Chapter 1

Executive Summary

Introduction

Cascade Natural Gas Corporation's (Cascade, CNGC, or the Company) Integrated Resource Plan (IRP or Plan) forecasts 28 years of expected system-wide customer and demand growth and analyzes the most reliable and least cost supply side and demand side resources that could be used to fulfill future customers' gas service needs. Planning how to best meet customers' future demand includes the consideration of possible policy changes and the resulting impact on customer prices, the Company's operations, and the ability of Cascade's distribution system to serve gas reliably as regional demand increases. This plan discusses these elements that impact how the Company may serve its customers from 2023 through 2050. While the Plan cannot predict the future, it is a useful guide. The following information is a progress report, and a short summary of each chapter included in this IRP. The details regarding methodologies as well as specific results are found in the chapters and appendices.

Key Points

- Each chapter provides an *at-a-glance* summary of the key points.
- The Company's short-term action plan provides the road map for future resource and planning activities.
- Load growth is forecasted to average negative 0.06% per year over the 26-year planning horizon.
- The total avoided cost ranges between \$1.38/therm and \$2.53/therm over the 26-year planning horizon.
- Cascade projects 26 million therms of energy efficiency in Washington by 2045.
- Cascade does not anticipate any near-term material upstream capacity deficiency in the 2025 IRP.
- This plan was informed by eight Targeted Technical Advisory Group (TAG) meetings and five regular TAG meetings, with active engagement by stakeholders.
- Cascade continues to be fully committed to the IRP process and maintaining a flexible short-term action plan.

Progress Report

As part of the 2023 IRP dis-acknowledgement letter, Washington Utilities and Transportation Commission (WUTC or Staff) Staff made several suggestions on areas where Cascade could improve the IRP. The comments provided suggestions on Renewable Natural Gas, Demand Forecast, Climate Commitment Act, Conservation, Price Forecasting, Climate Change Modeling, Upstream and Distribution Emissions, Plexos, GTN Xpress, and Public Outreach and Engagement:

- **Renewable Natural Gas (RNG)**: Similar to the previous IRP, RNG is modeled along with other low carbon alternative fuels. This is crucial for demonstrating Cascade's commitment to sustainable energy solutions.

- **Demand Forecast**: Due to significant uncertainty with customer load, Cascade has developed a relatively flat forecast to capture expected impacts of building code changes, a high forecast representing a rollback of these changes, and a low forecast for a scenario with a 1.5% annual decline in customer counts. This approach ensures that Cascade is prepared for various future scenarios, maintaining reliability, stability, and a pathway to meet carbon goals
- **Climate Commitment Act**: Cascade's plan complies with all applicable laws, evaluates compliance options, and develops a decarbonization plan that analyzes customer instability, reduces impacts to customers, and fully assesses the lowest cost mix of fuels and conservation, including electrification. This comprehensive approach is essential for meeting regulatory requirements while minimizing costs and disruptions for customers.
- **Conservation**: Cascade is developing a distributional equity analysis, which the Company anticipates completing in the near future. This analysis is important for ensuring that conservation efforts are equitable and benefit all customer segments.
- **Price Forecast**: Cascade continues to utilize current practices with updated information, analyzing cost risks and market volatility both deterministically and stochastically to determine the impacts of resource integration. This thorough analysis is vital for making informed decisions and managing financial risks.
- **Climate Change Modeling**: Cascade contracted with ICF to provide RCP 2-4.5 and RCP 3-7.0 projections for each of Cascade's weather locations. Accurate climate change modeling is crucial for planning and adapting to future weather patterns and their impacts on energy demand.
- **Upstream and Distribution Emissions**: Cascade has quantifies all emissions occurring in the gathering, transmission, and distribution of natural gas. This is part of the Company's avoided cost calculation, highlighting Cascade's commitment to transparency and environmental responsibility.
- **Plexos Modeling**: Cascade is utilizing Plexos again for this IRP and has reiterated areas where Plexos may act too perfectly compared to human planners. Additionally, Cascade has modeled low carbon alternative fuels that complies with the CCA in Plexos. This ensures that Cascade's planning tools are robust and aligned with regulatory requirements.
- **GTN XPress**: GTN XPress is now fully in service and will be reevaluated along with all other transportation agreements regarding the need for capacity. This reevaluation is important for optimizing resource allocation and ensuring efficient use of infrastructure.
- **Public Outreach**: Cascade has improved language accessibility in bill inserts and on the Company's website and developed an Equity Advisory Group that has collaborated with the IRP and CAG teams.

These efforts are essential for enhancing communication and engagement with all customer segments, ensuring that everyone has access to important information and resources.

Chapter 2: Company Overview

Cascade has been providing natural gas service since 1953. Over the years, the Company has expanded its service territory by purchasing and merging with other small natural gas utilities. As of 2007, Cascade is a subsidiary of Montana Dakota Utilities (MDU) Resources Inc., which is based in Bismarck, North Dakota.

Cascade serves over 318,500 customers located in smaller, mostly rural communities spread across Oregon and Washington. The Company's service territory poses some challenges for operating an energy distribution system, including the fact that the areas served are noncontiguous and the weather in each area can be vastly different. To capture this, Cascade groups its citygates into seven weather zones.

Cascade purchases natural gas from a variety of suppliers and transports gas supplies to its distribution system using primarily three natural gas pipeline companies. Northwest Pipeline LLC (NWP) provides access to British Columbia and domestic Rocky Mountain gas, Gas Transmission Northwest (GTN) provides access to Alberta and Malin gas, and Enbridge (Westcoast Transmission) provides British Columbia gas directly into the Company's distribution system.

In response to Order No. 09 issued in Docket UG-210755, Cascade incorporated an equity lens into its operations, focusing on four tenets of energy justice: recognition, procedural, distributional, and restorative justice. Cascade appointed an executive sponsor for equity, provided equity training to executives, and hired a program manager to lead equity initiatives. The Equity Advisory Group (EAG), formed with representatives from various community groups, began meeting in December 2023 to guide Cascade's equity processes. The EAG has discussed topics such as the general rate case process, the CARES program, and the Washington Incentive Program (WIP). Cascade has improved language accessibility and created a transparent CARES webpage based on EAG feedback. Cascade's programs, including WIP and CARES, offer weatherization services and bill assistance to income-qualified customers, significantly increasing participation through self-attestation and co-administration.

Chapter 3: Demand Forecast

Forecasting demand is foundational for both long- and short-term planning. The Company initiated its demand forecasting process by looking at each pipeline zone serving firm or uninterruptible service. These pipeline zones are assigned a weather zone because a significant portion of Cascade's customer usage fluctuates with temperature and wind.

Demand forecasting first requires a customer forecast. The Company developed three unique customer forecast for each pipeline zone and customer class by incorporating population and employment growth data from Woods and Poole as well as from internal market intelligence into a dynamic regression model. The forecasts were then further adjusted for building codes and differing potential futures.

Cascade developed a normal, or expected, future weather year by shaping 30 years of weather data provided by ICF to include climate change impacts. Heating degree day (HDD) values were assigned to each day in the model weather year. To ensure the Company will be able to serve its customers during extreme weather, the Company tested a system weighted peak HDD (the system weighted peak day developed through Monte Carlo simulations).

Peak day demand was then derived for each weather scenario by applying the HDD to the peak day forecast for each pipeline zone.

Load growth under the reference case across Cascade's system through 2050 is expected to average -0.06% annually. Load growth is split between residential, commercial, and industrial customers.

Cascade's different growth portfolios are then stress tested with different futures, mainly cost and supply of low carbon alternative fuels. Cascade's demand also allows Cascade to determine if more or fewer resources are needed to serve customers.

Chapter 4: Supply Side Resources

Chapter 4 provides an in-depth description of the supply side options the Company considered in this Plan.

Cascade's gas supply portfolio is sourced from three traditional supply areas of North America: British Columbia, Alberta, and the Rockies. The Company secures its gas through firm gas supply contracts and open market purchases. Cascade has added RNG to the supply portfolio with more plans in the future.

Firm supply contracts commit both the seller and the buyer to deliver and take gas on a firm basis, except during *force majeure* conditions. Supply contract terms for firm commodity supplies vary greatly. Some contracts specify fixed prices, while others are based on indices that float from month to month. Open market purchases are short-term and are subject to more volatile pricing.

The Company evaluates its demand curve and defines four categories of supply for meeting its demand. First, base load supply resources are used for the constant demand that occurs all year and does not fluctuate based on weather. Base load supplies are typically taken day in and day out, 365 days a year. Next, winter supplies meet demand occurring due to cooler weather. Winter gas supplies are firm gas supplies that are purchased for a short period during the winter months to cover increased loads, primarily for space heating. The contracts are typically three to five months in duration (primarily November through March). Next are peaking gas supplies which are used when colder weather spikes demand. Peaking gas supplies, similar to storage, are firm contracts purchased only as load actually materializes due to high winter demand. That is, the seller must deliver the gas when the Company requires it, but the Company is not required to take gas unless it is needed to meet customer load requirements. Lastly are needle peaking resources which are utilized during severe or arctic cold snaps when demand increases sharply for a few days. These resources are very expensive and are available for a very short period of time.

Cascade also utilizes natural gas storage to meet a portion of the requirements of its core market. Storing gas supplies, purchased and injected during periods of low demand, is a cost-effective way of meeting some of the peak requirements of Cascade's firm market. Cascade does not own any storage facilities and, therefore, must contract with storage owners to lease a portion of those owners' unused storage capacity.

Cascade has contracted for storage service directly from NWP since 1994. Storage is held in their Jackson Prairie underground and Plymouth Liquified Natural Gas (LNG) facilities. Jackson Prairie is located in Lewis County, Washington, approximately ten miles south of Chehalis. Plymouth is located in Benton County, Washington approximately 30 miles south of Kennewick. Both Jackson Prairie underground storage and the Plymouth LNG facility are located directly on NWP's transmission system. In addition, Cascade has leased Mist storage from NW Natural. The Mist facility is located in Columbia County, near Mist, Oregon. Mist has a direct connection to NWP for withdrawals and injections. Storage withdrawal rates can be changed several times during an individual gas day to accommodate weather driven changes in core customer requirements.

Cascade uses interstate pipeline transportation resources to deliver the firm gas supplies it purchases from three different regions or basins. Cascade has over 30 long-term annual contracts with NWP, numerous long-term annual and winter-only transportation contracts with GTN (including the upstream capacity on TransCanada Pipeline's Foothills and Nova systems), a long-term, annual contract with Ruby Pipeline, and one long-term annual contract with Enbridge (Westcoast Transmission) in British Columbia, Canada. These contracts do not include storage or other peaking services that may provide additional delivery capability rights ranging from nine to 120 days.

In order to evaluate the price of resource options, the Company analyzed gas price forecasts from various sources. Cascade used Wood Mackenzie, the Energy Information Administration (EIA), the Northwest Power and Conservation Council (NWPCC), and Cascade's trading partners to develop a blended long-range price forecast. With a monthly Henry Hub price from the above sources, the Company derived a weight for each source to develop the monthly Henry Hub price forecast for the 20-year planning horizon. These weights were calculated from the Symmetric Mean Absolute Percentage Error (SMAPE or Errors) of each source versus actual Henry Hub pricing since 2010. The inverse of these Errors was then used to determine the weight given to each source.

Besides currently used resources, Cascade considered alternative resources. Other potential incremental capacity options evaluated included: the Cross-Cascades Trail-West pipeline, additional GTN capacity, NWP Eastern Oregon Expansion, NWP Express Project or the I-5 Sumas expansion project, NWP Wenatchee Expansion, NWP Zone 20 (Spokane) Expansion, Pacific Connector, and Southern Crossing. Other storage options considered were: AECO, Gill Ranch Storage, Mist, Spire Storage (formerly Ryckman Creek Storage), and Wild Goose Storage.

Cascade also considered unconventional supplies such as satellite LNG, hydrogen, and the realignment of its Maximum Daily Delivery Obligations (MDDOs) on NWP. In addition to the Deschutes Landfill project, Cascade has also either contracted, or is in advanced stages, with three other RNG projects. Cascade has significantly increased how RNG is modeled and evaluated in its resource integration model in an effort to reduce emissions and meet CCA/CPP rules.

Long-term planning is not an exact science. The Company has considered the various risks that may challenge the assumptions used in this analysis. Risk can stem from potential Federal Energy Regulatory Commission (FERC) or Canada's Energy Regulator (CER) rulings that may impact the cost or availability of gas. The Company also considers the risk that firm supply may not be available when Cascade needs it or that pricing could vary due to any factor impacting the economy of supply and demand.

To mitigate risk, Cascade constantly seeks methods to ensure price stability for customers to the extent that it is reasonable. In addition to methods such as long-term physical fixed price gas supply contracts and storage, another means for creating stability is through the use of financial derivatives. Derivatives generally lock-in a forward natural gas price with a hedge, consequently eliminating exposure to significant swings in rising and falling prices. The Company's annual Hedge Execution Plan (HEP), approved by the Gas Supply Oversight Committee (GSOC), provides oversight and guidance for the Company's gas supply hedging strategy.

Chapter 5: Avoided Cost

The avoided cost is the estimated cost to serve the next unit of demand with a supply side resource option at a point in time. Avoided cost forecasts are used to establish a cost-effective threshold for demand side resources. If demand side resources cost as much as or less than the avoided cost, then the demand side resource is cost-effective and should be the next resource added to the Company's stack of resources.

Cascade's avoided cost includes fixed transportation costs, variable transportation costs, storage costs, commodity costs, a carbon tax, upstream emissions, a 10% adder, distribution system costs, and a risk premium. Essentially, the avoided cost is the cost of the Company's resource stack on a per therm basis plus three values for benefits specifically acquired with energy efficiency. The largest part of the avoided cost is the cost of gas.

Environment Compliance costs are included in the avoided cost in two ways, through the social cost of carbon as well as the most expensive expected marginal abated compliance cost under the CCA. Cascade's use of this forecast does not indicate a preference towards this carbon future in Washington, but rather signifies what the Company believes is the most probable form of carbon legislation in the state.

Next, 10% was added to the avoided cost to account for nonquantifiable, environmental benefits. This 10% adder was first recommended by the NWPCC based on Federal legislation.

For the 2025 IRP, the nominal system avoided costs ranges between $1.38/therm and $2.53/therm over the 26-year planning horizon. The increase over time is largely driven by the escalating cost of carbon.

Chapter 6: Environmental Policy

This chapter considers Greenhouse Gas (GHG) emission reduction policies and regulations that have the potential to impact natural gas distribution companies. In addition, this chapter examines methodologies for applying a cost of carbon to natural gas distribution companies and identifies the assumptions made in determining a 45-year avoided cost of natural gas and pairs these costs with associated two-year action items.

Significant emission policy development has occurred over the past couple of IRPs. The federal government as well as policymakers at the state and local levels in Washington and Oregon have actively pursued GHG emission reductions, and primarily CO_2 emission reductions. Policymakers in Washington have passed the Climate Commitment Act giving the Department of Ecology (Ecology) authority to regulate GHG emissions from natural gas distribution utilities, including customer emissions. In Oregon, Governor Brown issued an executive order directing state agencies to pursue GHG emission reductions under their authority, which included the Department of Environmental Quality issuing the Climate Protection Program (CPP) rule in late 2021. The CPP was later invalidated but has since been reinstated in 2025.

Cascade monitors environmental regulatory requirements in progress nationally, regionally, and locally that have impacts to natural gas distribution companies. As of November 21, 2022, there are no regulations at the federal level that would require the Company to reduce GHG emissions. However, the Climate Commitment Act (CCA) rule was finalized in Washington on September 29, 2022, and the Climate Protection Program (CPP) was reinstated in Oregon in January of 2025, which require GHG emissions reductions from natural gas distribution companies' customers use of natural gas. The CCA also applies to Cascade's operational GHG emissions. Cascade's compliance plan for these rules is modeled within this IRP.

Chapter 7: Demand Side Management

Demand Side Management (DSM) refers to the reduction of natural gas consumption through the installation of energy efficiency measures such as insulation, more efficient gas-fired appliances, or through load management programs. Cascade targets the saving of approximately 39.5 million therms systemwide through 2045; 23 million therms in Washington and 16.5 million therms in Oregon.

Unlike supply side resources, which are purchased directly from a supplier, demand side resources are purchased from individual customers in the form of unused energy as a result of energy efficiency. The WUTC requires gas utilities to consider cost-effective DSM resources in their energy portfolio on an equal and comparable basis with supply side resources. In the gas industry, DSM resources are conservation measures that include, but are not limited to, ceiling, wall, and floor insulation; higher efficiency natural gas appliances, insulated windows and doors, ventilation heat recovery systems and various other commercial/industrial equipment. By prompting customers and influencing customers through energy efficiency outreach to reduce their individual demand for gas, Cascade can supplant the need to purchase additional gas supplies, displace or delay contracting for incremental pipeline capacity, and possibly negate or delay the need for reinforcements on the Company's distribution system. It's also essential to recognize that the Company can prompt and encourage customers to reduce their consumption to aid load management, but it's ultimately the choice of the end user to manage consumption by recognizing an inherent value in energy efficiency.

There are two basic types of demand side resources: base load resources and heat sensitive resources. Base load resources offset gas supply requirements throughout the year, regardless of the weather and outside conditions. Base load DSM resources include measures such as high efficiency water heaters, higher efficiency cooking equipment, and ozone injection laundry systems. Heat sensitive DSM resources are measures whose therm savings increase during cold weather (meaning the measure is used more often during colder weather). For example, a high efficiency furnace will lower therm usage in the winter months when the furnace is utilized the most and will provide little, if any, savings in the summer months when the furnace is rarely used. Examples of heat sensitive DSM measures include ceiling, floor, and wall insulation measures, high efficiency gas furnaces, and improvements to ductwork and air sealing. These types of heat sensitive measures offset more of the peaking or seasonal gas supply resources, which are typically more expensive than base load supplies.

The conservation potential for this IRP is calculated through the Applied Energy Group (AEG)'s LoadMAP model, separated into the three customer classes for individual savings assumptions, market segmentations, and end uses (heat-sensitive resources have different savings potential by climate zone for the Residential section).

Energy efficiency and conservation efforts for the Company's Oregon customers are offered through the Energy Trust of Oregon (ETO) with program planning developed through the Cascade Oregon IRP cycle.

Chapter 8: Distribution System Planning

Cascade uses computer modeling for network demand studies to ensure its distribution system is designed to deliver gas reliably to customers as the number of customers and their demand change.

Cascade's geographical information system (GIS) keeps an up-to-date record of pipe and facilities, complete with all system attributes such as date of install and operation pressure. Using the Company's GIS environment and other input data, Cascade is able to create system models through the use of Synergi® software. The software provides the means to theoretically model piping and facilities to represent current pressure and flow conditions while predicting future events and growth. Combining these models with historical weather data can provide a design day model that will predict a worst-case scenario. Design day models that experience less than ideal conditions can then be identified and remedied before a real problem is encountered.

When modeling demonstrates that a portion of the distribution system is unable to meet future demand, Cascade engineers consider many possible remedies including reinforcements or expansions. Enhancements include pipeline looping, upsizing, and uprating. Pipeline looping is the most common method of increasing capacity in an existing distribution system. Pipeline upsizing involves replacing existing pipe with a larger size pipe. Pipeline uprating increases the maximum allowable operating pressure of an existing pipeline.

Besides modifying the pipelines, regulators or regulator stations can be added to reduce pipeline pressure at various stages in the distribution system. If pressures are too low, compressor stations can be added to boost downstream pressures.

Another possible solution is targeted conservation. Area specific incentives for installed energy efficiency measures can reduce demand in a constrained area either eliminating or forestalling the need to add or reinforce infrastructure.

Once the optimal solution is determined, projects are ranked based on numerous criteria and are scheduled. Chapter 8, Distribution System Planning, presents a summary of costs by district and Appendix I lists all known distribution projects.

Chapter 9: Resource Integration

Cascade made a change to the model used for resource optimization from SENDOUT® to PLEXOS®. This software 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. The model knows the exact load and price for every day of the planning period based on input and can therefore minimize costs in a way that would not be possible in the real world. It is important to acknowledge that PLEXOS® provides helpful but not perfect information to guide decisions. A large reason for switching to PLEXOS® is because of their ability to model everything SENDOUT® was capable of but PLEXOS® also allows for carbon emission modeling.

One of the purposes of integrated resource planning is to identify an illustrative resource portfolio to help guide specific resource acquisitions. In this planning cycle, the Company considered a host of resource alternatives that could potentially be added to its resource portfolio, including additional conservation programs, incremental off-system storage alternatives at AECO Hub, Mist, Spire, Wild Goose, and Gill Ranch. Additionally, incremental transportation capacity on NWP, Ruby, Nova Gas Transmission Ltd. (NGTL), Foothills and GTN pipeline systems was considered, along with on-system satellite LNG facilities, RNG, and imported LNG. With customer growth slowing, Cascade is also considering options to release capacity in order to lower costs. Also included were other options to meet carbon compliance such as low carbon alternative fuels, allowances, offsets, and Community Climate Investments (CCI).

Typically, utility infrastructure projects are “lumpy,” since demand grows annually at a small percentage rate, while capacity is typically added on a project-by-project basis. Utilities often have surplus capacity and must “grow into” their new pipeline capacity, because it is more cost effective for pipelines to build for several years of load growth at one time than to make small additions each year. However, the Company can minimize the impacts through the acquisition of citygate peaking resources which include both the supplies and the associated pipeline delivery for a certain number of days or through the purchase of other's excess capacity through short- or medium-term capacity releases.

Utilizing the PLEXOS® resource optimization model, portfolios were run on varying customer growths and different low carbon alternative fuel market scenarios to test the viability of acquiring incremental storage, transportation resources, and incremental carbon compliance resources based on existing recourse rates and discounted rates, and via capacity release through a third party. Additionally, for each portfolio Cascade analyzed the rate impacts, viability of rate instabilities, and electrification.

Over the 26-year planning horizon basins have AECO trading at a discount to Rockies, Malin, and Sumas. Shortfalls can come in two forms; the inability to serve increasing demand through lack of resources, or meeting demand but unable to secure enough carbon compliance options to meet the CCA or CPP.

Using input from these alternative resources, PLEXOS® derives a portfolio of existing and incremental resources that Cascade defines as the optimal portfolio that can be flexible with market and future policy changes. This provides guidance as to what resources should be considered to meet demand with a reasonable least cost and least risk mix of demand and supply side resources while meeting carbon reduction targets under expected pricing, weather, and growth environments.

A more detailed discussion regarding the Company's resource integration and the results can be found in Chapter 9, Resource Integration. The results of the Resource Integration chapter lead to the short-term action plan.

Chapter 10: Stakeholder Engagement

Input and feedback from Cascade's Technical Advisory Group (TAG) is an important resource for ensuring the IRP includes perspectives beyond the Company's and is responsive to stakeholders' concerns. Cascade held eight public targeted-TAG meetings and four public regular TAG meetings with internal and external stakeholders. Targeted-TAGs focused on methodology while regular TAGs focused on preliminary results.

Participants invited to these public meetings include interested customers, regional upstream pipelines, Pacific Northwest Local Distribution Companies and other utilities, Commission Staff, stakeholder representatives such as the Northwest Gas Association, Oregon Department of Ecology, Washington Public Counsel, Oregon Citizens' Utility Board, the Alliance of Western Energy Consumers, the Northwest

Energy Coalition, and the Green Energy Institute. Cascade has a dedicated internet webpage where customers and parties can view the IRP timeline, TAG presentations, TAG minutes, and a video recording of TAG meetings, as well as current and past IRPs. This information can be found at https://www.cngc.com/rates-services/rates-tariffs/washington-integrated-resource-plan.

Chapter 11: Short-Term Action Plan

Cascade's Short-Term Action Plan includes:

- Acquire all estimated potential energy efficiency savings of 1,782,212 therms in 2025 and 2,909,133 therms in 2026.
- Acquire all offsets or allowances to comply with the Climate Commitment Act.
- Investigate carbon capture technologies for potential inclusion in the mid- to long-term plan.
- Perform a Hybrid Heat Pump Pilot to explore non-conventional means to reduce GHG emissions and overall throughput while remaining mindful of customer affordability and energy burden. This research could also be an effective non-pipe alternative, as reduced throughput should reduce the need for new or additional pipeline infrastructure.
- Continue to develop a distributional equity analysis (DEA) to gauge the impacts a Company decision, such as a new or modified pipeline, may have on vulnerable communities.
- Look for opportunities to permanently or temporarily capacity release transportation contracts if Cascade's customer counts continue to experience low, flat, or declining growth.
- Develop Distribution Enhancements for six locations:
    - 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

Chapter 2

Company Overview

Company Overview

Cascade Natural Gas Corporation (CNGC, Cascade, or the Company) has a rich history that began over 70 years ago when business leaders and public officials in the Pacific Northwest initiated a campaign to bring natural gas to the region to replace other more expensive fuels. In 1953, five small utilities serving fifteen communities merged to form Cascade. Over the years, Cascade continued to grow, merging with, and acquiring other natural gas providers. The Company stock first traded on the New York Stock Exchange in 1973. In 2007, Cascade merged with Montana Dakota Utilities (MDU) Resources Group, Inc. which is headquartered in Bismarck, North Dakota[1]. Cascade's headquarters moved from Seattle, Washington to Kennewick, Washington in 2010. Figure 2-1 provides an overview of Cascade service territory.

Key Points

- Cascade serves diverse geographical territories across Washington and Oregon.
- Cascade's primary pipelines are Northwest Pipeline, Gas Transmission Northwest, and Enbridge, also known as Westcoast, with access to three other pipelines.
- Core customers represented 22% of total 2021 throughput, while non-core customers represented 78% of total throughput.
- Cascade is a subsidiary of Montana Dakota Utilities Resources Group, Inc. based in Bismarck, North Dakota.

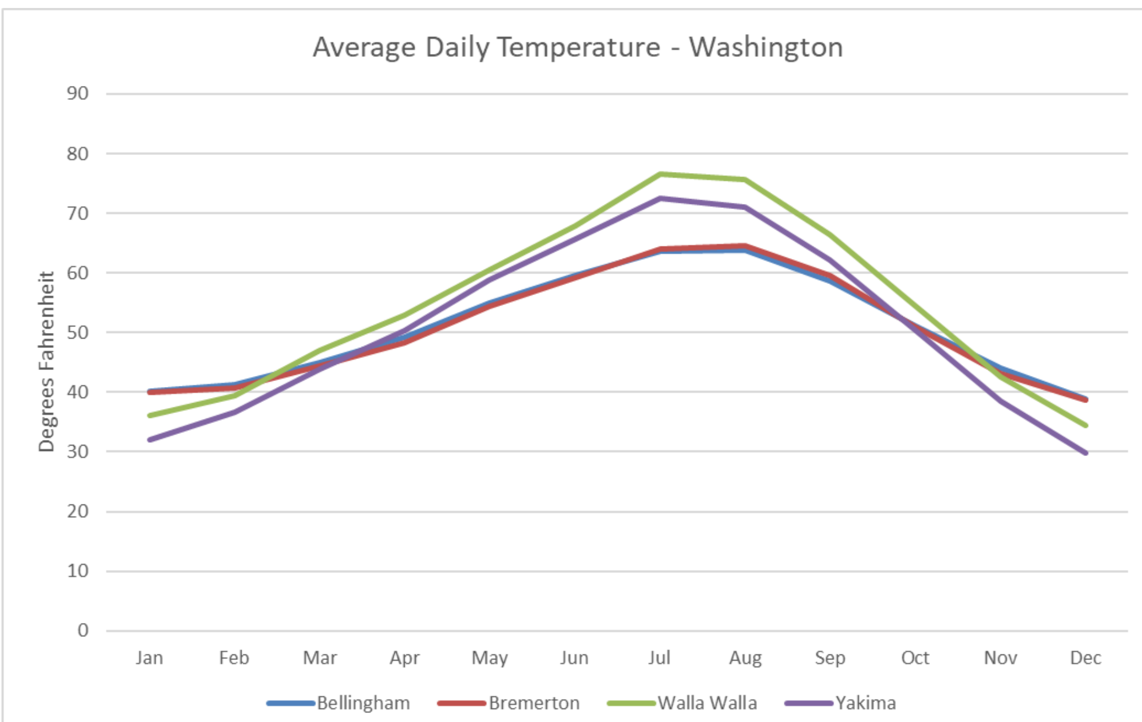
Figure 2-1: Cascade's Service Territory

[1] For more information about MDU, see https://www.mdu.com

Today, Cascade's service territory covers about 32,000 square miles and extends over 700 highway miles from end to end, encompassing a diverse economic base as well as varying climates. Cascade delivers natural gas service to more than 318,500 customers, with approximately 233,600 customers in Washington and 84,900 customers in Oregon. The Company's customers reside in a total of 95 communities, 67 in Washington and 28 in Oregon. Cascade's service area consists of communities across Washington as well as smaller, rural communities in central and eastern Oregon.

