CASCADE NATURAL GAS CORPORATION®

A Subsidiary of MDU Resources Group, Inc.

In the Community to Serve®

Integrated Resource Plan (WA) Technical Advisory Group Meeting #5

OCTOBER 20, 2022

MICROSOFT TEAMS/TELECONFERENCE

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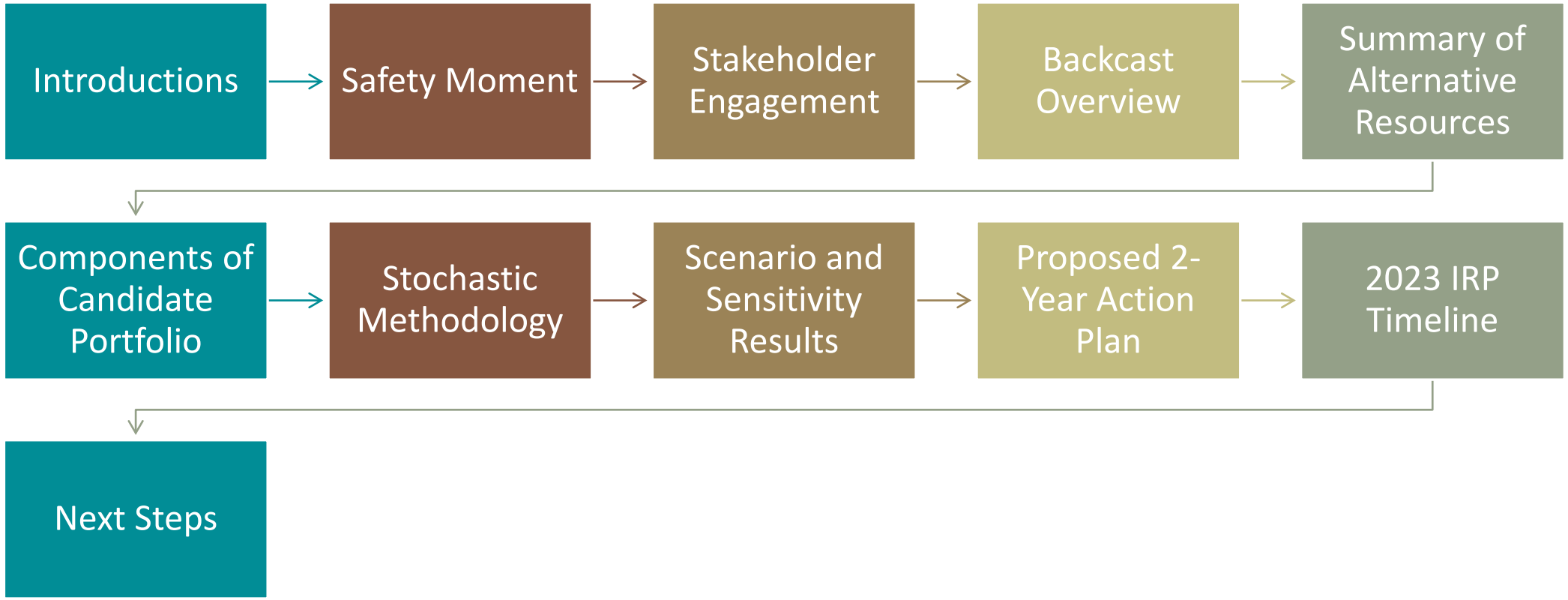
Agenda

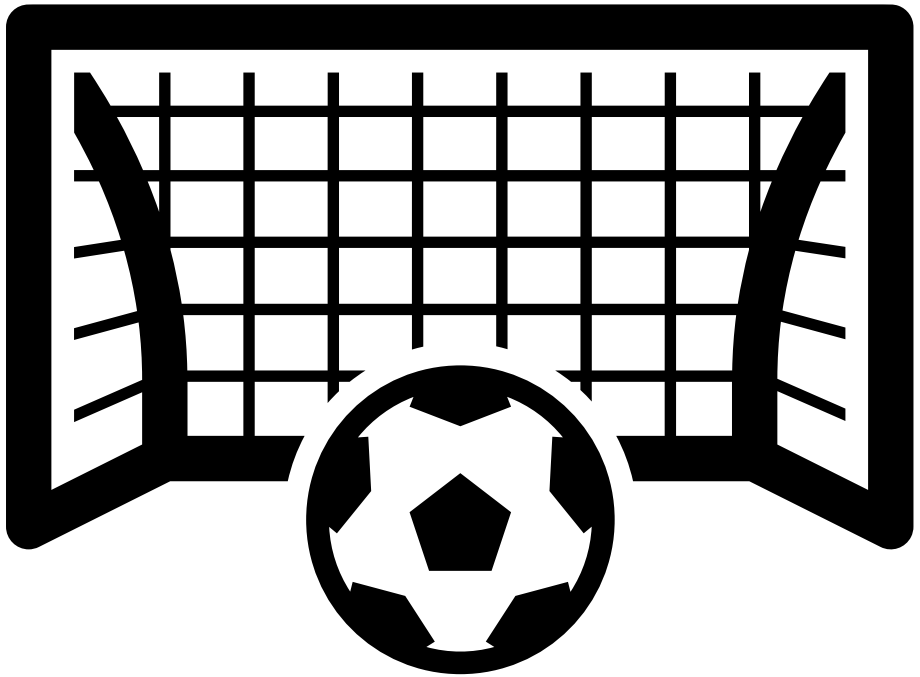

Introductions
Safety Moment
Stakeholder Engagement
Backcast Overview
Summary of Alternative Resources
Components of Candidate Portfolio
Stochastic Methodology
Scenario and Sensitivity Results
Proposed 2-Year Action Plan
2023 IRP Timeline
Next Steps

How to Relieve Stress

Stress can have a negative impact on bodies and overall health.
Here are some tips to relieve it:

- **Listen to Music** – Playing calm, meditative, relaxing music can help lower blood pressure. This can include listening to ocean waves or nature sounds.
- **Talk to Someone** – Take a break and talk to a friend or a counselor. When you are under a lot of stress a reassuring voice can help put everything into a better perspective.
- **Healthy Eating** – Try to avoid sugary and fatty snack foods. Eating fruits, vegetables, and fish with high Omega-3 fatty acids are a better alternative and have been shown to reduce stress symptoms.
- **Laugh** – Laughter they say is the best medicine and when it comes to stress, this is true. Laughing releases endorphins that decrease the levels of stress hormones. Laughing tricks your brain into making you happy.
- **Drink Tea** – Avoid coffee and caffeinated drinks; these beverages cause a short-term spike in blood pressure. Green tea has less caffeine and contains amino acids that have a calming effect.
- **Exercise** – Exercising, even for a short walk around the office or simply standing up and stretching will get your blood moving and release endorphins to immediately provide some relief to a stressful moment.
- **Breathe** – Taking deliberate, slow, deep breaths helps to center your body, clear your mind, and slow your heart rate. Understanding stress and how it effects your body can help you understand the right steps you need to take to help relieve it.

Safety Moment



Stakeholder Engagement[1]

While Cascade owns and is responsible for the IRP, the Company desires to have involvement from stakeholders to provide a diversity of perspectives.

A best practices IRP is informed by perspectives, analyses and access to concerns and approaches that the Company may not have considered.

Some stakeholders participate in multiple IRP processes and have a line-of-sight that may not be available to Cascade, despite the Company monitoring other utilities' IRPs and associated processes.

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1: SEE STAKEHOLDER ENGAGEMENT DESIGN DOCUMENT AT WASHINGTON INTEGRATED RESOURCE PLAN - CASCADE NATURAL GAS CORPORATION (CNGC.COM)

Backcast Overview

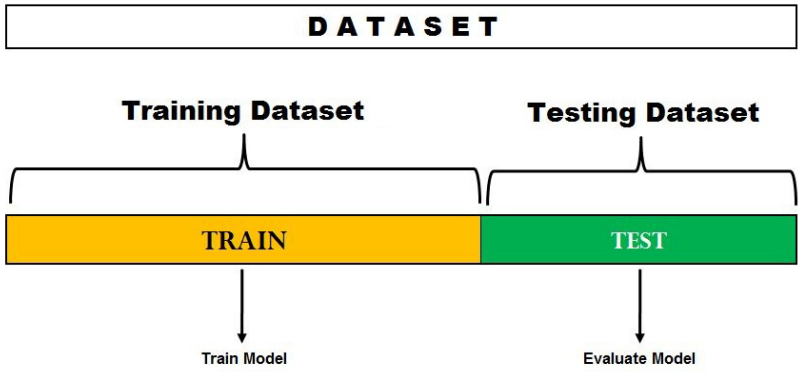
Backcasting (Cross-validation)

Cross-validation:

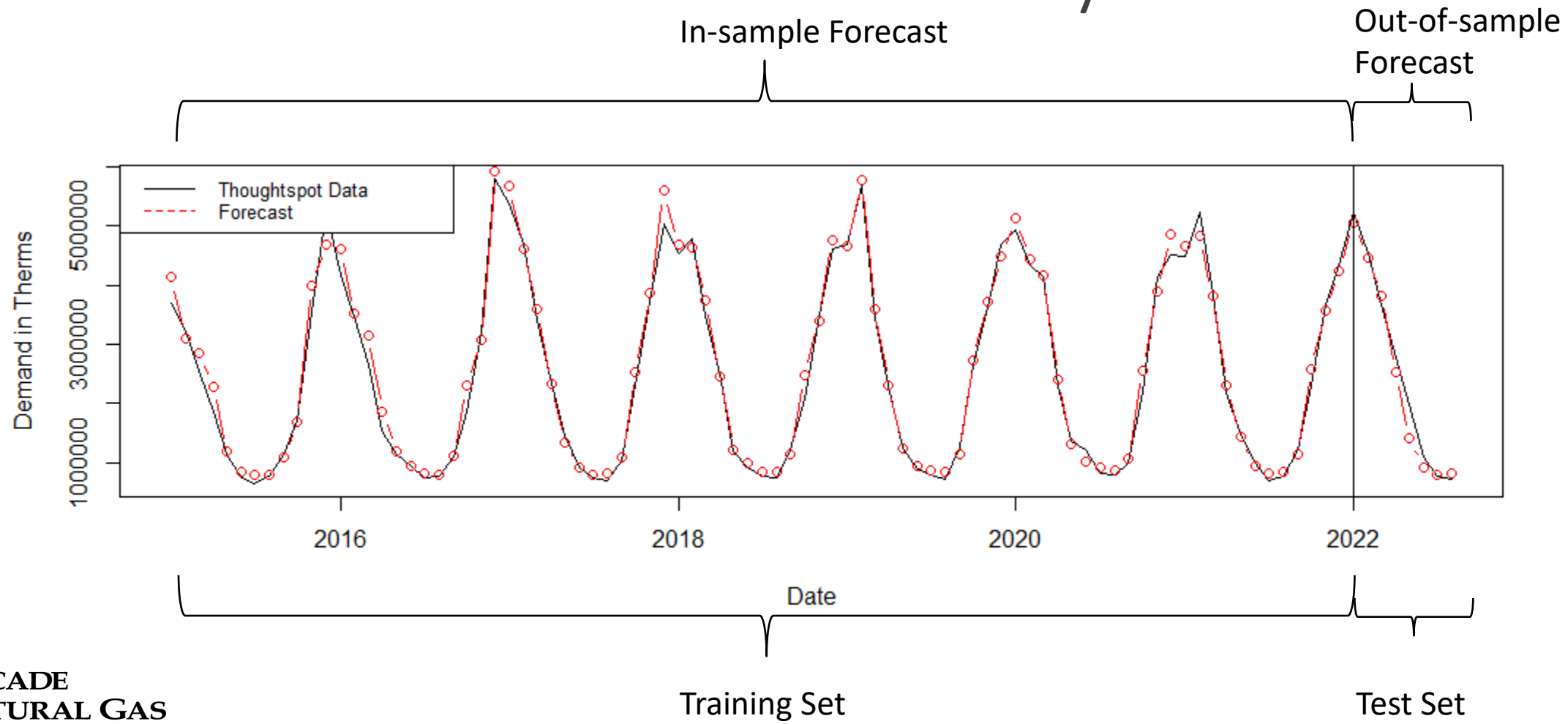
- Estimates the skill of a model on unseen data.
- Flags problems like overfitting, sampling bias…

Hold out cross validation:

- Data is split into “training” and “test” sets
- Model is fit to “training” set
- Model’s forecast is compared to “test” set for accuracy



Breakdown of a forecast analysis



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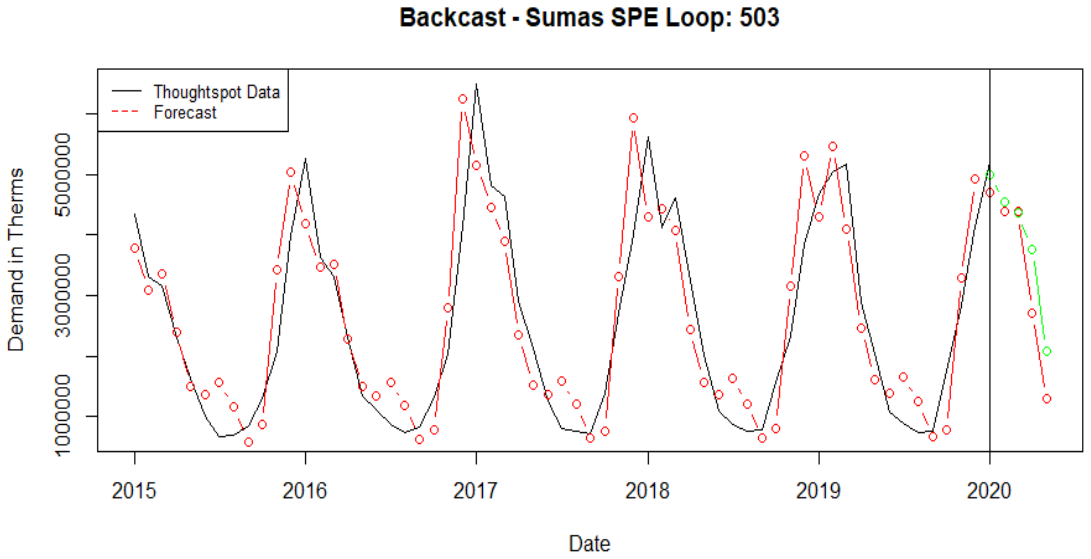
Sumas SPE Loop: 503 (Residential)

Last cross-validation:



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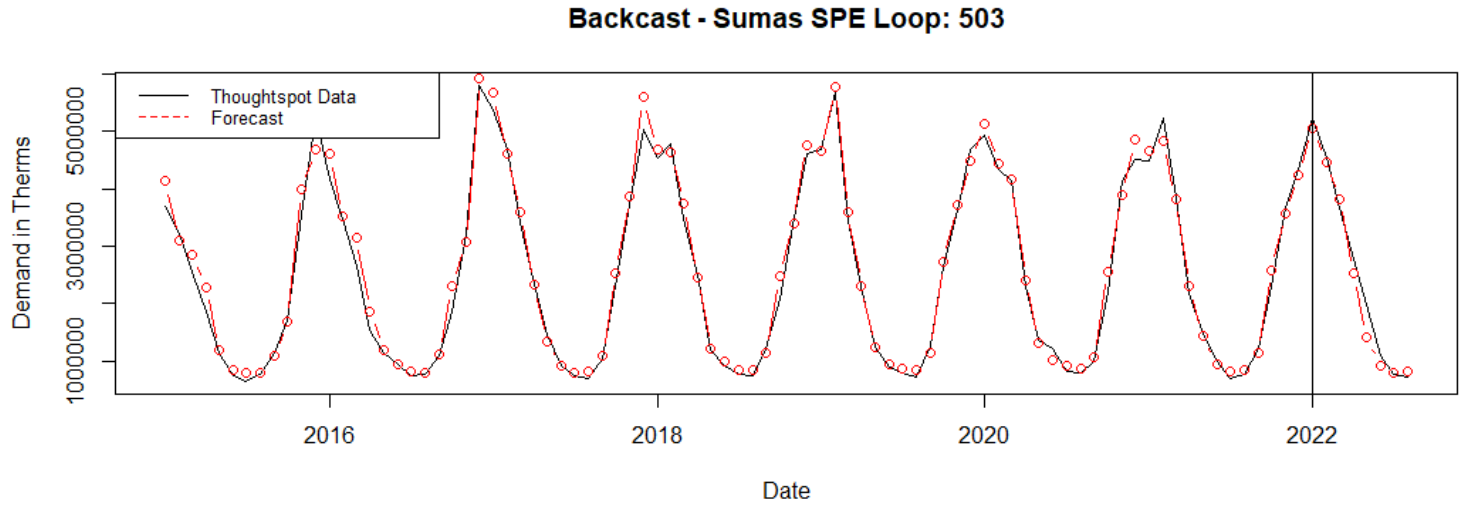

Sumas SPE Loop – 504 (Commercial)

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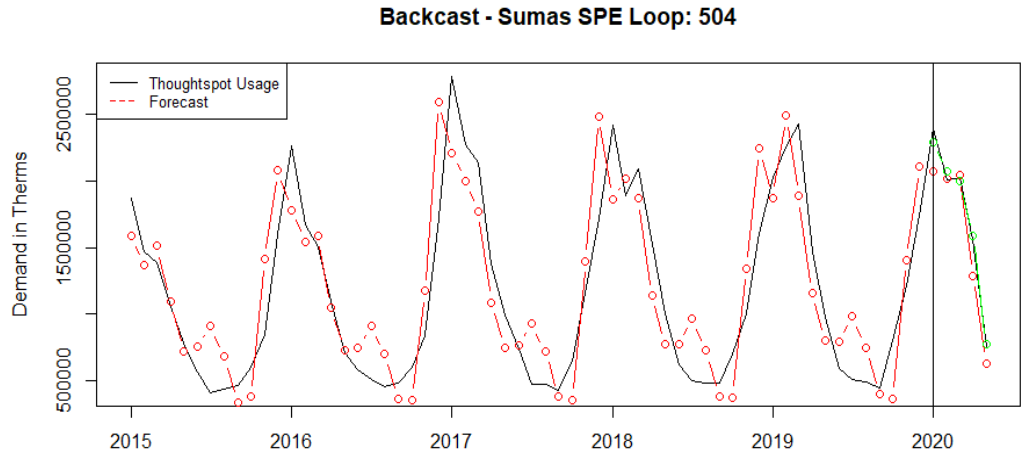

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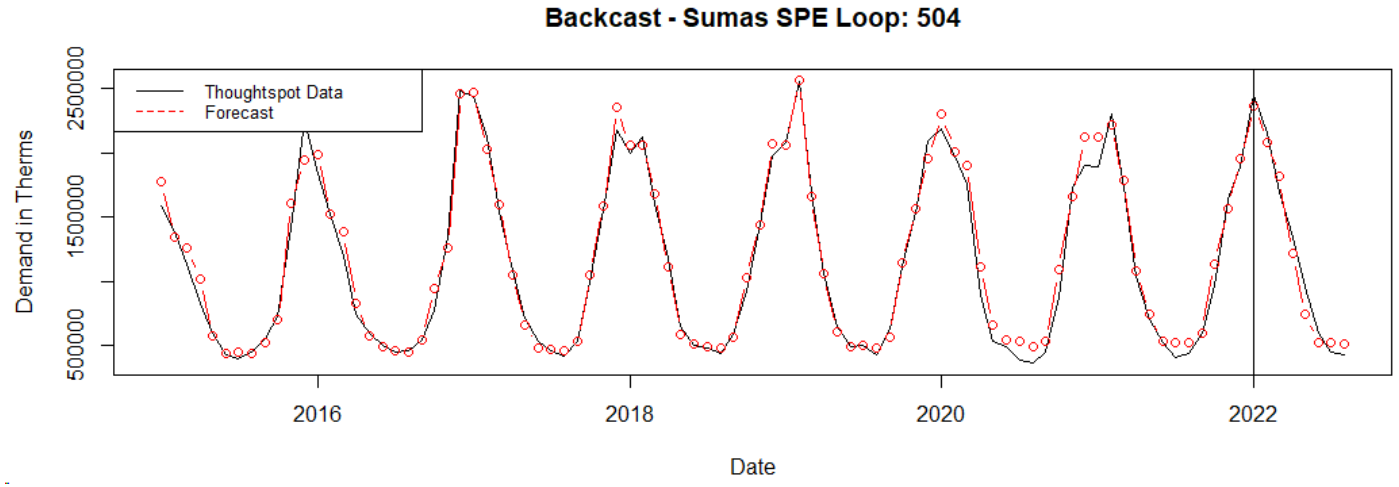

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Sumas SPE Loop – 505 (Industrial)

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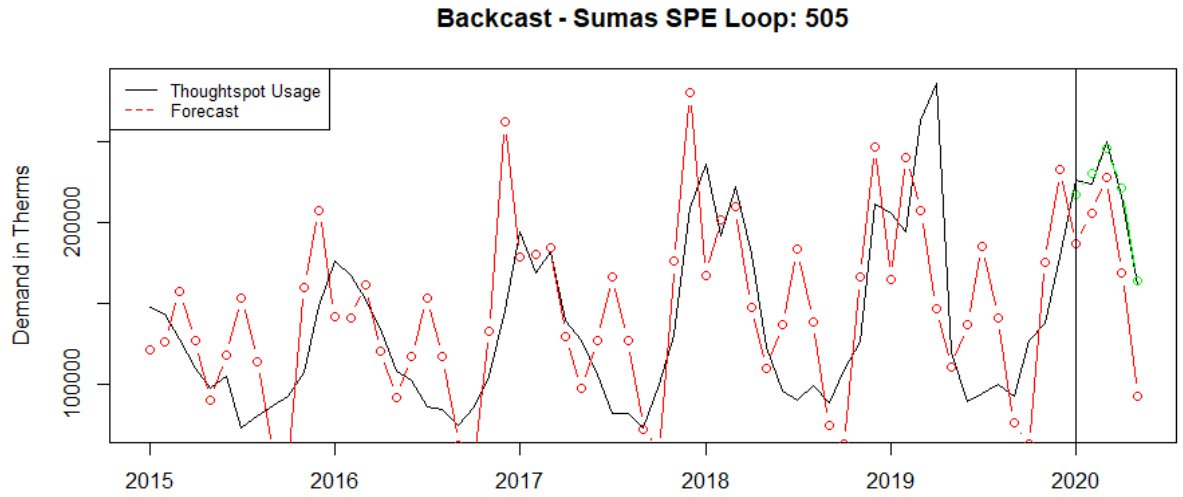

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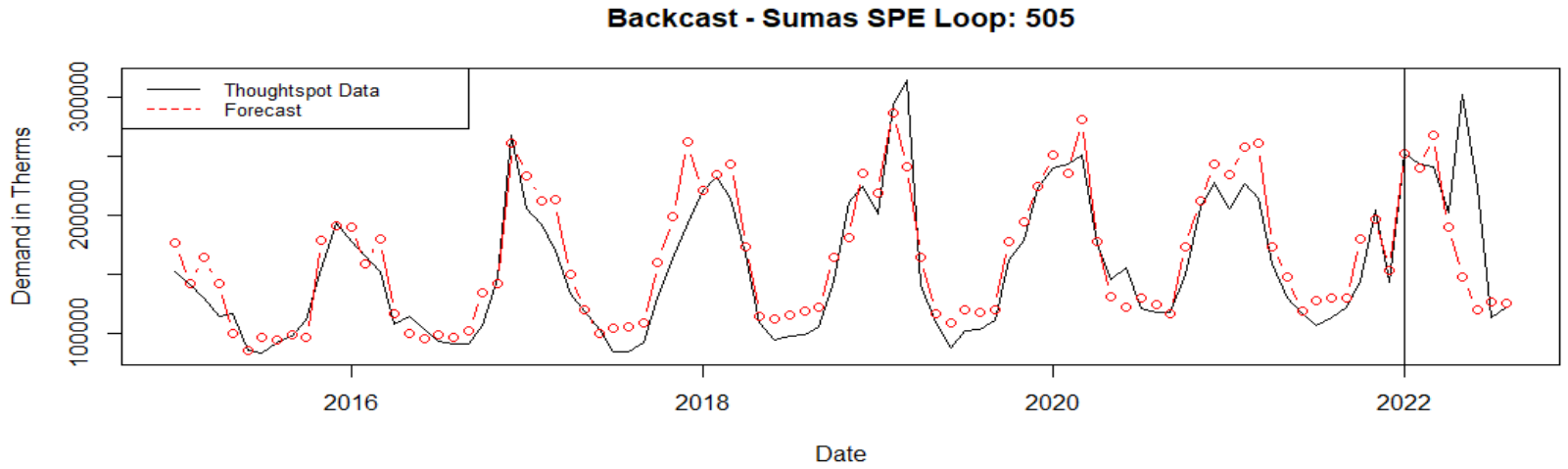

