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 #8

MAY 30, 2024

MICROSOFT TEAMS/TELECONFERENCE

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Agenda

- Introductions
- Safety Moment
- Resource Integration
- Feedback
- Next Steps

Safety Moment

Image by: Skitterphoto at pixabay.com

Be Prepared to Respond – Without Your Smartphone

Commit important numbers to memory

- ✓ Work
- ✓ Personal
- ✓ Local Emergency Providers

Create a card/list of numbers and keep in your wallet

- ✓ Include health related information if applicable
- ✓ Place a copy inside phone case

Create Emergency Contact List for a locked phone

Low Carbon Alternative Fuels

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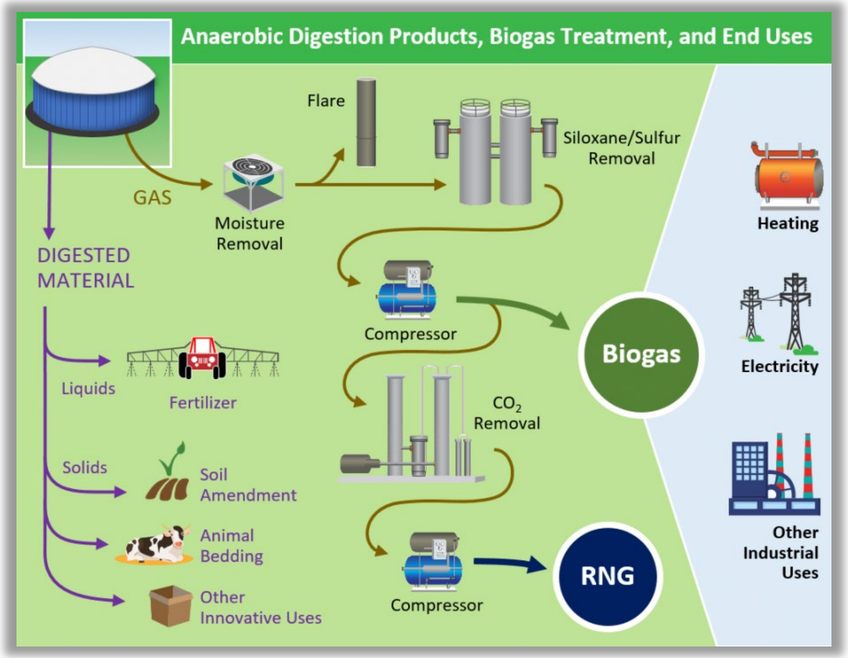
Renewable Natural Gas

Examples:

- Biogas from Landfills
  - Collect waste from residential, industrial, and commercial entities.
  - Digestion process takes place in the ground, rather than in a digester.
- Biogas from Livestock Operations
  - Collects animal manure and delivers to anaerobic digester.
- Biogas from Wastewater Treatment
  - Produced during digestion of solids that are removed during the wastewater treatment process.
- Other sources include organic waste from food manufacturers and wholesalers, supermarkets, restaurants, hospitals, and more.[1]



[1] U.S. Department of Energy, Alternative Fuels Data Center, Renewable Natural Gas

Benefits

Fuel diversity benefits – Use of RNG increases and diversifies domestic energy production. RNG can be used as a baseload fuel source with high availability rates. It leverages existing infrastructure such as pipelines and heavy-duty vehicles. Biogas feedstocks for RNG are generated continuously from a variety of sources.

Economic benefits – The development of RNG projects can benefit the local economy through the construction of RNG processing and fueling station infrastructure and sale of natural gas-powered vehicles. National, state and local incentives may be available depending on the end use, such as credits for production of RNG used for vehicle fuel. These financial incentives can provide additional economic drivers for project development.

