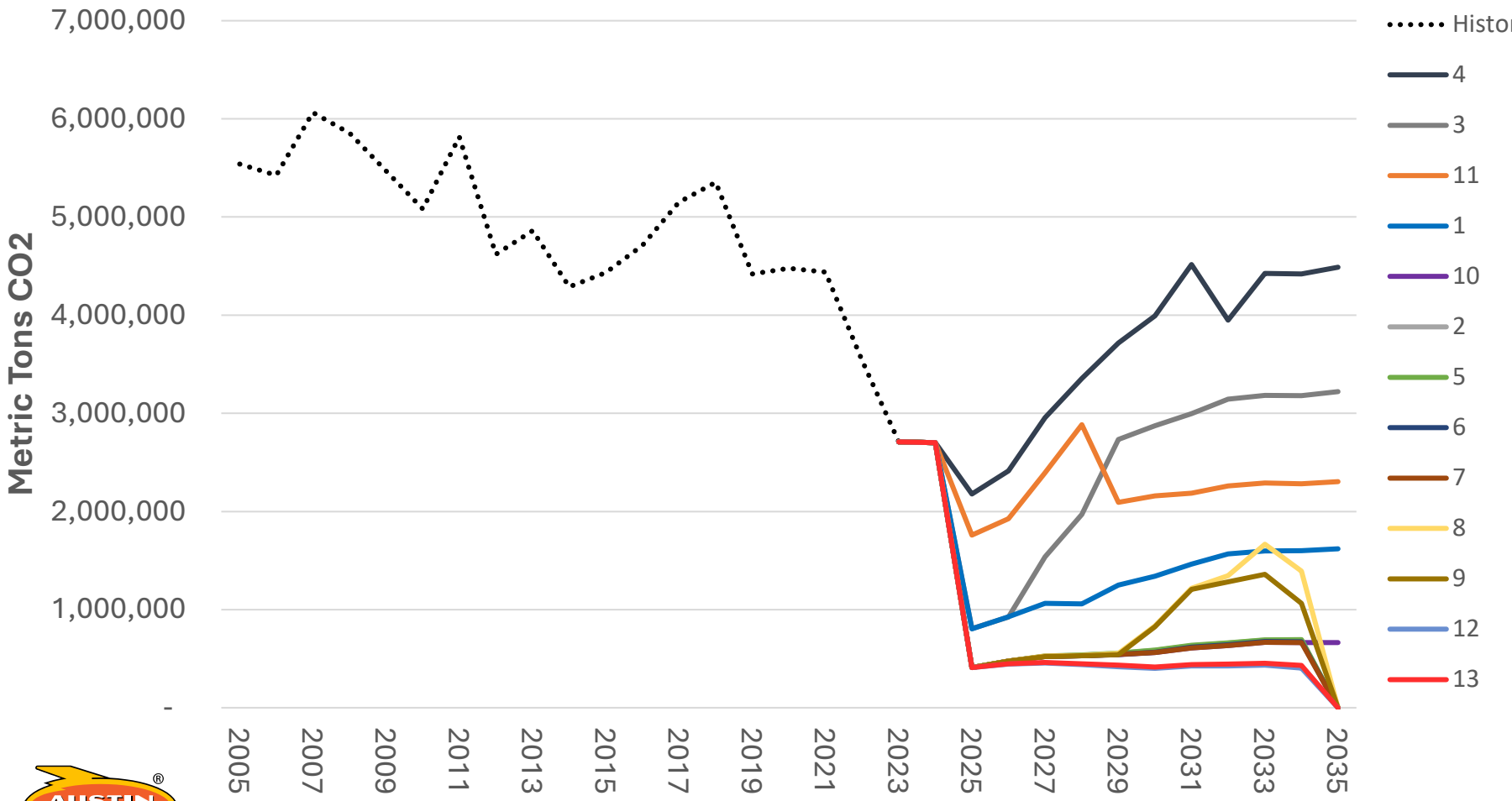


2035 Reliability Risk Events of 4,6 or 8 Hours

Portfolio Comparison – Emission Impacts

Modeled Austin Energy Stack CO_2 Emissions

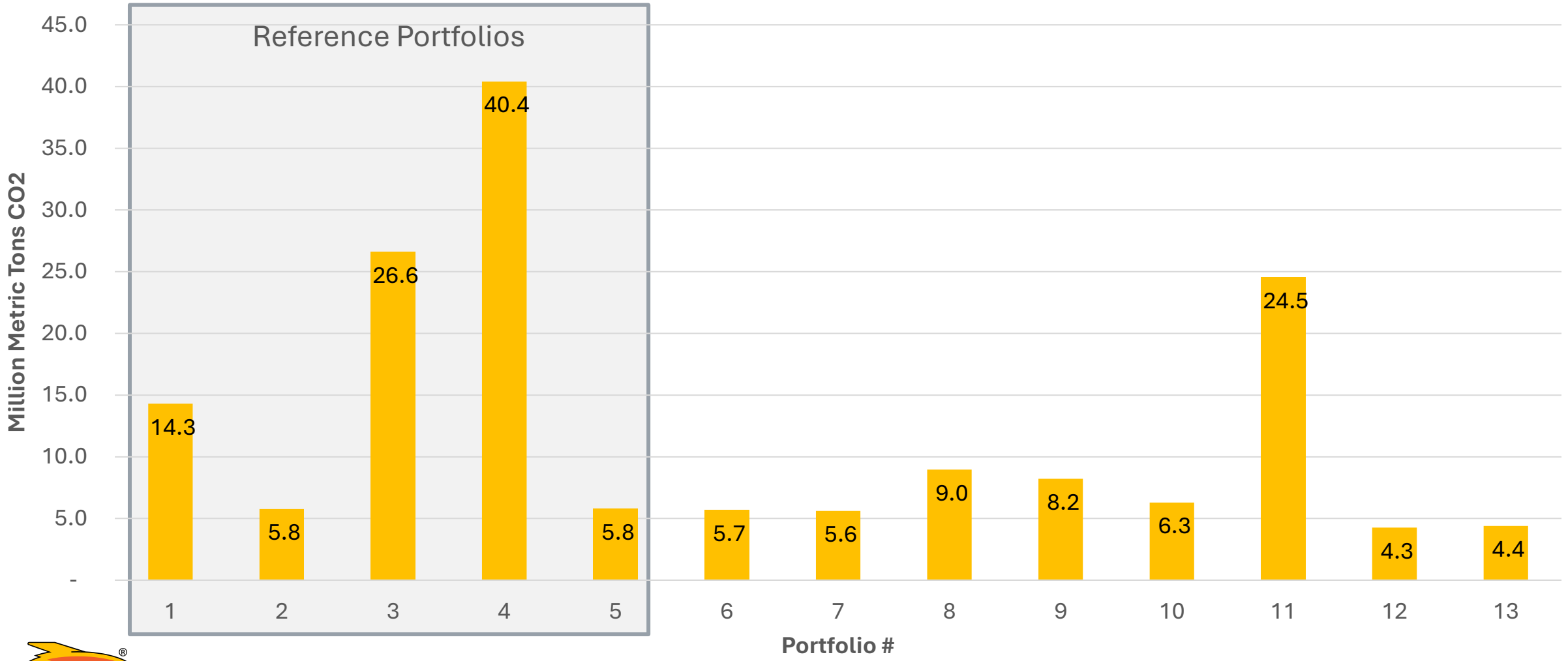
By Year vs. Historical



Portfolio #	2035 % Reduction (Relative to 2020)
4	-0.2%
3	28%
11	49%
1	64%
10	85%
2	100%
5	100%
6	100%
7	100%
8	100%
9	100%
12	100%
13	100%

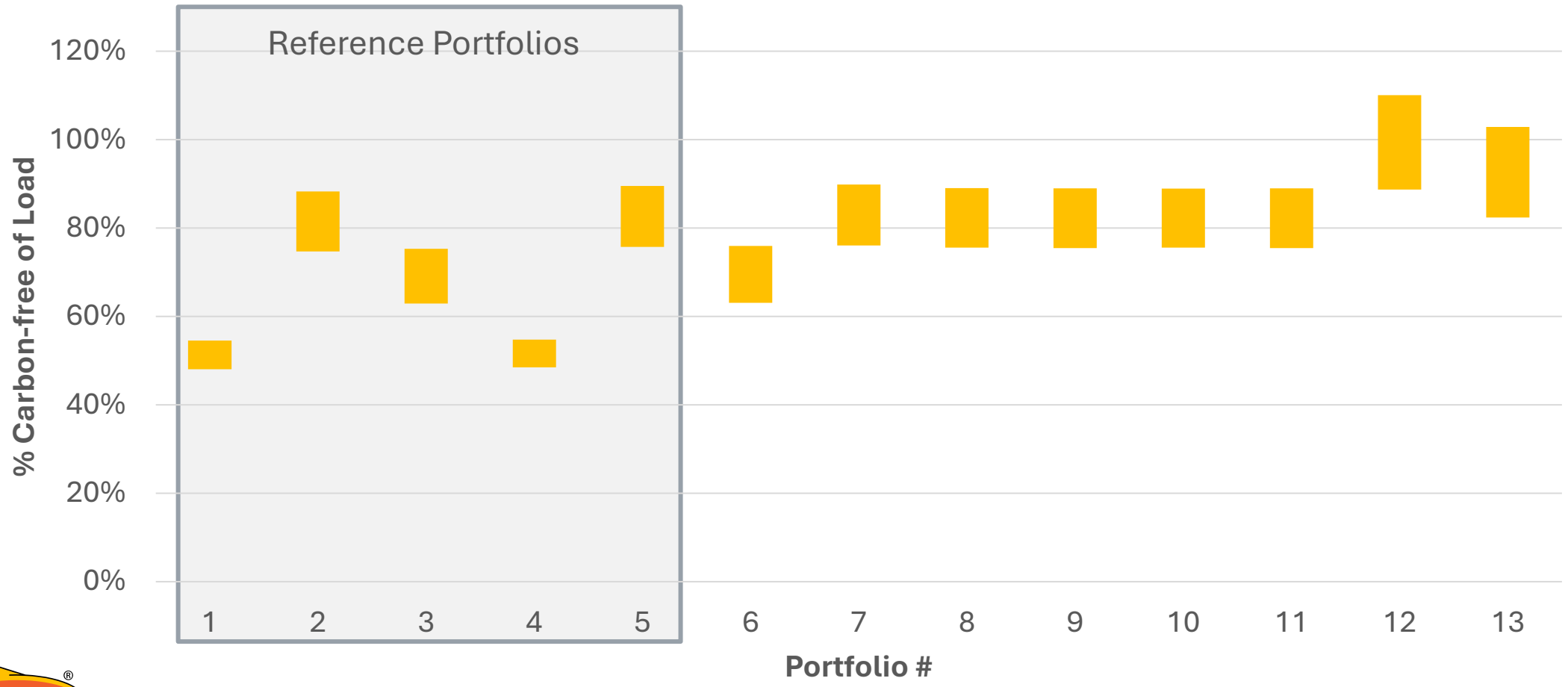
Total CO_2 Emissions (Million Metric Tons)

2025-2035



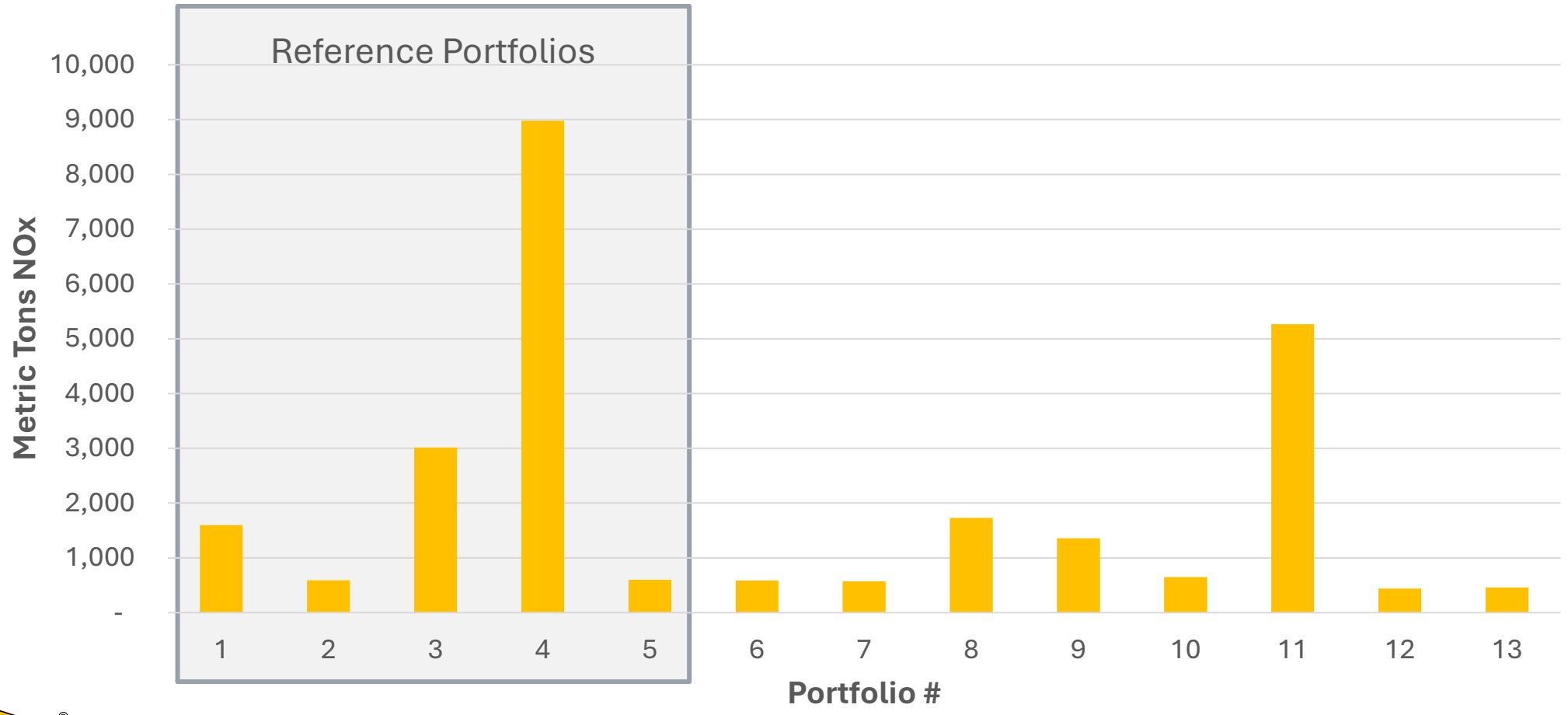
Percent of Load Matched with Carbon-Free Energy in 2035