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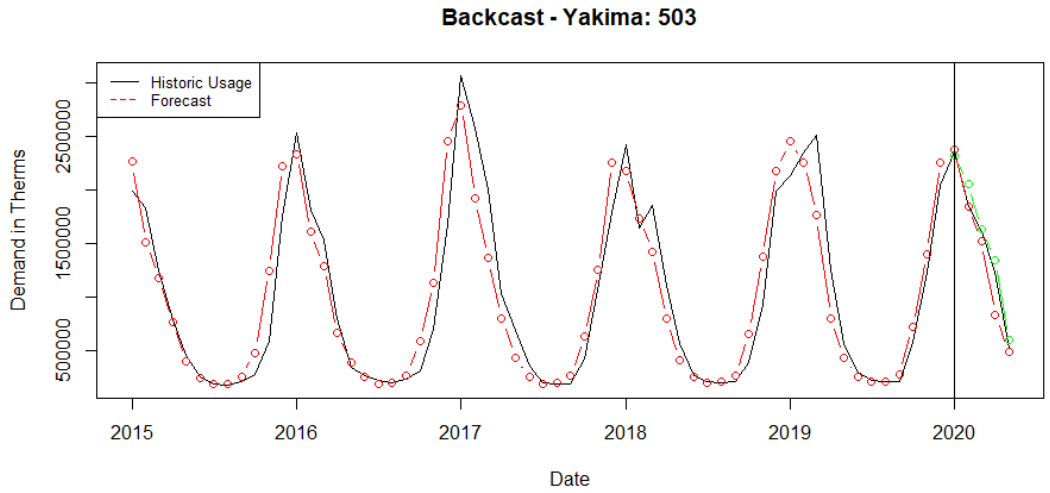
Yakima 503

Last cross-validation:



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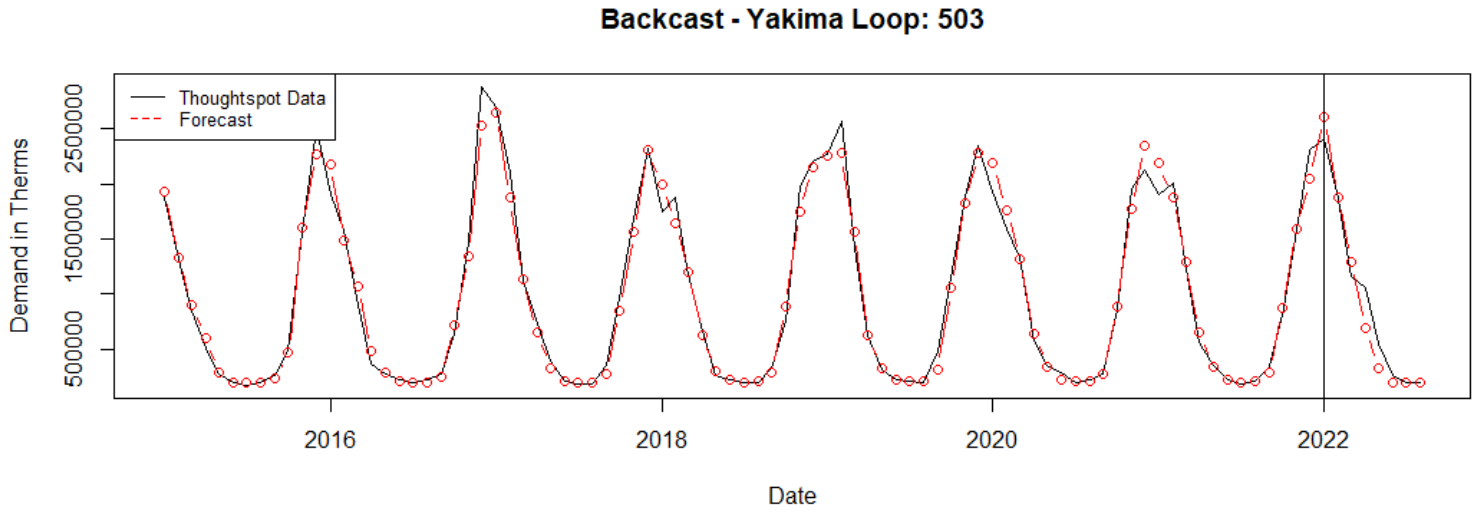

Yakima 504

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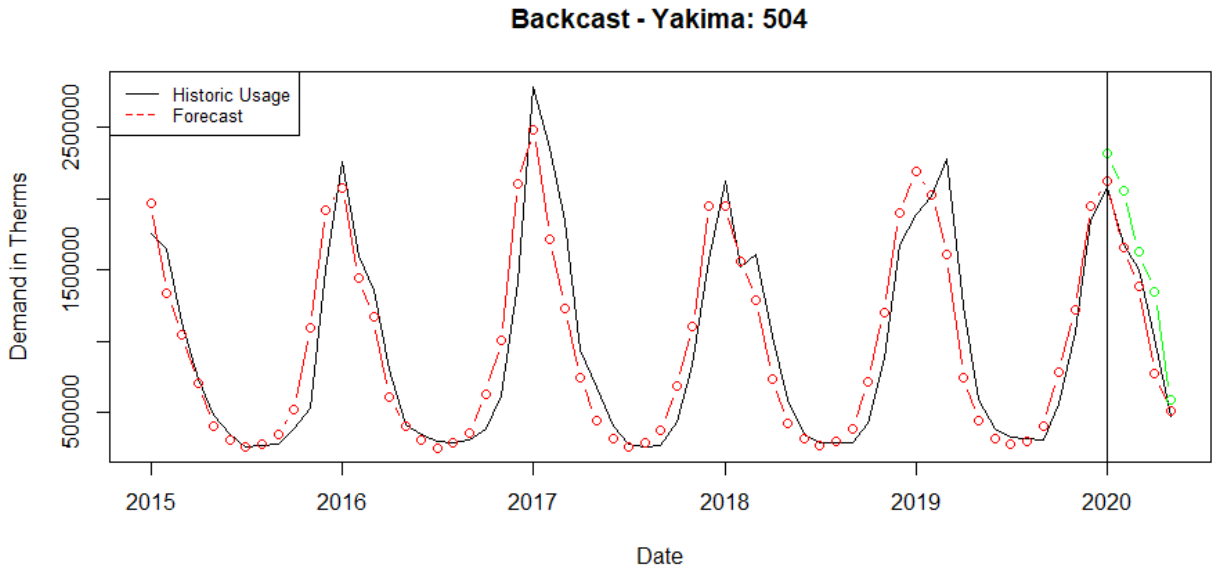

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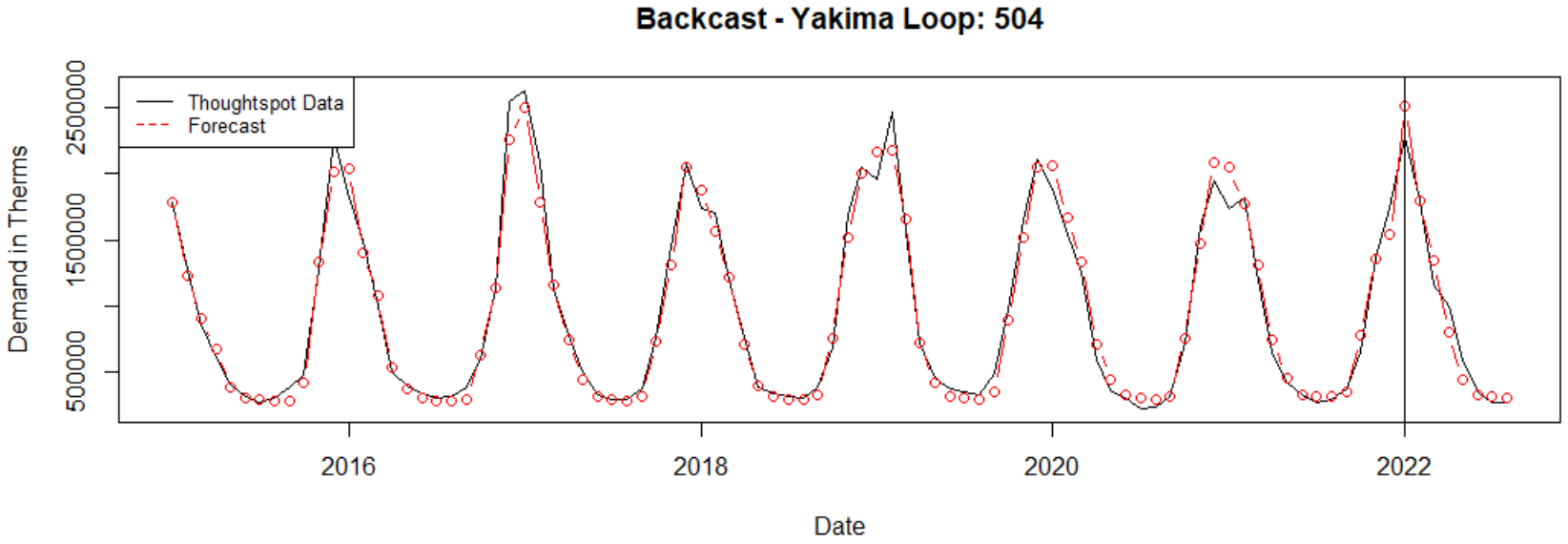

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Yakima 505

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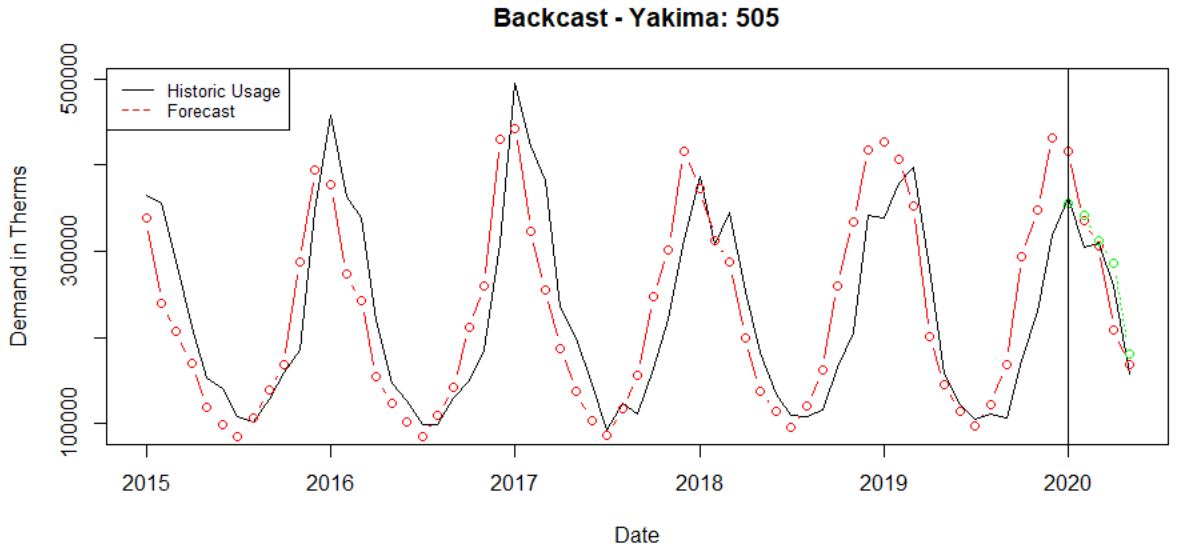

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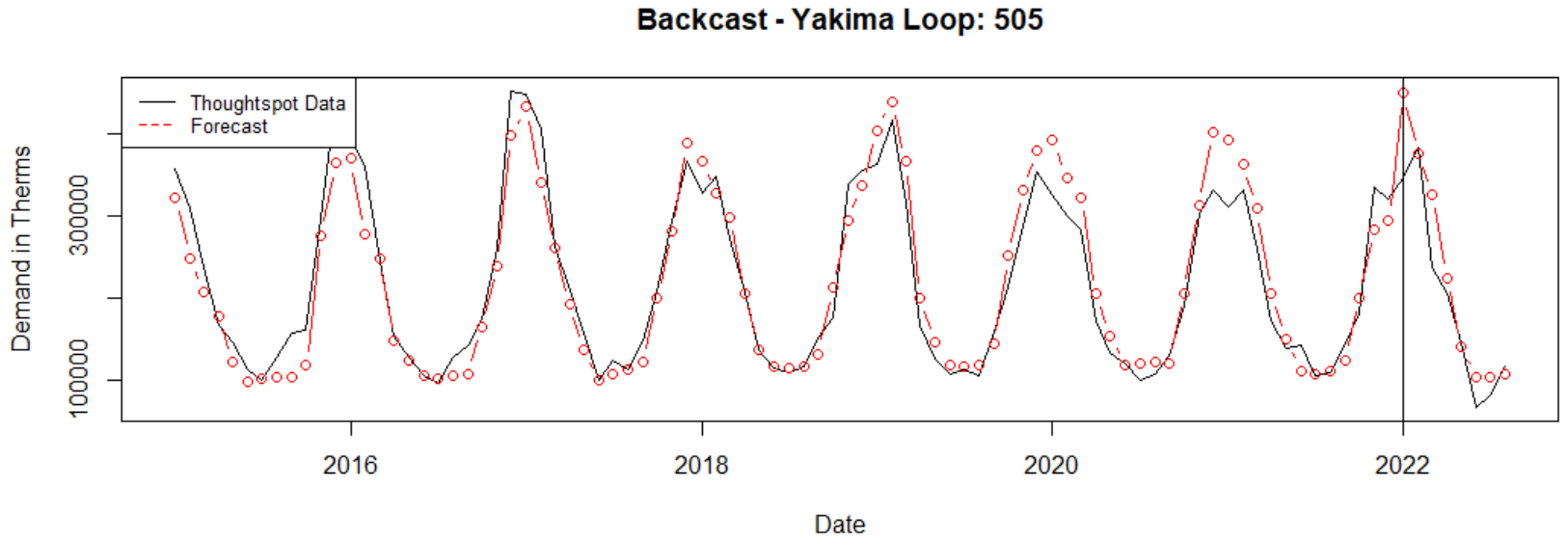
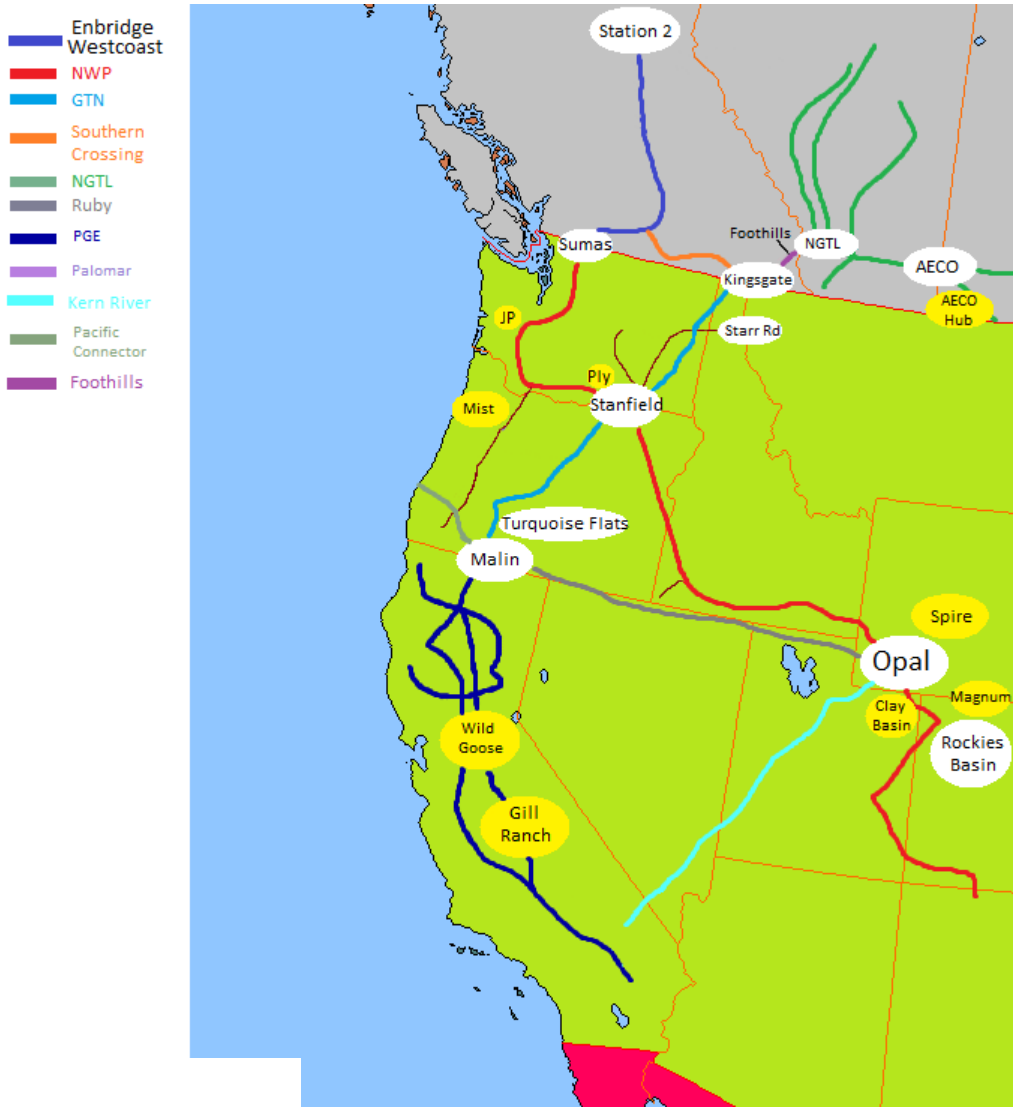


Next Steps:

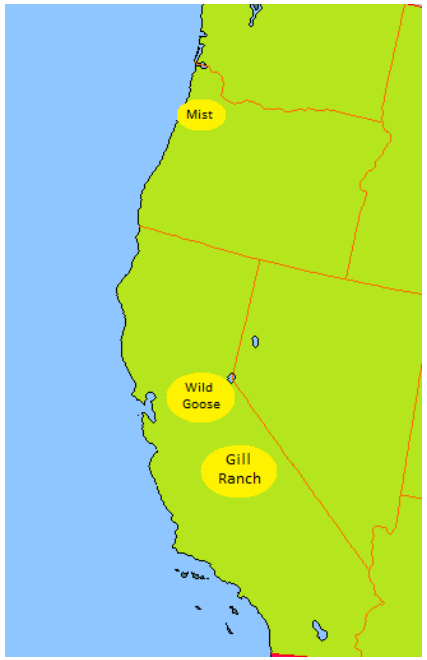
- Investigate industrial regressors to improve forecasts
- Build script for faster cross-validation

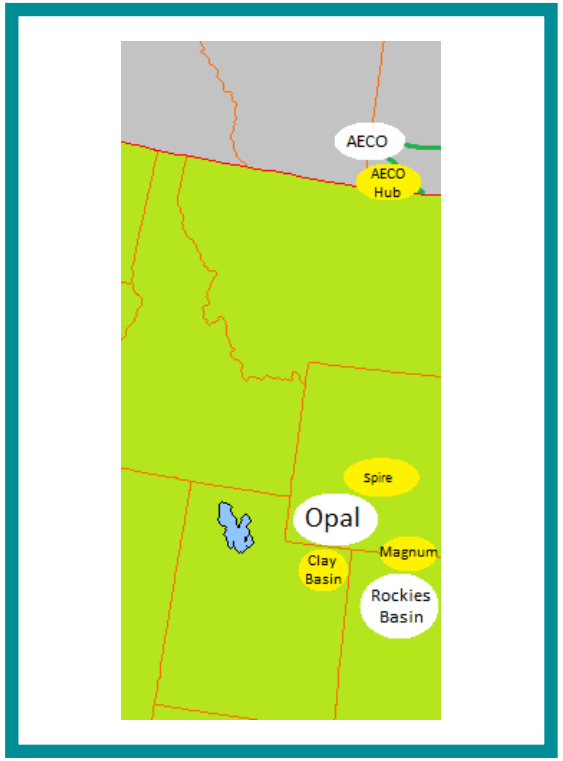
Summary of Alternative Resources



Incremental Transport

- Incremental Transport – Northwest Pipeline Bilateral
- Incremental Transport – North to South GTN
- Incremental Transport – South to North GTN
- Incremental Transport – T-South/Pacific Connector





Incremental Storage

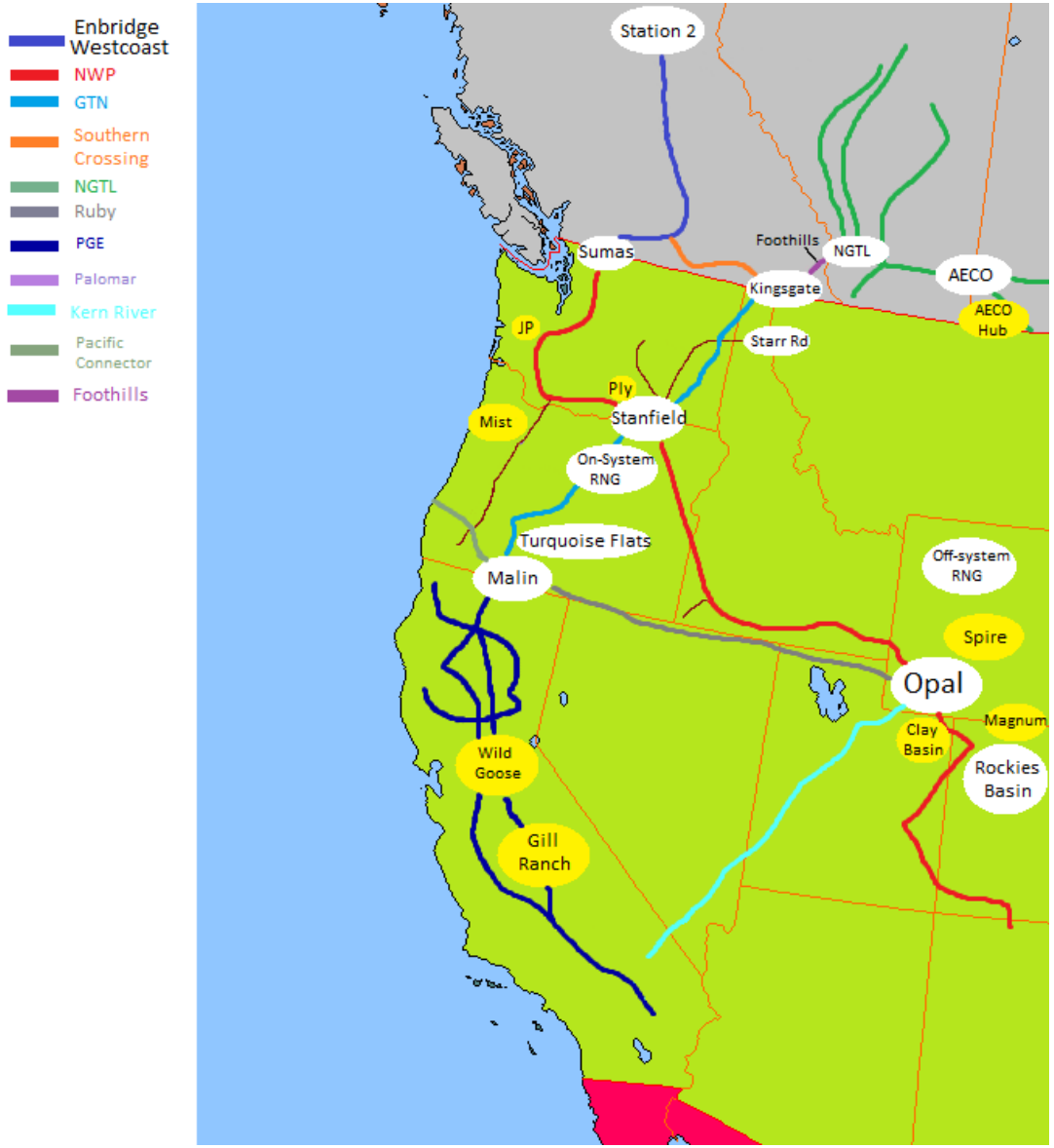
- Incremental Storage - North and East
- Incremental Storage - South and West

Incremental Supplies

Incremental Opal Supply – Additional supply around the Rockies Basin

Renewable Natural Gas – Incremental biogas supply directly to distribution system

Hydrogen – Incremental Hydrogen supply directly to distribution system



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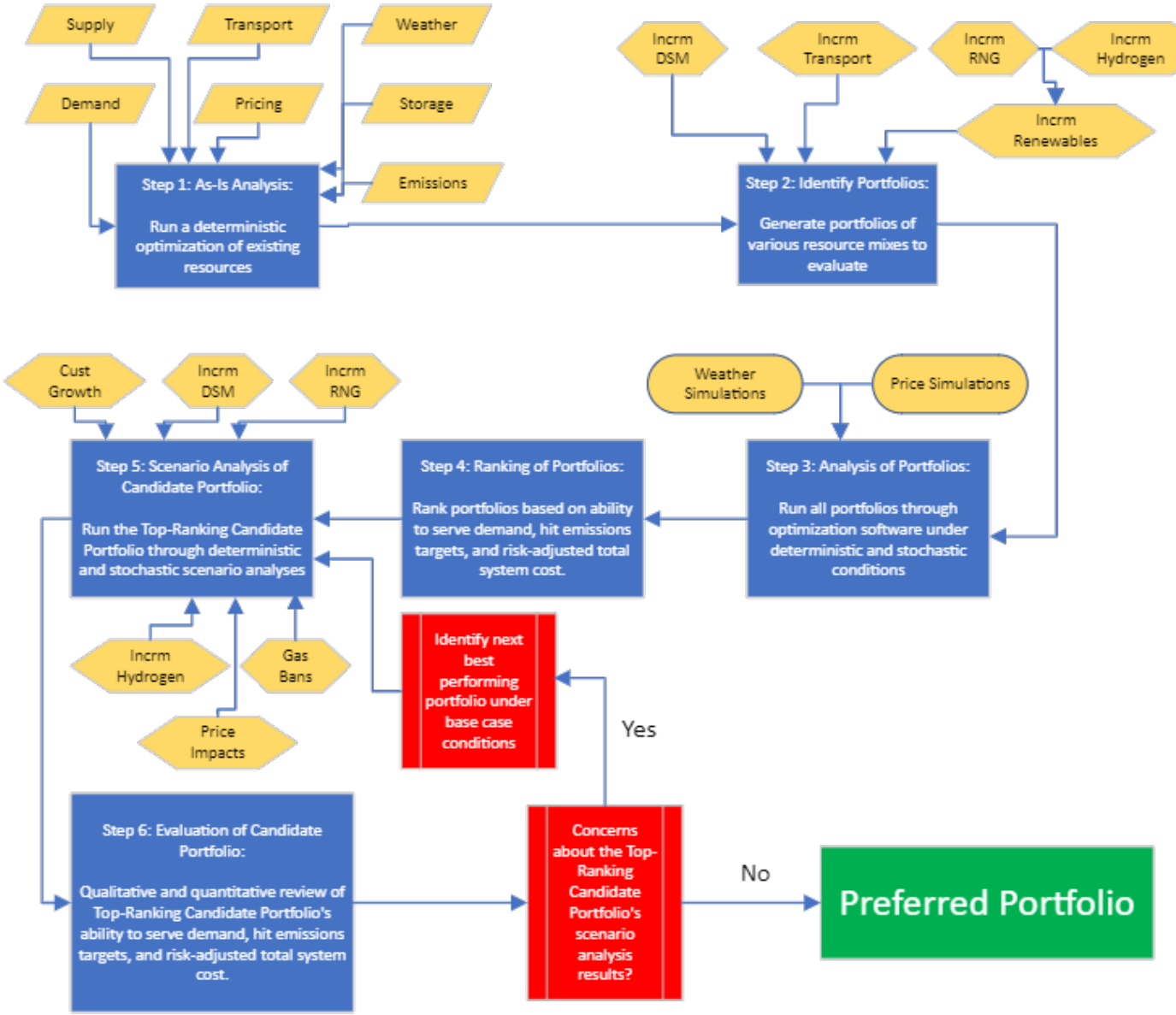
Components of Candidate Portfolios



Supply Resource Optimization Process Flow Chart

Supply Resource Optimization Process

Step 1: As-Is Analysis

- Run a deterministic optimization of existing resources to uncover timing and quantity of resource deficiencies.

