Round II Modeling Results

Austin Energy Resource, Generation and Climate Protection Plan to 2035

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Agenda

- Recap of Modeling Timeline
- Round II Modeling Results
- Insights From Modeling To Date
- Discussion & Next Steps

Modeling Timeline

- Modeling Inputs & Assumptions to EUC 7/10/24
- Portfolios + Scenarios to EUC 8/8/24
- Ascend Modeling Overview to EUC 9/9/24
- Modeling Results #1 to EUC 9/30/24
- Modeling Results #2 to EUC 10/21/24

JUNE	JULY	AUG	SEPT	OCT

1st Model Runs

2nd Model Runs

Data Sources

- 7/8 Webber Draft Report
- 7/15 EUC Feedback on Inputs & Assumptions
- 7/31 DNV Study Preliminary Results
- 8/12 EUC Input on Portfolios + Scenarios
- 10/1 – 10/4 EUC Office Hours to Refine Portfolios

Transitioning to Plan Development

Resource Modeling

- How well do different resource mixes mitigate reliability, liquidity and load zone price separation risk?
- What are the tradeoffs in reliability, cost, and emissions between different portfolio mixes?

Resource Planning

- What insights did we learn from the modeling process that should inform the plan?
- What are the key characteristics from the modeled portfolios that mitigate risk and balance tradeoffs?

Round II Modeling

Round II Portfolios

Austin Energy and EUC selected four new portfolios to improve our understanding of risks and tradeoffs

Portfolio 14 Results in Progress

14
- Variation of Portfolio 10 with incremental new local storage + gas
- Tests “floor” level of local resources needed to maintain reliability

15
- Variation of Portfolio 12 with more local solar + storage + DR
- Tests cost/reliability of aggressive mix of DSM + storage only

16
- Variation of Portfolio 12 with larger ratio of storage to solar + more DR
- Tests relative performance of different solar + storage mixes
- Maintains Decker/Sand Hill past 2034

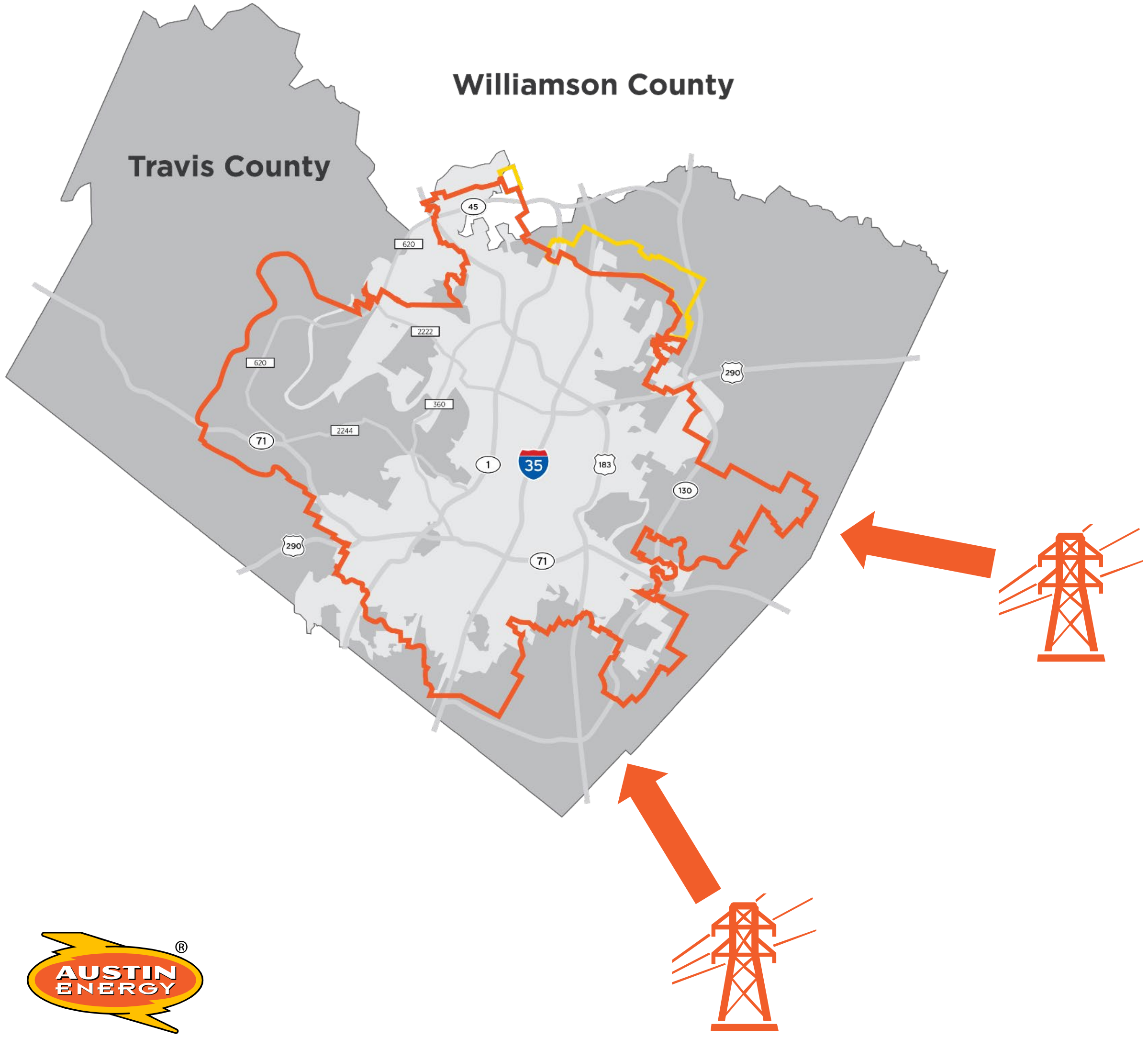
17
- Identical to Portfolio 12 with Decker/Sand Hill operating past 2034

Reference Guide to New Portfolios

REF #	DESCRIPTION
10	**395 MW local storage**, 100% DNV projections, 65% RE (1,800 MW wind/solar PPAs), REACH on gas, **Decker/Sand Hill run through 2035**
14	**125 MW local storage** (100 MW 4-hr, 25 MW 2-hr), **200 MW local peakers**, 100% DNV projections (431 MW local solar, 270 MW demand response), 250 MW import capacity increase, 65% RE (1,800 MW wind/ solar PPAs), REACH on gas, Decker/Sand Hill run through 2035
12	**525 MW local storage** (300 MW 12-hr, 200 MW 4-hr, 25 MW 2-hr)**, 700 MW local solar, 300 MW demand response**, 100% RE as % of load (2,500 MW wind/solar PPAs), 100% CF, REACH on gas, retire Decker/Sand Hill 2034
15	**625 MW local storage** (350 MW 12-hr, 250 MW 4-hr, 25 MW 2-hr), **960 MW local solar, 325 MW demand response**, 250 MW import capacity increase, 100% CF, 100% RE as % of load (2,500 MW wind/solar PPAs), REACH on gas, retire Decker/Sand Hill in 2034
16	**725 MW local storage** (400 MW 12-hr, 300 MW 4-hr, 25 MW 2-hr), **860 MW local solar, 400 MW demand response**, 250 MW import capacity increase, 100% RE as % of load (2,500 MW wind/solar PPAs), REACH on gas, Decker/Sand Hill run through 2035
17	Same as 12 except **Decker/Sand Hill run through 2035**

AUSTIN ENERGY

Transmission Import Capacity



Portfolios 14-16 include 250 MW increase of import capacity in 2031

- When the lines we use to bring electricity into the service territory get overloaded ("local congestion"), Austin Energy can experience higher costs and higher reliability risk
- Caused by high load, reduced local generation, issues with transmission system, or some combination of these

Scenarios

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

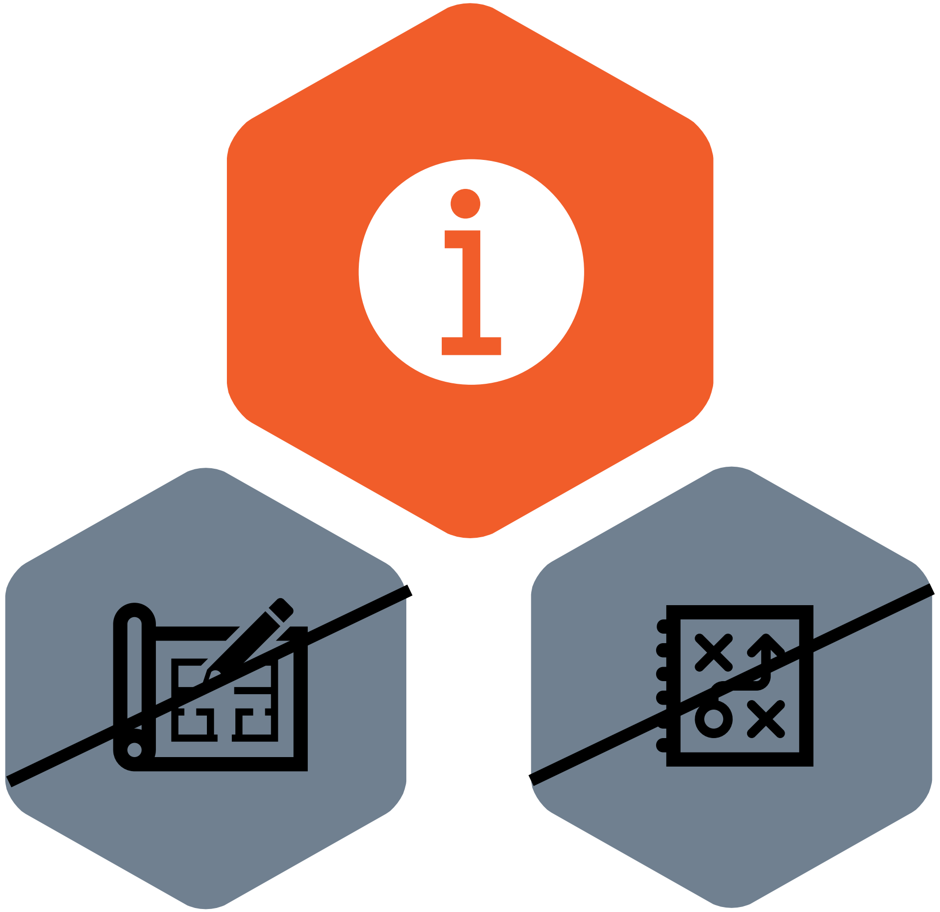
Austin Energy Load
Uses higher load growth projection from Webber Energy Group study

Extreme Local Congestion
Simulates local generation and/or transmission outages

Extreme Events
Summer heat, winter storm, low wind days

Natural Gas Prices
Gas price increases

Important Context for this Discussion



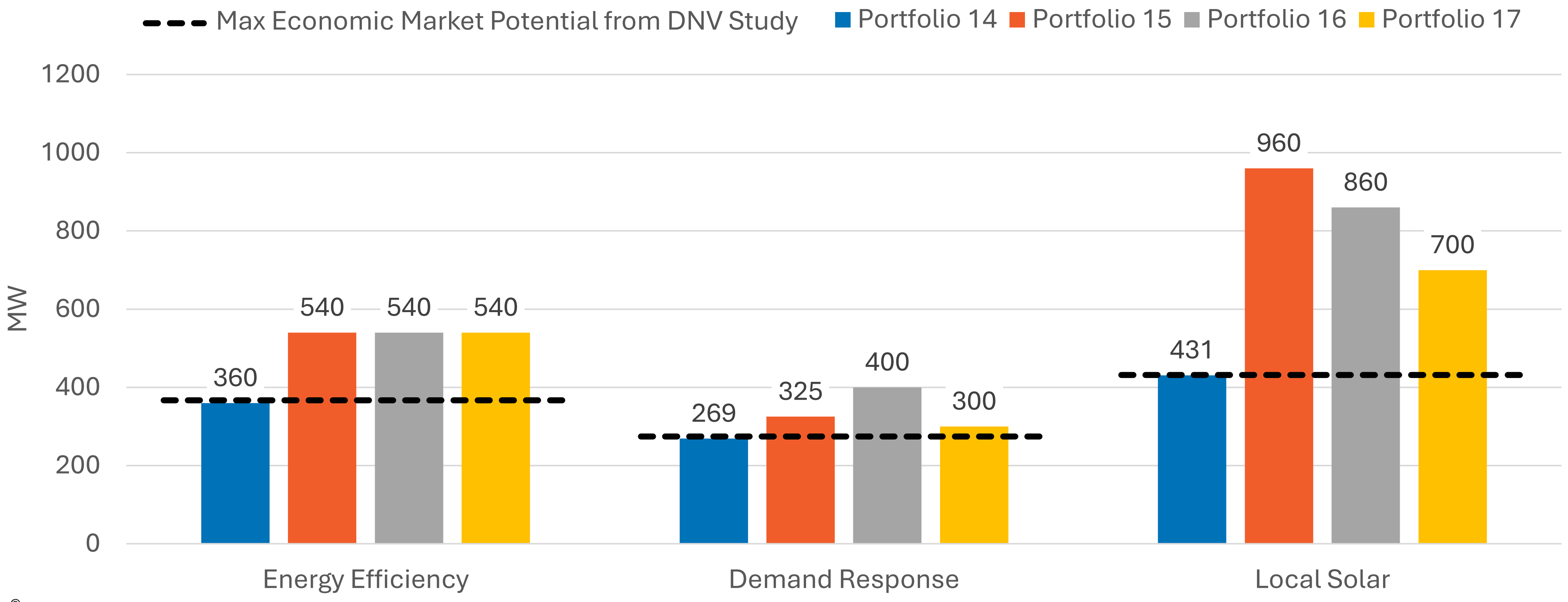
Models provide information

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.

