CASCADE NATURAL GAS CORPORATION®
A Subsidiary of MDU Resources Group, Inc.

In the Community to Serve®

Washington Integrated Resource Plan Targeted Technical Advisory Group Meeting #7

MAY 16, 2024

MICROSOFT TEAMS/TELECONFERENCE

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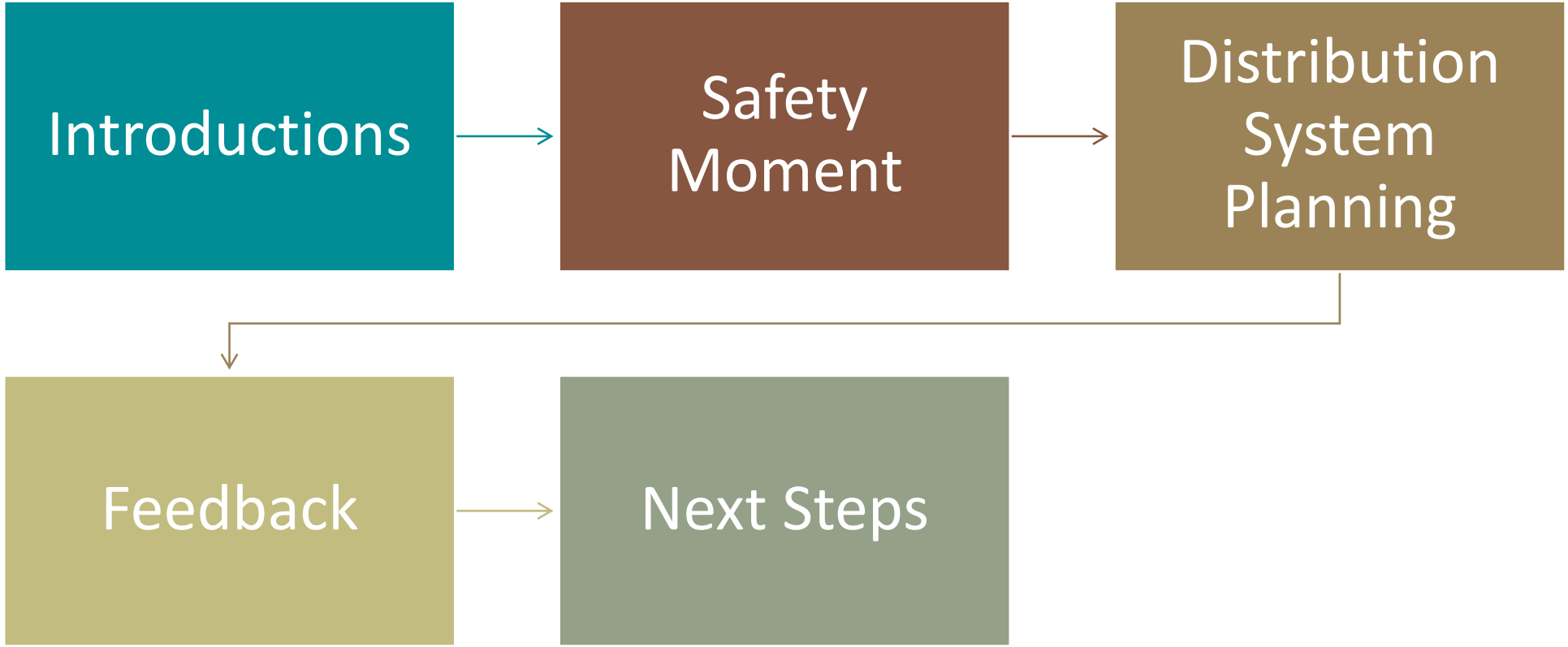
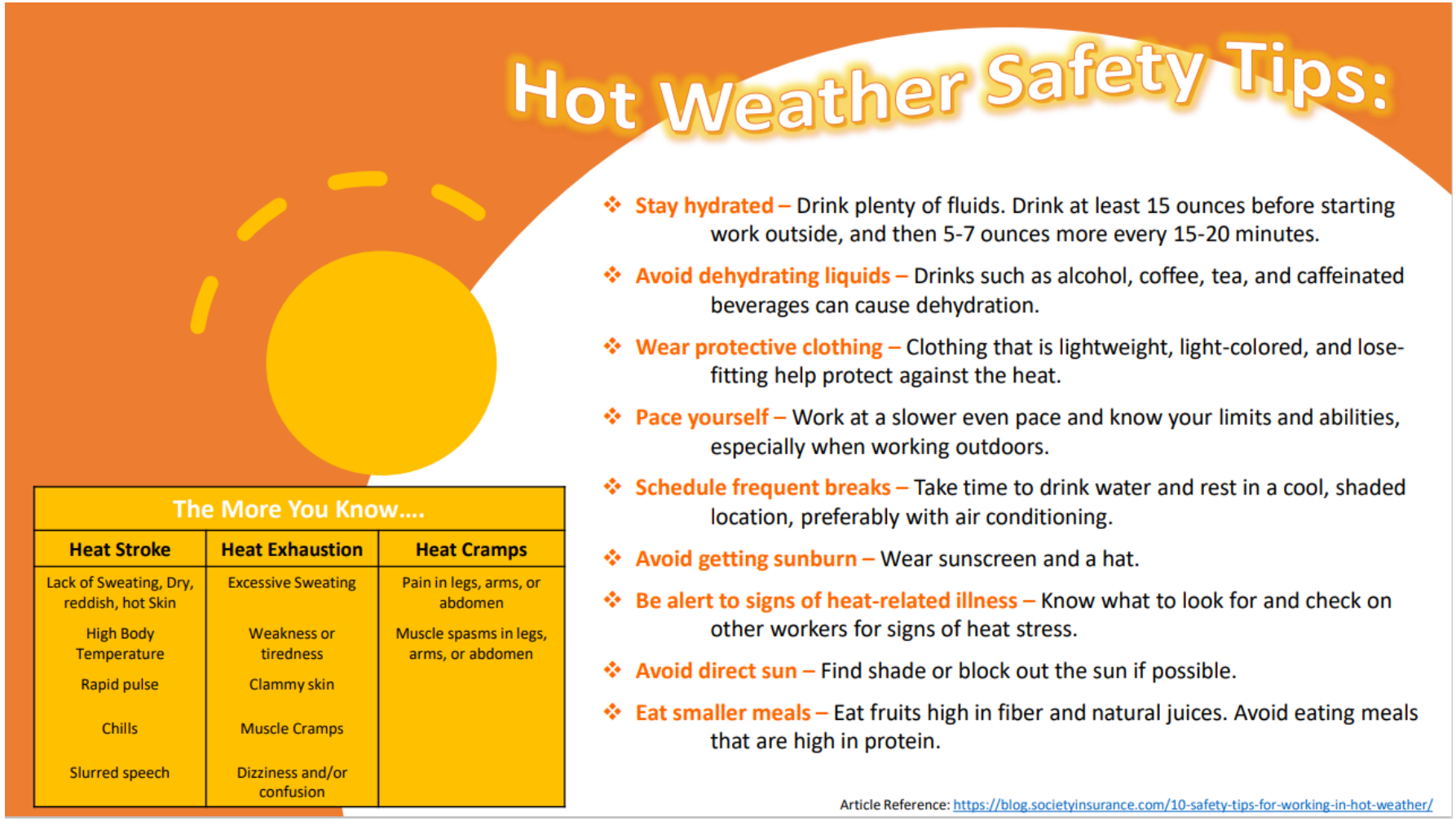
Agenda


