CASCADE NATURAL GAS CORPORATION®

A Subsidiary of MDU Resources Group, Inc.

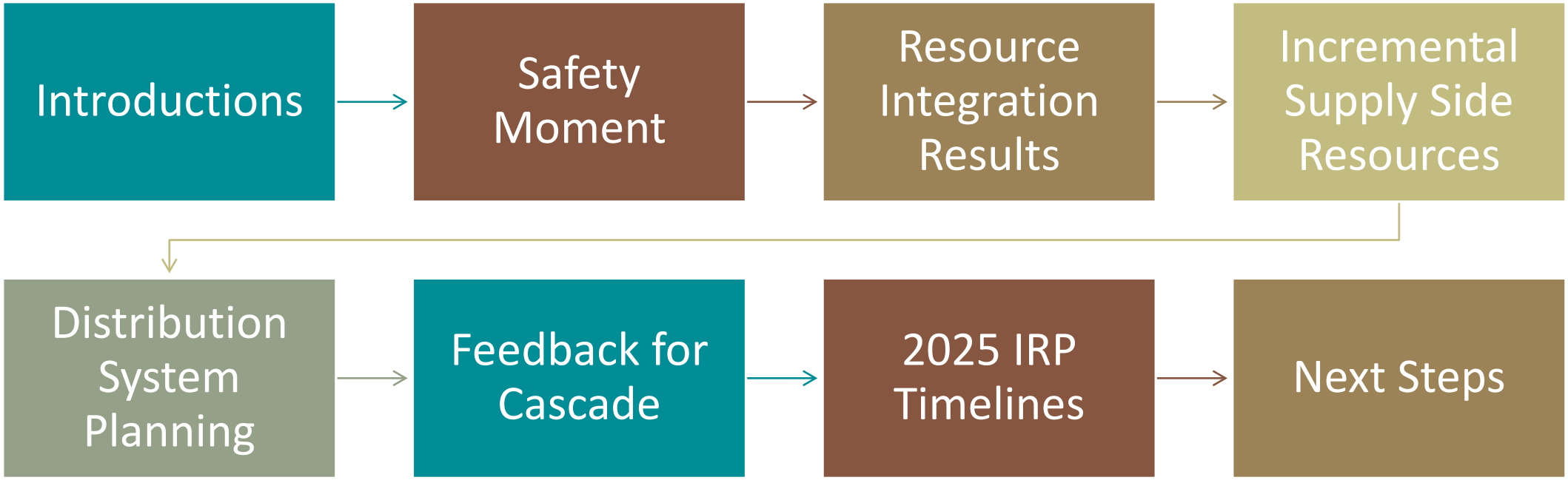
In the Community to Serve®

Integrated Resource Plan Technical Advisory Group Meeting #4

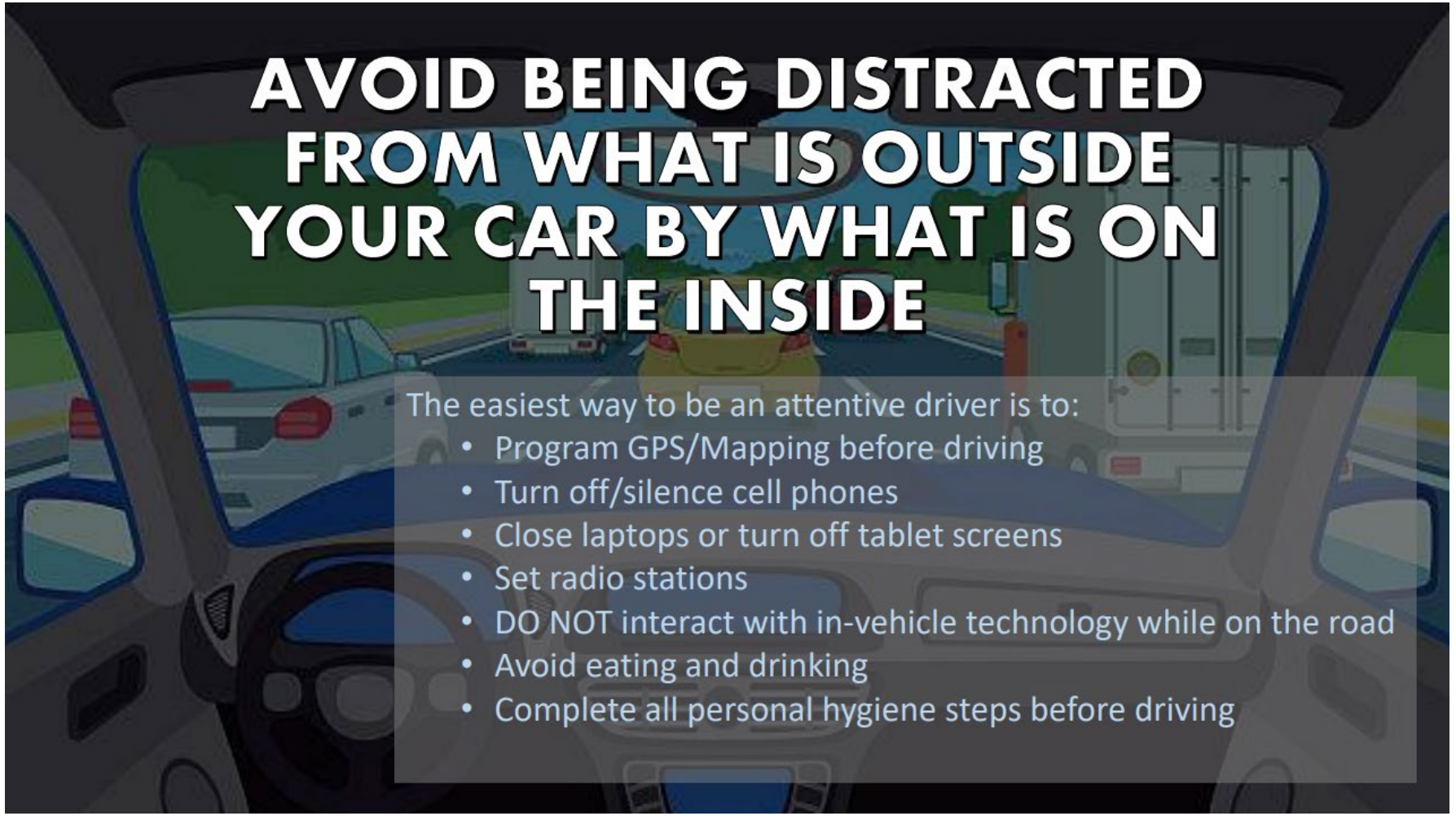
FEBRUARY 5, 2025

MICROSOFT TEAMS/TELECONFERENCE

Agenda


Introductions
Safety Moment
Resource Integration Results
Incremental Supply Side Resources
Distribution System Planning
Feedback for Cascade
2025 IRP Timelines
Next Steps

Safety Moment



What, Who, How?

Information on Cascade's IRP can be found on the Company's webpage.

Stakeholder Engagement Design Document

Pre- and Post-IRP Feedback Report

IRP Timeline

Previous IRPs

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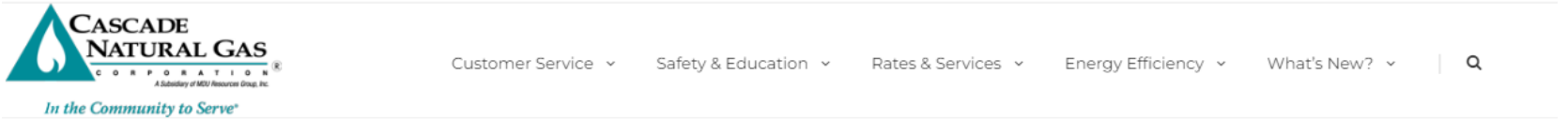


Cascade Home » Rates & Services » Rates & Tariffs » Washington Integrated Resource Plan

WASHINGTON | CASCADE NATURAL GAS | NATURAL GAS – INTEGRATED RESOURCE PLAN

The What: Cascade's Integrated Resource Plan describes the two- to four-year and twenty-year expectation of how Cascade expects to safely serve customers' energy needs at the lowest reasonable and safe cost. The analyses in this 12–18-month process includes existing and potential new pipelines and natural gas supply contracts (among others) as well as benefits of energy efficiency to customers. The IRP provides comprehensive and transparent insight into how Cascade plans for customers' energy future. To view what an IRP looks like, please see Previous Years' IRP at the bottom of the page. The Executive Summary and Key Points are designed to provide a quick, but descriptive, explanation of the process and plan.

The Who: Customers and the general public are invited to participate in a series of meetings on the variety of topics contained in the IRP, including energy efficiency and carbon emission reductions. Together, customers and the general public participating in the IRP process are called Stakeholders. Stakeholders also include the professional analytical staffs of the state utility commissions and groups representing residential and industrial customers. Community-based organizations and independent experts also attend the series of meetings.

How it works: The IRP process begins with a kick-off meeting to lay out the 12-18 month schedule of four to six meetings as well as provide an overview of what issues will be covered. These meetings are called Technical Advisory Group meetings or TAGs. Links are available to the TAG presentations, minutes, and written responses to Stakeholder's requests and comments.

What to expect: Expectations of participants and tips for the best way for Stakeholders (including customers and the general public) are described in Cascade's Stakeholder Engagement Design Document. This is a "living document" and suggestions for improvement are welcome.

Sign up! Join Cascade's distribution list. You may participate in multiple ways, ranging from attending the TAG meetings (either in-person or remotely) and receiving the agendas/presentations to opportunity to comment. Do so by contacting the Supervisor of Resource Planning, Brian Robertson at either Brian.Robertson@cngc.com or (509) 221-9808. You may also contact the Company's IRP email address at irp@cngc.com. Cascade uses MSTeams as its means to connect participants remotely. MSTeams is a free application to be used by Stakeholders including customers and the general public.

Accommodations: As shown as point #1 on page 2 of the Stakeholder Engagement Design Document, Cascade will provide reasonable accommodations for people with disabilities. Additionally, the Company will reasonably accommodate items such as requests for meeting locations, audio and visual capabilities, and other items requested by external stakeholders. If you have a request for accommodations, please reach out to one of the contacts listed above and the Company will gladly coordinate any reasonable requests for accommodations.

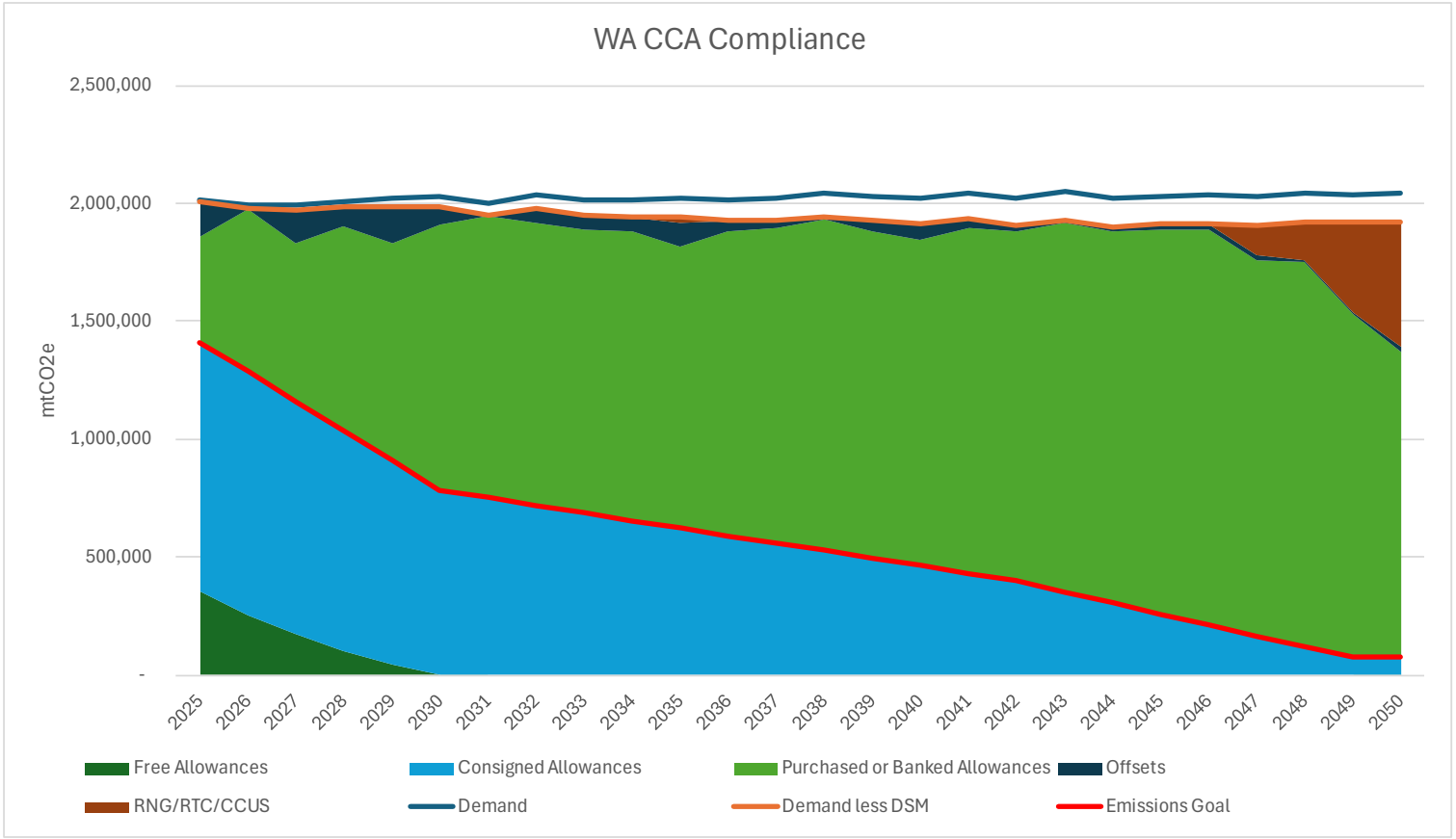
Pre- and Post-IRP feedback report:

Washington Integrated Resource Plan - Cascade Natural Gas Corporation (cngc.com)