Range Accounts for Curtailments



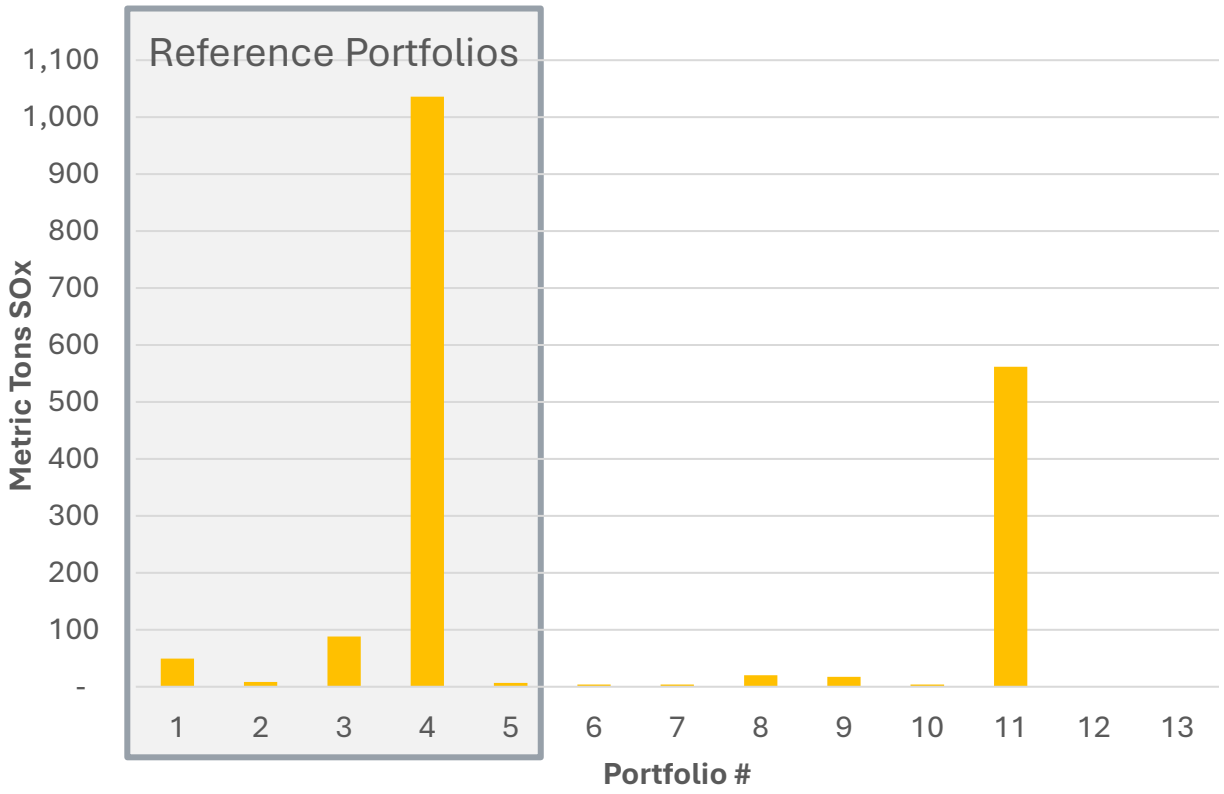
Total NOx Emissions (Metric Tons)

2025-2035

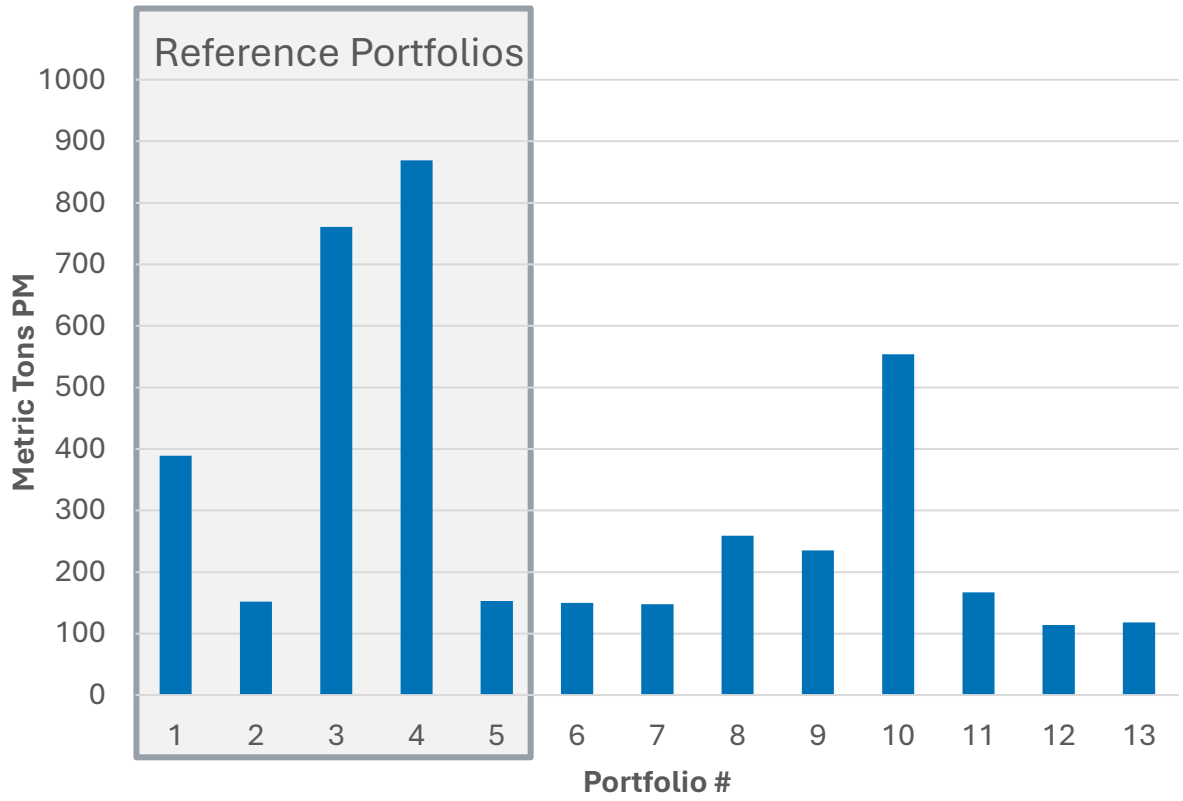


Emissions 2025-2035

Total SOx



Total Particulate Matter (PM)



Summary Tables with Overall Values and Rankings

Portfolio	Net Cost 20-yr NPV ($MM)	2035 Bill Impact ($/Month)	2035 Energy Burden (%)	Total Liquidity Need ($MM)	2035 Reliability Risk Events 4+ Hours (Count)	2035 Reliability Risk Hours (Hours)	Total CO_2 Emissions (Million Metric Tons)	Total NOx Emissions (Metric Tons)	Total SOx Emissions (Metric Tons)	Total PM Emissions (Metric Tons)
1	$9,771	$38	3.7%	$1,291	9	165	14	1596	49	389
2	$13,026	$67	4.5%	$1,685	17	2,204	6	589	8	152
3	$8,659	$33	3.5%	$424	0	0	27	3016	88	761
4	$7,336	$21	3.2%	$365	0	0	40	8978	1036	869
5	$13,029	$68	4.5%	$1,657	20	2,115	6	599	7	153
6	$12,913	$68	4.5%	$1,643	25	2,141	6	584	4	150
7	$13,053	$69	4.5%	$1,445	24	2,136	6	573	4	148
8	$10,629	$43	3.8%	$653	0	3	9	1730	20	259
9	$11,665	$55	4.1%	$961	20	438	8	1355	17	235
10	$12,155	$56	4.1%	$549	4	41	6	650	4	554
11	$9,273	$35	3.6%	$359	0	0	25	5267	562	167
12	$13,244	$75	4.7%	$1,111	55	1,369	4	440	0	114
13	$14,315	$81	4.9%	$1,313	56	2,449	4	457	1	118

Portfolio	Net Cost 20-yr NPV	2035 Bill Impact	2035 Energy Burden	Total Liquidity Need	2035 Reliability Risk Events 4+ hours	2035 Reliability Risk Hours	Total CO_2 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM Emissions
1	4	4	4	8	6	6	10	9	10	10
2	9	8	8	13	7	12	5	5	7	5
3	2	2	2	3	1	1	12	11	11	12
4	1	1	1	2	1	1	13	13	13	13
5	10	10	10	12	8	9	6	6	6	6
6	8	9	9	11	11	11	4	4	3	4
7	11	11	11	10	10	10	3	3	3	3
8	5	5	5	5	1	4	9	10	9	9
9	6	6	6	6	8	7	8	8	8	8
10	7	7	7	4	5	5	7	7	3	11
11	3	3	3	1	1	1	11	12	12	7
12	12	12	12	7	12	8	1	1	1	1
13	13	13	13	9	13	13	2	2	2	2

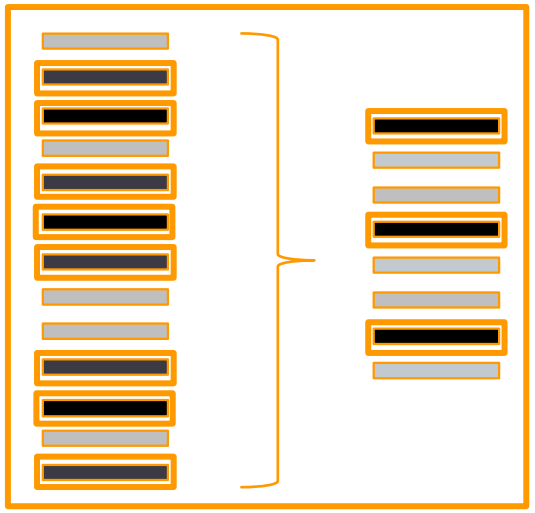
Ranks each portfolio 1-13 (1 = best, 13 = worst) within each output metric column

Customer Driven. Community Focused.SM

Portfolio Modeling Overview

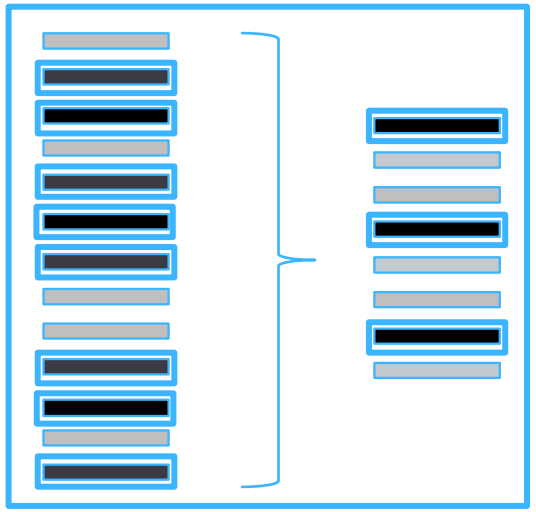
Austin Energy Modeling Process

Utilizing *UPLAN* and *PowerSIMM* modeling tools to evaluate the performance of multiple **human-made portfolios** across various scenarios.



3rd Party Modeling Process

Ascend's resource planning methodology and modeling tools generate **optimized portfolios based on specified constraints**.



Portfolio Evaluation

All modeling results will be evaluated to select portfolios for further consideration.

PORTFOLIO A
PORTFOLIO B
PORTFOLIO C
PORTFOLIO D
PORTFOLIO E
PORTFOLIO F

Shortlist of Portfolios

Ascend Analytics

Evaluating Options for Austin Energy's Portfolio Through 2035

Benjamin Anderson

Manager of Resource Planning

September 2024

Introduction

Introduction: Austin Energy's Resource, Generation and Climate Protection Plan to 2035

Analysis Goal:
Evaluate four generation portfolios that illustrate the tradeoffs between costs, emissions and reliability during the period of 2025-2035.

Purpose

Austin Energy commissioned Ascend Analytics to conduct this resource planning study. Results will supplement Austin Energy's Uplan analysis, to inform which portfolios are down-selected for further study. Ascend used the same cost and load assumptions as Austin Energy's Uplan analysis.

Methodology

Using its flagship PowerSIMM software, Ascend ran a capacity expansion model with different constraint sets to create four portfolios and ran these portfolios through production cost model to evaluate their costs, emissions, and reliability.

Modeled Portfolios

Overview of the Portfolios

Portfolio A (Baseline)

- Meets emissions and renewable energy targets
- Builds sufficient local firm capacity to cover peak loads
- Least-cost path to meet the constraints

Portfolio B

- Meets same emissions, renewable, and local firm capacity targets as Portfolio A, but without any new gas or hydrogen-burning plants
- Provides a path to zero emissions not dependent on clean hydrogen availability

Portfolio C

- No emissions or renewable targets
- Builds sufficient local firm capacity to cover peak loads

Portfolio D

- Meets the same emissions and renewable targets as Portfolio A
- Builds sufficient local firm capacity to cover peak loads plus a 15% margin

Portfolios A, B, & D are carbon-free by 2035 and achieve 65% renewable energy from 2027 onwards.

The Portfolios must build local storage or gas/hydrogen-fueled power plants to satisfy the local firm capacity constraint.

All portfolios include max assumptions about demand-side management buildouts from the DNV study, including the following by 2035:

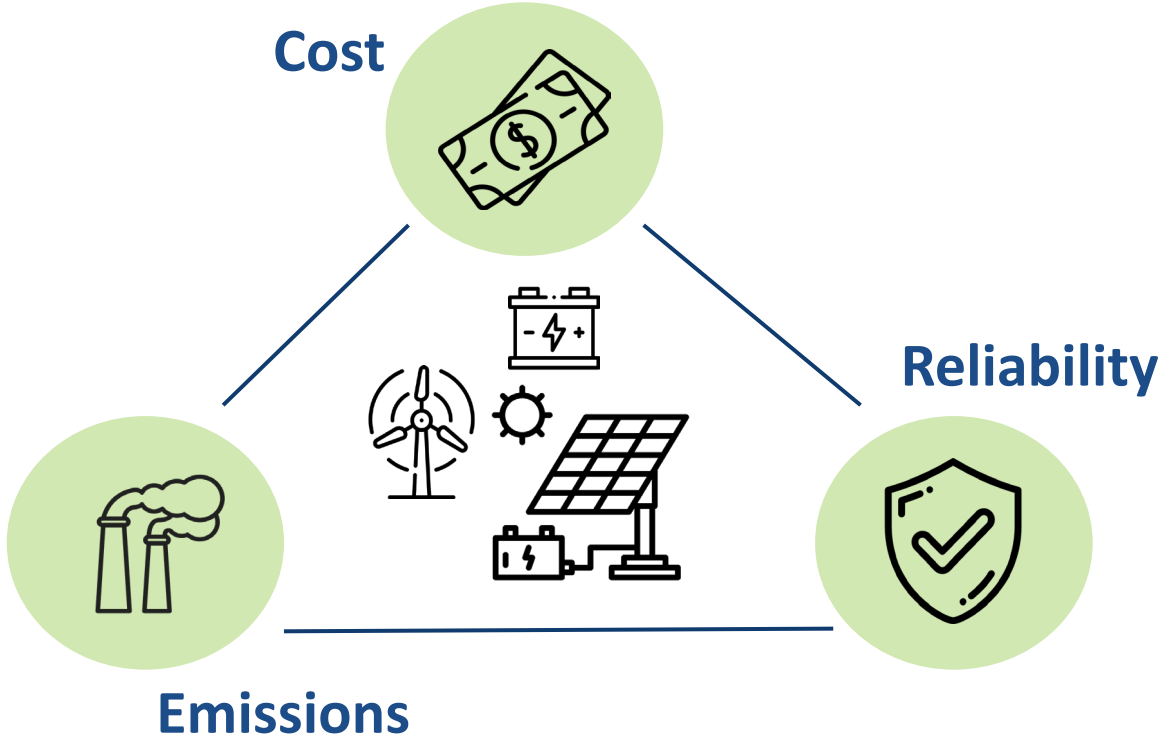
- 360 MW of energy efficiency
- 270 MW of demand response
- 371 MW of customer-sited solar
- 60 MW of community solar (Portfolio B builds additional)

Portfolio Constraints

	A	B	C	D
Coal-Free Portfolio: FPP is not included in the portfolio (assumes retirement 12/31/2024)	☑	☑		☑
Carbon-Free (annual emissions requirement): Starting with 2023 carbon emissions, ramp down linearly to zero in 2035	☑	☑		☑
65% Renewable (annual renewable energy requirement): Ensure renewable energy production is at least 65% of load in 2027 and beyond	☑	☑		☑
Green Hydrogen (conversion requirement): All new and existing natural gas plants convert to green hydrogen fuel in the 2030s	☑			☑
Local Reliability: Ensure local firm capacity (ELCC adjusted) plus import capacity exceeds annual peak load	☑	☑	☑	
Enhanced Local Reliability: Ensure local firm capacity (ELCC adjusted) plus import capacity exceeds annual peak load with 15% margin				☑
No New Natural Gas or Hydrogen: Prevents new natural gas or hydrogen units from satisfying local reliability requirement		☑		
Reduced Natural Gas Dispatch (REACH requirement): Applies a REACH adder to existing natural gas plants and retires the units at the end of 2034		☑		
No Fuel Restrictions: Allows continued operation of natural gas plants without hydrogen conversion			☑	

Ascend's Capacity Expansion Model

Ascend's capacity expansion model takes forecasts of load, weather, and market prices as inputs. It receives a set of technologies that can be built, and constraints that it must meet (including emissions, renewables, and reliability targets). It finds the cost-optimal resource buildout that satisfies these constraints.