The climate of Cascade's service territory is almost as diverse as its geographical reach. The western Washington portion of the service territory, nicknamed the I-5 corridor, has a marine climate with occasionally significant snow events. In general, the climate in the western part of the service territory is mild with frequent cloud cover, winter rain, and warm summers. Cascade's eastern Washington service territory has a semi-arid climate with periods of arctic cold in the winter and heat waves in the summer. Figure 2-1 compares the average temperatures by month of the two regions. Oregon's service territory is in rural areas throughout northern central, central, and eastern Oregon. All regions of Oregon have semi-arid climates with periods of arctic cold in the winter and heat waves in the summer.

Figure 2-1: Average Temperature by Washington Region

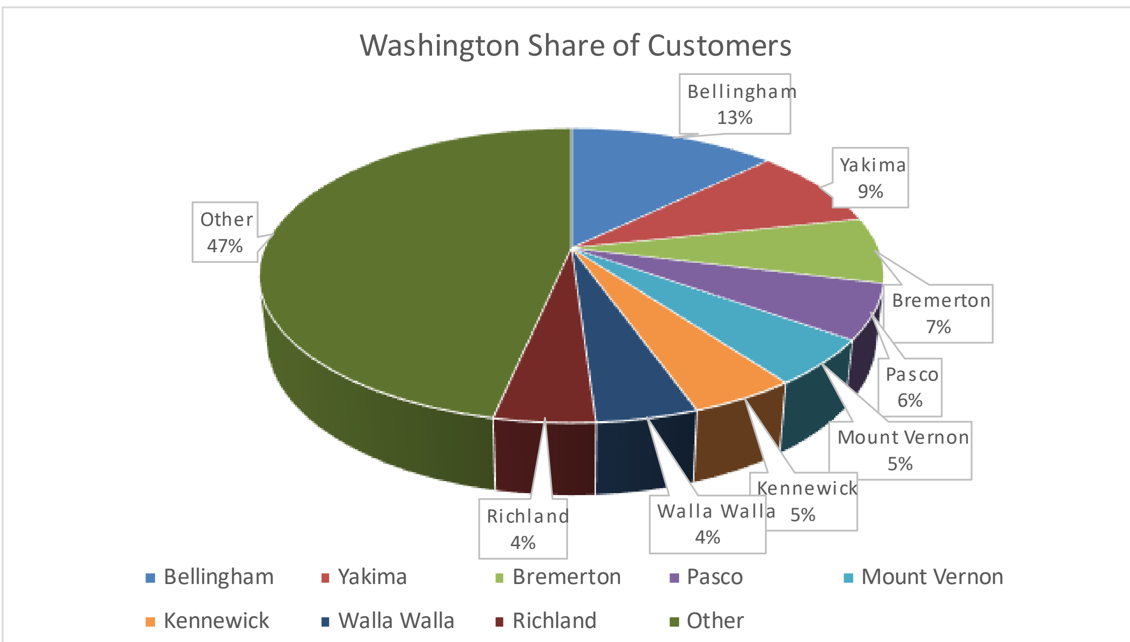


Below are some of the more populated towns within the regions Cascade provides distribution service:

- **Northwest** – Bellingham, Mt. Vernon, Oak Harbor/Anacortes, the Kitsap Peninsula, the Grays Harbor area and Kelso/Longview;
- **Central** – Sunnyside, Wenatchee/Moses Lake, Tri-Cities, Walla Walla and Yakima areas; and
- **Southern** – Bend and surrounding communities, Ontario, Baker City and the Pendleton/Hermiston areas.

Figure 2-2 shows a breakdown of Cascade's Washington customer density by city, including the eight largest cities. The other represents the smaller communities. A map of Cascade's certificated service territory is provided as Figure 12-13 in Chapter 13, Glossary and Maps.

Figure 2-2: Customer Density by City in Washington



Pipeline and Basin Locations

Cascade purchases natural gas from a variety of suppliers and transports gas supplies to its distribution system using three natural gas pipeline companies. Northwest Pipeline LLC (NWP) provides access to British Columbia and domestic Rocky Mountain gas, Gas Transmission Northwest (GTN) provides access to Alberta and Malin gas, and Enbridge (Westcoast or WCT) provides British Columbia gas directly into the Company's distribution system. Cascade also holds upstream pipeline transportation contracts on TransCanada Pipeline's Foothills Pipeline (FHBC), NOVA Gas Transmission Ltd. (also known as NGTL), and Ruby Pipeline.

More information about the pipelines and the supply basins is provided in Chapter 4, Supply Side Resources. Maps of select pipelines are found in Chapter 13, Glossary and Maps.

Core vs Non-Core Service

Cascade offers core service, which is the procurement of gas supply from an upstream basin or pipeline interconnect, such as Sumas or AECO, that is then transported to Cascade's citygates. From the citygate, Cascade then delivers gas on its distribution system to the end-use customer. Although Cascade offers core service to all its customers, not all of them take advantage of this type of firm service.

In 1989, concurrent with the passage of the Natural Gas Wellhead Decontrol Act, Cascade began allowing its large volume customers to purchase their own gas supplies and gas transportation services upstream of Cascade's distribution system.[2] These customers, referred to as large volume transportation or non-core customers, procure their own supply and transportation through third parties such as marketers. Cascade is only responsible for the distribution of non-core gas supply from the upstream pipeline citygate to the point of delivery at the customer's site. The Company currently has approximately 242 large volume customers who engage in this type of non-core service.

Since the Company does not provide gas supply and upstream pipeline transportation capacity resources to non-core customers, the Company does not plan for non-core customers in the conventional upstream resource analysis of its Integrated Resource Plan (IRP). However, with the implementation of the Climate Commitment Act (CCA) in Washington and the Climate Protection Plan (CPP) in Oregon, non-core emissions are considered in Cascade's resource integration and compliance planning. Also, non-core demand is a consideration in Chapter 8, Distribution System Planning.

In 2024, Cascade's residential customers represented approximately 12% of the total natural gas delivered on Cascade's system, while commercial customers represented roughly 9%, and the core industrial customers accounted for around 1% of total gas throughput. The remaining non-core industrial customers represented the remaining balance of 78% of total throughput.

[2] *See* Natural Gas Wellhead Decontrol Act of 1989 amends the Natural Gas Policy Act of 1978 to declare that the price guidelines for the first sale of natural gas do not apply to: (1) expired, terminated, or post-enactment contracts executed after the date of enactment of this Act; and (2) certain renegotiated contracts. Decontrols as of May 15, 1991, natural gas produced from newly spudded wells. Repeals permanently wellhead price controls beginning on January 1, 1993.

Equity Considerations

In Order No. 09 issued in Docket UG-210755 (Final Order 09), which approved Cascade's 2021 general rate case, the Washington Utilities Commission (WUTC) clarified its expectation that Cascade incorporate an equity lens in its daily operations. The WUTC defined the following four tenets of energy justice which are different aspects of an equity lens: (1) distributional justice, (2) procedural justice, (3) recognition justice, and (4) restorative justice. Cascade describes each tenet below:

1) Recognition Justice refers to understanding and acknowledging historical and ongoing inequalities.
2) Procedural Justice means that the Company should seek to collaborate transparently with a broad range of constituents within its service territory when it makes a decision that will impact customers directly or indirectly.
3) Distributional justice refers to the distribution of benefits and burdens across populations with the goal of ensuring that marginalized and vulnerable populations do not receive an inordinate share of the burdens or are not denied access to benefits.
4) Restorative Justice is using regulatory outcomes, such as tariff or rate case filings, for rate discounts or new programs to address or change inequities identified through the distributive justice process or the data collection process.

Cascade believes each tenet is a step in a systematic process toward righting a wrong.

Upon absorbing the contents of Final Order 09, Cascade realized it needed a paradigm shift. Applying an equity lens in all aspects of its business requires a top-down approach. To do this, Cascade identified an executive sponsor for equity, who provided equity training to all Cascade executives. The Company then hired a program manager who was tasked to be a central owner for equity related issues, questions, and Company integration. This program manager led the process of identifying vulnerable communities in the Company's service territory and then soliciting representation from these communities for the Company's Equity Advisory Group (EAG).

The EAG is comprised of seven members who provide representation from the following six community groups:

1. Highly Impacted Communities, Marginalized Populations, Low-Income Representation;
2. Named Community Resource: Public Health Advocate;
3. Named Community Resource: Sustainable Living Center;
4. Named Community Resource: Public Mental Health and Social Services Advocate;

5. Named Community Resource: Education Service District 105; and
6. Yakama Nation Tribes; Black, Indigenous, and People of Color (BIPOC) Community.

The EAG, which began meeting December 13, 2024, defines its purpose in its charter in the following way:

> The EAG is designed to inform the development of the Company's energy equity processes and provide guidance on other company activities relevant, but not limited to, community engagement, energy efficiency, regulatory obligations, bill payment assistance programs, resource planning, decarbonization, expanding access and removal of barriers for underserved and overburdened customers.

Since its first monthly meeting in December 2023, the EAG has discussed an array of topics, including the following:

- Cascade provided an overview of the Commission's proceeding in Docket A-230217, wherein the Commission intends to develop a policy statement to address the application of equity and justice in Commission processes and decisions. Cascade encouraged EAG members to respond to the Commission's Notice of Opportunity to File Written Comments, issued September 29, 2024;

- Cascade provided an overview of the general rate case process and notified members that it would be filing a multiyear rate plan the first quarter of 2024. The Company told members it would continue to provide updates on the filing and the process;

- Cascade presented an overview of the Cascade Arrearage Relief and Energy Savings (CARES) program, implemented October 1, 2023. CARES offers qualifying low-income customers with bill discounts and, if needed, arrearage relief through financial grants. This program and outreach for this program are discussed in detail in Daniel L. Tillis's testimony (Exh. DLT-1T);

- Commission Staff provided an overview of the general rate case process and explained how to track a docket, intervene in a proceeding, and submit comments;

- Cascade provided an overview of the Washington Incentive Program (WIP), which offers weatherization services and high efficiency appliance upgrades at no direct cost to qualifying low-income customers within the Company's Washington service territory;

- The committee members discussed best practices for informing hard-to-reach customers, which included discussions about improving non-English translations and accommodating customers with no internet or social media access;

- Cascade provided an overview of its Integrated Resource Process and asked for input on how the EAG would like to be involved; and

- The Company provided an overview of the Climate Commitment Act and the Company's compliance requirements.

Cascade believes the EAG provides a safe and welcoming space to under-represented communities in its service territory. These representatives have provided useful, actionable feedback. As a result of the EAG's recommendation to address linguistic isolation, Cascade upgraded its translation services subscription so that online and written communications are now available in a more readable Spanish translation as well as in Chinese, Hmong, Indonesian, Japanese, Korean, Vietnamese, Romanian, Russian, Somali, Swahili, Ukrainian, and French. Cascade also responded to the EAG's feedback on its CARES program, where the EAG advised the Company to create a clear and transparent webpage detailing CARES eligibility requirements. Cascade presented the new CARES website content to the EAG, and it was well-received.

Cascade plans to continue engaging the EAG in conversations about Company programs, services, and upcoming business decisions to understand the impact each action has on the burdens and benefits experienced by the members' communities.

Beyond working with the EAG, Cascade has programs that directly serve energy justice communities at no direct cost to income-qualified customers. These programs are Cascade's WIP and CARES. Community Action Agencies that administer WIP offer customers whole-home weatherization services which include a home energy audit, the installation of up to thirteen high-efficiency measures, and health and safety home repairs necessary for the efficacy of the installed energy-efficiency measures.

Cascade's bill assistance program, CARES, offers income-qualified customers with five tiers of generous bill discounts and, if needed, five tiers of arrearage forgiveness grants. This program, and its corresponding cost recovery mechanism, were approved in Order 01 issued in Docket UG-230551. Under CARES, Washington customers may call either a Community Action Agency or Cascade and self-attest to having a qualifying income. Co-administration and the ability for customers to qualify for program benefits through self-attestation have removed barriers experienced under the prior assistance program and have increased program participation significantly.

Customers are made aware of CARES through various communication channels, including bill inserts, postcards, emails, social media posts, Google Ads, third-party website banner ads, streaming audio and video ads, outbound and recurring phone calls to select customers, and door tags. To address linguistic preferences, all CARES program communications are provided in English and Spanish, and based on feedback from its Community Action Agencies, Cascade translated CARES flyers and paper applications into Tagalog, Burmese, Filipino, Punjabi, Chinese, Vietnamese, Ukrainian, Arabic, and Russian. Cascade is also overseeing a pilot that engages Community Based Organizations (CBOs) for CARES program outreach. Final Order 09, which requires a three-year pilot, describes CBO engagement as the use of “trusted messengers” for hard-to-reach customers.

An equity lens must include consideration of environmental impacts upon communities. Cascade Natural Gas, along with its three sister companies, provides the Environmental Community Opportunity (ECO) Fund to support projects that enhance environmental education and stewardship in the communities that Cascade serves. Environmental education projects may include grants for specific teacher training, books or equipment for classroom use, field trips, or special project support in the natural or physical sciences. Community environmental stewardship projects may include such things as nature trail development, wildlife area enhancement, recycling and community cleanup promotion, or the development of ‘living laboratories’ for the use of students and the general public. The Company is particularly interested in reaching traditionally underserved communities through such resources.

Cascade recognizes that to integrate equity into its daily operations, it must identify vulnerable populations and understand the specific inequities these communities face. In 2023 Cascade began mapping the Washington Department of Health’s highly impacted community (HIC) rankings per census tract in Cascade’s service territory and correlating the HIC data with billing data, such as customer-level information on arrearages, disconnections for non-payment, and participation in income-qualified programs. Through this process, Cascade expects it will be able to better identify and engage with customers who need protections, including CARES services, and further identify inequities in distributional justice and seek restorative justice through corrective measures that mitigate inequitable outcomes.

Much of Cascade’s initial work towards valuing equity has been on the frontlines of meeting customers where they are, providing meaningful bill payment assistance, communicating clearly, and reducing linguistic barriers. While this is an important step that will continually need to be reviewed to ensure practices stay current to customers’ needs, Cascade recognizes that it needs to go further; it needs to apply an equity lens farther back into its workstream. To do this, Cascade has been developing a Distributional Equity Analysis (DEA) to gauge the impacts a Company decision, such as a new or modified pipeline, may have on vulnerable communities. To date, the Company has a draft DEA that it has introduced to its EAG. Further conversations are needed to better develop the DEA with leadership. Once approved by the EAG, Cascade plans to adopt the use of DEA scoring for all projects exceeding a set dollar amount. Mitigating measures, including whether to proceed with a plan, seek community involvement or adapt the plan to something else such as a non-pipeline alternative, will be considered based on the DEA score.

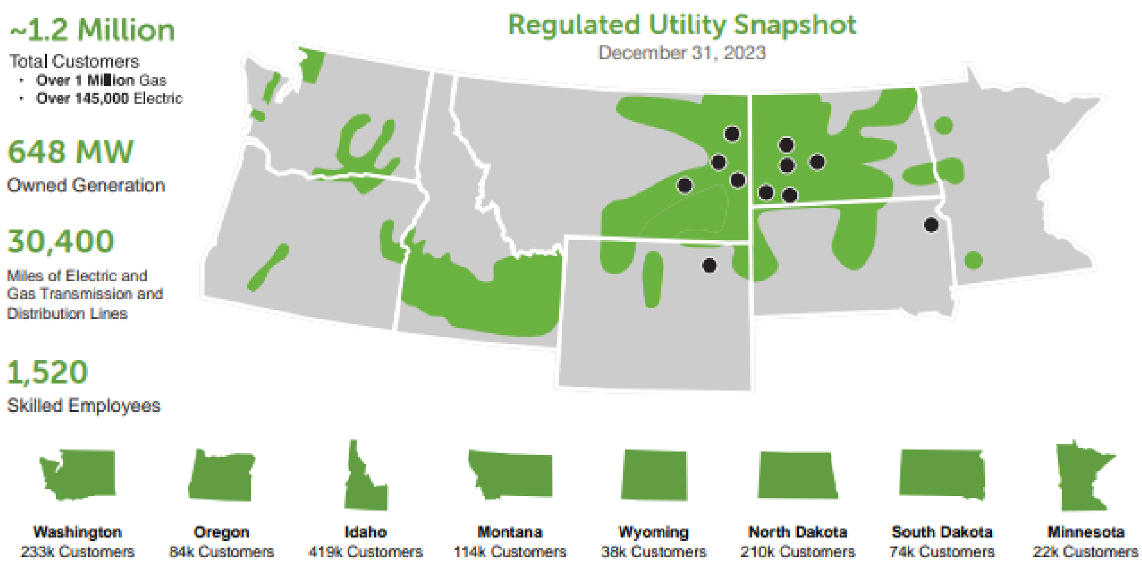
Overall, Cascade understands that making equity an integrated part of its daily operations must occur iteratively and through collaboration. Cascade has more work to do, but the Company has laid useful groundwork that will aid in implementing restorative justice. With the collaboration from the EAG. the CARES Advisory Group, and the Technical Working Group, Cascade has the forums to discuss issues and concerns, and the space for underrepresented customer groups to engage. Cascade looks forward to improving its understanding of the inequities it may inadvertently impose on vulnerable communities and seeing better ways to proceed in the future, including implementing mitigating measures where possible.

Cascade will monitor equity considerations in other regional IRPs and follow guidance from the Commission and its EAG. This will support the Company's efforts to incorporate increased equity considerations in the 2025 IRP.

Company Organization

In 2007, Cascade became a subsidiary of MDU Resources Group, Inc., a multidimensional regulated energy delivery and construction materials and services business, operating across the country and traded on the New York Stock Exchange under the symbol MDU. Cascade, with headquarters in Kennewick, Washington, is part of its utility group of subsidiaries. MDU Resources Group’s utility companies, when combined, serve approximately 1.2 million customers. Cascade distributes natural gas in Oregon and Washington. Great Plains Natural Gas Co. distributes natural gas in western Minnesota and southeastern North Dakota. Intermountain Gas Company distributes natural gas in southern Idaho. Montana-Dakota Utilities Co. generates, transmits and distributes electricity and distributes natural gas in Montana, North Dakota, South Dakota and Wyoming. Figure 2-3 provides a geographical representation of the various services/territories served by MDU Resources.

Figure 2-3: MDU Resources Services and Territory


~1.2 Million
Total Customers
Over 1 Million Gas
Over 145,000 Electric
648 MW
Owned Generation
30,400
Miles of Electric and Gas Transmission and Distribution Lines
1,520
Skilled Employees
Regulated Utility Snapshot
December 31, 2023
Washington
233k Customers
Oregon
84k Customers
Idaho
419k Customers
Montana
114k Customers
Wyoming
38k Customers
North Dakota
210k Customers
South Dakota
74k Customers
Minnesota
22k Customers

Chapter 3

Demand Forecast

Overview

Each year Cascade develops a minimum 20-year forecast of customers, therm sales, and peak requirements for use in short-term (annual budgeting) and long-term (distribution and integrated resource planning) planning processes. Cascade is extending its forecast out to 2050 in order to better align with carbon compliance goals. Sources of this forecast include historic data, market intelligence (i.e., building code changes), and regional economic data from Woods & Poole. This forecast is a robust portfolio of estimates created by expanding a single best-estimate forecast, which includes various potential economic, demographic, and marketplace eventualities, into scenarios such as a reference case, low, and high growth. The scenarios are used for distribution system enhancement planning and as inputs in optimization models to determine the reasonable least cost, least risk mix of supply and energy efficiency resources, revenue budgeting, and load forecasts associated with the purchased gas cost process.

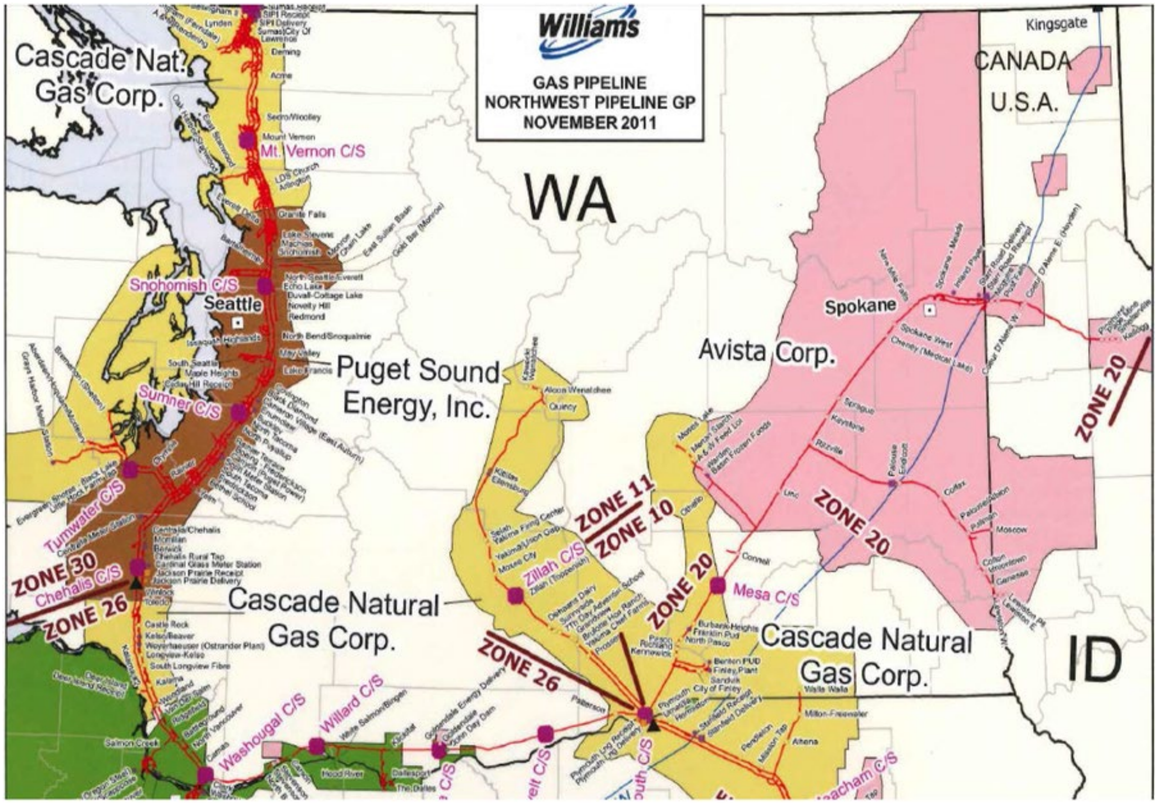
Key Points

- Cascade extended its forecast analyses of demand areas, HDDs, and wind from 20 years to 28 years to better align with emissions modeling.
- Peak day is analyzed stochastically using 10,000 Monte Carlo simulated draws for each weather zone.
- Cascade added a price regressor to the Use-Per-Customer forecast.
- The Company utilizes dynamic regression modeling techniques for customer and annual demand forecasts.
- High and low scenarios are included and alternative forecasting assumptions were considered.
- Cascade expects system load growth to average 1.10% per year over the 28-year planning horizon.
- For methodological changes from previous IRPs, please refer to the "Methodological Changes…" section of this chapter.
- Uncertainties in the future, such as economic and long-term weather conditions, as well as future legislation, may cause differences from the Company's forecast.

Demand Areas

For the 2025 IRP's planning horizon, 2025-2050, Cascade is forecasting at the pipeline zonal level and the rate class level. Historically, Cascade's forecast was at the citygate level rather than the pipeline zonal level. A map of Washington pipeline zones can be seen in Figure 3-1. Additionally, pipeline zone maps of Washington and Oregon can be found in Figures 12-9 and 12-10. In Figure 3-2, Cascade shows the citygates that belong to each pipeline zone.

Figure 3-1: Washington Pipeline Zone Map



Cascade has a total of 76 citygates, of which nine citygates feed only non-core customers and the remaining 67 serve at least one core customer. Of the 67 citygates that serve core customers, 22 are grouped into nine different citygate loops. These are then grouped by pipeline zone, made up of varying numbers of citygates and citygate loops. Each of these areas contain multiple rate classes, resulting in approximately 57 individual dynamic regression models. Each zone is assigned to a weather location. For this IRP, the Company assigned the zones to the closest weather location by distance. The forecast results are shown in Appendix B. In Figure 3-2, Cascade shows the citygates that belong to each pipeline zone.

Figure 3-2: Demand Areas

Citygate	Loop	State	Weather Location	Zone
7TH DAY SCHOOL		WA	Yakima	10
A/M RENDERING	Sumas SPE Loop	WA	Bellingham	30-W
ACME		WA	Bellingham	30-W
ARLINGTON		WA	Bellingham	30-W
ATHENA		OR	Pendleton	ME-OR
ATTALIA		WA	Walla Walla	GTN
BAKER		OR	Baker City	24
BELLINGHAM 1 (FERNDALE)	Sumas SPE Loop	WA	Bellingham	30-W
BEND	Bend Loop	OR	Redmond	GTN
BREMERTON (SHELTON)		WA	Bremerton	30-S
BURBANK HEIGHTS	Burbank Heights Loop	WA	Walla Walla	20
CASTLE ROCK		WA	Bremerton	26
CHEMULT		OR	Redmond	GTN
DEHAWN DAIRY		WA	Yakima	10
DEMING		WA	Bellingham	30-W
EAST STANWOOD	East Stanwood Loop	WA	Bellingham	30-W
FINLEY		WA	Walla Walla	20
GILCHRIST		OR	Redmond	GTN
GRANDVIEW		WA	Yakima	10
HERMISTON		OR	Pendleton	ME-OR
HUNTINGTON		OR	Baker City	24
KALAMA #1		WA	Bremerton	26
KALAMA #2		WA	Bremerton	26
KENNEWICK	Kennewick Loop	WA	Walla Walla	20
LA PINE		OR	Redmond	GTN
LAWRENCE		WA	Bellingham	30-W
LDS CHURCH		WA	Bellingham	30-W
LONGVIEW-KELSO	Longview South Loop	WA	Bremerton	26
LYNDEN	Sumas SPE Loop	WA	Bellingham	30-W
MADRAS		OR	Redmond	GTN
MCCLEARY (ABERDEEN/HOQUIAM)		WA	Bremerton	30-S
MILTON-FREEWATER		OR	Walla Walla	ME-OR
MISSION TAP		OR	Pendleton	ME-OR
MOSES LAKE		WA	Yakima	20
MOUNT VERNON	Sedro-Woolley Loop	WA	Bellingham	30-W
MOXEE (BEAUCHENE)		WA	Yakima	11
NORTH BEND		OR	Redmond	GTN
NORTH PASCO	Burbank Heights Loop	WA	Walla Walla	20
NYSSA-ONTARIO		OR	Baker City	24

Citygate	Loop	State	Weather Location	Zone
OAK HARBOR/STANWOOD	East Stanwood Loop	WA	Bellingham	30-W
OTHELLO		WA	Walla Walla	20
PASCO	Burbank Heights Loop	WA	Walla Walla	20
PATTERSON		WA	Yakima	26
PENDLETON		OR	Pendleton	ME-OR
PRINEVILLE		OR	Redmond	GTN
PRONGHORN		OR	Redmond	GTN
PROSSER		WA	Yakima	10
QUINCY		WA	Yakima	11
REDMOND		OR	Redmond	GTN
RICHLAND (Richland Y)	Kennewick Loop	WA	Walla Walla	20
SEDRO/WOOLLEY	Sedro-Woolley Loop	WA	Bellingham	30-W
SELAH	Yakima Loop	WA	Yakima	11
SOUTHRIDGE	Kennewick Loop	WA	Walla Walla	20
SOUTH BEND	Bend Loop	OR	Redmond	GTN
SOUTH LONGVIEW	Longview South Loop	WA	Bremerton	26
STANFIELD		OR	Pendleton	GTN
STEARNS (SUNRIVER)		OR	Redmond	GTN
SUNNYSIDE		WA	Yakima	10
UMATILLA		OR	Pendleton	ME-OR
WALLA WALLA LOOP		WA	Walla Walla	ME-WA
WALLULA		WA	Walla Walla	ME-WA
WCT-CNG INTERCONNECT	Sumas SPE Loop	WA	Bellingham	30-W
WENATCHEE		WA	Yakima	11
WOODLAND		WA	Bremerton	26
YAKIMA CHIEF RANCH		WA	Yakima	10
YAKIMA TRAINING CENTER		WA	Yakima	11
YAKIMA/UNION GAP	Yakima Loop	WA	Yakima	11
ZILLAH (TOPPENISH)		WA	Yakima	10

Weather

Heating Degree Day, or HDD, values are calculated with the daily average temperature, which is the simple average of the high and low temperatures for a given day. The daily average is then subtracted from an HDD degree threshold (for example 60°F) to create the HDD for a given day. Should this calculation produce a negative number, a value of zero is assigned as the HDD. Therefore, HDDs can

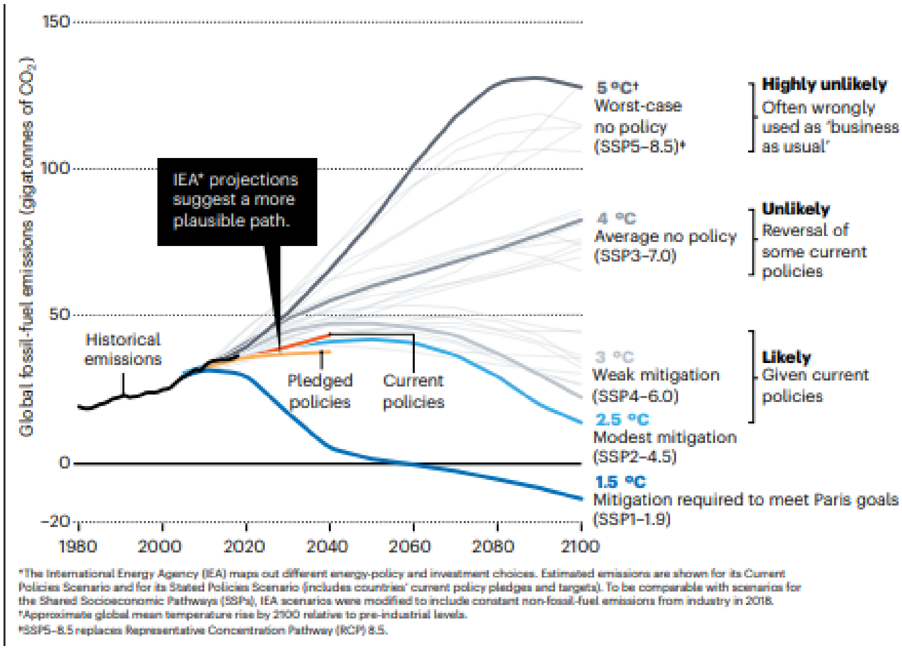
never be negative. The HDD threshold number is designed to reflect a temperature below which heating demand begins to significantly rise.[1]
Historical weather data is provided by a contractor, Schneider Electric. Cascade has seven weather locations, with four located in Washington and three in Oregon. The four locations in Washington are Bellingham, Bremerton, Walla Walla, and Yakima. Historically, Cascade has accessed data from National Oceanic and Atmospheric Administration (NOAA), but found many months/locations with missing data. The previous forecasts used 30 years of recent history as the normal weather.