Step 2: Identify Portfolios

- Cascade will be evaluating six different portfolios of incremental resources for the 2023 IRP. Each will be a mix of various incremental resources, including transportation capacity, RNG, Hydrogen, and DSM.

Step 3: Analysis of Portfolios

- Each portfolio will be run through the Plexos optimizer under expected conditions (see Base Case scenario.) The portfolios will be evaluated under deterministic and stochastic weather/pricing, and the timing/quantity if applicable of unserved demand and emissions reductions shortfalls will be recorded. Cascade will also record the risk-adjusted total system cost of each portfolio.

Supply Resource Optimization Process Cont.

Step 4: Ranking of Portfolios

- The Top Ranking Candidate Portfolio will be the portfolio that is able to serve all forecasted demand over the planning horizon while hitting all emissions reductions goals. In the case of multiple portfolios accomplishing this, the portfolio that does it with the lowest risk-adjusted total system cost will be the Top-Ranking Candidate Portfolio.

Step 5: Scenario Analysis of Candidate Portfolio

- The Top Ranking Candidate Portfolio is re-run through the Plexos optimizer under five scenarios. These scenarios will provide sensitivity testing of customer growth, energy efficiency, RNG, hydrogen, Natural Gas bans, and Natural Gas pricing. The portfolio will be evaluated under deterministic and stochastic weather/pricing, and the timing/quantity if applicable of unserved demand and emissions reductions shortfalls will be recorded. Cascade will also record the risk-adjusted total system cost of each portfolio.

Step 6: Evaluation of Candidate Portfolio

- Cascade performs a qualitative and quantitative review of Top-Ranking Candidate Portfolio's ability to serve demand, hit emissions targets, and the risk-adjusted total system cost of the portfolio under the scenarios evaluated. If there are concerns about the portfolio's ability to hit these metrics, or the cost of hitting these metrics, the Company may loop back to Step 5 with a new portfolio that might be more insulated against identified risks. Otherwise, the portfolio is named Cascade's Preferred Portfolio.

Recap – As-Is Analysis

Cascade has finalized its load forecast for the 2023 WA IRP.

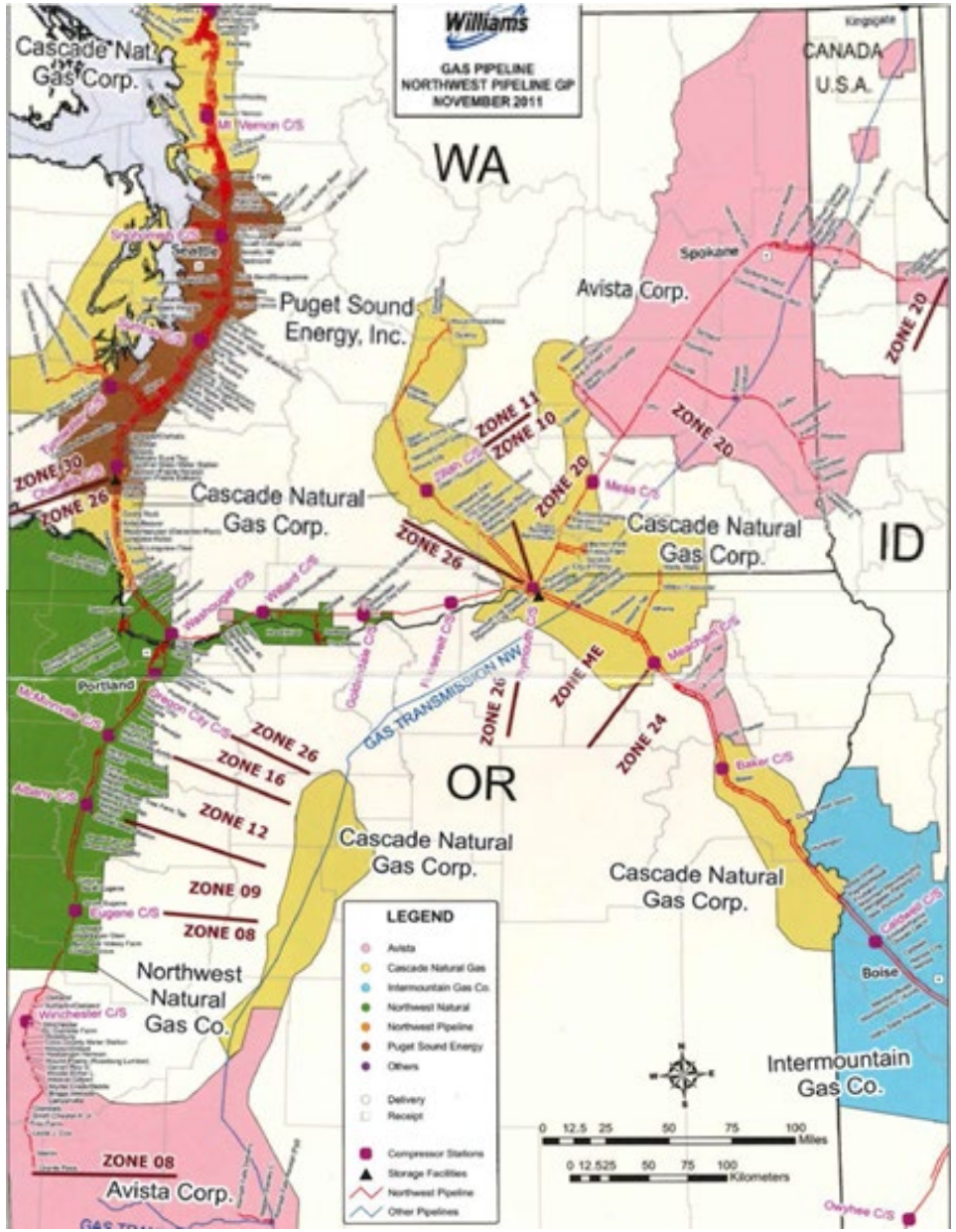
All of Cascade's existing resources have been run through PLEXOS® to complete the Company's As-Is analysis as discussed in Step 1 of the Supply Resource Optimization Process.

- Assuming contracts evergreen.
- Assuming emissions reduction requirements as outlined in the CCA and CPP, but no usage of compliance instruments.
- These preliminary results do not include the impacts of incremental DSM beyond existing installed measures.

Recap – As-Is Shortfalls

Transport (Dth)		
	First Year Shortfall	Max Shortfall
Zone 11	2034	7,570
Zone ME-WA and GTN	2038	20,390

Emissions (Dth)		
	First Year Shortfall	Max Shortfall
Washington	2024	40,047,090
Oregon	2023	17,114,540



List of Candidate Portfolios

All-In Portfolio

All-In Portfolio Less DSM

Transportation Only Portfolio

Offsets Only Portfolio

RNG Only Portfolio

Hydrogen Only Portfolio

RNG and Hydrogen (Renewables) Only Portfolio

All-In Portfolio

Best deterministic mix of all alternative resources considered:

- Incremental Transport Resources
- Incremental Storage Resources
- Cost Effective DSM from CPA
- Incremental RNG
- Incremental Hydrogen
- Compliance Instruments

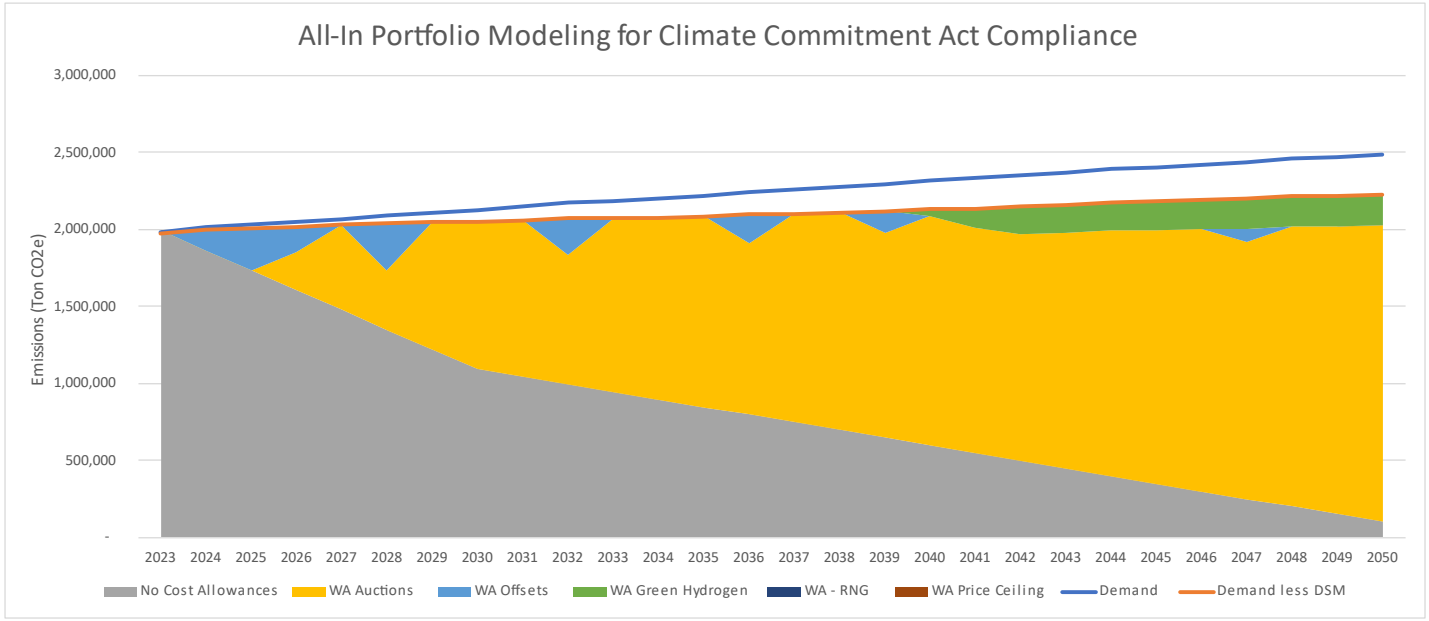
All-In Portfolio – PLEXOS® Suggested Resource Mix

All Cost-Effective DSM

Incremental RNG – Utilized mostly in Oregon, 154,210 Dth starting in 2023, up to 15,635,780 Dth by 2050

Incremental Hydrogen – 90,970 Dth starting in 2029, up to 524,700 Dth by 2050

Compliance Instruments – Utilized as needed, exact number discussed under confidential treatment in IRP



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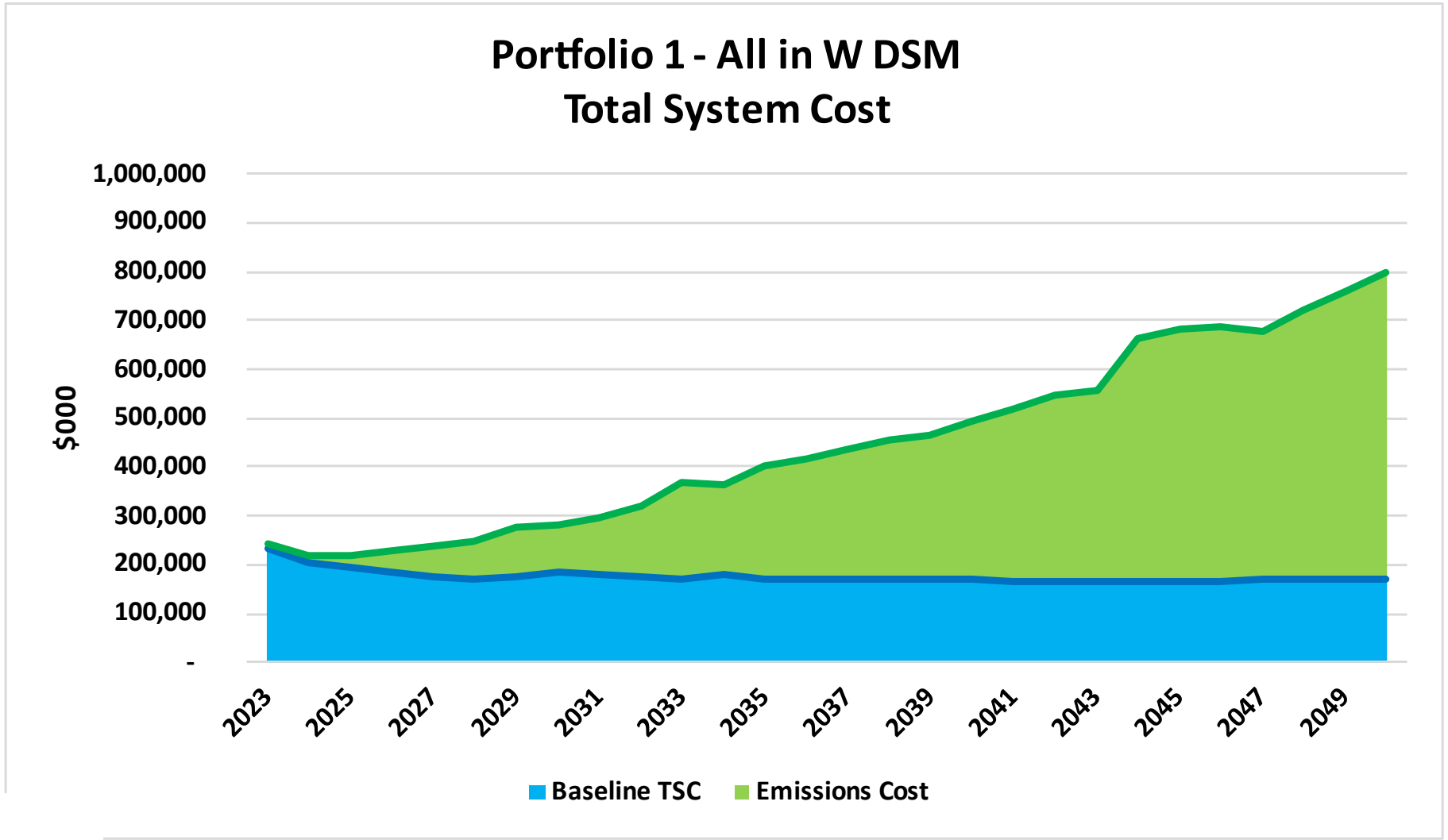

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All-In Less DSM Portfolio

Best deterministic mix of all alternative resources considered:

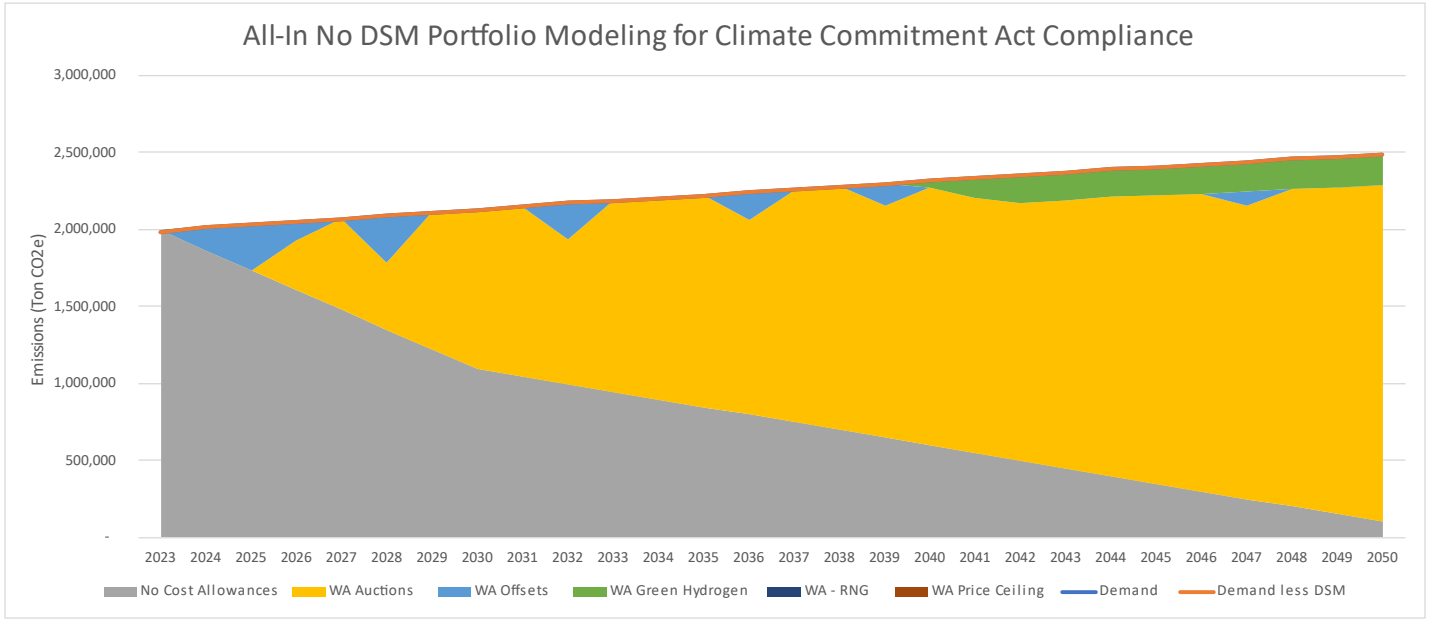
- Incremental Transport Resources
- Incremental Storage Resources
- Incremental RNG
- Incremental Hydrogen
- Compliance Instruments

All-In Less DSM Portfolio – PLEXOS® Suggested Resource Mix

Incremental RNG – Utilized mostly in Oregon, 298,180 Dth starting in 2023, up to 17,591,130 Dth by 2050

Incremental Hydrogen – 90,970 Dth starting in 2029, up to 524,700 Dth by 2050

Compliance Instruments – Utilized as needed, exact number discussed under confidential treatment in IRP



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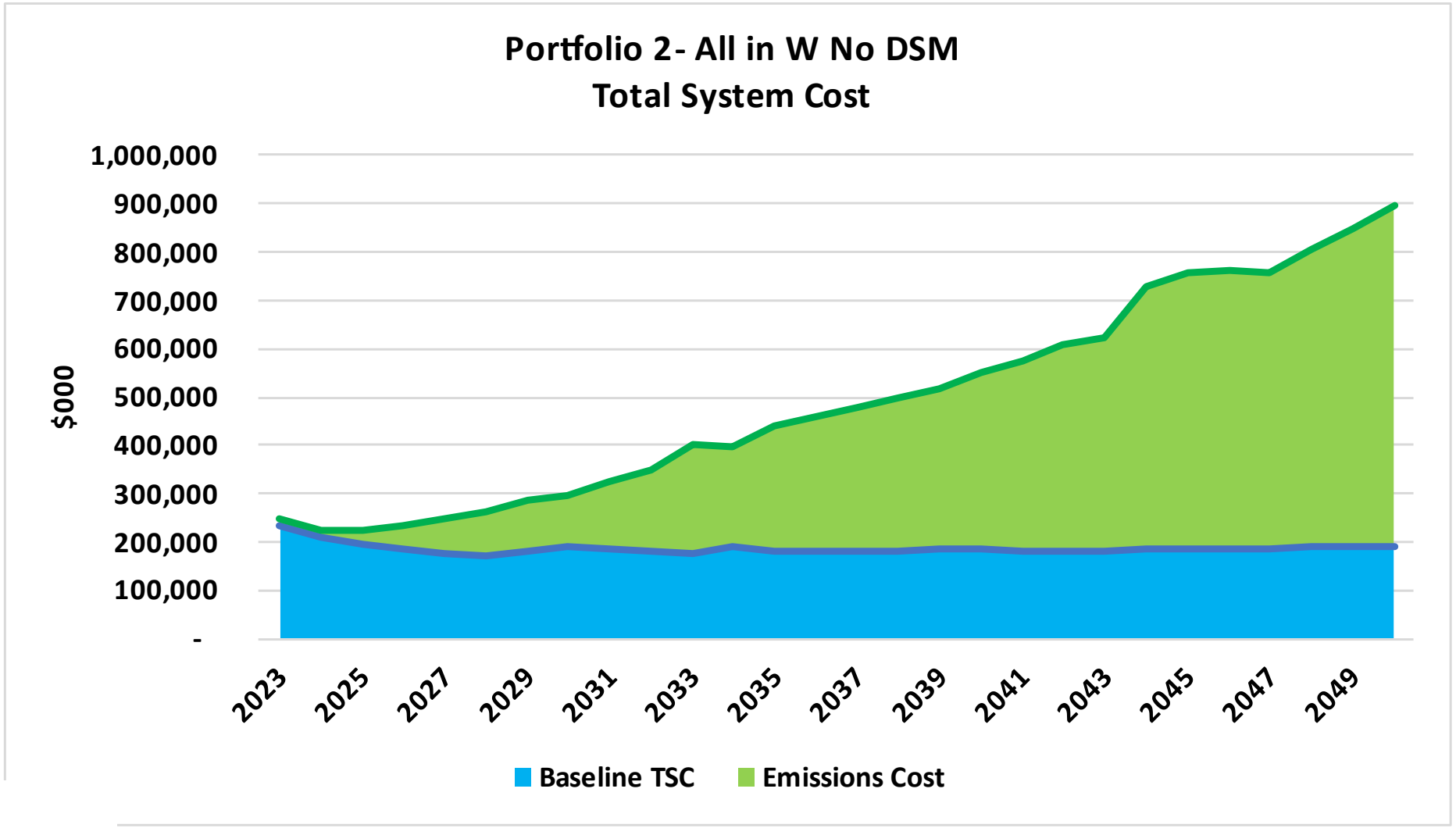

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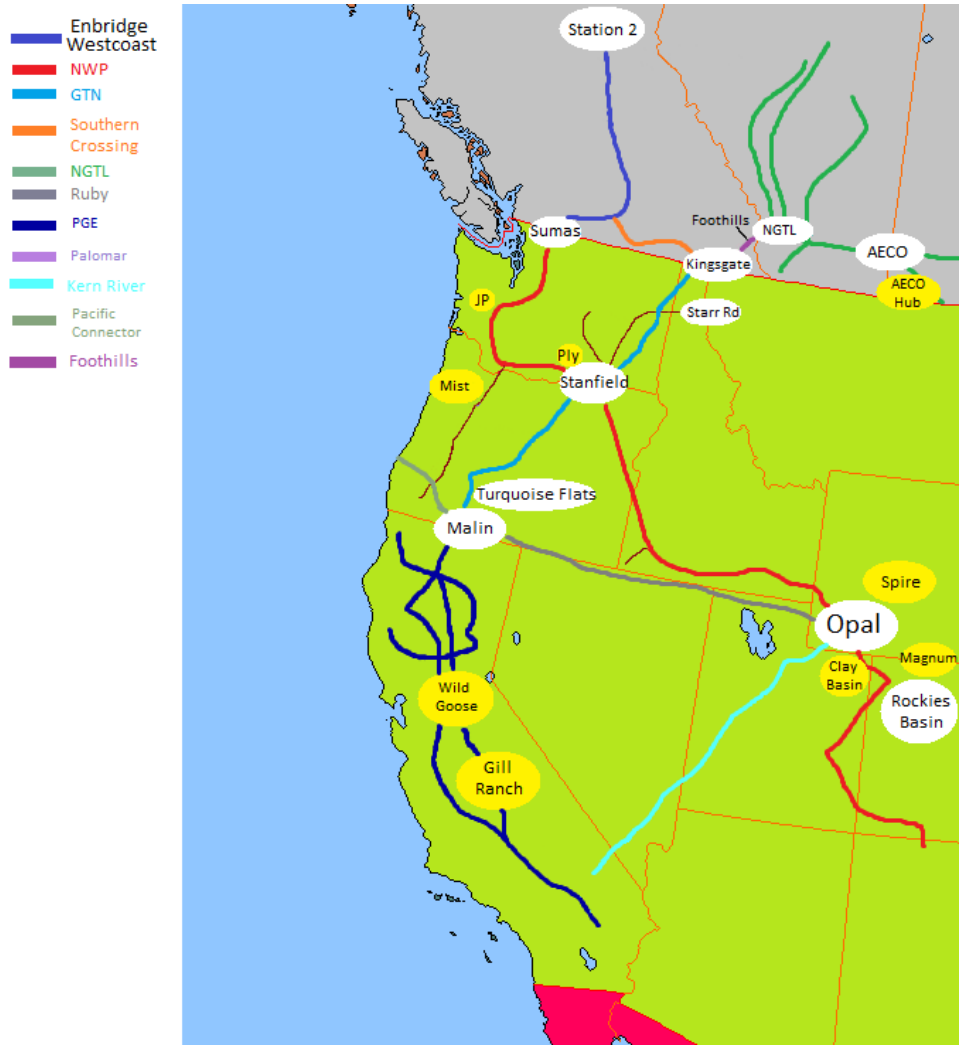
Incremental Transportation Only Portfolio