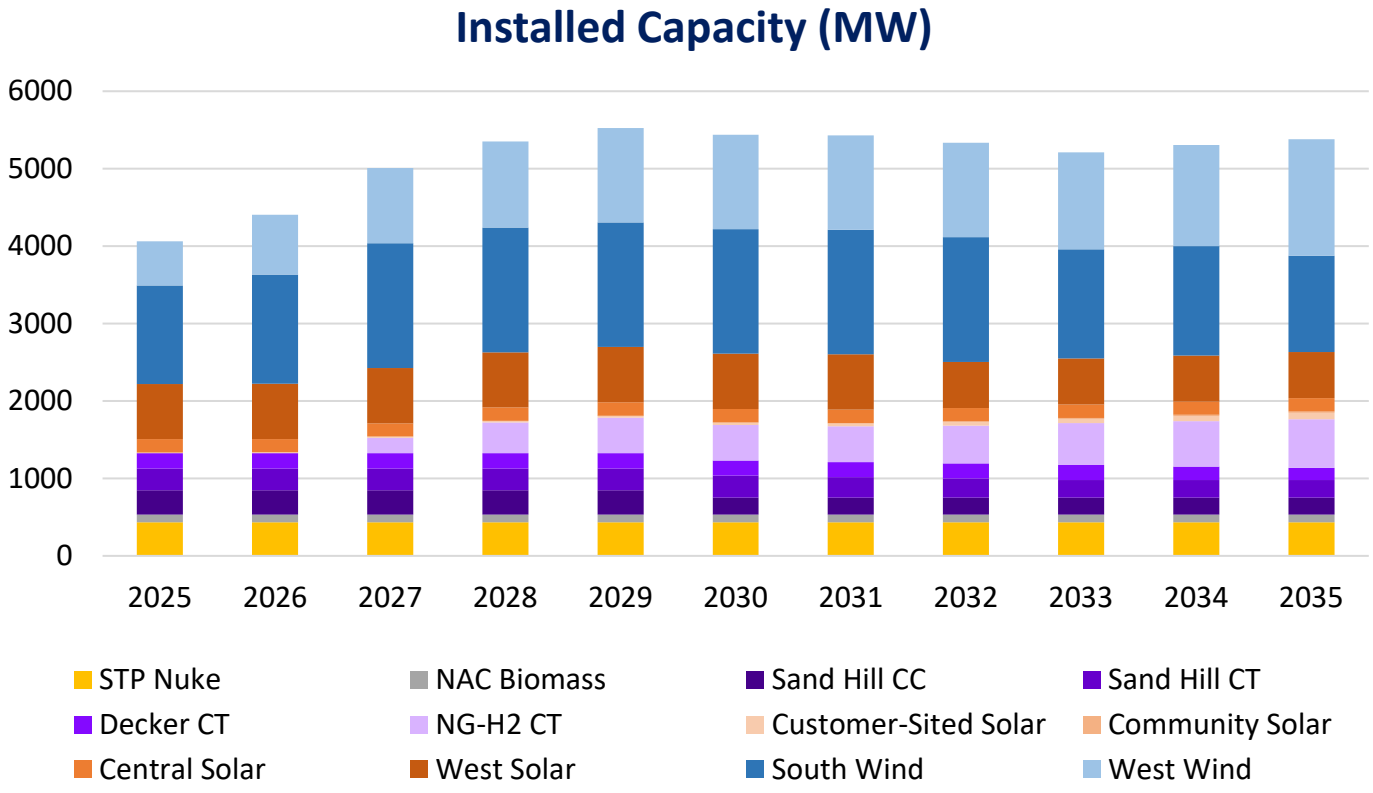


Portfolio Results

Portfolio A: Balancing Cost, Emissions, and Reliability

Buildouts: Wind PPA procurements, new gas buildouts, and conversion of both existing and new gas to hydrogen

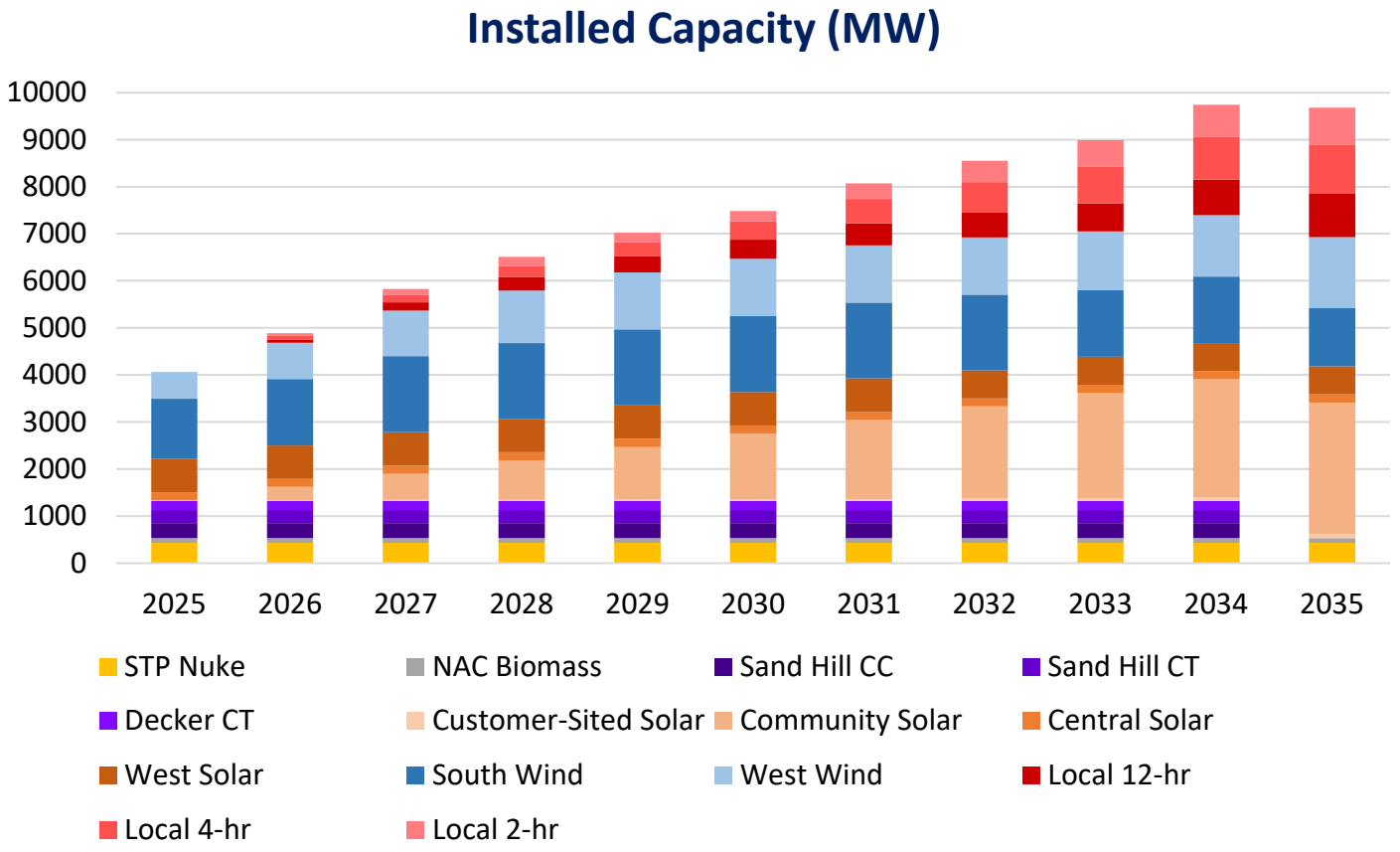
- 1885 MW of wind PPAs are procured to satisfy the 65% renewable energy target
- 630 MW of new, local, hydrogen-capable peakers built for reliability
- Sand Hill, Decker, and new peakers are converted to burn hydrogen in the 2030s and achieve zero carbon emissions by 2035



Portfolio B: Reaching Zero Emissions with Renewables and Batteries

Buildouts: Wind PPA procurements, local solar and storage buildouts, and the retirement of all gas-fired units provide a way to reach zero emissions without green hydrogen

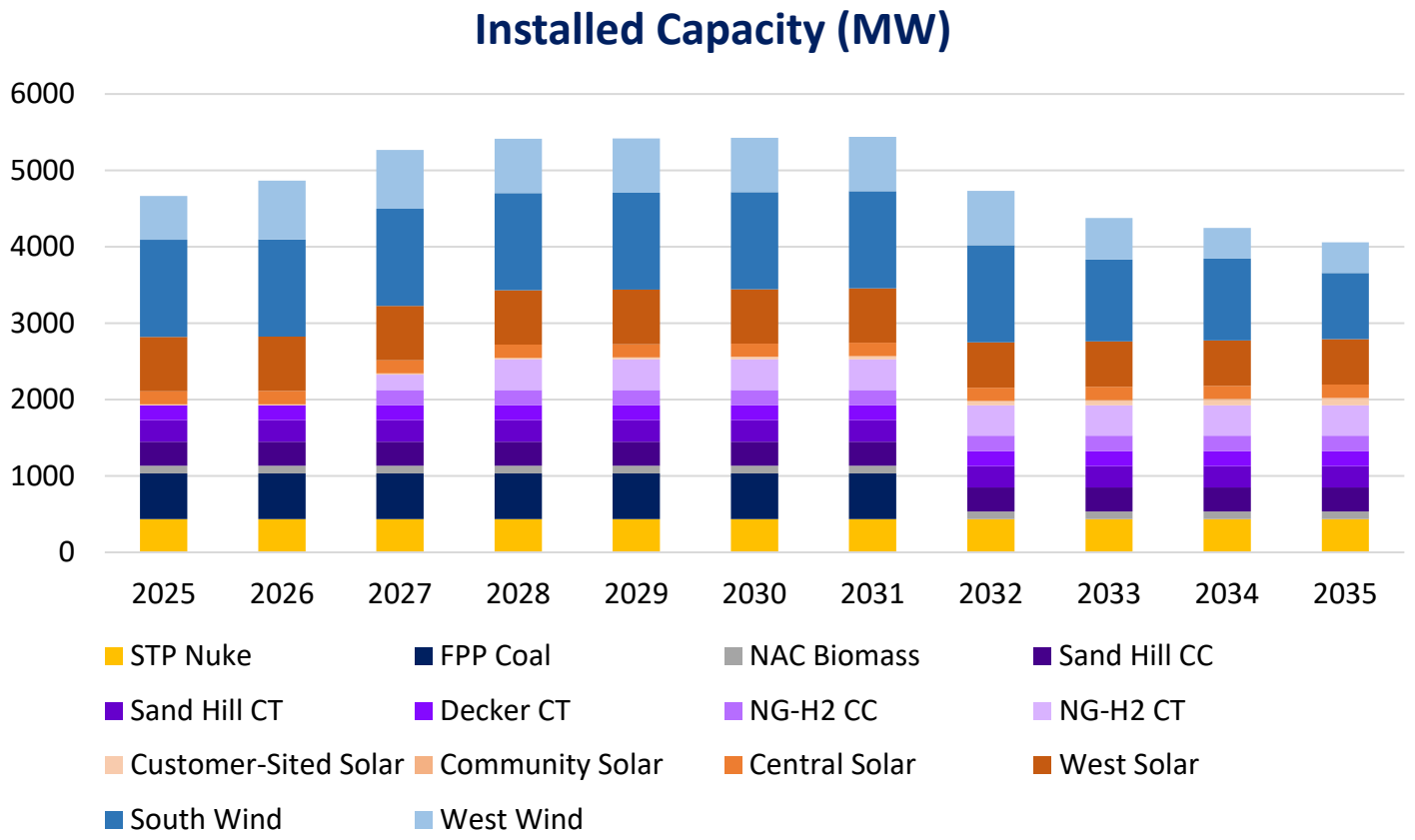
- 1885 MW of wind PPAs are procured to satisfy the 65% renewable energy target
- 2750 MW of local storage, charged by 2800 MW of community solar, provides local energy and capacity
- REACH adders were added to Sand Hill and Decker. They reduce runtime, leading to lower emissions, and retire in 2034.



Portfolio C: Economical and Reliable, but with High Emissions

Buildouts: Only economic wind PPAs are procured. A local CC and several peakers are built for reliability. Sand Hill and Decker don't retire or convert.

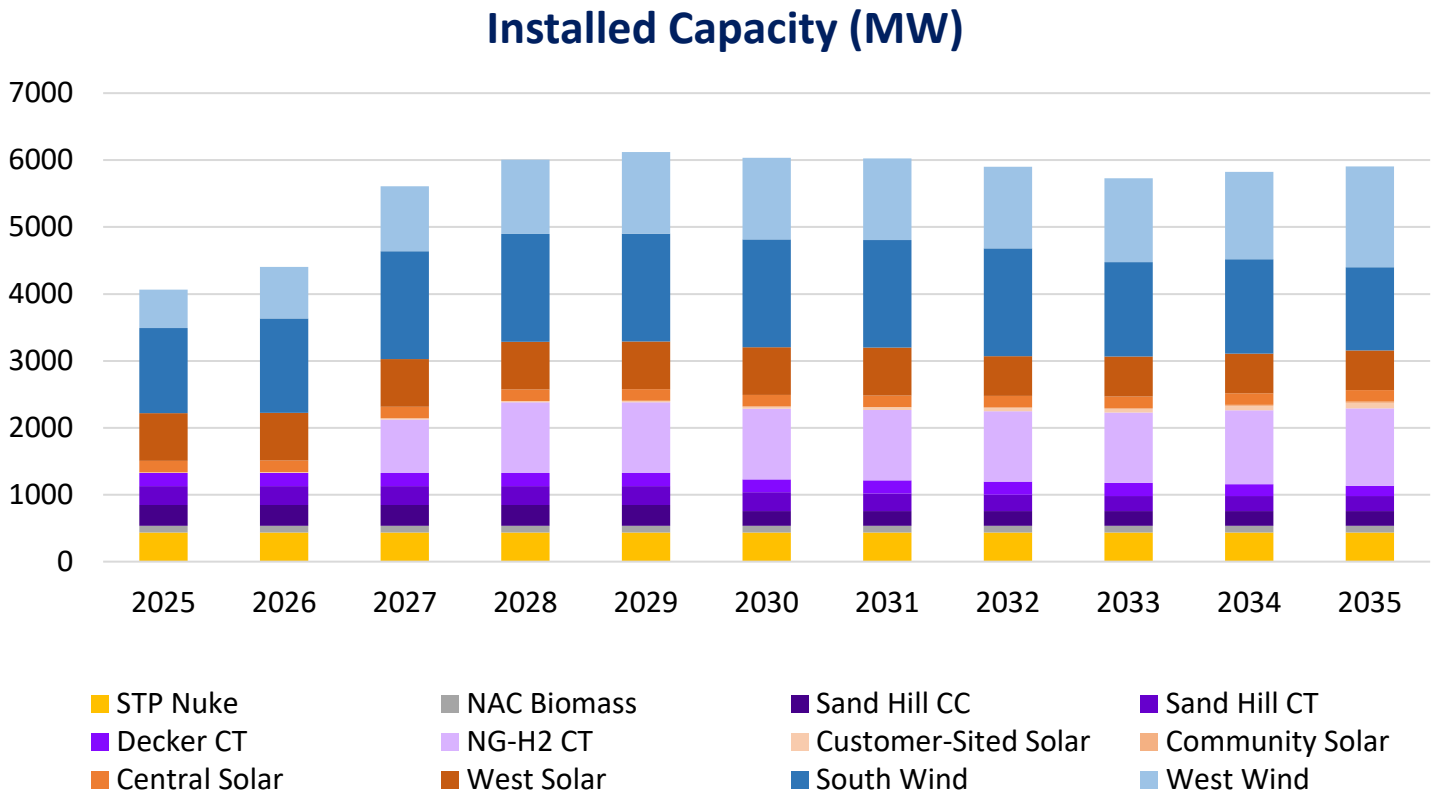
- 400 MW of economic wind PPAs are procured
- 400 MW of local peakers are built for reliability. A 200-MW, local CC is built for reliability.
- Sand Hill and Decker run on gas and don't retire
- FPP runs until end of 2031