Introductions
Safety Moment
Distribution System Planning
Feedback
Next Steps

Safety Moment



Distribution System Planning

KATHLEEN CAMPBELL, PE – SENIOR ENGINEER

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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. Utility Discussion on meeting energy needs

Distribution System Modeling

System Dynamics:

Piping:

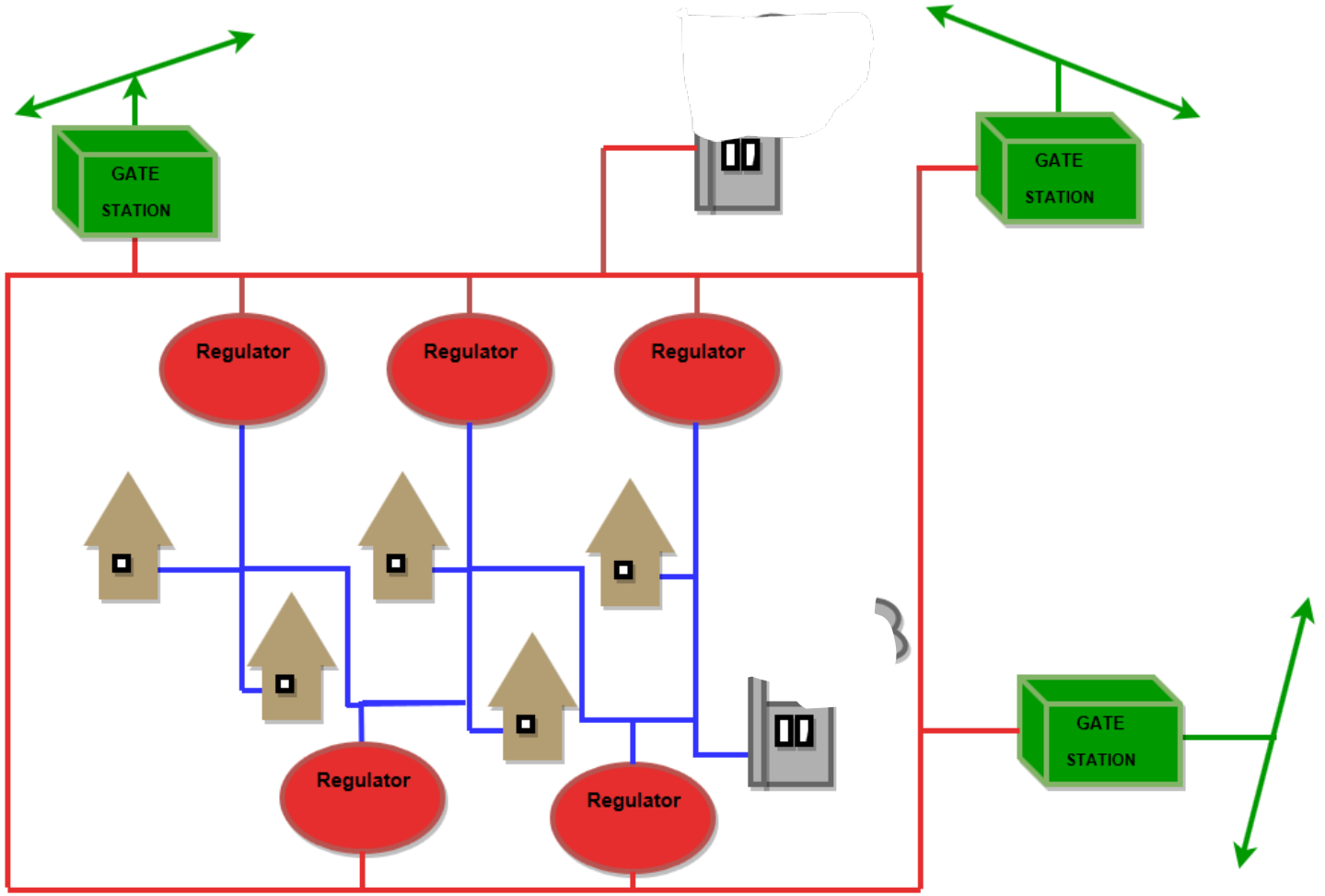
- Diameter – ½” to 20”
- Material – Polyethylene and Steel
- Operating Pressure – 20 psi to 900 psi
- Washington – approx. 4,893 miles of distribution & 170 miles of transmission
- Oregon – approx. 1,710 miles of distribution & 107 miles of transmission

System Dynamic's Cont.

Facilities:

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

System Design



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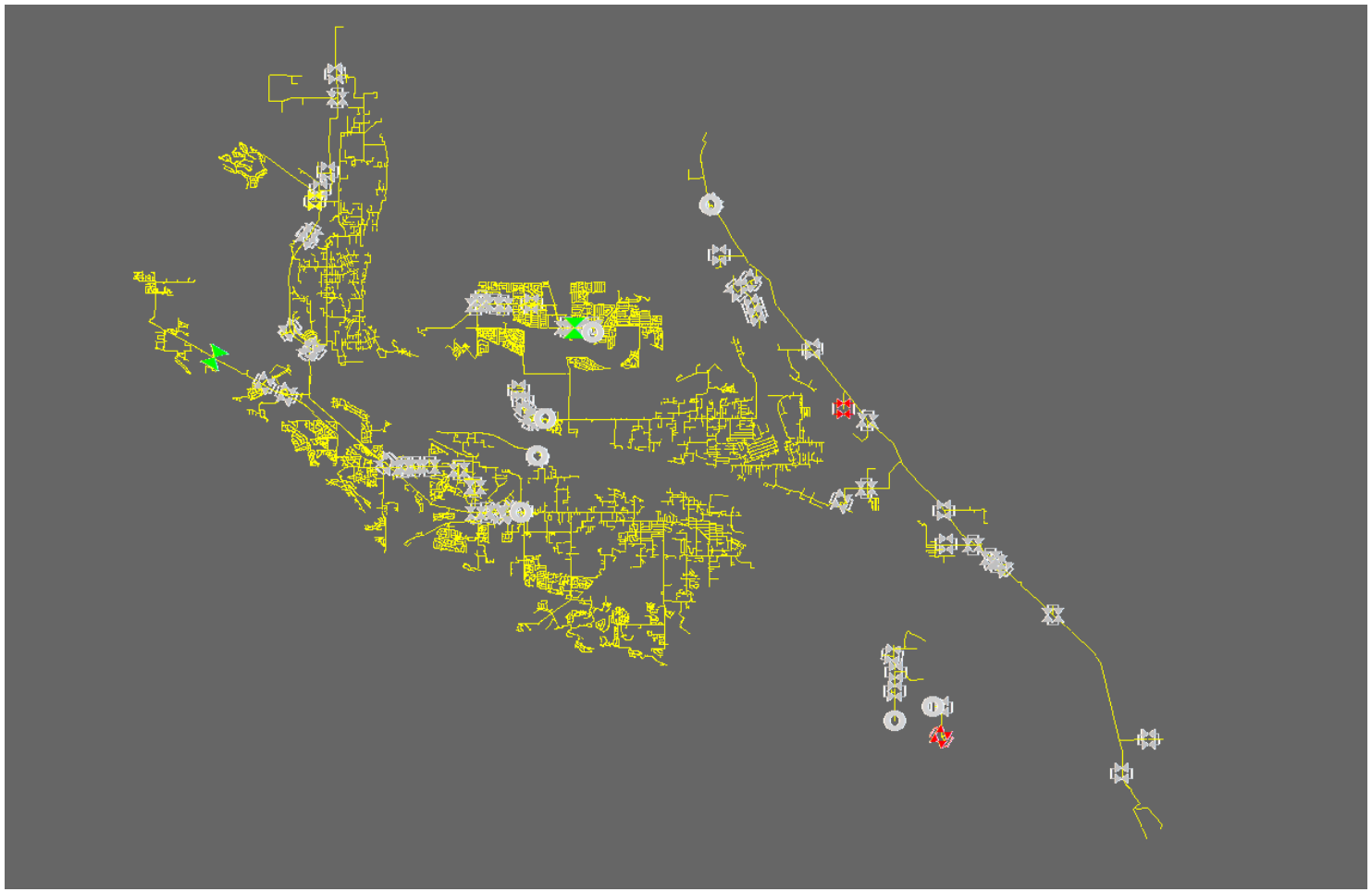
Synergi Gas Modeling

- Synergi gas is distributed and supported by DNV
- Synergi Gas models incorporates:
  - Total customer loads
  - Existing pipe and system configurations
- Synergi gas is an industry used 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 rebuilt and validated every three years and maintained between rebuilds

Synergi Model Example



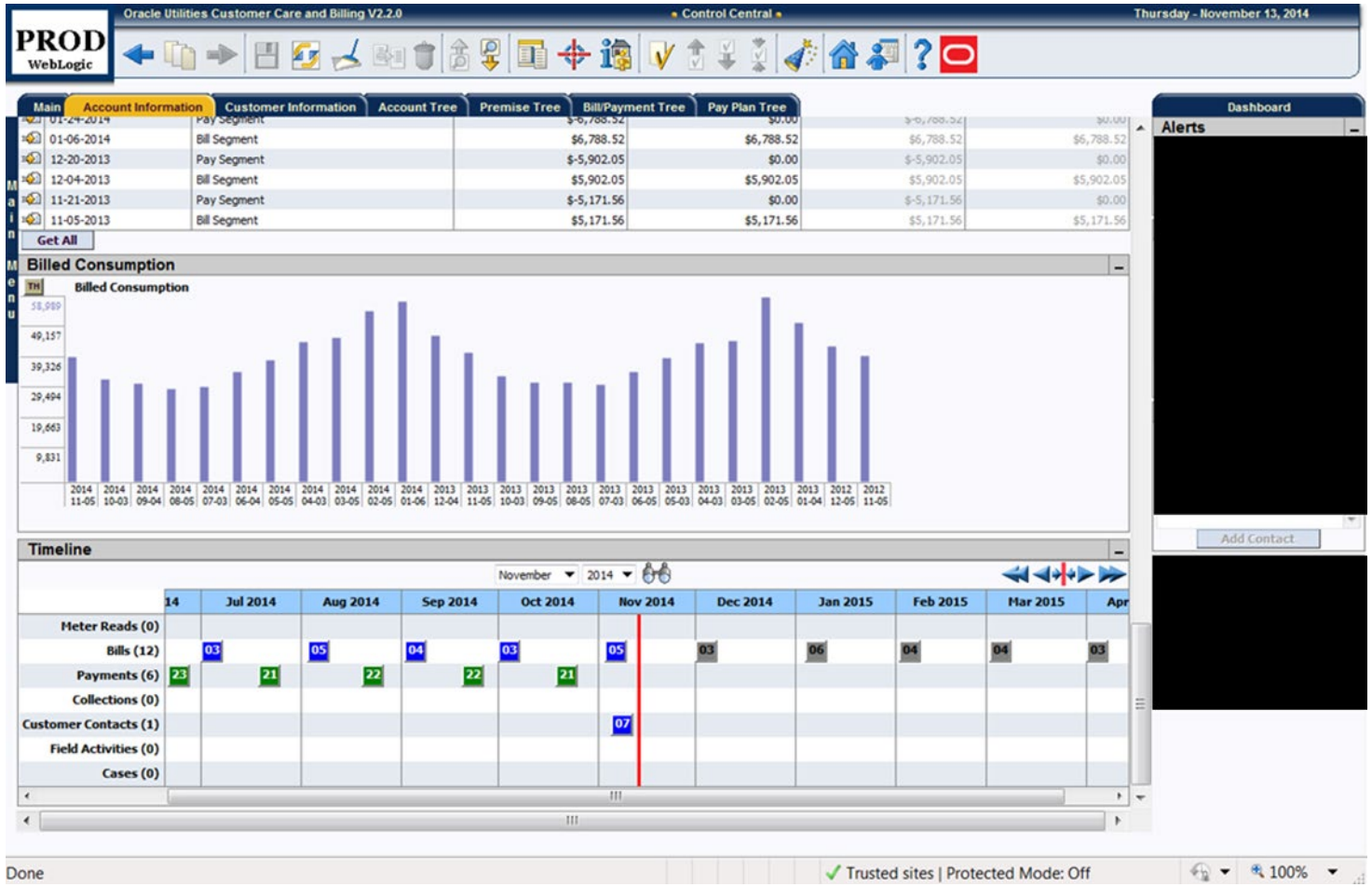
Model Building Process

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)

Data Gathering

CC&B (Customer Billing Data)