For the 2025 IRP, Cascade has contracted with ICF, a global advisory and technology service provider, to provide climate impact projections and a cold weather qualitative analysis. According to ICF, scientists develop climate change projections using Global Climate Models (GCMs), which are simulations of Earth's climate and physical processes. Using a method called downscaling, scientists can translate global climate data to a higher spatial resolution. This allows for projections to capture local climate characteristics and improve planning. The most recent climate projections, shown in Figure 3-3, use Shared Socioeconomic Pathways (SSPs) emission scenarios[2]:

- SSP 2-4.5 represents a more likely scenario assuming meaningful greenhouse gas emissions reductions by mid-century when compared to the likely scenario in Figure 3-3.
- SSP 3-7.0 represents a less likely scenario assuming greenhouse gas emissions increase throughout the century.

Figure 3-3: Possible Emission Futures Under CMIP6

[1] The historical threshold for calculating HDD has been 65 °F. However, as discussed in prior IRPs, Cascade has determined that lowering the threshold to 60 °F produces more accurate results for the Company's service area.
[2] *See:* https://media.nature.com/original/magazine-assets/d41586-020-00177-3/d41586-020-00177-3.pdf



For both SSPs, Cascade received 22 model projections for each of the Company's seven weather locations. Figure 3-4 shows the 22 models, as well as the average of all the models. The difference the impact between the two SSPs have on usage is minimal, which can be seen in Figure 3-5. For the reference case, Cascade projects the total therms to be approximately 9.3 billion therms and the difference between the two SSPs is approximately 10 million therms.

Figure 3-4: SSP 3-7.0 HDD projections

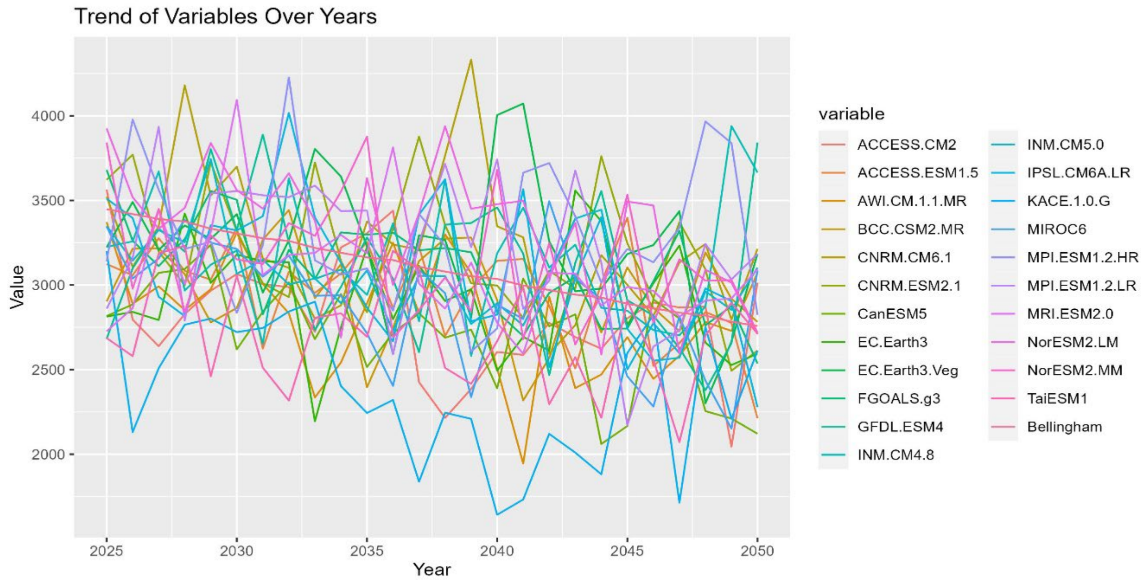
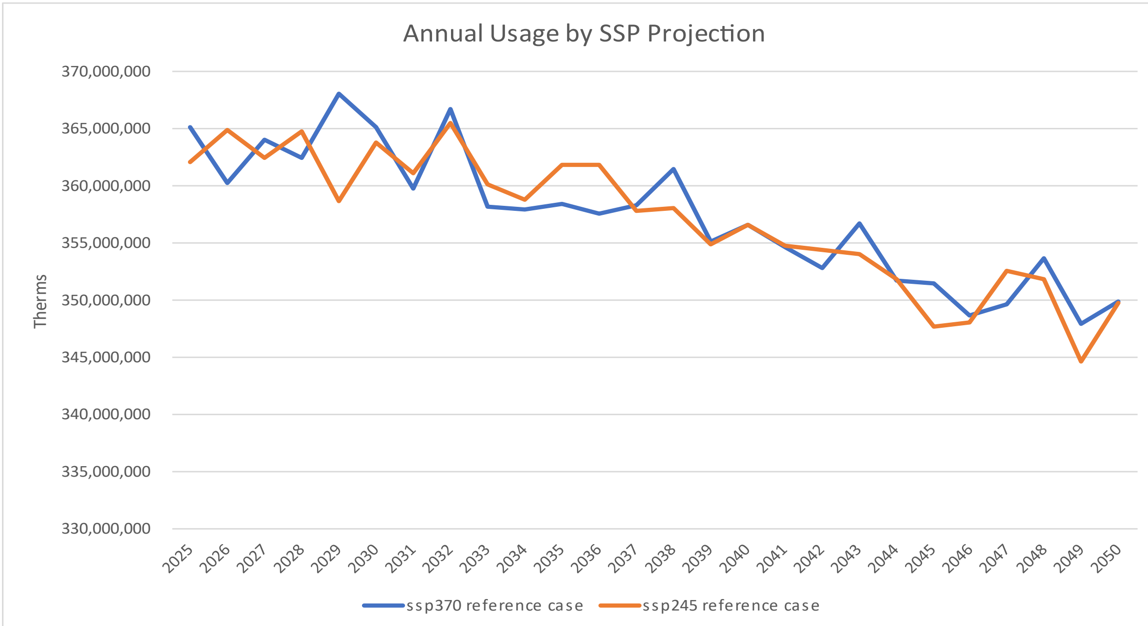

Trend of Variables Over Years
Value
Year
4000
3500
3000
2500
2000
2025
2030
2035
2040
2045
2050
variable
ACCESS.CM2
ACCESS.ESM1.5
AWI.CM.1.1.MR
BCC.CSM2.MR
CNRM.CM6.1
CNRM.ESM2.1
CanESM5
EC.Earth3
EC.Earth3.Veg
FGOALS.g3
GFDL.ESM4
INM.CM4.8
INM.CM5.0
IPSL.CM6A.LR
KACE.1.0.G
MIROC6
MPI.ESM1.2.HR
MPI.ESM1.2.LR
MRI.ESM2.0
NorESM2.LM
NorESM2.MM
TaiESM1
Bellingham

Figure 3-5: Annual Usage by SSP Projection



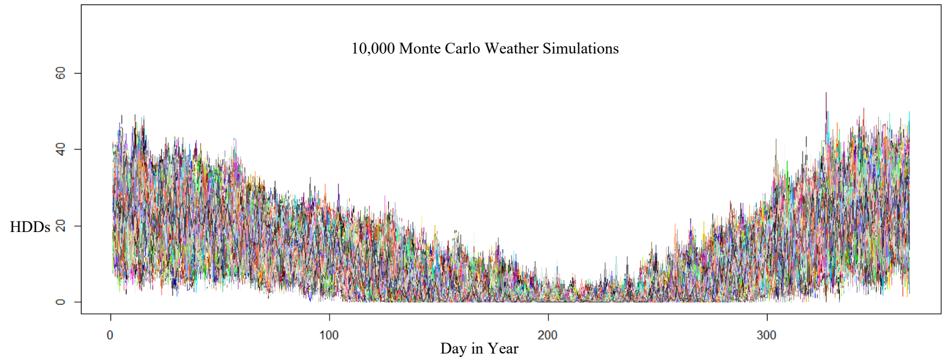
Peak Day Methodology

In order to ensure satisfaction of core customer demand on the coldest days, Cascade must use a methodology for determining what a peak day might be and then include it in the modeling. In the 2023 IRP, Cascade evolved its peak day methodology from a deterministic peak day to a stochastic peak day. Peak day forecasts enable Cascade to make prudent distribution system and peak upstream pipeline capacity planning decisions to fulfill its responsibility to provide heating under all but *force majeure* conditions, particularly as most space-heating customers will have no alternative heating source during the coldest days in the event gas does not flow.

The stochastic peak day that was analyzed in the forecast model is a weather zone specific 99th percentile peak day. This 99th percentile peak day will give Cascade the confidence that the system can handle a peak day based on the weather of each weather zone with varying amounts of demand. This peak day HDD methodology allows Gas Supply to plan for the highest peak event during a heating season.

The 99th percentile peak day is derived by running 10,000 Monte Carlo simulations on each of the seven weather zones. Once 10,000 draws are gathered and ordered for each weather zone, Cascade can pull the 9,900th draw as the 99th percentile to use in the demand forecast. Figure 3-6 displays all 10,000 draws graphed together.

Figure 3-6: 10,000 Monte Carlo Weather Simulations



For Plexos® modeling, Cascade uses this peak day for each weather zone by applying the HDDs on December 21st of each year in the forecast. The selection of December 21st is mostly arbitrary (though one of Cascade's coldest peak days did occur on December 21st), with the intention of mimicking a cold winter day. For example, all citygates associated with the Yakima weather station use the 99th percentile peak HDD for Yakima for each December 21st of the forecast period, and similarly for all the other weather stations and citygates. This provides the highest demand scenario for peak demand load based on Monte Carlo simulations of years of weather history for each citygate. Applying this stochastic peak day to December 21st of each forecasted year gives Cascade an accurate representation of the demand the Company could expect if this weather happened during the planning horizon.

Based on feedback from ICF's cold weather qualitative analysis, Cascade maintains the same peak day throughout the planning horizon and does not adjust it for climate impacts. Cascade Natural Gas' service area has historically experienced extreme cold events, though the magnitude of these extremes varies by region. Climate change is projected to continue to drive warmer temperatures in the Pacific Northwest, reducing the overall frequency of extreme cold events across the region in the long term. This does not preclude cold snaps from occurring. Some evidence suggests that climate change could worsen cold extremes resulting from polar vortex events or other processes in the near to medium term (e.g. through 2050). The non-Gaussian temperature distribution in the Pacific Northwest suggests that the region could experience a slower decrease in the number of extreme cold threshold exceedances.[3]

Cascade is continuously monitoring its peak day methodology to ensure an accurate and realistic peak day forecast.

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[3] *See:* Loikith, P.C. And Neelin, J.D. (2019). Non-Gaussian Cold-Side Temperature Distribution Tails and Associated Synoptic Meteorology. Journal of Climate. HTTPS://DOI.ORG/10.1175/JCLI-D-19-0344.1.

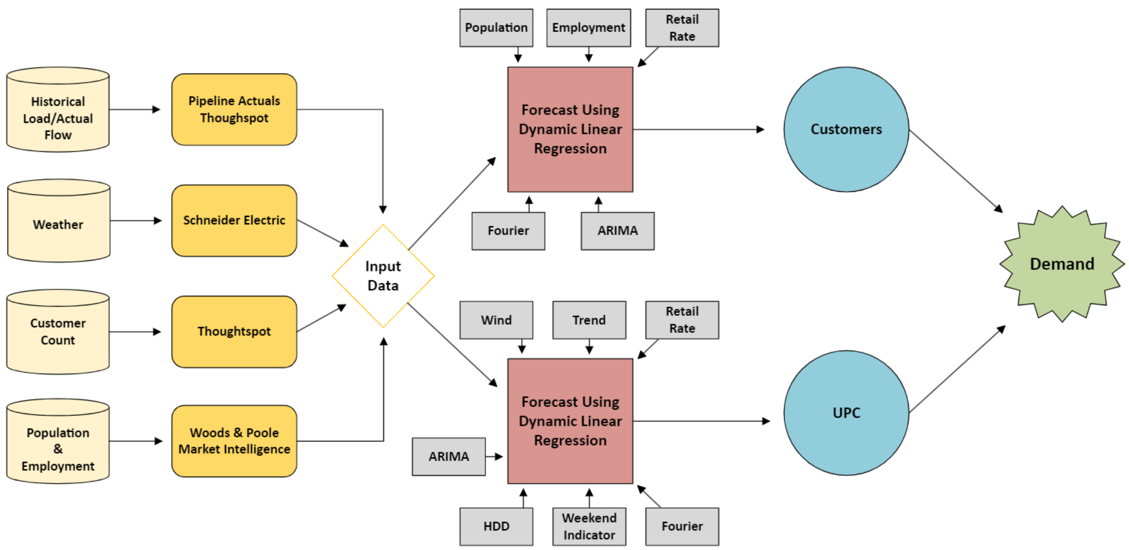
Wind

Wind values are calculated with the daily average wind speed, which is the simple average of the high and low wind speeds for a given day. Wind speeds are also weather location specific, similar to HDDs. Wind typically has a positive correlation with use in that when wind speeds are higher then usage is higher as well.

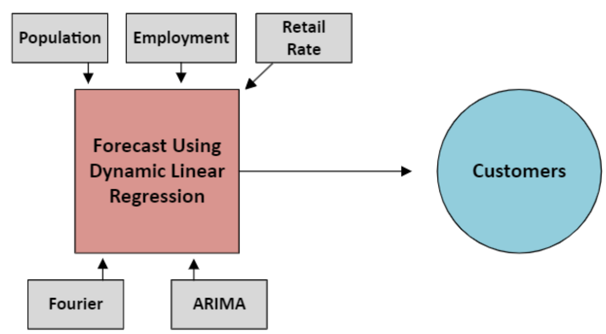
Demand Overview

Figure 3-7 provides a roadmap for Cascade's demand forecast. The inputs are displayed along with their sources in yellow and gold. The customer forecast and use-per-customer (UPC) forecast are shown in red along with their respective inputs into the model. Finally, the customer forecast is multiplied by the use-per-customer forecast to create the final demand forecast.

Figure 3-7: Demand Forecasting Process Overview



Customer Forecast Methodology



Customer count forecasts are designed to reflect both demographic trends and economic conditions each in the short- and long-term. Cascade uses population and employment growth data from Woods & Poole (W&P) to create an economical look at customer forecasts. W&P growth forecasts are provided at the county level. It should be noted that W&P forecasts can be adjusted whe￼e about a demand area indicates a significant difference from W&P regarding observed economic trends. Cascade utilizes dynamic regression models for the customer forecast as well as regression models for the UPC forecast, which will be discussed in the next subchapter. Below is the formula the Company used to run the regressions:

$$C_{Class}^{Zone} = \alpha_0 + \alpha_1 Pop^{Zone} + \alpha_2 Emp^{Zone} + \alpha_3 Rate^{Zone}\ Fourier(k) + ARIMA\epsilon(p,d,q)$$

Model Notes:

- $C_{Class}^{Zone} = Customers\ by\ Pipeline\ Zone\ by\ Class$
- $Pop^{Zone} = Population\ by\ Pipeline\ Zone$

- $Emp^{Zone} = Employment\ by\ Pipeline\ Zone$
- $Fourier = Terms\ used\ to\ capture\ seasonal\ patterns$
- $k = Number\ of\ Fourier\ terms\ used\ in\ model$
- $ARIMA\epsilon(p, d, q) =$ $Indicates\ that\ the\ model\ has\ p\ autoregressive\ terms, d\ difference\ terms, and\ q\ moving\ average\ terms.$

Cascade runs this model approximately 57 times to account for each customer class by pipeline zone. The Company begins by testing 31 different combinations of the regressors in both dynamic regression models and one Autoregressive Integrated Moving Average (ARIMA) only model. The dynamic regression models test Fourier, Population, Employment, Retail Rate and all combinations of those four regressors as an ARIMA model. The last model only uses ARIMA terms and no regressors. The method used to compare and select a model is called the AIC, or the Akaike Information Criterion. This is a measure of the relative quality of statistical models, relative to each of the other models. In each of the models, except for the 'ARIMA Only' model, an ARIMA term is used to capture any structure in the errors (or residuals) of the model. In other words, there could be predictability in the errors, so they could be modeled as well. If the data is non-stationary, the ARIMA function will difference the data. Most times, the data does not require differencing or, if so, only needs to be differenced once. Once the best model is selected for each customer class by citygate, a forecast is performed using the selected model.

Building Code Impacts

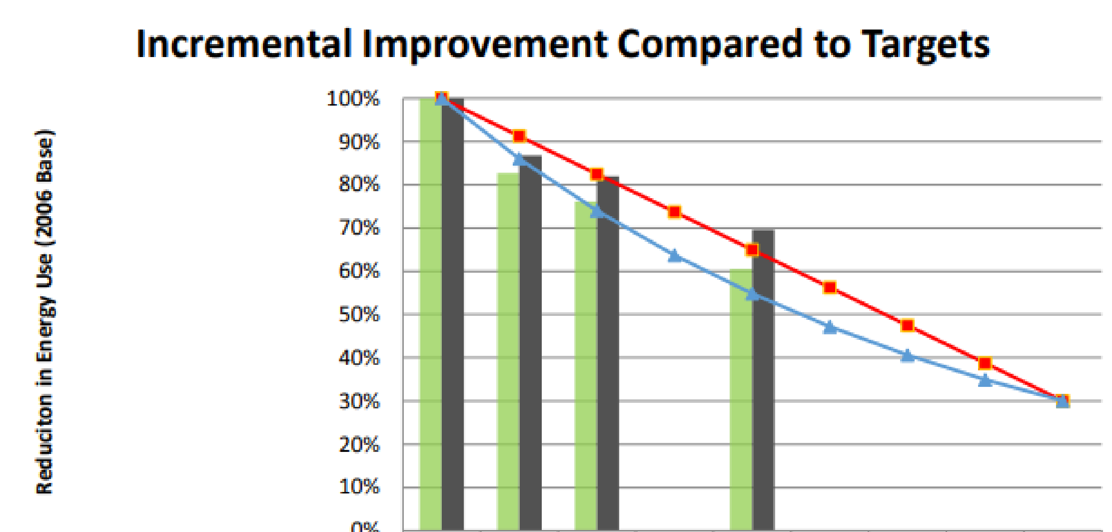
As the Washington State Energy Codes (WSEC) continue to progress and impact new construction for natural gas end use appliances, Cascade must consider these impacts in the Company's customer and load forecasts.

RCW 19.27A.020(2)(a) is a broad goal that provides direction to the Washington State Building Code Council (SBCC) to adopt amendments to the WSEC that progressively moves the needle for new construction houses and buildings to be non-emitting by 2031. To achieve this goal, it is important to consider that a non-emitting (zero fossil-fuel greenhouse gas emission) home/building is typically considered based upon the net emissions; however, the legislative direction does not specify "net" in this circumstance. Consideration of net emissions is important, as it allows for a broader and more reliable energy portfolio. To achieve net-zero, emitting energy uses can be offset by renewable energy production (i.e., wind or solar) or energy that has a negative carbon intensity (i.e., renewable natural gas); thus, allowing for emitting (i.e., natural gas) energy use during severe weather events, while still having a house/building that has net-zero emissions.

Under RCW 19.27A.020(2)(a), the SBCC is directed to "…help achieve the broader goal…" of zero emission homes/buildings. Note that this is a goal, not a mandate. Conversely, RCW 19.27A.160 is an explicit direction to the SBCC to move towards a 70% reduction in annual net energy consumption by 2031. This is a mandate and is clear that the goal is a "net" energy.

Since the enacting legislation, RCW 19.27A.020(2)(a), resulted from the 2009 Senate Bill 5854, the 2012, 2015, 2018, and 2021 code cycles were all likely impacted by this legislation. Figure 3-8 provides an explanation of how the SBCC has addressed the more explicit legislative direction of RCW 19.27A.160.

Figure 3-8: Reduction Targets in Energy Use[4]



	2006	2009	2012	2015	2018	2021	2024	2027	2030
Residential	100%	82.7%	76.1%		60.5%				
Commercial	100%	86.8%	82.0%		69.6%				
Target: 8.75 % savings compared to the 2006 WSEC	100%	91%	83%	74%	65%	56%	48%	39%	30%
Target: 14% savings compared to each previous code	100%	86%	74%	64%	55%	47%	41%	35%	30%

The most impactful measures were found in the 2018 and 2021 WSEC. For example, NEEA's Washington Residential Post Code Adoption Market Research Final Report[5] found that "…builder practices have significantly changed under the 2018 WSEC compared to the 2015 WSEC. This includes a shift towards electric space heating and water heating…" "…the incidence of electric primary space heating is 88% in this study of the 2018 WSEC; the 2015 WSEC study (CLEAResult 2020) recorded a 20% incidence of electric primary space heating for comparison. Water heating fuel is also

[4] Final Cost Benefit Analysis for the 2021 WSEC-R
[5] *See* Washington Residential Post-Code Adoption Market Research (neea.org)

showing significant changes. This study of the 2018 WSEC shows 87% electric water heating, while the 2015 WSEC study recorded 44% electric water heating." (Note that this NEEA report was focused solely on residential; NEEA's 2018 WSEC Energy Savings Analysis for Nonresidential Buildings provide some additional insight for commercial projects).[6]

With the 2021 WSEC, effective March 15, 2024, the use of natural gas for space and water heating is generally prohibited for commercial buildings and may only be used for supplementary (backup) heating or within gas heat pumps in residential buildings. Given the shift towards electric appliances already found from the 2018 WSEC, the 2021 WSEC will only further this trend. Figure 3-9 shows the energy equalization credits for residential construction.[7]

Figure 3-9: Energy Equalization Credits

System Type	Description of Primary Heating Source	Credits	
		All Other	Group R-2[a]
1	For combustion heating equipment meeting minimum federal efficiency standards for the equipment listed in Table C403.3.2(5) or C403.3.2(6)	0	0
2	For an initial heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(2) and supplemental heating provided by electric resistance or a combustion furnace meeting minimum standards listed in Table C403.3.2(5)[b]	1.5	0
3	For heating system based on electric resistance only (either forced air or Zonal)	0.5	-0.5
4[c]	For heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(2) or C403.3.2(9) **or** Air to water heat pump units that are configured to provide both heating and cooling and are rated in accordance with AHRI 550/590	3.0	2.0
5	For heating system based on electric resistance with: 1. Inverter-driven ductless mini-split heat pump system installed in the largest zone in the dwelling, **or** 2. With 2kW or less total installed heating capacity per dwelling	2.0	0

Customer count and therm forecasts are augmented by revisions to the base data and output to create a portfolio of potential scenarios. Since the economic models cannot accurately forecast the building code impacts, Cascade must make some assumptions. Cascade is assuming flat growth due to building code changes. These

[6] *See* Northwest Energy Efficiency Alliance (NEEA) | 2018 Washington State…

[7] *See:* HTTPS://SBCC.WA.GOV/STATE-CODES-REGULATIONS-GUIDELINES/STATEBUILDING-CODE/ENERGY-CODE

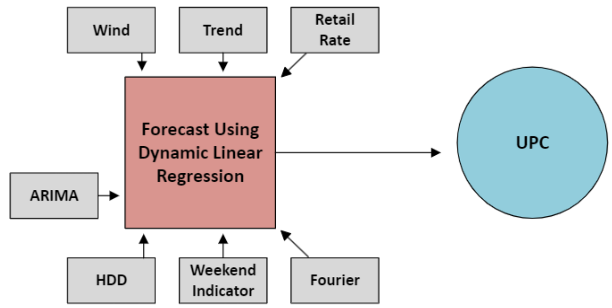
assumptions are built with the understanding that Cascade will see very little growth, assuming only homes with gas stoves or other appliances are added to the system. This is offset with minimal growth assuming losing customers each year. Historically, Cascade loses approximately 0.15% customers per year as they shut off gas connection without reconnecting.

The 2025 IRP is experiencing significant uncertainty around forecasting natural gas customer counts than in previous IRPs. The current restrictions under the 2021 WSEC regarding new construction, the Climate Commitment Act, the passage of initiatives such as I-2066, and the City of Berkley appeal causes forecasting natural gas customer counts to be difficult and must include wide ranges of outcomes.[8,9] Cascade's high customer growth scenario assumes building codes are amended and growth returns to existing rates before the adpotion of the 2018 WSEC pre-building code rates. On November 22, 2024, the WA SBCC voted to approve an out of cycle code review of the 2021 WSEC for compliance with I-2066 which may affect restrictions on natural gas use. The low scenario assumes a heavy push to reduce natural gas new construction to zero and Cascade begins to lose customers as houses are demolished and rebuilt under restrictive building codes. To capture an extreme impact, Cascade assumes losing 1.5% customers per year in the low forecast. Cascade is not predicting either will happen, nor is Cascade saying one is more likely than the other, but the Company must understand the risks that pertain in a high and low customer count future.

Cascade locked in the forecast model in September of 2024 as it is a key input for several other aspects of this IRP.

[8] Initiative 2066 Full Text.pdf
[9] City of Berkeley Agrees to Repeal Ban on Natural Gas in New Construction as Required by Federal Law - American Gas Association

Use-Per-Customer (UPC) Forecast Methodology



As previously mentioned, Cascade utilizes regression models for the UPC part of the demand forecast as well.[10] Sources for the inputs into this model are pipeline actuals, Cascade's gas management system, and Cascade's billing system data from ThoughtSpot. Cascade developed the UPC coefficient by first gathering historical pipeline demand data by day. The pipeline demand data includes core and non-core usage. The non-core data is backed out using Cascade's measurement data stored in the Company's Aligne energy transaction system which leaves only the daily core usage data. Then the daily data is allocated to a rate schedule for each citygate, which is now rolled up to the pipeline zonal level, by using Cascade's ThoughtSpot system, which analyzes the therms billed for each rate class. Finally, this data is divided by number of customers to come up with a UPC number for each day and for each rate schedule at each pipeline zone.

Below is the model used for the UPC forecast:

$$\frac{Therms}{C_{Class}^{Zone}} = \alpha_0 + \alpha_1 HDD^{Zone,M} + \alpha_2 I_w + \alpha_3 WIND^{Zone,M} + \alpha_4 Rate^{Class,M} + Fourier(k) + ARIMA(p,d,q)$$

Model Notes:

- $C_{Class}^{Zone} = Customers\ by\ Pipeline\ Zone\ by\ Class.$
- $HDD^{Zone} = Heating\ Degree\ Days\ from\ Weather\ Location$
- $m = month$
- $w = weekend$
- $I = Indicator\ variable, 1\ if\ weekend, and\ 0\ if\ weekday.$
- $WIND^{Zone} = Daily\ average\ wind\ speed\ from\ Weather\ Location$
- $Rate^{Class} = Daily\ retail\ rate\ from\ class$
- $Fourier(k) = Captures\ seasonality\ of\ k\ number\ of\ seasons.$
- $ARIMA(p,d,q) = Indicates\ model\ has\ p\ autoregressive\ terms,\ d\ difference\ terms, and\ q\ moving\ average\ terms.$

[10] A regression model provides a function that describes the relationship between one or more independent variables and a response, dependent, or target variable. A regression analysis provides the means for many types of prediction and for determining the effects on target variables. Multiple regression indicates there are more than one input variables that may affect the outcome, or target variable.