Cost Effective DSM from CPA

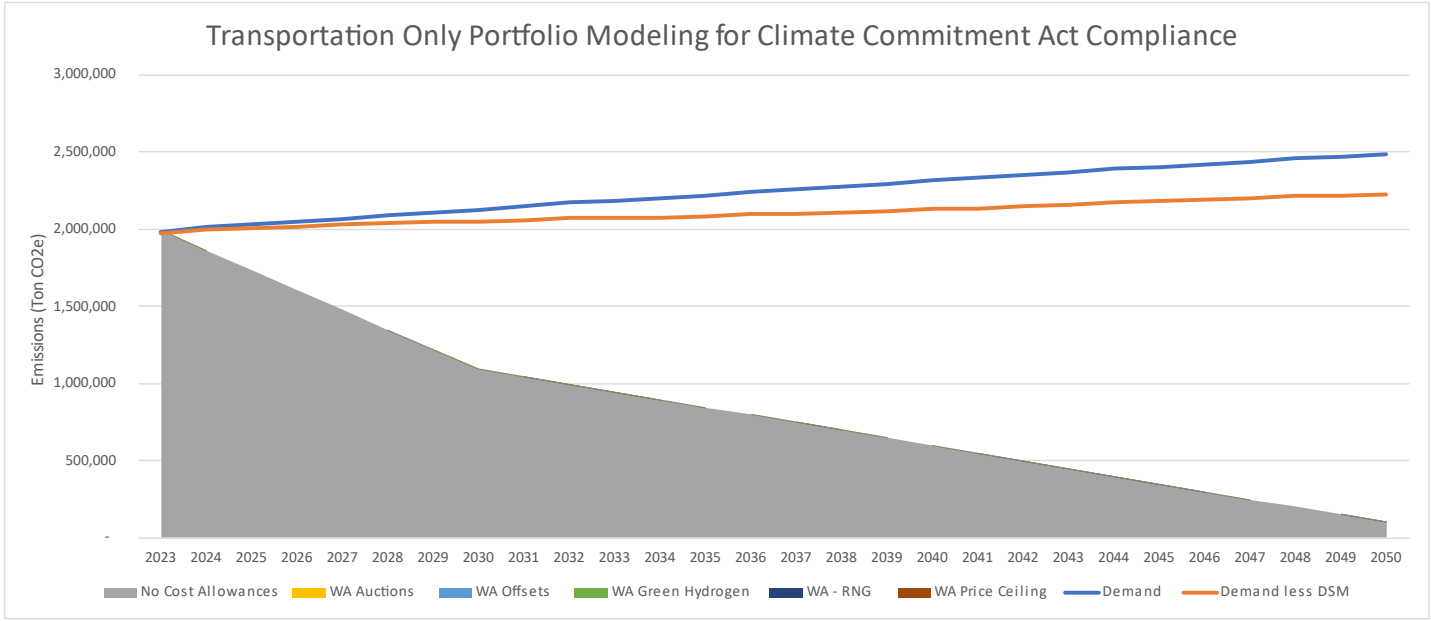
Best deterministic mix of all Transportation Resources:

- Incremental Transport – North to South
- Incremental Transport – Northwest Pipeline
- Incremental Transport – South to North
- Incremental Transport – Bilateral



Incremental Transportation Only Portfolio – PLEXOS® Suggested Resource Mix

All Cost-Effective DSM



*Not Considered as a Candidate Portfolio due to emissions reductions shortfalls

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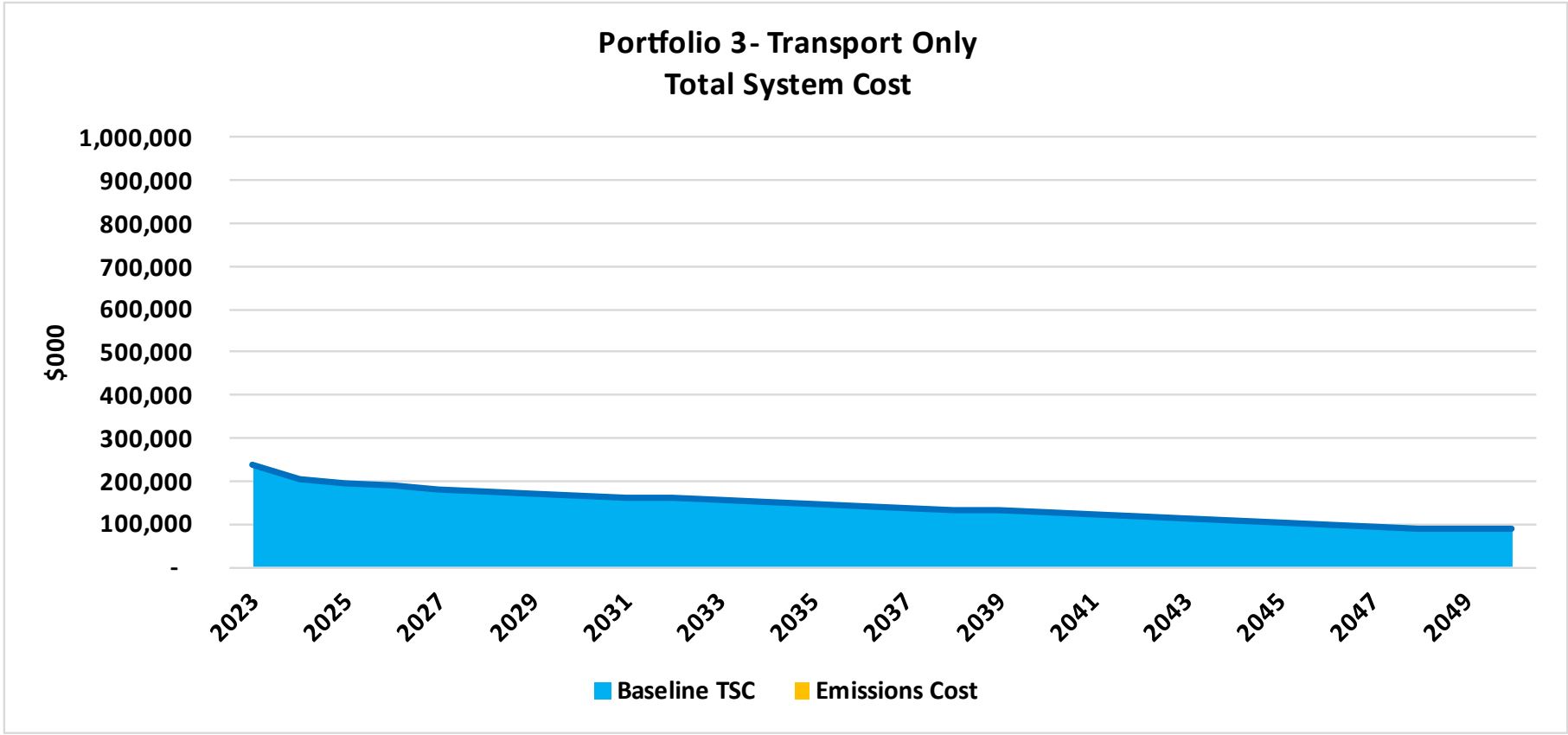


*Not Considered as a Candidate Portfolio due to emissions reductions shortfalls

Offsets Only Portfolio

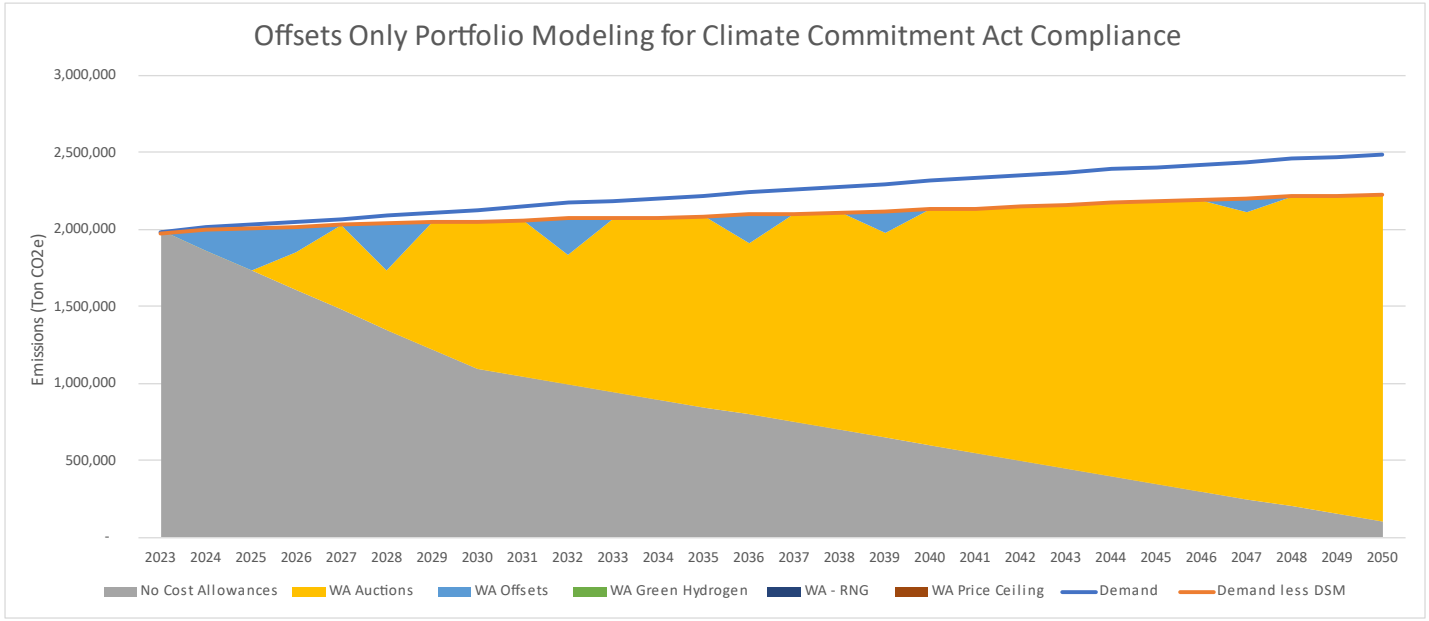
Cost Effective Demand Side Management from Conservation Potential Assessment

Best deterministic mix of Auction Allowances and Offsets in Washington, and Community Climate Investments (CCI) in Oregon

Offsets Only Portfolio – PLEXOS® Suggested Resource Mix

All Cost-Effective DSM

Compliance Instruments – Maximum possible utilization with no other emissions reduction resource



*Not Considered as a Candidate Portfolio due to emissions reductions shortfalls in Oregon

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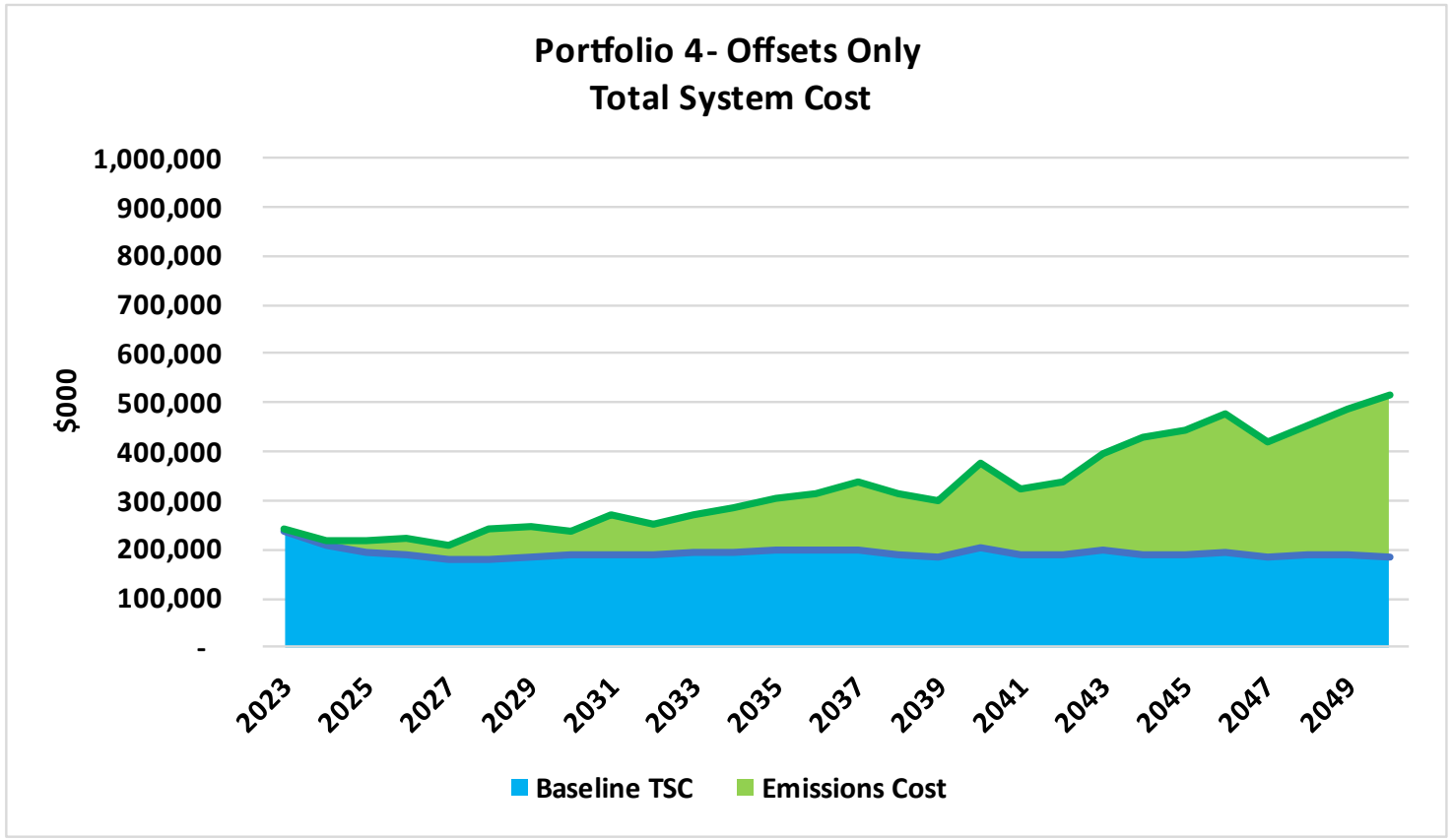


*Not Considered as a Candidate Portfolio due to emissions reductions shortfalls

RNG Only Portfolio

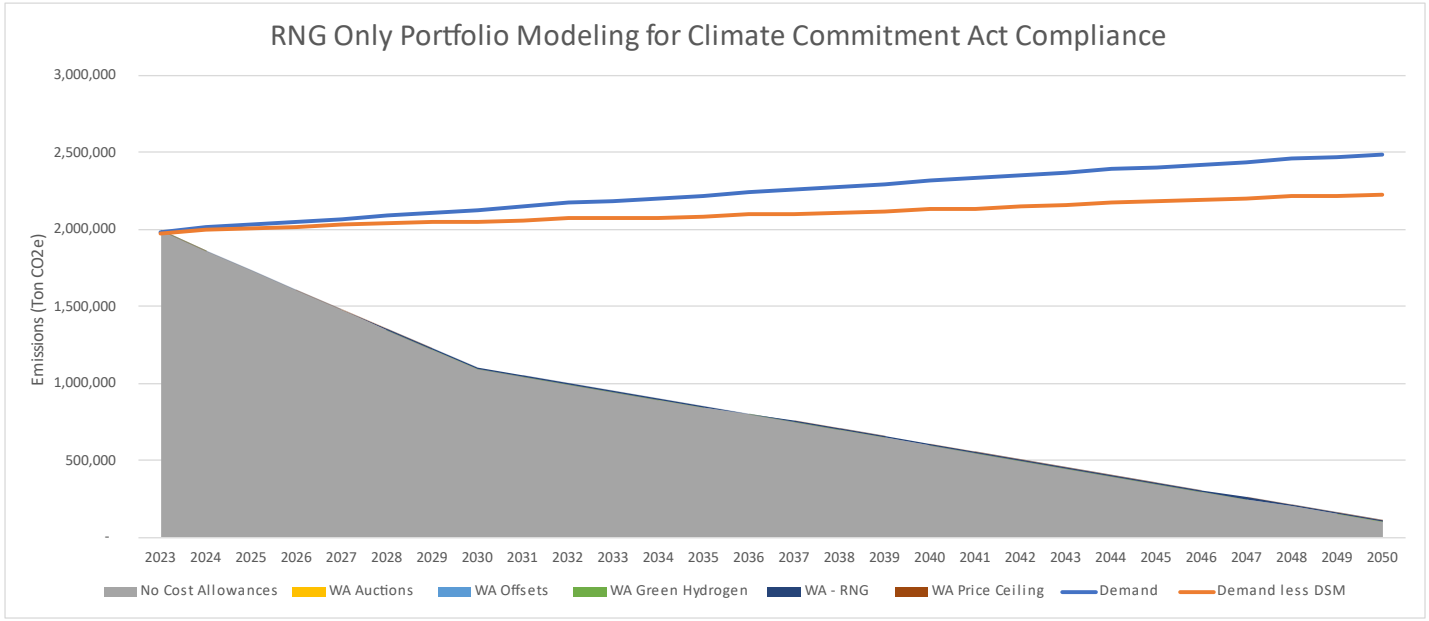
Cost Effective DSM from CPA

Incremental RNG

RNG Only Portfolio – PLEXOS® Suggested Resource Mix

All Cost-Effective DSM

Incremental RNG – Utilized mostly in Oregon, 1,218,140 Dth starting in 2023, up to 17,264,820 Dth by 2050



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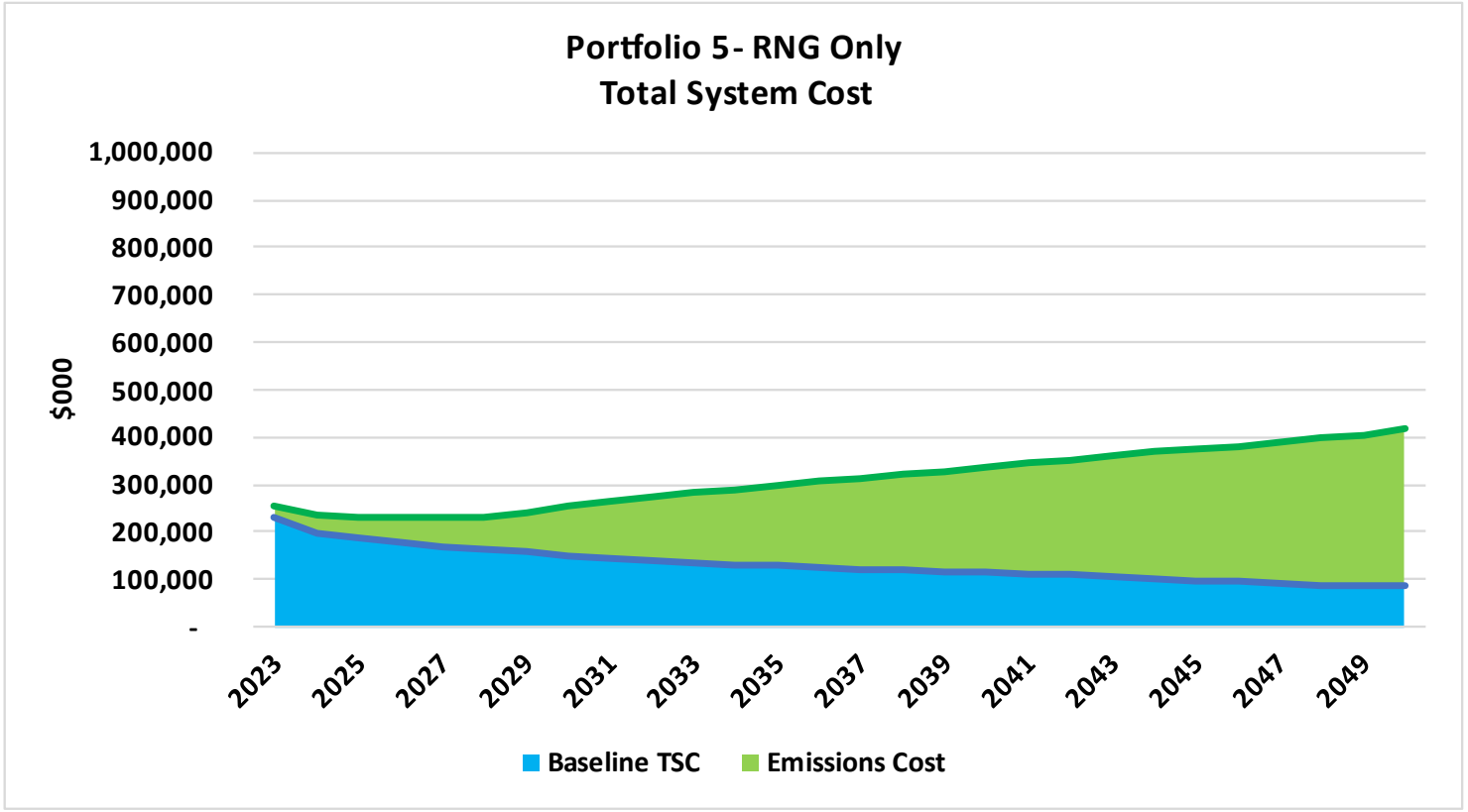


*Not Considered as a Candidate Portfolio due to emissions reductions shortfalls

Hydrogen Only Portfolio

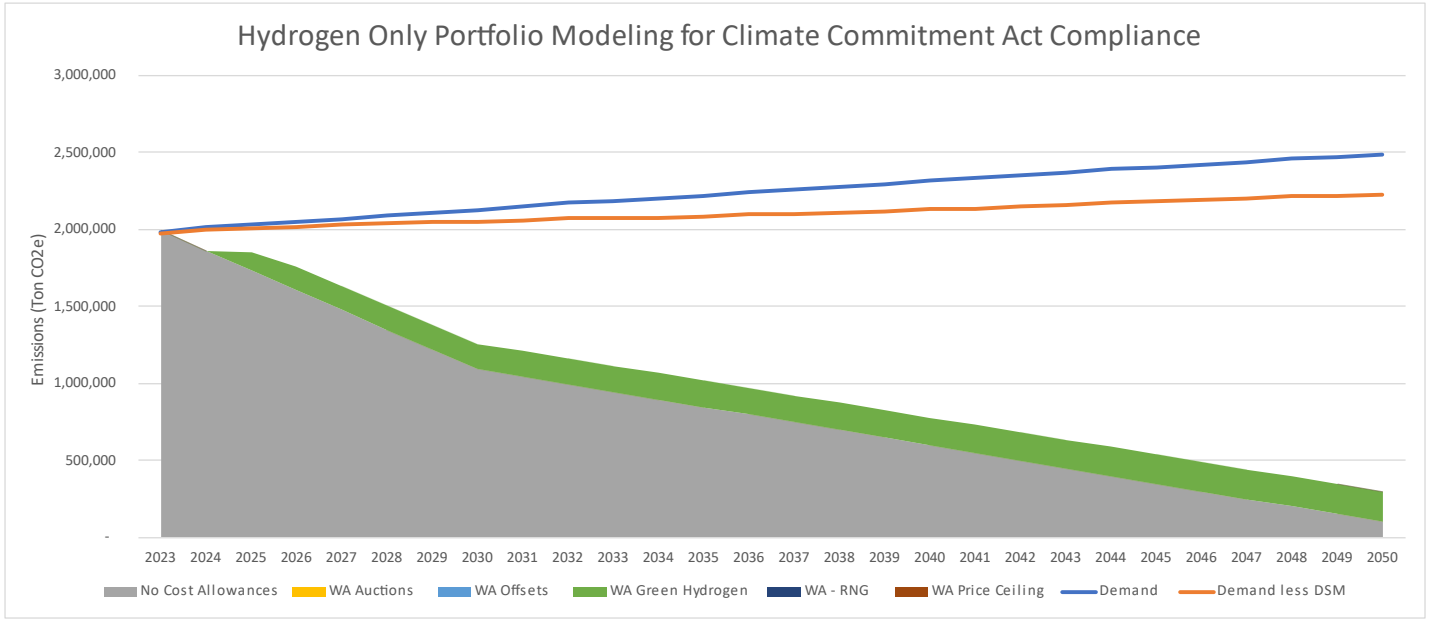
Cost Effective DSM from CPA

Incremental Hydrogen

Hydrogen Only Portfolio – PLEXOS® Suggested Resource Mix

All Cost-Effective DSM

Incremental Hydrogen – 3,029,770 Dth starting in 2023, up to 5,260,150 Dth by 2050