Portfolio D: Enhanced Reliability

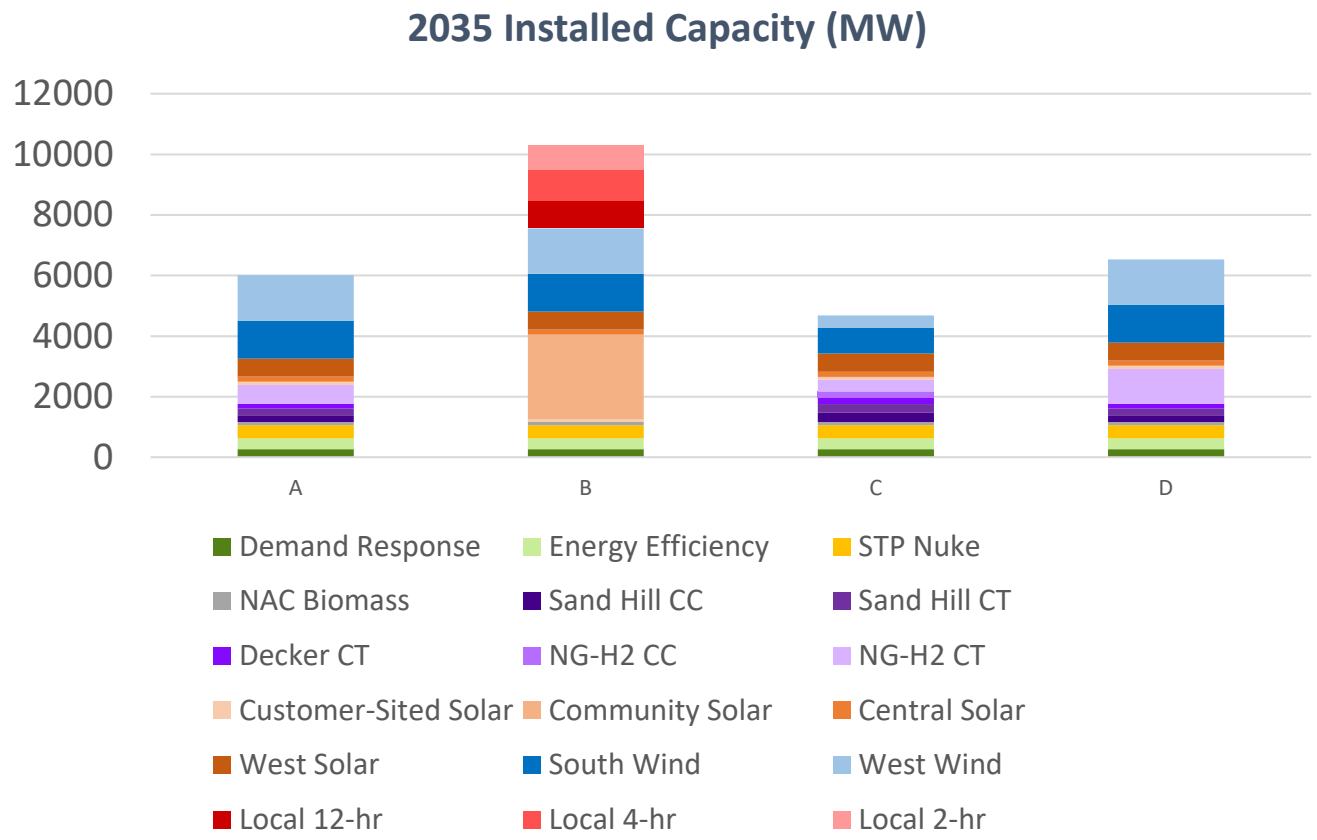
Buildouts: Wind PPA procurements, increased new gas buildouts, and conversion of both existing and new gas to hydrogen provide a clean portfolio with enhanced reliability

- 1885 MW of wind PPAs are procured to satisfy the 65% renewable energy target
- 1,155 MW of new, local, hydrogen-capable peakers built for enhanced reliability
- Sand Hill, Decker, and new peakers are converted to burn hydrogen in the 2030s and achieve zero carbon emissions by 2035



Portfolio Buildouts

- In Portfolios A, B, & D, wind and solar provide most of the energy by 2035
- West and South wind are the primary renewables selected due to their lower net costs.
- Portfolios A, C, & D build local peakers and CCs to provide reliability, whereas Portfolio B uses local storage and solar
- Portfolio A has 1,330 MW of local generation, whereas Portfolio B has 5,631 MW.
- Numbers for this graph are in a table in the Appendix



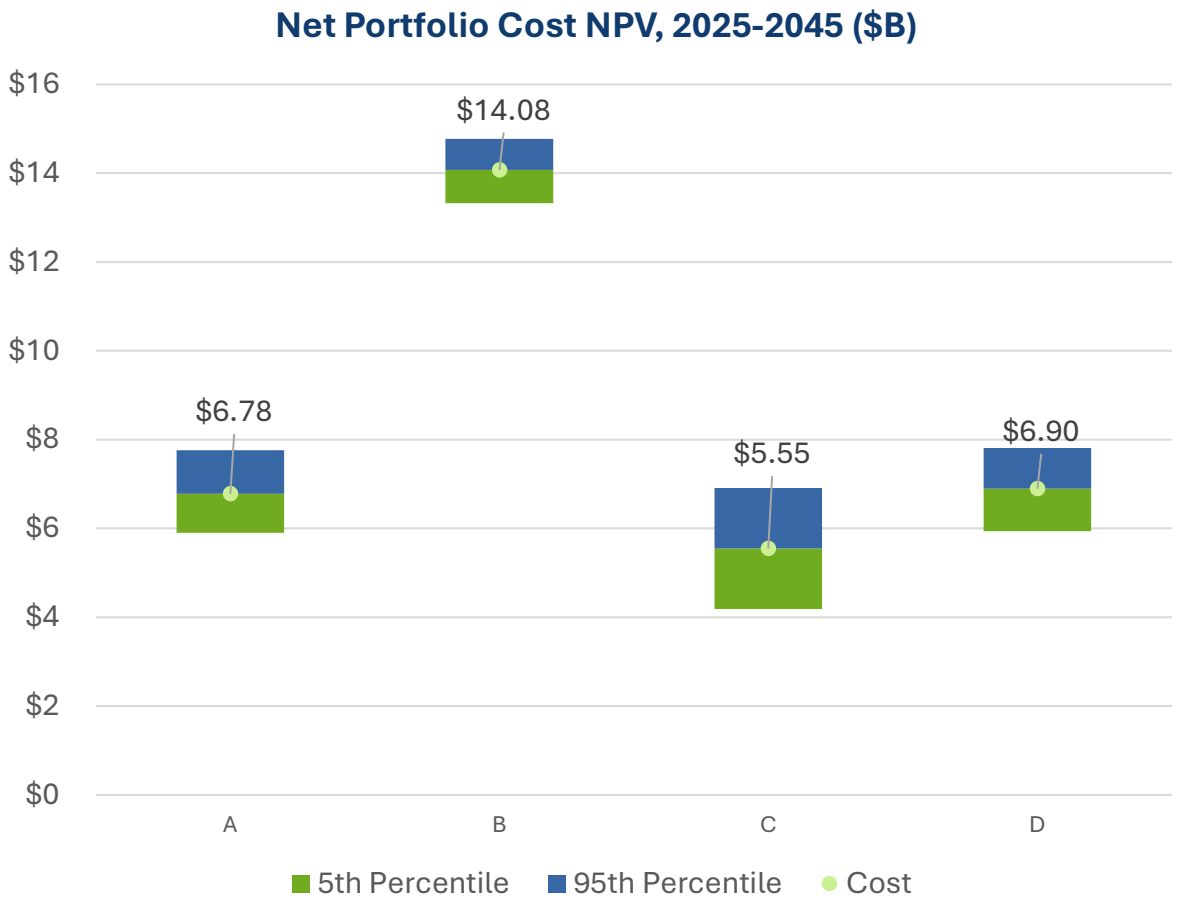
Portfolios A, B & D have more buildouts than Portfolio C to achieve the renewable energy target

Costs, Emissions, & Reliability

Portfolio Costs

- **Portfolio A**: A steady increase in net costs from building new peakers, converting peakers and CCs to hydrogen, and procuring wind PPAs
- **Portfolio B:** Most expensive option, with most costs coming from battery tolls and community solar
- **Portfolio C:** Having plants burn gas and only procuring economical PPAs yields the lowest-cost portfolio, but is the only one with carbon and SO2 emissions in 2035
- **Portfolio D:** Similar to Portfolio A. Increased peaker buildout has roughly equal cost and revenue.

Rates* increase marginally from 9.5c/kWh in 2025 to 12-13c/kWh in 2035, for Portfolios A, C, & D. Portfolio B has much higher rates: 20c/kWh in 2035.



*DISCLAIMER: these are representative results based on modeling for the 2035 Resource Generation Plan and are not projections of AE's future prices. The results are not inclusive of factors beyond the scope of this modeling. These rates are not comparable to bill impact for Uplan analysis.

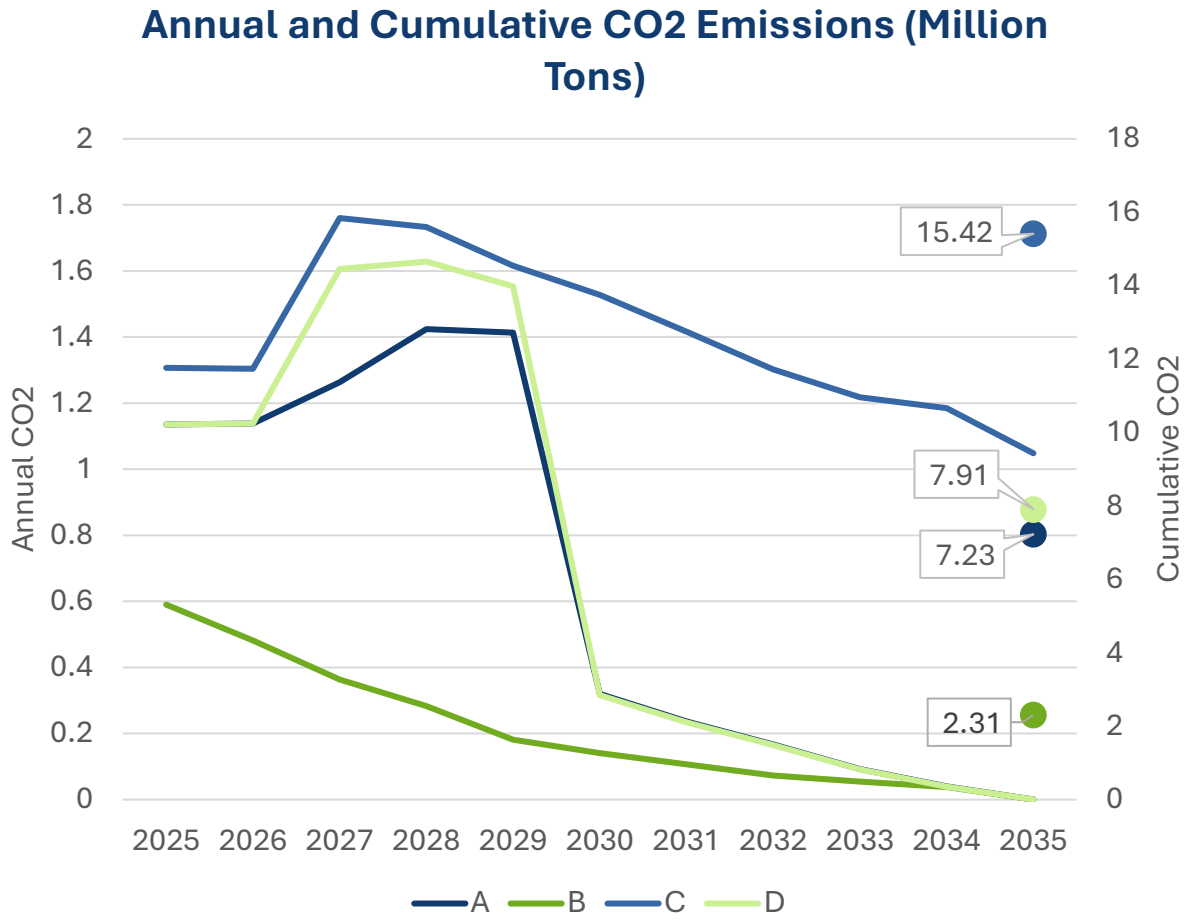
Portfolio Costs Continued

Cost Metric	Portfolio A	Portfolio B	Portfolio C	Portfolio D
2035 Rates ($/kWh)	0.132	0.202	0.121	0.133
2025-2045 NPV ($B)				
Net Costs Mean	$6.78	$14.08	$5.55	$6.90
Net Costs P5	$5.90	$13.33	$4.18	$5.94
Net Costs P95	$7.76	$14.77	$6.91	$7.81
Load Costs	$6.70	$6.70	$6.70	$6.70
Levelized Capital Costs	$0.36	$4.37	$0.34	$0.61
O&M costs	$6.15	$10.55	$4.07	$6.25
Revenue	$6.43	$7.55	$5.56	$6.66

Portfolio Emissions

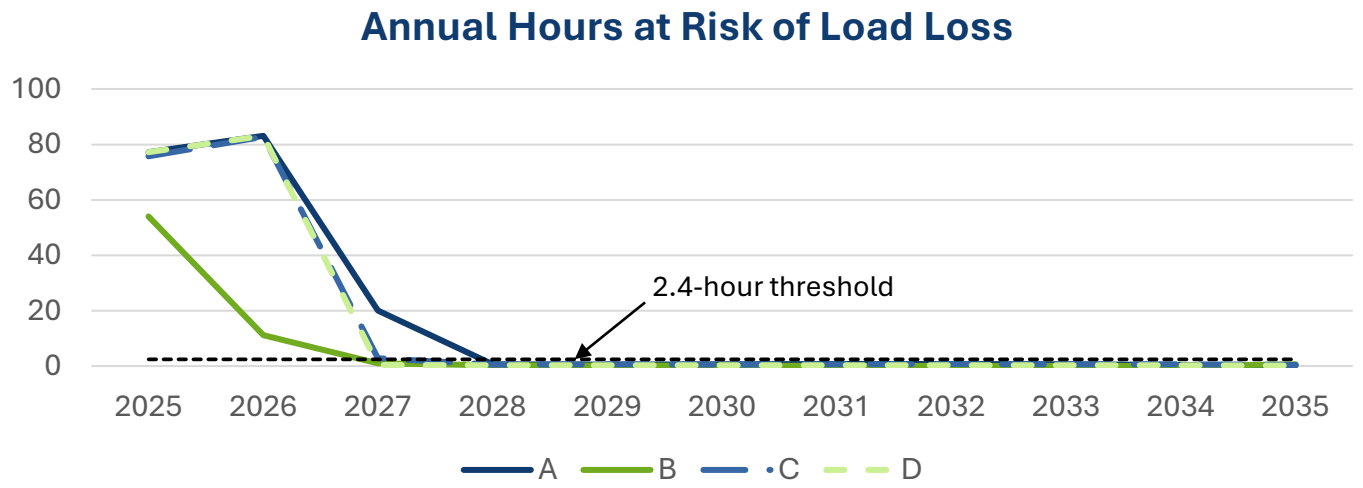
- Emissions are significantly reduced by 2030 in Portfolios A, B, & D, as gas plants convert to hydrogen or operate at low capacity factors
- Compared to Portfolio A, cumulative emissions decrease 68% in B, more than double in C, and increase 9% in D
- In 2035, only Portfolio C has carbon emissions
- Portfolio B is the only portfolio that does not emit NOx in 2035, because it retires all its thermal assets in 2034

Zero carbon emissions can be achieved either by converting gas-burning plants to hydrogen, or by retiring & replacing them with local solar and storage.