Cascade runs this model for each of the ten pipeline zones, breaking each of those out into their respective rate classes results in 57 different regressions. Cascade begins each model with a simple linear model regressing on HDDs, wind, retail rate, and weekend. If the residuals analyzed show structure, then the models are expanded to include ARIMA and Fourier terms.

Retail Rate as a New Regressor

Retail Rate is a slight adjustment to the price regressor for this IRP.[11] Overall, retail rate has not seen much significance in the models. The largest coefficients were on the commercial and industrial customer classes, and even then the coefficients were quite small, seemingly insignificant. The residential coefficients were close to zero. Through the targeted TAG process, stakeholders suggested Cascade replace the price regressor with a retail rate regressor in an attempt to better capture customer behavior. Cascade is looking forward to performing this analysis in the next demand forecast.

Uncertainties

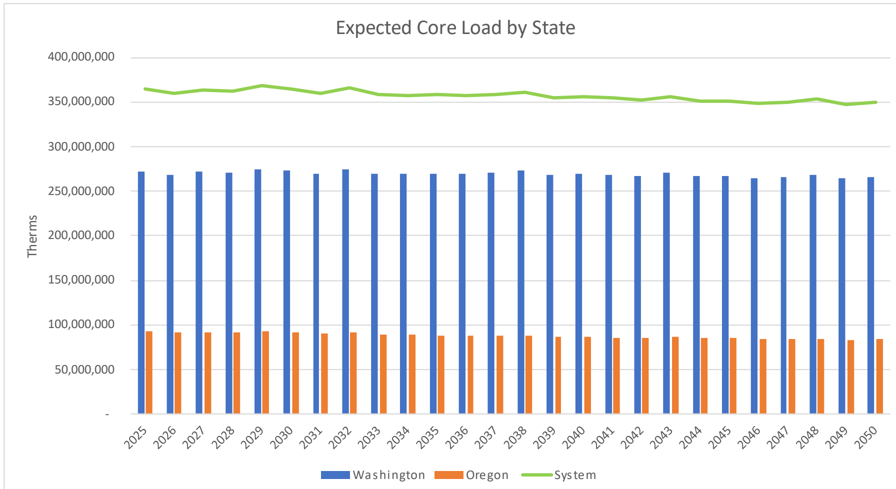
This forecast represents Cascade's best estimate about future events. At this time, several important factors make predicting future demand particularly difficult such as continued economic growth, carbon legislation, building code changes, direct use of natural gas campaigns, energy efficiency, and long-term weather patterns. The range of scenarios presented here and in Chapter 9 encompass the full range of possibilities through econometric analysis. These forecasts were created after statistical analyses of a matrix of different functional forms and economic indicators. The chosen indicators were selected because of their consistency in returning statistically valid results. While they may be the best results mathematically, they are not the sole and only determinants of demand. As a result, while Cascade believes the numbers provided here are accurate and that the scenarios presented represent the full range of possibilities; there are, and always will be, uncertainties in forecasting future periods.

Forecast Results

Load across Cascade's two-state service territory is relatively flat, to slightly declining under the reference case. Cascade's reference case forecast anticipates flat customer counts, with a decline in use per customer. Figure 3-10 shows the reference case core load volumes by state.

[11] A regressor is the name given to any variable in a regression model that is used to predict a response variable.

Figure 3-10: Reference Case Core Load by State (Volumes in Therms)



Load growth across Cascade's system through 2050 fluctuates due to accounting for leap years and including retail rates in the customer and load forecast models. Figure 3-7 illustrates the growth forecast for Cascade's system load year over year, showing growth on Cascade's system but at a declining rate.

For the SSP 3-7.0 HDD projections, the reference case results in Washington growth rates of -0.09%. For the SSP 3-7.0 HDD projections, the reference case results in Washington growth rates of -0.06%. Figure 3-10 represents the load comparison for Washington state between SSP 3-7.0 and SSP 2-4.5. Figure 3-11 represents the system load compared to previous IRPs. Figure 3-12 represents the load stack between Residential, Commercial, and Industrial customers.

Figure 3-10: Washington Annual Load Comparison by SSP

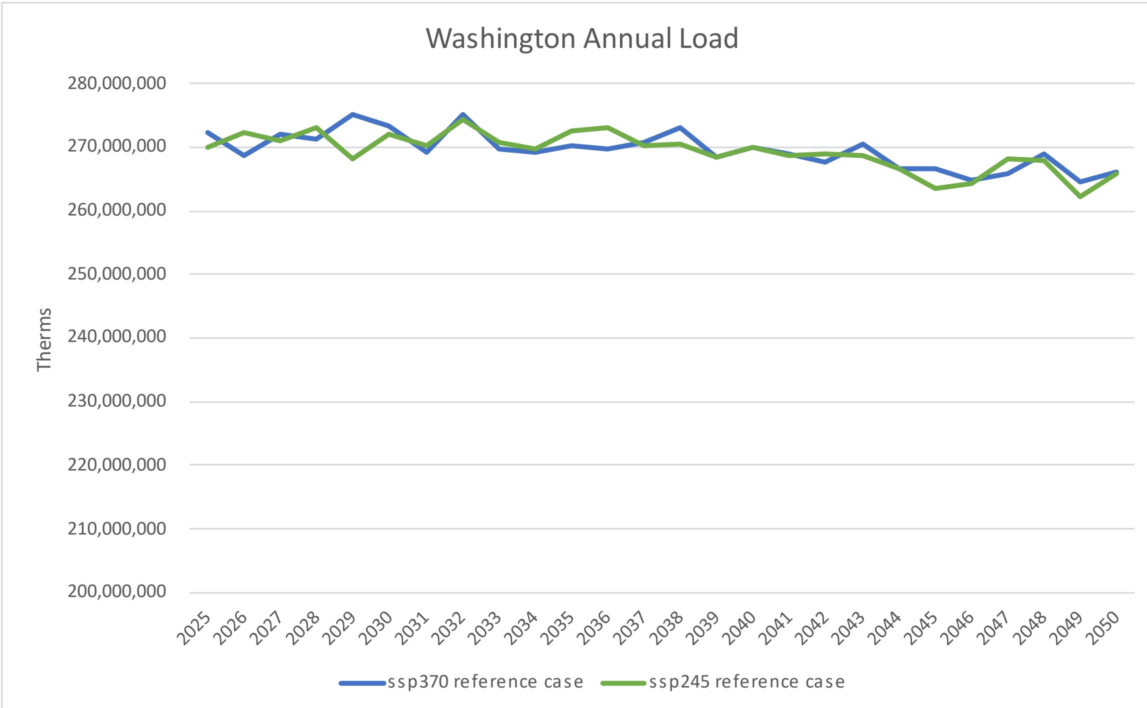


Figure 3-11: System Load Comparison to Previous IRPs

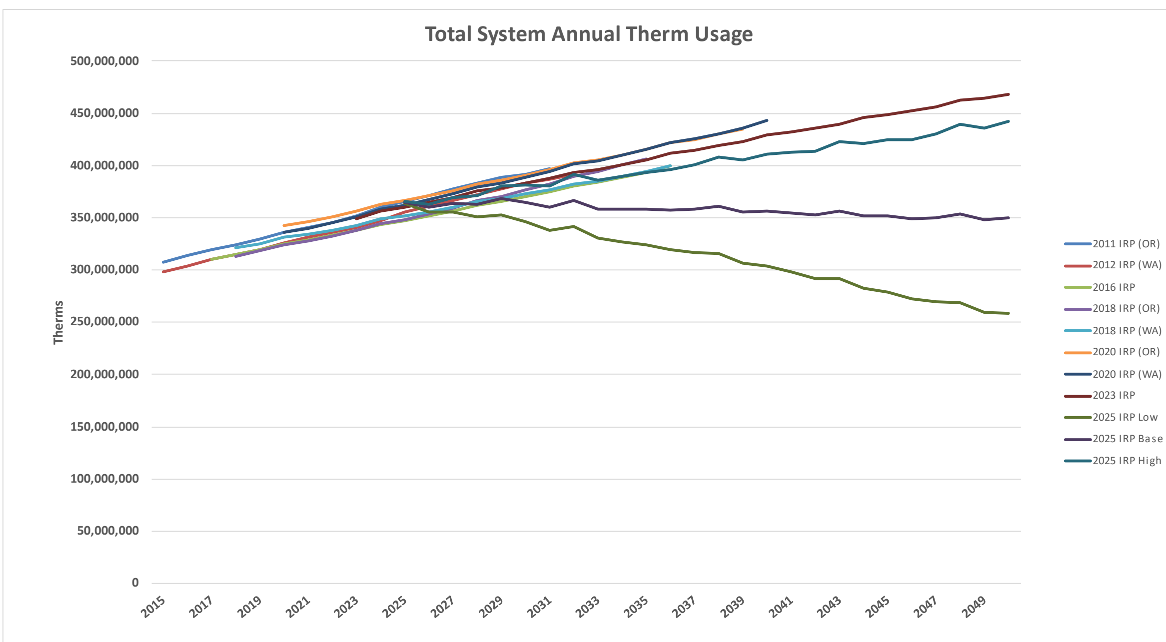
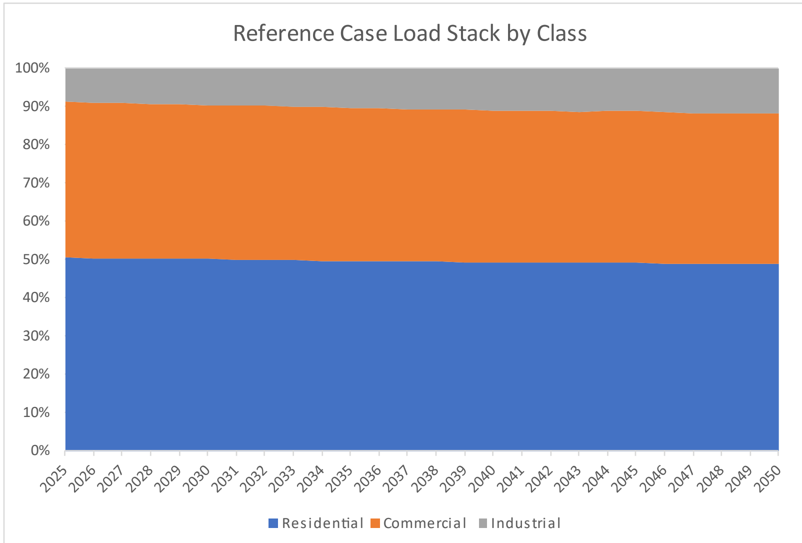


Figure 3-12: Expected Load Stack by Class

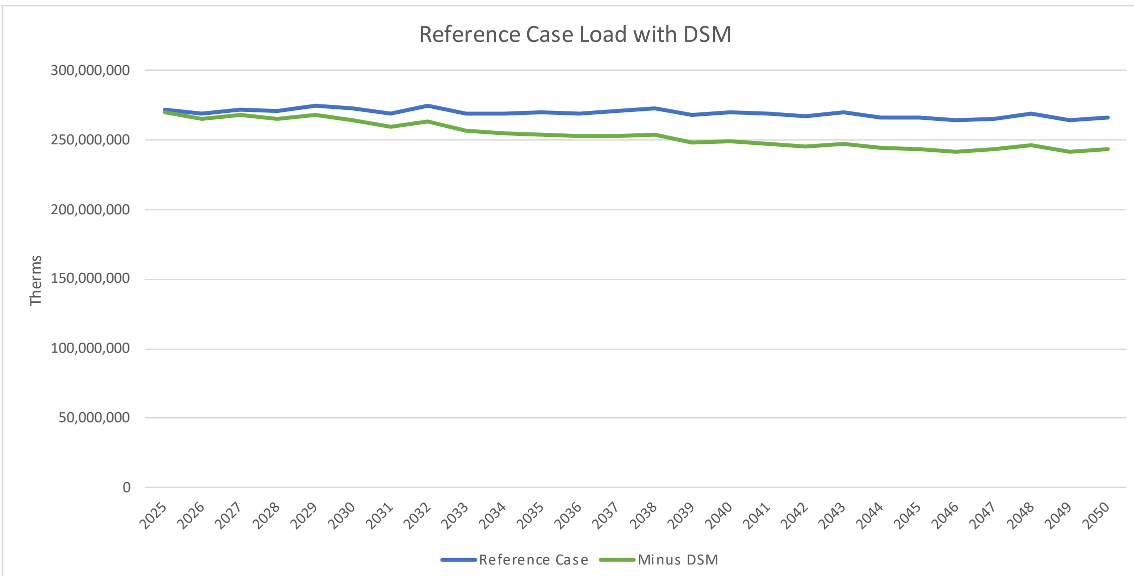


System Load and Demand Side Management (DSM)

Demand Side Management (DSM) refers to the reduction of natural gas consumption through the installation of energy efficiency or through other load management programs such as demand response efforts that shift gas consumption to off-peak periods. For more details, please refer to Chapter 7, Demand Side Management.

Figure 3-13 displays total Washington and Oregon DSM projected annual savings as it compares to Cascade's system load forecast.

Figure 3-13: System Base Load vs DSM



With DSM projections factored in, Cascade's anticipated Washington average annual growth rate drops from -0.09% to -0.42%. This represents approximately 22 million therms saved by 2050.

Geography

For Cascade to ensure the Company has the appropriate amount of transportation rights on the upstream pipelines described in Chapter 4, Supply Side Resources, Cascade must understand the Company's demand at the pipeline zonal level. Figure 3-14 shows the annual system load by each of Cascade's pipeline zones. For a map of the pipeline zones, please refer to Figures 13-10 and 13-11. For a detailed list, Figure 3-1 gives information on each citygate's zone. Lastly, Figure 3-15 displays the expected system core peak day growth over the planning horizon. Peak day average annual growth is expected to be approximately 1.58%.

Figure 3-14: System 28-Year Load by Pipeline Zone (Volumes in Therms)

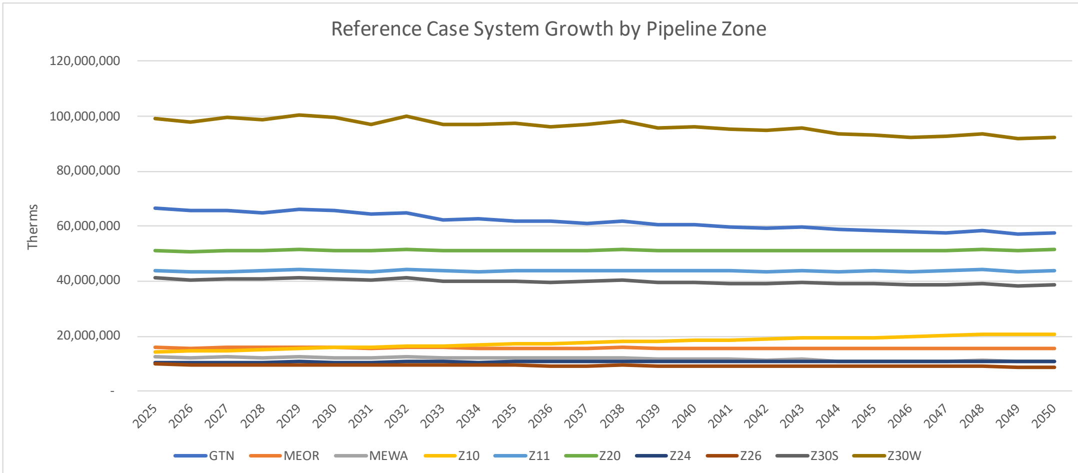
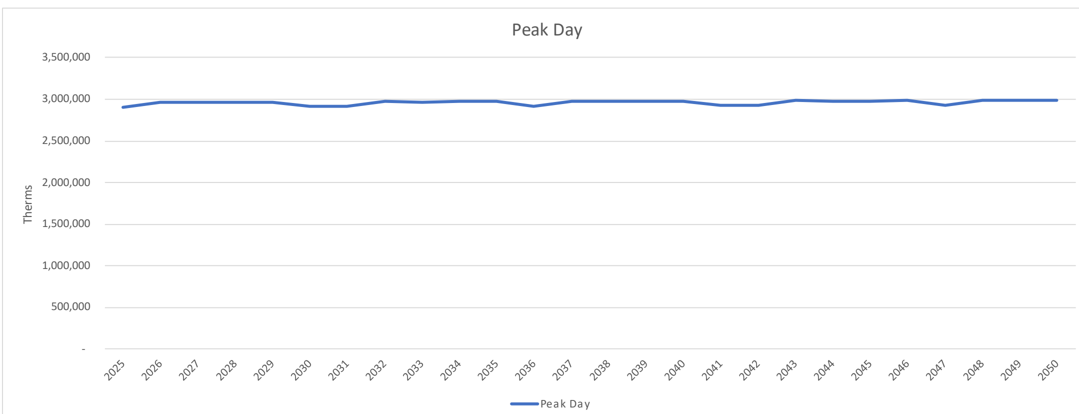


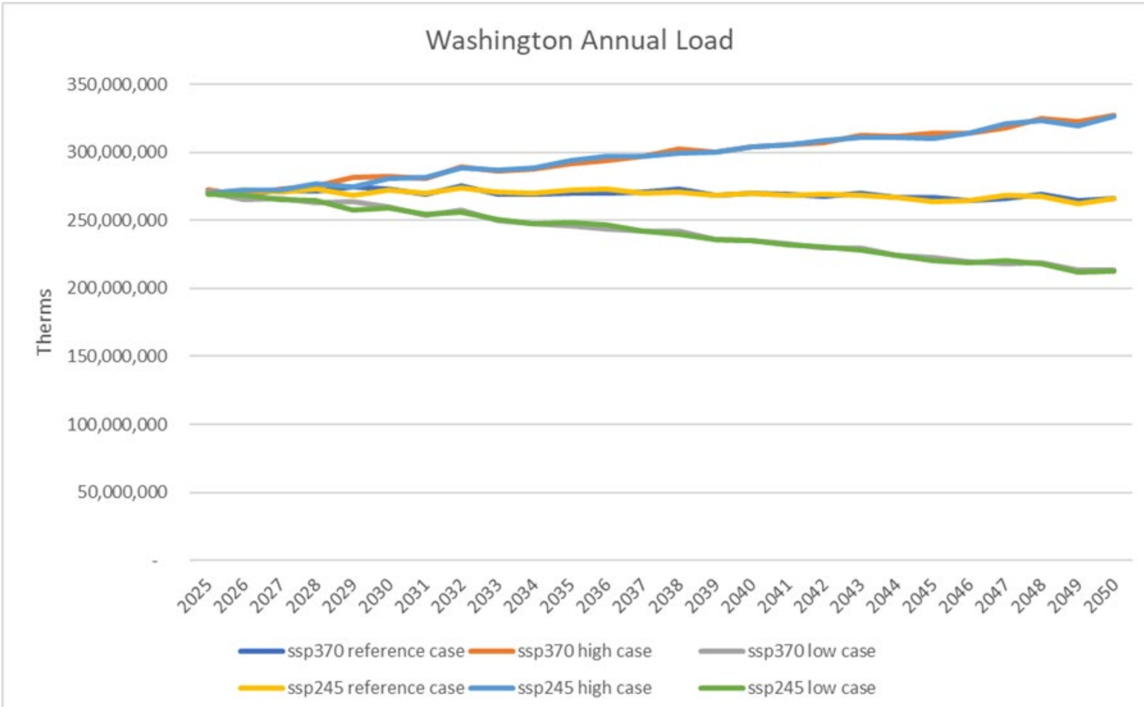
Figure 3-15: Expected System Peak Day Growth (Volumes in Therms)



High and Low Growth Scenarios

In the previous IRP, Cascade analyzed the slowest and fastest growth years of each citygate by comparing them to the average growth rate of each citygate. In the 2025 IRP, as described in the building codes section, Cascade has taken the approach of putting together updated assumptions around building code impacts. Figure 3-16 displays the total system load growth across the various growth scenarios.

Figure 3-16: Total System Load Growth Across Scenarios



Load growth under the low scenario shows a decline of approximately 0.96% from 2025 to 2050. High growth under the high growth scenario is showing an increase at approximately 0.74% from 2025 to 2050.

Non-Core Outlook

Unlike the core, non-core (or transportation) customers are customers who schedule and purchase their own gas and upstream pipeline contracts, generally through a marketer, to get gas to the citygate. The customer then uses Cascade's distribution system to get the gas to the customer's facility. Cascade has approximately 242 transportation customers, with seven of those customers being electric generation customers. In both Washington and Oregon, the 2025 forecast for non-electric generation customers is approximately 525 million therms and that for electric generation customers is about 598 million therms for a total of 1.123 billion therms for the transportation customers. For information on the emissions for these customers, see Chapter 6 – Environmental Policy.

Conclusion

Cascade has moved to utilizing a reference case, with a high and low scenario. The reference case is built using all assumptions Cascade currently has around use per customer, climate change, and building code impacts. High and low scenarios were considered and alternative forecasting assumptions were analyzed. Extensive modeling included: extending the forecast analyses of demand areas, HDDs, and wind out to 2050 to better align with emissions modeling; analyzing peak day stochastically using 10,000 Monte Carlo simulated draws for each weather zone; adding a retail rate regressor to the Use-Per-Customer forecast, and utilizing dynamic regression modeling techniques for customer and annual demand forecasts.

Chapter 4

Supply Side Resources

Overview

Cascade's core market residential and small volume commercial and industrial customers expect and require the highest reliability of energy service. Because of the Company's obligation to provide gas service to these customers, Cascade must determine and achieve the needed degree of service reliability and attain it at the most reasonable lowest cost and least risk possible while maintaining infrastructure that is sufficient for customer growth. Assuming such infrastructure is operating effectively, the most important functions necessary for reliable natural gas service are planning for, providing, and administering the gas supply, interstate pipeline transportation capacity, and distribution service purchased by core market customers.

This chapter describes the various gas supply resources, renewable natural gas (RNG), storage delivery services from Jackson Prairie underground storage, MIST underground storage and Plymouth liquified natural gas (LNG) service, and transportation resource options available to the Company as supply side resources.

Key Points

- To meet the Company's core market demand, Cascade accesses firm gas supplies and short-term gas supplies purchased on the open market, in addition to utilizing storage.
- Cascade purchases gas from the Rockies, British Columbia (Sumas), and Alberta (AECO). Gas is transported to the Company's system via pipelines by either bundled or unbundled contracts.
- Extensive discussion of Renewable Natural Gas (RNG) and other low carbon alternative fuels is included in this chapter.
- The long-term planning price forecast is based on a blend of futures market pricing along with long-term funda-mental price forecasts from multiple sources.
- The Company identifies potential incremental supply resources for the 2020 IRP.
- Risk management policies are implemented to promote price stability.
- Cascade's Gas Supply Oversight Committee (GSOC) oversees the Company's gas supply purchasing strategy.
- Modeling of Cascade's available resources results in the lowest reasonably priced optimum portfolio.

Gas Supply Resources

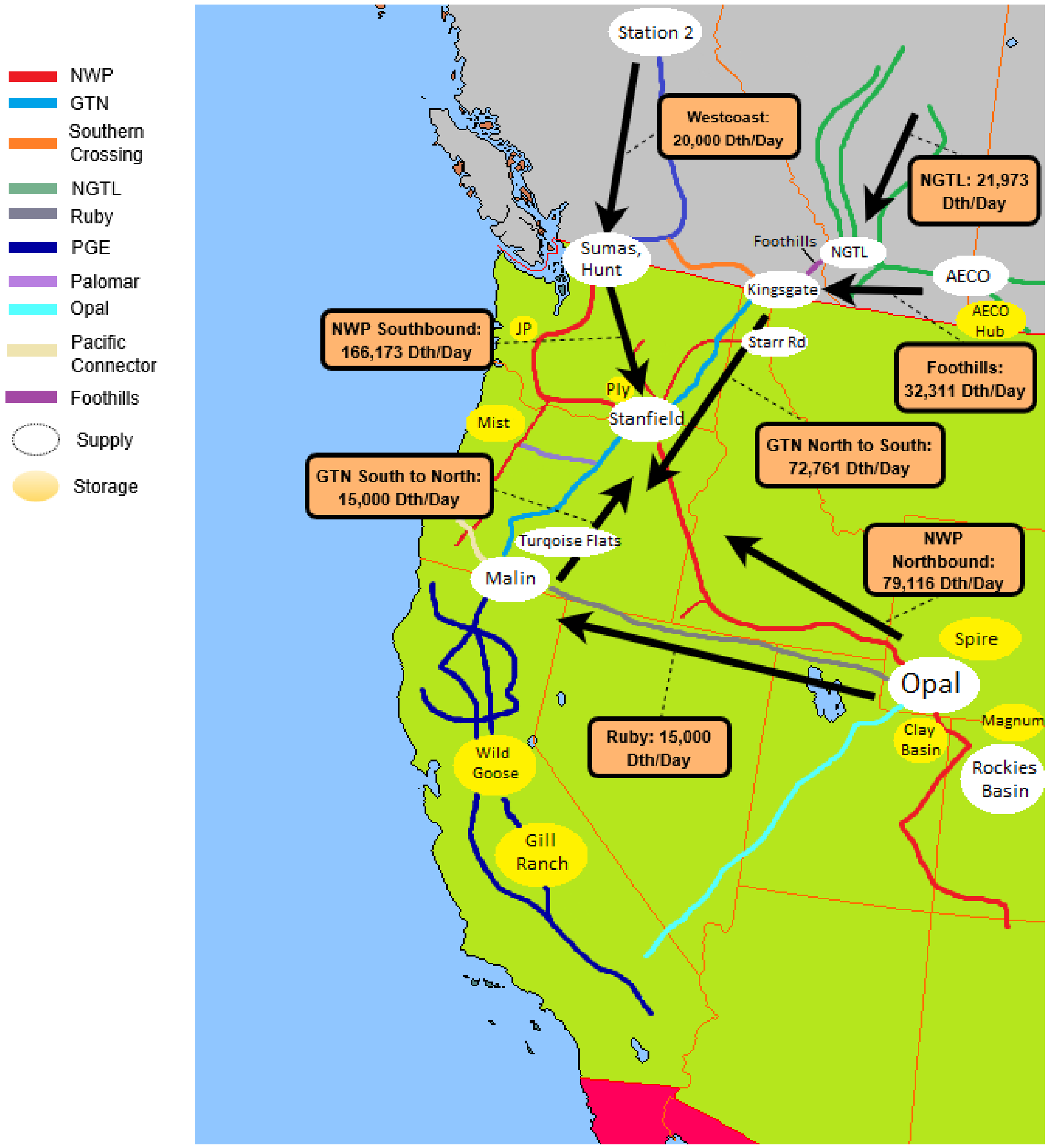
Gas supply options available to Cascade to meet the core market demand requirements generally fall into two groups: 1) Firm gas supplies on a short- or long-term basis, and 2) Short-term gas supplies purchased on the open market as needed in a particular month for one or more days. A third option, RNG, is emerging.[1] A separate and important source of gas supply is natural gas storage service, which is

[1] In Cascade's last IRP, renewable natural gas was addressed in the Renewable Natural Gas chapter but is now included in this chapter.

required to provide economical service to low load factor customers during seasonal and other high demand periods.

Cascade's gas supply portfolio is sourced from three basic areas of North America: British Columbia, Alberta, and the Rockies. Figure 4-1 provides a general overview of regional gas flows to Cascade's distribution system.[2]

Figure 4-1: Regional Map Showing General Flow Paths for System Gas Supplies



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[2] This map does not reflect three contracts Cascade acquired and was placed in full service December of 2024: GTN North to South of 20,000 dth/day, 20,000 dth/day on NGTL, and 10,000 dth/day on Foothills.

Firm Traditional Supply Contracts

Firm supply contracts commit both the seller and the buyer to deliver and take gas on a firm basis, except during *force majeure* conditions. From Cascade's perspective, the most important consideration is the seller's contractual commitment to make gas available day in and day out regardless of market conditions. Firm supplies are a necessary component of Cascade's core market portfolio given its obligation to serve and the lack of easily obtainable alternatives for customers during periods of peak demand. Firm supply contracts can provide base load services, seasonal load increases during winter months, or they can be used to meet daily peaking requirements. Quantities vary, depending on the need and length of the contract. Operational considerations regarding available upstream pipeline transportation capacity and any known constraints must also be considered. Base load contracts can range from as small as 500 Dth/day to quantities in excess of 10,000 Dth/day. Blocks of 1,000, 2,500, 5,000 and 10,000 Dth/day are standard as these are the most operationally and financially viable blocks for suppliers.