Round II Portfolios Demand-Side Management vs. DNV Market Potential Study

DSM targets in Portfolios 15-17 exceed the maximum economic market potential from recent DNV market potential study

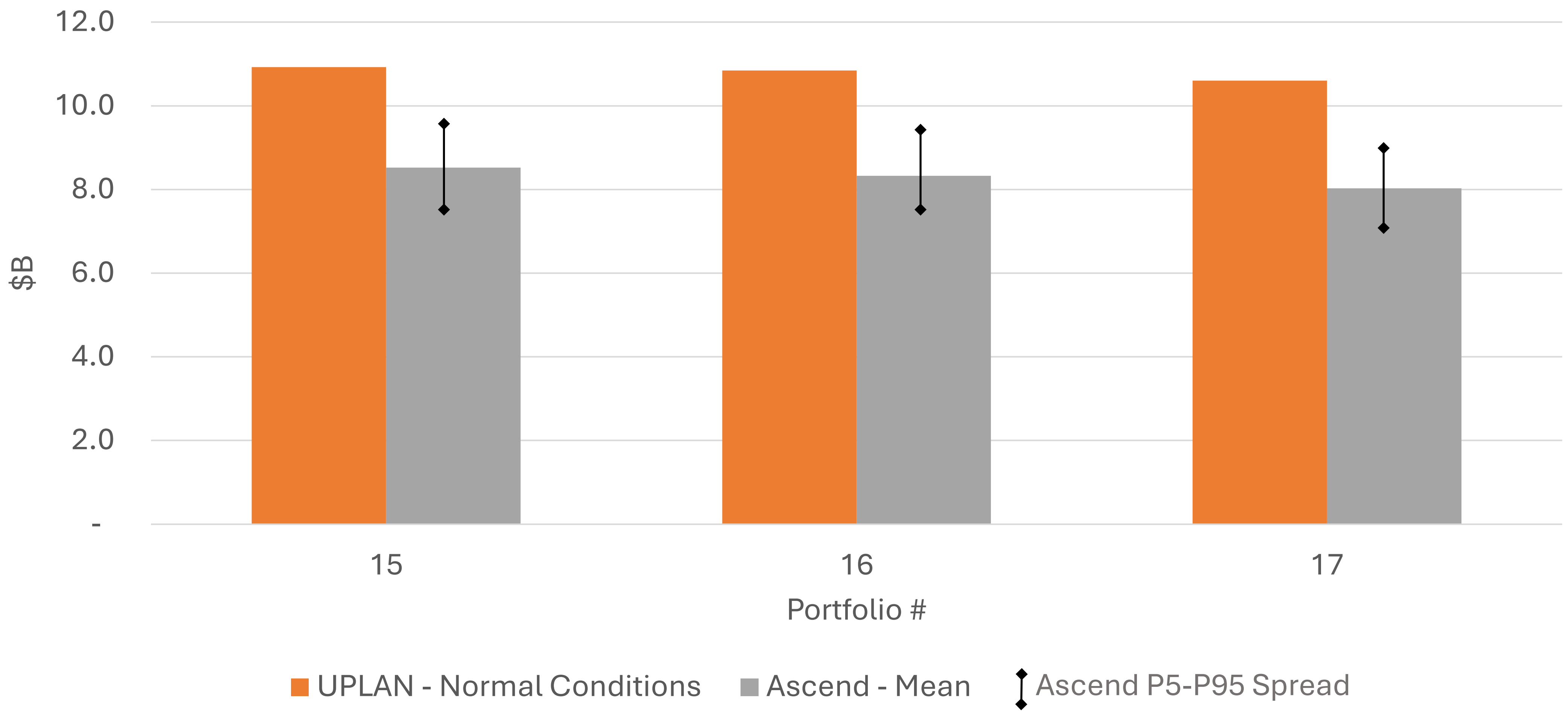


Round II Modeling Portfolio Comparison – Net Cost

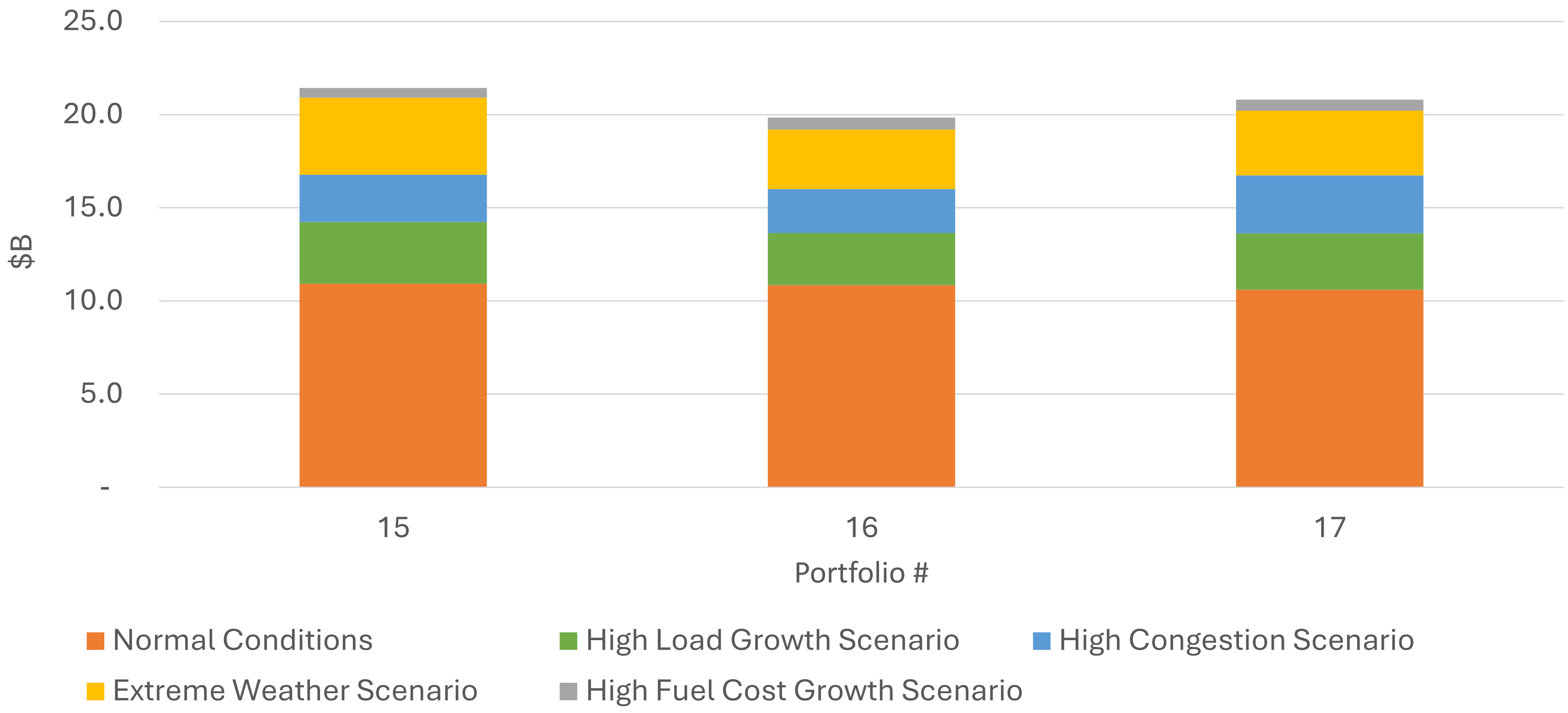
Net Cost

- “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.

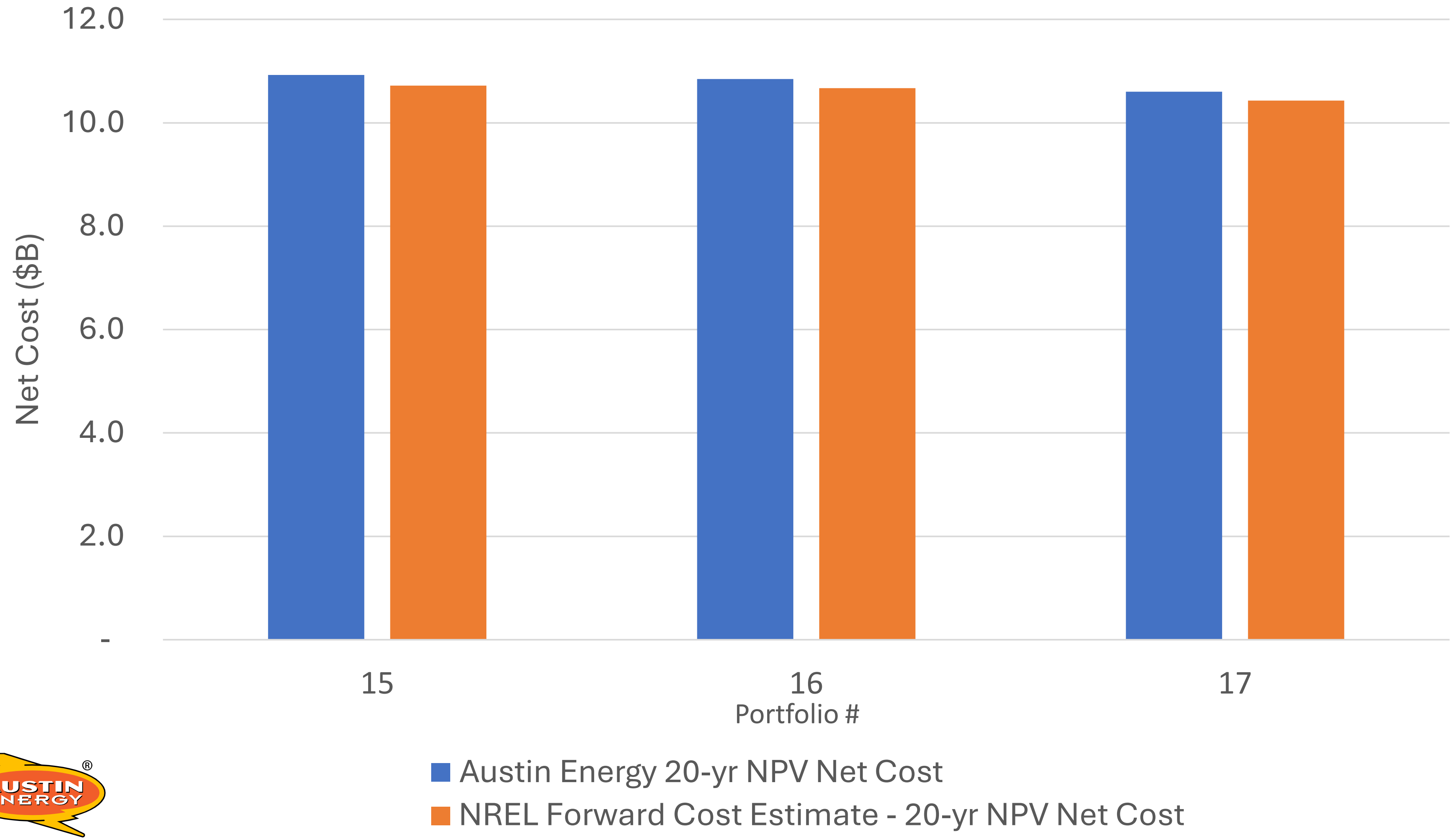
Net Present Value of 20-Yr Annual Net Costs ($B)



Net Present Value of 20-Yr Annual Net Costs ($B) – All Scenarios - UPLAN



Net Present Value of 20-Yr Annual Net Costs ($B) – Sensitivity of Forward Battery Costs