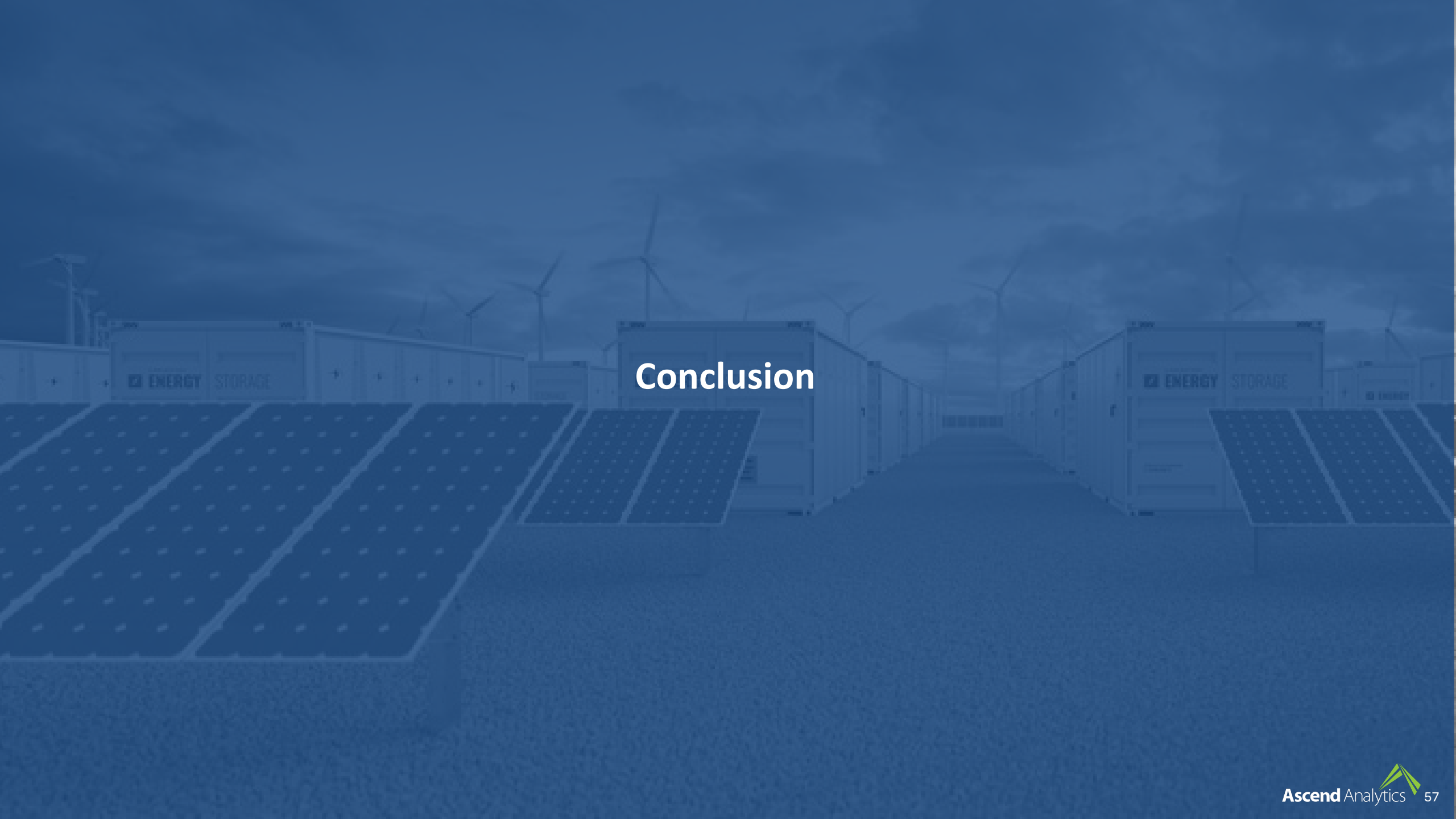


Portfolio Reliability

- Reliability improves over time, with all portfolios far more reliable in 2035 than in 2025 as more local resources are built to serve high load periods. All are below a typical 2.4-hour threshold used in reliability analysis.
- Portfolios start with ~70 hours at risk of load loss, decreasing to under one hour by 2035
- Extra local, firm peaker capacity enables Portfolio D to handle extreme load events and contingencies
- Reliant solely on transmission, local solar, & local storage for energy and capacity in 2035, Portfolio B has the highest risk of load loss



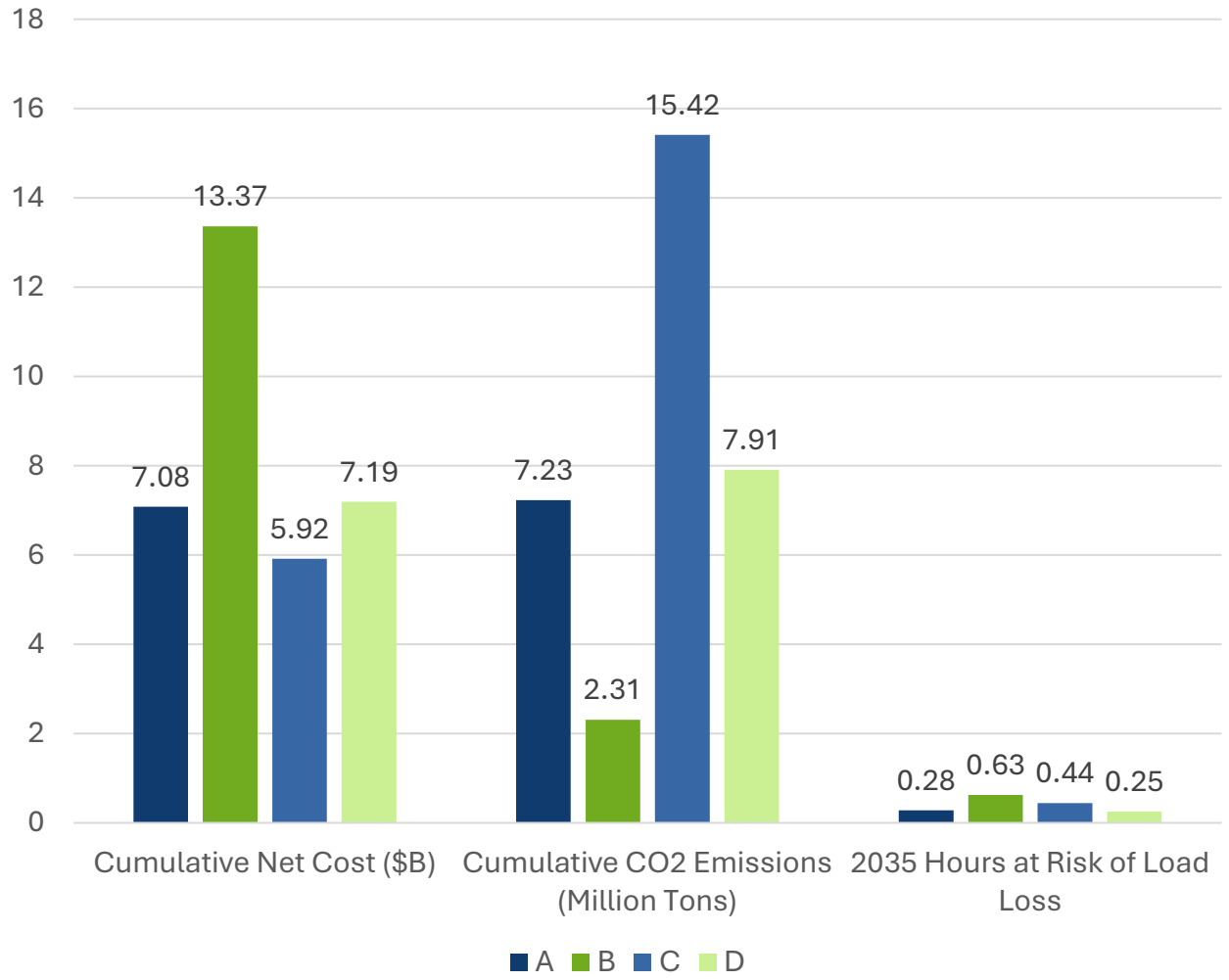
2035 Hours at Risk of Load Loss	Portfolio A	Portfolio B	Portfolio C	Portfolio D
P5	0.16	0	0.14	0.15
MEAN	0.28	0.63	0.44	0.25
P95	0.63	4.76	0.89	0.40



Conclusion

Key Takeaways

- **Using renewables and storage instead of peakers is very expensive:** In Portfolio B, costs nearly double and 28,000 acres in Austin are required to site solar and storage (10% of Austin Energy's service area). However, B is the only Portfolio with no NOx emissions in 2035.
- **There is increasing marginal cost to remove emissions:** Reducing cumulative carbon emissions from 15 to 7 Million tons increases total net costs by $1 Billion. Further reducing emissions from 7 to 2 million tons increases costs by $6 Billion.
- **All Portfolios are reliable by 2035:** Portfolio D adds 525 MW more local peakers than A does. This improves reliability and increases emissions by about 10% each and has a negligible cost impact.



Moving Forward...

There is more than one way to get to zero supply stack emissions by 2035

In finding a balance between cost and emissions over the next decade, there is increasing marginal cost to remove emissions

To achieve zero carbon and local reliability, limiting which dispatchable technologies can be chosen has the potential to greatly increase cost and siting needs.

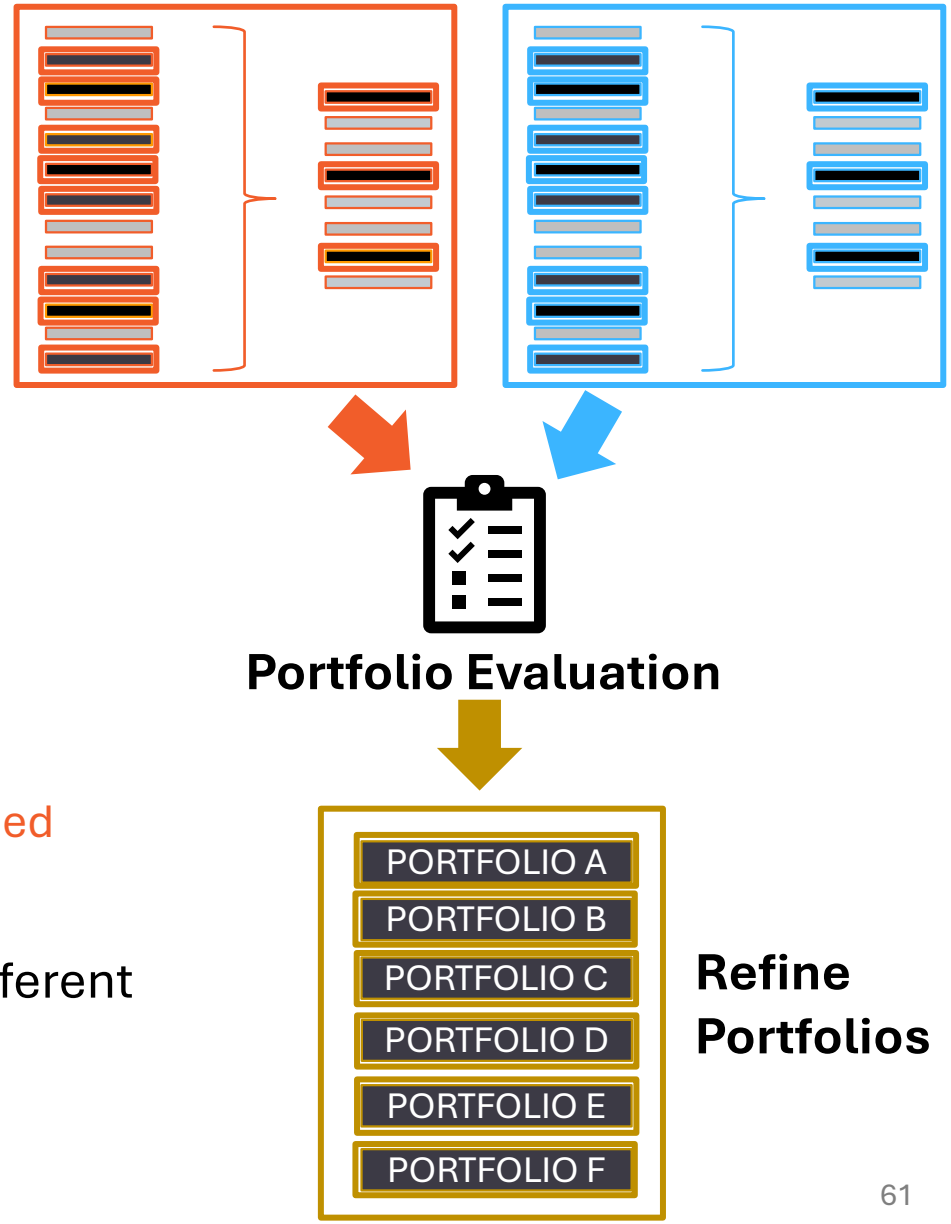
Building local peakers increases reliability with a negligible increase in cost and a marginal increase in emissions.

Ben Anderson
Manager of Resource Planning
banderson@ascendanalytics.com

1877 Broadway Street | Suite 706 | Boulder, CO 80302 | (303) 415 1400

General Reminders

- 17 portfolios studied to date
  - 13 Austin Energy & EUC-defined portfolios
  - 4 Ascend Analytics (software-optimized) portfolios
- Several portfolios included for reference only
  - Edge cases, purposefully defined to help understand the boundaries
- Slides show raw data for comparison across portfolios
- We're not drawing conclusions
  - With these portfolios, tradeoffs are significant
  - With the information gained from these portfolios, we will need to refine
- Next step: Ask "what if?" and refine portfolios by mixing different technologies, seeking a more acceptable set of tradeoffs



Discussion & Collaboration

What did you observe?

What surprised you?

What questions do you have?

If you could change something and then re-run the model, what would it be?

EUC Office Hours

- Tuesday, Oct. 1 1 p.m. – 3 p.m.
- Wednesday, Oct. 2 11 a.m. – 1 p.m.
- Thursday, Oct. 3 2:30 p.m. – 4 p.m.
- Friday, Oct. 4 10 a.m. – 12 p.m.

If none of the above times work, please let us know so we can find a time to collaborate.