Base load supply resources are those that are typically taken day in and day out, usually 365 days a year. As a result, base load gas tends to be the least expensive of the firm supply contracts because it matches the production of gas and guarantees the producer that the volumes will be taken. The Company’s ability to contract for base load supplies is limited because of the relatively low summer demand on Cascade’s system. Base load resources are used to meet the non-weather sensitive portion of the core market requirements or may be used to refill storage reservoirs during periods of lower demand.

Winter gas supplies are firm gas supplies that are purchased for a short period during the winter months to cover increased loads, primarily for space heating. The contracts are typically three to five months in duration (primarily November through March). This enables the Company to ensure firm winter supplies without incurring obligations for high levels of supply contracts during periods of low demand in the summer months. Winter supplies combined with base load supplies are adequate to cover the moderately cold days in winter.

Supply contract terms for firm commodity supplies vary greatly. Some contracts specify fixed prices, while others are based on indices that float from month to month. Most contain penalty provisions for failure to take the minimum supply identified in the North American Energy Standards Board (NAESB) contract terms. Contract details will also vary for each individual supplier’s needs and the NAESB contract special addendums.

Gas that is purchased for a short period of time (one to thirty days) when neither the seller nor the buyer has a longer-term firm commitment to deliver or take the gas is referred to as a spot market purchase. Spot market supplies differ from firm resources in that they are more volatile, both in terms of availability and price, and are largely influenced by the laws of supply and demand.

In general, spot market supplies (i.e., day gas) are provided from gas supplies not under any long-term firm contract. Therefore, as firm market demand decreases, more gas becomes available for the spot market. Prices for spot market supplies are market driven and may be either lower or higher than prices under firm supply contracts. In warmer weather, as firm market demand requirements decrease, usually more gas becomes available for the spot market, resulting in lower prices. In colder weather, as firm markets demand their gas supplies, the remaining spot market supplies can carry higher prices.

The role for spot market gas supply in the core market portfolio is based on economics. Spot market supplies may be used to supplement firm contracts during periods of high demand or to displace other volumes when it is cost effective to do so. Depending upon availability and price, spot market volumes may be used in place of storage withdrawal volumes to meet firm requirements on a given day or for mid-heating season refills of storage inventory during periods of moderate weather.

While Figure 4-1 provides a general overview of regional gas flows to Cascade's distribution system, supporting detail is included in Appendix E.

Renewable Natural Gas

RNG is an emerging supply option that brings many benefits, chief among them emissions reduction. Since submitting its last IRP, Cascade has continued to refine its process for analyzing, planning, and acquiring RNG and Renewable Thermal Certificates (RTCs). This section, and elsewhere in this IRP, will highlight key issues related to RNG and RTCs. A quick reference guide to specific subjects is found in the inset box.

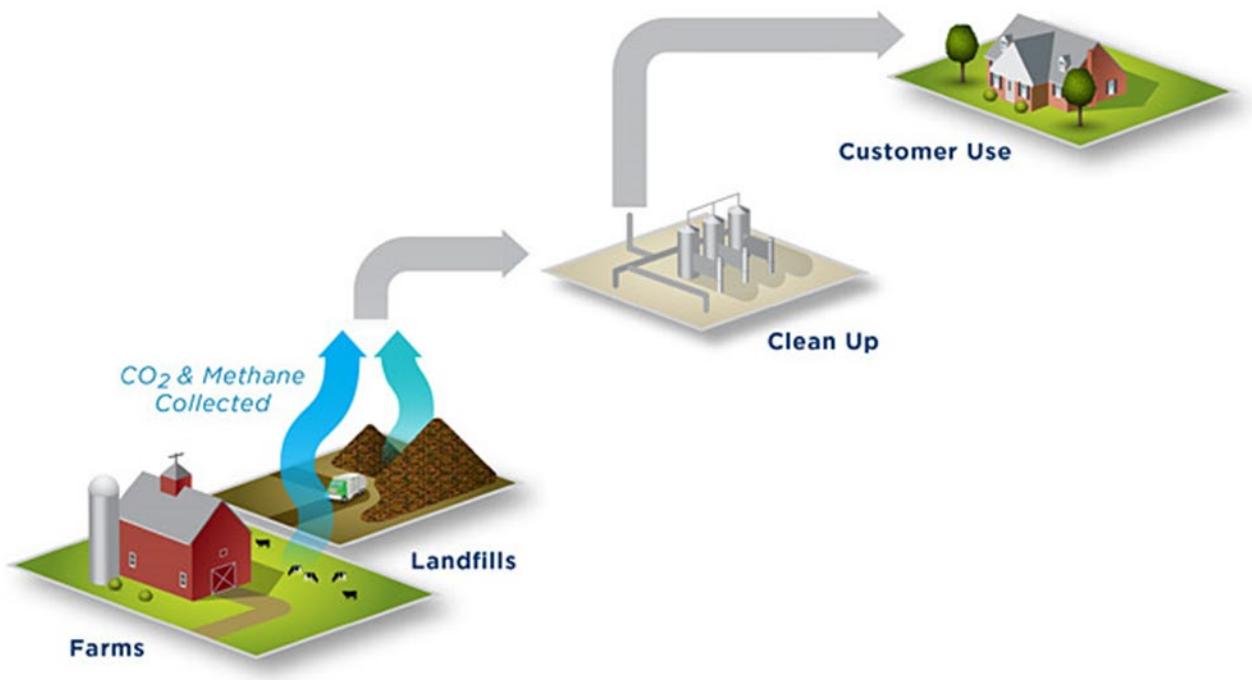
QUICK REFERENCE TO RNG LOCATIONS IN IRP

RNG, as defined in RCW 54.04.190,[3] is a gas consisting largely of methane and other hydrocarbons derived from the decomposition of organic material in landfills,

[3] *See* https://app.leg.wa.gov/rcw/default.aspx?cite=54.04.190

wastewater treatment facilities, and anaerobic digesters. Cascade is committed to developing programs that allow the Company to acquire RNG under guidelines and rules stated in Washington HB 1257 and Oregon SB 98.
Figure 4-2,[4] provides an example of a general RNG process from landfill to end-user.

Figure 4-2: Example of RNG process from landfill to end user



The terms RNG, biomethane, and biogas are sometimes used interchangeably but they are different biofuel products along the value chain:

- Biogas is a mixture of carbon dioxide and hydrocarbons, primarily methane gas, from the biological decomposition of organic materials;
- Biomethane is a biogas-derived, high BTU gas that is predominately methane after the biogas is upgraded to remove contaminants; and
- RNG is biomethane upgraded to natural gas pipeline-quality standards so it can substitute or blend with conventional natural gas.[5]

Examples of RNG sources include:

- Biogas from Landfills: Collect waste from residential, industrial, and commercial entities; digestion process takes place in the ground, rather than in a digester;

[4] U.S. Department of Energy, Alternative Fuels Data Center, Renewable Natural Gas
[5] American Natural Gas.com

- 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; and
- Other sources: Include organic waste from food manufacturers and wholesalers, supermarkets, restaurants, hospitals, and more.[6]

Biofuel estimates vary, for example, E3 estimates 25 million dry tons of biomass supply available to Washington and Oregon, compared to Washington State's deep decarbonization study which assumed 23.8 million dry tons available to the state.[7]

RTCs, for contrast, are a regulatory instrument that reflects only the environmental attributes associated with RNG. There are no physical molecules associated with RTCs, and RTCs can be separated from and transacted without the associated gas molecules from RNG.

Applicable Regulations

In the past few years, RNG has been driven by public policy with the intent to reduce emissions. These laws and regulations are summarized below. Compliance with these requirements, from the perspective of targets to be achieved, is addressed in Chapter 6, Environmental Policy.

On April 15, 2019, Washington House Bill 1257[8] (HB 1257) was passed by the Senate and on April 18, 2019, the bill was passed by the House. Several sections within the bill are related to RNG and will be covered in this chapter.

Below, Cascade lists key portions of the House Bill relevant to RNG:

Sec. 12. (1) The legislature finds and declares that:

(a) Renewable natural gas provides benefits to natural gas utility customers and to the public; and

(b) The development of renewable natural gas resources should be encouraged to support a smooth transition to a low carbon energy economy in Washington.

(2) It is the policy of the state to provide clear and reliable guidelines for gas companies that opt to supply renewable natural gas resources to serve their customers and that ensure robust ratepayer protections.

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

[7] Energy + Environmental Economics, Pacific NW Pathways to 2050: Achieving an 80% reduction in economy-wide greenhouse gases by 2050.

[8] *See* http://lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bills/House%20Passed%20Legislature/1257-S3.PL.pdf?q=20201020144814.

Following the adoption of HB 1257 into law,[9] workshops were convened to determine how best to comply with these new mandates. Cascade has actively participated in all relevant workshops under Docket UG-190818, RNG Staff Investigation. Multiple company representatives engaged in these proceedings. The Company has also worked closely with its trade organization, the Northwest Gas Association, to provide the information and feedback necessary to support proposals submitted on behalf of the northwest LDCs.

In addition to Section 12, HB 1257 included two other sections with language pertaining to the development of renewable natural gas and offset programs:

Sec. 13. A new section is added to chapter 80.28 RCW to read as follows:

(1) A natural gas company may propose a renewable natural gas program under which the company would supply renewable natural gas for a portion of the natural gas sold or delivered to its retail customers. The renewable natural gas program is subject to review and approval by the commission. The customer charge for a renewable natural gas program may not exceed 5% of the amount charged to retail customers for natural gas.
(2) The environmental attributes of renewable natural gas provided under this section must be retired using procedures established by the commission and may not be used for any other purpose. The commission must approve procedures for banking and transfer of environmental attributes.
(3) As used in this section, "renewable natural gas" includes renewable natural gas as defined in RCW 54.04.190. The commission may approve inclusion of other sources of gas if those sources are produced without consumption of fossil fuels.

Cascade has been identifying viable pathways for the inclusion of renewable natural gas as part of its fuel mix, following the guidelines developing from the UG-190818, RNG Staff Investigation workshops and compliance obligations under Oregon's Climate Protection Plan (CPP) and Washington's Climate Commitment Act (CCA). Cascade has entered into one contract to bring RNG onto its system plus has been the selected bidder to enter into another contract. Cascade continues sourcing RNG with several producers as it performs analyses across its Washington and Oregon service areas. Fourteen projects are in various stages of planning and development. Cascade discusses the projects that are either contracted for, or are very close, beginning on page 4-12.

The Company's current timeline to incorporating RNG onto the system under its first contract is late 2023. In the meantime, Cascade continues developing a cost effectiveness evaluation tool, as described in the following subsection, for RNG to

[9] Signed by Governor Jay Inslee on May 13, 2019, with an effective date of July 28, 2019.

allow the Company to model the impact to retail customers in order to not exceed the 5% of the amount charged from section 13.1 of the bill.

Sec. 14. A new section is added to chapter 80.28 RCW to read as follows:

> (1) Each gas company must offer by tariff a voluntary renewable natural gas service available to all customers to replace any portion of the natural gas that would otherwise be provided by the gas company. The tariff may provide reasonable limits on participation based on the availability of renewable natural gas and may use environmental attributes of renewable natural gas combined with natural gas. The voluntary renewable natural gas service must include delivery to, or the retirement on behalf of, the customer of all environmental attributes associated with the renewable natural gas.
>
> (2) For the purposes of this section, "renewable natural gas" includes renewable natural gas as defined in RCW 54.04.190. The commission may approve inclusion of other sources of gas if those sources are produced without consumption of fossil fuels.

As noted above, Cascade is constantly assessing options for how to best acquire RNG and its associated attributes. These resources would be applied for the purposes described under Sec 13 and 14 of HB 1257 and to meet the obligations under the CCA and CPP. Cascade is in the process of identifying internal and external resources to support the acquisition of environmental attributes and renewable gas for the voluntary renewable natural gas service required under Washington law prior to the first contracted RNG coming into Cascade's system in late 2023.

Cascade Project Cost Effectiveness Evaluation Methodology

Several departments within the Company have collaborated to create a model that allows Cascade to evaluate the cost-effectiveness of all potential RNG projects before entering into an agreement with potential suppliers. Similar to the Company's PLEXOS® modeling, the results of this calculation help inform final acquisition decisions, but ultimately must be combined with qualitative analysis from RNG subject matter experts. This subsection will present the model notes, a discussion of the static and dynamic inputs to the model and provide an understanding of how the results should be interpreted.

Cost Effectiveness Evaluation Model Notes

$$\boldsymbol{C_{RNG} = I_{RNG} - AC_U - AC_D + \sum_{T=1}^{365} (P_{RNG} + VC - CIF) * Q}$$

$$C_{Conventional} = \sum_{T=1}^{365} (P_{Conventional} + VC) * Q$$

Where:

C_{RNG} = The all-inclusive annual cost of a proposed RNG project
I_{RNG} = The annual required investment to procure a proposed RNG resource. If Cascade is simply buying the gas and/or environmental attributes, this value is zero.
AC_U = Avoided upstream costs
AC_D = Avoided distribution system costs
P_{RNG} = Daily price of renewable natural gas being evaluated
Q = Daily quantity of gas being evaluated
VC = Variable cost to move one dekatherm of gas to Cascade's distribution system. This value can be zero if a project connects directly to the Company's system.
CIF = Carbon Intensity Factor. This is calculated by multiplying the Company's expected carbon compliance cost by 1 minus the ratio of a proposed project's carbon intensity to conventional gas' carbon intensity. For the purpose of compliance with the CCA and CPP, the CIP factor is just Cascade's expected carbon compliance cost in the various jurisdictions, as these rules do not account for the variable carbon intensities of various sources of RNG.
$C_{Conventional}$ = The all-inclusive annual cost of conventional natural gas.
If $C_{Conventional} \geq C_{RNG}$, a project can be considered cost effective, and should be acquired. If not, the project may still be considered under the regulatory exceptions discussed earlier in this chapter.

Static Versus Dynamic Inputs

Inputs to Cascade's model can be classified as either static or dynamic. Static inputs are ones that are not project specific, but rather related to the Company's system as a whole. They include Cascade's avoided costs, costs associated with the price of conventional gas, and regulatory factors that are used to calculate the impact to revenue requirement. Dynamic inputs on the other hand, are ones that need to be updated on a project-by-project basis. These include the price and quantity of the RNG, initial investment required, and carbon intensity of the project.

Purchase Versus Build

Cascade utilizes different proprietary models based on whether the Company is evaluating the purchase of RNG or the building and ownership of an RNG generating facility. While philosophically the same, the models are calibrated to account for slight differences in the various decision-making processes. The build decision model allows for more detailed inputs and evaluation of overhead variables related to ownership, such as tax impacts of ownership and depreciation of assets. The purchase model, on the other hand, allows for analysis of variable purchase structures, where Cascade may only purchase a fraction of the RNG quantity that will ultimately be flowed from an RNG deal, which also allows the model to consider revenue that the Company would earn from transportation agreements related to the volumes of RNG that Cascade would not own, but would still flow on its system.

Model Results

Once all inputs are populated, the model provides three main pieces of information: The potential enterprise value of the project over its lifetime, the first-year dollar impact to revenue requirement, and the first-year percentage impact to revenue requirement. As discussed in the model notes, if the cost of conventional gas is greater than or equal to the cost of RNG, the project can be considered cost effective. If not, the impact to revenue requirement provides a valuable insight as to whether the project is attractive from a regulatory perspective.

Selling Versus Procuring

As highlighted in other sections of this IRP, one of the major challenges associated with long-term planning is the difficulty around projecting resource needs over the planning horizon. Stakeholders have highlighted this as a point of concern during this IRP process, as many of the procurement contracts Cascade evaluates with the model discussed above are long-term contracts. If demand projections do not materialize as expected, or demand reductions driven by forces such as electrification materialize faster than expected, the Company could find itself in a situation where it has procured more RNG than it needs for a given year. In situations like these, Cascade explores a multitude of options, including utilizing the RNG in other jurisdictions, in voluntary programs, or selling the RNG on the open market. Cascade is constantly engaging with market participants to ensure that if the Company does need to sell a portion of its RNG portfolio, it is done prudently to the benefit of its customers.

RNG Projects

Cascade is currently progressing on RNG projects at varying stages of development. There are three types of RNG projects with which Cascade is involved: Purchase Projects, Transport Projects, and Production Projects.

Purchase Projects are defined as projects where the Company would invest in the Cascade infrastructure required to on-board or flow the RNG produced by a third party into the Company's distribution system and purchase the environmental attributes or RTCs to be utilized for compliance obligations or voluntary RNG tariffs. The Company's investment in the infrastructure influences the negotiated price to purchase the RNG.

In Transport Projects, RNG produced by a third party is injected into the Company's distribution system, and Cascade transports the customer's RNG so that the customer may market the environmental attributes to other parties. Cascade is not the purchaser of the environmental attributes of Transport Projects, either because they are priced higher than would be prudent for cost recovery from utility customers or they are already committed to another customer. For a Transport Project, the third-party producer will normally be placed on Cascade's transportation rate schedule 663, and Cascade will make an investment in the infrastructure required to flow the gas in the distribution system in accordance with Cascade's line extension tariff. Although Cascade plays an essential role in enabling Washington's emissions reductions through its facilitation of RNG Transport Projects, under current rules, Cascade receives no credit for the emissions reductions accorded to the RNG production entity.

The third type of RNG projects, Production Projects, are defined as projects where Cascade invests in the RNG production facility as well as the infrastructure required to flow the RNG into the distribution system. Cascade will ultimately produce and own the RNG, including the associated environmental attributes. Cascade plans to grow its portfolio of RNG Production Projects over time to support Washington and Oregon's GHG emissions reduction goals.

Cascade has signed contracts for five RNG projects. Four are contracts with third-party producers where the gas will be injected into Cascade's distribution system. Three of the four projects are Purchase Projects, where Cascade will be purchasing some of, or all, the environmental attributes. The fourth is a Transport Project where Cascade is only facilitating the transportation of RNG on its distribution system. The fifth project is a Production Project where Cascade will own and operate the production facility and retain both the biomethane and RTCs for use by its customers. Cascade is also pursuing several other potential RNG projects at varying stages of development.

Below are the details of the Purchase Projects under contract:

City of Richland – Horn Rapids Landfill & Lamb Weston RNG Project – Richland, Washington

Source - 3rd party developer has rights to raw biogas from two sources in close proximity to each other.

1. Landfill Gas from the City of Richland's Horn Rapids Landfill
2. Food Waste from potatoes at Lamb Weston's Richland Processing Plant.

Scope of Cascade Work

- Design and construct interconnect facilities; and
- Design and construct pipeline from interconnect facility to local distribution system.

Status & Terms

- Placed in-service March 2024;
- 1,860,000 therm/yr; and
- 15-year term.

Industrial Wastewater RNG Project - Franklin County Washington

Source - Industrial wastewater processing facility currently serving several aggregated industrial food processors & growers.

Scope of Cascade Work

- Design and construct interconnect facilities; and
- Design and construct pipeline from interconnect facility to local distribution system.

Status & Terms

- Interconnect facilities currently under construction;
- 3,400,000 therm/yr;
- 20-year term; and
- Projected in-service date Q4 2024.

The following are details of the Transportation Project under contract:

Food Waste RNG Project – Cowlitz County, Washington

Source – Aggregated food waste from approximately 100 chain grocery outlets in Washington and Oregon

Scope of Cascade Work

- Design and construct interconnect facilities; and

- Design and construct pipeline from interconnect facility to local distribution system.

Status & Terms

- Interconnect facilities under construction;
- 1,800,000 therm/yr (non-Cascade compliance therms);
- 10-year term; and
- Projected in-service date early Q2 2025.

The following are details of the Production Project currently under contract:

Deschutes County Landfill RNG Project - Bend Oregon

Source - Cascade/Jacobs Engineering Team was successful candidate chosen through RFP process to own and operate processing facilities to convert landfill gas to RNG

Scope of Cascade Work

- Build, own, operate, and maintain the gas processing plant;
- Design and construct interconnect facilities; and
- Design and construct pipeline from interconnect facility to local distribution system.

Status & Terms

- Plant and interconnect facilities engineering and design in progress;
- 2,500,000 therm/yr;
- 20-year term; and
- Projected in-service date Q4 2025.

Renewable Thermal Certificates (RTCs)

The Oregon Department of Environmental Quality (DEQ) has adopted M-RETS as the tracking platform to validate and track environmental attributes from RNG and hydrogen in the CCP. M-RETS utilize RTCs to track the production, transfer and retirement of these qualified environmental attributes. The RTC includes specific details like source, vintage, location, feedstock and a unique identifier. Each RTC is equal to one dekatherm of RNG produced. Currently, Washington only allows environmental attributes to be used for RCW 80.28.390, the voluntary renewable natural gas service. The current rules of the CCA do not allow for environmental attributes, whereas the CPP in Oregon does. Cascade is currently in discussions with several producers to secure the necessary environmental attributes to meet future voluntary RNG programs as well as the CPP in Oregon.

Hydrogen and other low carbon alternative fuels

Cascade consulted with ICF to develop forecasts for levelized cost, technical potential, resource life, and carbon intensity for various energy resources, including renewable natural gas, hydrogen, synthetic methane, carbon capture & geologic storage, and renewable thermal credits for Oregon and Washington. This collaboration aimed to provide a comprehensive analysis of these resources to support future energy planning and policy decisions. Understanding these factors is crucial for making informed decisions about the viability and sustainability of different energy sources.

ICF modeled several different types of hydrogen, considering various hydrogen feedstocks and carbon intensity ranges. This detailed modeling helps to understand the potential environmental and economic impacts of different hydrogen production methods, ensuring a thorough evaluation of hydrogen as a viable energy source. Evaluating different hydrogen types allows for a more nuanced approach to integrating hydrogen into the energy mix, optimizing both performance and sustainability.

Synthetic methane was subcategorized into methanization of syngas from biomass and hydrogen with CO_2. This distinction allows for a more precise analysis of the production processes and their respective benefits and challenges, contributing to a better understanding of synthetic methane's role in the energy landscape. By examining these subcategories, Cascade can identify the most efficient and environmentally friendly methods for producing synthetic methane.

Cascade outlined potential candidate customers for carbon capture to be included in the carbon capture analysis. This analysis also considered the costs associated with utilizing or storing the captured carbon elsewhere, providing a holistic view of the economic and logistical aspects of carbon capture and storage. Identifying candidate customers and understanding the costs involved are essential for developing practical and economically viable carbon capture solutions.

Additionally, Cascade considered the implications of the Inflation Reduction Act (IRA), particularly the Section 45V Clean Hydrogen Production Tax Credit, which provides incentives for clean hydrogen production based on carbon intensity.[10] They also took into account the Section 45Q tax credit for carbon capture and sequestration, which offers financial incentives for capturing and storing carbon dioxide.[11] These considerations are vital for leveraging federal support to enhance the economic feasibility of clean hydrogen and carbon capture projects.

Each of these analyses produced expected results as well as stochastic results. Cascade will use these outcomes to model potential resource integration futures for

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[10] *See:* Clean hydrogen production credit | Internal Revenue Service

[11] *See:* IF11455

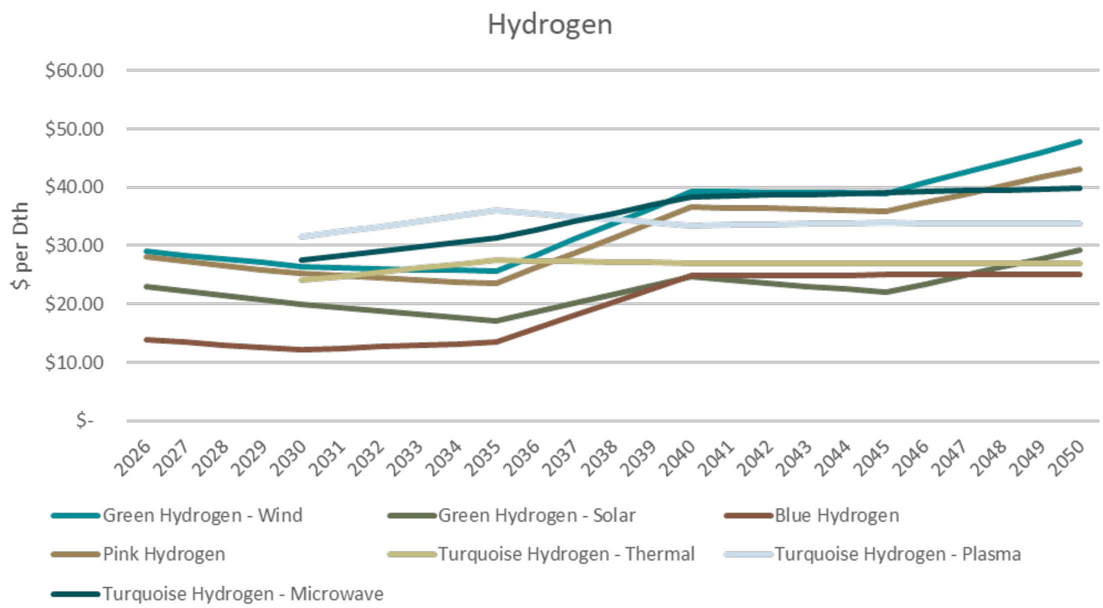
planning consideration, ensuring that their energy strategies are robust and adaptable to various scenarios. Considering both expected and stochastic results helps Cascade to prepare for a range of possible futures, enhancing the resilience and flexibility of their energy planning.

Low Carbon Alternative Fuel Projections

RNG and RTCs prices range significantly due to the carbon intensity. For example, RTCs from landfill gas RNG projects range from about $8/Dth to $30/Dth whereas RTCs from animal manure RNG projects range from about $50/Dth to $150/Dth. As mentioned in the build versus purchase section on page 4-10, there is a difference between RTCs from building (referred to as RNG projects) versus RTCs from a purchasing (referred to as RTC projects). ICFs RTC projections have similar varying results between types of RTC projects, although RTC projects are generally more expensive. For example, RTCs from landfill gas RTC projects range from about $10 per dekatherm to $50/Dth whereas RTCs from animal manure RTC projects range from about $55/Dth to $200/Dth.

Hydrogen projections were provided by various feedstocks and carbon intensity ranges, denoted by different coloring scales; Green being solar or wind, Blue being natural gas or RNG from small module reactor and autothermal reforming with 97% carbon capture and storage, Turquoise being natural gas and RNG from methane pyrolysis, and pink being nuclear energy. Prices range between approximately $12/Dth to $50/Dth over the planning horizon.

Figure 4-3: Hydrogen Projected Prices



ICF provided low carbon alternative fuels by national and regional values, which are described in Appendix G. Once the national and regional values were provided as a total Washington and Oregon value, Cascade further reduced those values as the Company applied a customer weighted value between Avista, Northwest Natural, Puget Sound Energy, and Cascade. This value is calculated to be approximately 13%. Cascade's annual load without any carbon reduction is equal to approximately 2,300,000 to 2,700,000 mtCO_2e annually over the planning horizon dependent on growth. ICF projections at a 13% weight range from 1.2 million to 17 million mtCO_2e over the planning horizon. Even at a lower share, 5% for example, that range is 0.5 million to 6.5 million mtCO_2e. These projections suggest Cascade would have a significant amount of low carbon alternative fuel options even if Cascade's share reduced significantly.

Storage Resources

Cascade also utilizes natural gas storage to meet a portion of the requirements of its core market. Storing gas supplies, purchased and injected during periods of low demand, is a cost-effective way of meeting some of the peak requirements of Cascade's firm market. Natural gas can be stored in naturally occurring reservoirs, such as depleted oil or gas fields, salt caverns or other geological formations with an impermeable cap over a porous reservoir. Gas can also be stored in tanks under pressure as compressed natural gas (CNG) or cooled to a liquid state (i.e., LNG).

Natural gas storage service is not only an excellent supply source for meeting peak winter demand, but it can also be an important gas supply management tool. Storing excess or unused supply during periods of low demand increases the annual utilization rate of a supply contract, thereby improving the annual load factor for the Company's gas supplies. Improving the annual load factor of a supply contract improves the Company's ability to purchase gas supplies on a more economical basis. Purchasing natural gas for storage during periods of low demand generally yields prices at the low point on the seasonal price curve.

Depending upon the location of the storage facility, pipeline transportation may also be required to move the gas from the facility to the distribution system. Storage facilities located within the Company's distribution system or on the immediately upstream interstate pipeline are preferable to those located off-system. Off-system storage requires additional upstream pipeline transportation and may limit the flexibility of the resource. Cascade does not own any storage facilities and, therefore, must contract with storage owners to lease a portion of those owners' unused storage capacity. Figure 4-1 on page 4-3 displays the location of some of the storage facilities in the region.

Cascade has contracted for storage service directly from NWP since 1994. Jackson Prairie is located in Lewis County, Washington, approximately ten miles south of Chehalis. The following paragraph explaining the Jackson Prairie facility is found on Puget Sound Energy's website.[12] Puget owns one-third of the Jackson Prairie facility.