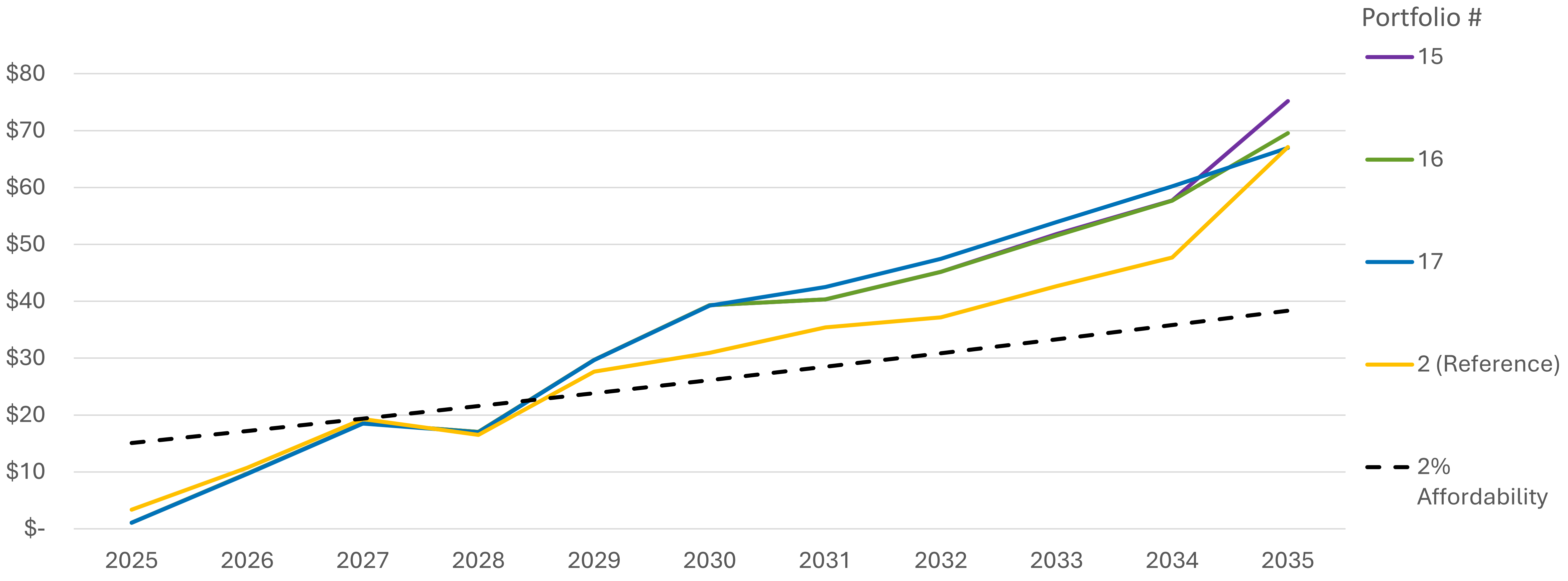
Portfolios 15-17: Average cost difference is 2% ($190M) using NREL Cost Estimates

Bill Impact

- "Average Monthly Residential Bill Increase" = expected increase in a typical Austin Energy residential customer's monthly electricity bill over time 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 Austin Energy capital or O&M costs in the future

2035 Average Monthly Residential Bill Increase

Austin Energy 2% Affordability Target is not adjusted for inflation.
Monthly bill impact data provided in nominal dollars

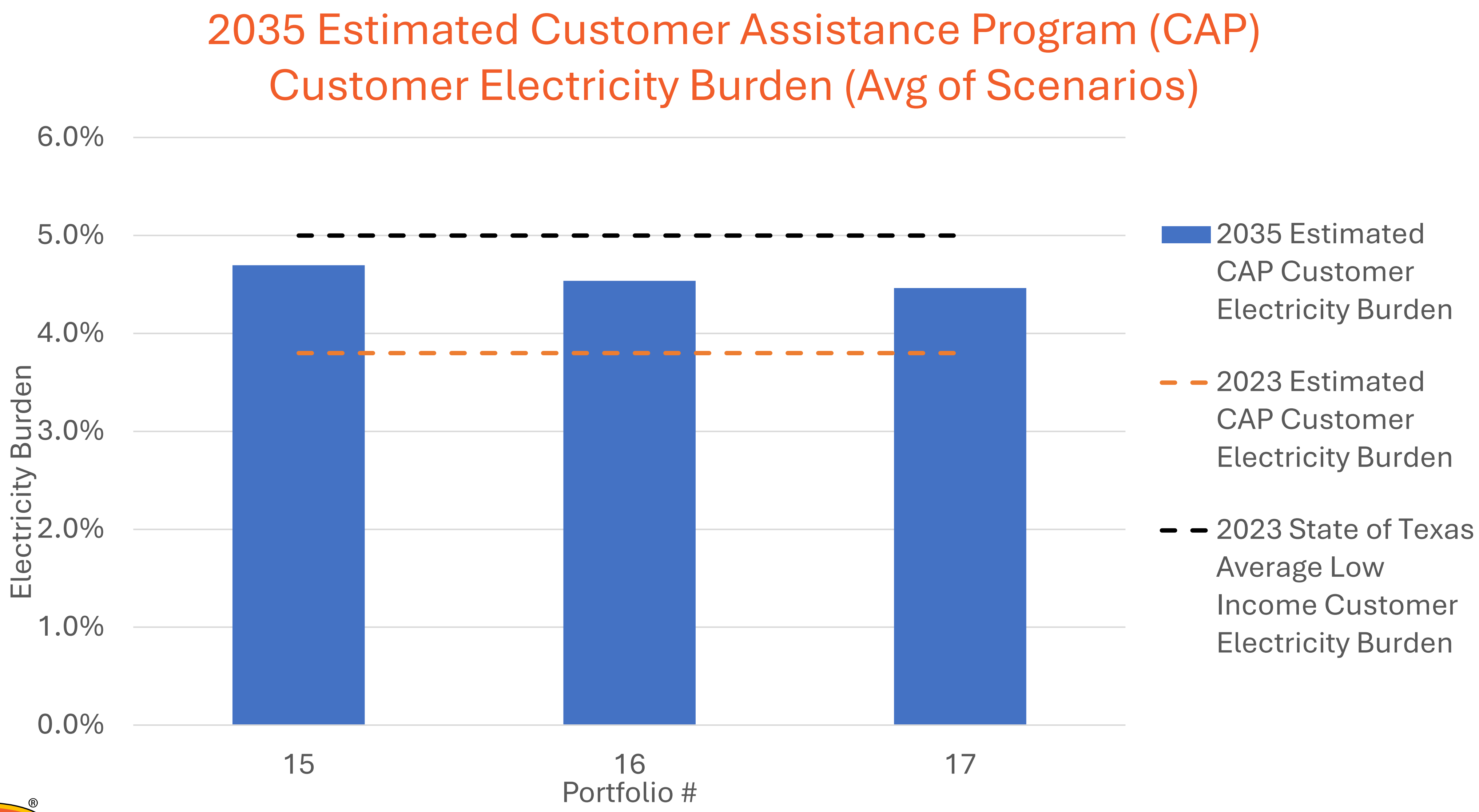


DISCLAIMER: These are representative results based on modeling for the 2035 Resource Generation Plan and are not projections of Austin Energy's future prices. The results are not inclusive of factors beyond the scope of this Resource Generation Plan modeling.

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 Austin Energy 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 Electricity Burden



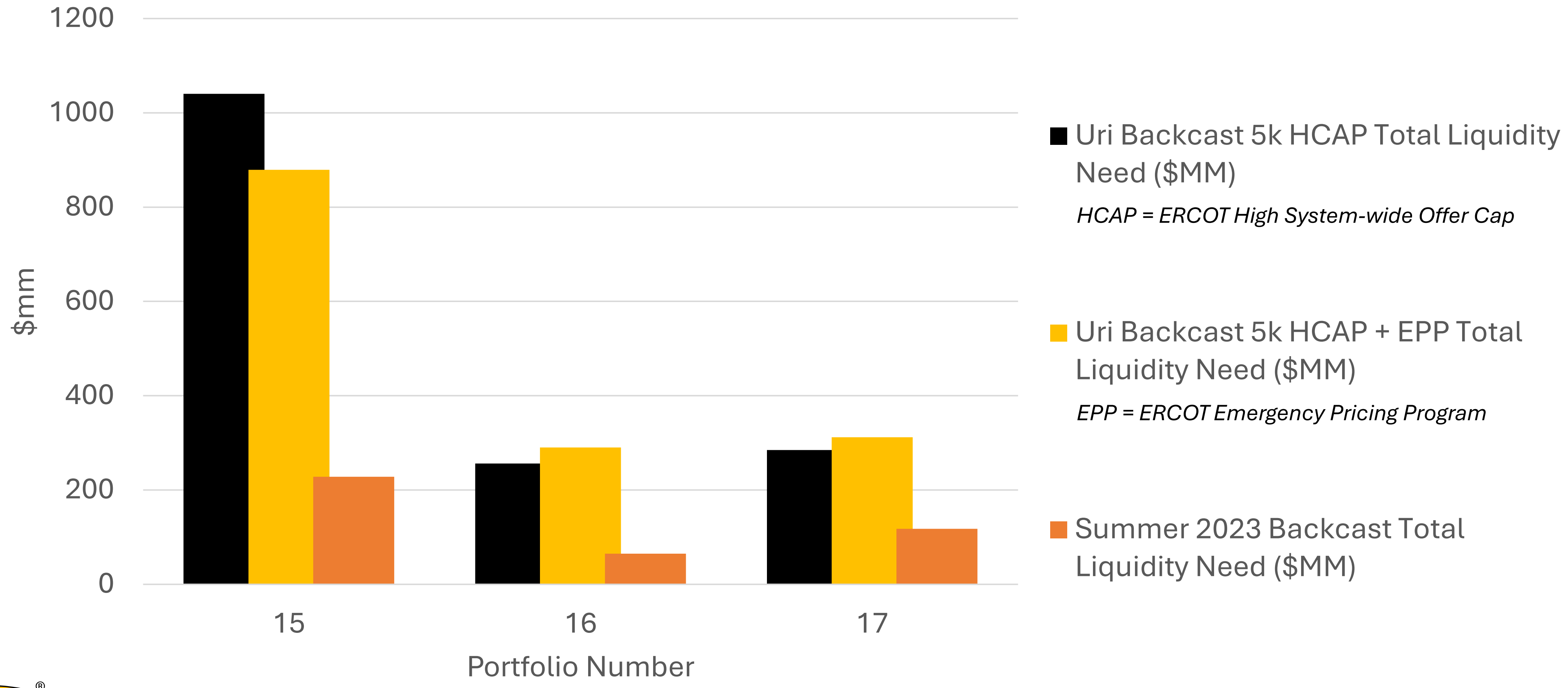
Round II Modeling Portfolio Comparison – Liquidity Risk

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 extreme winter & summer event
- 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