Office Hours Objectives:

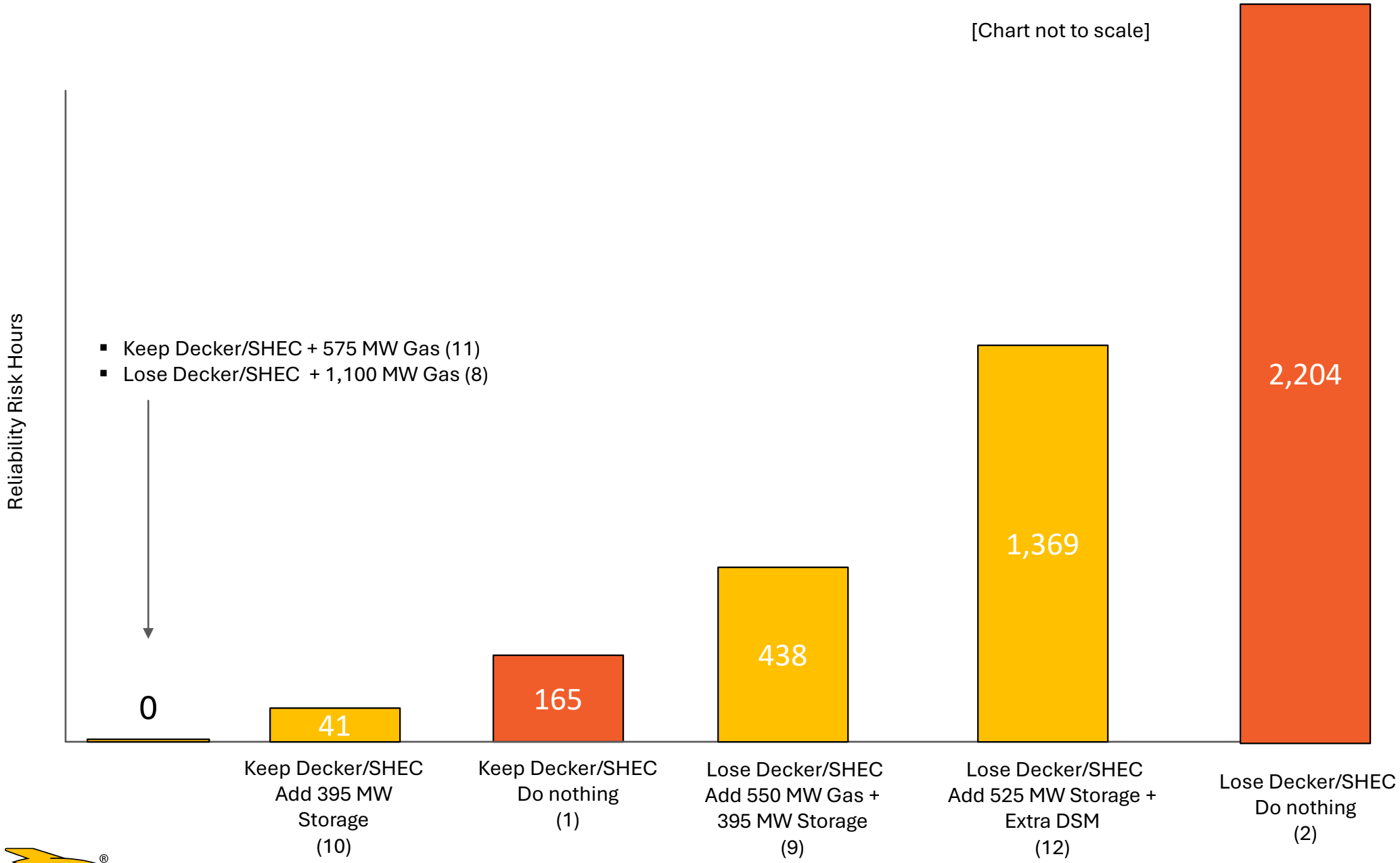
- Review detailed results
- Ask questions
- Determine takeaways
- Refine portfolios

By Friday, Oct. 4 – Define a small set of portfolios for further analysis

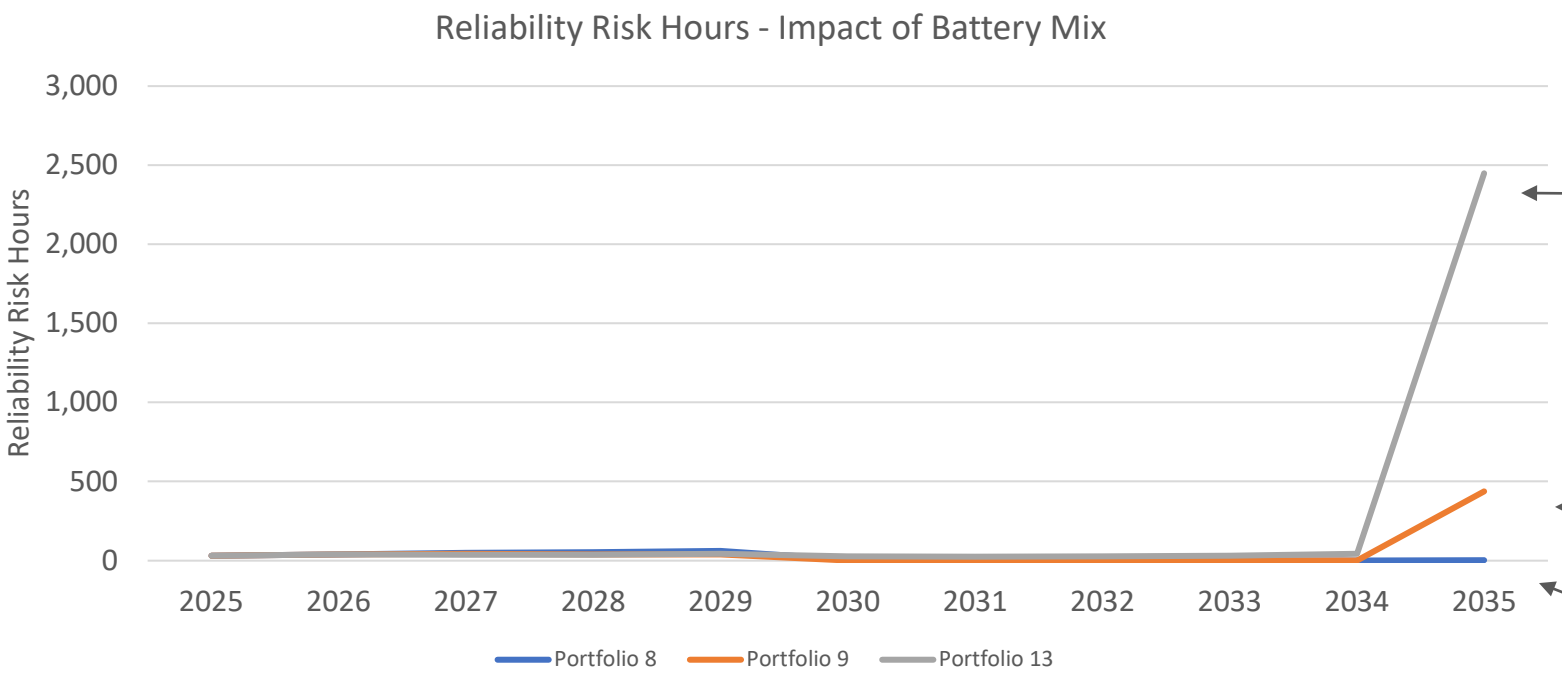
Customer Driven. Community Focused.SM

Austin Energy Appendices

[Chart not to scale]



Reliability Risk Hours – Impact of Battery Mix



2035 Resource Mix

P13 = 925 MW Local Storage

P9 = 550 MW Hydrogen,
395 MW Local Storage

P8 = 1,100 MW Hydrogen

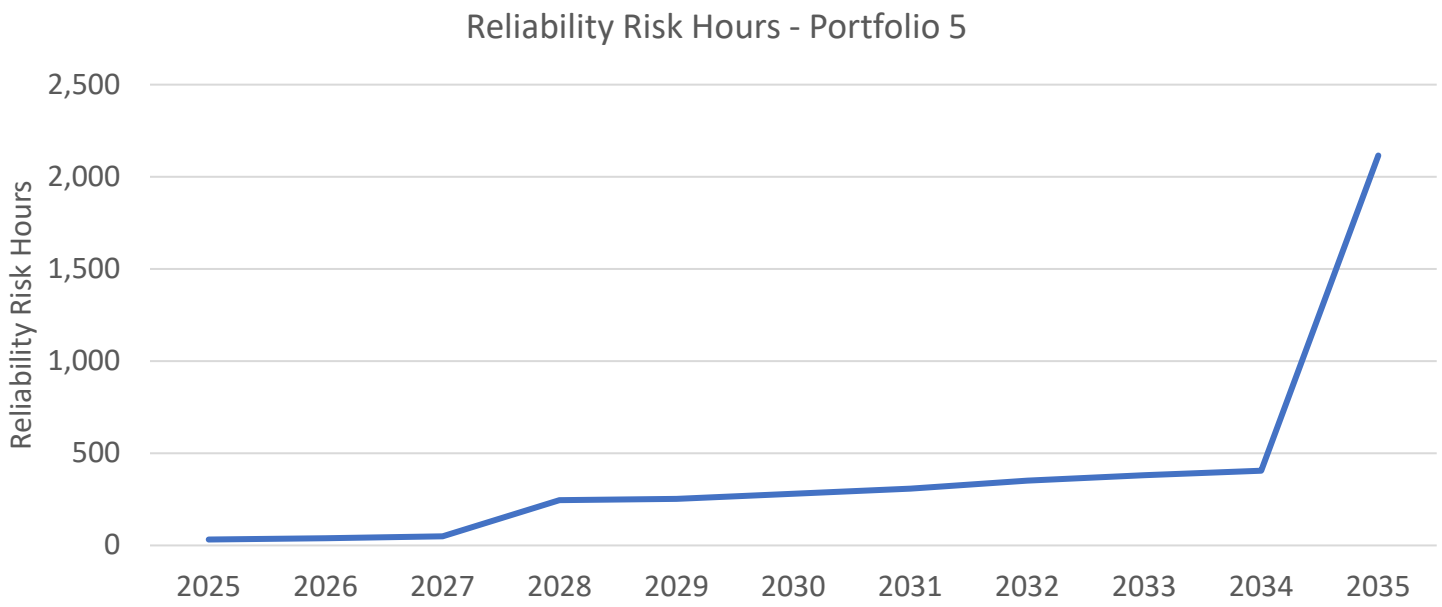
Decker, SHEC
retire 2034

Max DSM for all

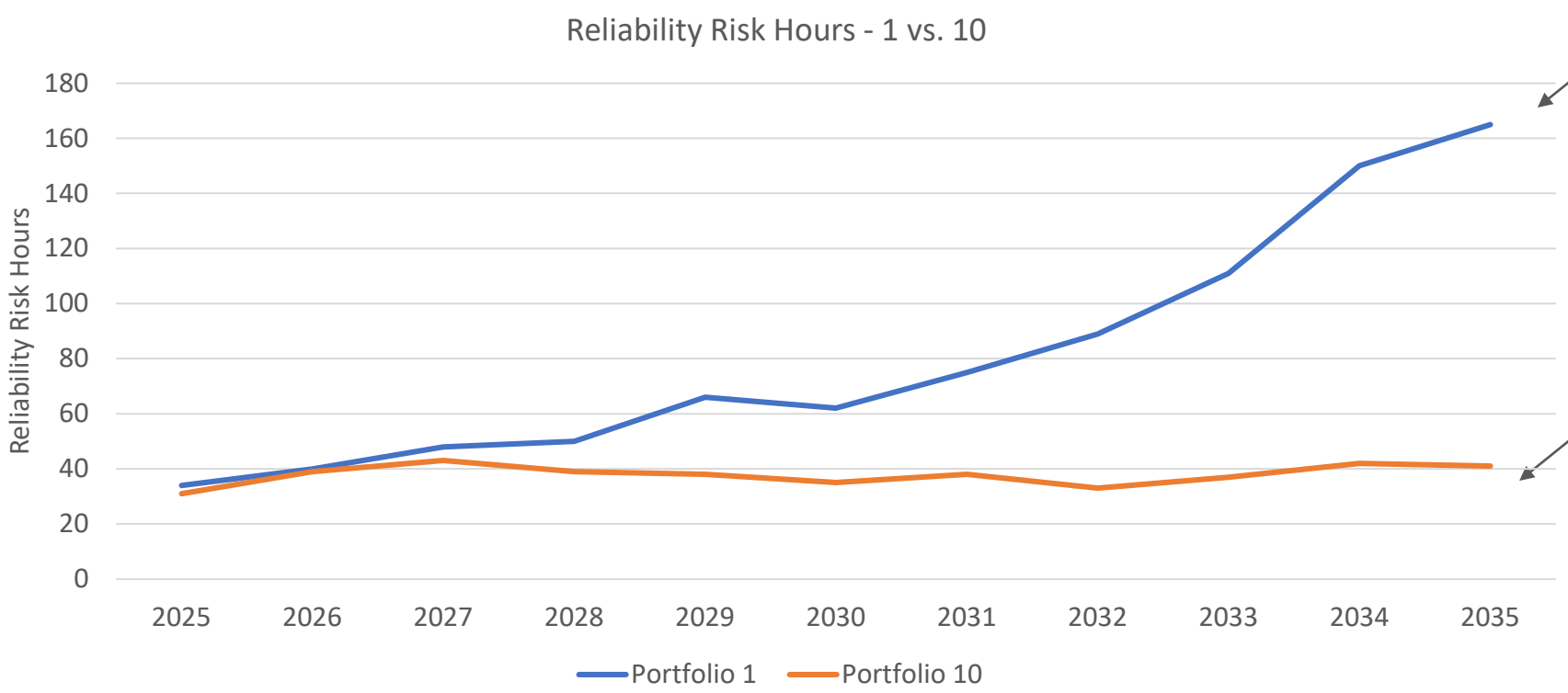
Reliability Risk Hours – Importance of Local Resources

Portfolio 5

- Decker CTs shut down in 2027 (200 MW)
- SHEC shuts down in 2034 (795 MW)
- No new local storage or gas