"Jackson Prairie is a series of deep underground reservoirs-basically thick, porous sandstone deposits. The sand layers lie approximately 1,000 to 3,000 feet below the ground surface. Large compressors and pipelines are employed at JP to both inject and withdraw natural gas at 45 wells spread across the 3,200-acre facility. Currently it is estimated that Jackson Prairie can store nearly 25 Bcf of working gas. The facility also includes "cushion" gas which provides pressure in the reservoir of approximately 48 Bcf. In terms of withdrawal capability, the facility is capable of delivering 1.15 Bcf of natural gas per day."

The Company also has contracted for service from NWP's Plymouth, Washington LNG facility. Plymouth is located in Benton County, Washington approximately 30 miles south of Kennewick. According to NWP's website, the total facility has storage capacity of 2.4 Bcf. Cascade has leased approximately 28% of this storage capacity.

In addition to the other storage facilities, the Company leases storage capacity from Mist. The Mist facility is located near Mist, Oregon and is adjacent to Northwest Natural Gas' distribution system and has a direct connection to NWP for withdrawals and injections. The Mist facility is owned and operated by Northwest Natural Gas. Cascade has 1,640,000 Dth of leased capacity.

[12] *See:* Jackson Prairie Underground Natural Gas Storage Facility, https://www.pse.com/pages/energy-supply/natural-gas-storage, as of February 2, 2021.

Both the Jackson Prairie and the Plymouth facilities are located directly on NWP's transmission system, while Mist Storage is located on the Northwest Natural Gas system that is connected to NWP via two different citygates. Therefore, storage withdrawal rates can be changed several times during an individual gas day to accommodate weather driven changes in core customer requirements. This type of operating flexibility would not necessarily be available with off-system storage. Withdrawal capabilities must also be accompanied by firm capacity on the transporting pipeline(s) to be of any value as a reliable source of gas supply. Cascade's Jackson Prairie storage and Plymouth LNG service require TF-2 firm transportation service for storage withdrawals; Cascade has sufficient firm TF-2 service to meet its storage daily deliverability levels. The Company’s contracted storage services are summarized in Figure 4-6.

Figure 4-6: Cascade Leased Storage Services (Volumes in Therms)

Facility	Storage Capacity	Withdrawal Rights
Jackson Prairie (Principle)	6,043,510	167,890
Jackson Prairie (Expansion)	3,500,000	300,000
Jackson Prairie (2012)	2,812,420	95,770
Plymouth LNG (Principle)	5,622,000	600,000
Plymouth LNG (2016)	1,000,000	181,250
Mist	16,400,000	500,000

Capacity Resources

Capacity options are either interstate pipeline transportation resources or capacity on Cascade's local distribution system. Cascade's local distribution system is built to serve the entire connected load in its various distribution service areas on a coincidental demand basis, dependent upon the type of service the customer has contracted to receive.

Pipeline transportation resources are utilized to transport the gas supplies from the producer/supply sources to Cascade's system. Cascade currently purchases supplies from three different regions or basins: U.S. Rockies, British Columbia, and Alberta, Canada. Unless the supplier has bundled its sale of gas supplies with capacity (i.e. a citygate delivery), these resources require pipeline transportation to deliver them to Cascade's local distribution system. Transportation resources historically have been purchased from the pipeline(s) at the time of an expansion under long-term (20- to 30-year) contracts.

Cascade has over 30 long-term annual contracts with NWP, numerous long-term annual and winter-only transportation contracts with GTN (including the upstream capacity on TransCanada Pipeline's Foothills and Alberta systems), a long-term, winter-only contract with Ruby Pipeline, and one long-term annual contract with Enbridge (Westcoast Transmission) in British Columbia, Canada. These contracts do not include storage or other peaking services that may provide additional delivery capability rights. Figure 4-1 on page 4-3 provides a general flow of Cascade's combined contracted pipeline transportation rights.

Natural Gas Price Forecast

For IRP purposes, the Company develops a baseline, high, and low natural gas price forecast. Demand, oil price volatility, the global economy related to inflationary pressure, geopolitical turmoil, and LNG imports/exports, electric generation, opportunities to take advantage of new extraction technologies, hurricanes and other weather activity will continue to impact natural gas prices for the foreseeable future. Cascade did reach out to its hedging consultant, Gelber & Associates, who provided the following analysis in the Company's 2024 Hedge Plan:

"Gelber & Associates has identified several primary drivers of the natural gas market in its annual Natural Gas Price Forecast. For 2024, there are four key identified pricing factors at play:

- Production has climbed back from lows seen in 2Q 2024, supported by a sizeable rally in June.
- Far above-average storage levels going into the 2024 fall season.
- Demand increases from pending LNG export demand growth from Plaquemines LNG and Golden Pass LNG beginning in 2025. There is also increased reliance on natural gas power generation this summer and winter with the current La Niña weather pattern.
- LNG Canada and Woodfibre LNG will begin to weigh on Canadian supply and further link Canada to international pricing dynamics."

Cascade considers price forecasts from several sources, such as Wood Mackenzie, Energy Information Administration (EIA), S&P Global, NYMEX Henry Hub, Northwest Power and Conservation Council (NWPCC), as well as Cascade's own observations of the market to develop the low, base, and high price forecasts. For confidentiality purposes, the Company refers to the selected sources as Sources 1-4 when discussing how these sources are weighted in Cascade's Henry Hub forecast. The following discussion provides an overview of the development of the baseline forecasts.

Cascade's long-term planning price forecast is based on a blend of futures market pricing along with long-term fundamental price forecasts from multiple sources. Since pricing on the market is heavily influenced by Henry Hub prices, the Company closely monitors this market trend. While not a guarantee of where the market will ultimately finish, the futures market (i.e., NYMEX) is the most current information available that provides some direction as to future market prices. On a daily basis, Cascade can see where Henry Hub is trading and how the future basis differential in the Company's physical supply receiving areas (i.e., Sumas, AECO, Rockies) is trading.

Cascade believes that relying on a single source for developing the Company's 20-year price forecast is not the most reasonable approach. Some sources such as EIA and Wood Mackenzie produce Henry Hub pricing over the long-term; whereas other sources like the NYMEX basis (e.g., Sumas) provide price indicators over a shorter period of time. Additionally, price forecast sources produce their forecasts or indicators at varying points in time throughout the year. Finally, most forecasts are at an annual level versus a monthly level. In order to capture the potential seasonality as well as the variances of monthly price within the producing basins, the Company blends the pricing data from these various forecast sources.

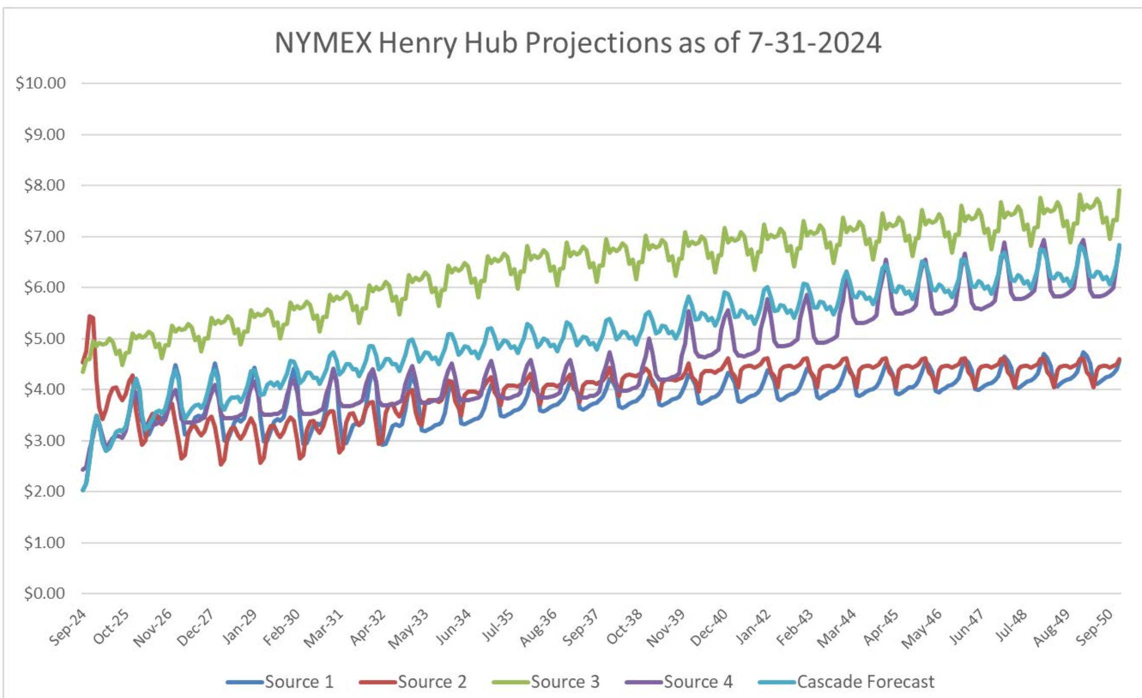
The fundamental forecasts of Wood Mackenzie, the EIA, NWPCC, Platts, S&P Global, and Cascade's trading partners are resources for the development of a blended long-range price forecast. Wood Mackenzie publishes a long-term price forecast twice a year to subscribing customers. This forecast was broken down by month through the planning horizon and includes Henry Hub as well as basis differentials, or price differential from Henry Hub, for the Company's receiving areas. Cascade also considers the EIA forecast; however, it has its limitations since it is not always as current as the most recent market activity. Further, the EIA forecast provides monthly breakdowns in the short-term, but longer-term forecasts are only by year. Many of the other sources mentioned only provide price forecasts by year. Given Cascade's load profile and the need for more winter gas than summer, the Company developed a pattern based on the market monthly forward prices to create a long-term, monthly Henry Hub price.

With a monthly Henry Hub price determined from the above sources, the Company assigned a weight to each source to develop the monthly Henry Hub price forecast for the 20-year planning horizon. These weights were derived by calculating the Symmetric Mean Absolute Percentage Error (SMAPE) of each source versus actual Henry Hub pricing since 2010. The inverse of these error terms was then used to determine the weight given to each source. A sample of the forecast weighting factors are shown in Figure 4-8. A comparison of the sources Cascade uses in its forecast and the actual blended forecast is provided in Figure 4-9. Cascade's price forecast was locked in on July 31, 2024.

Figure 4-8: Sample of Cascade's Henry Hub Price Forecast Weights

Date	Source 1	Source 2	Source 3	Source 4
T+24	75.000%	8.950%	9.333%	6.717%
T+25	72.917%	9.559%	10.283%	7.241%
T+26	70.833%	10.127%	11.278%	7.761%
T+27	68.750%	10.653%	12.322%	8.275%
T+28	66.667%	11.132%	13.417%	8.784%
T+29	64.583%	13.160%	12.372%	9.884%
T+30	62.500%	13.954%	13.142%	10.404%
T+31	60.417%	14.722%	13.944%	10.917%
T+32	58.333%	15.455%	14.786%	11.426%
T+33	56.250%	16.141%	15.677%	11.932%
T+34	54.167%	16.777%	16.620%	12.436%
T+35	52.083%	17.365%	17.615%	12.937%
T+36	50.000%	17.901%	18.666%	13.433%

Figure 4-9: Henry Hub Price Forecast by Source ($US/Dth)



Age-Dampening Mechanism

To ensure that the forecast is accounting for the most current information in the market, Cascade has introduced an age-dampening mechanism to its price forecast. Every month, if there is a source that is over one year old, all sources' weights are reduced by their share of the total number of months that all sources are outdated by. For example, if Source 1's forecast was fifteen months old, Source 2's was seven months old, and Source 3's was two months old, then each of these sources would be reduced by 15/24, 7/24, and 2/24 respectively. The detracted weights are then added back into the weight of the forwards market since that will always be the most current source (as it is updated daily). The one-year threshold was chosen qualitatively, as this methodology could be too punishing if all sources were not that old. For example, if one source was two months old, another was one month old, and another brand new, the first source would lose 66% of its weight to the forward curve, even though it still contains relatively current information regarding the market.

Cascade weighs the futures market at 100% for the first fifteen months of the forecasting period. The weights are then linearly interpolated over the next two years in order to align them with the calculated weights as described above.

The Company recognizes the importance of verifying forecast accuracy periodically and as such, will perform routine cross-validation to evaluate the impact of any modifications to the price forecast.

Development of the Basis Differential for Sumas, AECO and Rockies

Cascade utilizes the basis differential from Wood Mackenzie's most recently available update and compares that to the future markets' basis trading as reported in the public market because the Company's physical supply receiving areas (i.e., Sumas, AECO, and Rockies) are typically traded at a discount to Henry Hub. Correspondingly, the Company applied a weighted average to determine the individual basis differential in the price forecast.

Pros and Cons of Methodology Changes

The changes made in the 2018 and 2020 IRPs represent a continual methodological improvement over the forecasts in previous IRPs. Using the daily NYMEX forwards for short-term forecasting allows the Company's forecast to incorporate current market data, such as weather and *force majeure* events, into its projections. Additionally, the age dampening mechanism favors sources that have been updated more recently, which better captures a paradigm shift in the markets on a long-term basis versus a forecast that may be a few months or even years old. Finally, the use of SMAPE to assign weights to the sources creates a more scientific rationale for the blending of forecasts.

While Cascade believes this forecast is accurate, there are always areas of potential improvement. Since the forecast is a blending of other forecasts, the Company relies on the accuracy of its sources. While the SMAPE calculation helps to reward the more accurate forecasts, if all sources failed to capture a major market movement, Cascade's forecast would ultimately end up inaccurate as well. Additionally, some sources produce fairly infrequent forecasts, creating a small sample size for them to be evaluated in the SMAPE calculation. The Company is monitoring these problems to ensure they do not skew the forecast and has mechanisms in place to allow for a manual adjustment if market intelligence deems such a modification to be appropriate.

Incremental Supply Side Resource Options

As is more thoroughly described in Chapter 10, Resource Integration, some of the load growth under the high growth scenario, described in Chapter 3, may require Cascade to secure incremental supply side resources. The purpose of this section is to identify the potential incremental supply resources the Company considered for the high growth scenario.

Cascade models its incremental resources simultaneously through PLEXOS®. This allows the Company to evaluate each resource as a potential solution relative to all other resources, without any bias towards a particular option. Cascade utilizes functionality within PLEXOS® to allow the program to deterministically select the optimum timing and quantity of incremental supply resources. Any of the following resources that do not appear in Cascade's final preferred portfolio were deemed by PLEXOS® to be either not cost-effective or not optimal in comparison with other resource options.

Pipeline Capacity

- **Cross-Cascades, Trail West (Palomar, NMax, Sunstone, Blue Bridge, et al):** Trail West is a proposed pipeline starting at GTN's system near Madras, Oregon, and connecting NWP's Grants Pass Lateral near Molalla, Oregon. Since portions of the Company's distribution system are not connected to Molalla, incremental pipeline capacity would be needed to transport gas northbound to certain load centers. NWP has proposed a transport service that would bundle Trail West capacity with NW Natural's northbound Grants Pass Lateral capacity. From Cascade's perspective, this might present an alternative means to move Rockies gas to the I-5 corridor. At this time, there has been no new activity associated with this project. The development of this project would likely have a two- to three-year lead time.

- **GTN Capacity Acquisition:** The Company would acquire currently unsubscribed capacity on GTN in order to secure its gas supplies at liquid trading points primarily to serve Central Oregon.

- **NWP Eastern Oregon Expansion:** This alternative resource would be incremental NWP capacity from a Washington State receipt point that is designed to serve load growth needs in Zone 24 and Zone ME-OR. Examples of the Cascade service areas that would benefit from this project are Pendleton and Baker City. Similar to a proposed NWP Wenatchee expansion, it would be relatively small scale and could be expected to have a relatively high unit cost. The development of this project would likely have a three or four year lead time. As of this writing, there hasn't been any new activity associated with the potential project.

- **NWP Express Project/I-5 Sumas Expansion Project (Regional or Cascade Specific Project):** Cascade envisions this project as expanding capacity from Sumas on a potential NWP project that is the successor to the Western Expansion project. It would potentially combine Cascade's infrastructure expansion needs with other regional requests from parties such as local distribution companies (LDCs), power generators, and large petrochemical projects. The scale of this project is larger, potentially resulting in a more favorable unit cost; although with scale and multiple parties involved, timing for in-service dates may vary by the various participants. Examples of the Cascade service areas that would benefit from this project are Bellingham, Mount Vernon, Bremerton, and Longview. Cascade, through the Company's active membership in various industry task forces and associations, works with regional pipelines and LDCs to consider potential pipeline expansions. The development of this project would likely have a three or four year lead time. As of this writing, there hasn't been any new activity associated with the potential project.

- **NWP Wenatchee Expansion:** This alternative resource would be incremental NWP capacity from a Washington State receipt point (e.g. Sumas) that is designed to serve load growth needs in Zone 10 and Zone 11. Examples of the Cascade service areas that would benefit from this project are Yakima and Wenatchee. Accordingly, it would have a relatively small scale and so could be expected to have a relatively high unit cost. The development of this project would likely have a three or four year lead time. As of this writing, there hasn't been any new activity associated with the potential project.

- **NWP Zone 20 Expansion:** This alternative resource would be incremental NWP capacity from a Washington State receipt point that is designed to serve load growth needs in Zone 20. Examples of the Cascade service areas that would benefit from this project are Kennewick and Moses Lake. Similar to a proposed NWP Wenatchee expansion, it would have a relatively small scale and so could be expected to have a relatively high unit cost. The development of this project would likely have a three or four year lead time. As of this writing, there hasn't been any new activity associated with the potential project.

- **Pacific Connector:** The Pacific Connector Pipeline project is tied to the development of the Jordan Cove LNG export terminal in Coos Bay, Oregon. This pipeline would start near Malin, Oregon, and would cross NWP's Grants Pass Lateral (GPL) in the vicinity of Roseburg, Oregon. This project presents an opportunity as a potential supply resource for this IRP. Cascade would not be seeking to become a shipper on Pacific Connector. The Company views this project as a bundled pipeline supply service from Malin to the Company's citygates. The project was initially denied due to lack of demand, which has since increased, but faces considerable opposition including but not limited to landowners, activists, and protesters. Incremental transport involving GTN might be necessary to ensure transport from Malin to Cascade's GTN receipt point at Turquoise Flats. On January 19, 2021, federal regulators upheld Oregon's decision to deny a water quality certification for Jordan Cove and Pacific Connector.[13] This latest event has led to some concern the project may not proceed.

- **Southern Crossing Expansion:** FortisBC Southern Crossing is considering an addition of 300-400 MMcf/d of bidirectional capacity. FortisBC has proposed a reinforcement project for the Southern Crossing Pipeline that would permit more flow of Alberta gas to Sumas. This would also require an expansion of NWP from Sumas at the Canadian border which, in the Company's view, does not need to be modeled since it essentially is replicated by the current inclusion of the NWP I-5 expansion project. This is primarily a price arbitrage opportunity, but the Company does not see any significant advantage to the system at this point given limited availability to move the gas from Sumas. However, Cascade will continue to consider this resource to see if it might make sense as a potentially cost-effective dedicated resource for the Company's direct connect with Westcoast.

[13] *See* https://www.oregonlive.com/politics/2021/01/federal-regulators-deliver-potentially-fatal-blow-to-jordan-cove.html

Storage Opportunities

- **AECO Hub Storage:** This is Niska's commercial natural gas storage business in Alberta, Canada. The service is comprised of two gas storage facilities: Suffield (South-eastern Alberta) and Countess (South-central Alberta). Although the two AECO facilities are geographically separated across Alberta, the toll design of the Nova Gas Transmission Ltd. (NGTL) system means they are both at the same commercial point. Capacity at one of the facilities is possible as an alternative resource. However, some services are available for limited periods of time but are subject to possible interruption. Incremental transport involving NGTL, Foothills, GTN, and possibly NWP would also be necessary.

- **Gill Ranch Storage:** Gill Ranch Storage is an underground intra-state natural gas storage facility near Fresno, Calif. It includes a pipeline that links the facility to Pacific Gas & Electric Company's (PG&E) mainline transmission system, allowing it to serve customers throughout California. Storage from this facility would require California Gas Transmission (CGT) transport, which has a potentially cost-prohibitive demand charge of $0.50/Dth to $1.00/Dth. Incremental transport involving GTN would also be necessary.

- **Mist Storage:** This facility is located near Mist, Oregon and is adjacent to NW Natural Gas' distribution system and has a direct connection to NWP for withdrawals and injections. The Mist facility is owned and operated by NW Natural Gas. NW Natural's 2018 IRP (LC71), Chapter 9, Section 9.2.1 indicates that "Mist storage capacity is currently reserved for the core market… NW Natural has developed additional capacity in advance of core customer need. This capacity currently serves the interstate/intrastate storage (ISS) market but could be recalled for service to NW Natural's utility customers as those third-party firm storage agreements expire."

  In the past several years NW Natural has held a Mist open season in 2017, followed by two Mist RFPs. Cascade became a Mist ISS customer for the first time in May 2019. The Company leases 600,000 Dth of storage capacity. This lease is set to expire in 2024.

  On January 14, 2021, NW Natural sent their latest RFP to Cascade with bids due by January 29, 2021. With assistance in modeling from Cascade's asset manager, Tenaska Marketing, Cascade's Gas Supply Oversight Committee (GSOC) authorized Cascade to submit a bid at 76% of the maximum rate (for reference, the current Mist agreement is at 100% of the maximum rate). Cascade was awarded 540,000 Dth of additional

Mist capacity on February 1, 2021. The term of this additional Mist service is May 1, 2021, through April 30, 2026.

In the previous IRP, the latest Mist leased storage was not included in the IRP analysis. It is important to note that Cascade does not own any storage. In addition to the currently leased Mist storage, the Company leases storage at Jackson Prairie and Plymouth LNG. Given the Company's wide geographical and noncontiguous service territory, storage has a unique role in daily upstream operations compared to other regional LDCs. For Cascade, storage functions primarily as an operational tool for balancing and upstream pipeline operational flow orders as opposed to use primarily for price arbitrage. Also, Cascade continues to have the lowest ratio of customers to storage capacity in comparison to other regional LDCs. The addition of this second Mist account improves the Company's portfolio flexibility with minimal impact to customer rates.

- **Spire (formerly Ryckman Creek) Storage:** As of December 2017, Ryckman Creek, LLC operates as a subsidiary of Spire Inc. Spire Gas Storage Facility is located near the town of Evanston, Wyoming and approximately twenty-five miles southwest of the Opal Hub. Spire Storage has converted a partially depleted oil and gas reservoir into a gas storage facility with 35 Bcf of working gas and a maximum daily withdrawal rate of 480,000 Dth/d. Spire Storage currently has interconnects with Questar Gas Pipeline, Kern River Transmission, Questar Overthrust Pipeline, Ruby Pipeline, and NWP. Incremental transport involving Questar and possibly Ruby would be necessary.

- **Wild Goose Storage:** Wild Goose is located north of Sacramento in northern California and is the first independent storage facility built in the state. The facility commenced full commercial operations in April 1999 and in April 2004 completed its first expansion. Storage from this facility would require California Gas Transmission (CGT) transport, which has a potentially cost-prohibitive demand charge of $10.50/Dth to $1.00/Dth. Incremental transport involving GTN would also be necessary.

- **Magnum Gas Storage:** Magnum is currently developing the Magnum Gas Storage facility at the Western Energy Hub. Magnum Gas Storage will be the first high-deliverability storage facility in the Rocky Mountain Region. The facility will contain four solution mined storage caverns capable of storing 54 Bcf of natural gas.[14] Magnum would be connected to the Kern River Gas Transmission and Questar Pipeline systems at Goshen, Utah. Incremental transport involving Questar and possibly Ruby would be necessary.

[14] *See* https://www.wyopipeline.com/magnum-gas-storage-llc-western-energy-hub-project/

- **Clay Basin:** Clay Basin is located in Northeast Utah and is a 54 Bcf working gas storage facility. Clay Basin is connected to the Questar Pipeline system. Incremental transport involving Questar and possibly Ruby would be necessary.

Other Alternative Gas Supply Resources

- **Satellite LNG:** Some gas utilities rely on satellite LNG tanks to meet a portion of their peaking requirements. The term satellite is commonly used because the facility is scaled down and has no liquefaction capability. LNG facilities in this context are peaking resources because they provide only a few days of deliverability and should not be confused with the much larger facilities such as LNG export or import terminals. The concept is that a small tank serving a remote area would be filled with LNG as winter approaches, and the site operated during cold weather episodes when vaporization is required. Since satellite LNG has no on-site liquefaction process, the facility is fairly simple in design and operation. While likely as expensive as some pipeline projects, satellite LNG may be more practical in areas where pipeline capacity shortfalls for peak day are the highest and most immediate. The addition of satellite LNG could defer significant pipeline infrastructure investments for several years. A project of this nature would likely have a three- to four-year lead time.

- **Additional transportation realignments:** The Company's geographically widespread service territory gives Cascade great flexibility to utilize 316,994 Dth/day of delivery rights vs 205,123 Dth/day of receipt rights. Cascade has the right to deliver gas to any delivery point within Washington and Oregon so long as the total MDDOs are not exceeded. Cascade and NWP have worked continuously in recent years for ways to address Cascade's potential peak day capacity shortfalls through re-alignment of the Company's contractual rights where possible, which mitigates the need to acquire incremental NWP capacity through expansions.

Cascade considers unconventional gas supply resources such as supplies from an LNG Import Terminal, local bio-natural gas, or other manufactured gas supply opportunities as potentially speculative supply side resources at this point in time. Ultimately these gas supply resources are treated as alternative resources and have to compete with traditional gas supplies from the conventional gas fields in Canada or the Rockies for inclusion in the Company's portfolio planning.

Supply Side Uncertainties

Several uncertainties exist in evaluating supply side resources. These include regulatory risks, deliverability risks, and price risks. Regulatory risks include the unknown impacts of future Federal Energy Regulatory Commission (FERC) or Canada's Energy Regulator (CER)[15] rulings that may impact the availability and cost of interstate pipeline transportation.

Deliverability risk is the risk that the firm supply will not be available for delivery to the Company's distribution system. Purchasing resources from larger producers or marketers who typically have gas reserves in multiple locations may minimize this risk. The risks associated with prices rising or falling during any winter period represent another supply side uncertainty. To the extent the Company purchases firm contracts that are tied to an index price, it may be at risk for paying more than was initially anticipated for the resource after the resource decision has been made. Price risks associated with climbing prices can be minimized through the use of fixed price contracts or through the use of financial derivatives.

As the United States continues to search for environmentally friendly, economically viable options to displace gasoline and coal, natural gas is seen as a fuel that could be a viable resource in a greener future. It is worth noting that some planned and proposed projects could have a direct impact on the availability of supply or at least may pose potential risks to increasing the price of supplies sourced from British Columbia and Alberta. For example, Coastal GasLink Pipeline 670-kilometer project was completed and will transport natural gas from northeast British Columbia to an LNG export facility near Kitimat BC near the Pacific coast. Shippers using this pipeline will likely lead to increased competition for gas supplies in the region. Also, expansions on the TransCanada pipelines in 2022 and 2023 have also increase competition for available gas supplies in Alberta and British Columbia. The Company will continue to monitor and be actively involved in the various pipeline forums as these initiatives develop.

As mentioned in Chapter 3, predicting demand is challenging due to the unpredictable nature of building codes and environmental policies in Washington and Oregon. In the reference case scenario, where Cascade shows flat growth, and in the low growth scenario, Cascade might consider offloading transportation or storage contracts. This could involve temporarily or permanently releasing capacity or choosing not to renew a contract. More discussion on this topic can be found in Chapter 10.

[15] The Canada Energy Regulator (CER) is the agency of the Government of Canada under its Natural Resources Canada portfolio, which licenses, supervises, regulates, and enforces all applicable Canadian laws as regards to interprovincial and international oil, gas, and electric utilities. The agency came into being on August 28, 2019, under the provision of the Canada Energy Regulator Act of the Parliament of Canada superseding the National Energy Board from which it took over responsibilities.

Financial Derivatives and Risk Management

Cascade constantly seeks methods to ensure customers of price stability. In addition to methods such as long-term physical fixed price gas supply contracts and storage, another means for creating stability is through the use of financial derivatives. The general concept behind a derivative is to lock in a forward natural gas price with a hedge, consequently mitigating exposure to significant swings in rising and falling prices. Financial derivatives include futures, swaps, and options on futures or some combination of these.

Natural gas futures contracts are actively traded on the NYMEX. The use of futures allows parties to lock in a known price for extended periods of time (up to six years) in the future. Contracts are typically made in quantities of 10,000 Dth to be delivered to agreed-upon points (e.g., NWP Sumas, Westcoast Station 2, NGTL AECO, NWP Rockies, etc.).

In a swap, parties agree to exchange an index price for a fixed price over a defined period. In this scenario, Cascade would be able to provide its customers with a fixed price over the duration of the swap period. In theory, the price would be levelized over the long-term. Futures and swaps are typically called costless collars.