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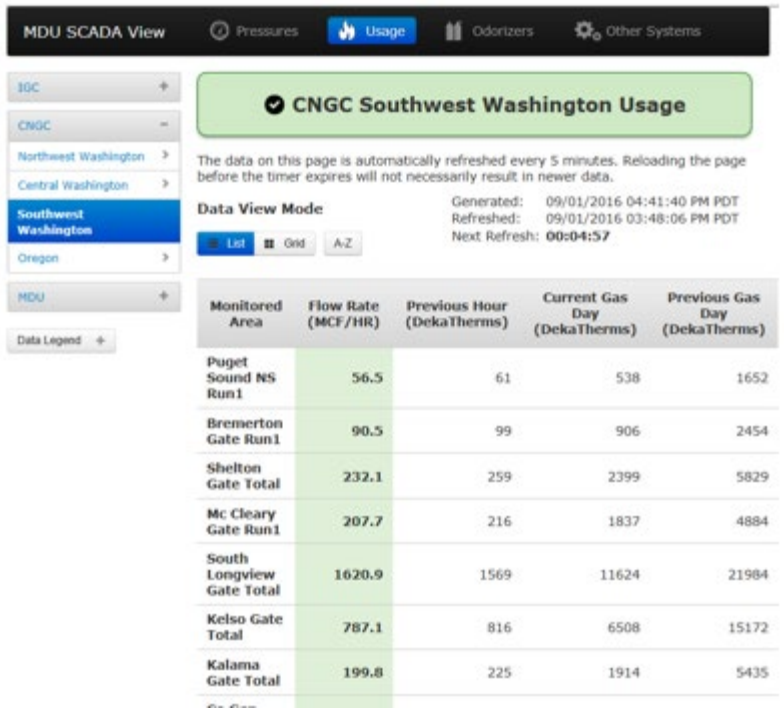
Data Gathering



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

SCADA Data

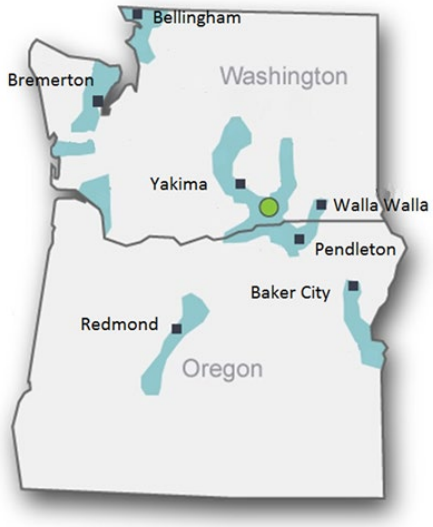
Real time and historical flow characteristics at specific locations in the system

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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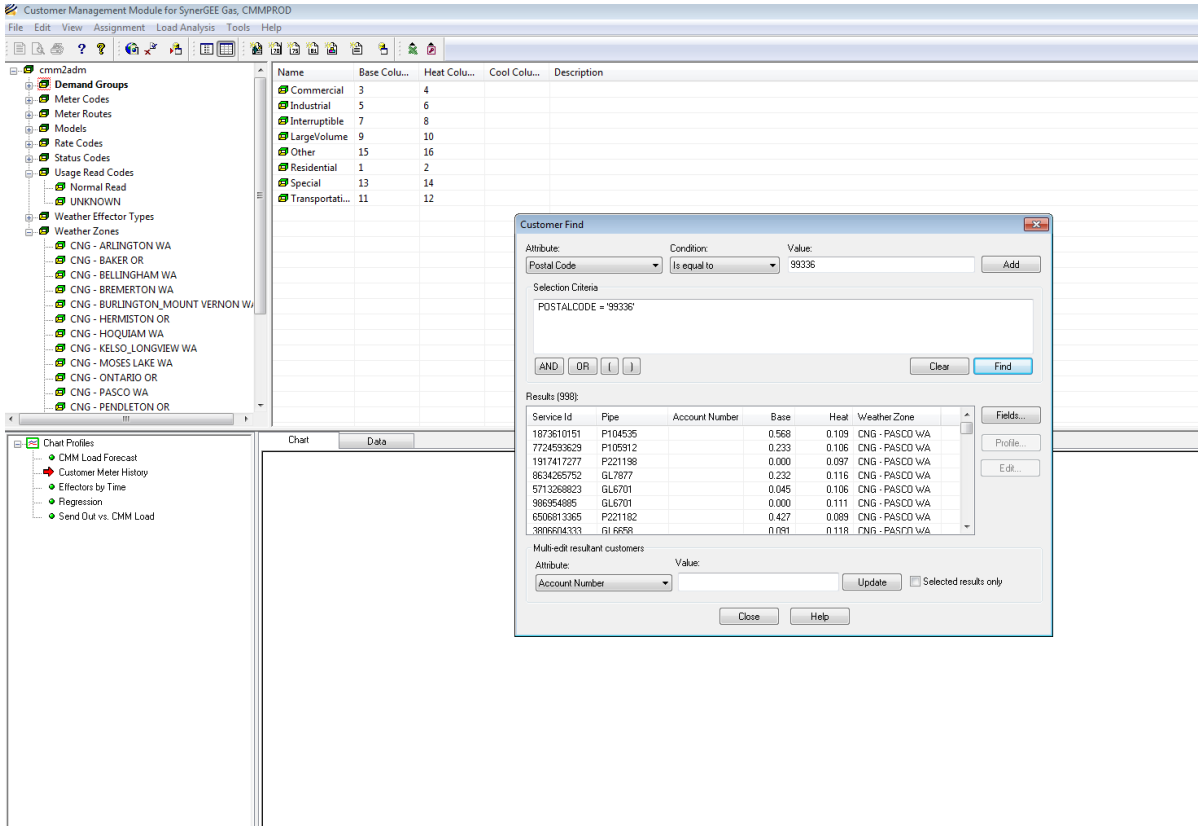
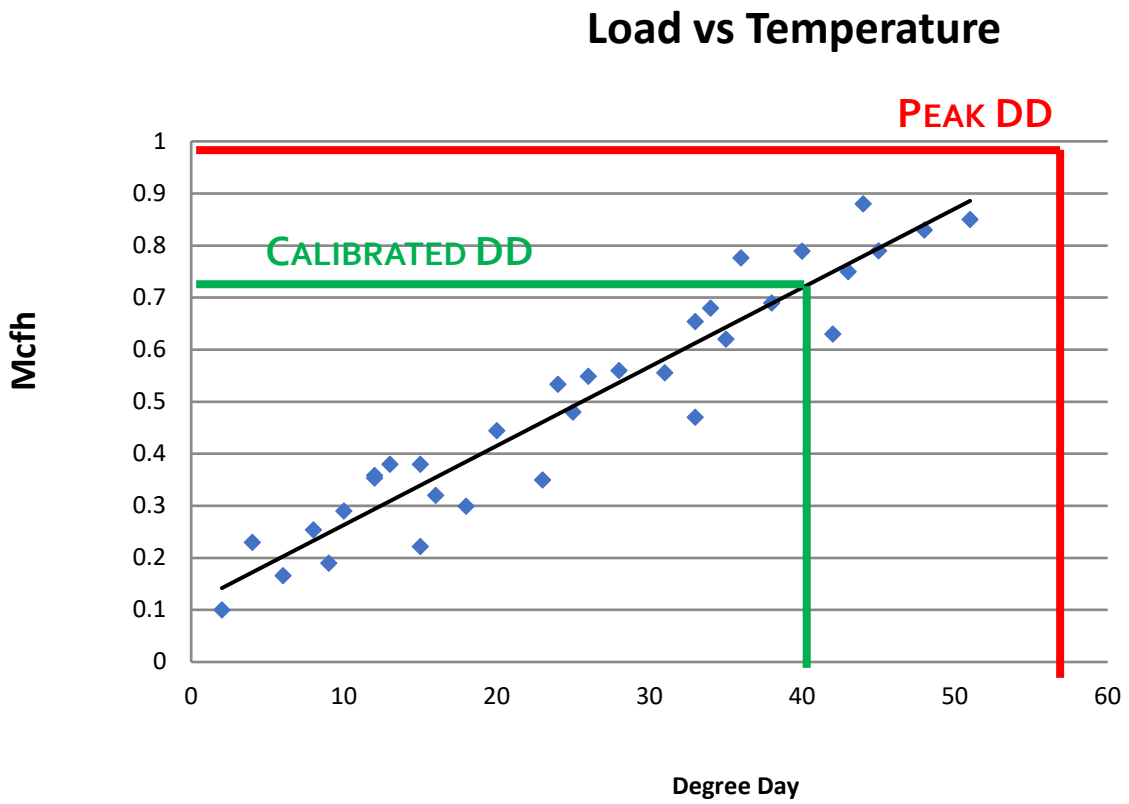
Customer Management Module (CMM)