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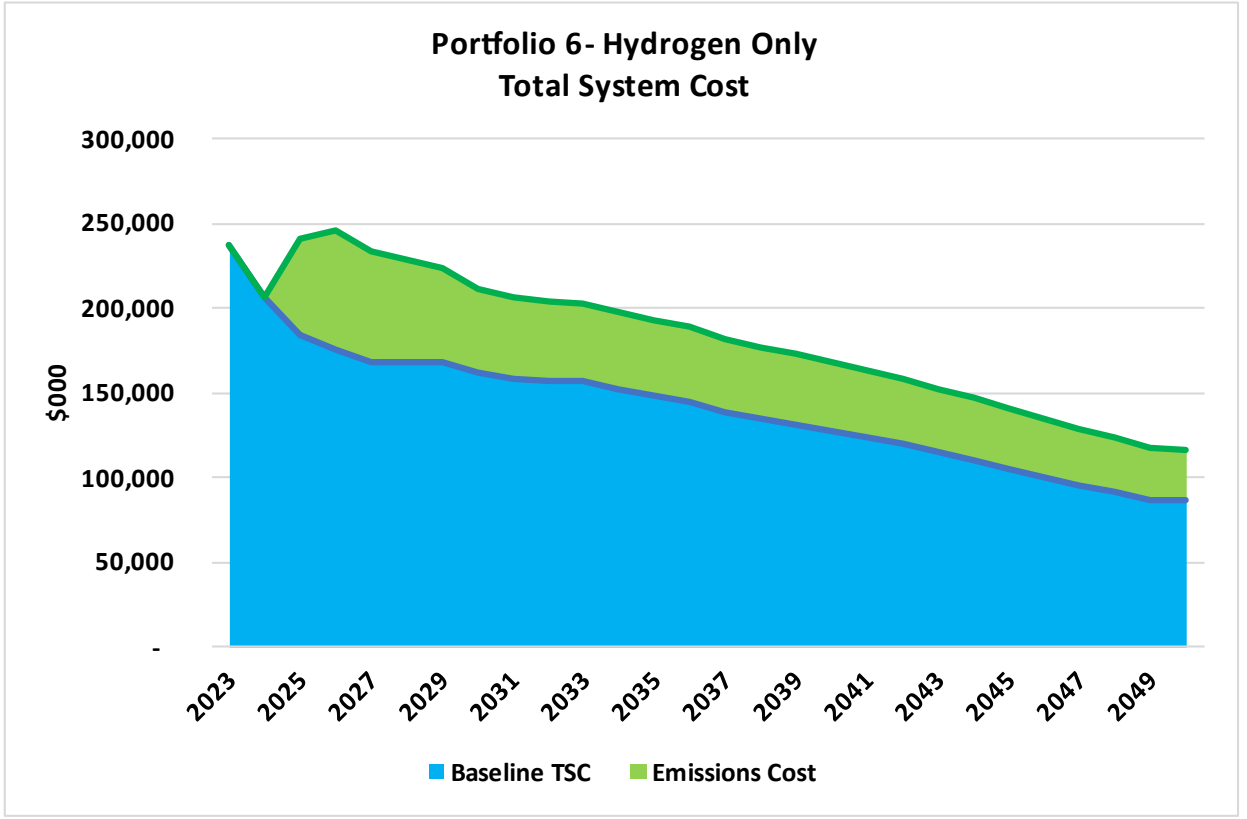


*Not Considered as a Candidate Portfolio due to emissions reductions shortfalls

Renewables Only Portfolio

Cost Effective DSM from CPA

Incremental RNG

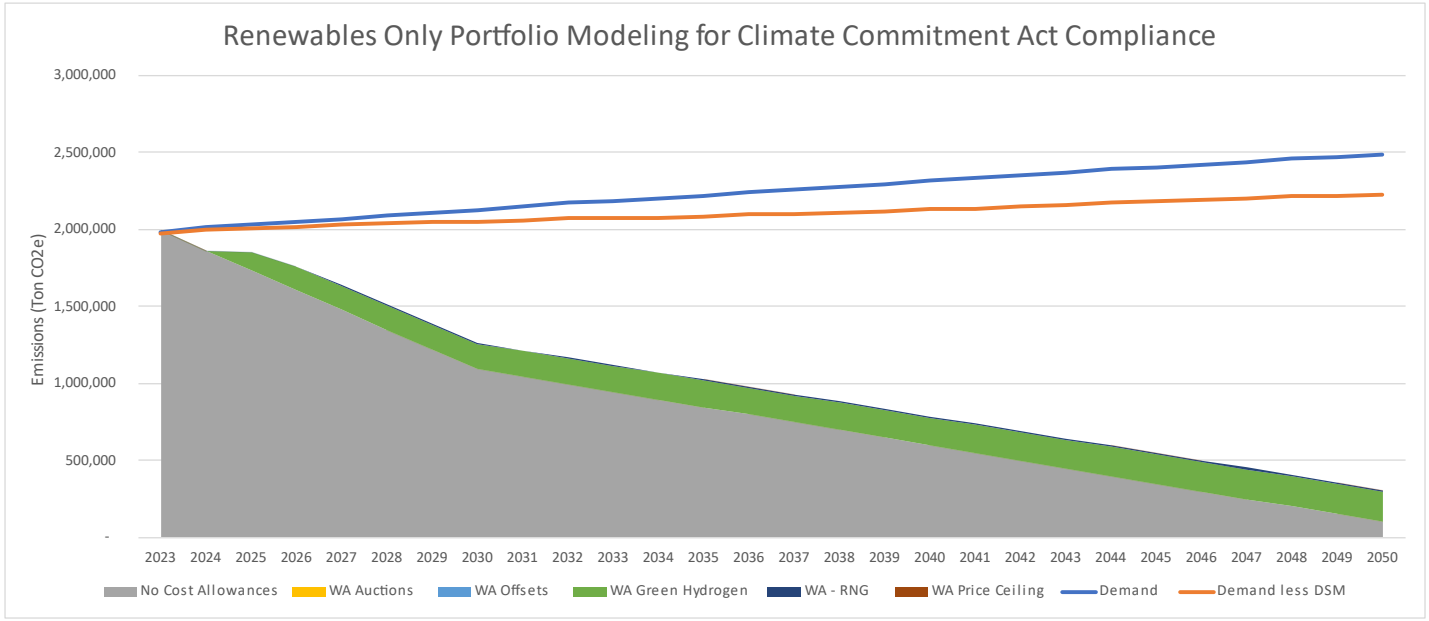
Incremental Hydrogen

Renewables Only Portfolio – PLEXOS® Suggested Resource Mix

All Cost-Effective DSM

Incremental RNG – Utilized mostly in Oregon, 1,218,400 Dth starting in 2023, up to 15,768,420 Dth by 2050

Incremental Hydrogen – 2,167,550 Dth starting in 2023, up to 5,427,200 Dth by 2050



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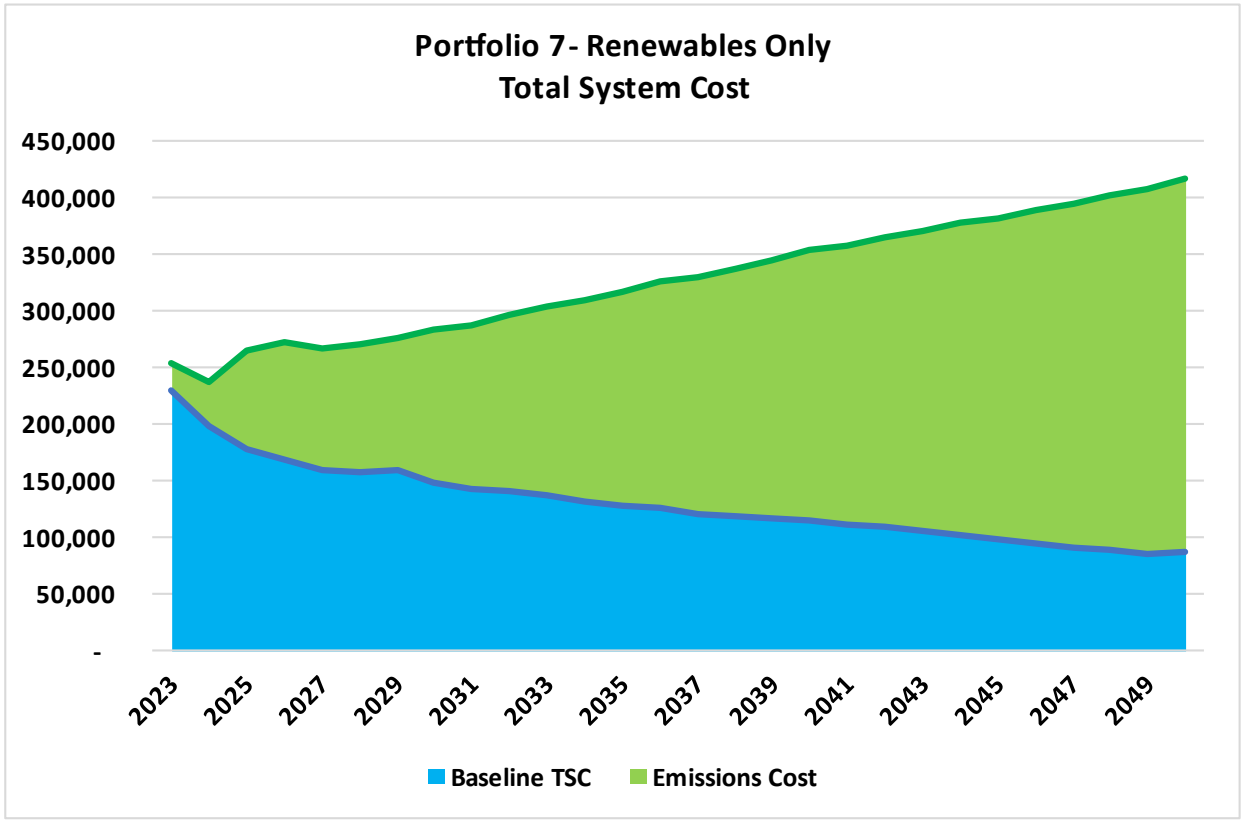


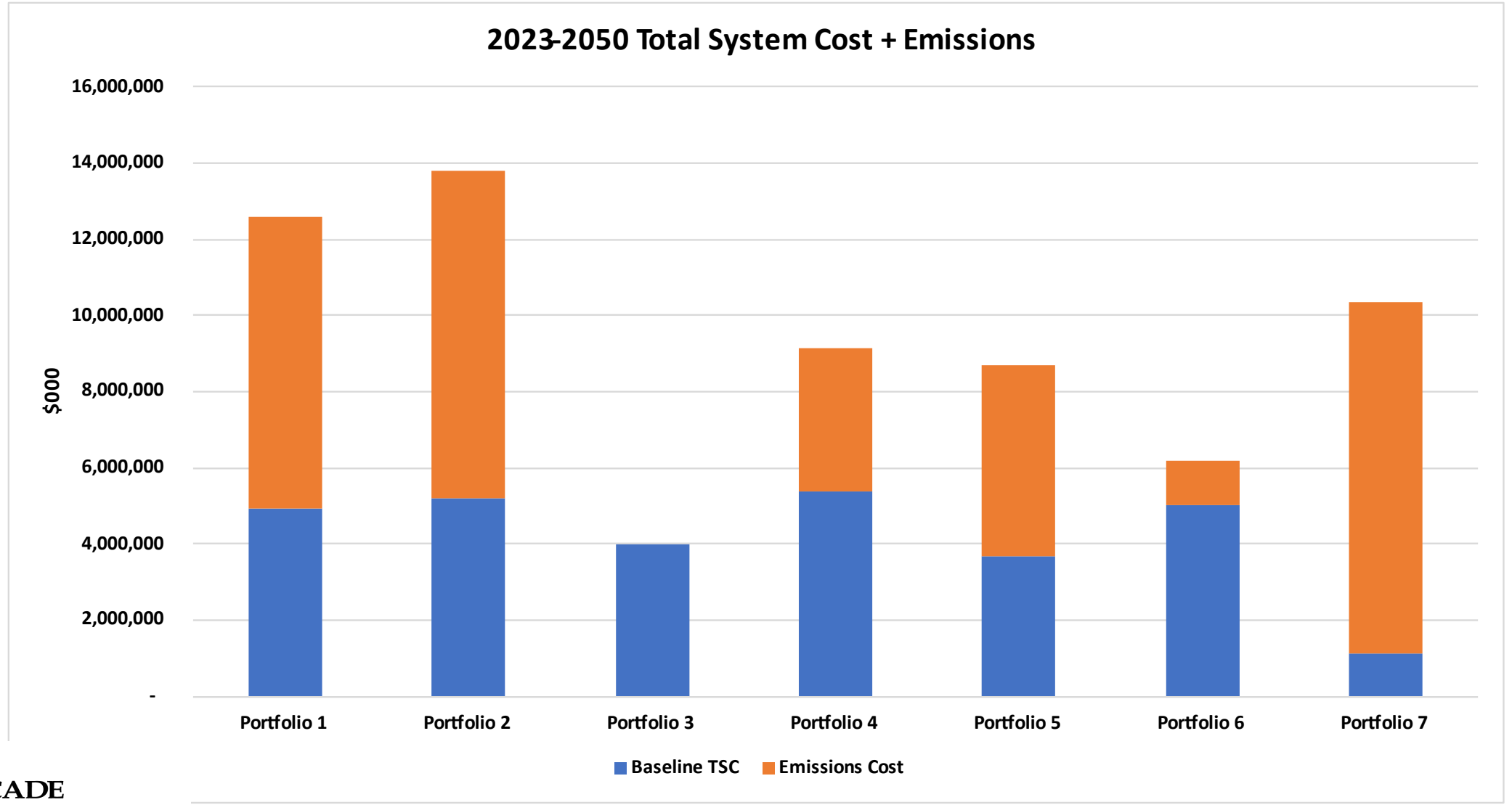
*Not Considered as a Candidate Portfolio due to emissions reductions shortfalls

Methodology Behind Ranking of Portfolios

Cascade uses deterministic results to identify the intrinsic value of a portfolio, and Value at Risk (VaR) analysis to capture the extrinsic value.

Additionally, portfolios are ranked primarily on their peak day unserved demand, and secondarily on their total system costs.

Deterministic results are given 75% weight, and stochastic results 25% weight. The concluding values are Cascade's Risk-Adjusted Results.



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Final Ranking of Portfolios

Portfolios with deterministic Emissions Reduction Shortfalls will not be considered for Preferred Portfolio

Portfolio	Total System Cost ($000)	Emissions Reduction Shortfalls?
All-In	12,597,464	No
All-In Less DSM	13,801,375	No
Transportation Only	4,006,652	Yes
Offsets Only	9,143,372	Yes
RNG Only	8,708,882	Yes
Hydrogen Only	6,172,433	Yes
Renewables Only	10,340,747	Yes

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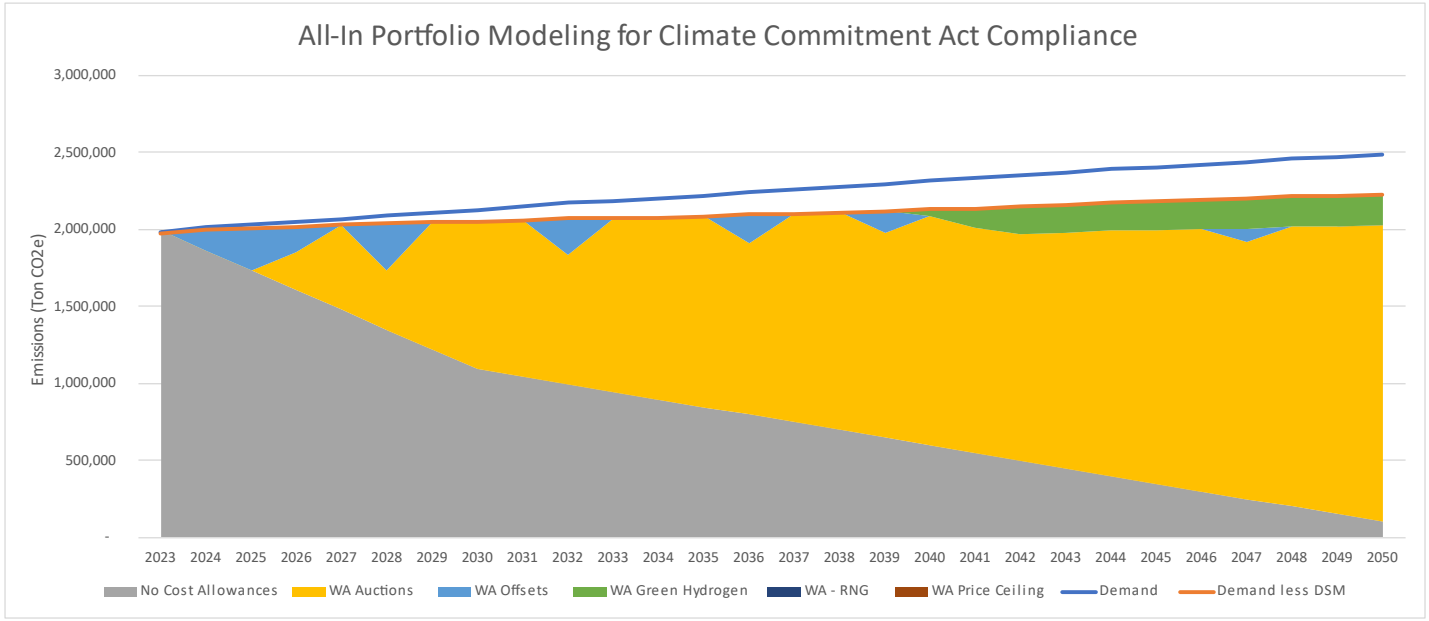
Top Ranked Candidate Portfolio Components

All Cost-Effective DSM

Incremental RNG – Utilized mostly in Oregon, 154,210 Dth starting in 2023, up to 15,635,780 Dth by 2050

Incremental Hydrogen – 90,970 Dth starting in 2029, up to 524,700 Dth by 2050

Compliance Instruments – Utilized as needed, exact number discussed under confidential treatment in IRP



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Stochastic Methodology

Stochastic Model Methodology

Prior to the 2018 IRP, Cascade used the Monte Carlo functionality within SENDOUT® to run its stochastic analyses.

- SENDOUT® has computational limitations related to the number of draws it can perform, and the time it takes to complete those draws.

For the 2018 IRP, Cascade enhanced its methodology to allow for a more robust Monte Carlo simulation on weather and price.

For the 2020 IRP, Cascade has further enhanced the Monte Carlo simulation's basin correlations regarding price and weather is correlated between weather stations.

For the 2023 IRP, Cascade has kept the same Monte Carlo simulation process. Prices are correlated between basins and weather is correlated between weather stations.

Cascade's Methodology (Cont'd)

Cascade will continue to perform a 10,000 draw Monte Carlo Simulation of weather and price using R.

For each weather location Cascade records daily mean temperatures, standard deviations, correlations, and the largest 1 day jump to have historically occurred in that month.

For each basins' pricing, Cascade records historic averages, lows, highs, standard deviations, and correlations.

This data is all loaded into R where R can perform 10,000 28-year (2023-2050) unique weather patterns and price paths.

Cascade's Methodology

First, Cascade runs 1 draw of its Monte Carlo simulation for its first weather location.

The remaining weather locations are then run for draw 1 but correlated to the first weather location's results using a mathematical process called Cholesky Decomposition. This process helps create a more realistic simulation for each draw.

This process is repeated 10,000 times, with the calculated HDDs from each draw stored in a separate matrix.

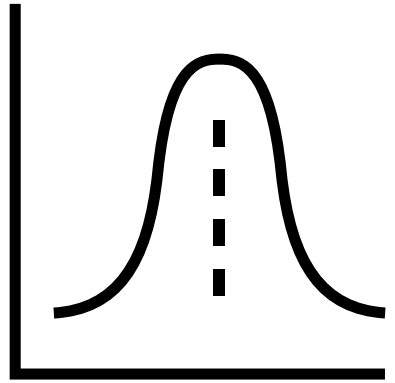
A similar process is followed for price.

Cascade's Methodology (Cont'd)

Historical Correlated Weather							
City	Baker City	Bellingham	Bremerton	Pendleton	Redmond	Walla Walla	Yakima
Baker City	1.00000						
Bellingham	0.63383	1.00000					
Bremerton	0.65848	0.86889	1.00000				
Pendleton	0.70245	0.73001	0.69979	1.00000			
Redmond	0.71736	0.76293	0.76183	0.79743	1.00000		
Walla Walla	0.71051	0.72579	0.69180	0.95952	0.78995	1.00000	
Yakima	0.66974	0.69391	0.68315	0.79445	0.70062	0.81950	1.00000

Non-Adjusted Correlations from Random Monte Carlo Variables							
City	Baker City	Bellingham	Bremerton	Pendleton	Redmond	Walla Walla	Yakima
Baker City	1.00000						
Bellingham	-0.02544	1.00000					
Bremerton	0.06280	0.17484	1.00000				
Pendleton	0.00031	-0.13384	-0.05538	1.00000			
Redmond	0.03081	0.09014	0.10164	-0.02054	1.00000		
Walla Walla	-0.00535	-0.18812	0.07940	0.06387	0.03300	1.00000	
Yakima	-0.00832	-0.09987	-0.01647	-0.03853	0.17427	0.12550	1.00000

Cholesky Adjusted Correlations from Cholesky Adjusted Monte Carlo Variables							
City	Baker City	Bellingham	Bremerton	Pendleton	Redmond	Walla Walla	Yakima
Baker City	1.00000						
Bellingham	0.58003	1.00000					
Bremerton	0.59590	0.87959	1.00000				
Pendleton	0.67497	0.64893	0.62268	1.00000			
Redmond	0.68570	0.76602	0.77980	0.72101	1.00000		
Walla Walla	0.68806	0.60883	0.60391	0.95098	0.70710	1.00000	
Yakima	0.67272	0.60801	0.62417	0.76391	0.63660	0.79252	1.00000



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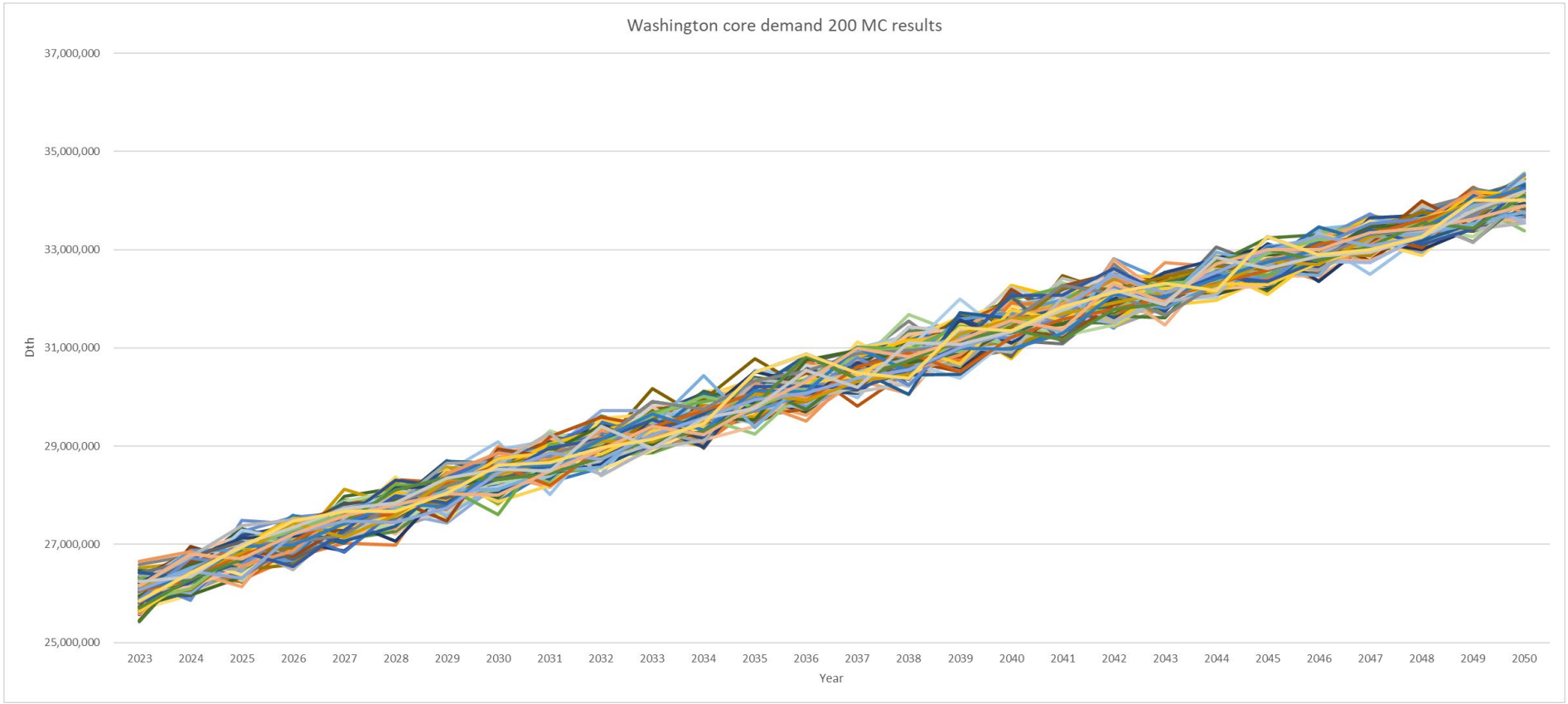
Cascade's Methodology

In the previous IRP, Cascade calculated a system weighted HDD for each draw, identifying the draw that results in the 99th percentile of stochastic weather. The daily HDDs of each weather location in this draw are then loaded into SENDOUT®, which allows the Company to capture the costs and unserved demand of a given portfolio under extreme conditions.