Resource Integration Results

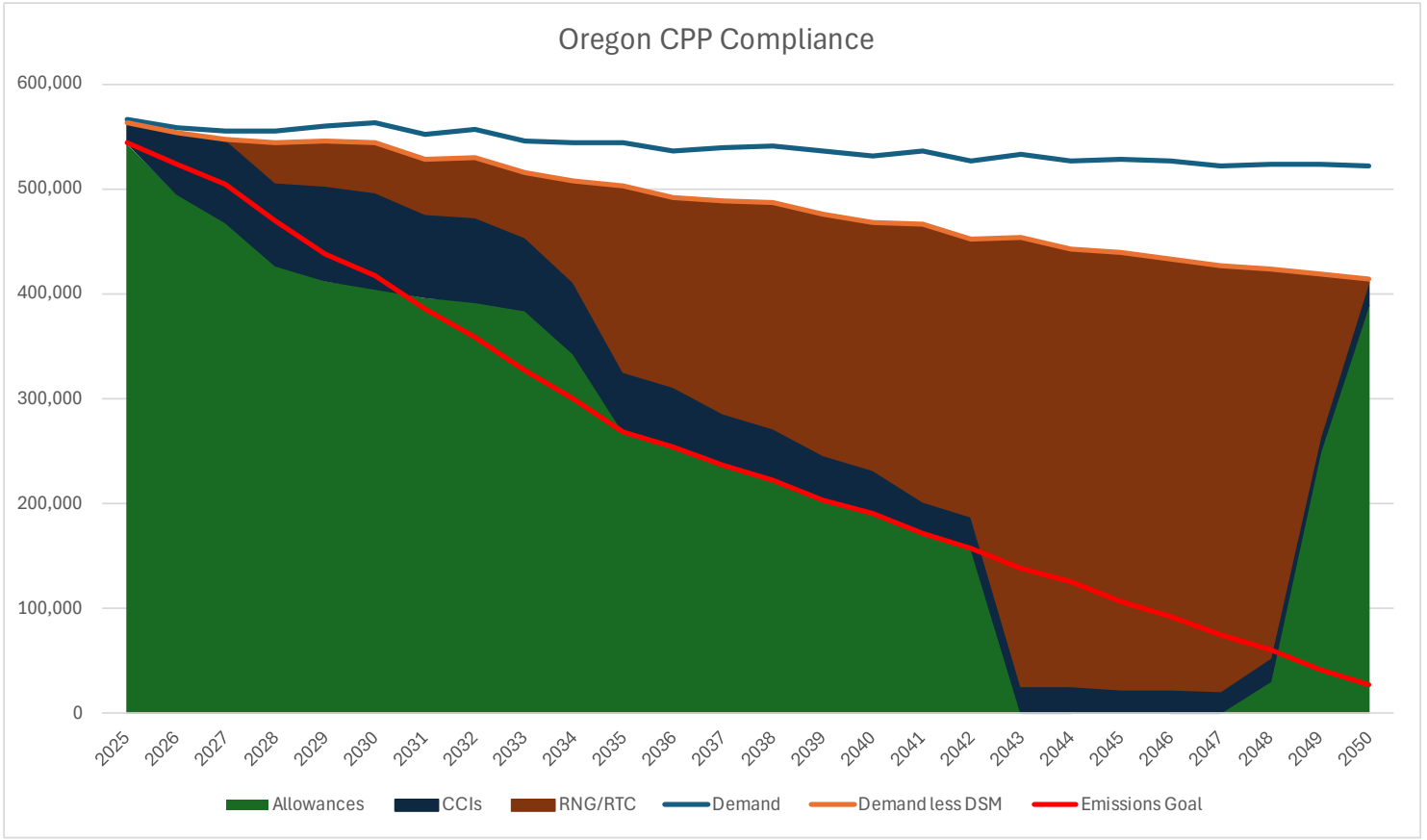
Washington Climate Commitment Act Compliance

- Cascade expects to meet reference case emission targets with free allowances, repurchased consigned allowances, offsets, carbon capture and RTCs.
- RTCs are needed in future years, but allowances remain the cheaper option.



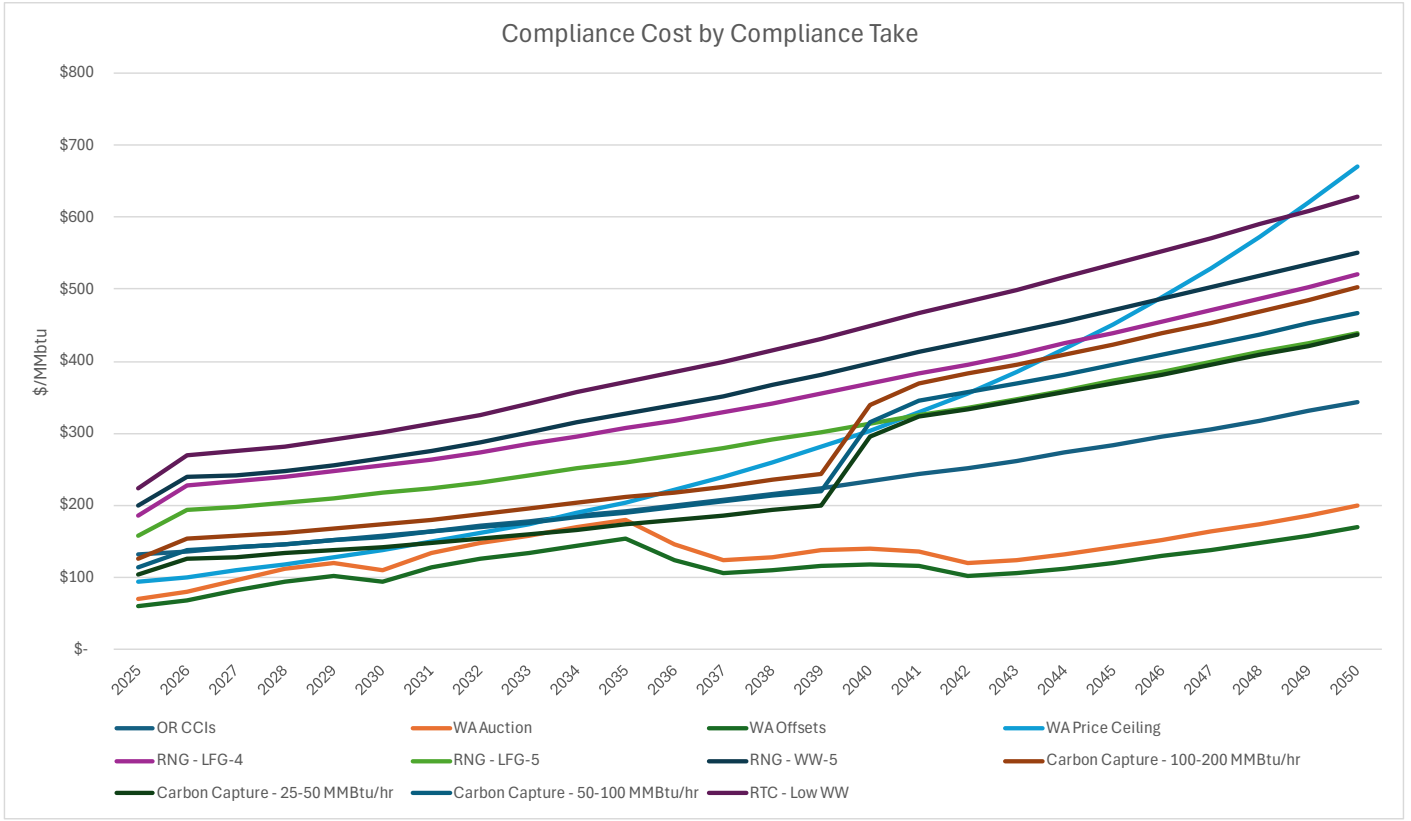
Oregon Climate Protection Program Compliance

- Cascade expects to meet reference case emission targets with allowances, CCIs, and RTCs.
- Plexos recommends utilizing RTCs earlier than needed in order to bank allowances for future use in order to minimize costs in future years when pricing is higher.
- Cascade would need to utilize RTCs earlier if CCIs are not available.



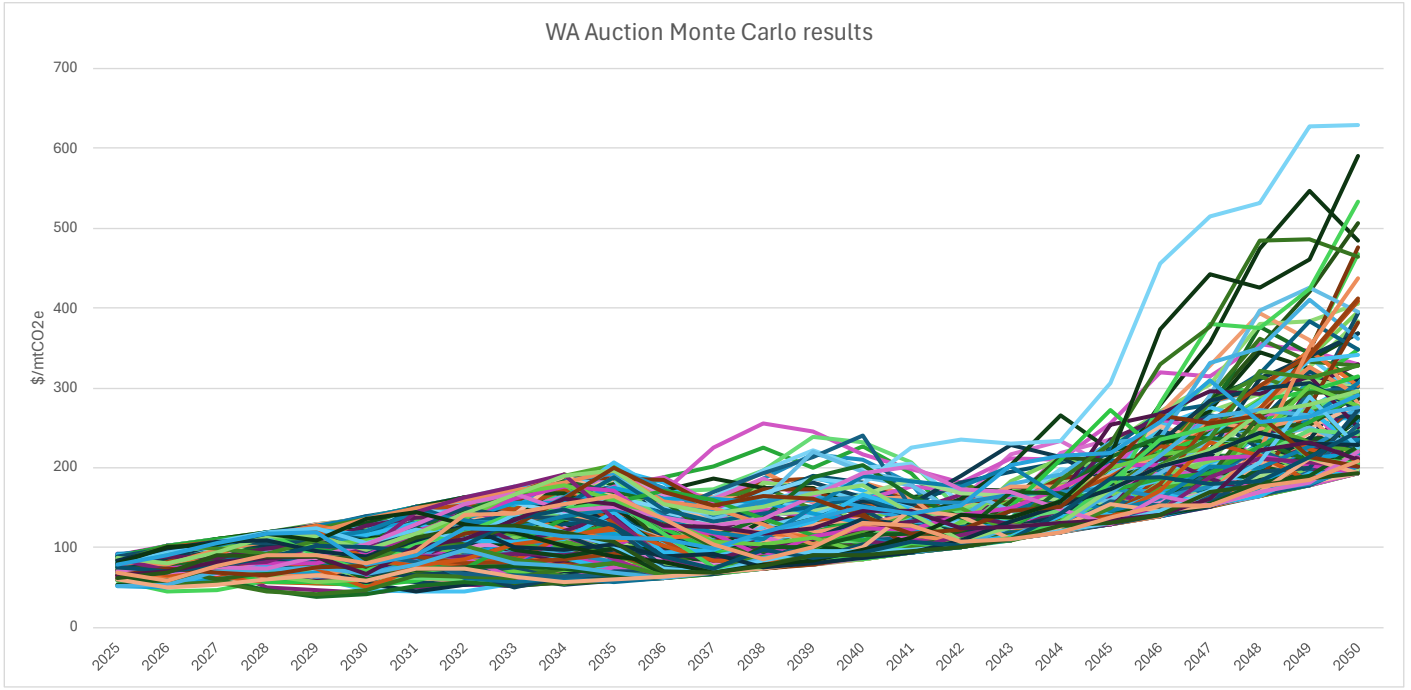
Price by Compliance Take (WA and OR)

- In Washington, the lowest cost option for meeting compliance targets is offsets, and allowances.
- Price ceiling allowances begin as the third lowest cost, but the highest cost by 2050.
- WA Allowances forecast is provided by a third-party consultant.



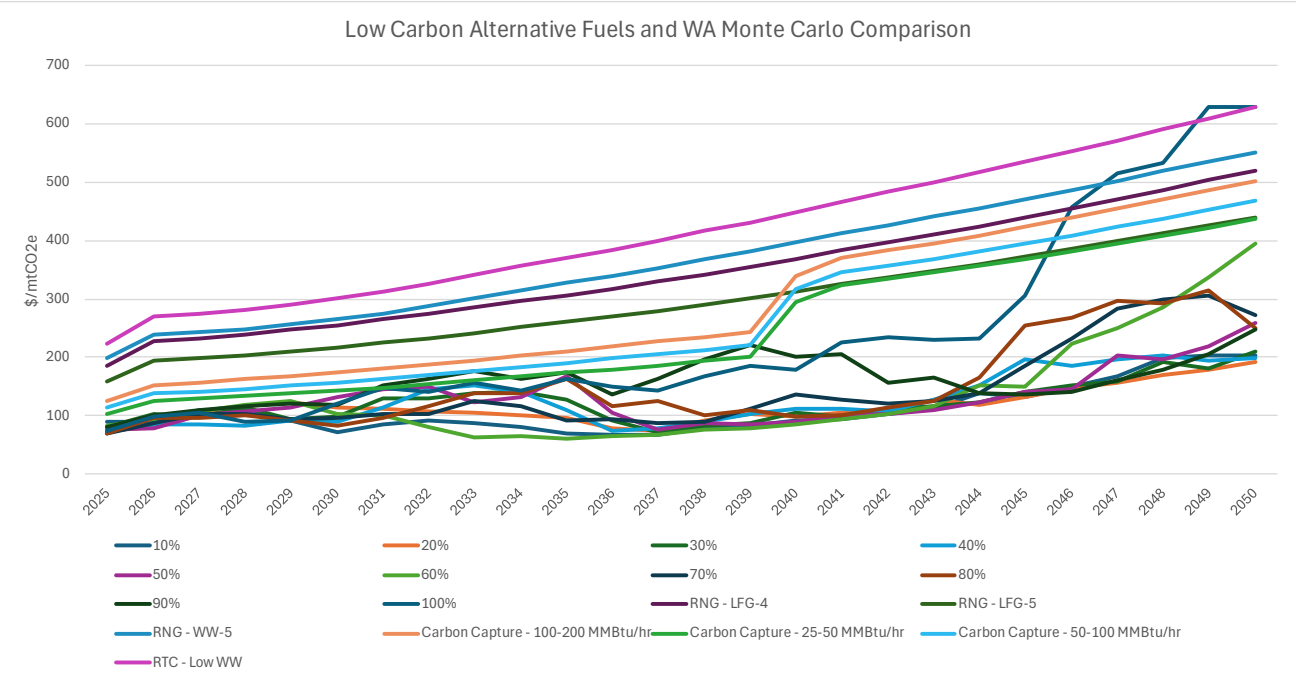
WA Allowance Monte Carlo Results

- Cascade ran 200 monte carlo simulations in order to analyze ranges of allowance cost futures.
- Cascade utilized returns (quarter over quarter percentage changes) from the California/Quebec auction as a proxy for standard deviation.