Benefits

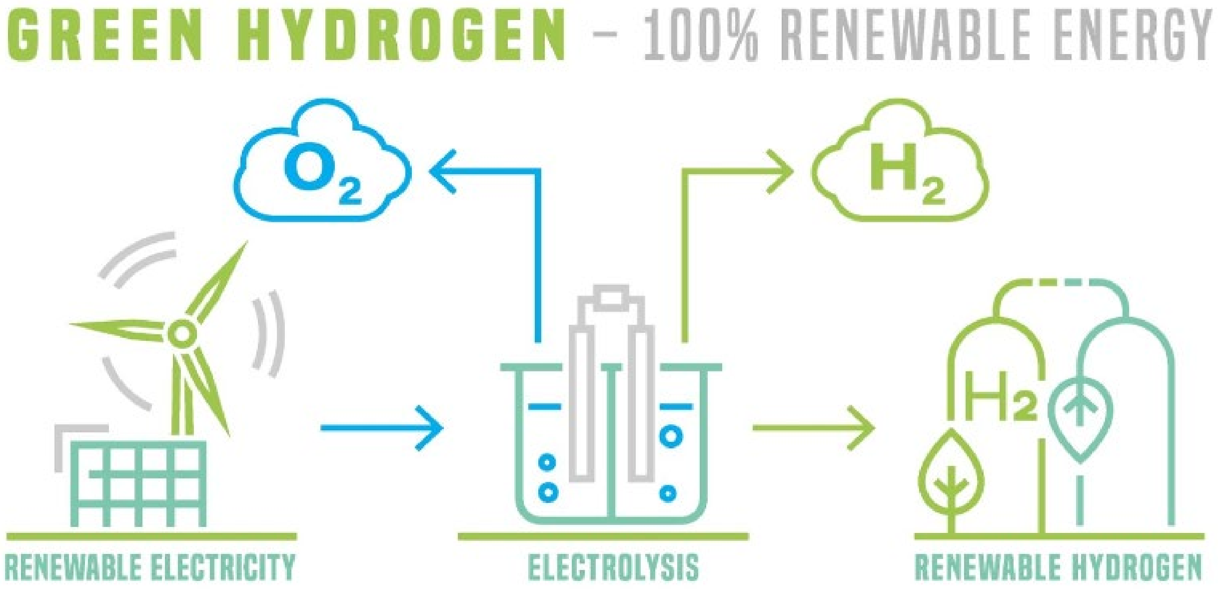
Local air quality benefits – Replacing traditional diesel or gasoline with RNG can significantly reduce emissions of nitrogen oxides and particulate matter, resulting in local air quality benefits. RNG is comprised primarily of methane; compared to fossil natural gas, RNG contains zero to very low levels of constituents, such as ethane, propane, butane, pentane or other trace hydrocarbons.

Greenhouse gas emission reductions – RNG projects capture and recover methane produced at a landfill or anaerobic digestion (AD) facility. Methane has a global warming potential more than 25 times greater than CO2 and a relatively short (12-year) atmospheric life, so reducing these emissions can achieve near-term beneficial impacts in mitigating global climate change. For facilities that are not already required to mitigate such emissions, an RNG project can reduce methane emissions significantly.

Hydrogen

Examples:

- Blue
  - Steam methane reforming with carbon sequestration
- Turquoise
  - Reforming methane into hydrogen gas and a solid carbon byproduct
- Green
  - Utilizing electrolysis from renewables to split the molecule into hydrogen and oxygen
- Pink
  - Similar to green, but utilizes electricity from nuclear power
- Gold
  - Microbe conversion of residual hydrocarbons from depleted, abandoned oil wells



Photo/Innovation News Network

[1] U.S. Department of Energy, Alternative Fuels Data Center, Renewable Natural Gas

Synthetic Methane

Green and pink hydrogen made through electrolysis can be combined with waste CO_2 to produce synthetic methane using chemical or biological processes. This process known as methanation entails incremental cost to the production of green and pink hydrogen.

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Carbon Capture

Carbon Capture and storage is a process in which a relatively pure stream of carbon dioxide from industrial sources is separated, treated and transported to a long-term storage location.

Cascade is looking at Carbon Capture for all customers.

Carbon Capture is not currently eligible for Oregon or Washington compliance programs, these projects could provide a way to offset carbon.

Renewable Thermal Certificate

A Renewable Thermal Credit (RTC) is a market-based instrument designed to incentivize the use of renewable energy sources for heating and cooling purposes. While renewable energy credits (RECs) have traditionally focused on electricity generation from renewable sources like wind or solar, RTCs specifically target the use of renewable energy for thermal applications, such as space heating, water heating, and industrial processes.

The mechanism works by assigning a certain value or credit to each unit of renewable thermal energy produced or consumed. These credits can then be traded or sold on the market, allowing entities that generate excess renewable thermal energy to sell their credits to those who need them to meet regulatory requirements or sustainability goals.

RTC programs vary by region and may be implemented at the state or regional level, often as part of broader renewable energy or greenhouse gas reduction initiatives. By creating a market for renewable thermal energy, RTCs help drive investment in renewable heating and cooling technologies, reduce greenhouse gas emissions, and promote the transition to a more sustainable energy system.

Resource Information

- Reference Case
  - Levelized Costs
  - Technical Potential
  - Resource Life
  - Carbon Intensity
- Monte Carlo Simulations
  - Levelized Costs
  - Technical Potential
  - Resource Life and Carbon Intensity will be held constant
  - Correlation shocks across time and fuel resources where appropriate

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Electrification

Electrification

How should electrification be modeled?