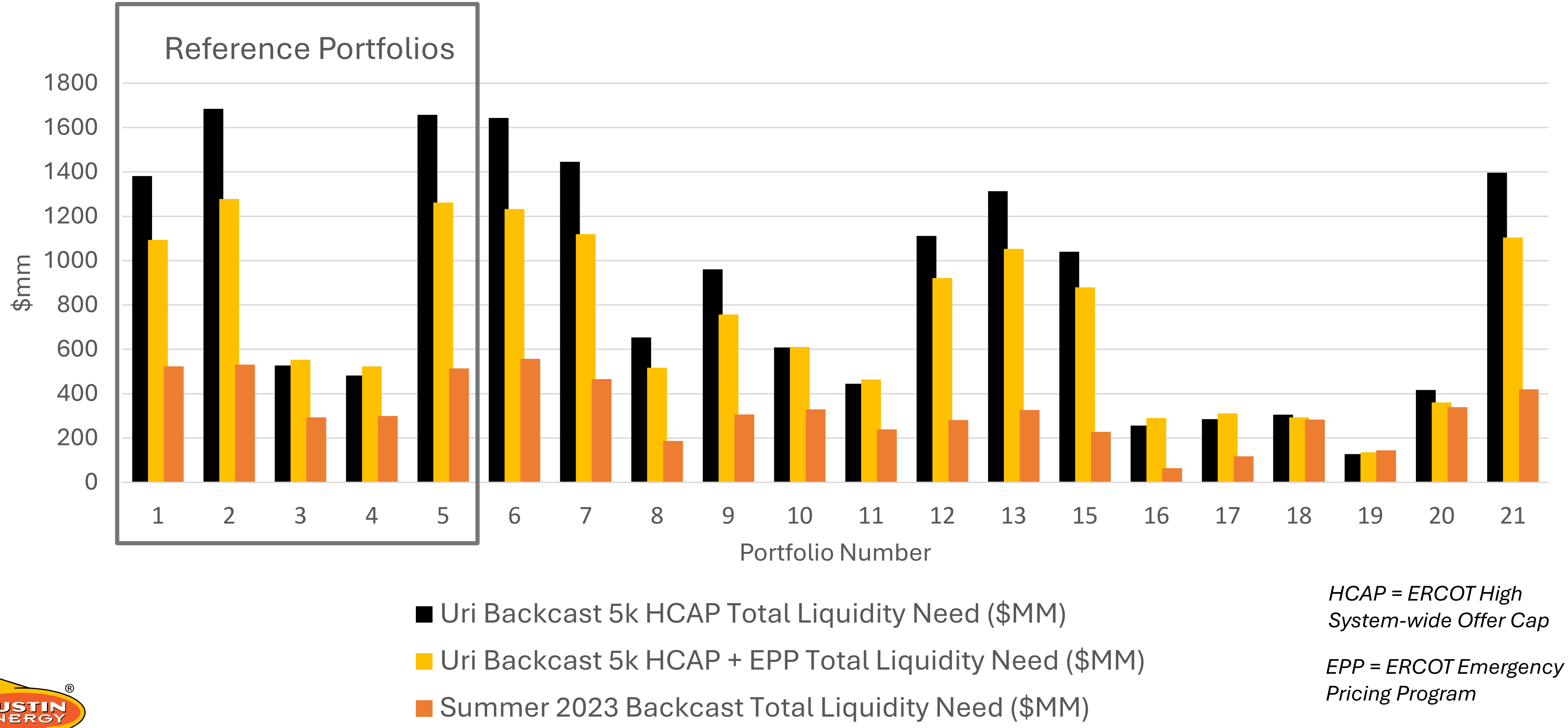
Stress Test Results – Liquidity Risk

Based on 2035 portfolio mix



Stress Test Results – Total Liquidity Risk

Based on 2035 portfolio mix



HCAP = ERCOT High System-wide Offer Cap

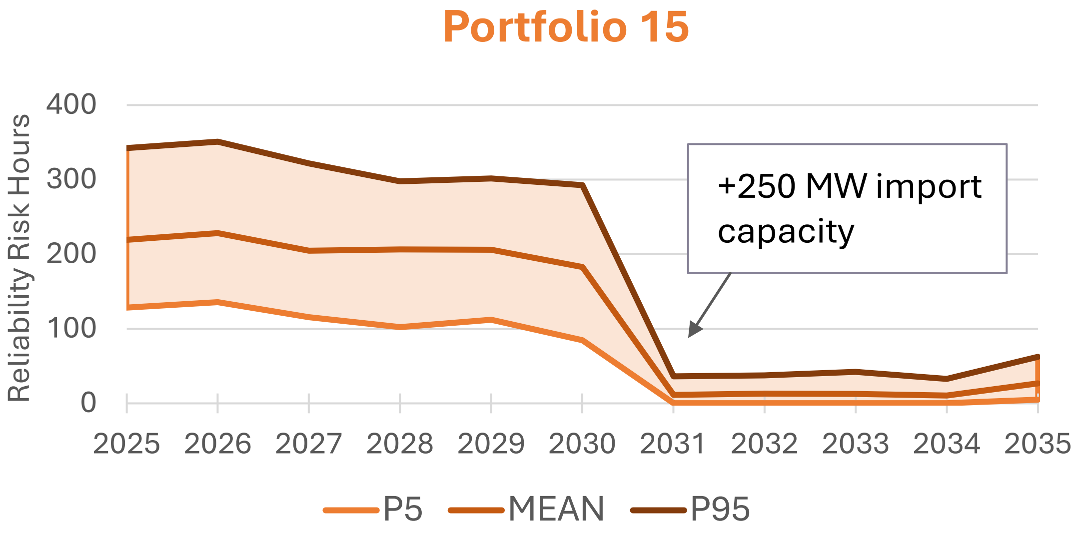
EPP = ERCOT Emergency Pricing Program

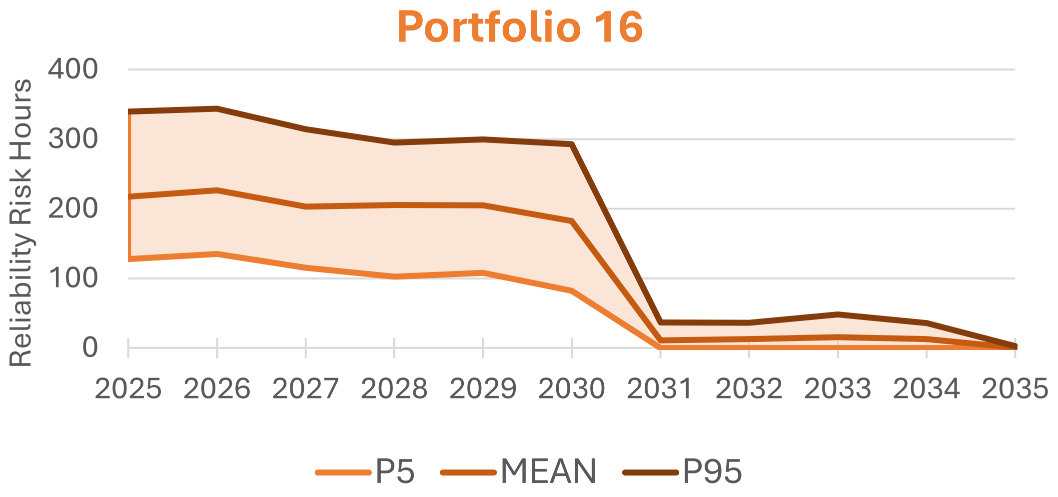
Round II Modeling Portfolio Comparison – Reliability