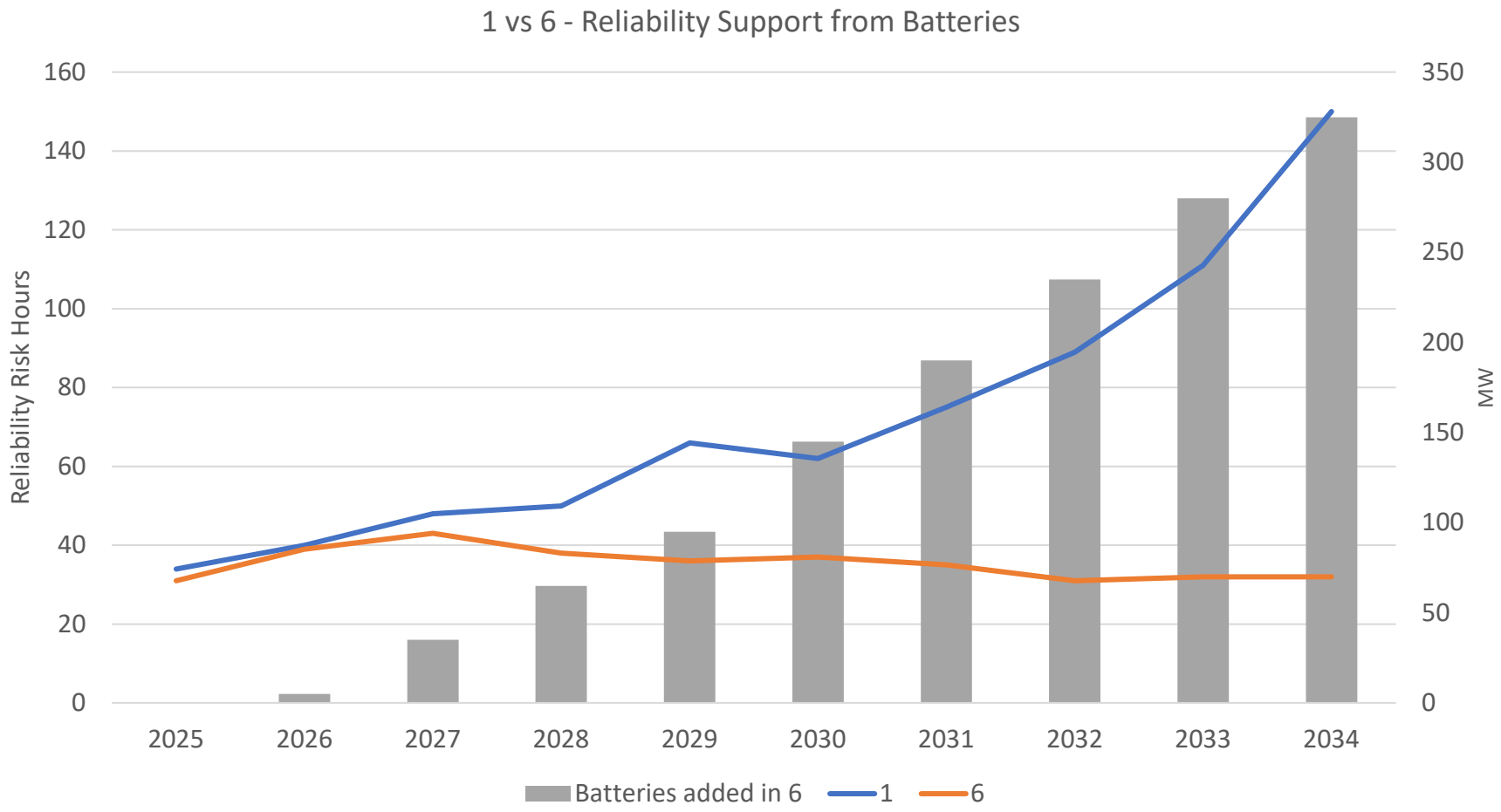
Reliability Risk Hours – 1 vs. 10

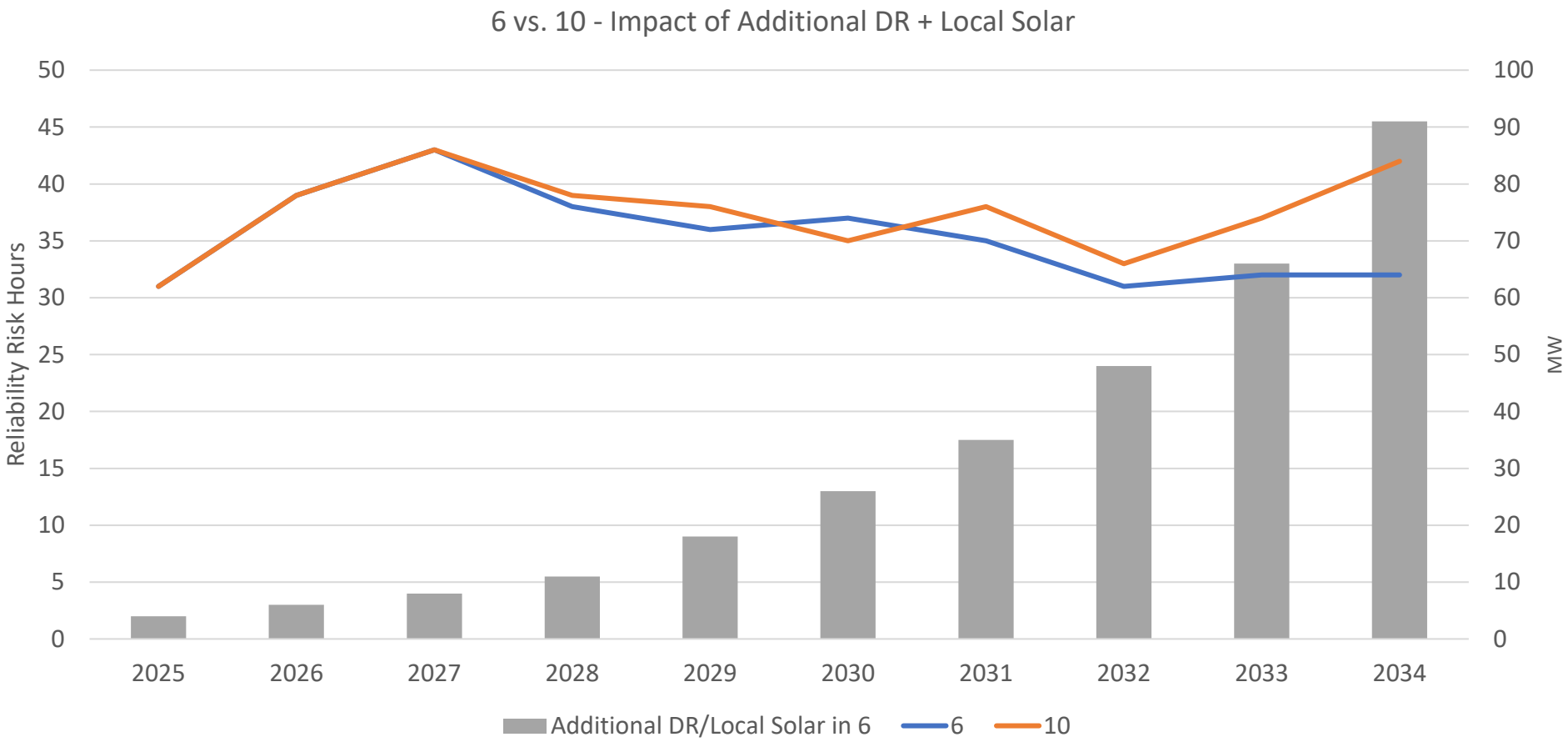


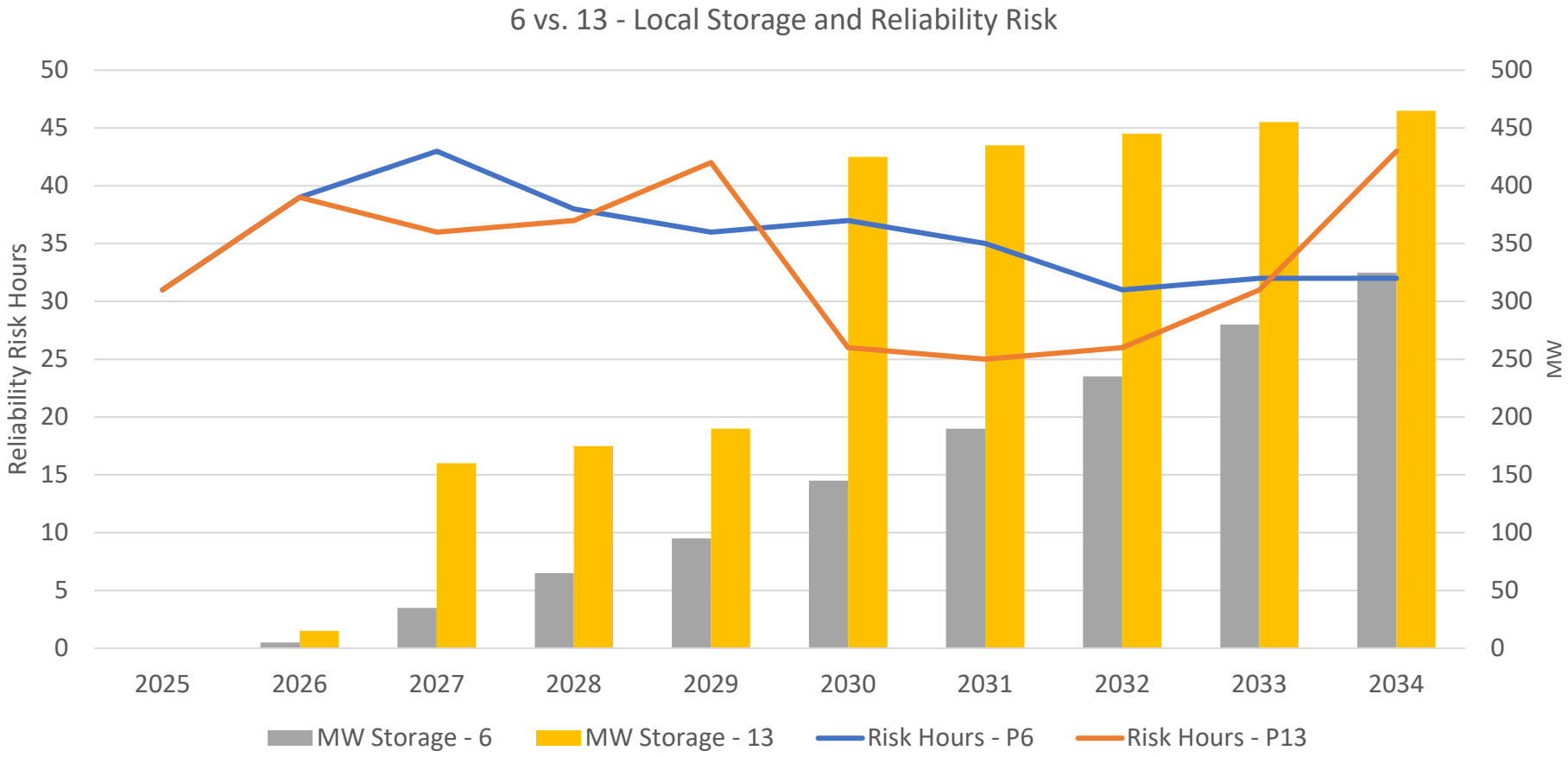
P1 adds no new generation or DSM

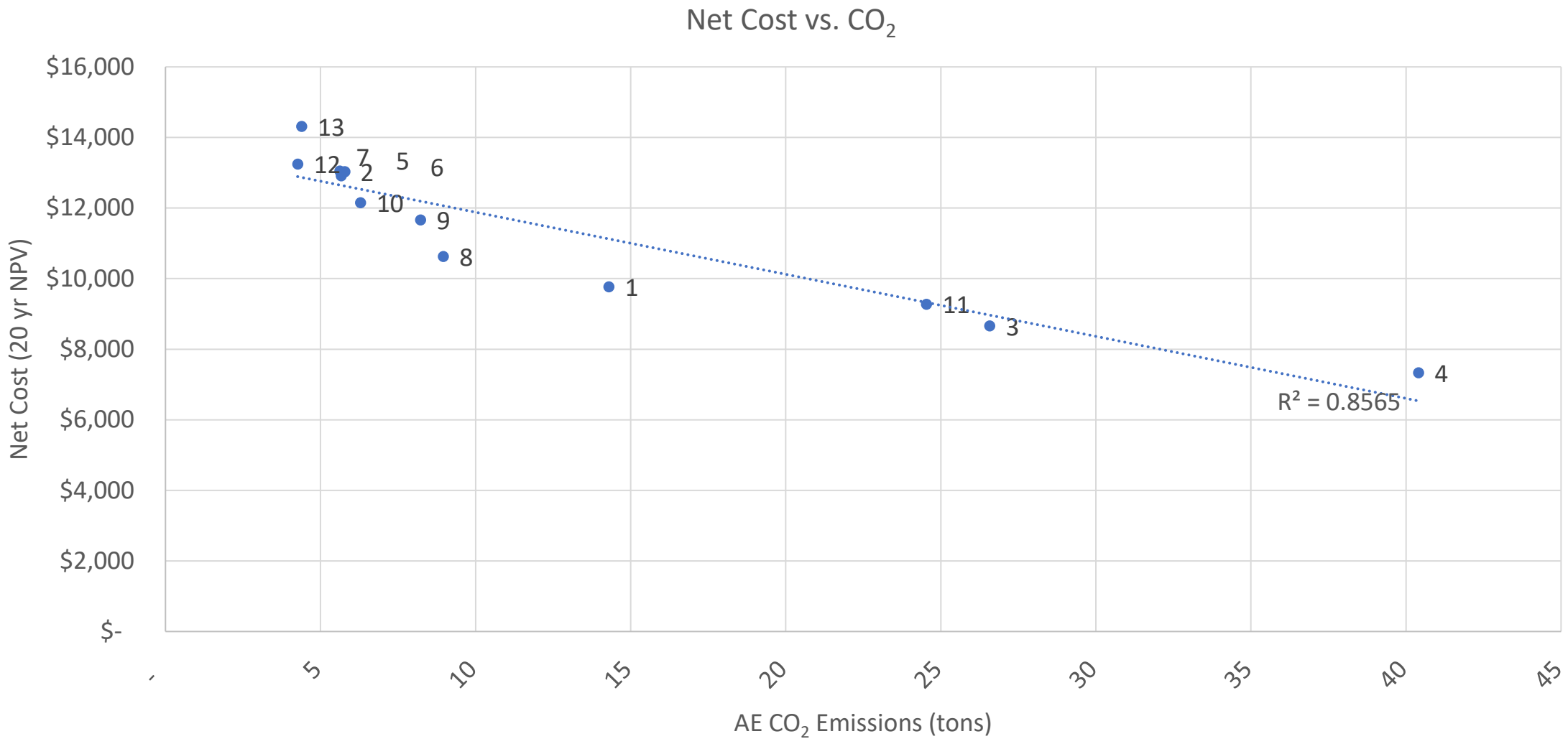
P10 adds 395 MW batteries by 2035 + Max DSM

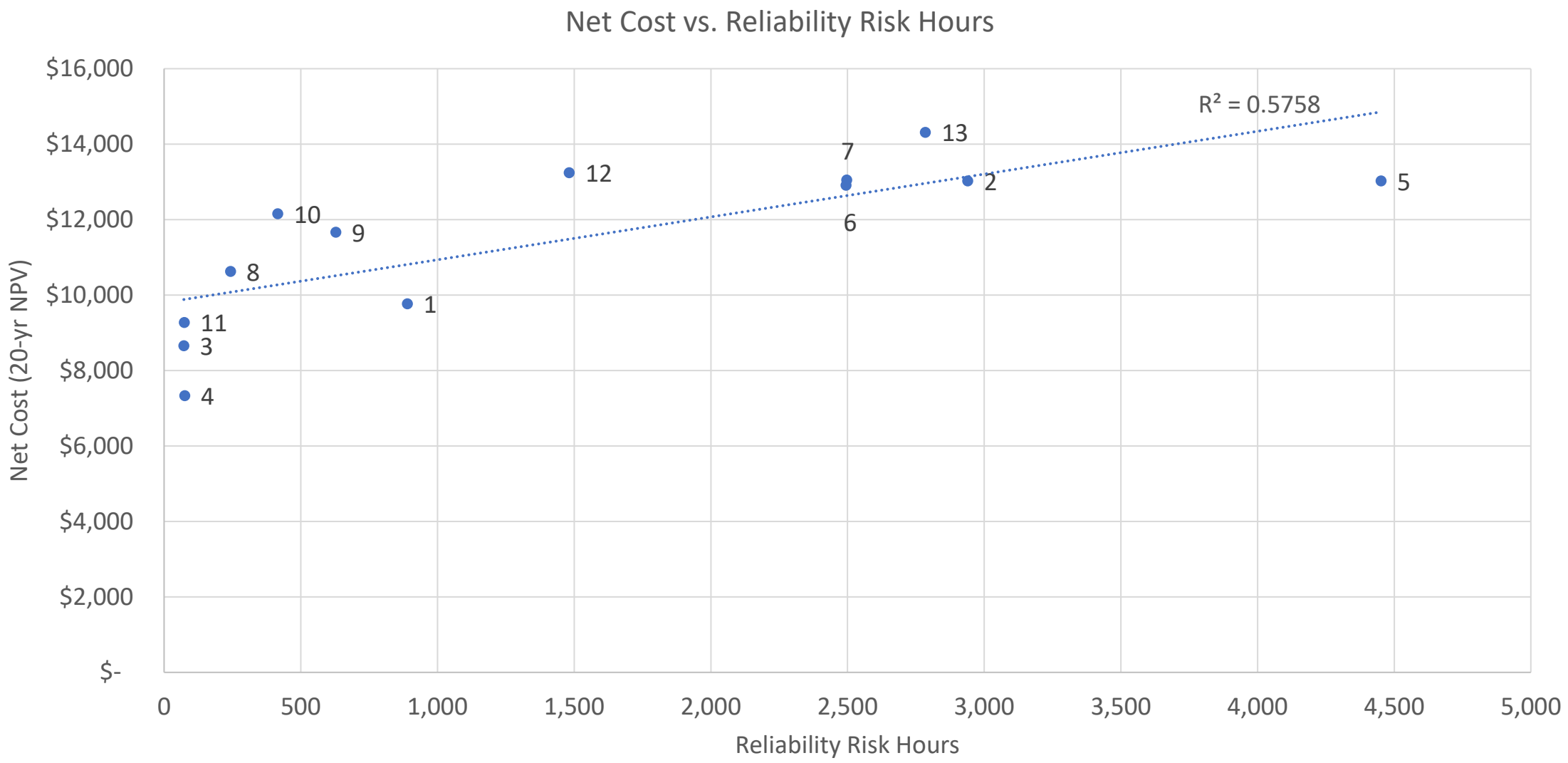
Decker, SHEC do not retire in 2034 (795 MW)