A similar process is undertaken for Monte Carlo simulations on price.

In the current IRP, Cascade loaded in 200 random draws into PLEXOS® so Cascade's integrated model can optimize around 200 different weather and price paths.

Monte Carlo Demand Results



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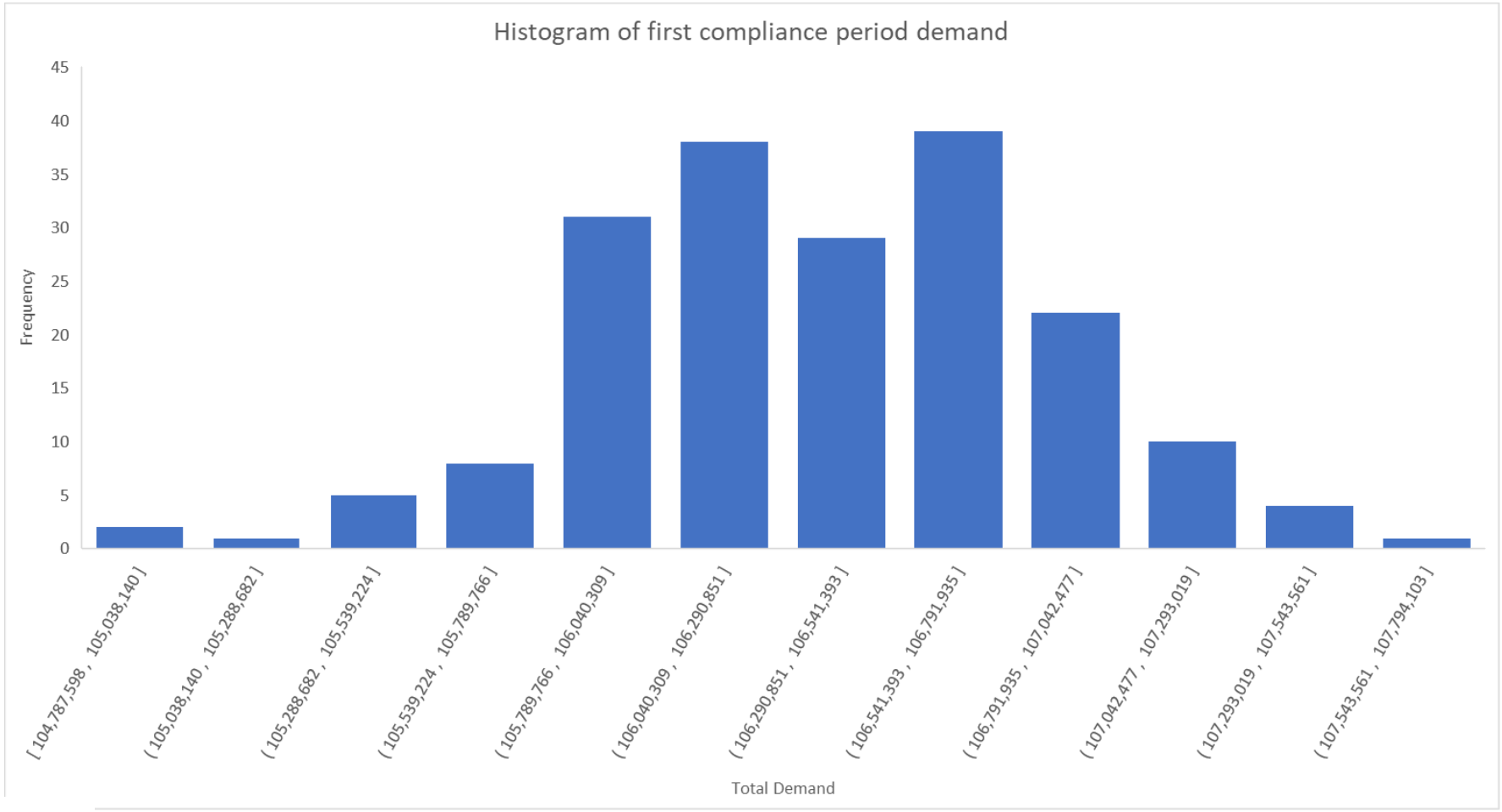
WA first compliance period demand



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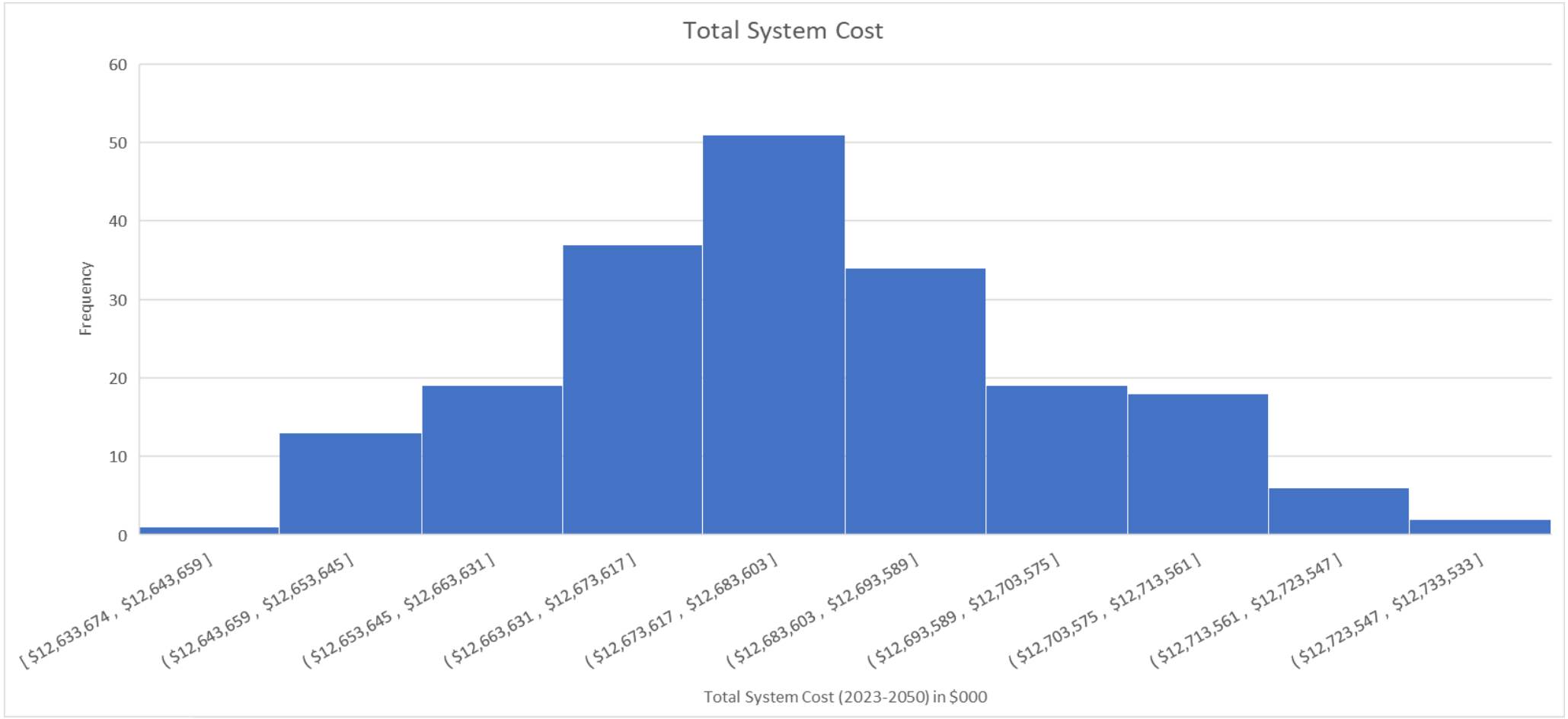
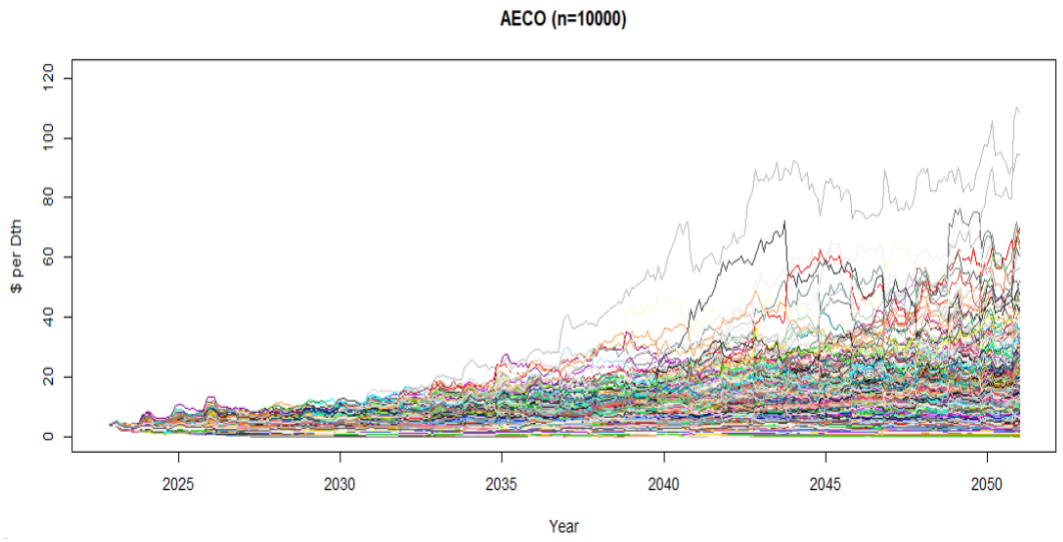
Total System Cost (2023-2050)

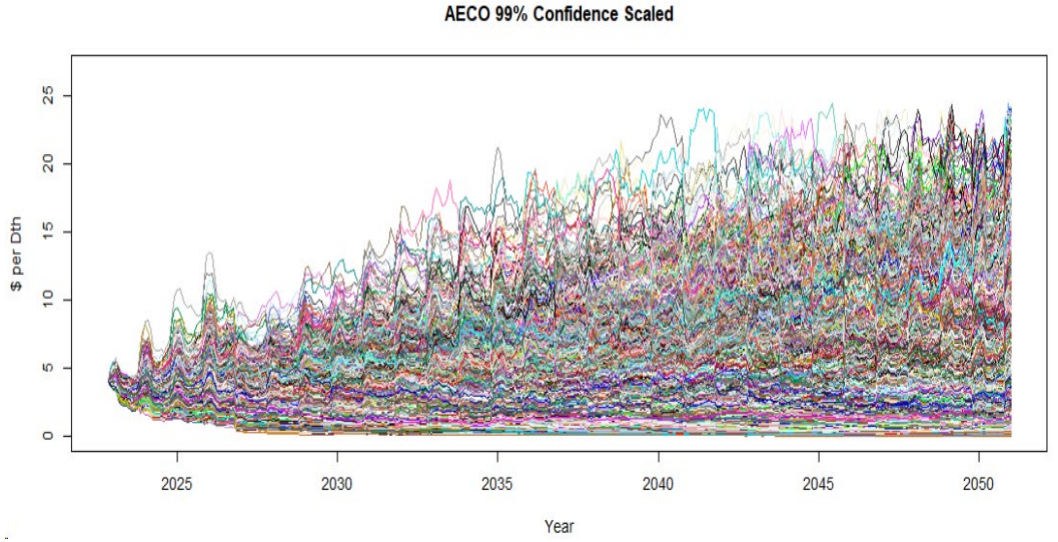


AECO Price Simulations

10,000 Simulations

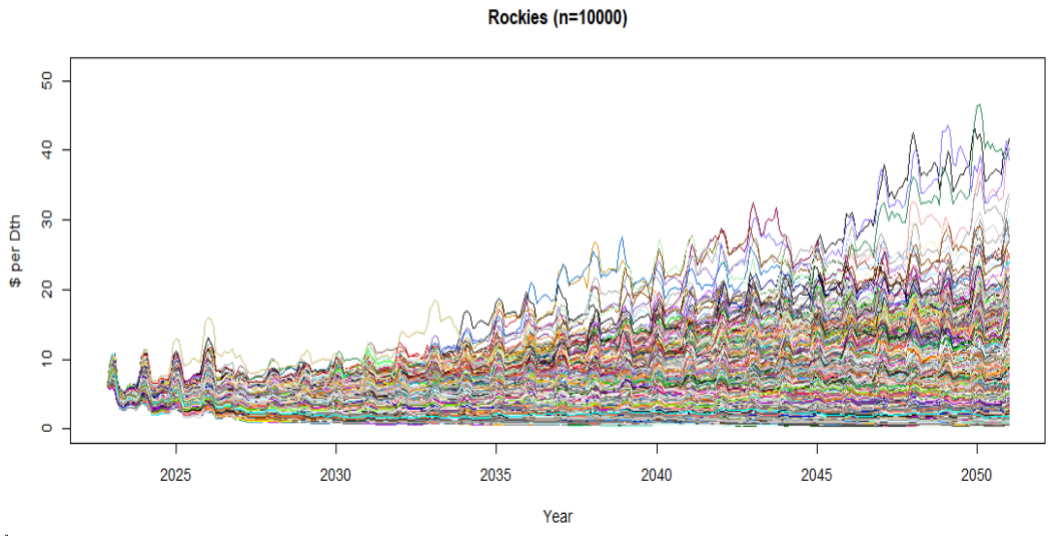


99th Percentile

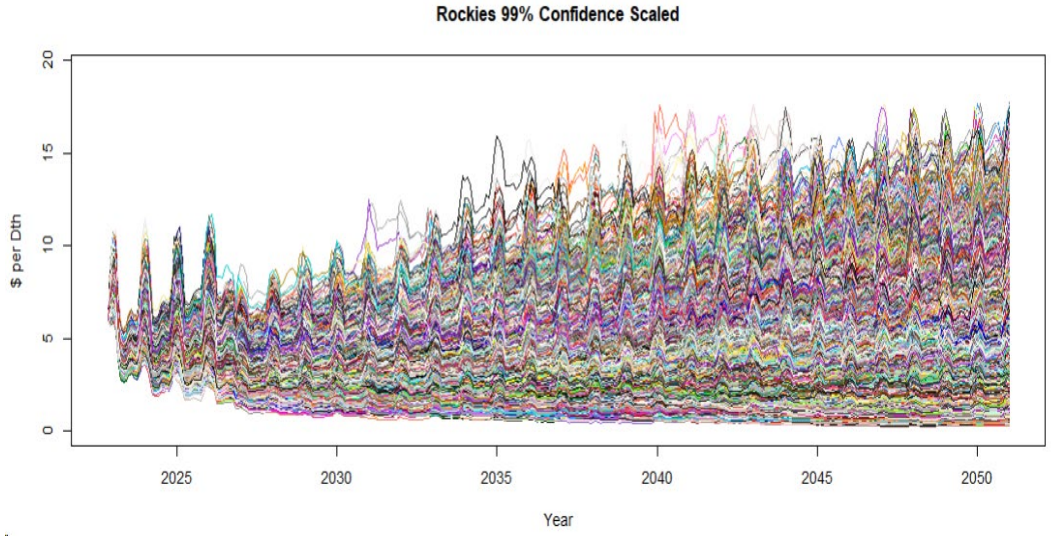


Rockies Price Simulations

10,000 Simulations



99th Percentile



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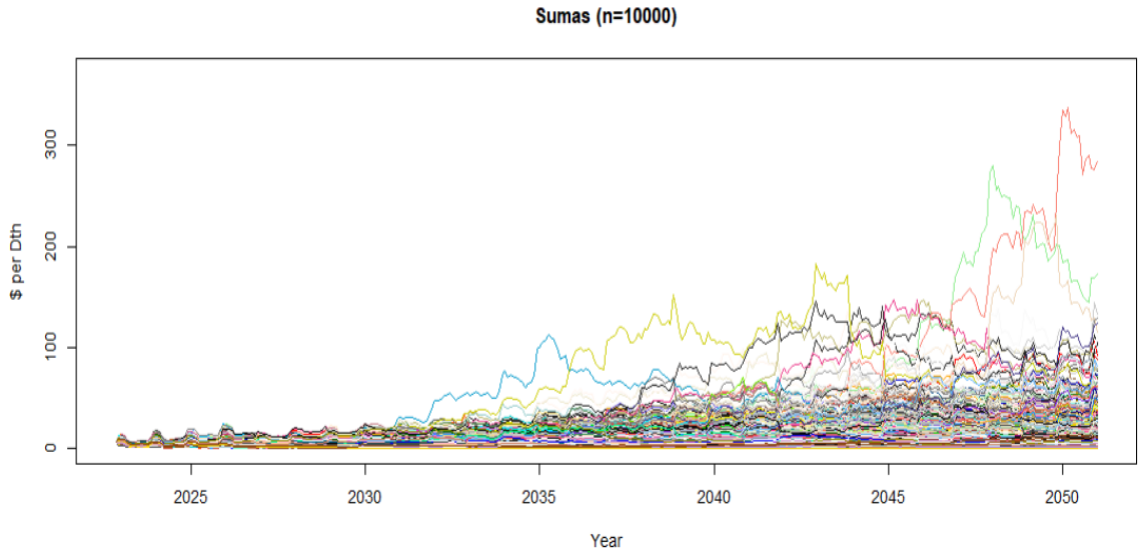
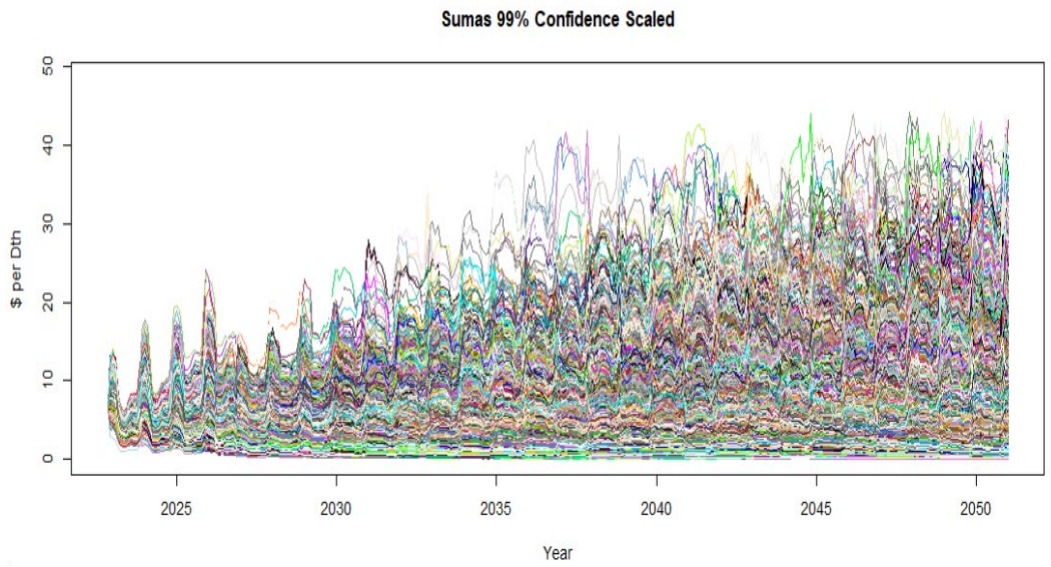
Sumas Price Simulations

10,000 Simulations



99th Percentile



Scenario and Sensitivity Results

New Philosophy Behind Scenario/Sensitivity Modeling

In previous IRPs, Cascade modeled a wide breadth of scenarios and sensitivities that, according to some stakeholder feedback, may have been too expansive for the IRP

- Pro – Allowed the Company to analyze the impact of a wide number of externalities
- Con – Time constraints do not allow for a deep analysis of the results of scenario modeling

For the 2023 IRP, Cascade had reduced the number of scenarios run to five, but each scenario will include a robust quantitative and qualitative analysis of the expected changes to costs and ability to meet emissions reduction requirements under the scenario.

Scenario – A series of assumptions (sensitivities) that differ from the Company's base case modeling

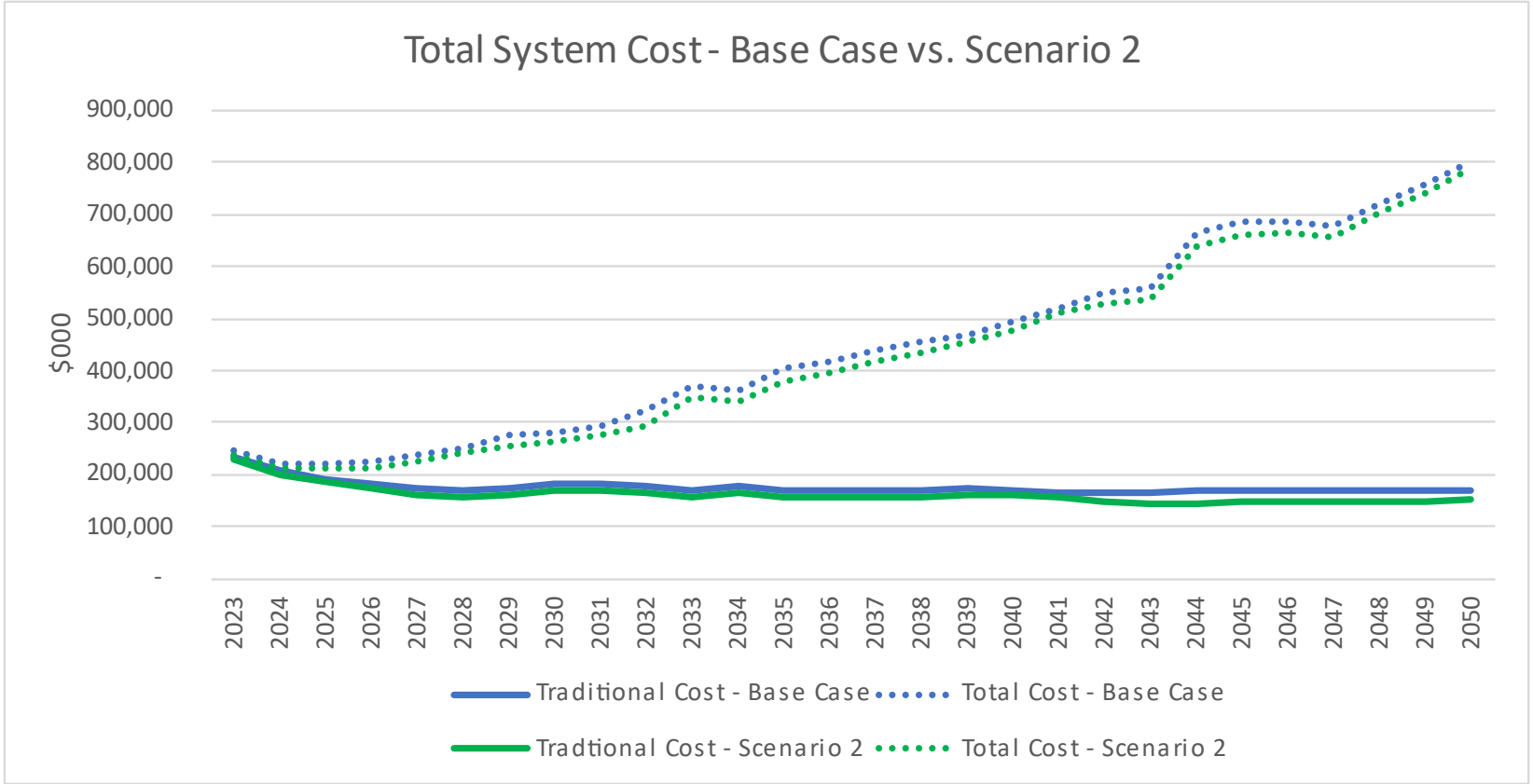
Sensitivity – A variable within a given scenario that may be modified to reflect the assumptions of that scenario

2023 IRP Proposed Scenarios	Scenario						
	Base Case - OR-CPP and WA-CCA	**Carbon Neutral by 2050**	**Limited RNG availability**	**Electrification**	**High Customer Case**	**High Price - Interrupted Supply**	**Other?**
Customer Growth	Current Expectations			No new customers after 2030	High Customer Counts	Current Expectations	
Energy Efficiency	CPA Projections	Scenario 2 CPA Projections				CPA Projections	
Renewable Natural Gas	Expected Availability	Expected - High Avail.	Low Availability	Expected - High Avail.		Expected Availability	
Hydrogen	Expected Availability	Expected - High Avail.	Low Availability	Expected - High Avail.		Expected Availability	
Natural Gas Bans	Current Bans			Additional Bans	Current Bans		
Natural Gas Price	Expected Price	Adjusted Price?	Expected Price	Adjusted Price?		High Price	