Cascade’s preference is to model electrification as an alternative resource that is modeled in Plexos. Cascade is still in the process of gathering data.

Information needed:

- Technical potential -- leverage equipment burn out as point of transition (uniform distribution)
- Electricity cost by area
- Electrification data such as gas to electric conversion rates and efficiencies
- Others?

Scenario modeling

- Expected
- Low

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Plexos Optimization Modeling

Plexos Model

Cascade utilizes Plexos for resource optimization.

This model permits the Company to develop and analyze a variety of resource portfolios to help determine the type, size, and timing of resources best matched to forecast requirements.

Plexos is very powerful and complex. It operates by combining a series of existing and potential demand side and supply side resources and optimizes their utilization at the lowest net present cost over the entire planning period for a given demand forecast and emissions constraints.

Plexos is a unified energy modeling and forecasting software platform. Its powerful simulation engine analyzes zonal and nodal energy models ranging from long-term investment planning to medium-term operational planning and down to short-term, hourly, and intra-hourly market simulations.[1]

It is important to recognize that Plexos provides helpful but not perfect information to guide decisions.

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1 SEE: PLEXOS | ENERGY MARKET SIMULATION SOFTWARE | ENERGY EXEMPLAR

Modeling Challenges

Supply needs to get gas to the citygate.

Many of Cascade's transport agreements were entered into decades ago, based on demand projections at that point in time.

Sum of receipt quantity and aggregated delivery quantity can help identify resource deficiency depending on how rights are allocated.

The aggregated look can mask individual citygate issues for looped sections, and the disaggregated look can create deficiencies where they don't exist.

In many cases operational capacity is greater than contracted.

Supply, storage, and upstream transportation focuses on the core, but non-core must be included for emissions modeling.

Plexos has perfect knowledge.

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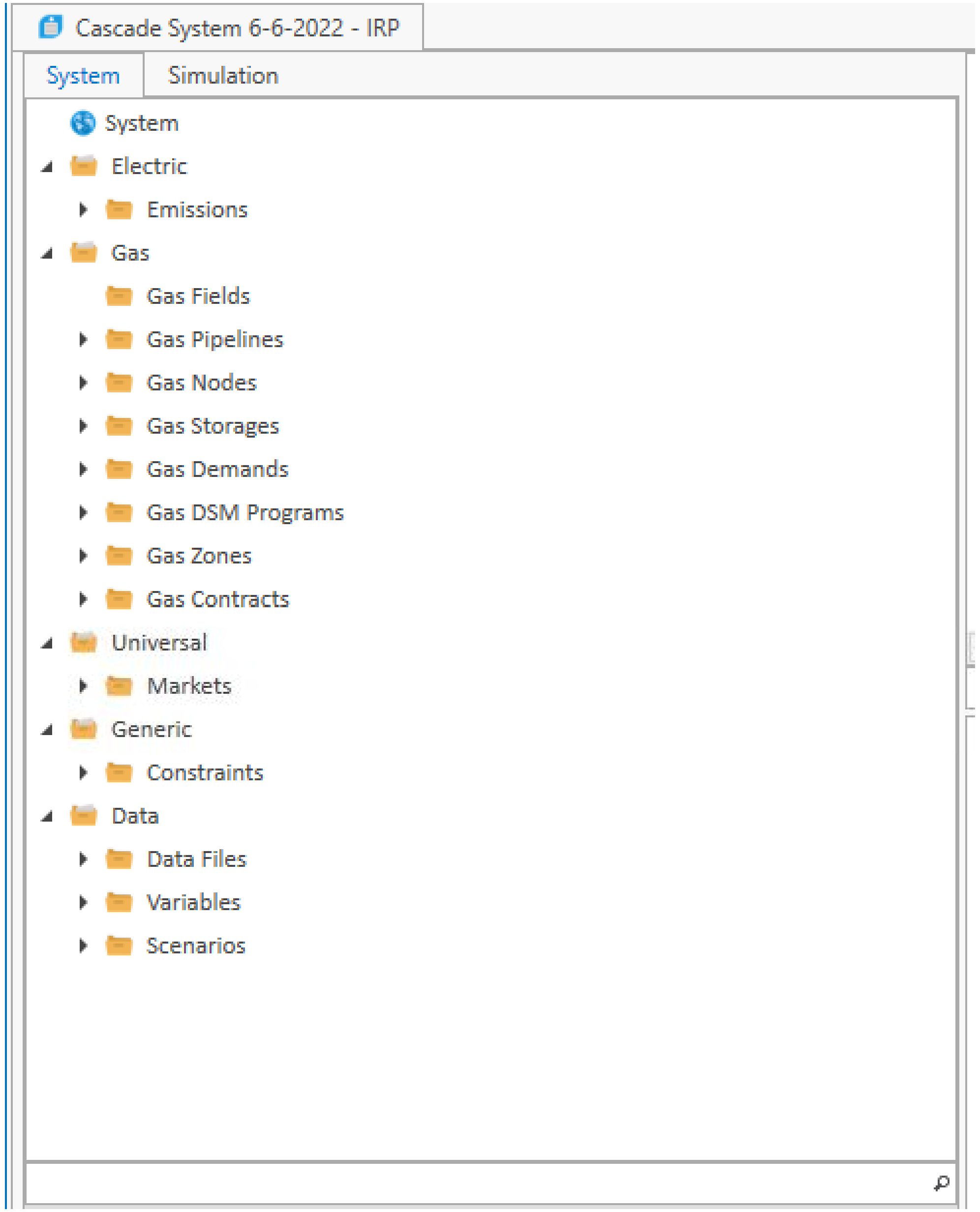
Base Case Plexos Inputs