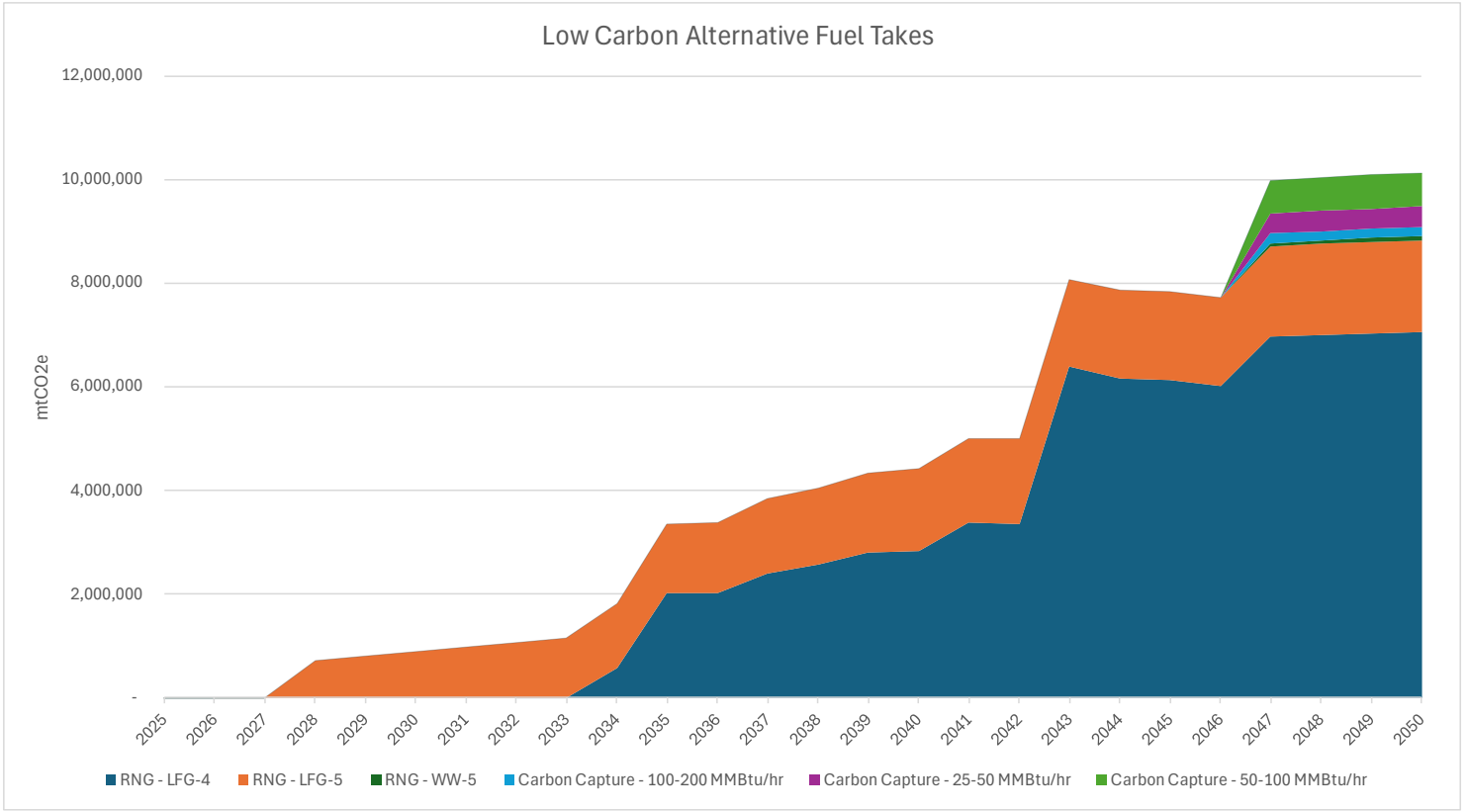
WA Allowance Monte Carlo Results and Low Carbon Alternative Fuel Price Comparison

- Under higher allowance cost scenarios, carbon capture may become cost effective earlier
- In early years, allowance prices expect to hover near the price ceiling cost.
- In some instances, allowance prices increase above low carbon alternative fuels, making those the least cost option.



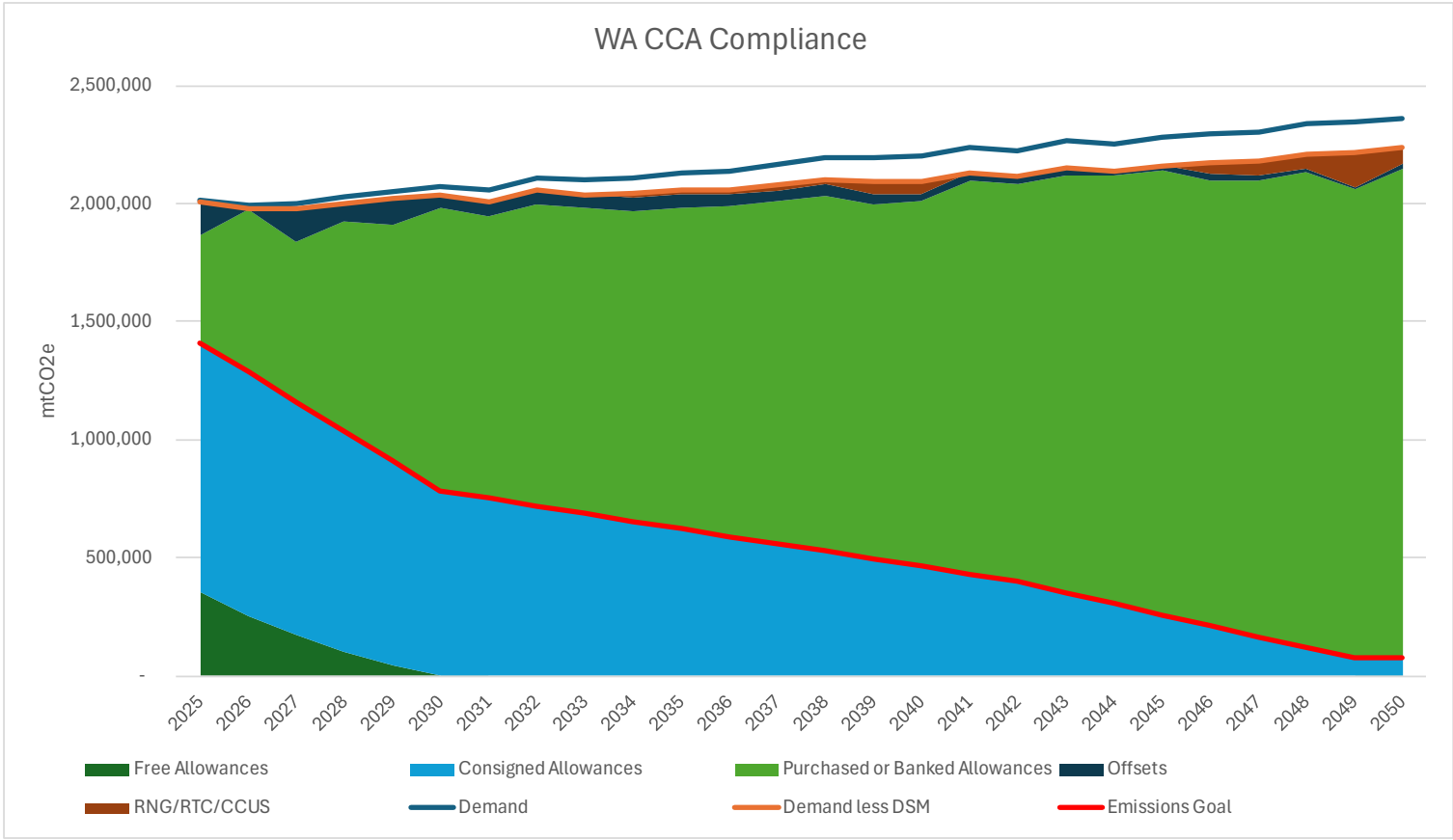
Low Carbon Alternative Fuel Take by Compliance (WA and OR)

- Cascade maximized the amount of RNG – LFG-5, RNG – LFG-4, RNG – WW-5, and carbon capture that was available by 2050.
- RNG/RTC is utilized earlier as needed in Oregon.
- Carbon capture is utilized in the later years when it is needed in Washington.



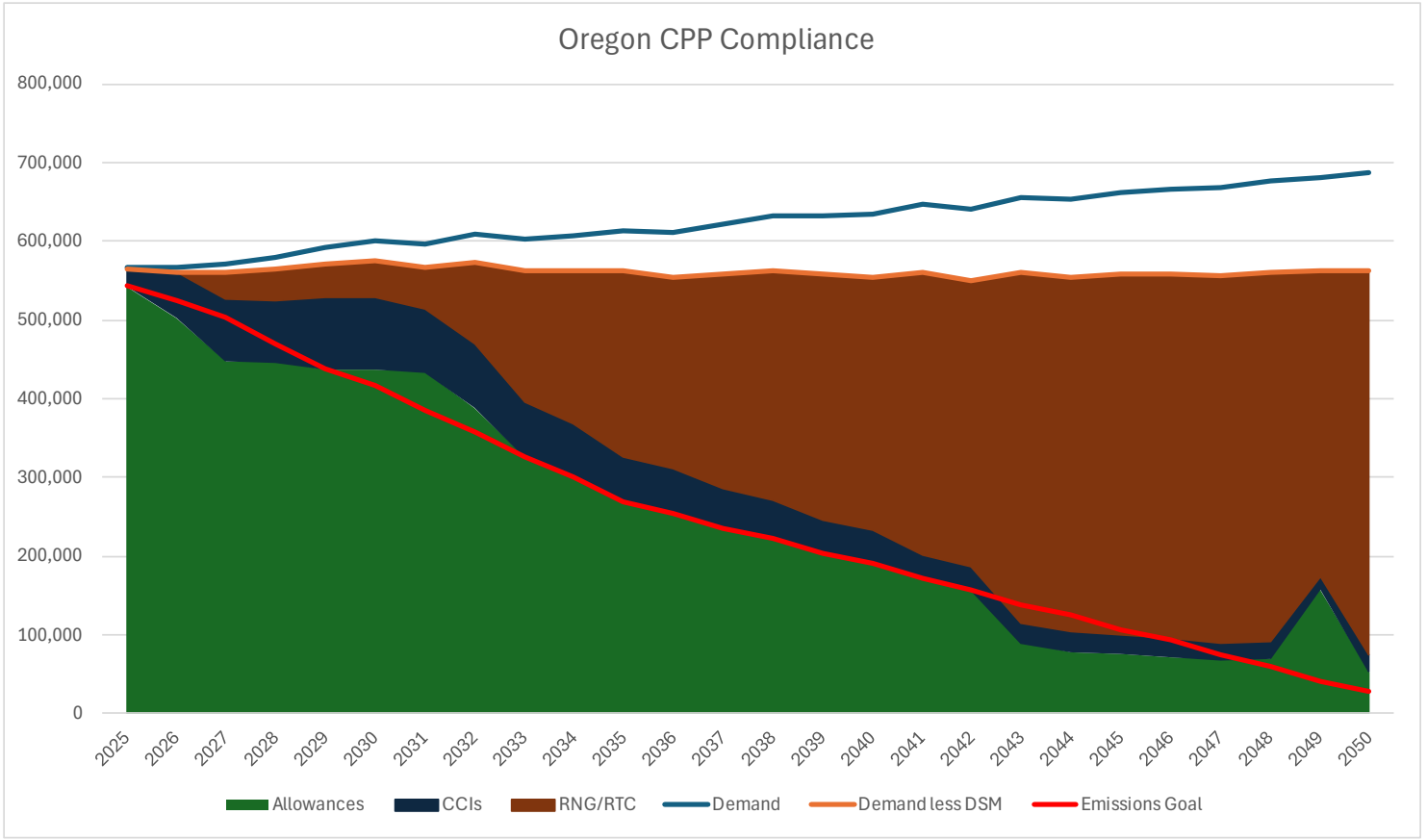
Washington Climate Commitment Act Compliance (High Customer Growth)

- Cascade expects to meet high case emission targets with free allowances, repurchased consigned allowances, offsets, carbon capture.
- More RTCs are needed in future years, but allowances remain the cheaper option.



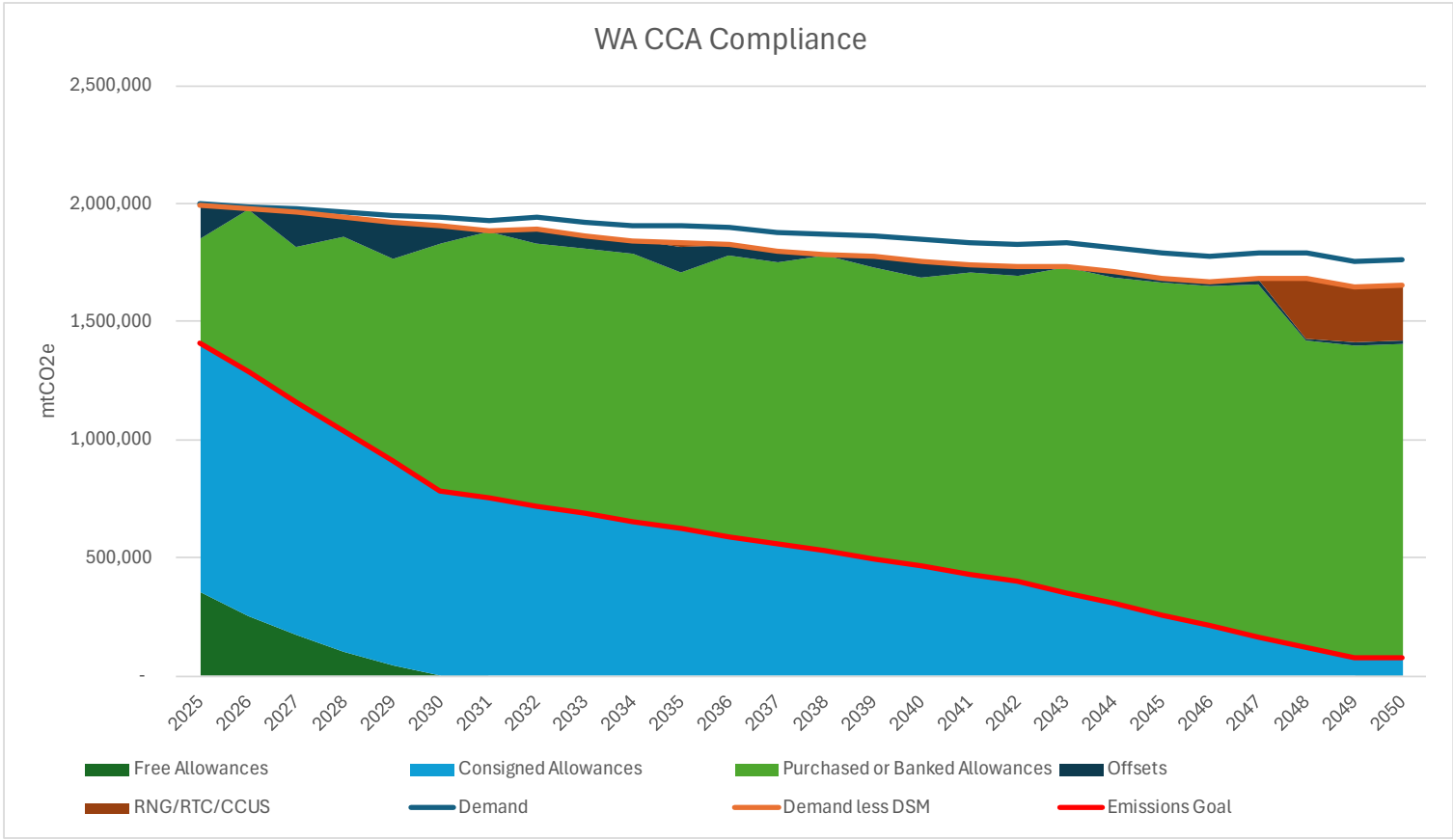
Oregon Climate Protection Program Compliance (High Customer Growth)

- Cascade expects to meet high case emission targets with allowances, CCIs, and RTCs.
- Similar to the reference case, Plexos recommends utilizing RTCs earlier than needed in order to bank allowances for future use in order to minimize costs in future years when pricing is higher.