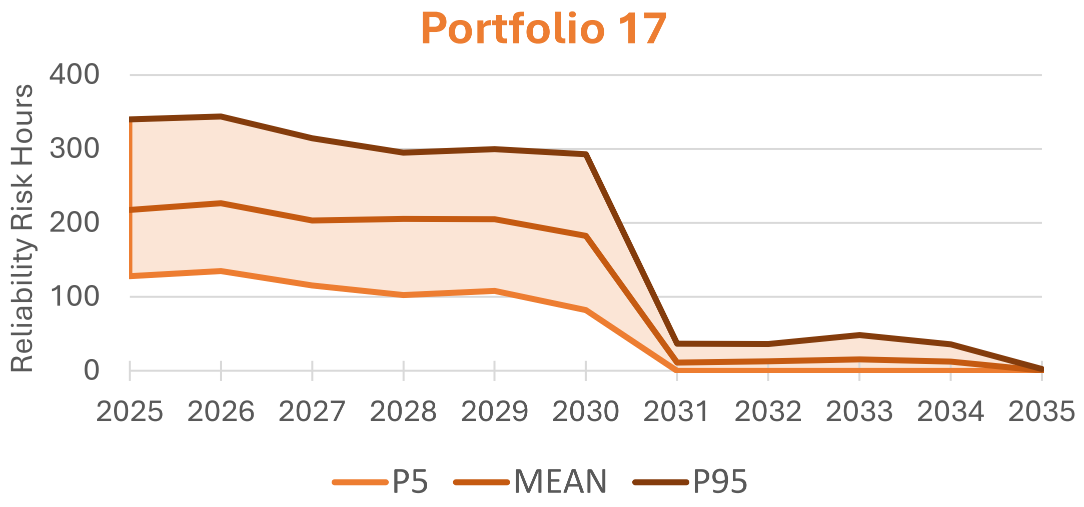
Reliability Risk Hours

- "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

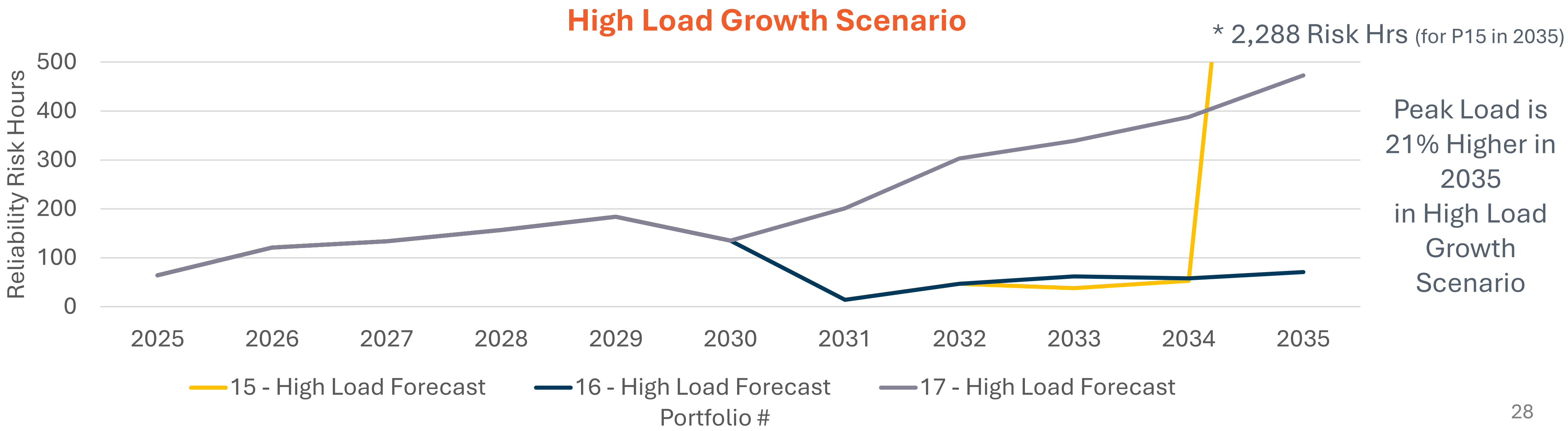
Reliability Risk Hours – Ascend







Reliability Risk Hours – UPLAN

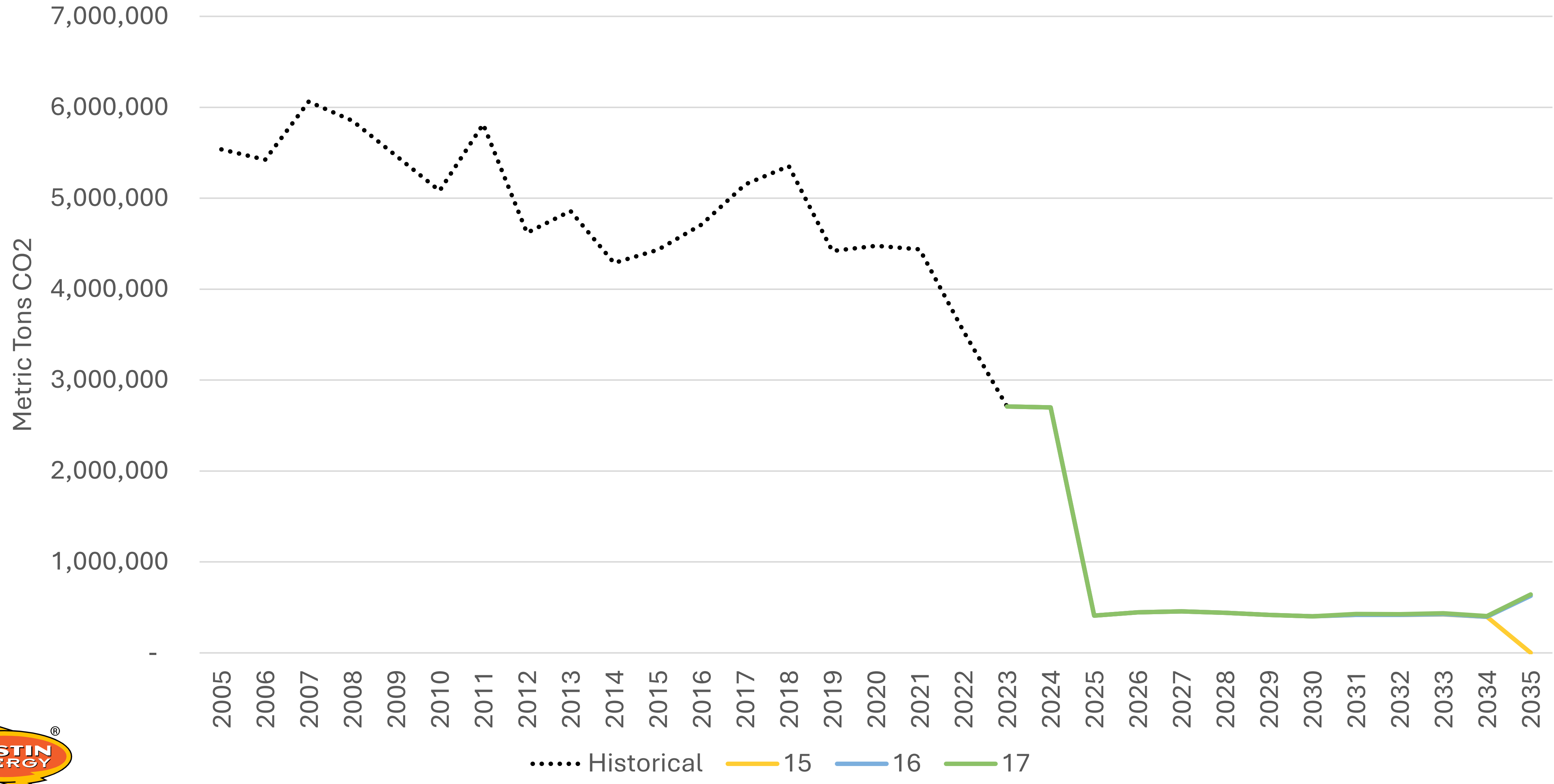


Peak Load is 21% Higher in 2035 in High Load Growth Scenario

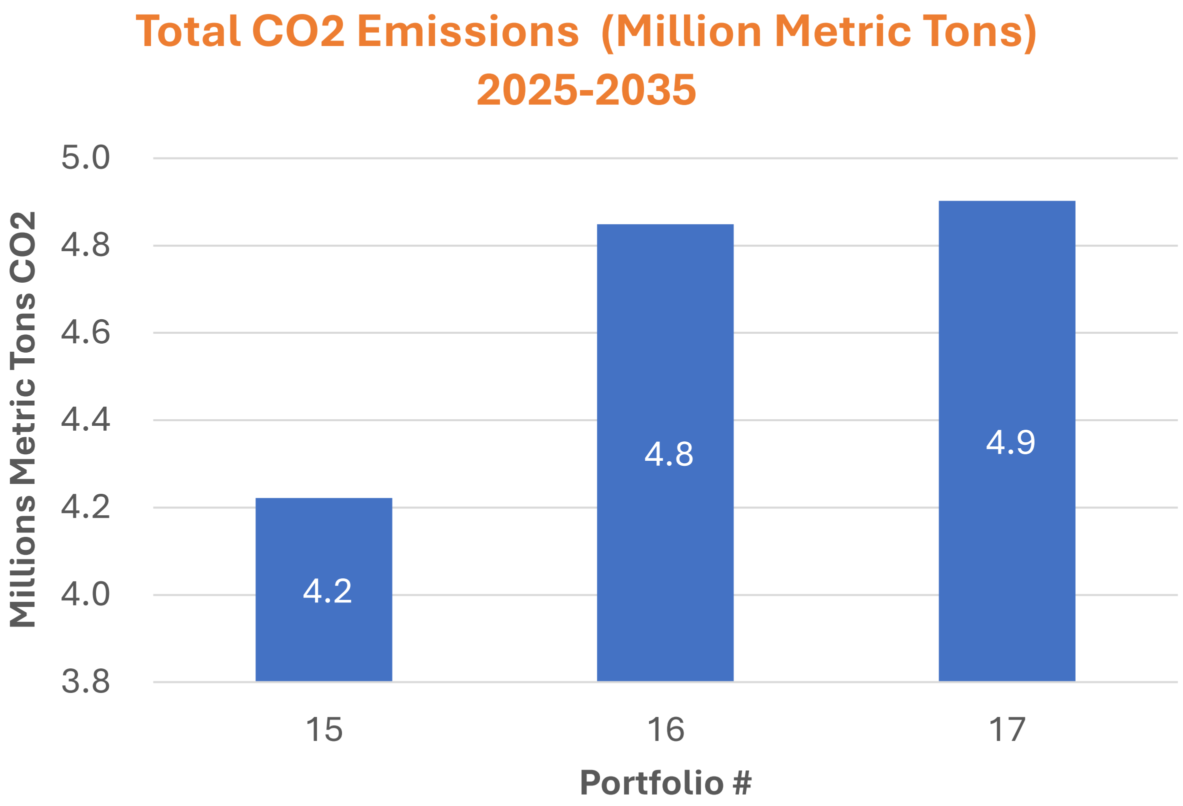
Round II Modeling Portfolio Comparison – Emissions

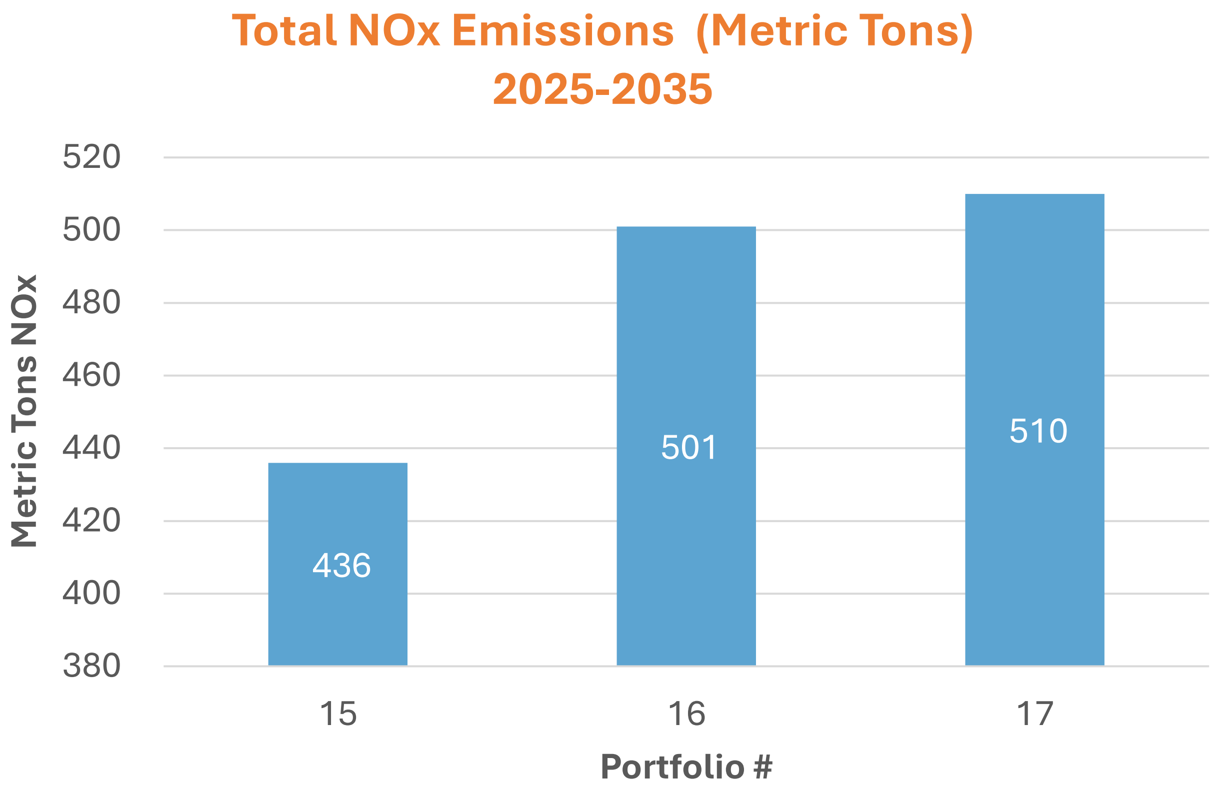
Modeled Austin Energy Stack CO_2 Emissions

By Year vs. Historical



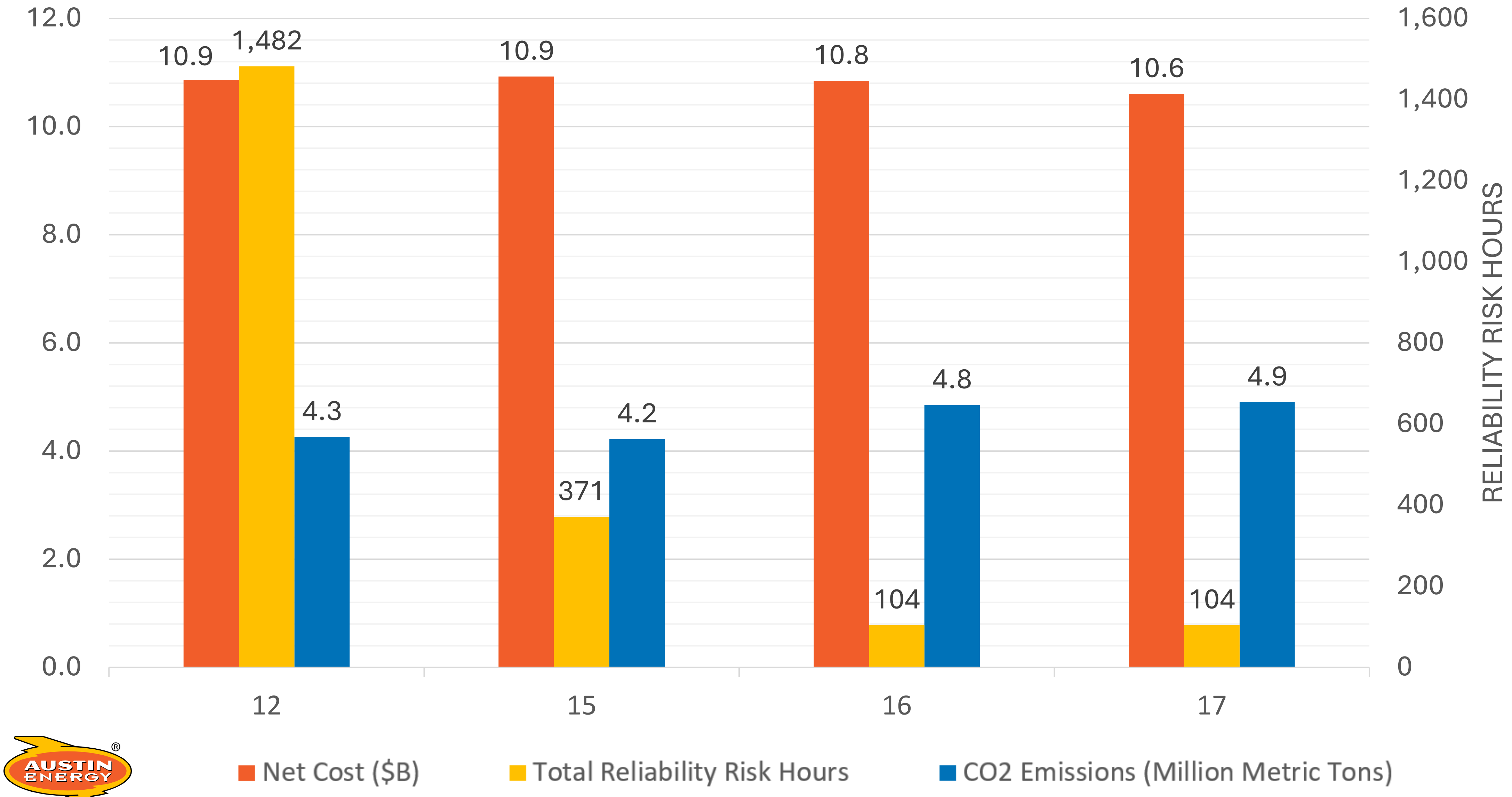
Modeled Austin Energy Stack Emissions





Round II Modeling Portfolio Comparison - Summary

P12 vs. P15-17 (2025-2035)



Key Insights from Modeling To Date and Next Steps

Transitioning to Plan Development

Resource Modeling

- How well do different resource mixes mitigate reliability, liquidity and load zone price separation risk?
- What are the tradeoffs in reliability, cost, and emissions between different portfolio mixes?

Resource Planning

- What insights did we learn from the modeling process that should inform the plan?
- What are the key characteristics from the modeled portfolios that mitigate risk and balance tradeoffs?

Key Insights from Modeling Results – Austin Energy

- Addition of 250 MW import capacity beyond known transmission upgrades significantly reduces reliability risk and net costs
- Loss of generation from Decker and Sand Hill significantly increases reliability risk and net costs
- High levels of new energy efficiency, demand response, local solar and storage plus existing generation manage reliability and liquidity risk – at a high cost, and pace of adoption exceeds estimated feasibility
- Model results are very sensitive to high load growth scenario

Discussion & Collaboration

What did you observe?

What surprised you?

What insights did you gain?

What are the key characteristics from the modeled portfolios that you would like to see reflected in the plan?

EUC Office Hours

- Tuesday, Oct. 22 — 3 p.m. – 4 p.m.
- Wednesday, Oct. 23 — 8:30 a.m. – 10 a.m.
- Thursday, Oct. 24 — 2:30 p.m. – 4 p.m.
- Friday, Oct. 25 — 9:30 a.m. – 10:30 a.m.

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

Office Hours Objectives:

- Answer questions
- Share detail
- Discuss learnings

By Wednesday, Oct. 30 – Seeking survey response from every Commissioner

Survey Questions

Requested by Oct. 30

What **key insights** or **lessons learned** did you take away from the 2035 Resource Generation Plan modeling exercise?

What are the **most important characteristics** from the portfolios we modeled that **you would like to see reflected** in the Resource, Generation and Climate Protection Plan to 2035?