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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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

Demand Side Management

- Built into our 5-year growth predictions
- Past demand side management efforts have been incorporated into updated CMM/CC&B data used on the 2023 model rebuild.
- Could be considered as an alternative to address a deficit

Renewable Natural Gas (RNG) Modeling Update

- Cascade now has RNG flowing onto our system from the Horn Rapids Landfill and Lamb Weston RNG (both in Richland, WA).
- Still seeing significant interest from RNG developers in Cascade's service territory.
- Additional RNG will be coming online in 2024.
- Cascade currently models RNG at 1/100 of contract demand in design day models.

Identification of System Deficits/Constraints

What is a Capacity Deficit?

A deficit is defined as a critical system that has reached a 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
- Velocity

Growth Modeling

- Model out 5-year growth predicted in the IRP to determine if or when a capacity deficit exists.
- Iterative process to determine deficit timing.
- We want to make sure that our systems can support growth and maintain reliable service during peak demand.

System reviews to avoid deficits

- Complete a comprehensive review of each distribution system model 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

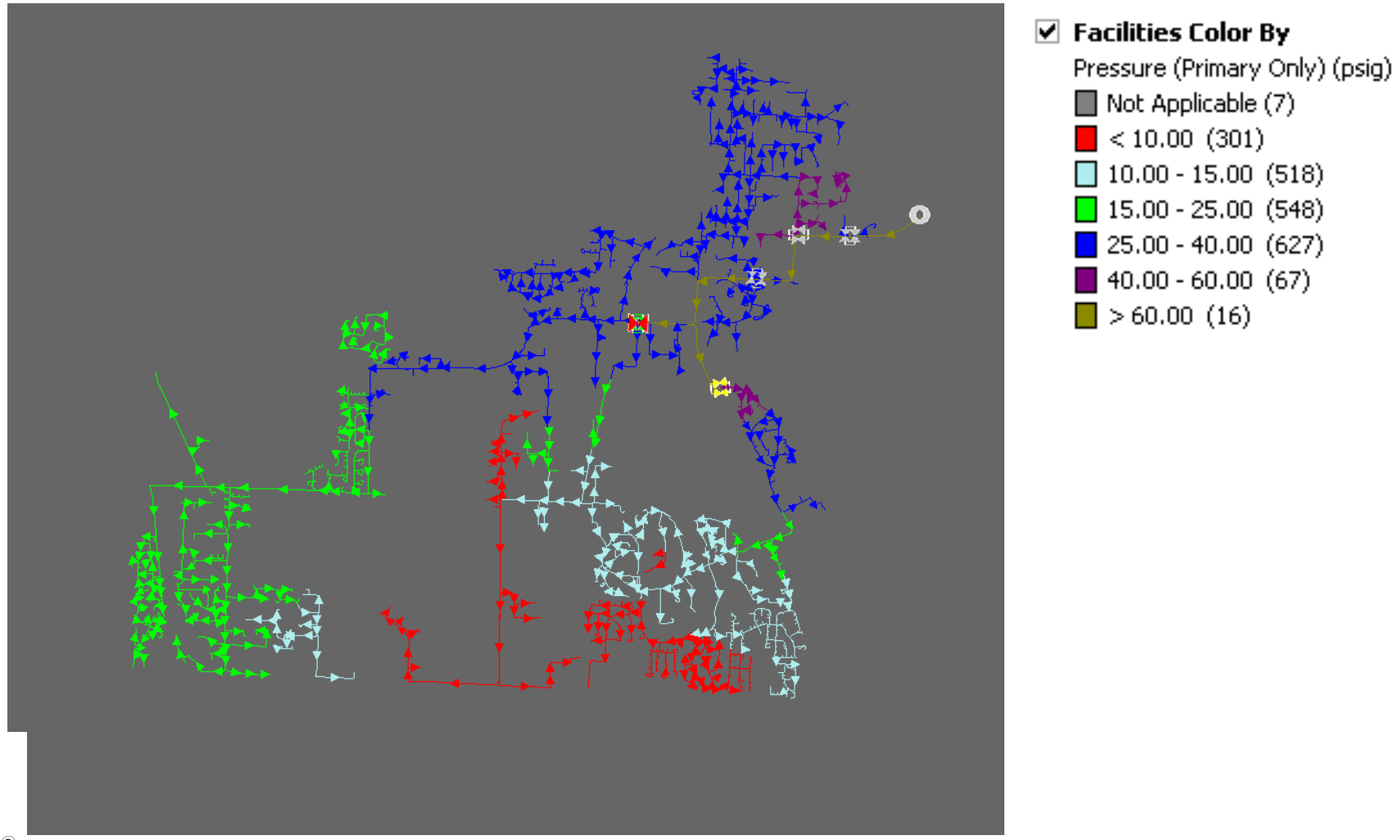
Additional Regulator Stations feeding the distribution system