Unlike futures and swaps, an option only provides protection in one direction - either against rising or falling prices. For example, if Cascade wanted to protect customers against rising gas prices but keep the ability to take advantage of falling prices, Cascade would purchase a call option on a natural gas future contract. This arrangement would give the Company the right (but not the obligation) to buy the futures contract at a previously determined price (i.e., the strike price). Similar to insurance, this transaction only protects the Company from volatile price spikes, via a premium. The premium is typically a function of the variance between the strike price compared to the underlying futures price, the period of time before the option expires, and the volatility of the futures contract.

Cascade’s GSOC oversees the Company’s gas supply hedging strategy. The Company’s current gas hedging strategy is outlined below:

Hedged Fixed-Price Physical or Financial Swap Targets

- Year one target set at 50-60% of annual requirements.
- Year two target set at 30-40% of annual requirements.
- Year three target set at 15-25% of annual requirements.

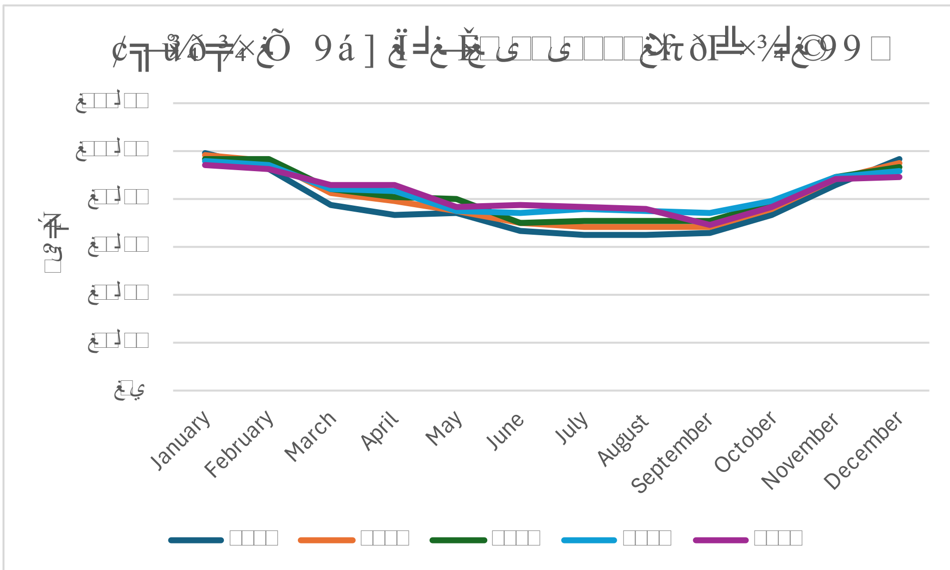
Depending on market conditions, the strategy allows for the ratchets to increase to 75%, 40%, and 25%, respectively, provided current market information supports moving to a different level.

Cascade employs prudent risk management strategies within designated parameters to minimize the risk of operating losses or assumption of liabilities from commodity price increases because the price the Company pays for gas is subject to market conditions. Risk is associated with business objectives and the external environment. The number of hedging strategies to deal with risk are almost infinite. The decision-making process to manage a risk categorizes whether the risk is one to be avoided, one to be accepted and controlled, or a risk left uncontrolled. When a risk is high impact with a high likelihood of occurrence, the risk is probably too high in relation to the reward and should be avoided. It is reasonable to accept business risks that can be managed and controlled. For some risk, the measurable impact is low, and the risk may not be worth controlling at all. These are risks where the Company can absorb a loss with little financial or operational impact. The Company's policy is directed toward those risks that are considered manageable, controllable, and worth the potential reward to customers. This manageable risk includes acceptable analysis of the possible side effects on the financial position of the Company as compared to the rewards.

The use of derivatives is permitted only after identified risks have been determined to exceed defined tolerance levels and are considered unavoidable. Cascade's GSOC makes these decisions. In recent years, the GSOC has adjusted the percentage of the portfolio hedged based on volatility of the market. For example, in the early 2000s, the Company hedged up to 90% of the base gas supply portfolio. When MDU Resources acquired Cascade in 2007, this threshold was reduced to 75% to align with MDU Resources' Corporate Derivatives Policy. As the market began to fall dramatically in the 2008-2010 period, the Company continued to lower the percentage to approximately 30%. Current MDU Resources' corporate policy encourages Cascade to keep the hedging percentage at approximately 55%. For the 2020 procurement design, GSOC felt that it prudent for Cascade to enter into its first financial derivative during the 2019-2020 period, which the Company successfully executed.

The Company entered into fixed price physical transactions and one financial swap for the current programmed buying period. The Company entered into fixed price physical transactions rather than executing financial swaps for the current programmatic buying period. Fixed prices consist of locked-in prices for physical supplies. As discussed in Appendix E, the Company utilizes a multi-tiered buying approach for locking in or hedging gas supply prices. The Company monitors market conditions and stands ready to execute financial swaps when market and pricing conditions warrant. Figure 4-10 provides a graph showing the Company's projected weighted average cost of gas (WACOG), including the Social Cost of Carbon, for the 2025 IRP.

Figure 4-10: Projected Cascade WACOG as of July 2024



With the assistance of Gelber & Associates (G&A or Gelber), an energy consulting firm with 30 years of experience in utility hedging, Cascade has continued to evolve its hedging practices to develop a hedging plan that uses a data-driven approach and provides the flexibility to manage both upside price risk and downside hedge loss risk.

Gelber has been working in close coordination with Cascade to design and implement processes and analytics to comply with the Washington Utility and Transportation Commission UG-132019 policy statement while simultaneously complying with Oregon Public Utility Commission UM-1286 PGA integrated hedging guidelines.

WUTC's Docket UG-132019 requires that hedging programs steer away from inflexible, programmatic practices employed previously to become more "risk responsive" and "data driven". WUTC requires an annual hedging plan submission that demonstrates risk responsive strategies in addition to retrospective hedge reporting. Gelber believes and Cascade concurs that the use of a diversified portfolio of hedging instruments including swaps, call options, and fixed-price physicals is the appropriate design criteria to satisfy Commission requirements.

An update on Cascade's work with Gelber on an evolving hedge program can be found in the Company's 2024 Annual Hedge Plan in Appendix E.

Portfolio Purchasing Strategy

As stated earlier, GSOC oversees the Company's gas supply purchasing strategy. The Company contracts physical supplies for up to three years. The Company's current gas procurement strategy is to secure physical gas supplies for approximately one-third of the core portfolio supply needs each year for the subsequent rolling three-year period. This method ensures some portion of the current market prices will affect a portion of the next three years of the portfolio.

GSOC determines the framework for the portfolio design including the allowable percentage of fixed-priced purchases. The execution of the portfolio and the hedging plan is accomplished primarily by the Manager of Gas Supply, under the leadership of the Director of Gas Control & Supply for the Western Region. Either the Manager or Director can execute purchases under the current plan; additionally, they may designate a backup within Gas Supply with the responsibility to execute trades in the event of their absence. The Manager of Upstream Resources and Special Projects functions as compliance manager regarding the WUTC's UG-132019 policy statement. These teams are overseen by the Director, Director of Gas Control & Supply for the Western Region.

Under this procurement strategy, approximately 5% to 12% of the annual portfolio is to be met with spot purchases. Spot purchases consist of either first of the month transactions, executed during bid week for the upcoming month, or day purchases which are utilized to meet incremental daily needs.

Once GSOC has approved the portfolio procurement strategy and design, the Company employs a variety of methods for securing the best possible transactions under existing market conditions. The Company employs a variety of methods for securing the best possible deal under existing market conditions. CNGC employs a number of processes when procuring fixed-price physical and indexed-riced spot physical. There is a separate process for financial derivatives as discussed throughout this annual hedge plan.

Physical Supply

CNGC utilizes TruMarx's COMET transaction bulletin board system to assist in communicating, tracking, and awarding most activities involving the Company's physical supply portfolio. In the procurement process for physical natural gas the Company posts an RFP to Cascade's 25+ physical supply parties to solicit offers on needed supply. The Company then collect bids from these parties over a period, depending on the number or time requirements of the packages sought, comparing the indicative pricing to each party as well as comparing the information to market intelligence available at the time. Ideally, after monitoring these indicatives and the market, CNGC awards the posted packages. Please note that posting on COMET does not obligate CNGC to execute any proposal made by physical suppliers.

Naturally, price is the principal factor; however, CNGC also considers reliability, financial health, past performance, and the party's share of the overall portfolio as to ensure party diversity. It should be noted that there is always the possibility the lowest market price may be during period when the Company is initially gathering the price indicatives; in that situation there is a risk that a sudden price run-up may lead to filling the transaction at the higher end of the bids over time or delay the acquisition to another time. However, the reverse is also true—the initial price indicatives may start high and drop over time, allowing CNGC to capture the transaction on the downward swing. In the end, timing is always a factor as the market cannot be perfectly predicted. As discussed, beginning at page 4-7, compliance with applicable laws is a primary factor for RNG rather than price.

Occasionally, an operational situation may occur where time is of essence, such as a need to acquire spot gas to meet sudden swings in load demand or in response to an upstream pipeline operational event. In such situations, CNGC may make a short procurement purchase within a narrow time window to procure and schedule the supply. The Company contacts one to three reliable physical parties to meet these short-term supply needs. Again, price is the principle but not the only driver for the awarding of these supply needs. Also, please note the Company always encourages physical suppliers to propose other transactions or packages that they feel may be of interest in helping CNGC secure cost effective and operationally flexible transactions to meet CNGC's needs. In addition to analysis using Excel, CNGC also uses the PLEXOS® resource optimization model, which is a useful tool for examining logical, operationally, and financially feasible physical packages that best utilizes CNGC's various transportation, storage, and operational capabilities.

Financial Derivatives

For financial derivatives, CNGC contacts Company-approved financial counterparties ("counterparties") to request bids consistent with the GSOC approved hedge execution plan (HEP). Naturally, this process requires additional analysis regarding financial reasonableness, timing, hedging strategy, and volumes. The Monthly Guidance and CNG Book Model are the primary tools used to identify and analyze potential financial derivatives possibilities. Price comparisons may also become more complicated since pricing could be tiered; part of a structure deal may be tied to an index or contain floors, caps, etc. Bids are received from the counterparties and, similar to the physical portfolio, the Company then collect bids from these parties over a period, depending on the number or time requirements of the packages sought, comparing the indicative pricing to each party as well as applying the information from market intelligence available at the time. Furthermore, G&A uses MarketView and CNGC has limited access to ICE. Both deliver real-time market pricing information for hedging transactions. Ideally, after monitoring these indicatives and the market, CNGC will award the specific packages to individual parties. Again, please note that CNGC is not obligated to execute any offer received. Further information regarding Cascade's evolving hedge program can be found in the Company's 2024 Annual Hedge Plan in Appendix E.

Conclusion

Cascade's supply side resource goal over the planning horizon is to continue to meet the energy needs of its core market customers and compliance requirements for emission reductions. This is accomplished through a package of services that combines adequate gas supplies, low carbon alternative fuels, and cost-effective winter peaking services with long-term pipeline transportation contracts and sufficient distribution system capacity at the lowest possible cost. The Company has identified several transport, storage, and other alternative resources which may be modeled to join the Company's existing demand and supply side resources to address the load demand needs over the planning horizon.

Chapter 5

Avoided Costs

Overview

The avoided cost is the estimated cost to serve the next unit of demand with a supply side resource option at a point in time. This incremental cost to serve represents the cost that could be avoided through energy efficiency. The avoided cost forecast can be used as a guideline for comparing energy efficiency with the cost of acquiring and transporting natural gas to meet demand.

This chapter presents Cascade's avoided cost forecast and explains how it was derived. While the IRP planning horizon is 25 years, avoided costs are forecasted for 45 years to account for the full measure life of some energy efficiency measures, such as insulation, which has a 30-year life. The avoided cost forecast is based on the performance of Cascade's resource portfolio under expected conditions.

Key Points

- Avoided cost forecasting serves as a primary input for determining energy efficiency targets.
- Cascade's avoided costs include fixed transportation costs, variable transportation costs, commodity costs, carbon compliance costs, distribution system costs, a risk premium, and a 10% adder.
- As per WUTC guidelines, Cascade is using the Social Cost of Carbon with a 2.5% discount rate as its base carbon compliance costs
- The total avoided cost ranges between $1.38and $2.54/therm over the 28-year planning horizon.

Costs Incorporated

The components that go into Cascade's avoided cost calculation are as follows:

$$AC_{nominal} = (TC_f + TC_v + SC_v + CC + E_{Comp} + DSC + RP) * E_{adder}$$

Where:

- $AC_{nominal}$ = The nominal avoided cost for a given year. To put this into real dollars apply the following: Avoided Cost/ (1+Discount Rate)^Years from the reference year.
- TC_f = Incremental Fixed Transportation Costs
- TC_v = Variable Transportation Costs
- SC_v = Variable Storage Costs
- CC = Commodity Costs
- E_{Comp} = Environmental Compliance Costs
- DSC = Distribution System Costs
- RP = Risk Premium

- E_{adder} = Environmental Adder, as recommended by the Northwest Power and Conservation Council

The following parameters are also used in the calculation of the avoided cost:

- The most recent load forecast (February 2024);
- The inflation rate used to scale the Social Cost of Carbon (SCC) from Real $2007 to Real $2024 uses the chain type price index for the Gross Domestic Product from the Bureau of Economic Analysis (BEA)[1]; and
- The discount rate of 6.09% (30-year fixed mortgage rate as of 8/15/2024).

Understanding Each Component

- **Incremental Fixed Transportation Costs**

  In the 2025 IRP, Cascade has not included any additional upstream capacity in its preferred portfolio for the 25-year planning horizon. If such a need were to be identified, fixed transportation costs would represent the average reservation rate of all incremental contracts that would be used to solve shortfalls. Importantly, in some cases, these costs are an estimate based on information from the pipeline companies, and furthermore, are treated as confidential as any incremental fixed transportation costs could ultimately be a negotiated rate.

- **Variable Transportation Costs**

  Variable transportation costs are the cost per therm that Cascade pays only if the Company moves gas along a pipeline. This rate is set by the various pipeline companies and can be changed if one of the pipeline companies files a rate case. The final rates filed at the conclusion of a rate case (whether reached through a settlement or a hearing) must be approved by the Federal Energy Regulatory Commission (FERC) for U.S. pipelines and the Canadian Energy Regulator (CER) for Canadian pipelines. To model rate changes in its forecast, Cascade multiplies its transportation costs by the CPI escalator every four years. Four years is a proxy, since rate cases may not be filed each year.

- **Storage Costs**

  Storage costs are the cost per therm that Cascade would pay for a storage contract that solved some or all of Cascade's peak day shortfalls. This

[1] *See* https://officeofbudget.od.nih.gov/gbiPriceIndexes.html

would include an on-system storage facility, or a satellite LNG facility connected to Cascade's distribution system. Cascade does not project a need for this resource in its 2025 IRP.

- **Commodity Costs**

  Commodity costs are the costs of acquiring one therm of gas. Cascade first uses PLEXOS® to calculate the monthly percentage of gas that the optimizer would purchase from each of the three basins to serve that climate zone. These weights are then used to derive a single price for the acquisition of that therm. The source for the price that is used for each month's calculation is the monthly price from each year of Cascade's 25-year price forecast.

- **Environmental Compliance Costs**

  Once the Company has calculated its average cost of gas, a price for expected carbon compliance costs must be added. Cascade converts the cost of carbon in dollars per metric ton to dollars per dekatherm, accounting for the upstream natural gas value chain emissions in this calculation. Further information about this calculation can be found in Chapter 6, Environmental Policy. Accurate modeling of these costs has been challenging in years past due to uncertainty surrounding how these costs will ultimately be quantified. For this IRP, Cascade will continue to follow the guidance outlined in Docket U-190730 by using the SCC with a 2.5% discount rate as its carbon compliance cost. Cascade will also follow the WUTC guidance for adjusting the values of the SCC from Real $2007 to Real $2024 by using GDP data published by the BEA. Cascade is also using the marginal abatement cost for emissions compliance in a given year, in addition to the SCC, as reflected by the cost of the next most expensive resource for emissions reduction (e.g., RNG, Hydrogen, projected allowance price in auction).

  Cascade calculates the inflation adjusted SCC to start at $104.67/Metric Ton CO_2e in 2025, rising to $147.15/Metric Ton CO_2e in 2050. In Cascade's initial avoided cost calculation, these values were equivalent to $5.55/Dth in 2025, rising to $7.81/Dth in 2050. Overall, carbon compliance costs related to the SCC are a significant factor in Cascade's avoided cost calculation, accounting for as much as 40.25% of the total system avoided cost in a given year.

- **Environmental Adder**

  Cascade includes a 10% adder for non-quantifiable environmental benefits as recommended by the Northwest Power and Conservation Council. As a result of conversations with various stakeholders during the 2023 IRP process, Cascade modified its methodology for applying the 10% adder. In the Company's 2025 IRP the adder will be applied to all elements of the avoided cost. For reference, this adder was only applied to the Commodity and Environmental Compliance Costs in prior IRPs.

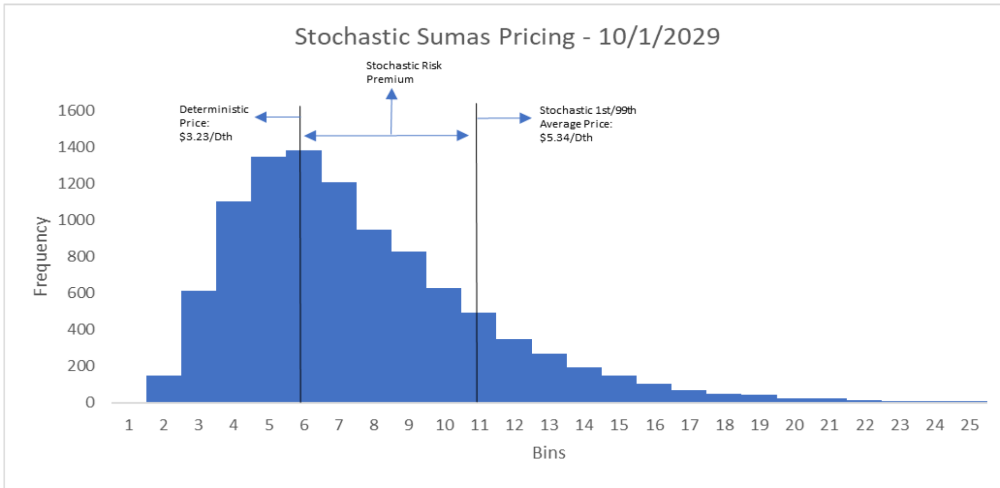
- **Distribution System Costs**

  Distribution system costs capture the costs of sending gas from the citygate to Cascade's customers. During the 2023 IRP, Cascade moved away from defining these costs as a function of margin and towards a capacity deferral valuation calculation. It is important to recognize that while energy efficiency may not be able to fully eliminate the need for a distribution system enhancement, it can defer the need for these enhancements to a later year. Because of the economic principle of the time value of money, this deferral has value, and that value is the avoided distribution system cost for the 2025 IRP. To calculate these costs, the Company projects what investments it may need to make related to growth of the distribution system and divides that by the projected peak day load growth from Cascade's load forecast. Cascade generally calculates distribution system costs for both peak day and peak hour, as distribution system analysis is most concerned about system capabilities during a peak hour scenario. Cascade's reference case does not anticipate growth, therefore, does not include distribution system costs in the avoided cost.

- **Risk Premium**

  Cascade defines risk premium as the difference between the impacts of a potential extreme upward price movement versus that of an extreme downward price movement. Due to the lognormal nature of gas prices, the risk presented from rising prices will typically exceed that of falling prices. This is presented visually in Figure 5-1, which shows the frequency of Sumas pricing over 10,000 stochastic draws for a given month. By identifying the average of the 1st and 99th percentile of these draws, and comparing that to the deterministic or expected pricing, the Company can identify a Stochastic Risk Premium.

Figure 5-1: Stochastic Sumas Pricing 10/1/2029



The Stochastic Risk Premium is then entered into the company's Risk-Adjusted Risk Premium Final Calculation, which is defined as:

Deterministic Price * .75 + (((99th Percentile Stochastic Price + 1st Percentile Stochastic Price) /2) * .25)) - Deterministic Price

The result of this calculation is the Company's risk premium input to its avoided cost calculation.

Application

The 2025 IRP makes several enhancements in calculating and applying the avoided costs, specifically related to enhancements of the environmental compliance cost calculation methodology. This cost metric becomes the foundation for prudency determinations regarding energy efficiency, both operationally and from a resource planning perspective. It may be helpful to think of the final avoided cost figure as something of a cutoff point. Any action that would save a therm of gas could be evaluated based on the cost per therm saved of that measure. If that number is lower than the avoided cost, it may make sense to implement that measure. If not, such a measure may not be optimal to engage in.

Avoided Cost Sensitivity Analysis

The 2025 IRP incorporates emissions reduction goals related to the Climate Commitment Act in Washington and the Climate Protection Program in Oregon. To mitigate risks from the uncertainty around these regulations, the Company is performing scenario analyses around customer growth that may impact Cascade's compliance options. The Company is evaluating the amount of energy efficiency that Cascade can acquire under a low and high growth scenario. The impact of this sensitivity adjustment can be found in Appendix H.

Results

Figure 5-2 displays a comparison of the average nominal avoided cost over the planning horizon for the current and past IRPs. Figure 5-3 displays the total avoided cost by each conservation zone over the 25-year IRP horizon, while Figure 5-4 provides the net present value of avoided costs over the planning period. Conservation Zone 1 covers the west side of Cascade's service territory, with load centers such as Bellingham, Stanwood, and the Sedro/Wooley area. Conservation Zone 2 refers to the central Washington service area, with load centers such as Bremerton, Longview, and Castle Rock. Conservation Zone 3 covers the eastern Washington service area, including Yakima, Walla Walla, and the Tri Cities. Finally, Zone 4 refers to Oregon citygates. A map of the Conservation Zones can be found in Figure 12-14 in Chapter 12, Glossary and Maps. For the 2025 IRP, nominal system avoided costs range between $1.38/therm and $2.54/therm, with the average avoided cost of $1.99/therm.

As mentioned earlier, the avoided cost is based on the performance of the portfolio under expected conditions for the entire 25-year planning horizon. Overall, avoided costs for the 2025 IRP are higher than in the 2023 IRP. The main driver of this would be the increase in the commodity cost as well as the addition of the SCC. The 45-year avoided costs and other detailed tables of avoided costs are found in the Excel version of Appendix H.

Figure 5-2: Avoided Cost Comparison to Previous IRPs

	2012 IRP	2014 IRP	2016 IRP	2018 IRP	2020 IRP	2023 IRP	2025 IRP
Nominal $/Therm	$ 0.810	$ 0.528	$ 0.610	$ 0.673	$ 0.936	$ 1.779	$ 1.992

Figure 5-3: Nominal Avoided Costs by Zone (Cost per Therm)

Nominal Avoided Cost (By Zone) - $/Therm							
	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2025	$ 1.379	$ 1.379	$ 1.379	$ 1.379	$ 1.379	$ 1.379	$ 1.379
2026	$ 1.468	$ 1.468	$ 1.468	$ 1.468	$ 1.468	$ 1.468	$ 1.468
2027	$ 1.586	$ 1.586	$ 1.586	$ 1.586	$ 1.586	$ 1.586	$ 1.586
2028	$ 1.668	$ 1.668	$ 1.668	$ 1.668	$ 1.668	$ 1.668	$ 1.668
2029	$ 1.720	$ 1.720	$ 1.720	$ 1.720	$ 1.720	$ 1.720	$ 1.720
2030	$ 1.669	$ 1.669	$ 1.669	$ 1.669	$ 1.669	$ 1.669	$ 1.669
2031	$ 1.852	$ 1.852	$ 1.852	$ 1.852	$ 1.852	$ 1.852	$ 1.852
2032	$ 1.947	$ 1.947	$ 1.947	$ 1.947	$ 1.947	$ 1.947	$ 1.947
2033	$ 2.029	$ 2.029	$ 2.029	$ 2.029	$ 2.029	$ 2.029	$ 2.029
2034	$ 2.107	$ 2.107	$ 2.107	$ 2.107	$ 2.107	$ 2.107	$ 2.107
2035	$ 2.183	$ 2.183	$ 2.183	$ 2.183	$ 2.183	$ 2.183	$ 2.183
2036	$ 1.950	$ 1.950	$ 1.950	$ 1.950	$ 1.950	$ 1.950	$ 1.950
2037	$ 1.866	$ 1.866	$ 1.866	$ 1.866	$ 1.866	$ 1.866	$ 1.866
2038	$ 1.934	$ 1.934	$ 1.934	$ 1.934	$ 1.934	$ 1.934	$ 1.934
2039	$ 2.018	$ 2.018	$ 2.018	$ 2.018	$ 2.018	$ 2.018	$ 2.018
2040	$ 2.066	$ 2.066	$ 2.066	$ 2.066	$ 2.066	$ 2.066	$ 2.066
2041	$ 2.061	$ 2.061	$ 2.061	$ 2.061	$ 2.061	$ 2.061	$ 2.061
2042	$ 1.974	$ 1.974	$ 1.974	$ 1.974	$ 1.974	$ 1.974	$ 1.974
2043	$ 2.032	$ 2.032	$ 2.032	$ 2.032	$ 2.032	$ 2.032	$ 2.032
2044	$ 2.119	$ 2.119	$ 2.119	$ 2.119	$ 2.119	$ 2.119	$ 2.119
2045	$ 2.183	$ 2.183	$ 2.183	$ 2.183	$ 2.183	$ 2.183	$ 2.183
2046	$ 2.248	$ 2.248	$ 2.248	$ 2.248	$ 2.248	$ 2.248	$ 2.248
2047	$ 2.316	$ 2.316	$ 2.316	$ 2.316	$ 2.316	$ 2.316	$ 2.316
2048	$ 2.387	$ 2.387	$ 2.387	$ 2.387	$ 2.387	$ 2.387	$ 2.387
2049	$ 2.461	$ 2.461	$ 2.461	$ 2.461	$ 2.461	$ 2.461	$ 2.461
2050	$ 2.539	$ 2.539	$ 2.539	$ 2.539	$ 2.539	$ 2.539	$ 2.539

Figure 5-4: Real $2021 Avoided Costs by Zone (Cost per Therm)

Real 2021$ Avoided Cost (By Zone)							
	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2025	$ 1.379	$ 1.379	$ 1.379	$ 1.379	$ 1.379	$ 1.379	$ 1.379
2026	$ 1.383	$ 1.383	$ 1.383	$ 1.383	$ 1.383	$ 1.383	$ 1.383
2027	$ 1.409	$ 1.409	$ 1.409	$ 1.409	$ 1.409	$ 1.409	$ 1.409
2028	$ 1.397	$ 1.397	$ 1.397	$ 1.397	$ 1.397	$ 1.397	$ 1.397
2029	$ 1.358	$ 1.358	$ 1.358	$ 1.358	$ 1.358	$ 1.358	$ 1.358
2030	$ 1.242	$ 1.242	$ 1.242	$ 1.242	$ 1.242	$ 1.242	$ 1.242
2031	$ 1.299	$ 1.299	$ 1.299	$ 1.299	$ 1.299	$ 1.299	$ 1.299
2032	$ 1.288	$ 1.288	$ 1.288	$ 1.288	$ 1.288	$ 1.288	$ 1.288
2033	$ 1.264	$ 1.264	$ 1.264	$ 1.264	$ 1.264	$ 1.264	$ 1.264
2034	$ 1.238	$ 1.238	$ 1.238	$ 1.238	$ 1.238	$ 1.238	$ 1.238
2035	$ 1.209	$ 1.209	$ 1.209	$ 1.209	$ 1.209	$ 1.209	$ 1.209
2036	$ 1.018	$ 1.018	$ 1.018	$ 1.018	$ 1.018	$ 1.018	$ 1.018
2037	$ 0.918	$ 0.918	$ 0.918	$ 0.918	$ 0.918	$ 0.918	$ 0.918
2038	$ 0.897	$ 0.897	$ 0.897	$ 0.897	$ 0.897	$ 0.897	$ 0.897
2039	$ 0.882	$ 0.882	$ 0.882	$ 0.882	$ 0.882	$ 0.882	$ 0.882
2040	$ 0.851	$ 0.851	$ 0.851	$ 0.851	$ 0.851	$ 0.851	$ 0.851
2041	$ 0.800	$ 0.800	$ 0.800	$ 0.800	$ 0.800	$ 0.800	$ 0.800
2042	$ 0.723	$ 0.723	$ 0.723	$ 0.723	$ 0.723	$ 0.723	$ 0.723
2043	$ 0.701	$ 0.701	$ 0.701	$ 0.701	$ 0.701	$ 0.701	$ 0.701
2044	$ 0.689	$ 0.689	$ 0.689	$ 0.689	$ 0.689	$ 0.689	$ 0.689
2045	$ 0.669	$ 0.669	$ 0.669	$ 0.669	$ 0.669	$ 0.669	$ 0.669
2046	$ 0.650	$ 0.650	$ 0.650	$ 0.650	$ 0.650	$ 0.650	$ 0.650
2047	$ 0.631	$ 0.631	$ 0.631	$ 0.631	$ 0.631	$ 0.631	$ 0.631
2048	$ 0.613	$ 0.613	$ 0.613	$ 0.613	$ 0.613	$ 0.613	$ 0.613
2049	$ 0.596	$ 0.596	$ 0.596	$ 0.596	$ 0.596	$ 0.596	$ 0.596
2050	$ 0.579	$ 0.579	$ 0.579	$ 0.579	$ 0.579	$ 0.579	$ 0.579

Chapter 6

Environmental Policy

Purpose

This chapter considers Greenhouse Gas (GHG) emission reduction policies and regulations that impact, or have the potential to impact, natural gas distribution companies and Cascade's methodologies for applying the cost of carbon to natural gas distribution. This discussion also includes the assumptions made in determining a 45-year avoided cost of natural gas and pairs these costs with associated two-year action items.