- Demand
- Supply
- Price Forecast
- Storage
- Transportation
- Constraints
- Emissions



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Resource Integration

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Resource Integration

Scenarios:

- Customer Growth
  - Washington State Building Code Council rules w/ flat customer growth
  - Washington State Building Code Council rules w/ 1.5% decay in building stock attrition
  - Washington State Building Code Council repealed after 2 years, return to normal growth after
- Climate Regulation
  - Climate Commitment Act/Climate Protection Plan
  - Social Cost of Carbon
- Electrification
  - Expected Costs
  - Low Costs
- Weather
  - SSP 2-4.5
  - SSP 3-7.0
- Low Carbon Alternative Fuels
  - Monte Carlo Simulations (100+ draws)

Resource Integration Cont’d

Reference Case:

- Washington State Building Code Council rules w/ flat customer growth
- Climate Commitment Act/Climate Protection Plan
- Electrification – Expected Costs
- SSP 3-7.0 Climate Model
- Low Carbon Alternative Fuels – Reference Case

Stochastic Scenario Modeling:

- Cascade plans to run the combination of growth policies, climate policies, electrification costs, climate models, and low carbon alternative fuels.
- The combination of the three growth policies, two climate policies, and two electrification costs results in twelve scenarios.
- These scenarios will be modeled under both climate models and all 100+ draws of the low carbon alternative fuels.
- This will result in 2400+ draws.

Resource Integration Cont’d

Cascade will utilize the reference case, as well as the stochastic scenario that matches the reference case, to build out the 2- to 4-year action plan. The short-term plan will have a preferred portfolio that is based on shortfalls and the risk adjusted total system cost.

For the long-term plan, Cascade will utilize the stochastic scenario modeling to provide future potential portfolios, providing results on incremental or offtake transportation, storage, total system cost, demand shortages, and overall risk to ratepayers.

For the long-term plan, Cascade will not have a preferred portfolio, but rather an understanding of potential future outcomes. However, Cascade will analyze the lowest reasonable cost options of twelve scenario combinations.

Feedback for Cascade?

Do you have comments or ideas that Cascade should consider regarding Resource Integration?

2025 WA IRP Schedule

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	

Proposed Updated 2025 WA IRP Schedule

Process Item	Date	Process Element
TAG 1	Thursday, September 12, 2024	Process, Key Points, IRP Team, Timeline, Regional Market Outlook, Avoided Costs, 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, September 27, 2024	
TAG 2	Thursday, October 24, 2024	Respond to TAG 1 Feedback, Alternative Resources, Price Forecast, Current Supply Resources, Transport Issues, Carbon Impacts, Energy Efficiency, Bio-Natural Gas, Preliminary Resource Integration Results.
Receive feedback on TAG 2	Friday, November 8, 2024	
First Draft	Friday, December 6, 2024	
Comments Due	Friday, January 10, 2025	
TAG 3	Wednesday, February 5, 2025	Respond to TAG 2 feedback, Distribution System Planning, Final Integration Results, finalization of plan components, Proposed new 2- to 4-year Action Plan
Final Draft	Tuesday, March 4, 2025	
Comments Due	Tuesday, April 15, 2025	
TAG 4 (if needed)	Thursday, May 1, 2025	
Final Complete By	Friday, May 16, 2025	
File	Friday, May 23, 2025	

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Questions/Next Steps

Contact us at irp@cngc.com

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