New Strategically placed Gate Stations

Compressor Stations

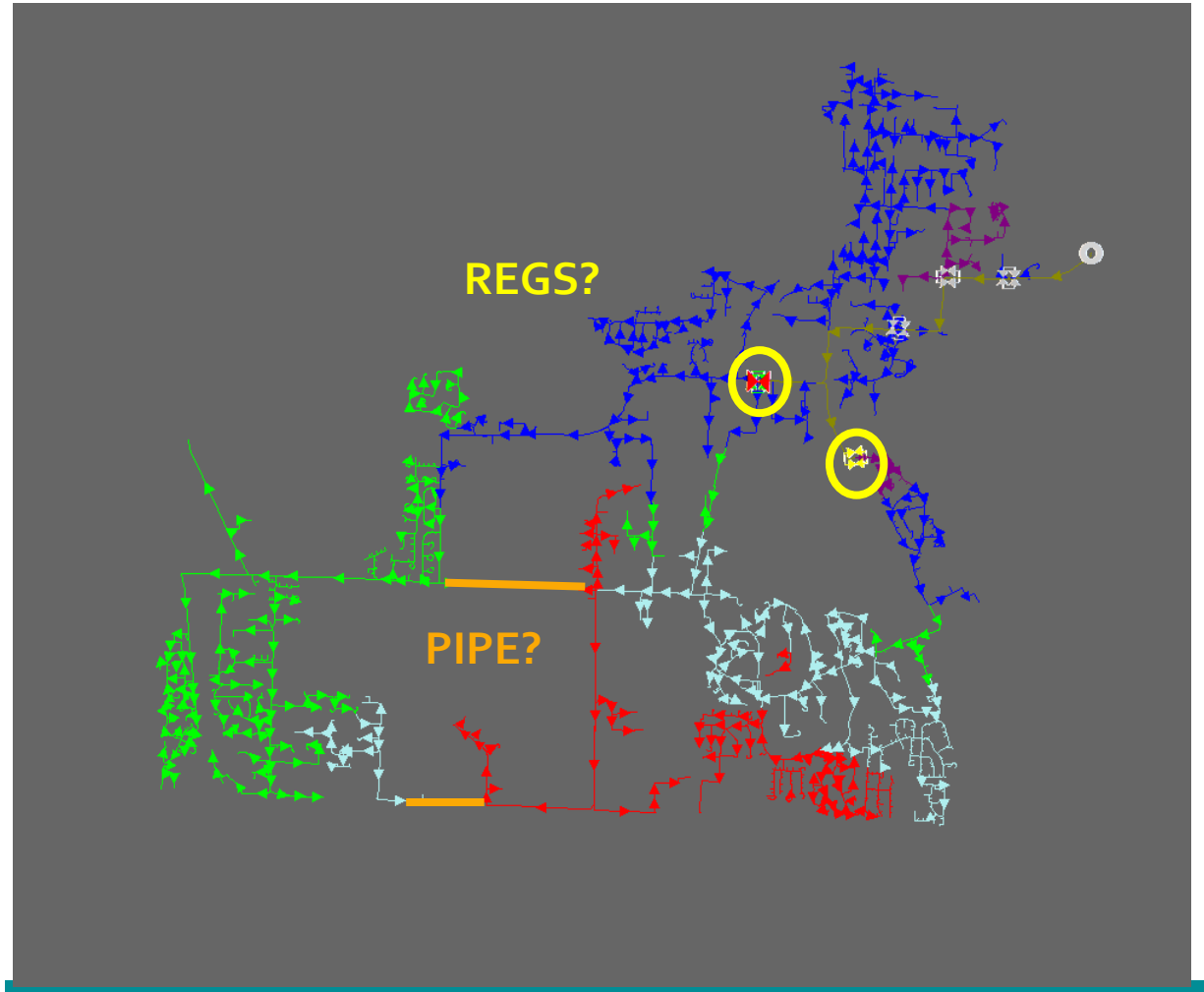
Distribution Enhancement Example

Theoretical low-pressure scenario



Distribution Enhancement Options

Low pressure scenario

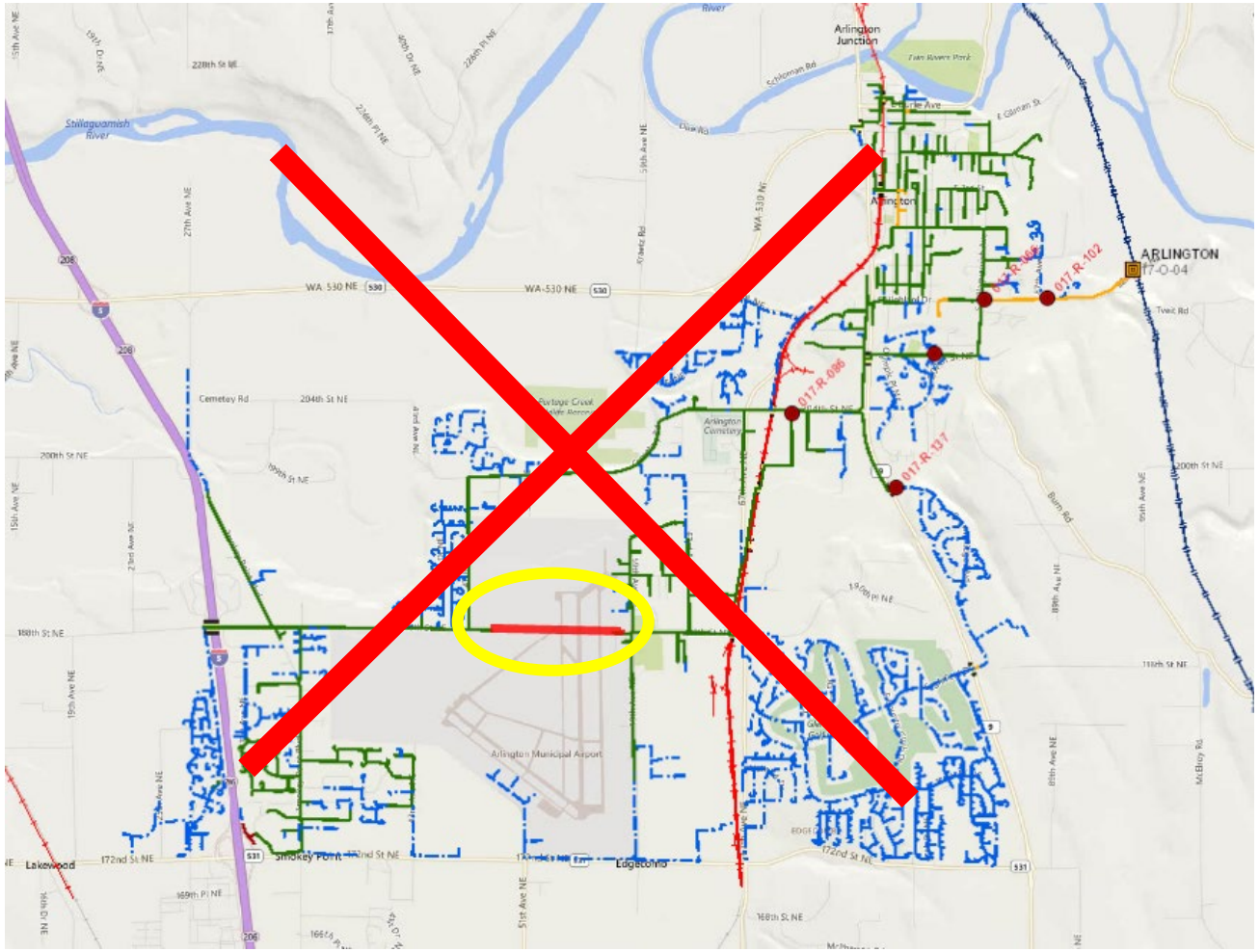


Facilities Color By
Pressure (Primary Only) (psig)
- Not Applicable (7)
- < 10.00 (301)
- 10.00 - 15.00 (518)
- 15.00 - 25.00 (548)
- 25.00 - 40.00 (627)