Customer Driven.
Community Focused.℠

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

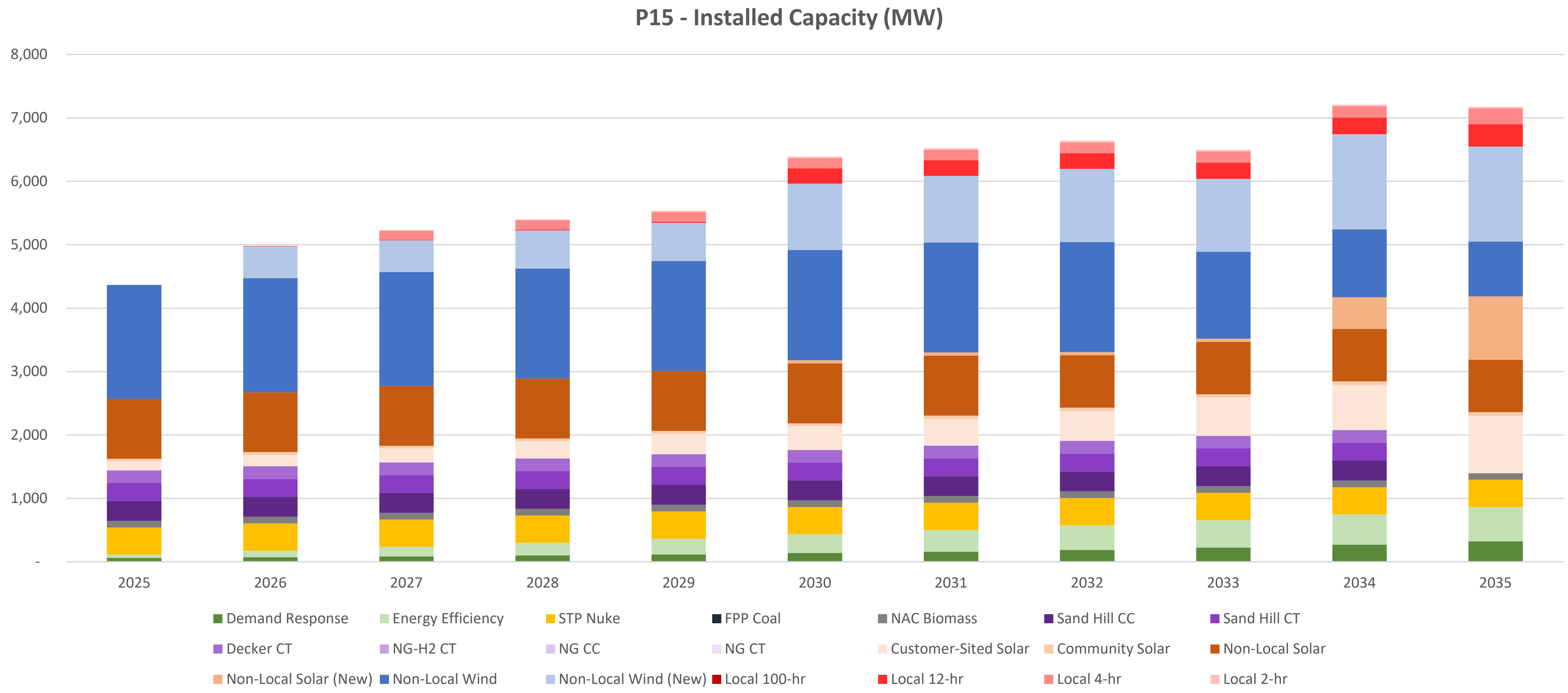
*DNV projections refers to the quantities of Demand-Side Management (Demand Response, Energy Efficiency, and Local Solar) resulting from the market potential study performed by DNV Energy Insights

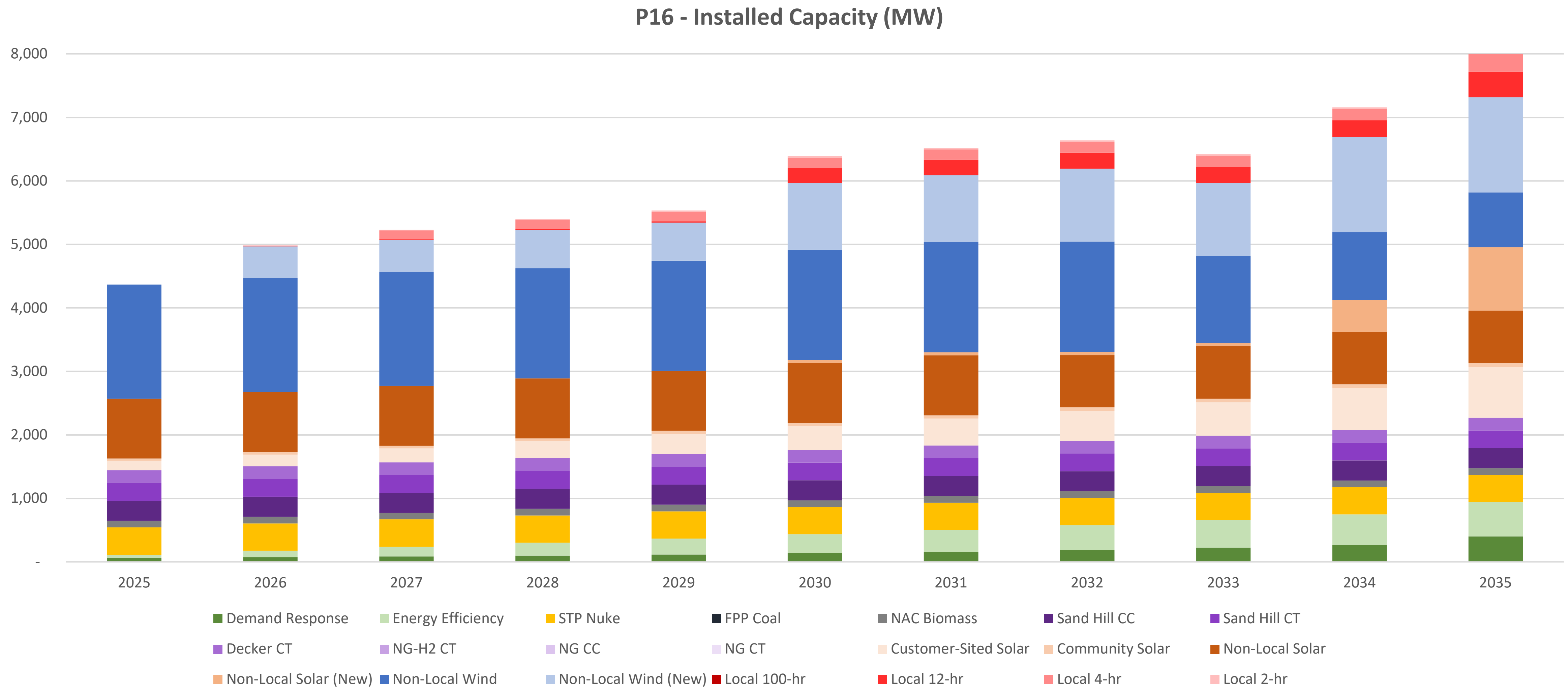
2035 Modeled Installed Capacity

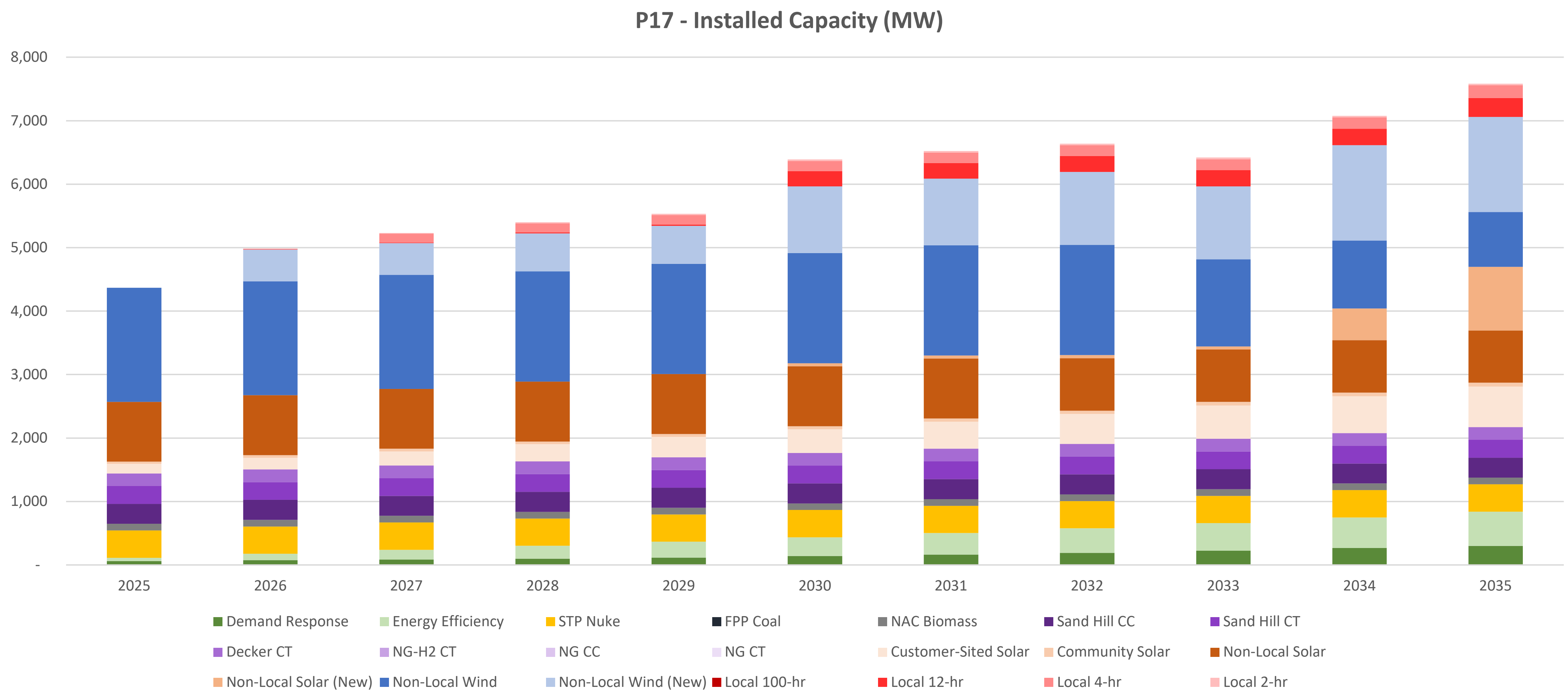
Portfolio	1 - No New Commitments	2 - 2030 Current Plan	3 - Local Gen/Storage + Margin	4 - Local Dispatchable + Margin	5 - Meet Env Goals + Expand DSM	6 - Aggressive DSM + Local Storage and Maintain Current RE Levels	7 - Aggressive DSM + Local Storage and Meet 65% RE Goal	8 - Hydrogen	9 - Hydrogen + Storage	10 - Keep Existing Gas + Storage	11 - Replace FPP in 2028 w/ Gas	12 - (EUC) Workgroup Recs	13 - (EUC) Increase Batteries	15 - (EUC) 12 + More Solar/Storage/ DR	16 - (EUC) 12 + More Solar/Storage/ DR + Keep Decker/SHEC	17 - (EUC) 12 + Keep Decker/SHEC
RESOURCES																
Non-Local Solar (New)		700	118		700	118	700	700	700	700	700	1000	1000	1,000	1000	1000
Non-Local Wind (New)		1100	932		1100	932	1100	1100	1100	1100	1100	1500	1500	1,500	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	25	25	25
Local 4-hr			100			100	100		100	100		200	360	250	300	200
Local 12-hr			150			150	150		150	150		300	540	350	400	300
Local 100-hr						120	120		120	120						
Import Capacity Improvement														250	250	
Decker CT	200		200	200						200	200				200	200
Sand Hill CC	315		315	315						315	315				315	315
Sand Hill CT	280		280	280						280	280				280	280
FPP Coal																
STP Nuke	430	430	430	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	105	105	105
Non-Local Wind	864	864	864	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	826	826	826
Customer-Sited Solar	290	290	371	330	371	439	439	371	371	371	371	640	371	900	800	640
Community Solar	42	42	60	51	60	60	60	60	60	60	60	60	60	60	60	60
Demand Response	120	120	270	195	270	325	325	270	270	270	270	300	270	325	400	300
Energy Efficiency (additional)	360	360	360	360	360	360	360	360	360	360	360	540	360	540	540	540