Scenario 2 – Carbon Neutral by 2050

- Main Element: Zero CO2e emissions by 2050 as per CCA/CPP guidelines
- Customer Growth: Based on 2023 IRP Load Forecast
- Energy Efficiency: Based on adjusted 2023 CPAs from Cascade (WA) and ETO (OR) using higher commodity cost as input into avoided cost
- RNG Availability: Cascade weighted share of technical potential of American Gas Foundation/ICF Study
- Hydrogen Availability: Maximum blend of 30% supply by volume
- Natural Gas Bans: Consideration of all expected bans in load forecast
- Natural Gas Price: 10% downward adjustment to 2023 IRP Price Forecast, higher price of RNG volumes above and beyond base case, capped at $26/dth

Scenario 2 – Carbon Neutral by 2050 Cost Comparison



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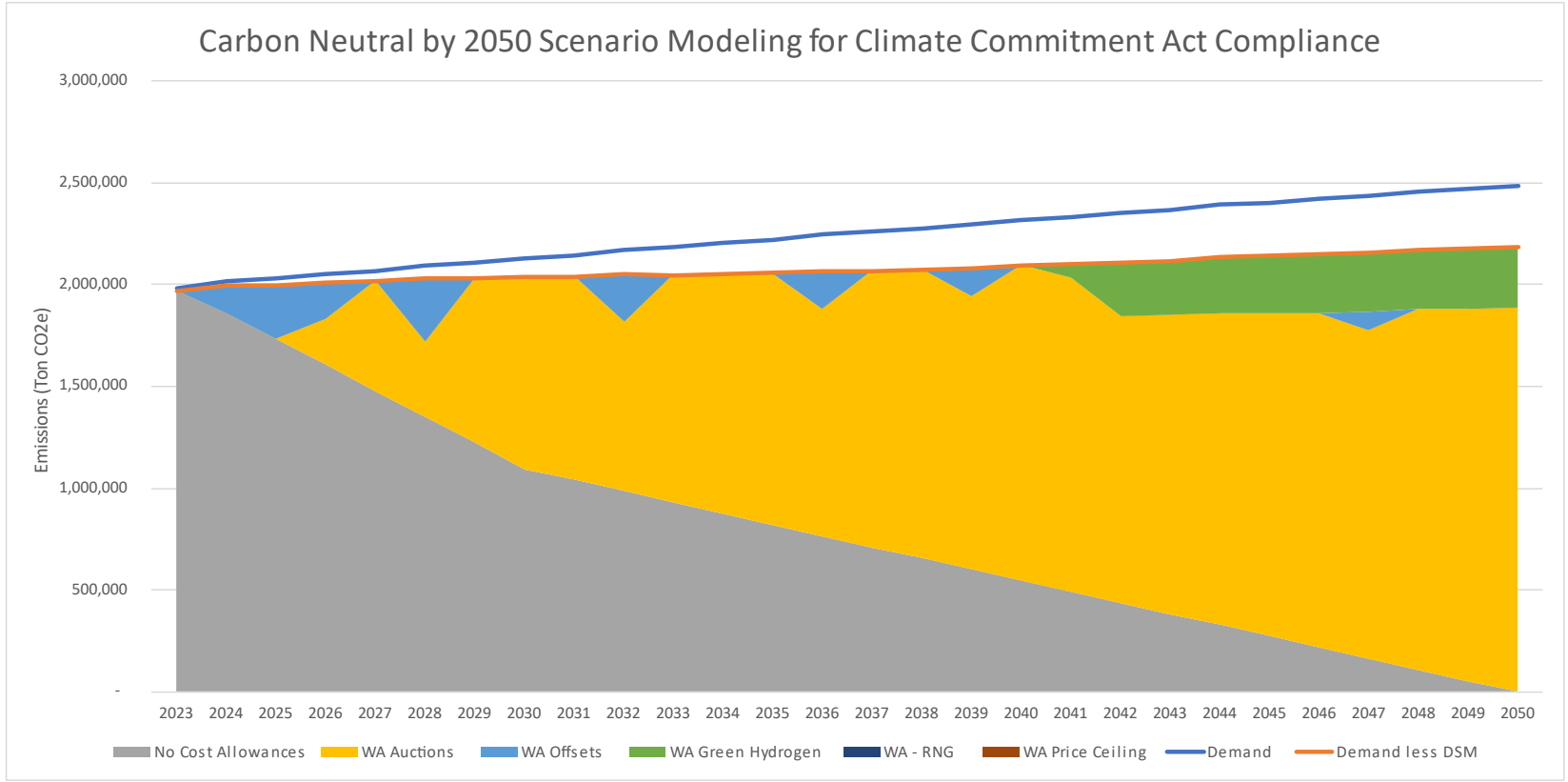
Scenario 2 – Carbon Neutral by 2050 Resource Stack



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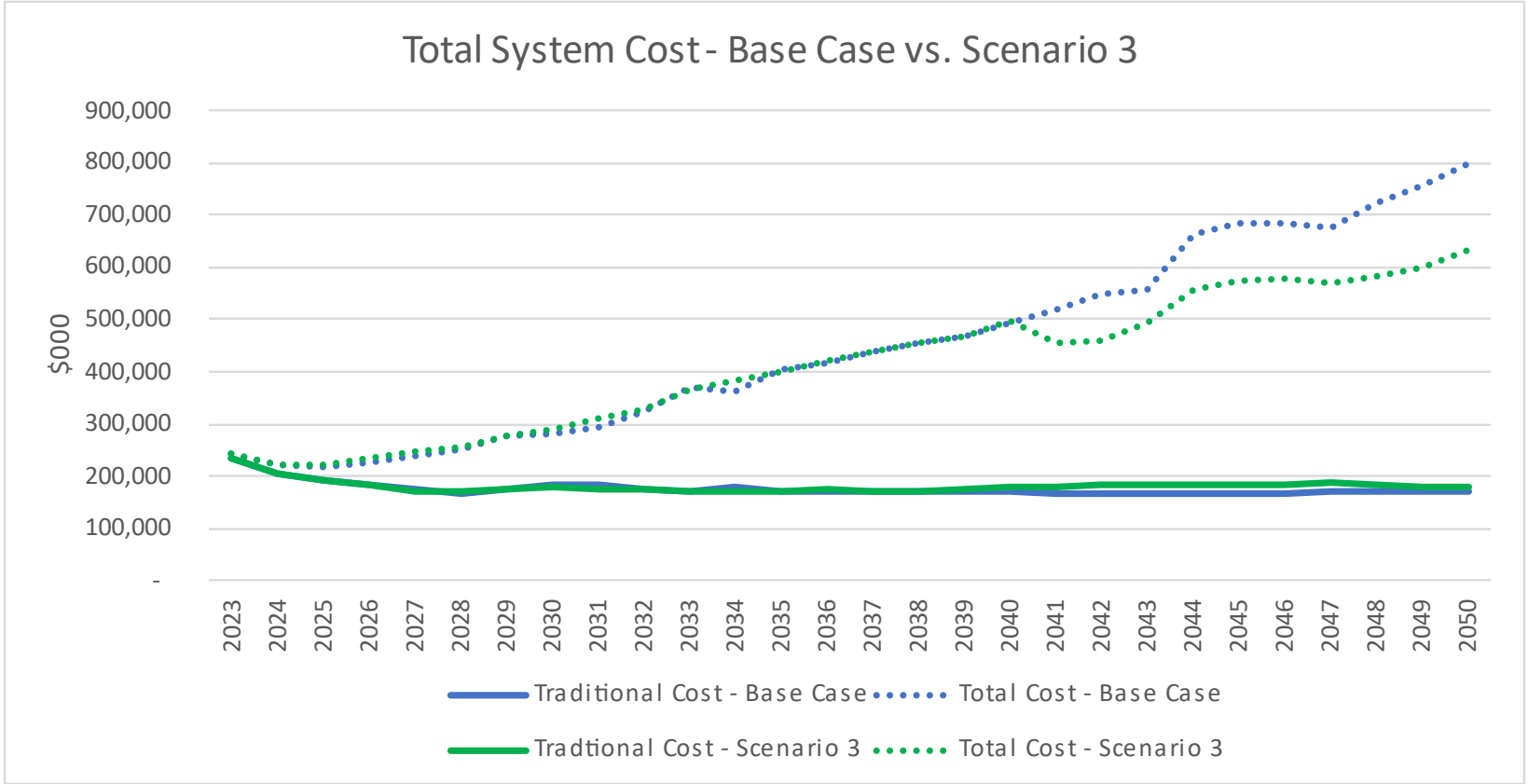
Scenario 2 – Key Takeaways

- Cascade does believe it would be able to hit emissions reduction goals even in a Carbon Neutral by 2050 scenario.
- Aggressive utilization of green Hydrogen in later years is key to the Company's success in this scenario.
- If market conditions were to manifest as modeled (lower price of traditional natural gas due to presumed regional effort at carbon neutrality, declining pricing of hydrogen) cost would not be a barrier to accomplishing this goal.

Scenario 3 – Limited RNG Availability

- Main Element: Competition and stagnating technology leads to lower than expected RNG availability, conservative approach to hydrogen blending
- Customer Growth: Based on 2023 IRP Load Forecast
- Energy Efficiency: Based on adjusted 2023 CPAs from Cascade (WA) and ETO (OR) using higher commodity cost as input into avoided cost
- RNG Availability: Cascade weighted share of low potential of AGF/ICF Study
- Hydrogen Availability: Maximum blend of 5% supply by volume
- Natural Gas Bans: Consideration of all expected bans in load forecast
- Natural Gas Price: Geologic gas based 2023 IRP Price Forecast. Consideration of higher price for RNG

Scenario 3 – Limited RNG Availability Cost Comparison



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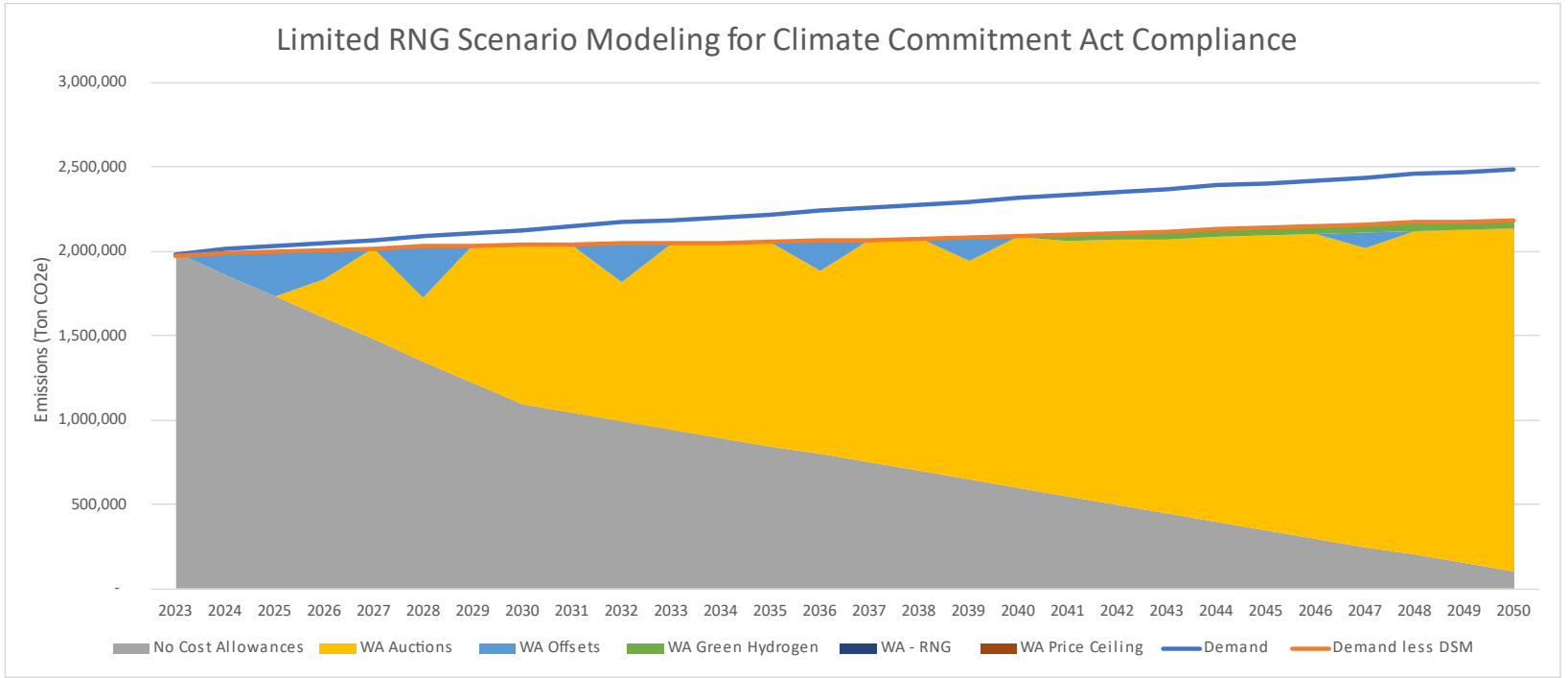
Scenario 3 – Limited RNG Availability Resource Stack - Washington



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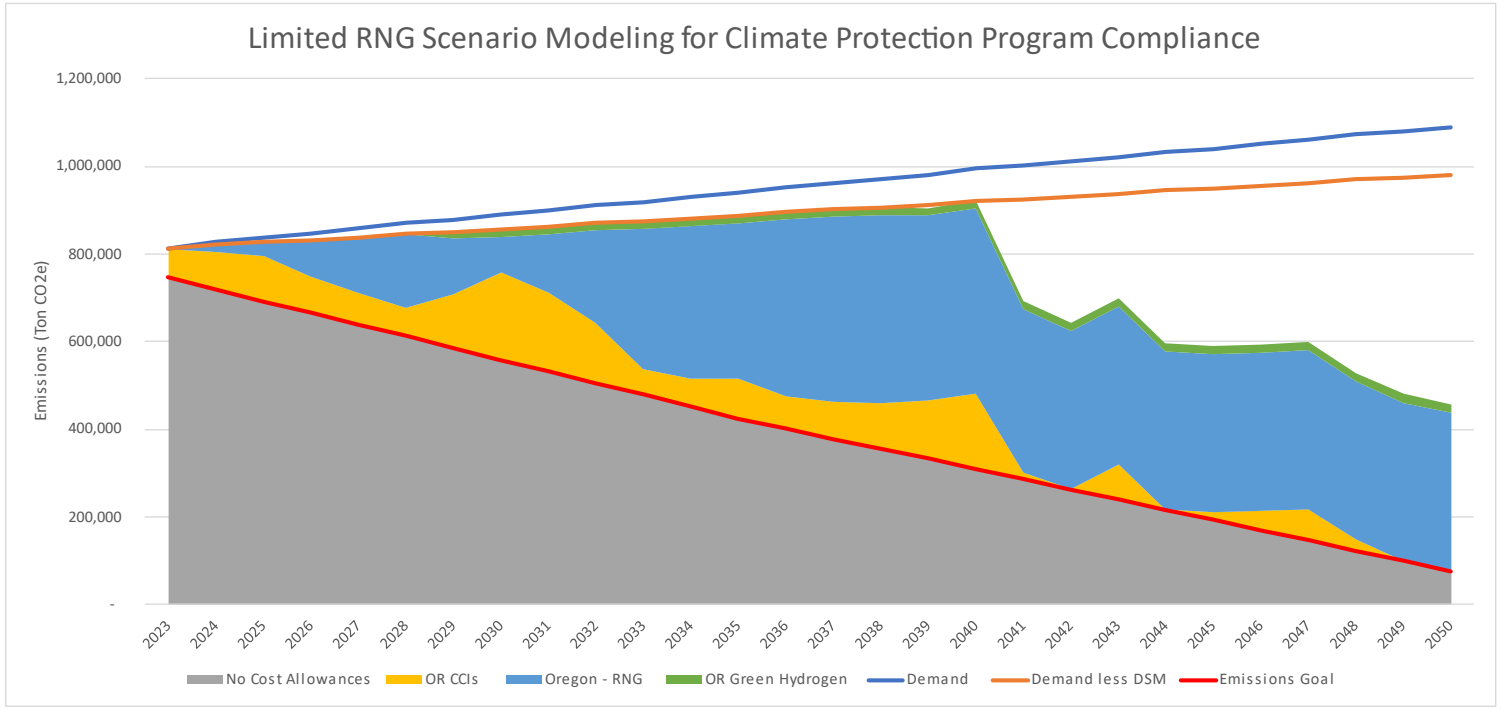
Scenario 3 – Limited RNG Availability Resource Stack - Oregon



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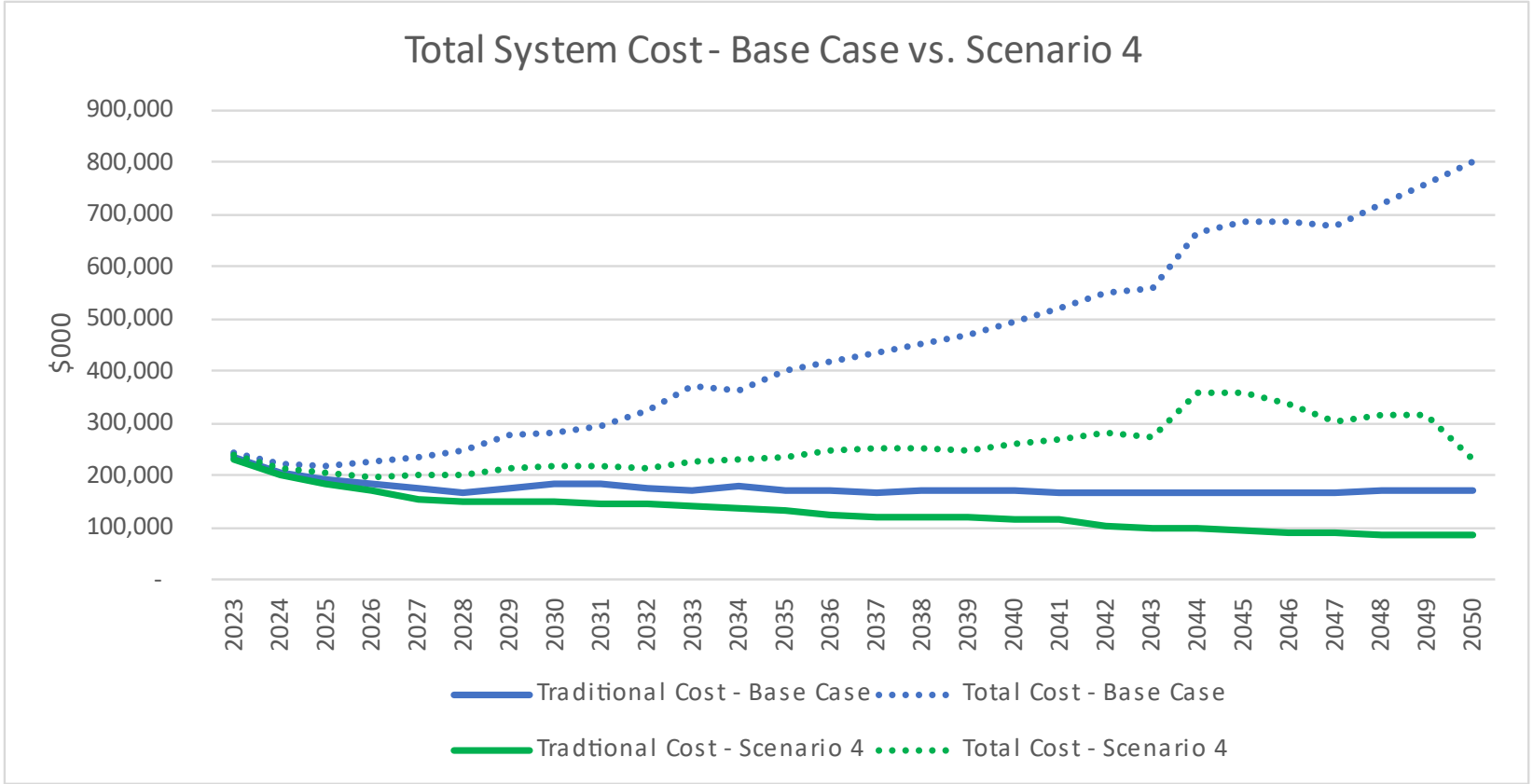
Scenario 3 – Key Takeaways

- Cascade does believe it would be able to hit emissions reduction goals in a low RNG environment in Washington, but will be challenged to be successful in meeting its goals in Oregon
- Aggressive pursuit of RNG will be vital to the Company's success
- While in compliance, costs were typically higher in a limited RNG scenario, but not prohibitively so.

Scenario 4 – Increased Electrification

- Main Element: Lower than expected load projections due to both discretionary electrification and increased regulatory bans on natural gas.
- Customer Growth: customer growth in Cascade's residential and commercial rate classes gradually slows to zero growth in 2025 and afterwards, residential and commercial customer count reduced to 10% by 2050.
- Energy Efficiency: Based on adjusted 2023 CPAs from Cascade (WA) and ETO (OR) using higher commodity cost as input into avoided cost.
- RNG Availability: Cascade weighted share high/technical blend of AGF/ICF Study.
- Hydrogen Availability: Maximum blend of 20% supply by volume.
- Natural Gas Bans: Consideration of all expected and proposed bans in load forecast.
- Natural Gas Price: 10% downward adjustment to 2023 IRP Price Forecast.

Scenario 4 – Increased Electrification Cost Comparison



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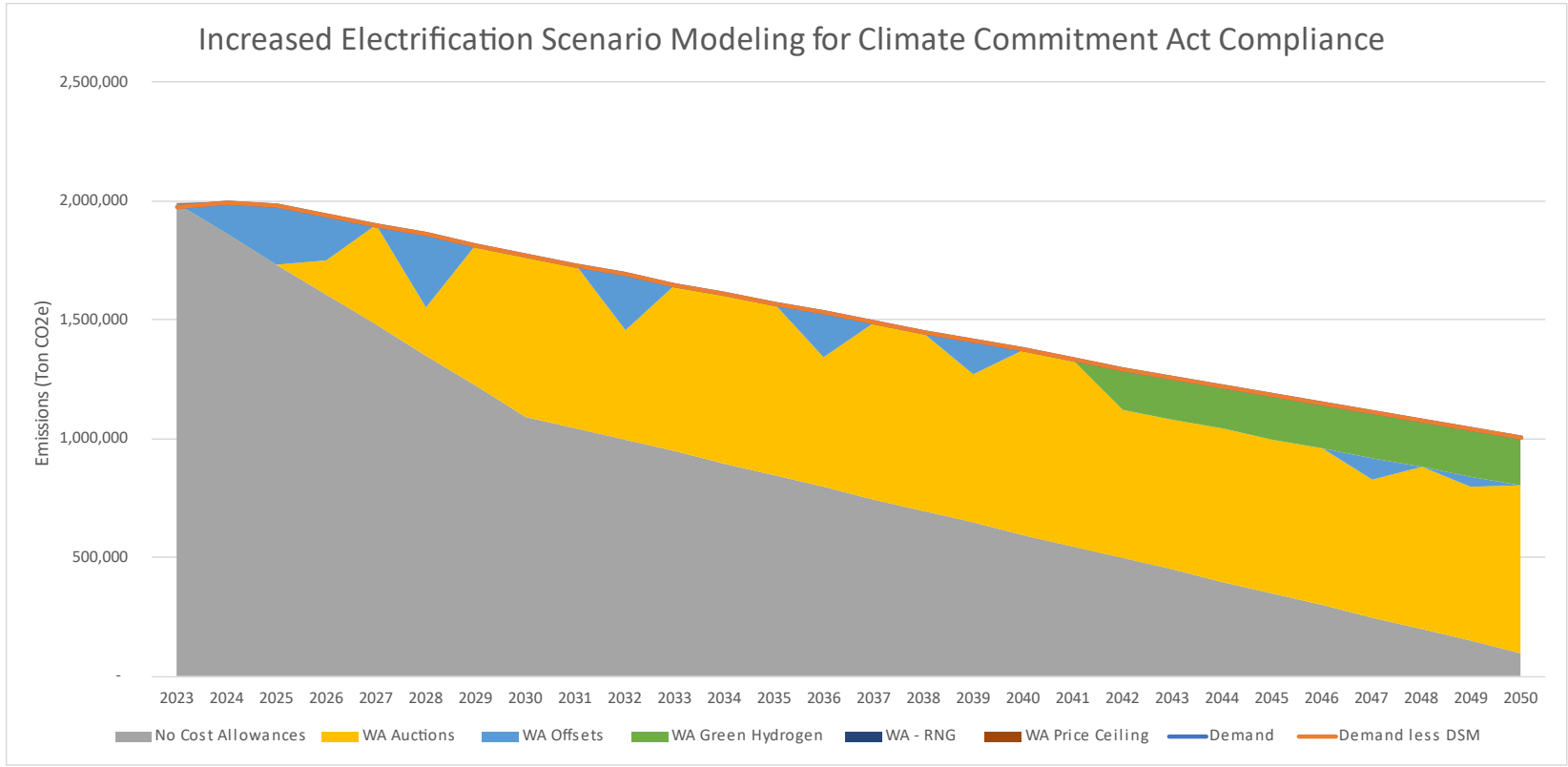
Scenario 4 – Increased Electrification Resource Stack



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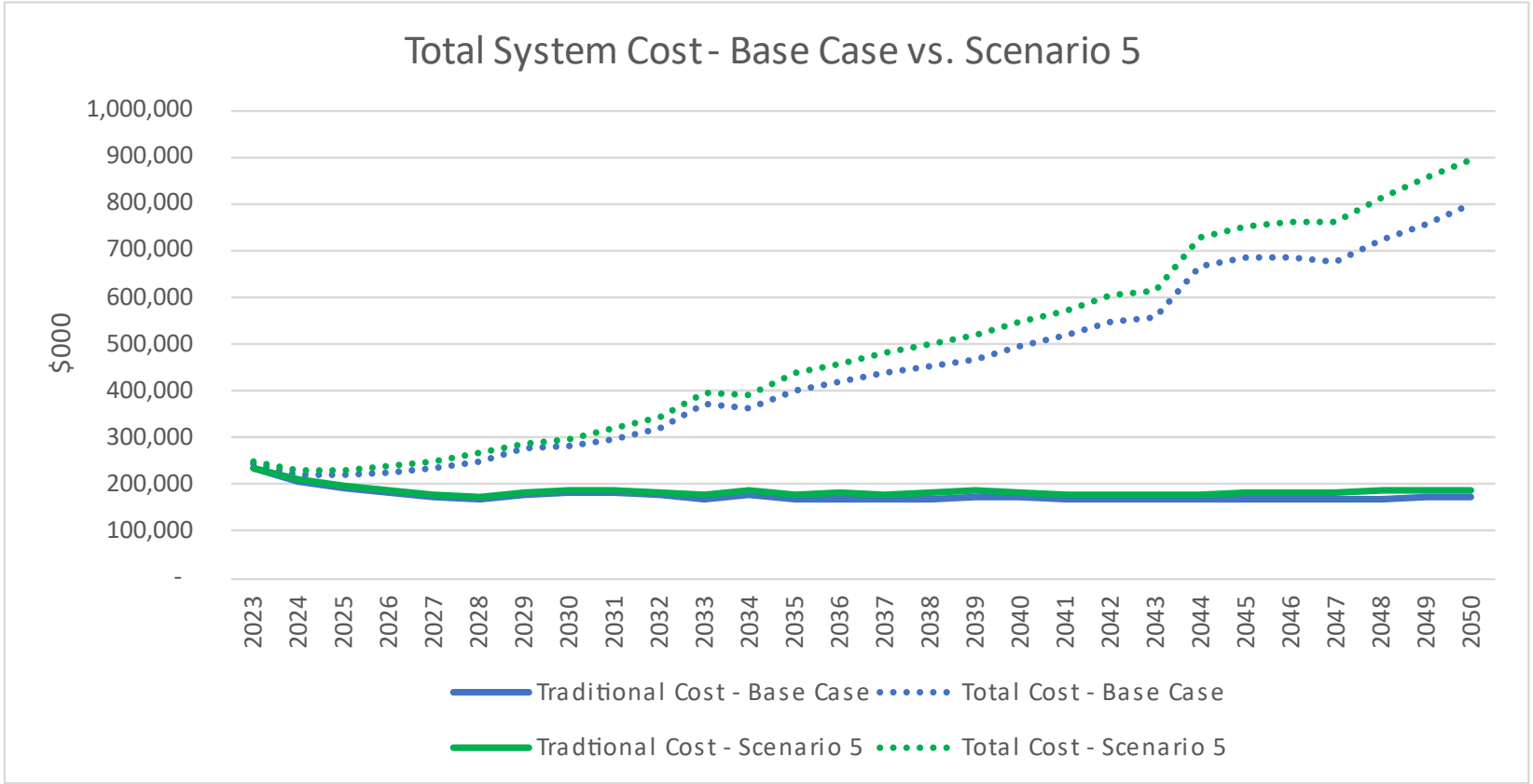
Scenario 4 – Key Takeaways

- Increased electrification would make compliance with emissions reduction requirements far easier.
- Costs under electrification are significantly lower ***to Cascade,*** but this is a result of those costs being shifted elsewhere. Before any policy decisions can be made based on this, an apples to apples comparison of what the resulting cost increases to customers would be must be performed.
- Lower costs do not necessarily reflect lower rates to customers, as lower customer counts may lead to higher costs per customer. Cascade will be performing rate impact analysis to be included in the final IRP.