- 40.00 - 60.00 (67)
- > 60.00 (16)

- Compressor station infeasible
- Other Solutions?

Distribution Enhancement Options

Reinforcement option #1



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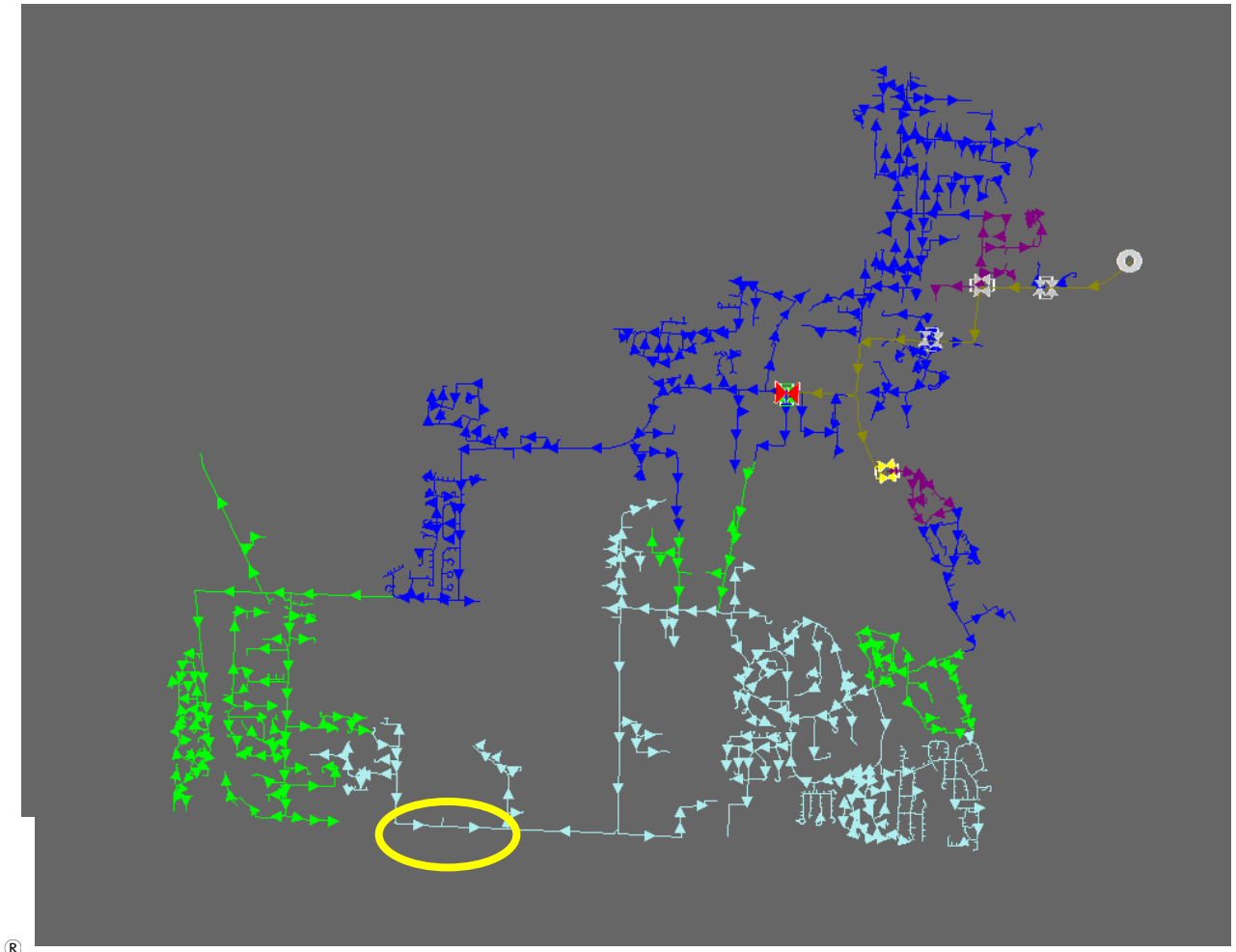
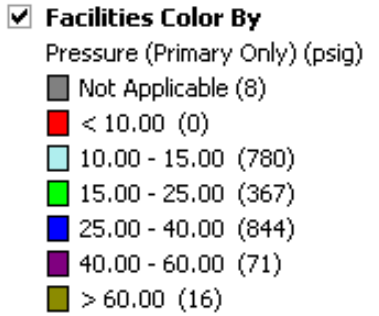
Distribution Enhancement Options

Reinforcement option #2





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Enhancements Considerations:

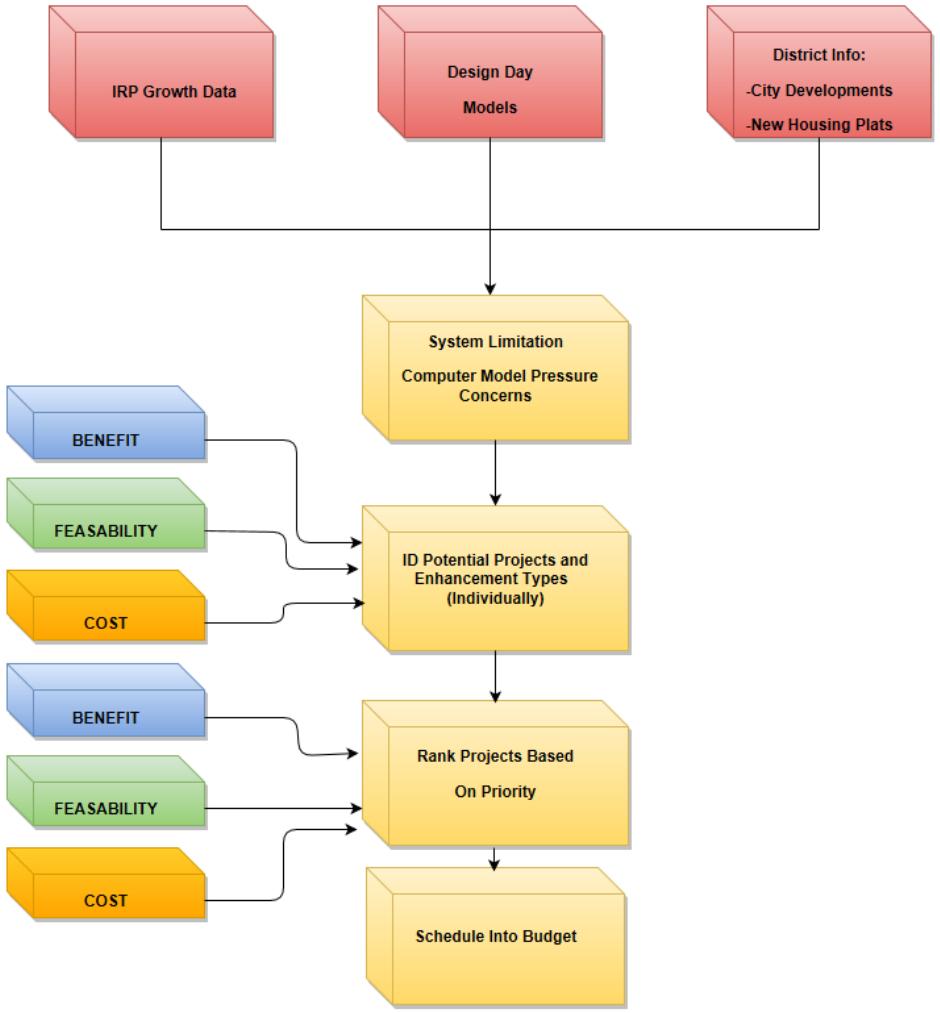
- Scope
- Cost
- Capacity Increase
- Timing
- System Benefits
- Alternative Analysis
- Environmental Impact

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

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Ongoing Steps/Process to review/identify IRP projects

- Assess our systems and identity deficits caused by 5-year growth modeling
- Propose and evaluate alternatives to address deficits
- Discuss deficits and alternatives with management
- Work through alternative analysis process
- Budget projects needed to meet 5-year core growth

Feedback for Cascade?

Do you have comments or ideas that Cascade should consider regarding Distribution System Planning?

Process Item	Date	Process Element
Targeted-TAG	Thursday, January 25, 2024	What is an IRP and how to get involved
Targeted-TAG	Thursday, February 15, 2024	Avoided Cost
Targeted-TAG	Wednesday, March 6, 2024	Energy Efficiency
Targeted-TAG	Thursday, March 28, 2024	Equity in the IRP
Targeted-TAG	Thursday, April 11, 2024	Customer/Load Forecast
Targeted-TAG	Tuesday, May 7, 2024	CCA/Compliance Modeling
Targeted-TAG	Thursday, May 16, 2024	Distribution System Planning
Targeted-TAG	Thursday, May 30, 2024	Resource Integration
TAG 1	Thursday, June 13, 2024	Process, Key Points, IRP Team, Timeline, Regional Market Outlook, Planned Scenarios and Sensitivities, Stakeholder Engagement, Demand and Customer Forecast and Non-Core Outlook, Drilling down into segments of demand forecast. Upstream Pipeline presentation.
Receive feedback on TAG 1	Friday, June 28, 2024	
TAG 2	Thursday, July 25, 2024	Respond to TAG 1 Feedback, Distribution System Planning, Alternative Resources, Price Forecast, Avoided Costs, Current Supply Resources, Transport Issues, Carbon Impacts, Energy Efficiency, Bio-Natural Gas, Preliminary Resource Integration Results.
Receive feedback on TAG 2	Friday, August 9, 2024	
First Draft	Friday, September 6, 2024	
Comments Due	Friday, October 4, 2024	
TAG 3	Wednesday, October 30, 2024	Respond to TAG 2 feedback, Final Integration Results, finalization of plan components, Proposed new 2- to 4-year Action Plan
Final Draft	Tuesday, December 3, 2024	
Comments Due	Tuesday, January 14, 2025	
TAG 4 (if needed)	Thursday, January 30, 2025	
Final Complete By	Friday, February 14, 2025	
File	Monday, February 24, 2025	

2025 WA IRP Schedule

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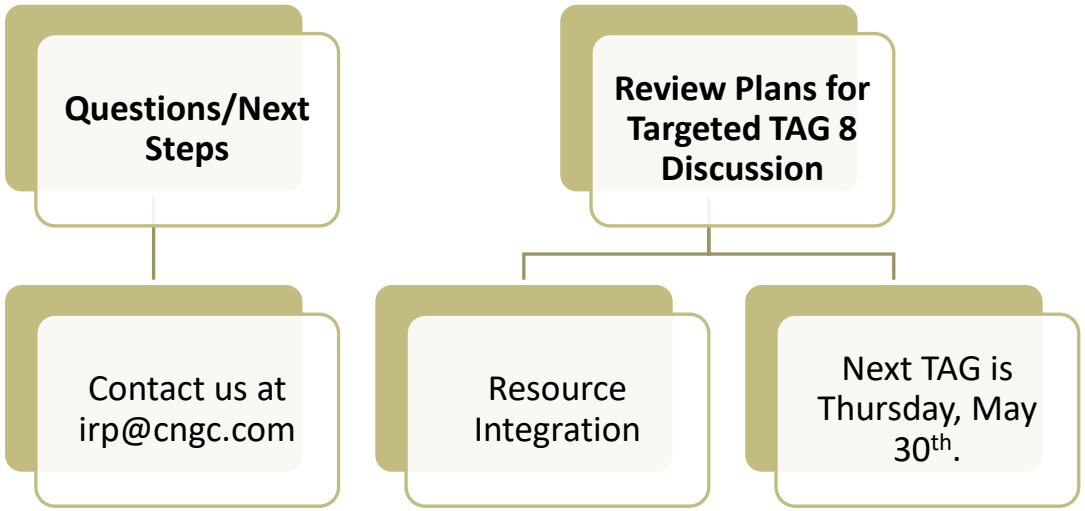

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