Summary UPLAN results Round II Portfolio

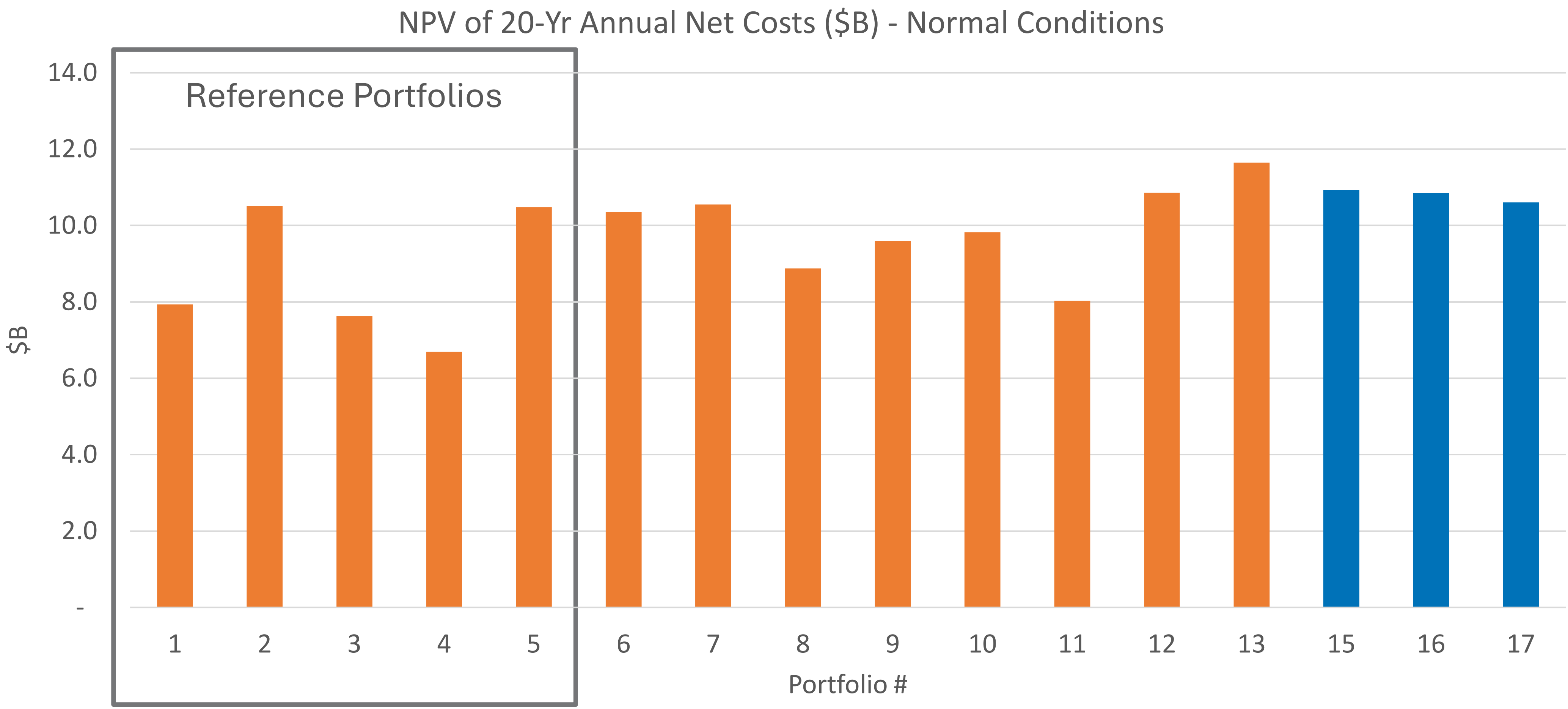
	20-yr NPV ($B)	2035 Bill Impact ($/Month)	2035 Energy Burden (%)	Total Liquidity Need - Winter Event ($MM)	Total Liquidity Need - Summer Event ($MM)	Total Reliability Risk Hours (Hours)	Total 3+ Hour Reliability Risk Events (Count)	Total CO2 Emissions (Million Metric Tons)	Total NOx Emissions (Metric Tons)	Total SOx Emissions (Metric Tons)	Total PM Emissions (Metric Tons)
15	$10.9	$75	4.7%	$879	$228	371	54	4	436	<1	113
16	$10.9	$70	4.5%	$290	$65	104	19	5	501	<1	130
17	$10.6	$67	4.5%	$312	$118	104	20	5	510	<1	132

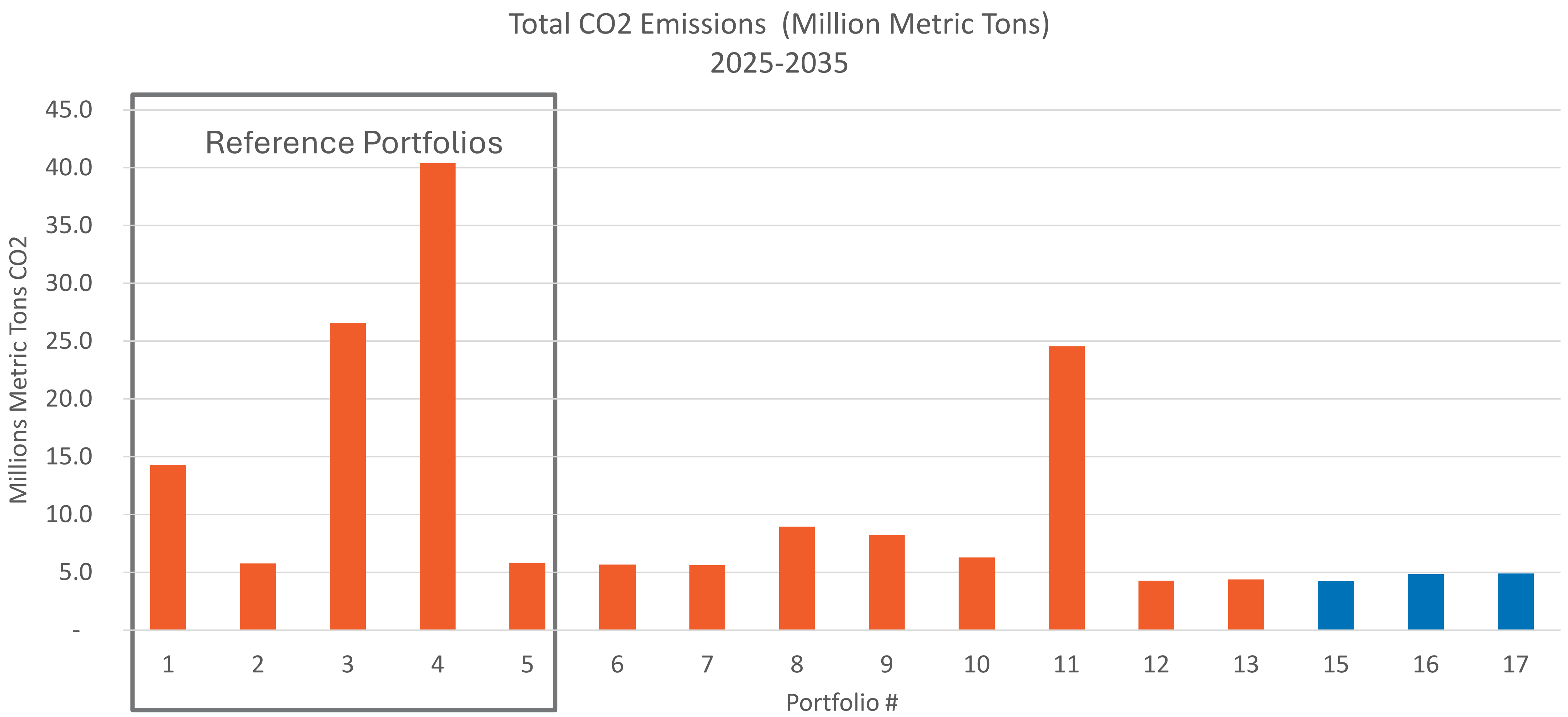

P15 - Installed Capacity (MW)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Demand Response
Energy Efficiency
STP Nuke
FPP Coal
NAC Biomass
Sand Hill CC
Sand Hill CT
Decker CT
NG-H2 CT
NG CC
NG CT
Customer-Sited Solar
Community Solar
Non-Local Solar
Non-Local Solar (New)
Non-Local Wind
Non-Local Wind (New)
Local 100-hr
Local 12-hr
Local 4-hr
Local 2-hr

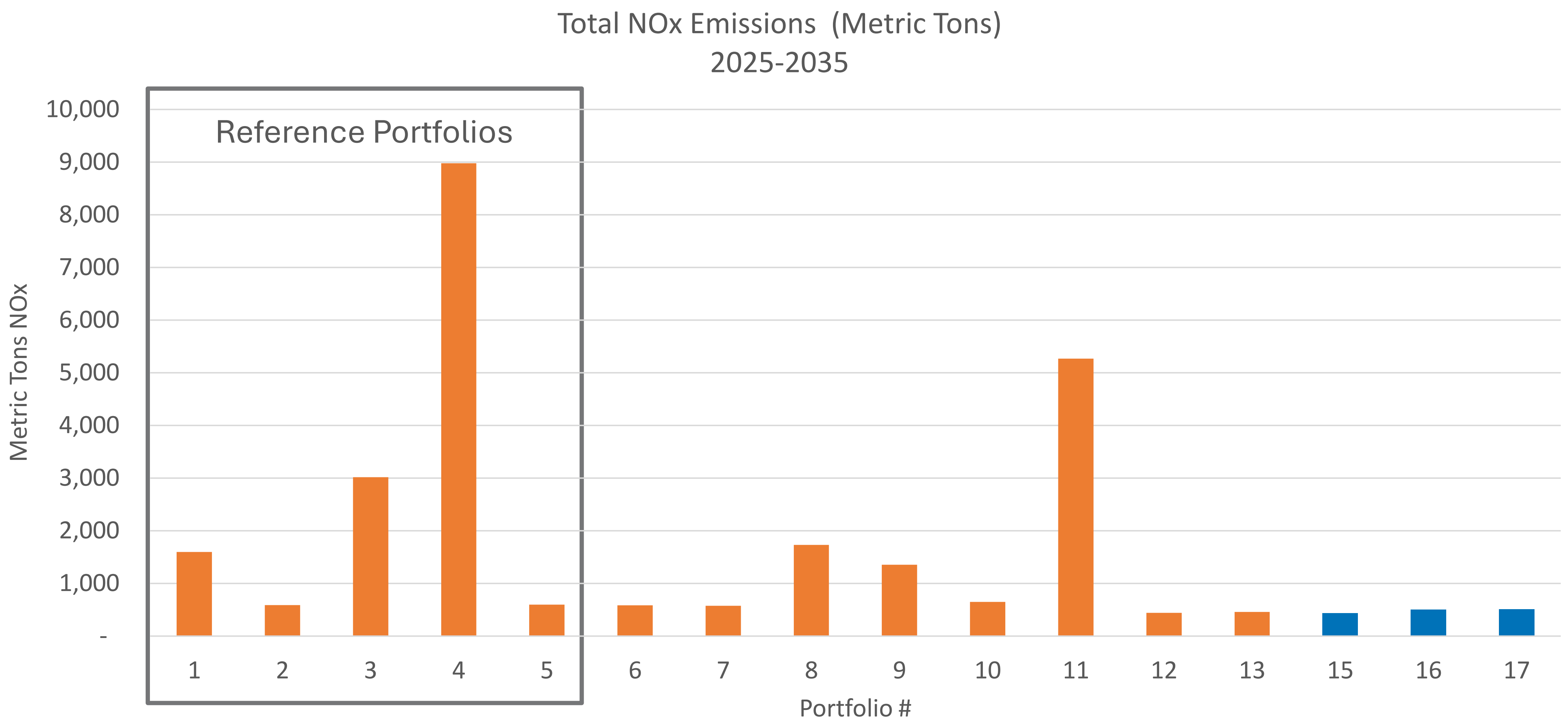

P16 - Installed Capacity (MW)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Demand Response
Energy Efficiency
STP Nuke
FPP Coal
NAC Biomass
Sand Hill CC
Sand Hill CT
Decker CT
NG-H2 CT
NG CC
NG CT
Customer-Sited Solar
Community Solar
Non-Local Solar
Non-Local Solar (New)
Non-Local Wind
Non-Local Wind (New)
Local 100-hr
Local 12-hr
Local 4-hr
Local 2-hr


P17 - Installed Capacity (MW)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Demand Response
Energy Efficiency
STP Nuke
FPP Coal
NAC Biomass
Sand Hill CC
Sand Hill CT
Decker CT
NG-H2 CT
NG CC
NG CT
Customer-Sited Solar
Community Solar
Non-Local Solar
Non-Local Solar (New)
Non-Local Wind
Non-Local Wind (New)
Local 100-hr
Local 12-hr
Local 4-hr
Local 2-hr