Washington Climate Commitment Act Compliance (Low Customer Growth)

- Cascade expects to meet low case emission targets with free allowances, repurchased consigned allowances, offsets, and carbon capture.
- More RTC and RNG is utilized in the low case because lower cost RNG and RTCs are available in future years.



Oregon Climate Protection Program Compliance (Low Customer Growth)

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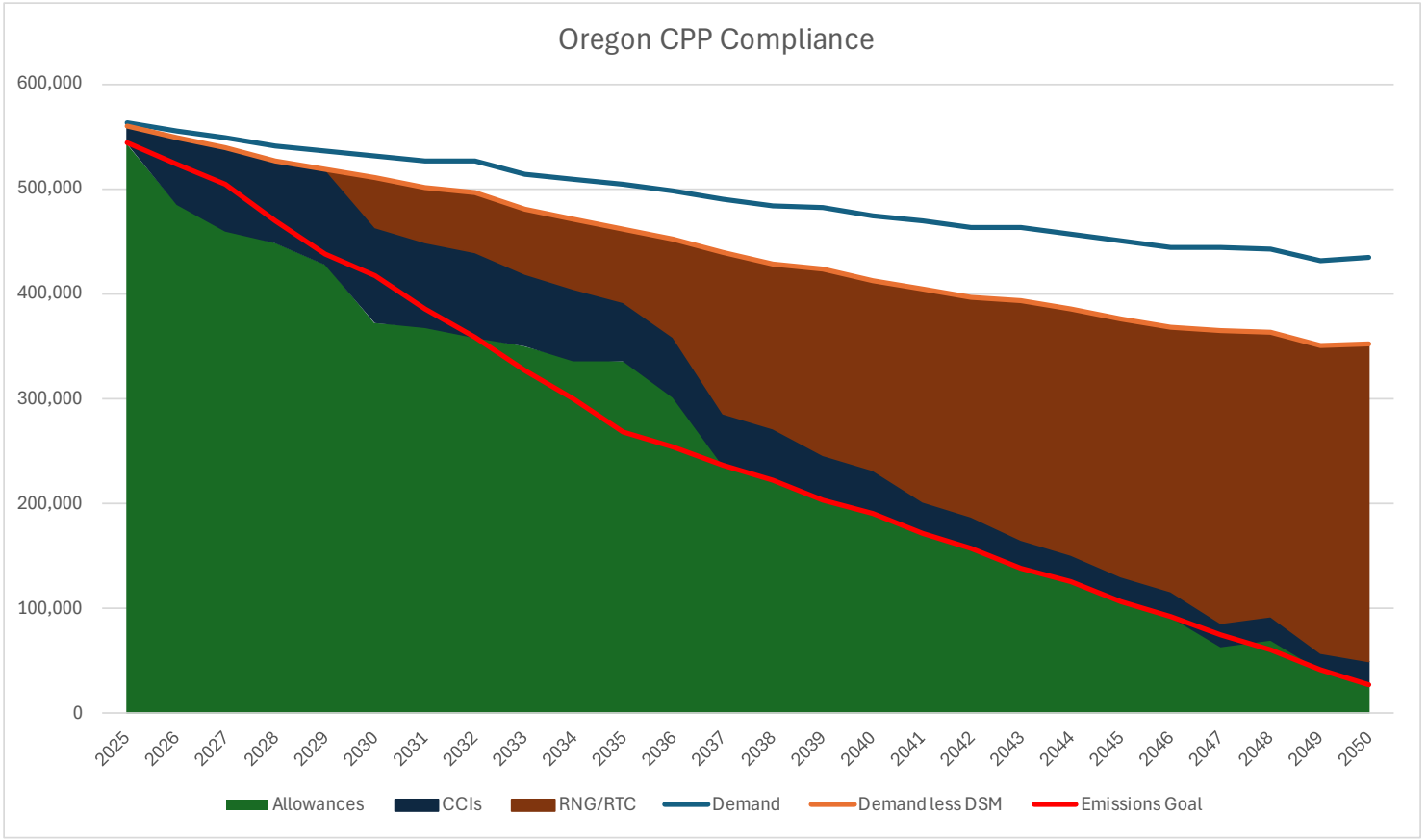
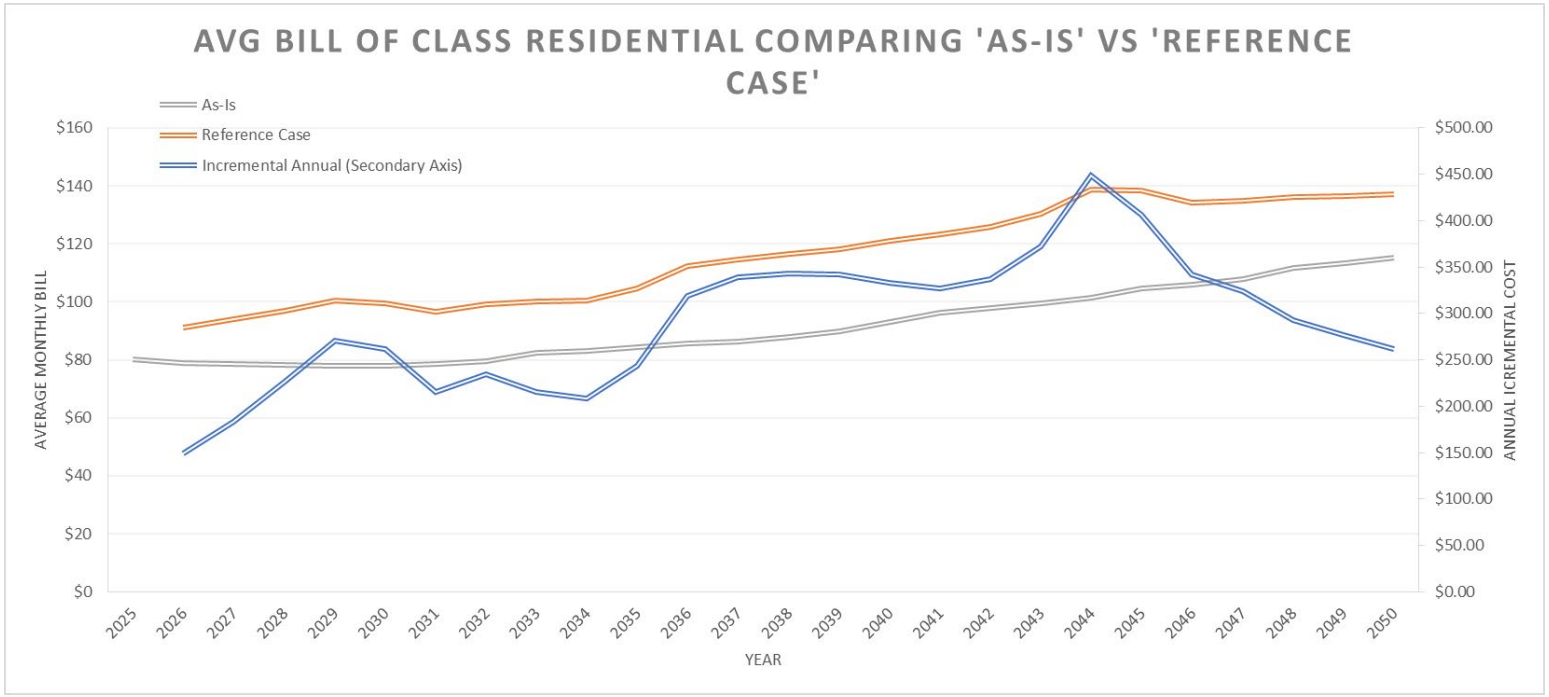


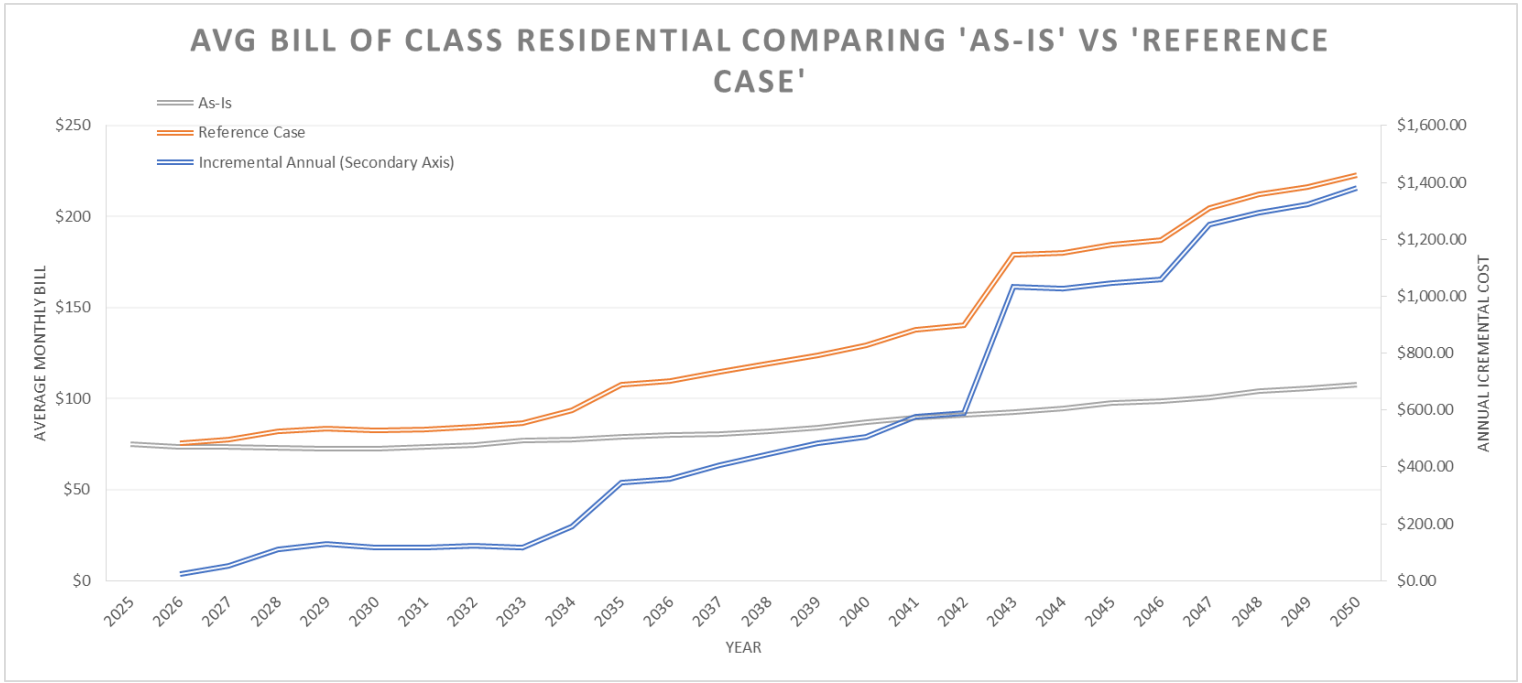
Washington Residential Bill Impacts

- The difference between as-is and expected is compliance costs.
- Cascade expects average bills to nearly double from 2025 to 2050 under the reference case.
- The per therm values will be used in the electrification model.



Oregon Residential Bill Impacts

- The difference between as-is and expected is compliance costs.
- Cascade expects average bills to increase from ~$75 per month to ~$225 per month from 2025 to 2050 under the reference case.
- The per therm values will be used in the electrification model.



Low Carbon Alternative Fuels Monte Carlo Pricing

- Renewable Natural Gas from Landfill Gas ranges from $156 to $627 per mtCO2e in 2025.
- Renewable Natural Gas from Wastewater ranges from $196 to $854 per mtCO2e in 2025.
- The range between the minimum and maximum expands by 2050.
- Plexos optimizes 200 samples to determine the least cost for each sample.
- Cascade will provide the remaining Monte Carlo inputs in the IRP appendices.