Scenario 5 – High Customer Growth

- Main Element: Higher than expected customer growth, with the same emissions reduction requirements in the CPP/CCA
- Customer Growth: Based on high growth projections of the 2023 IRP Load Forecast
- Energy Efficiency: Based on adjusted 2023 CPAs from Cascade (WA) and ETO (OR) using higher commodity cost as input into avoided cost
- RNG Availability: Cascade weighted share of the technical potential in the AGF/ICF Study
- Hydrogen Availability: Maximum blend of 30% supply by volume
- Natural Gas Bans: Consideration of all expected bans in load forecast
- Natural Gas Price: 10% upward adjustment to 2023 IRP Price Forecast, higher price of RNG volumes above and beyond base case, capped at $26/dth

Scenario 5 – High Customer Growth Cost Comparison



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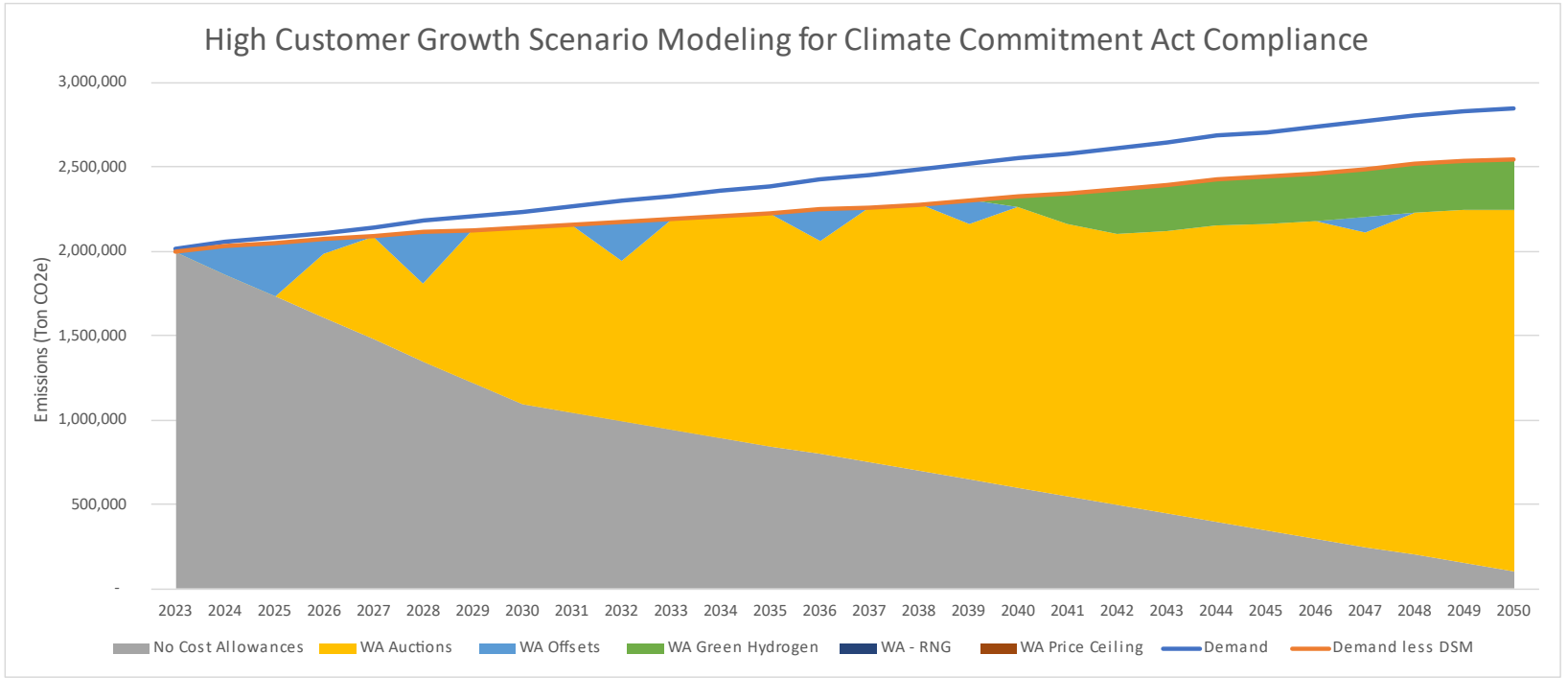
Scenario 5 – High Customer Growth Resource Stack



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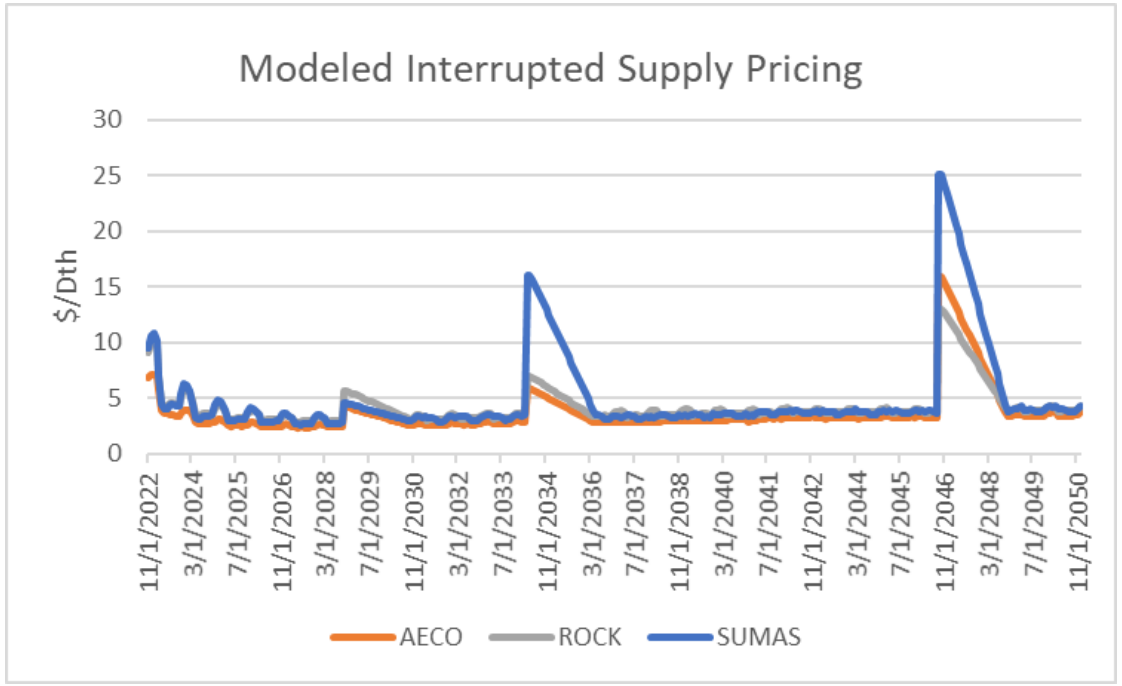
Scenario 5 – Key Takeaways

- Cascade is pleased to see that Company expects to be able to meet customer demand and reach emissions reductions goals in a high growth scenario.
- Aggressive participation in WA allowance auction, including the use of price ceiling allowances when needed, will be vital to the Company's success, along with aggressive RNG acquisition in Oregon.
- As expected, costs will be higher under a high growth scenario, mostly driven by increased costs related to emissions reduction requirements. These costs do not appear to be cost prohibitive under deterministic modeling.

Scenario 6 – High Price – Interrupted Supply

- Main Element: Indiscriminate, stochastically derived incidents cause disruptions in availability of geologic gas at specific basins
- Customer Growth: Based on high growth projections of the 2023 IRP Load Forecast
- Energy Efficiency: Based on 2023 CPAs from Cascade (WA) and ETO (OR)
- RNG Availability: Cascade weighted share high/technical blend of AGF/ICF Study
- Hydrogen Availability: Maximum blend of 20% supply by volume
- Natural Gas Bans: Consideration of all expected bans in load forecast
- Natural Gas Price: During incidents, price at other basins spike to 99th percentile stochastic pricing


Modeled Interrupted Supply Pricing
$/Dth
30
25
20
15
10
5
0
11/1/2022
3/1/2024
7/1/2025
11/1/2026
3/1/2028
7/1/2029
11/1/2030
3/1/2032
7/1/2033
11/1/2034
3/1/2036
7/1/2037
11/1/2038
3/1/2040
7/1/2041
11/1/2042
3/1/2044
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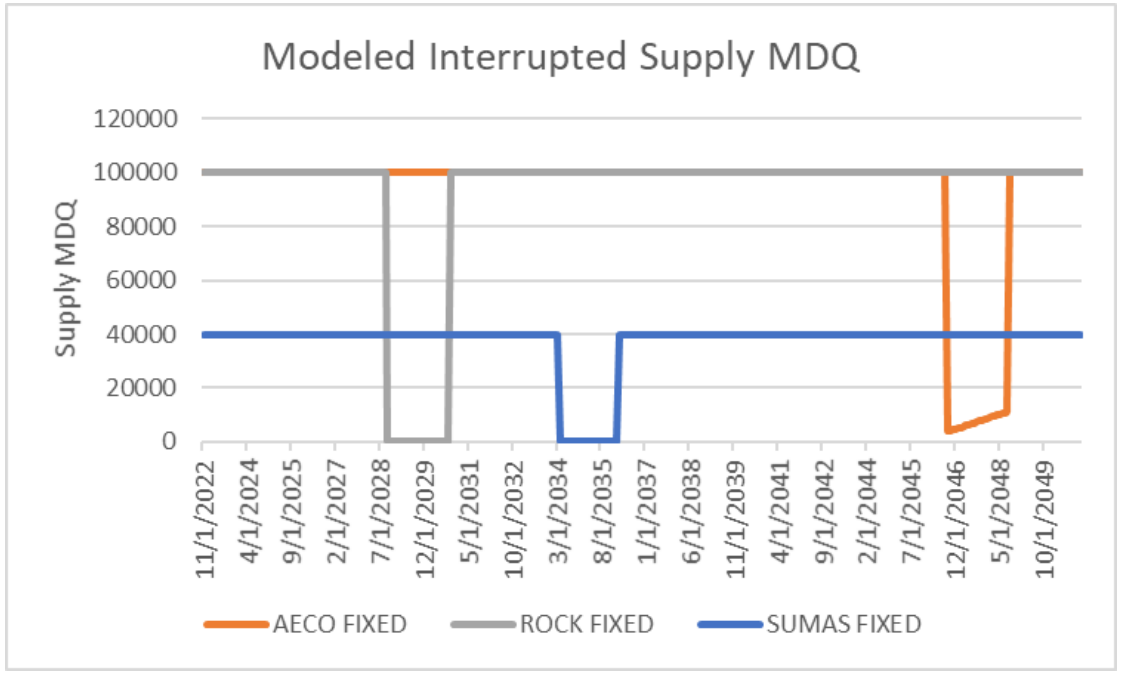
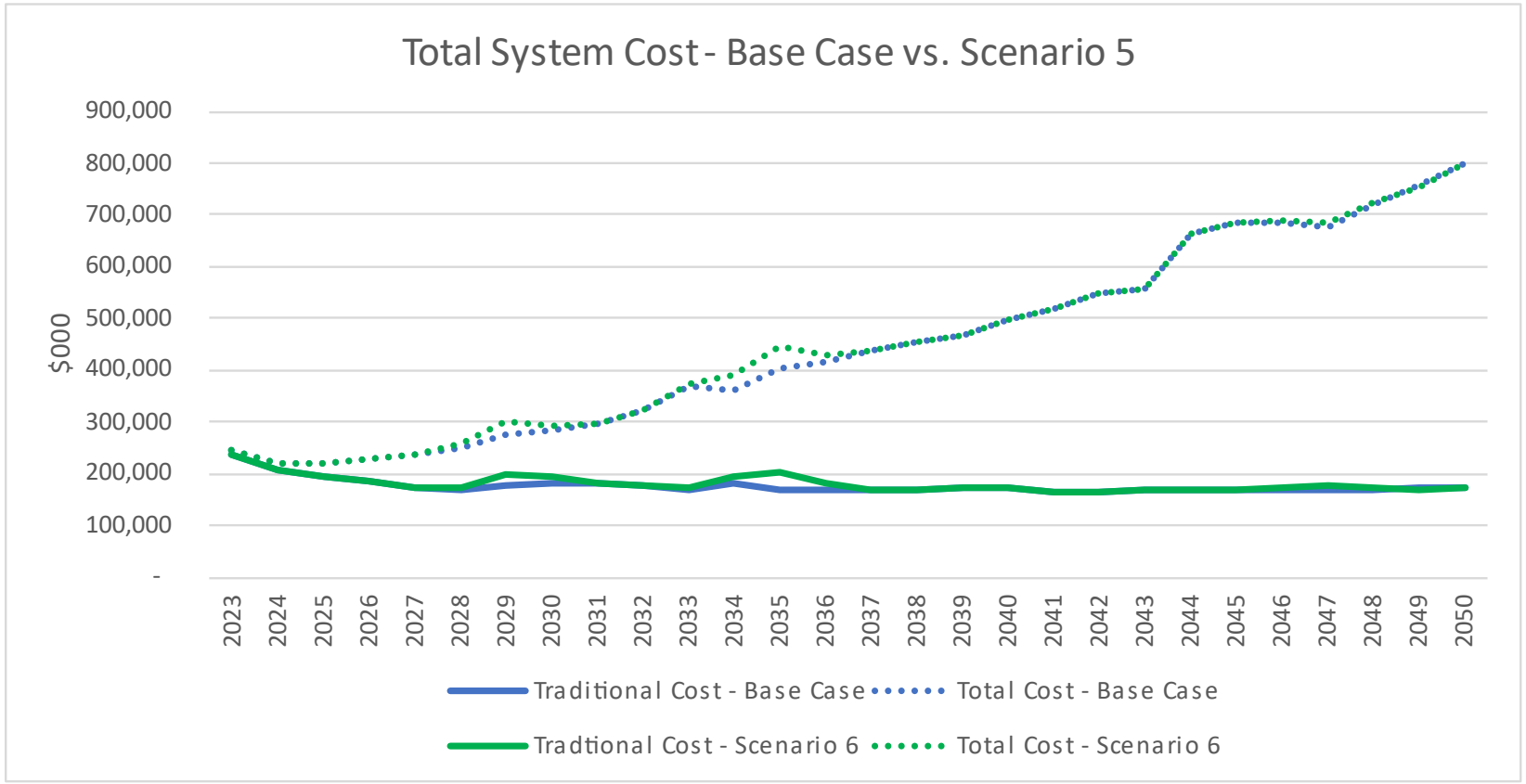
7/1/2049
11/1/2050
AECO
ROCK
SUMAS


Modeled Interrupted Supply MDQ
Supply MDQ
120000
100000
80000
60000
40000
20000
0
11/1/2022
4/1/2024
9/1/2025
2/1/2027
7/1/2028
12/1/2029
5/1/2031
10/1/2032
3/1/2034
8/1/2035
1/1/2037
6/1/2038
11/1/2039
4/1/2041
9/1/2042
2/1/2044
7/1/2045
12/1/2046
5/1/2048
10/1/2049
AECO FIXED
ROCK FIXED
SUMAS FIXED

Scenario 6 – High Price/Interrupted Supply Cost Comparison



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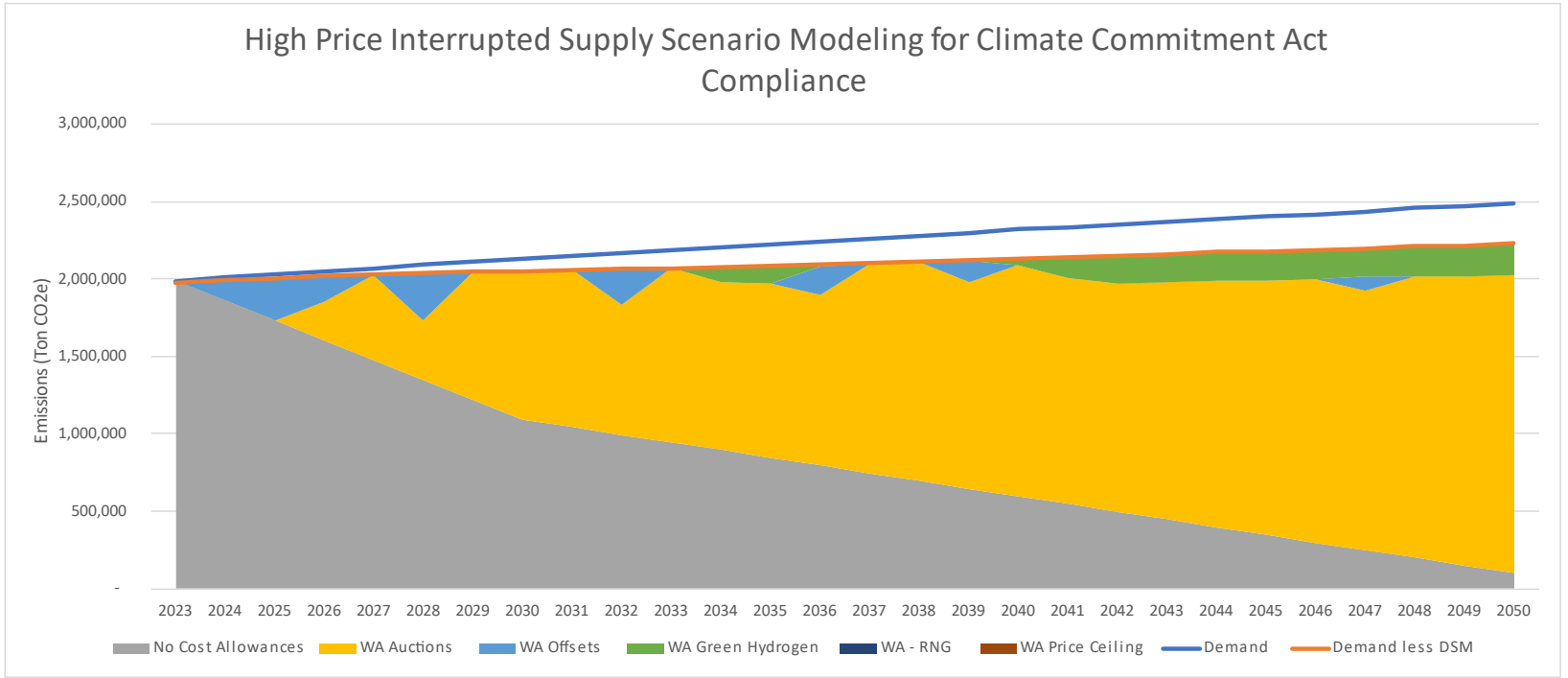
Scenario 6 – High Price/Interrupted Supply Resource Stack



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Scenario 6 – Key Takeaways

- Cascade is able to meet emissions reductions targets, but has identified a potential shortfall in serving load in 2034 during the modeled Sumas incident
  - Cascade will include discussion in the narrative about how an incident like this would be handled, including lessons learned from prior instances.
- Cascade's participation in hydrogen markets is largely dependent on when pricing becomes attractive. Interrupted supply modeling indicates that price shocks from incidents could accelerate Cascade's entry into these markets as short term hedges/protection against these price movements.
- As expected, costs will be higher during price shock incidents, but not as significantly as the Company initially expected.

Proposed Two-Year Action Plan

Two-Year Action Plan

- Demand:
  - Incorporate end use forecasting in the load forecast model
- Avoided Cost:
  - Investigate incorporating a separate avoided cost for transportation (non-core) customers
  - Explore how environmental compliance costs from the CCA/CPP impact the avoided cost
- Demand Side Management:
  - EM&V: Operating under Biennial Conservation Plan
  - New CPA: Completing in 2023
  - Municipal Gas Bans: Impact on future assumption i.e., scenario B & C
  - Code changes
  - Low income
  - Adaptive management

Two-Year Action Plan (Cont'd)

- Compliance:
  - Acquire the number of offsets and allowances needed to meet compliance under the Climate Commitment Act.
  - Acquire on-system RNG (System resource that will be utilized in OR and WA as needed).
  - Continue to participate in the local climate community action plans around Cascade's service territory.
- Distribution System Planning:
  - Kitsap Phase V Pipeline Reinforcement
  - Aberdeen HP Reinforcements
  - Bellingham 6-inch HP Reinforcement –Meador Ave
  - Richland HP Reinforcements
  - South Kennewick Reinforcements
  - Pasco 6-inch HP Reinforcement
  - Burlington South Feed Reinforcement
  - Wapato 4-inch HP Replacement

2023 IRP Remaining Schedule

Process Items	Process Elements	Date
TAG 5 (OR)	Final Integration Results, finalization of plan components, Proposed new 4-year Action Plan.	11/9/2022
Draft of 2022 IRP distributed (WA)	Filing of Draft IRP	11/23/2022
Draft of 2022 IRP distributed (OR)	Filing of Draft IRP	1/5/2023
Comments due on draft from all stakeholders (WA)	Comments due from Stakeholders	1/13/2023
Comments due on draft from all stakeholders (OR)	Comments due from Stakeholders	2/24/2023
TAG 6, if needed (WA)	An additional TAG if needed based on comments from Stakholders	2/1/2023
TAG 6, if needed (OR)	An additional TAG if needed based on comments from Stakholders	3/15/2023
IRP filing (WA)	IRP Final Filing	2/24/2023
IRP filing (OR)	IRP Final Filing	4/14/2023

Questions/Next Steps

Review Plans for Draft IRP and TAG 5 Discussion

- Draft IRP will be filed Wednesday, November 23
- Next OR TAG (TAG 5) is Wednesday, November 9
  - Final Integration Results
  - Finalization of Plan components
  - Proposed new Action Plan

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CASCADE NATURAL GAS CORPORATION®

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In the Community to Serve®

Integrated Resource Plan (WA) Technical Advisory Group Meeting #5

OCTOBER 20, 2022

MICROSOFT TEAMS/TELECONFERENCE

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