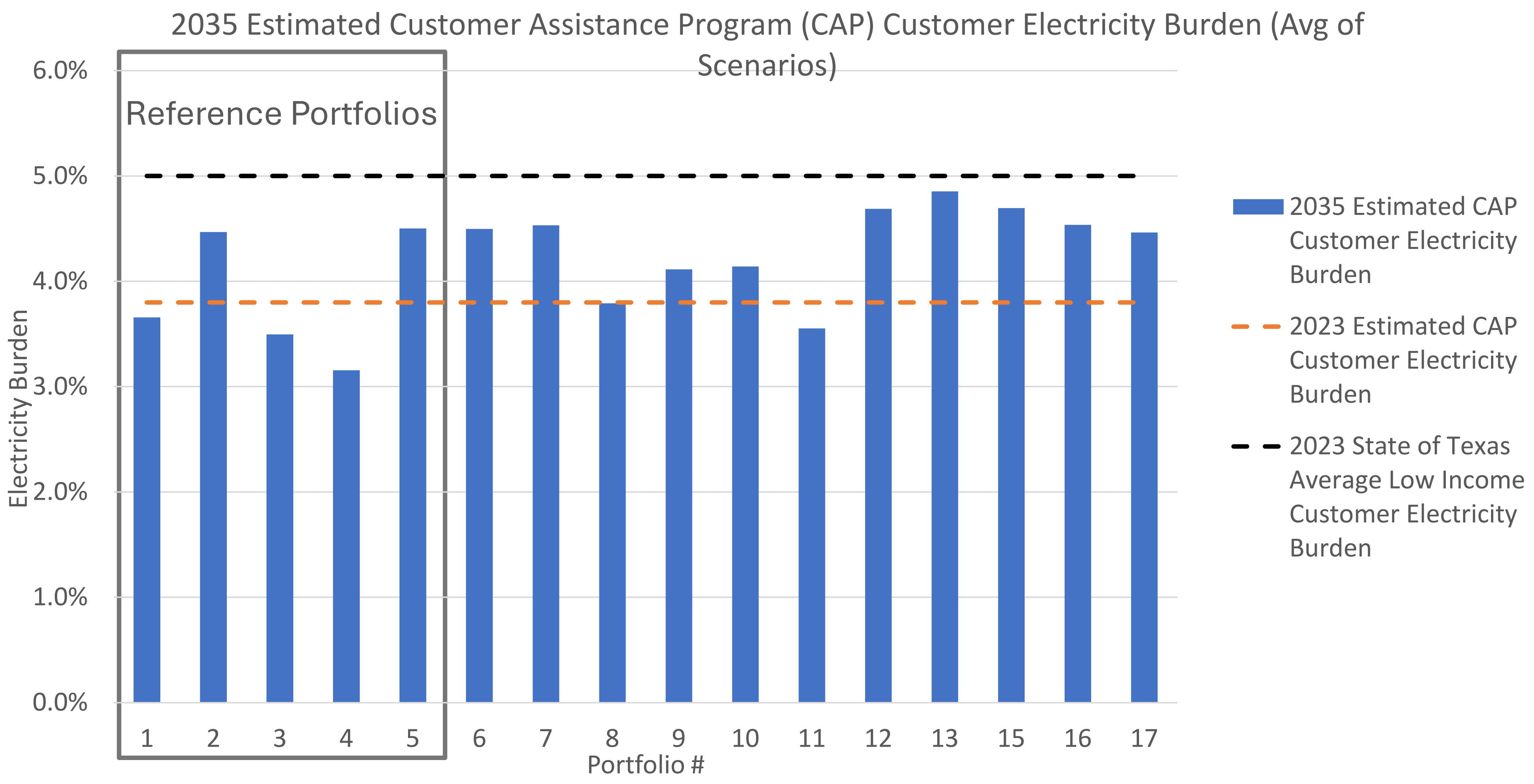
20-year NPV of Net Cost – All Portfolios




Total CO2 Emissions (Million Metric Tons)
2025-2035
Reference Portfolios
Millions Metric Tons CO2
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
-
1
2
3
4
5
6
7
8
9
10
11
12
13
15
16
17
Portfolio #

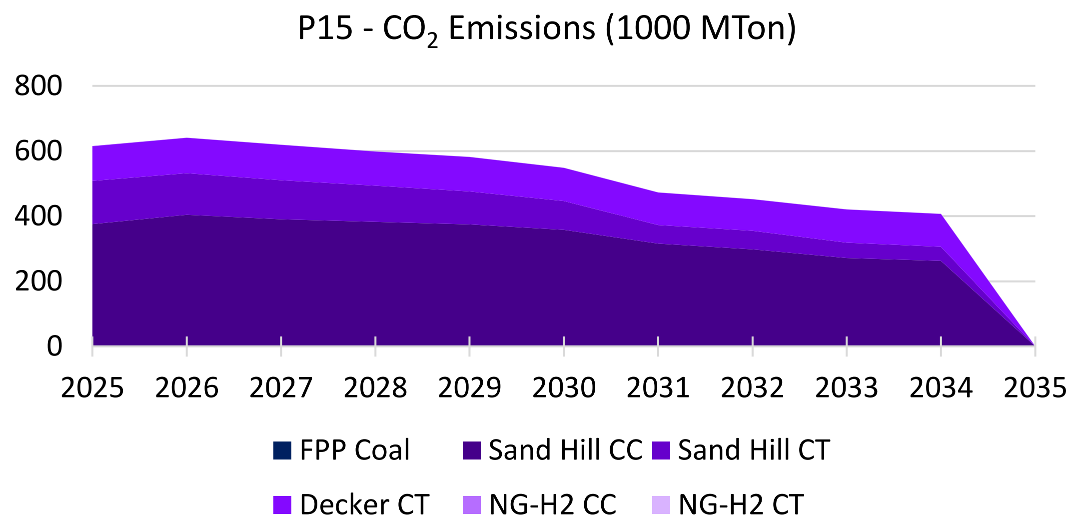


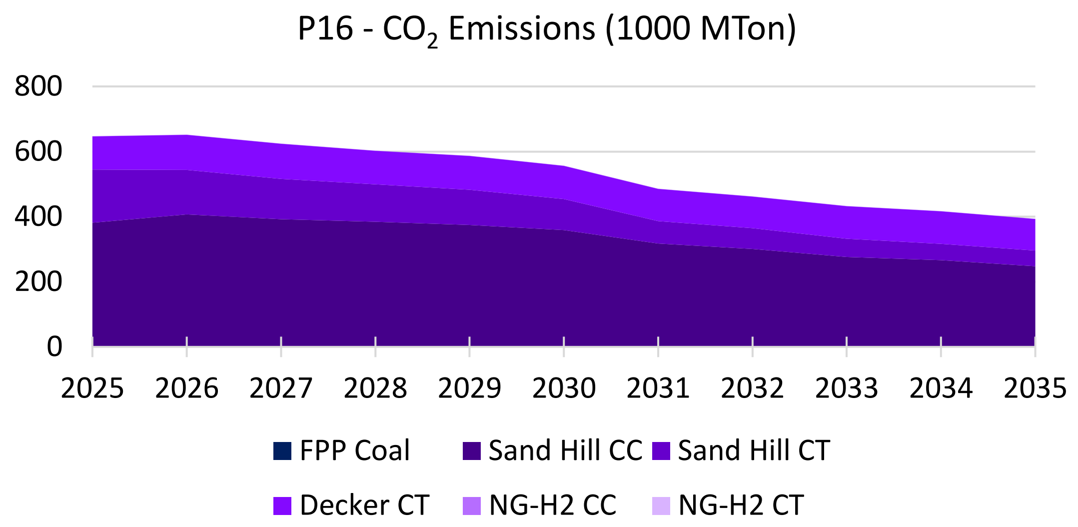
Total NOx Emissions (Metric Tons)
2025-2035
Reference Portfolios
Metric Tons NOx
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
1
2
3
4
5
6
7
8
9
10
11
12
13
15
16
17
Portfolio #

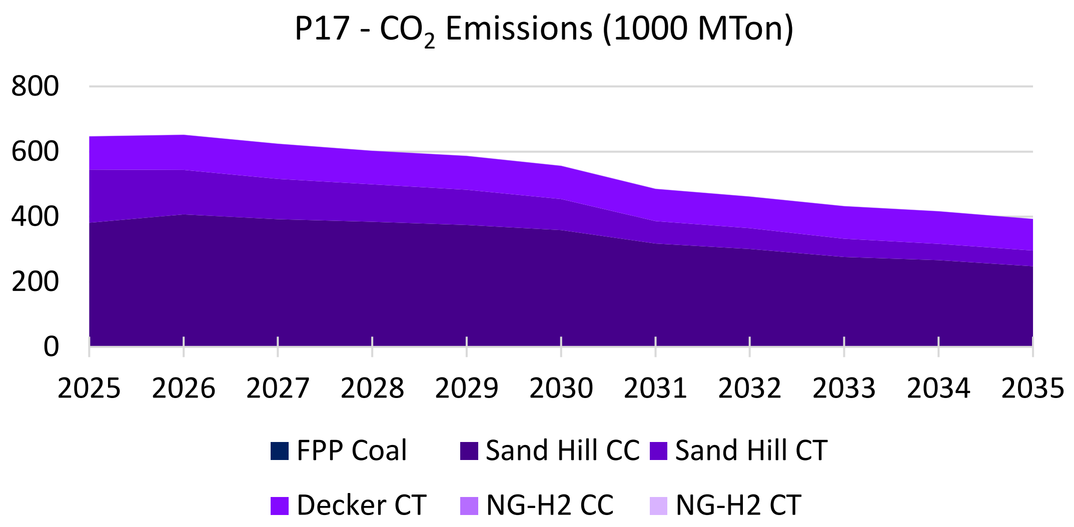


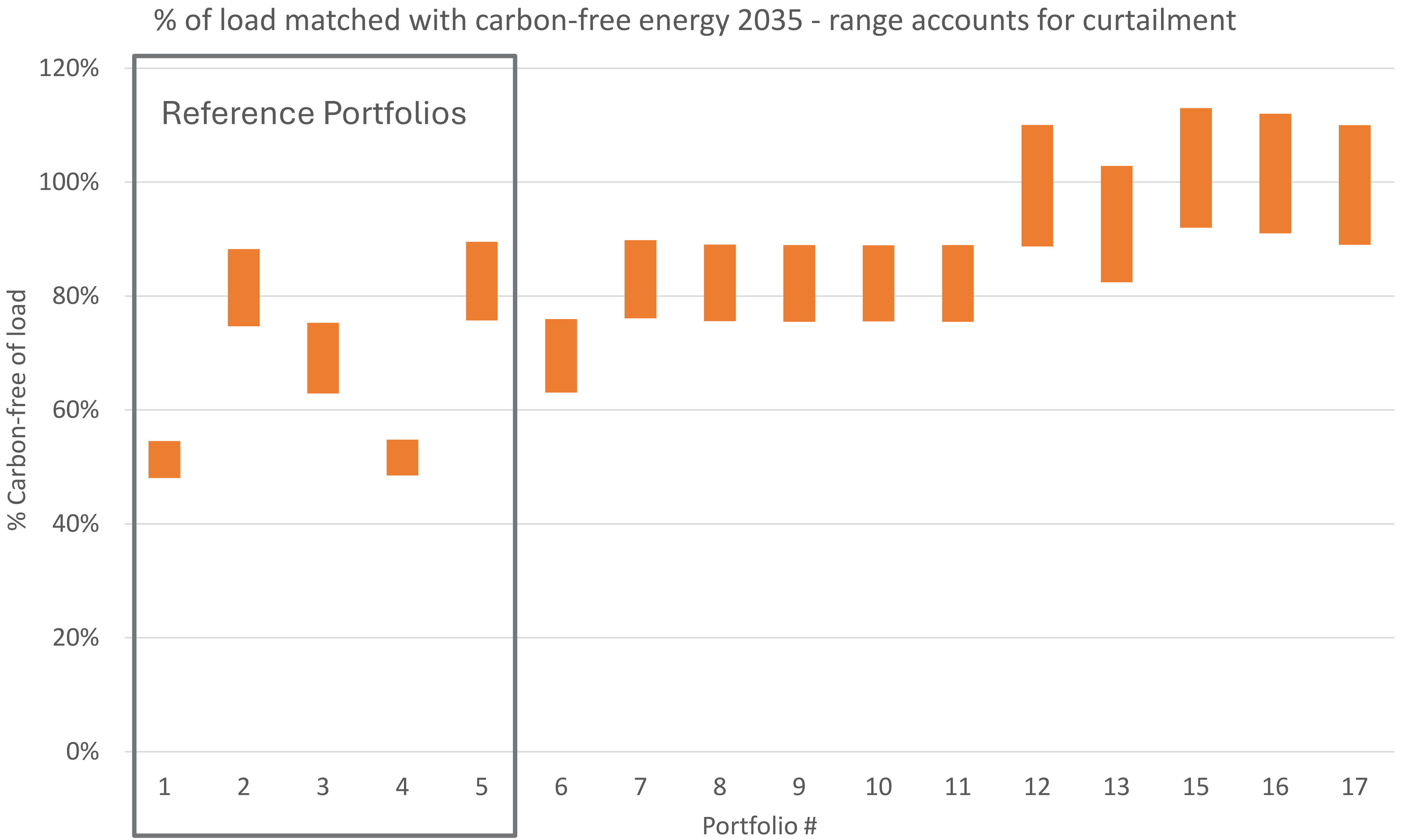
2035 Estimated Customer Assistance Program (CAP) Customer Electricity Burden (Avg of Scenarios)
Reference Portfolios
Electricity Burden
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
1
2
3
4
5
6
7
8
9
10
11
12
13
15
16
17
Portfolio #
2035 Estimated CAP Customer Electricity Burden
2023 Estimated CAP Customer Electricity Burden
2023 State of Texas Average Low Income Customer Electricity Burden

Ascend Emissions Trends









% of load matched with carbon-free energy 2035 - range accounts for curtailment
Reference Portfolios
120%
100%
80%
60%
40%
20%
0%
% Carbon-free of load
1
2
3
4
5
6
7
8
9
10
11
12
13
15
16
17
Portfolio #

UPLAN vs. Ascend Modeling Overview

Portfolios 14-17

UPLAN

- Single portfolio runs through multiple future scenarios
- "Deterministic" model does not account for randomness
- Simulates ERCOT grid operational and pricing function in detail

Ascend Analytics

- Single portfolio runs through 100 simulations
- "Stochastic" model estimates probabilities of outcomes given uncertainties (P5-P95)
- Does not simulate ERCOT grid