RNG: Landfill Gas ($/mtCO2e)		
Year	***Min***	***Max***
2025	$ 156	$ 627
2030	$ 211	$ 898
2035	$ 251	$ 1,104
2040	$ 299	$ 1,363
2045	$ 354	$ 1,680
2050	$ 413	$ 2,065

RNG: Wastewater ($/mtCO2e)		
Year	***Min***	***Max***
2025	$ 196	$ 854
2030	$ 262	$ 1,230
2035	$ 320	$ 1,539
2040	$ 385	$ 1,924
2045	$ 453	$ 2,394
2050	$ 525	$ 2,971

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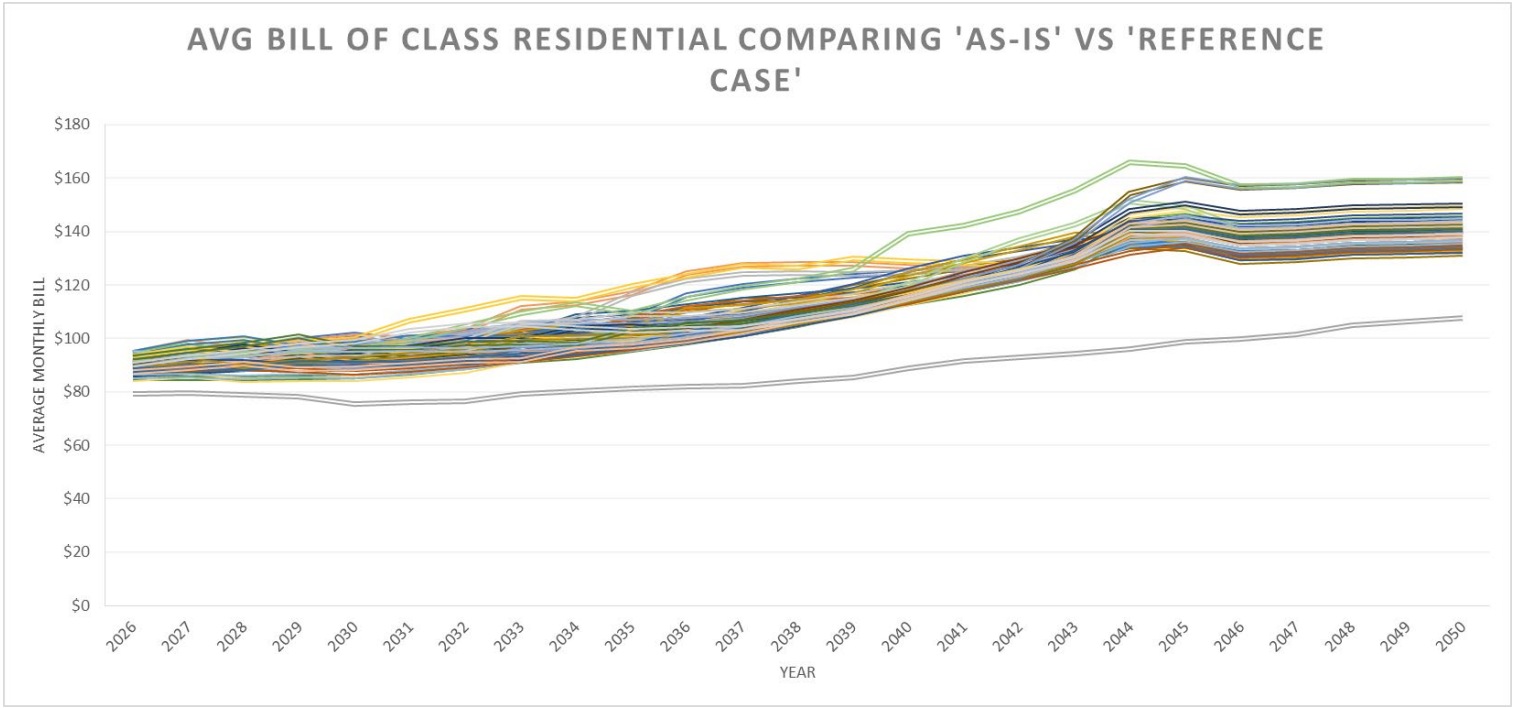
Low Carbon Alternative Fuels Monte Carlo Takes

- This table identifies the first year a compliance option was taken
- LFG-5 was the earliest option taken as it is the lowest cost option.
- Carbon Capture for the smaller facilities range from beginning in 2032 to 2047.
- These results only include 50 Monte Carlo samples.
- Cascade will provide the remaining Monte Carlo inputs in the IRP appendices.

First Year Takes	
Fuel Type	**Year**
LFG-3	2050
LFG-4	2034-2037
LFG-5	2028-2030
Blue Hydrogen	2030-2035
2032-2036	2032-2036
Carbon Capture: 25-50 MMBtu/hr	2032-2047
Carbon Capture: 50-100 MMBtu/hr	2047
Carbon Capture: 100-200 MMBtu/hr	2047
RTC: WW - Low	2048-2050

Washington Residential Bill Impacts

- Cascade will be computing the bill impacts for all 200 samples. Pictured here is only 50 samples.
- The 50 samples resulted in a ~$20-$40 range impact to average monthly bills.
- Cascade will provide all rate schedule impacts in the IRP appendices for WA and OR.



Incremental Supply Side Resources

New Storage Opportunity

Current Leased Storage Accounts

- **Jackson Prairie**
  - 4 accounts with 1,235,593 Dth of Capacity
- **Plymouth**
  - 2 accounts with 662,200 Dth of Capacity
- **Mist**
  - 1 account with 1,640,000 Dth of Capacity

New Storage Contract

Cascade has signed a new storage contract which is expected to begin service in mid-2029 with a 25-year term

This contract is not recallable, meaning that Cascade will have access to this contract for the full 25-year term and has also secured extension rights

Expected Storage Volumes

- Maximum Daily Injection Quantity (MDIQ): ~8,000 Dth/day
- Maximum Daily Withdrawal Quantity (MDWQ): ~20,000 Dth/day
- Maximum Storage Capacity (MSC): ~800,000 Dth

Further contractual details, including the negotiated rates, are bound by confidentiality agreements at this time, but will be available at a future date

Cascade Needs More Storage

Cascade continues to lag our regional peers in storage availability and flexibility

- Other regional LDCS have between ~2.5 and ~ 7 times the amount of storage capability compared to Cascade
- Other regional LDCs have more than twice the working inventory vs annual load requirements than Cascade
- Other regional LDCs have approximately twice the number of customers served per dth of peak day load as compared to Cascade

Missed opportunities for price arbitrage

As we look at potential for declining traditional pipeline transport, increased flexibility of storage is going to be necessary to deal with winter peaks and other critical operational challenges

Expectedly supply challenges with the increased British Columbia because of Woodfibre LNG, declining Rockies basins, and potential Westcoast expansion projects.

Distribution System Planning

ZACHARY SOWARDS– SENIOR ENGINEER

Presentation will cover:

1. Distribution system modeling process
2. Identification of system deficits/constraints
3. Distribution enhancements/reinforcements options to address deficits
4. Enhancement review and selection process to capital budget
5. Enhancement/reinforcements identified in 2025-2029 capital budget
6. Iterative process of IRP

System Dynamics:

Piping:

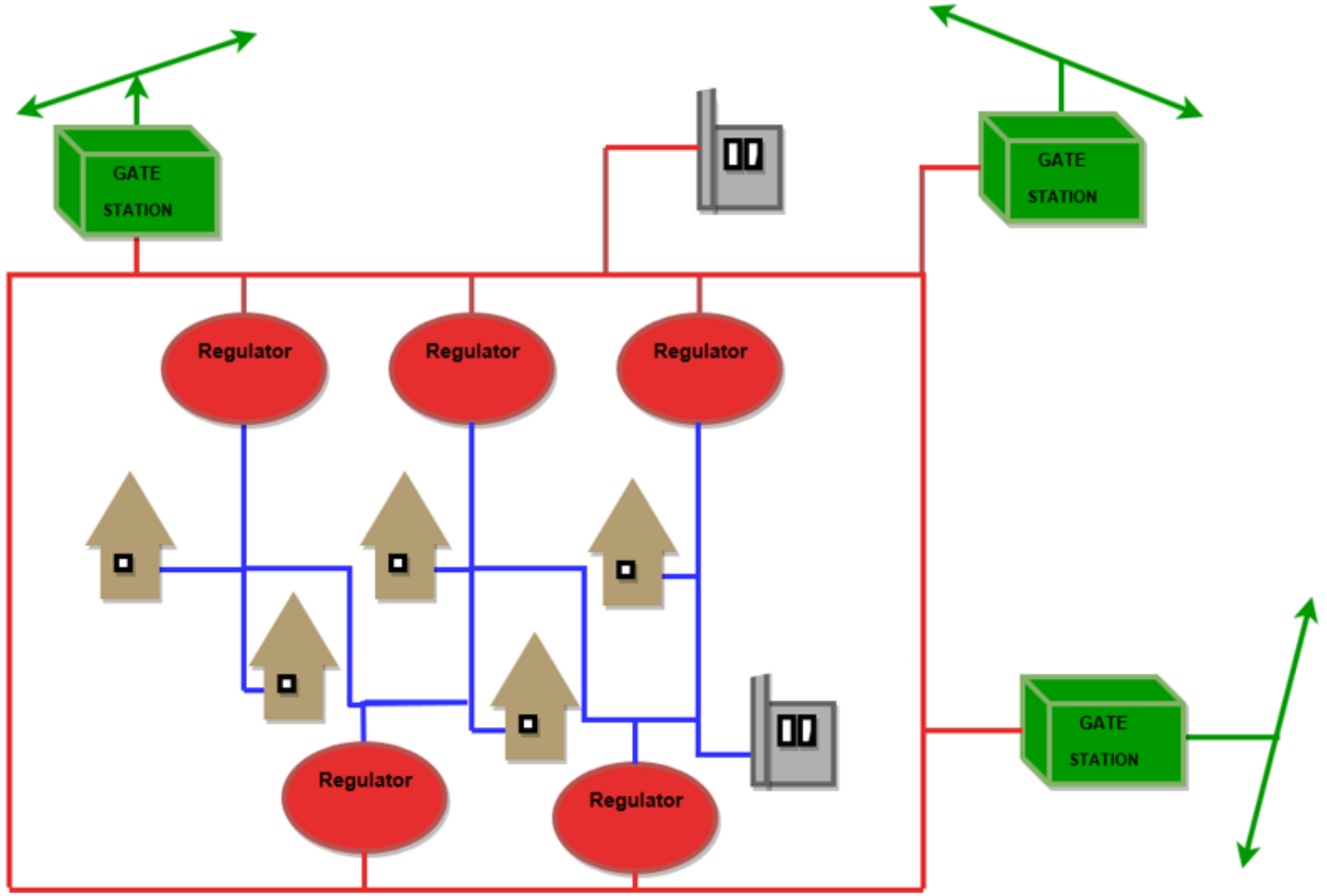
- Diameter – ½” to 20”
- Material – Polyethylene and Steel
- Operating Pressure – 20 psi to 900 psi
- Washington – approx. 5,083 miles of distribution & 170 miles of transmission
- Oregon – approx. 1,768 miles of distribution & 107 miles of transmission

System Dynamic's Cont.

Facilities:

- Regulator stations – Over 700
- Valves – Over 1,600
- Other equipment such as heaters, odorizer and compressors

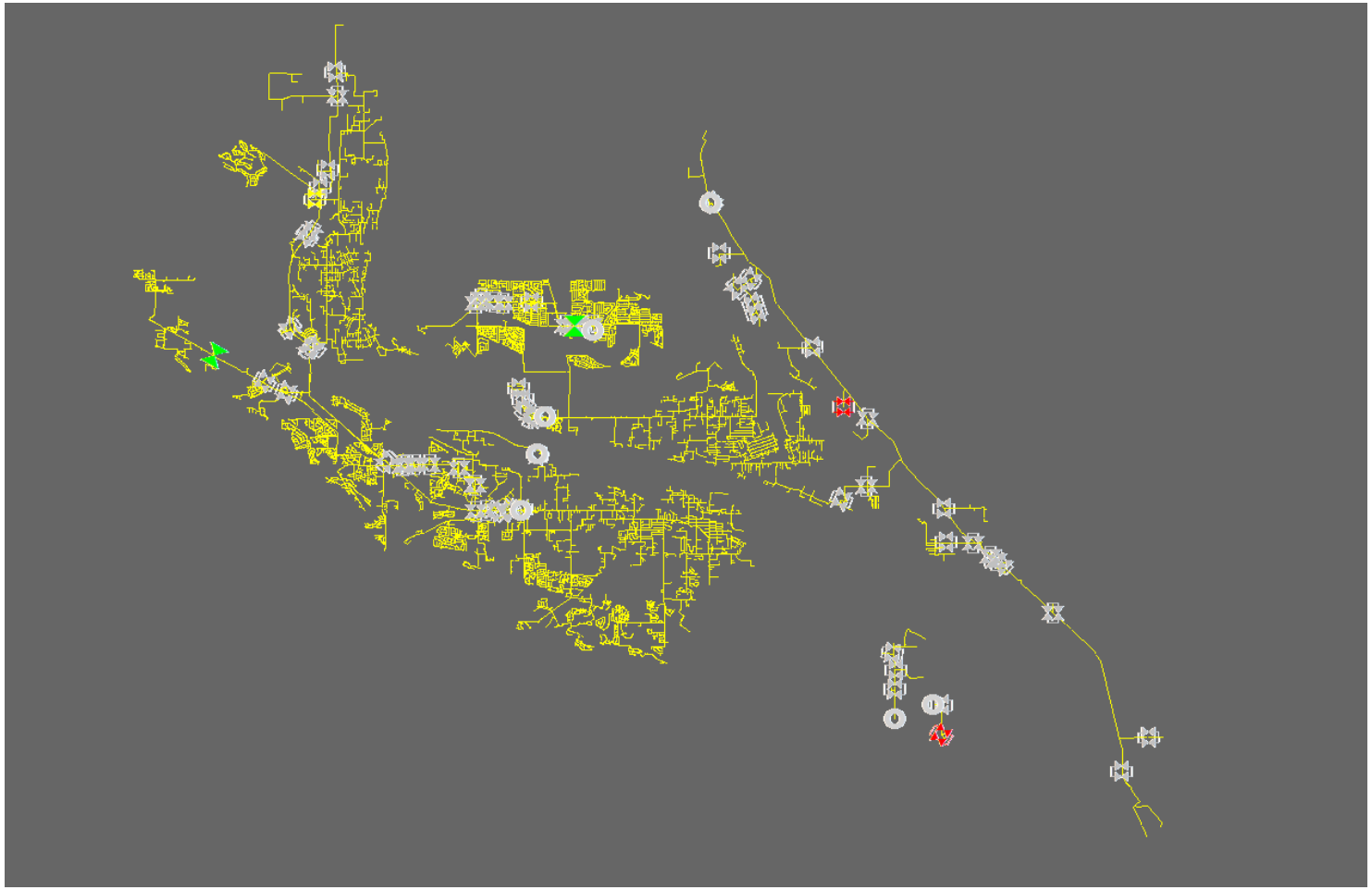
System Design



Synergi Gas Modeling

- To evaluate our systems for growth and potential future deficits we use our gas modeling software, Synergi Gas
- Synergi Gas is distributed and supported by DNV
- Synergi Gas models incorporate:
  - Total customer loads
  - Existing pipe and system configurations
- Synergi gas is a hydraulic modeling software that allows us to predict flows and pressures on our system based on gas demands predicted during a peak weather event.
- Synergi models are updated every three years and maintained between rebuilds