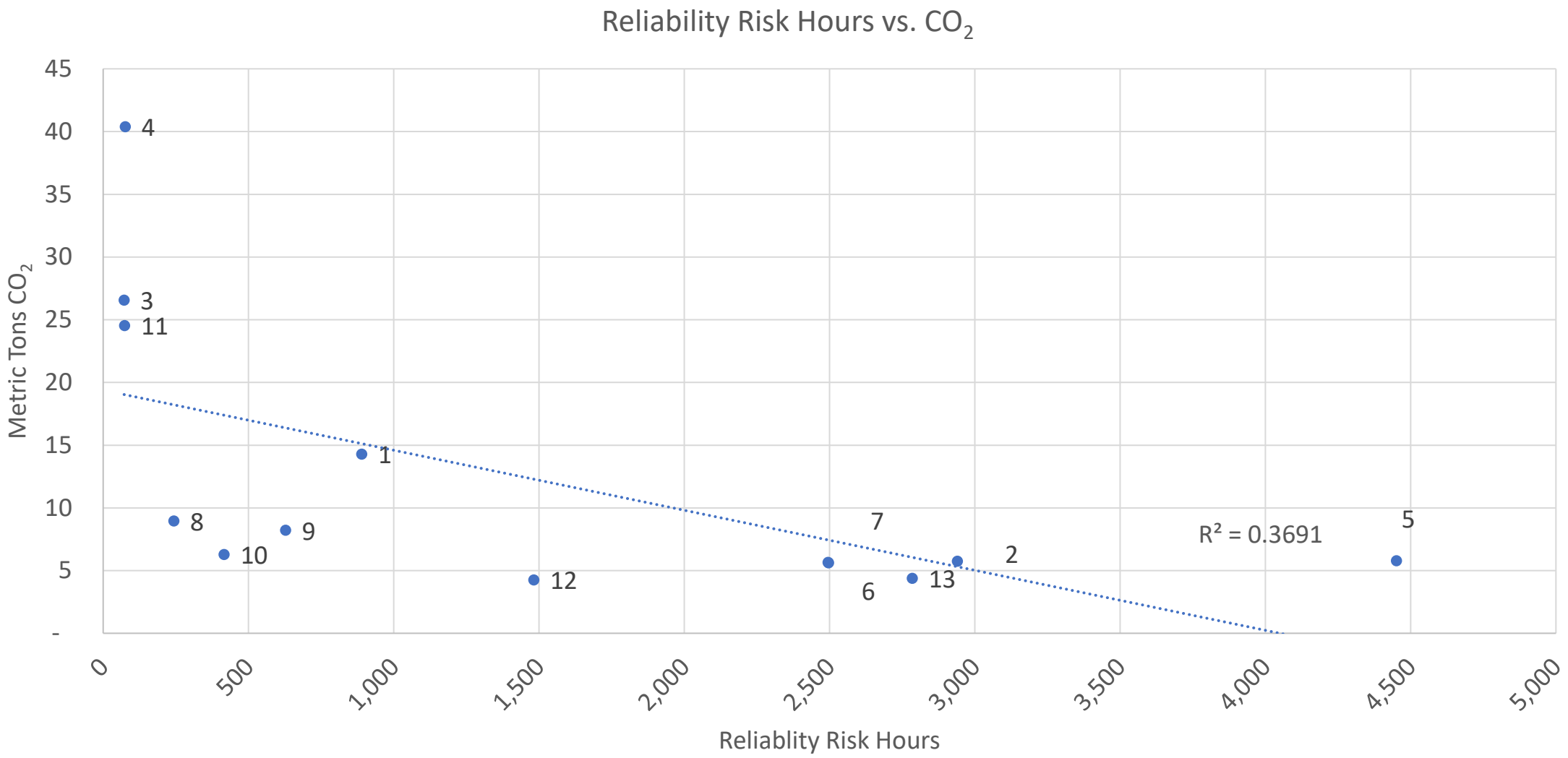

1 vs 6 - Reliability Support from Batteries
Reliability Risk Hours
MW
160
140
120
100
80
60
40
20
0
350
300
250
200
150
100
50
0
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
Batteries added in 6
1
6


6 vs. 10 - Impact of Additional DR + Local Solar
Reliability Risk Hours
MW
50
45
40
35
30
25
20
15
10
5
0
100
90
80
70
60
50
40
30
20
10
0
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
Additional DR/Local Solar in 6
6
10

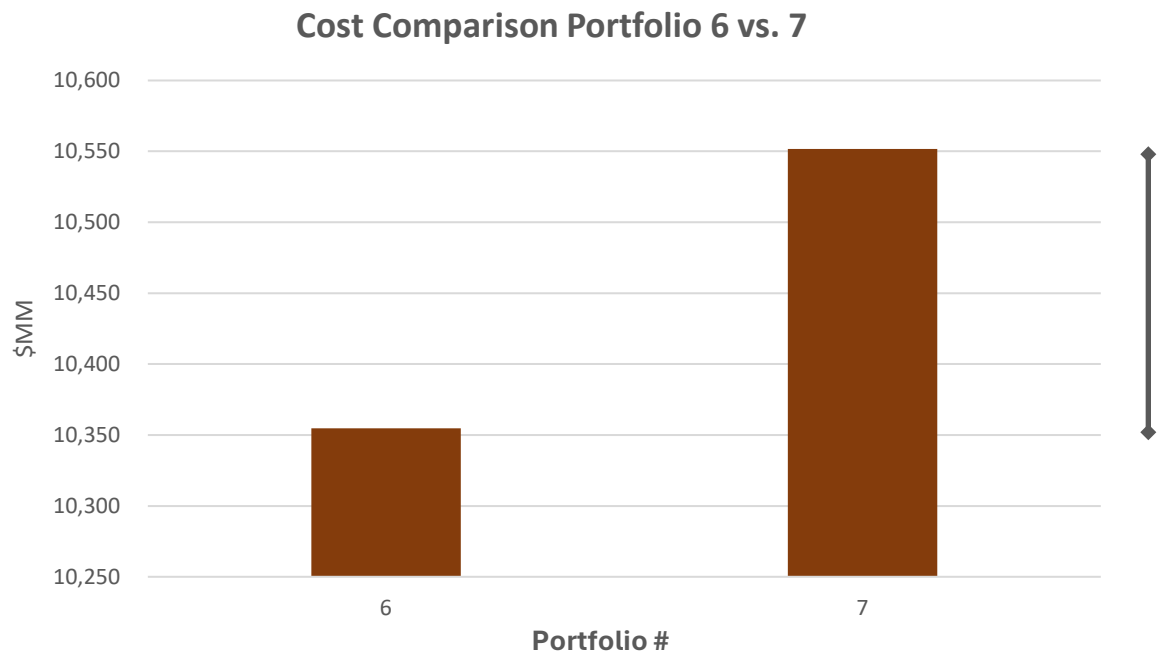

6 vs. 13 - Local Storage and Reliability Risk
Reliability Risk Hours
MW
50
45
40
35
30
25
20
15
10
5
0
500
450
400
350
300
250
200
150
100
50
0
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
MW Storage - 6
MW Storage - 13
Risk Hours - P6
Risk Hours - P13


Net Cost vs. CO_2
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Net Cost (20 yr NPV)
13
12
7
2
5
6
10
9
8
1
11
3
4
$R^2 = 0.8565$
-
5
10
15
20
25
30
35
40
45
AE CO_2 Emissions (tons)


Net Cost vs. Reliability Risk Hours
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Net Cost (20-yr NPV)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Reliability Risk Hours
R² = 0.5758
13
7
12
2
5
10
9
6
8
1
11
3
4


Reliability Risk Hours vs. CO_2
Metric Tons CO_2
45
40
35
30
25
20
15
10
5
-
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Reliablity Risk Hours
4
3
11
1
8
9
10
12
7
6
13
2
5
R² = 0.3691

Net Cost of Non-Local Wind and Solar



Only difference between Portfolios 6 and 7 is the amount of non-local wind and solar PPAs added

P6 just replaces existing PPAs
P7 adds enough new to meet 65% RE goal

$197M net cost difference ($18M/year)

Scenarios

Future states (2025-2035) through which portfolios are stress-tested to measure risk to customers

Extreme grid-wide events
(extreme summer heat, Uri-like winter freeze, extreme low wind)

Local congestion
(simulates local generation and/or transmission outages)

New market regulations
(models impact of potential new PUCT rules on generation capacity)

Note: Extreme grid-wide events and new market regulations scenarios are based on data and assumptions published by ERCOT.

Sensitivity Analysis

- Adjust certain model variables between model runs to measure impact to output metrics
- Expected to be conducted only on short-list portfolios

Austin Energy Load:
Uses higher load growth projection from Webber Energy Group study

Fuel Prices:
Increased prices ERCOT-wide over modeling horizon

Import/Export Capacity:
Changes import capacity to Austin Energy Load Zone

ERCOT Resource Retirements:
Accelerates coal plant shutdowns across ERCOT due to new EPA regulations

Ascend Analytics Appendices

Increased Cost from Removing Thermal Generation (A vs B)

- Portfolio A serves as a baseline because it meets carbon emissions, renewables, and reliability targets at the lowest cost
- Portfolio B cannot build new peakers and retires existing gas-burning peakers in 2034. To maintain a reliable system, it must build out 2800 MW of community solar and 2750 MW of local storage by 2035.
- This buildout needs about 28,000 acres of land
- B is the only Portfolio with no NOx emissions in 2035
- Cumulative CO2 emissions are the lowest, down 68% from Portfolio A, due to a REACH adder on gas-burning plants and no new gas plants built
- **If renewables and storage are used instead of new peakers, costs double and massive amounts of land are required to maintain a reliable system**

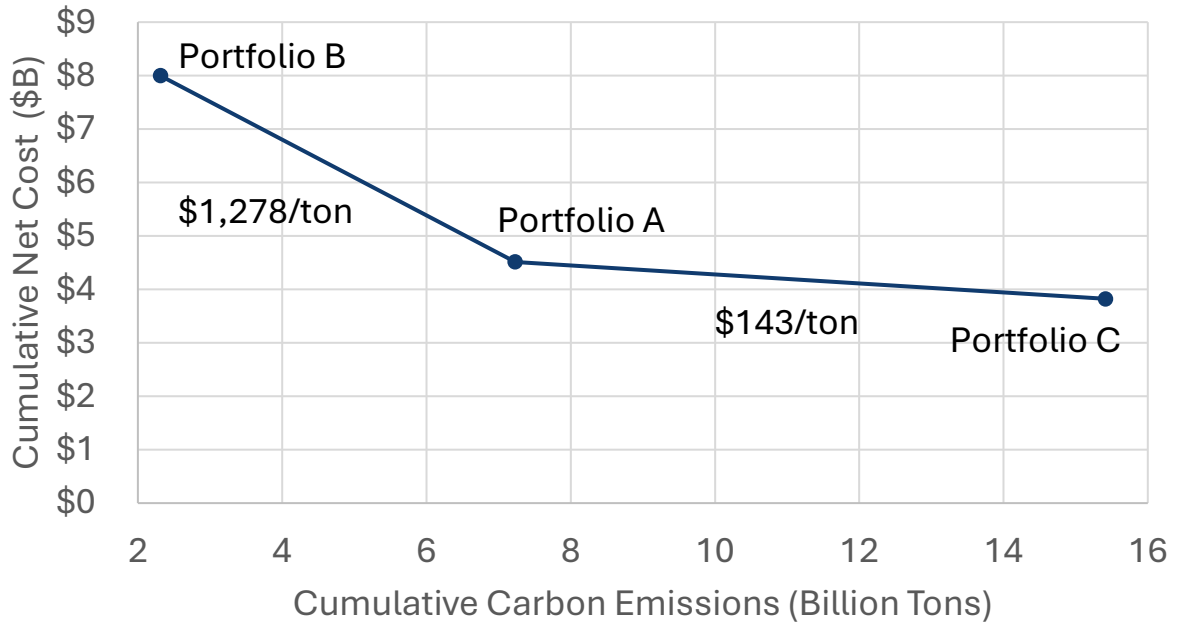
	Portfolio A	Portfolio B	Difference (B-A)
Net Cost NPV ($B)	$6.8	$14.1	$7.3
Cumulative CO2 emissions (Million Tons)	7.2	2.3	-4.9
2035 NOx Emissions (Ton)	120	0	-120

The Cost of Reducing Cumulative Emissions through 2035

- Portfolio A converts all gas to hydrogen by 2035, achieving zero emissions
- Portfolio B retires all gas and builds solar + storage by 2035, achieving zero emissions
- Portfolio C keeps gas plants online through 2035
- B has only 1/3 the cumulative carbon emissions, but double the cost, of A
- C has over double the cumulative emissions, but 18% lower cost, than A
- Comparing A and C's cumulative costs and emissions: from 2025-2035, it costs $143/ton CO2 saved
- This cost is similar to an estimated levelized cost to add 95% carbon capture and sequestration to the Sand Hill CC. ($138/ton), and on the lower end of an estimated cost range for direct air capture ($100-340/ton).
- Comparing A and B's cumulative costs and emissions: from 2025-2035, it costs $1,278/ton CO2 saved
- Comparing A and C's 2035 cost and emissions: it costs $174/ton CO2 saved

There is increasing marginal cost to remove cumulative emissions beyond Portfolio A's levels

	Portfolio A	Portfolio B	Portfolio C
Cumulative Net Cost ($B)	$7.1	$14.1	$5.9
Cumulative CO2 emissions (Million Tons)	7.2	2.3	15.4
2035 Net Cost ($M)	767	2,050	584
2035 CO2 Emissions	0	0	1,048



Building Local Peakers for Reliability (A vs D)

- Portfolio D is identical to Portfolio A, but with increased local peaker buildout
- In both portfolios, new local peakers switch from gas to hydrogen in 2030
- Both portfolios are reliable, but D will be more resilient in the face of extreme weather events and contingencies, with less price separation
- Portfolio D has 9% more cumulative emissions (occurring before 2030)
- The revenue and costs of the peakers are roughly equal
- **Local peakers increase reliability with minimal emissions or cost penalties**

	Portfolio A	Portfolio D	Difference (D-A)
2035 peakers (MW)	630	1,155	525
2035 HatR P5	0.16	0.15	-0.01
2035 HatR Mean	0.28	0.25	-0.03
2035 HatR P95	0.63	0.40	-0.23
Net Cost NPV ($B)	$6.78	$6.90	$0.11
Cumulative CO2 emissions (Million Tons)	7.2	7.9	0.68

HatR: Hours at Risk

High Level Comparison

2035 Electric Rates ($/kWh)	Portfolio A	Portfolio B	Portfolio C	Portfolio D
P5	0.126	0.198	0.112	0.127
MEAN	0.132	0.202	0.121	0.133
P95	0.137	0.206	0.132	0.138

Cumulative CO2 Emissions (Million Tons)	Portfolio A	Portfolio B	Portfolio C	Portfolio D
P5	5.9	1.4	11.3	6.2
MEAN	7.2	23.1	15.4	7.9
P95	8.8	3.8	22.6	10.1

2035 Installed Capacity (MW)

2035 Installed capacity (MW)	A	B	C	D
STP Nuclear	435	435	435	435
NAC Biomass	100	100	100	100
Sand Hill CC	220	0	314	220
Sand Hill peaker	226	0	282	226
Decker peaker	156	0	195	156
NG-H2 CC	0	0	200	0
NG-H2 peaker	630	0	400	1155
Customer-Sited Solar	81	81	81	81
Community Solar	18	2800	18	18
Central Solar	173	173	173	173
West Solar	595	595	595	595
South Wind	1244	1244	864	1244
West Wind	1505	1505	400	1505
Local 12-hr	0	915	0	0
Local 4-hr	0	1040	0	0
Local 2-hr	0	795	0	0
Demand Response	270	270	270	270
Energy Efficiency	360	360	360	360