Synergi Model Example



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Model Building Process

Synergi models are completely rebuilt every three years and maintained/updated between rebuilds

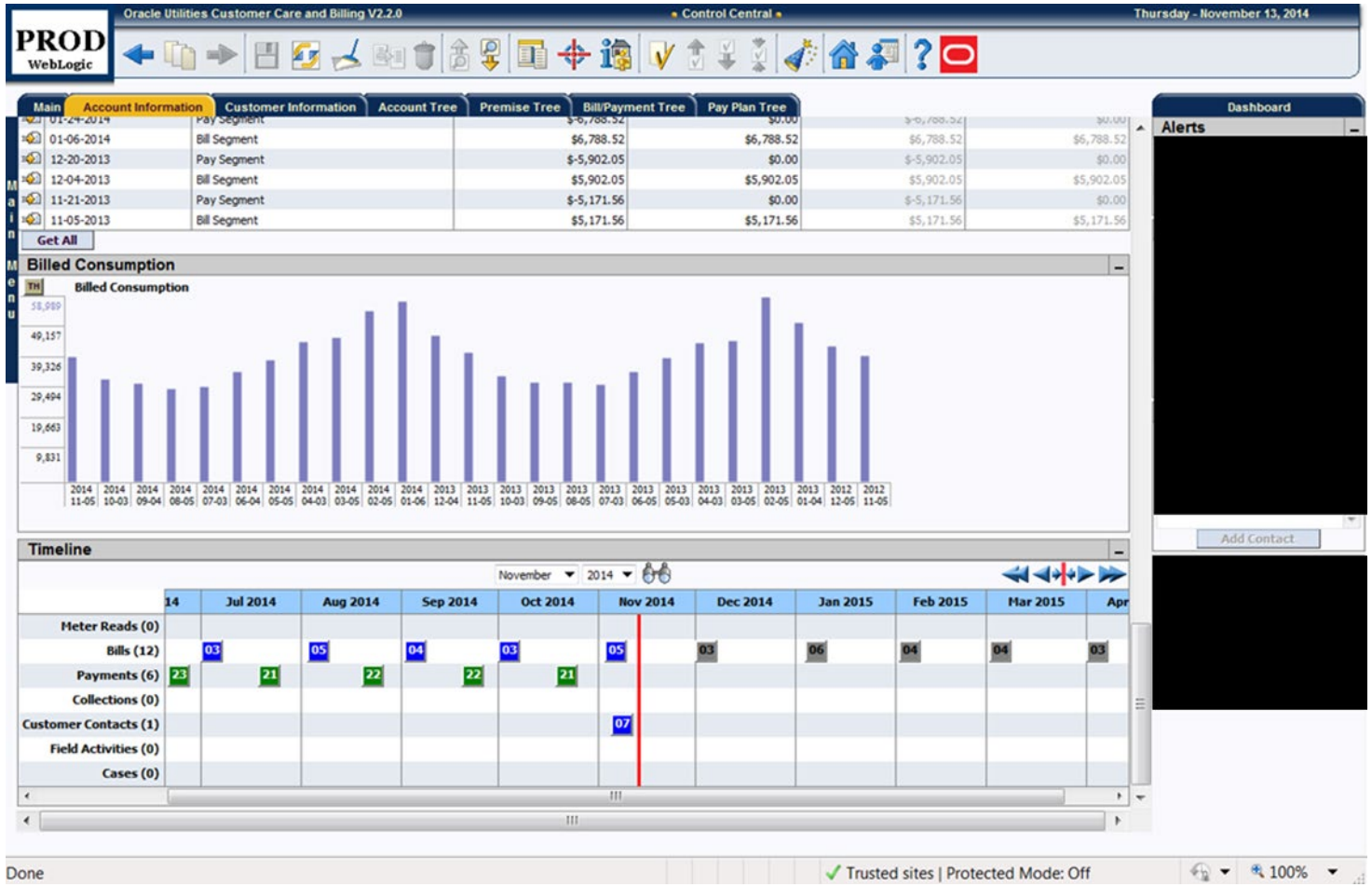
When models are rebuilt

- We export current GIS data to build spatial model
- We export current CC&B billing data to CMM to create an updated demands file
- We validate and calibrate each district model to a recent low-pressure event using existing data (ERXs/pressure charts/SCADA/metertek/LV usage)
- We create a design day model based on the updated heating degree day determined by gas supply (determined by trending historical weather events)

CNG models were rebuilt in 2024

Data Gathering

CC&B (Customer Billing Data)



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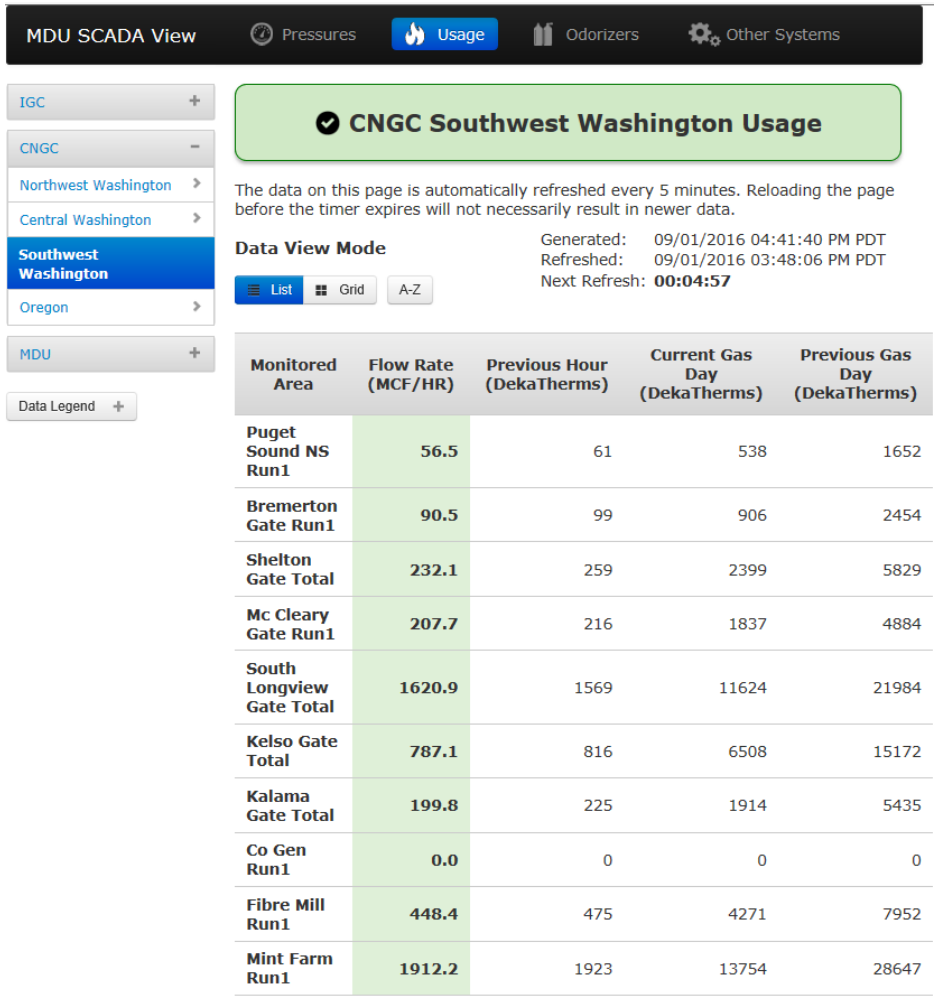
Data Gathering



Monitored Area	Flow Rate (MCF/HR)	Previous Hour (DekaTherms)	Current Gas Day (DekaTherms)	Previous Gas Day (DekaTherms)
Puget Sound NS Run1	56.5	61	538	1652
Bremerton Gate Run1	90.5	99	906	2454
Shelton Gate Total	232.1	259	2399	5829
Mc Cleary Gate Run1	207.7	216	1837	4884
South Longview Gate Total	1620.9	1569	11624	21984
Kelso Gate Total	787.1	816	6508	15172
Kalama Gate Total	199.8	225	1914	5435
Co Gen Run1	0.0	0	0	0
Fibre Mill Run1	448.4	475	4271	7952
Mint Farm Run1	1912.2	1923	13754	28647

SCADA Data

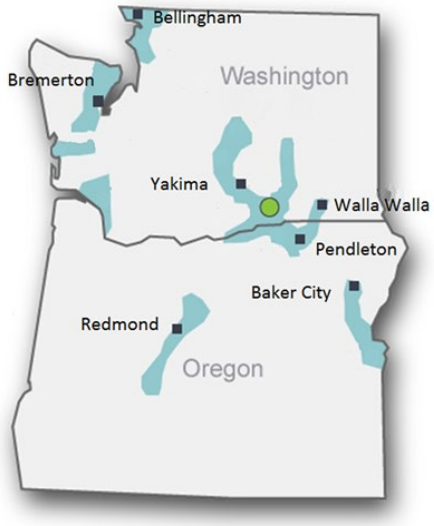
Real time and historical flow characteristics at specific locations in the system

Data Gathering

District	HDD	Avg Daily Temperature (°F)
Aberdeen	46	14
Bellingham	47	13
Bend	71	-11
Bremerton	46	14
Eastern Oregon	73	-13
Kennewick	65	-5
Longview	46	14
Mt Vernon	47	13
Pendleton	67	-7
Walla Walla	66	-6
Wenatchee	65	-5
Yakima	65	-5

Peak Heating Degree Day (HDD) modeled by CNG based on historical weather data

Peak HDD = 60 – Average Daily Temp



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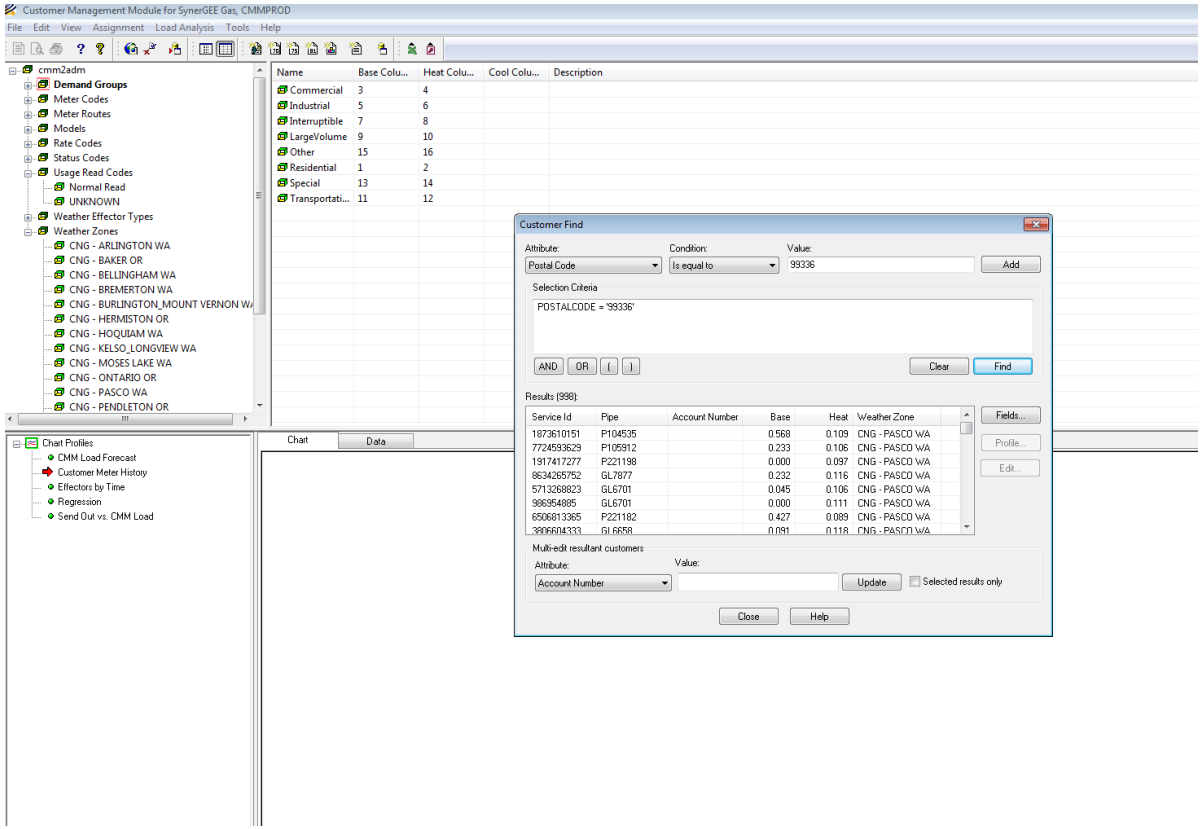
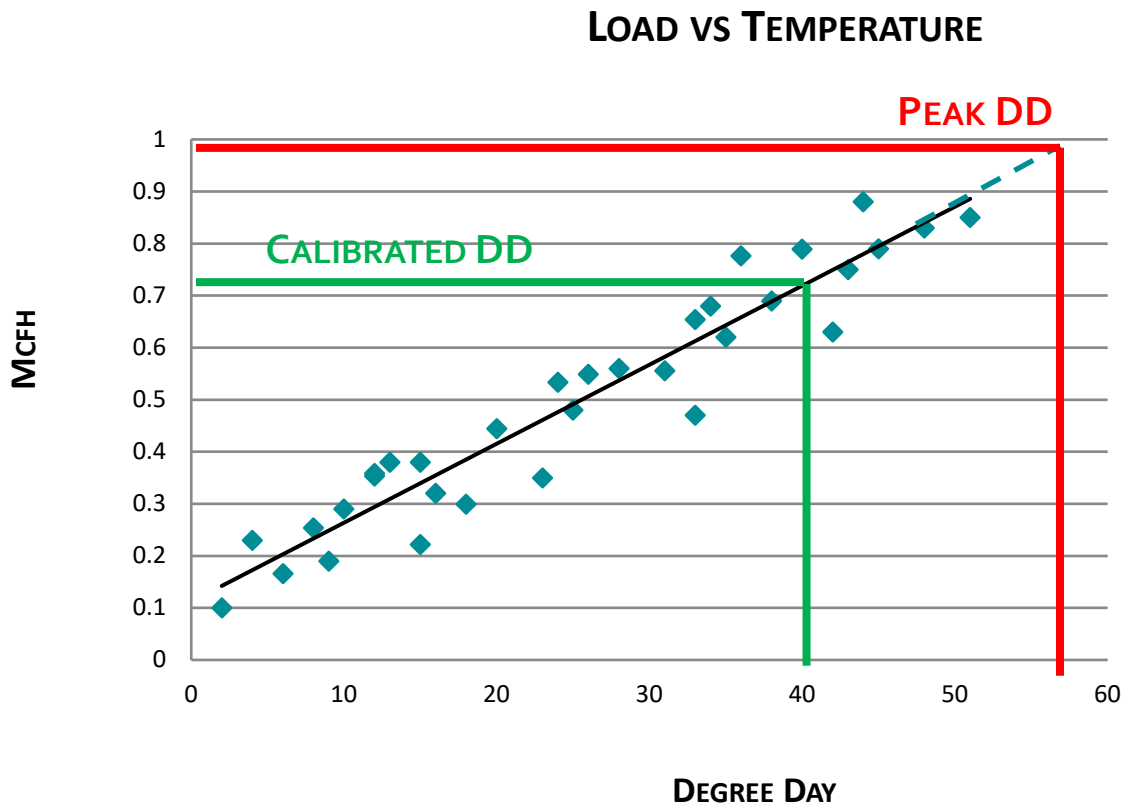
Customer Management Module (CMM)



Brings CC&B customer data into Synergi as demands file

Demand file applies load spatially in the model.

Calibrated vs Peak Degree Day



$y = 0.0152x + 0.1118$

HEAT BASE

40 DD = 0.72 MCFH

58 DD = 0.99 MCFH

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Identification of system deficits/constraints

Synergi Modeling Capabilities:

- Review Large Volume Customer requests
- Model RNG
- Supports design/sizing of pipe and pipeline components (regulator stations, compressors)
- Future planning
- Model IRP predicted growth
- Identify deficiencies
- Determine system reliability
- Optimize distribution enhancement options

What is a capacity deficit?

A deficit is defined as a critical system that is at or limiting capacity.

Critical system examples include:

- Pipeline bottlenecks
- Minimum inlet pressure to a regulator station or HP system
- Not meeting a required customer delivery pressure
- Component limiting capacity

Distribution System Modeling Process to ensure we can meet IRP growth predictions

As part of the IRP process, we complete a comprehensive review of all of our distribution system models every two years to ensure that we can maintain reliable service to our customers during peak low temperature events.

With our capital budget cycle, we also complete system reviews on an annual basis.

If a deficit is predicted the system is evaluated and a reinforcement/enhancement is proposed and selected based on alternative analysis considerations and placed into the capital budget based on timing needs of the predicted deficit.

Distribution Enhancement/Reinforcement Options to Address Deficits

Enhancement Options

Pipeline:

- Replacements
- Reinforcements
- Loops & Back feeds
- Pressure Increases
- Uprates

Facility Upgrades

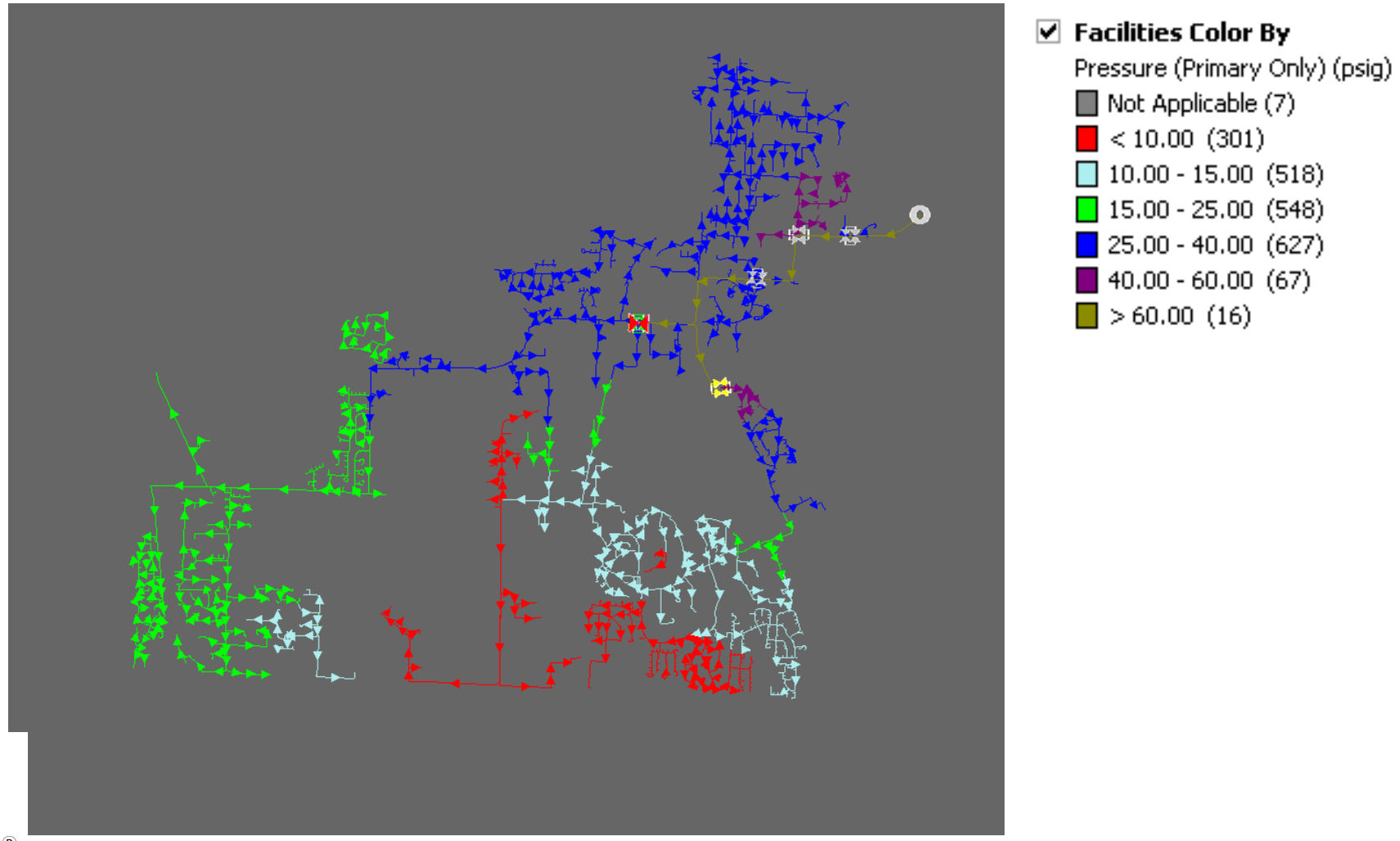
Additional Regulator Stations feeding the distribution system

New Strategically placed Gate Stations

Compressor Stations

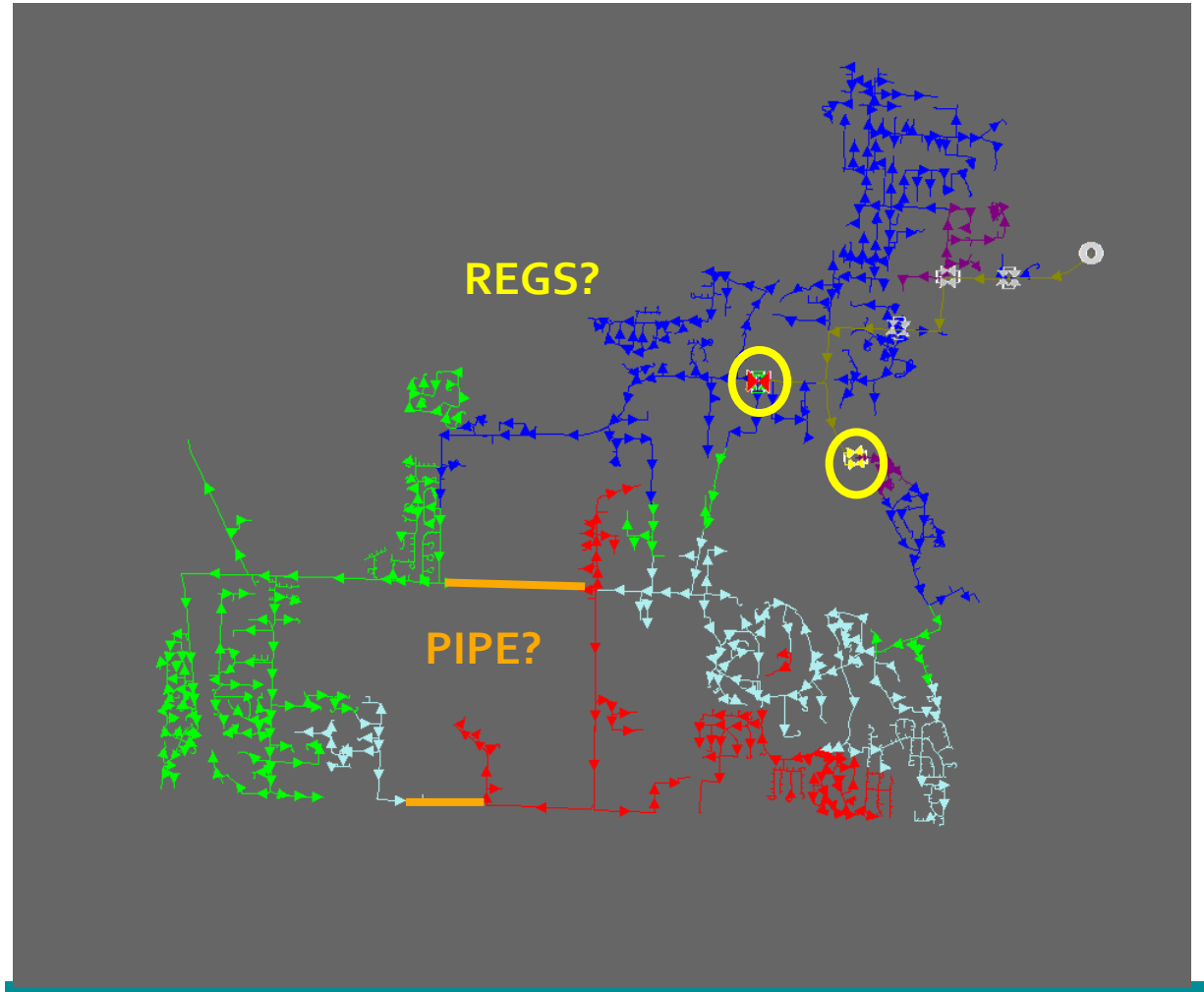
Distribution Enhancement Example

Theoretical low-pressure scenario



Distribution Enhancement Options

Low pressure scenario

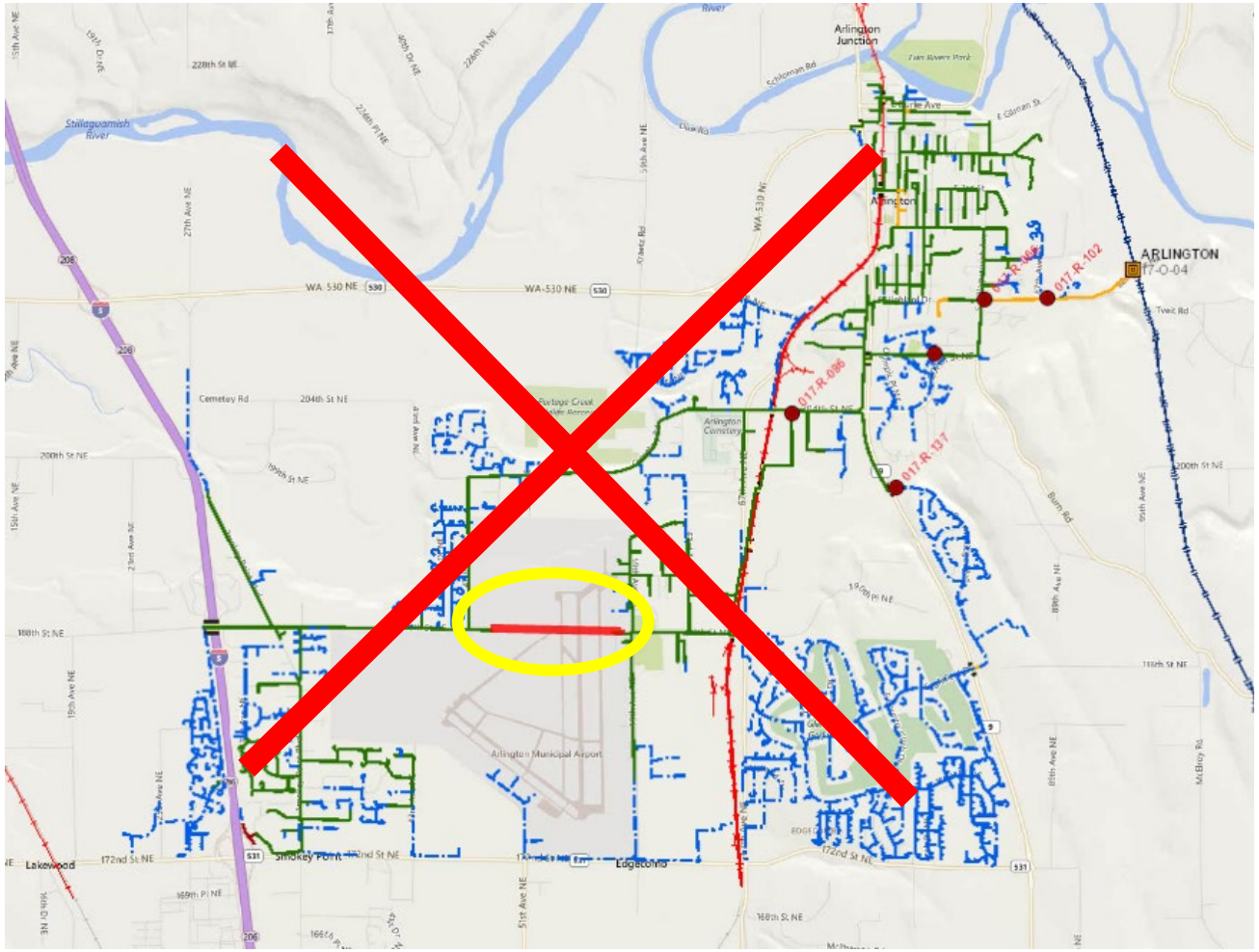


Facilities Color By
Pressure (Primary Only) (psig)
- Not Applicable (7)
- < 10.00 (301)
- 10.00 - 15.00 (518)
- 15.00 - 25.00 (548)
- 25.00 - 40.00 (627)
- 40.00 - 60.00 (67)
- > 60.00 (16)

- Compressor station infeasible
- Other Solutions?

Distribution Enhancement Options

Reinforcement option #1



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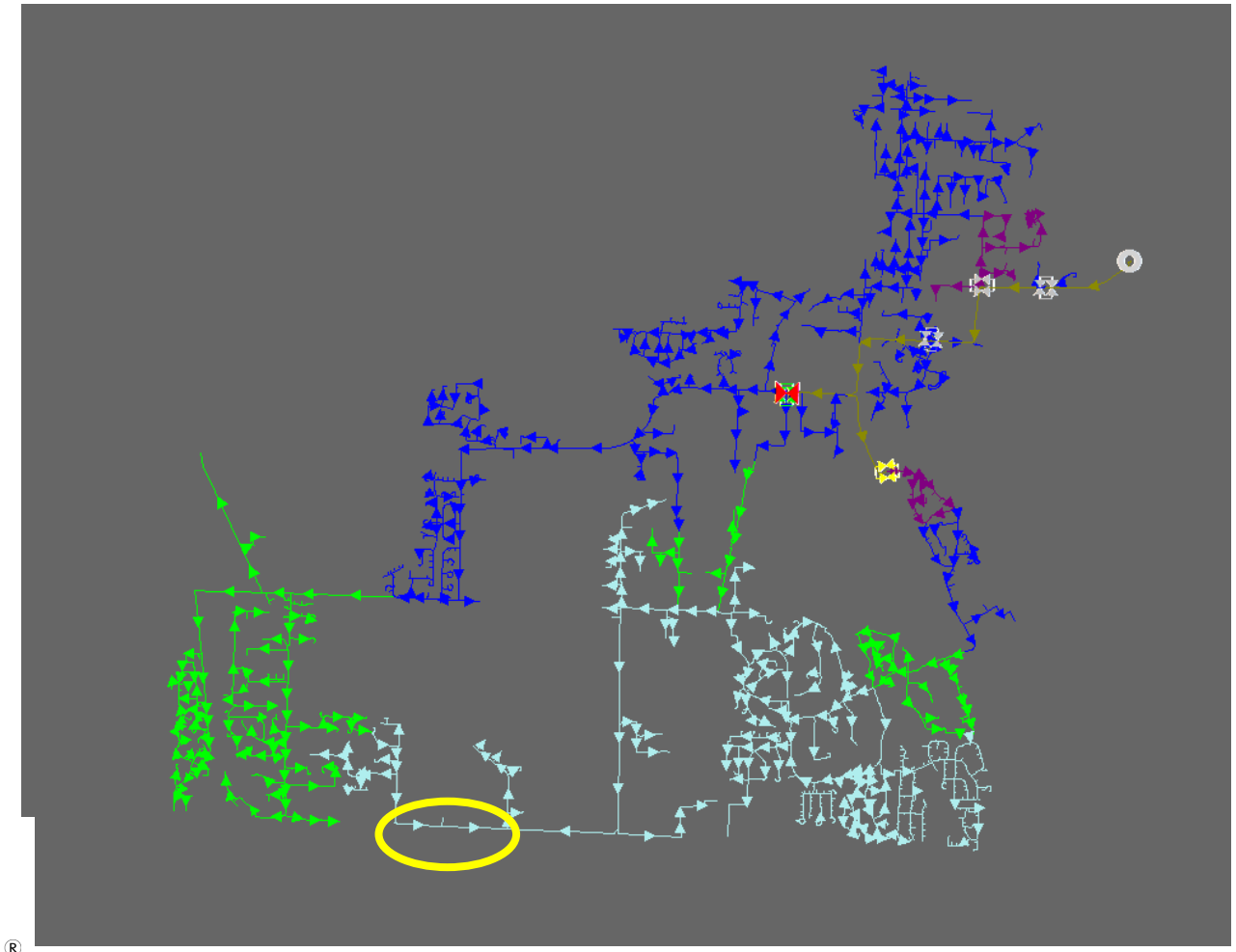
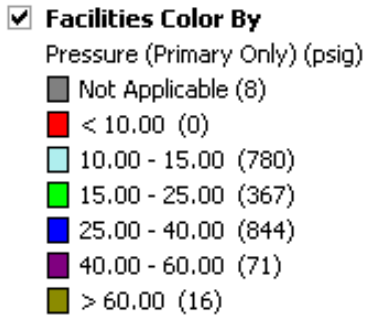
Distribution Enhancement Options

Reinforcement option #2





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Enhancements Considerations

Scope

Cost

Capacity Increase

Timing

System Benefits

Alternative Analysis

Enhancement Review and Selection Process to Capital Budget

Enhancement Selection Guidelines:

Shortest segment of pipe that addresses deficiency

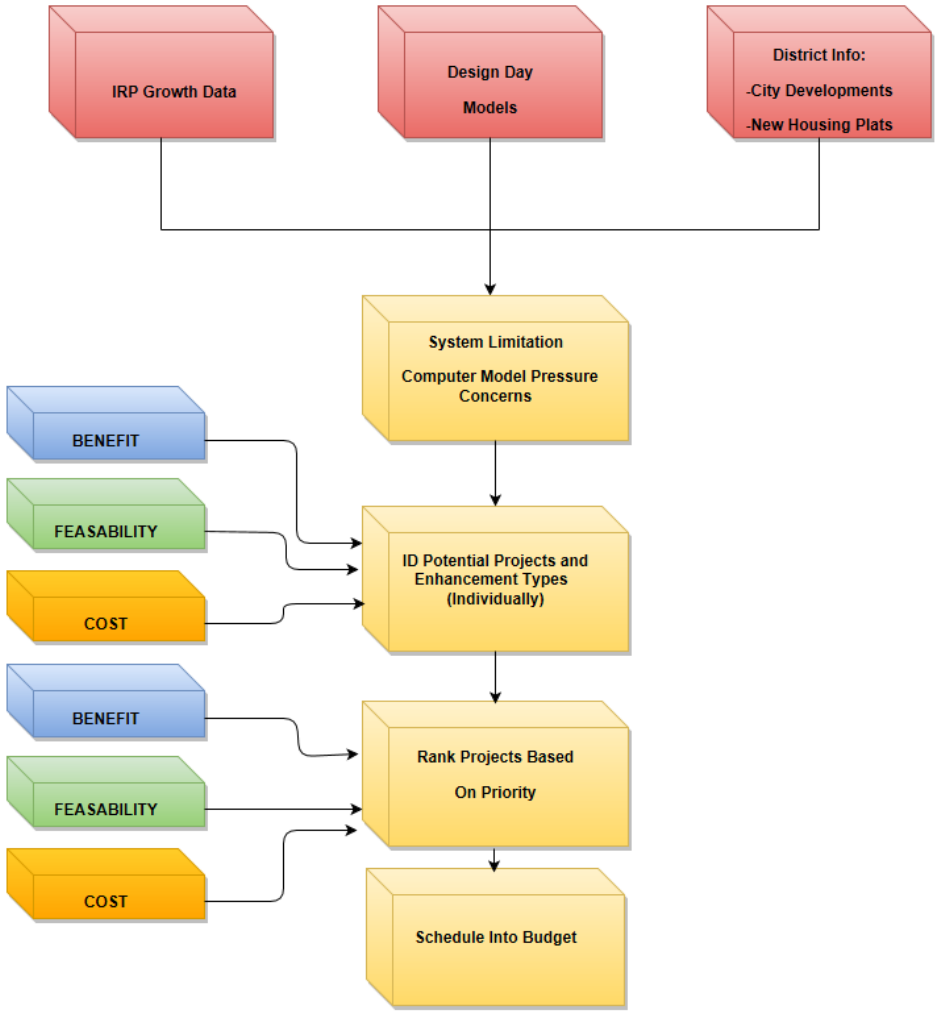
Segment of pipe with the most favorable construction conditions

Segment of pipe that minimizes environmental concerns and impacts to the community

Segment of pipe that provides opportunity to add additional customers

Total construction cost including restoration

Enhancement Selection Process:



Info & Data

Project & Schedules

Enhancements/Reinforcements Identified in 2025-2029 Capital Budget

2025-2029 WA Distribution Enhancements:

- Kitsap Phase V Pipeline Reinforcement
- Aberdeen 8-inch HP – Wishkah Rd
- Richland HP Reinforcements
- Pasco 6-inch HP Reinforcement
- Burlington South Feed Reinforcement
- Elma Gate

Kitsap Phase V Pipeline Reinforcement

Scope: 4 miles of 12-inch HP

Cost: $690k in 2026 and $6.9M in 2027

Timing:

- 2026 Design and Permitting
- 2027 Construction

Benefits: Completes 12-inch Loop from Shelton to Bremerton on 8-inch Kitsap Transmission Line (installed in 1963)

Alternative Considered: Supports long term system planning, ties into Phase IV and Phase III

Aberdeen 8-inch HP - Wishkah Rd

Scope: 9,000 ft of 8-inch HP

Cost: $540k from 2023-2024 & $7.1M in 2025

Timing: 2023-2024 Design/Permitting & 2025 Construction

Benefits: Provides capacity for continued growth in Aberdeen

Alternatives Considered: Uprating/reinforcing an existing HP system in addition to a gate station rebuild.

Richland HP Reinforcements

RICHLAND 12-INCH HP PHASE 2

Scope: 3.75 miles of 12-inch HP

Cost: $9.56M in 2025

Timing: 2025 Construction

RICHLAND Y GATE UPGRADE

Scope: Gate Upgrade

Cost:

- CNG
  - $2.05M in 2025
- NWP
  - $4.53M in 2025

Timing: 2025 Construction

Benefits: Solves capacity deficit in Richland and provides a back feed to Richland HP

Alternatives Considered: Upgrading the Kennewick gate and replacing the 6-inch Richland HP lateral on Clearwater and Columbia Center

Pasco 6-inch HP Reinforcement

Scope: 5 miles of 6-inch HP

Cost: $5.8M in 2025

Timing:

- 2025 Construction

Benefits: Addresses high pressure capacity deficit in Pasco

Alternatives Considered: Upgrade North Pasco gate and reinforce HP out of gate

Burlington South Feed Reinforcement

Scope: 15,000 ft of 6-inch PE and Reg Station

Cost: $500k between 2022-2024 & $1.1M in 2025

Timing:

- 2022-2024 Design and Permitting
- 2025 Construction

Benefits: Addresses low pressure issues in Burlington, loops system

Alternatives Considered: HP extension with a new reg station, no equivalent DP loops

Elma Gate Station

Scope: Second supply source to the Greys Harbor Lateral

Cost:

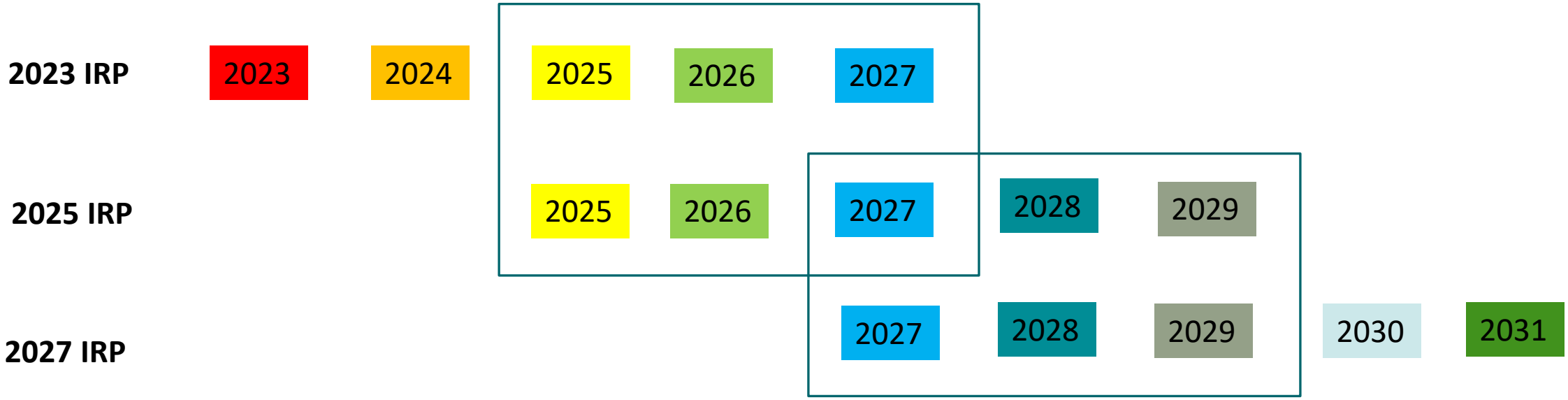
- CNG
  - $259k in 2027 & $1.8M in 2028
- NWP
  - $520k in 2027 & $3.7M in 2028

Timing: 2027 Design/Permitting & 2028 Construction

Benefits: Addresses high pressure issues in Aberdeen and provides redundancy to McCleary Gate

Alternatives Considered: Reinforce and or replace Greys Harbor Lateral

Iterative Process of IRP



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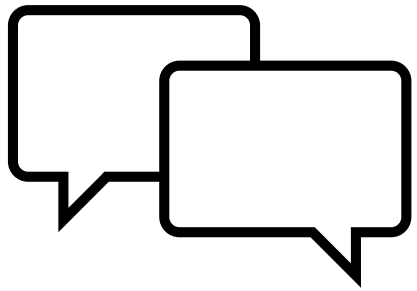
Feedback for Cascade



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2025 WA IRP Schedule

Process Item	Date	Process Element
Final Draft	Tuesday, March 4, 2025	
Comments Due	Tuesday, April 15, 2025	
TAG 5 (if needed)	Thursday, May 1, 2025	
Final Complete By	Friday, May 16, 2025	
File	Friday, May 23, 2025	

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Integrated Resource Plan
Technical Advisory Group Meeting #4

FEBRUARY 5, 2025

MICROSOFT TEAMS/TELECONFERENCE

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