Key Points

- State agencies have issued GHG emission reduction regulations that are considered in the 2025 IRP.
- On July 21, 2021, the Washington legislature passed the Climate Commitment Act directing the Department of Ecology (Ecology) to develop and enforce a rule for implementing a GHG cap and trade program. Ecology released the final Climate Commitment Act rule on September 29, 2022, and plans linkage with California and Quebec in future.
- Cascade models carbon compliance costs as the SCC with a 2.5% discount rate, updated to real $2024 and per Washington Climate Commitment Act requirements.
- On March 20, 2020, Oregon Governor Brown issued EO 20-04 directing state agencies to reduce GHG emission under their existing authority. The Oregon Court of Appeals invalidated the rule and DEQ reestablished the Climate Protection Program on November 21, 2024.
- Washington state building code revisions effective July 1, 2023, limit natural gas use for space and water heating in new and retrofitted commercial and residential.
- Cascade continues to monitor and engage in state, local, and federal regulatory and legislative actions.

Policymakers in Washington passed the Climate Commitment Act (CCA) in July 2021, giving the Department of Ecology (Ecology) authority to regulate GHG emissions from natural gas distribution utilities, including customer emissions. Also, two initiatives were on the November 5, 2024, Washington state ballot. Ballot initiative 2117, which would have repealed the CCA, did not pass, while ballot initiative 2066 did pass. Initiative 2066 prohibits state and local governments from restricting access to natural gas and is anticipated to have impacts on building code adoption and other state actions affecting natural gas use limitations.

In Oregon, Governor Brown issued an executive order in 2020 directing state agencies to pursue GHG emission reductions under their authority, which included the Department of Environmental Quality (DEQ) issuing the Climate Protection Program (CPP) rule in late 2021 which established a cap on GHG emissions for certain sectors, including natural gas distribution customers, and required significant reductions between 2022 and 2050. In December 2023, the CPP was invalidated by the Oregon Court of Appeals. DEQ revised and reestablished the CPP with the Environmental Quality Council's unanimous approval of the revised CPP rule on November 21, 2024. The rule is effective January 1, 2025, requiring significant emission reductions from the original CPP rule 2017-2019 average emissions baseline of 50% reduction by 2035 and 90% by 2050.

Federally, under the Biden Administration, the Environmental Protection Agency (EPA) released a revised GHG emissions standard rule for electric generating units that requires carbon dioxide pollution controls on new natural gas-fired combustion units and existing coal-fired units in Spring 2024. President Trump, after taking office on January 20, 2025, directed the EPA to re-evaluate this rulemaking.

Federal legislation also passed under the Biden Administration, which incentivized development of lower or zero-carbon energy resources. President Trump has made known his administration's plans for re-evaluating or rolling back the Biden Administration policy initiatives and congressional actions. Cascade will evaluate impacts from policy changes in the new administration when they are implemented.

Company Environmental Policy

Cascade's policy states:

"The Company will operate efficiently to meet the needs of the present without compromising the ability of future generations to meet their own needs. The environmental goals are:

> *To minimize waste and maximize resources;*
> *To be a good steward of the environment while providing high quality and reasonably priced products and services; and*
> *To comply with or surpass all applicable environmental laws, regulations and permit requirements."*

Cascade is committed to maintaining compliance with all laws and regulations and strives to operate in a sustainable manner, while taking into consideration the cost to customers. Cascade actively engages in public proceedings related to federal and state legislative and regulatory activities. This includes offering comments and suggested improvements on environmental policy, including air emissions and other environmental requirements. The Company has also established memberships in relevant trade organizations to assist in monitoring the potential impact of proposed legislation and regulation on the Company's operations. Cascade's goal is to ensure safe, affordable, reliable energy for Cascade's customers while serving as stewards of the Company's natural resources, balancing our commitment to economic, environmental, and social considerations to ensure our operations continue to provide essential products and services for our customers.

Overview

Cascade monitors environmental regulatory requirements that are in progress at the national, regional, and local levels that impact natural gas distribution companies. At this time, there are no regulations at the federal level that would require the Company to reduce GHG emissions. However, the CCA rule was finalized in Washington on September 29, 2022, which require GHG emissions reductions from natural gas distribution companies' customers use of natural gas as well as Cascade's distribution infrastructure and operations GHG emissions. On November 21, 2024, Oregon re-instated the CCPP, which is effective January 1, 2025. The CPP requires GHG emissions reductions from natural gas distribution companies' customers use of natural gas. Cascade's compliance plan for these rules is modeled within this IRP.

There have been no congressional bills or federal agencies proposing direct GHG reductions that would significantly impact natural gas distribution. Rather, on a federal level, most programs established provide platforms to encourage the natural gas distribution segment to make voluntary commitments in reducing GHG emissions. One of the voluntary platforms is EPA's Natural Gas Star Methane Challenge Program. The Methane Challenge Program[1] was established by the EPA with Cascade participating as a founding partner of the program in March 2016 along with about 50 other oil and natural gas companies. Partners in the program demonstrate their commitment and concern for the environment through voluntary methane emissions reductions. With the EPA amending Subpart W which has expanded emissions reporting requirements and the passage of the Inflation Reduction Act (IRA), the EPA plans to end the Methane Challenge Program in 2024. Under the IRA, the Methane Emissions Reduction Program[2] (MERP) was created to help reduce oil and gas sector GHG emissions by providing financial and technical assistance through funding opportunities. Cascade has been monitoring opportunities for grants under MERP and has not yet identified viable opportunities applicable to our operations. With President Trump taking office on January 20, 2025, and a republican majority in congress as of 2025, changes are anticipated in the IRA. Cascade will continue to monitor federal actions.

At the suggestion of WUTC in past IRPs, and as outlined in Docket U-190730, Cascade is using the Social Cost of Carbon (SCC) with a 2.5% discount rate in

[1] Methane Challenge Partnership (2016 – 2024) | US EPA
[2] Methane Emissions Reduction Program | US EPA

avoided cost modeling and as the main CO_2 adder in sensitivity modeling. This discount rate was established by the Interagency Working Group (IWG) on Social Cost of Greenhouse Gases to model societal costs of GHG emissions resulting from customers' combustion of natural gas. Agencies, such as the EPA, have used the SCC in determining the cost of climate impacts from rulemaking.

Cascade has been involved in state-focused evaluation of renewable natural gas (RNG) opportunities in Washington, Oregon, and regionally. Cascade also monitors federal and regional RNG policy development through the Company's membership in trade organizations. Cascade provides further discussion of RNG projects and additional RNG procurement opportunities in Chapter 4, as this energy resource is important to consider for Oregon and Washington GHG emissions compliance and community interest in reducing GHG emissions.

There are community-driven efforts to achieve GHG emission reduction targets within, and adjacent to, Cascade's service areas. On February 7, 2022, the Bellingham City Council passed an ordinance requiring electric space and water heating equipment for new commercial and large (i.e., 4-plus story) multifamily buildings. The electric-only mandate for space and water heating does not apply to single family construction, detached houses, duplexes, townhomes or row houses. The ordinance took effect on August 7, 2022. However, voters' approval of Initiative 2066 may have long-term implications for the passage of state and local policies with impacts to the usage of natural gas. Cascade continues to monitor associated litigation pertaining to the Washington State Building Code and I-2066. In the meantime, Cascade continues to engage both internally and externally on pathways to reduce GHG emissions and support the environmental priorities of the communities we serve. This includes the onboarding of a Thermal Energy Networks (TENs) manager to support the Company's pursuit of networked thermal energy pilots following the passage of HB 2131, the TENs bill in Washington.

Cascade's decarbonization-related efforts in Oregon have included a pilot energy assessment for Cascade's transportation customers in the Bend region. These efforts are ongoing and offer pathways for further GHG reductions which are shared with the energy assessment participants. Cascade will continue engaging with our local communities to support GHG emission reduction targets and goals while supporting the triple bottom line of economics, equity, and sustainability.

Cascade integrates policies and regulatory activities like those mentioned above and they are taken into consideration when determining GHG emissions compliance or carbon costs for the IRP analyses. The Company considers both proposed and final regulations and legislation in this process. The following subsections provide discussion of the policy and regulatory developments that have been most informative in evaluating carbon impacts on Cascade's operations and customers. Cascade also includes discussion on the Company's GHG emissions, and actions and commitments the Company has taken to reduce GHG emissions.

Federal Regulation and Policy

Following President Trump taking office on January 20, 2025, many of President Biden's regulations and policy enactments are being rolled back. Cascade will continue to evaluate impacts from policy changes in the new administration as they are implemented.

1. **Congressional Actions**

   Cascade has monitored congressional actions on clean energy and decarbonization matters enacted by the Biden Administration and discusses them below. As mentioned above, the Trump Administration is rolling some of, or all, this back and Cascade will continue to monitor congressional actions ongoing.

   a. **Infrastructure, Investment and Jobs Act**

      President Biden signed the Infrastructure, Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law (BIL), into law in November 2021. The law provides infrastructure funding opportunities, including direction to EPA in making investments in communities to improve water quality, promote cleanup of contaminated sites and recycling and waste management of batteries, decarbonizing school buses, and overall pollution prevention. Also, per the IIJA, DOE has launched a notice of intent for funding opportunities for Clean Energy Programs, including demonstration of regional clean hydrogen hubs. The IIJA hydrogen programs work in combination with the Hydrogen Energy Earthshot (Hydrogen Shot) which DOE launched in June 2021 which aims to accelerate a breakthrough in hydrogen as an abundant, affordable, and reliable clean energy solution and reduce the cost of clean hydrogen by 80% to $1 per 1 kilogram of hydrogen in 1 decade ("1 1 1").

      In addition, and in consideration of the Hydrogen Shot, IIJA and the IRA, DOE posted a draft National Clean Hydrogen Strategy and Roadmap in September 2022. The draft roadmap proposes a clean hydrogen strategy and roadmap focusing on a goal of achieving use of 10 million metric tons of clean hydrogen annually by 2030, 20 million metric tons annually by 2040, and 50 million metric tons annually by 2050. By 2050, DOE projects this hydrogen implementation would reduce U.S. GHG emissions by 10% relative to 2005 levels, with a focus on developing cost-effective hydrogen for specific sectors having limited decarbonization alternatives, such as industrial facilities. Three key strategies noted by DOE for clean hydrogen include targeting strategic high impact uses, focusing on regional networks (hydrogen hubs), and reducing its cost.

Most of the funding opportunities in the IIJA are directed to communities and do not appear to be directly available to utilities. However, there may be opportunities for utilities to participate or partner with other organizations regarding low carbon fuels and tax credits. Cascade has been engaging with its trade organizations and other LDCs to understand the opportunities. We are engaged with Northwest Energy Efficiency Alliance (NEEA) as it monitors federal programs and identifies these opportunities. Cascade will continue to monitor these decarbonization programs through media alerts or government outreach for opportunities where the Company can best participate and/or provide support.

b. Inflation Reduction Act of 2022

The IRA was signed into law by President Biden on August 16, 2022. The law aims to address inflation through a number of measures including investment in domestic energy production and clean energy infrastructure for decarbonizing the economy. The law includes a waste emissions charge (WEC). The WEC applies fees to methane releases for certain oil and gas facilities that emit beyond 25,000 metric tons of carbon dioxide equivalent (CO_2e) annually and incentivizes investments in reducing methane leaks from oil and gas infrastructure. These requirements do not apply to distribution systems. As WEC fees go into effect starting in 2024, the cost of natural gas could increase as the upstream segments begin to pay their fees.

The IRA also incentivizes RNG development projects which could benefit Cascade and customers. The company has assessed opportunities for Section 48 tax credits for RNG. Cascade is pursuing a landfill gas RNG project at the Deschutes County Knott Landfill near Bend, Oregon. CNGC is working with a consultant to assist in ensuring the landfill project qualifies for IRA Section 48 tax credits. Cascade will continue to evaluate the IRA for potential opportunities in developing RNG projects, as well as other elements that may impact natural gas distribution.

2. Federal Agency Actions

Cascade monitors federal agency actions on clean energy and decarbonization matters and describes them below. The Trump Administration is rolling back some of, or all, the Biden Administration's agency regulatory actions that are discussed below. Cascade will continue to monitor.

a. Loper Bright Decision

On June 28, 2024, the Supreme Court issued a 6-3 decision in *Loper Bright Enterprises v. Raimondo* in which the Court overruled the two-step Agency deference doctrine from *Chevron v. NRDC* as incompatible with the Administrative Procedure Act (APA). The majority's opinion focuses largely on the applicability of *Chevron* deference, the "two step" doctrine that afforded deference to agencies' interpretations of their authority as established by their governing statutes. The decision may have significant consequences for current and future rulemaking across all federal agencies, including clean energy and decarbonization. Cascade will continue to keep apprised of potential impacts that may result from this decision.

b. U.S. Department of Energy

The Department of Energy (DOE) establishes energy efficiency standards for many products used in residential, commercial, and industrial buildings and applications. The DOE is also required to review and update these standards periodically. The DOE considers in its rulemaking what is technically feasible and economically justified. In 2022, the DOE began holding public meetings to gain input from stakeholders on rulemaking for commercial water heating equipment energy conservation standards. Cascade reviewed these standards and shared information with potentially impacted internal departments such as Energy Efficiency, since incentives offered by Cascade do include condensing model furnaces which would be mandated under the new standards. On September 19, 2024, the U.S. Court of Appeals for the District of Columbia Circuit issued an order setting American Gas Association v. U.S. Department of Energy, for oral argument on November 21, 2024. This case involves the AGA challenge of three DOE final rules. These rules include:

1. Energy Conservation Standards for Residential Furnaces and Commercial Water Heaters, Notification of Final Interpretive Rule, 86 Fed. Reg. 73,947 (Dec. 29, 2021);
2. Energy Conservation Standards for Commercial Water Heating Equipment, 88 Fed. Reg. 69,686 (Oct. 6, 2023); and
3. Energy Conservation Standards for Consumer Furnaces, 88 Fed. Reg. 87,502 (Dec. 18, 2023).

AGA states these rules "will result in the unavailability of noncondensing gas-fired appliances" in violation of the federal Energy Policy and Conservation Act, which AGA states "expressly prohibits efficiency standards that will eliminate product classes that consumers rely on for their 'performance characteristics.'" AGA claimed DOE committed procedural violations in communicating the Consumer Furnaces rule. The DOE responded that they properly followed procedure requirements, and the rules improve appliance efficiency without compromising performance characteristics. A decision on this case could come in spring or summer of 2025.

c. Environmental Protection Agency

i. EPA Subpart W Oil and Gas Sector Emissions Reporting Amendments

On May 14, 2024, the Environmental Protection Agency (EPA) released the finalized updates to 40 CFR Part 98 Subpart W (Petroleum and Natural Gas Systems) GHG emissions reporting. These include updated emission factors for determining methane emissions from distribution mains and services, leaking components surveyed at transmission-distribution transfer stations, and below ground meter-regulating stations. The rule also requires reporting of additional emissions sources, including blowdowns, pneumatic devices, and other large release events. Other large release events are defined as release events that emit methane at any point in time at a rate of 100 kg/hr and are not fully accounted for using existing Subpart W methodology. Cascade is integrating the new requirements into its current procedures and GHG Monitoring Plan.

ii. EPA Electric Generating Unit GHG 111(b) and 111(d) New Source Performance Standards Amendments

On June 30, 2022, the U.S. Supreme Court issued an opinion in West Virginia v. EPA, regarding the scope of the EPA's authority under section 111(d) of the CAA for regulating EGUs. The Court did not call into question the EPA's authority to regulate GHGs under the CAA. The Court concluded that the EPA could not regulate under that section in a way that would force the power grid to shift from one type of generation to another. The Court also brought the "major questions doctrine" into the discussion, by observing that the Constitution does not authorize agencies to use regulations as substitutes for laws passed by Congress.

The EPA held stakeholder meetings and a non-rulemaking docket in 2022 to solicit input on amending the rule. The EPA proposed a revised rule on May 23, 2023, and published the final New Source Performance Standards for GHG Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired EGUs; Emission Guidelines for GHG Emissions from Existing Fossil Fuel-Fired EGUs; and Repeal of the Affordable Clean Energy Rule in the Federal Register on May 9, 2024. The new requirements became effective on July 8, 2024. The rule requires carbon capture and sequestration technology installation by January 1, 2032, at existing coal-fired units to operate beyond January 1, 2039. The rule did not address standards for existing natural gas-fired units. New natural gas-fired electric generating units permitted for construction after July 8, 2024, and allowed to operate at annual capacity factors above 40% must install carbon capture and sequestration controls by January 1, 2032. Industry has issued legal challenges and requested stays of the rule at the District of Columbia Circuit Court of Appeals (DC Circuit) and Supreme Court of the United States. Both courts denied rule stays. Oral argument is scheduled at the DC Circuit on December 6, 2024. Recently, the EPA requested the court to hold the case in abeyance in order to allow new leadership to review the underlying rule, and the DC Circuit granted the EPA's request on February 19, 2025.

On March 25, 2024, the EPA opened a non-regulatory docket and issued framing questions to gather input on regulating GHG emissions from the entire fleet of existing gas combustion turbines in the power sector under Clean Air Act Section 111(d). The non-regulatory docket was open for public comment for 60 days and closed on May 28, 2024. Cascade anticipates the Trump Administration to change course on this regulatory action.

d. Securities and Exchange Commission GHG and Climate-related Risk Disclosure Rulemaking

On March 6, 2024, the Securities and Exchange Commission (SEC) adopted the GHG and Climate-Related Risk Disclosure rules. The Climate-Related Risk Disclosure rule is applicable to Cascade through Cascade's parent company MDU Resources Group, Inc.

This rule requires publicly traded companies to disclose company climate-related risks, including actual and potential material impacts of these climate-related risks and if these material impacts have been integrated into their business model or strategy. The rule also requires disclosure of a company's GHG reduction targets or goals, as well as how the company intends to meet these goals, a plan for tracking progress, and what progress has been made. It also requires companies to report their material Scope 1 and 2 GHG emissions. Attestation will be required for reported Scope 1 and 2 emissions. Scope 3 emissions are not required to be reported, nor does the SEC prescribe use of a specific calculation methodology.

On April 4, 2024, the SEC issued an order staying these requirements to allow for a judicial resolution of legal challenges. On February 11, 2025, highlighting the recent change in administration and the January 20th Presidential Memorandum regarding a regulatory freeze, the acting SEC chair asked the Eighth Circuit Court not to schedule the climate rule arguments, saying that the Commission needs more time to deliberate and determine the appropriate next steps in these cases. Cascade will continue monitoring the outcome of this process.

3. Social Cost of Carbon

The Social Cost of Carbon (SCC) is estimated using different discount rates to develop a range of costs in dollars per ton of CO_2 that would represent the avoided cost of long-term damage from climate change caused by a ton of CO_2 emitted in a given year. Agencies, such as the EPA, have used the SCC in determining the cost of climate impacts within rulemakings. Other agencies, such as FERC, continue to consider whether and/or how to incorporate the SCC into their permitting and rulemaking processes.

At the suggestion of WUTC Staff and in consideration of the 2019 Clean Buildings legislation HB 1257 adding further instruction within RCW 80.28 on conducting avoided cost calculations, Cascade has modeled societal costs of CO_2 emissions resulting from customers' combustion of natural gas in the past IRPs using the SCC with a 2.5% discount rate that was established by the U.S. Governmental Interagency Working Group (IWG) on Social Cost of Greenhouse Gases. In this IRP Cascade continues to apply the SCC with a 2.5% discount rate from the IWG's August 2016 SCC report, but now updated to real $2024, as the carbon compliance adder in modeling impacts of a potential price that could be placed on CO_2 emissions from customers' usage of natural gas.

According to Section 6 of President Trump's Executive Order "Unleashing American Energy", the federal government is to issue future guidance on the use of SCC, particularly in consideration of domestic versus international effects.

State Regulation and Policy

New and revised environmental regulations and policies have been enacted in Washington and Oregon. The purpose of these policies and rules is to address GHG emissions resulting from the use of fossil fuels. Some of these regulations result in increases to Cascade operating costs and reduce the sale and usage of conventional natural gas.

1. **Washington**

   In July 2021, the Washington legislature passed the CCA, codified at Chapter 70A.65 RCW. The CCA provides the Department of Ecology (Ecology) the authority to regulate GHG emissions from natural gas distribution companies, of which Ecology's former Clean Air Rule (CAR) could not. The CCA gives direction to Ecology to implement a cap on greenhouse gas emissions from covered entities and a program to track, verify, and enforce compliance through the purchase of auction allowances and other compliance instruments.

   The majority of the CCA's requirements are promulgated within Ecology's WAC 173-446 rulemaking, establishing a program to cap greenhouse gas emissions and implement an allowance trading market. Ecology also completed WAC 173-446A rulemaking which establishes criteria to identify emissions-intensive, trade-exposed (EITE) industries for allowance allocation purposes and amended WAC 173-441, the emissions reporting rule associated with determining WAC 173-446 compliance obligations. Cascade summarizes requirements on the main WAC 173-446 rulemaking below and Ecology's progress with linking the program with California and Quebec cap-and-trade programs.

A few other important actions in Washington include State Building Code Council building code revisions impacting natural gas usage, status of the UTC study examining natural gas utility decarbonization pathways per SB 5092, and Ecology's amended schedule for the GHG Assessment for Projects (GAP) rulemaking. Cascade provides some brief discussion of these state actions further below.

a. Washington Climate Commitment Act WAC 173-446

On September 29, 2022, the Washington Department of Ecology released a final CCA rule, WAC 173-446, a Washington state GHG emissions cap-and-trade rule. The rule became effective on October 30, 2022, and the emissions cap applies to 2023 emissions and onward.

The rule regulates most GHG emissions, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) from covered entities emitting 25,000 metric tons or more of CO_2e per year. Covered entities include large stationary emission sources (e.g., manufacturing and industrial facilities), petroleum fuel suppliers, natural gas suppliers, suppliers of carbon dioxide, and electric utilities.

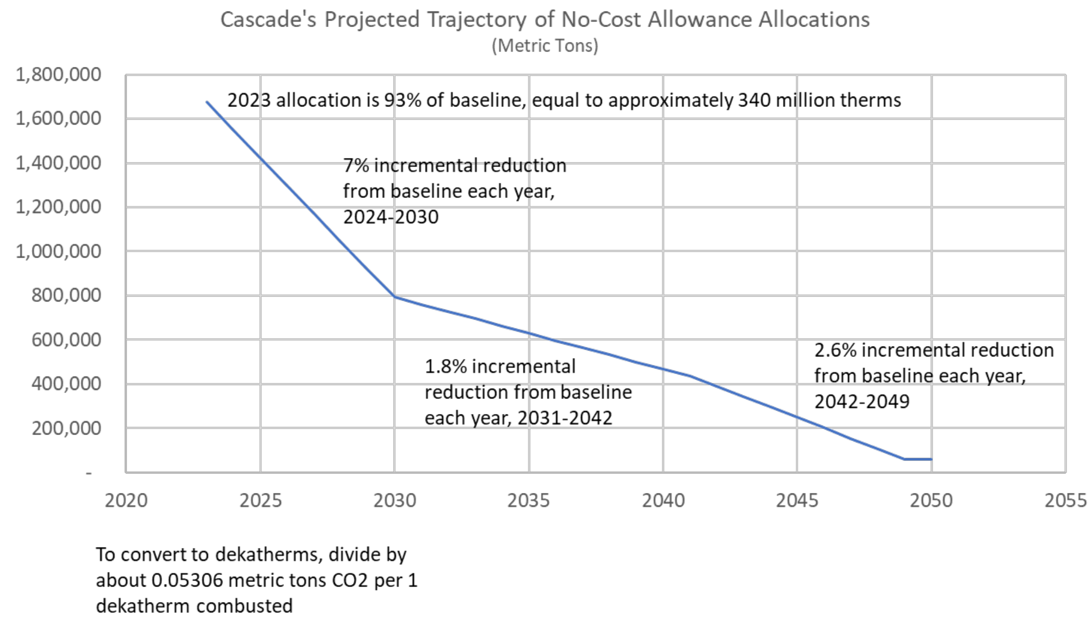
The emissions cap, or emissions allowance budget, is based on an average of 2015-2019 baseline emissions levels and declines over time to meet rule targets of 45% below 1990 levels by 2030 and 95% below 1990 levels by 2050. Natural gas suppliers are regulated for the GHG emissions in Washington associated with a company's aggregated customers' combustion or oxidation of natural gas where customers report less than 25,000 metric tons CO_2e to Ecology and are not covered entities themselves. For Cascade, regulated customer emissions are predominantly from core customers but also include some non-core (transport) customer emissions from facilities that do not emit 25,000 metric tons of CO_2e per year. Cascade's baseline customer emissions were about 1.8 million metric tons of CO_2e. Cascade's operational combustion and methane leakage emissions (e.g., Mt. Vernon compressor station combustion emissions and pipeline infrastructure) are also regulated under the CCA as those emissions have been reported at slightly higher than 25,000 CO_2e per year.

Excluded emissions for natural gas distribution companies include emissions from larger industrial customers who are covered entities themselves, customers who choose to opt-in to Ecology's program, customers who qualify under Ecology requirements as an Emissions Intensive Trade Exposed industry, or military facilities that fall under the national security NAICS code 928110. Other excluded emissions are CO_2 from the combustion of biomethane or RNG purchased for natural gas customers.

Compliance can be demonstrated through a combination of methods, such as purchasing and retiring emissions allowances and carbon offsets. Allowances can be banked indefinitely and used for future years of compliance. Discussion of allowance purchases in the IRP is for informational purposes and not meant to be indictive of Cascade's purchase strategy but rather a presentation of compliance options that are available. Emission reductions can also be achieved by replacing a portion of conventional natural gas supply with RNG and hydrogen in the future, and through implementing energy efficiency and conservation programs. Cascade provides charts and additional discussion of the compliance instruments and proposed compliance pathways modeled in Chapter 9, Resource Integration.

Ecology will distribute an amount of no-cost allowances to natural gas utilities that decline over time with the CCA program allowance budget cap. Cascade's no-cost allowances in 2023 were equivalent to 93% of the company's baseline of 2015-2019 average emissions of about 1.8 million metric tons of CO_2e. The no-cost allowances decline annually by 7% of Cascade's baseline, incrementally each year from 2024 to 2030, 1.8% annually from 2031 to 2042, and 2.6% annually from 2043 to 2049. Cascade's projected no-cost allowance distributions over time are shown in Figure 6-1.

Figure 6-1: Cascade's Projected Trajectory of No-Cost Allowance Allocations



Each year, Ecology will distribute no-cost allowances by October 24th of the prior year. For example, 2025 no-cost allowances were distributed by October 24, 2024.

Full compliance demonstrations must be made by November 1st of the year following each four-year compliance period, with the first period from 2023 to 2026. Therefore, the first full compliance period deadline is November 1, 2027. There are also compliance demonstrations within the four-year compliance period required by November 1st annually, where covered entities must demonstrate compliance with 30% of the prior years' emissions compliance obligation. For example, the first annual compliance demonstration was November 1, 2024, to comply with 30% of the 2023 compliance obligation.

Ecology joined the Western Climate Initiative (WCI) in late 2021 and is utilizing WCI's allowance auction platform to administer the allowance auctions and manage covered entity and auction participant holding and compliance accounts, as well as the limited use accounts for electric and natural gas utilities to receive no-cost allowance allocations. WCI's system is referred to as the Compliance Instrument and Tracking System Services (CITSS). Covered entity account representatives are required to register in CITSS and establish accounts for receipt of allowance allocations and potential auction participation. Cascade has registered account representatives within CITSS.

Covered entities will be assigned a holding account where purchased allowances are distributed to covered entities by Ecology after each auction an entity participates in and a compliance account where a covered entity holds allowances it has requested Ecology transfer from the entity's holding account for compliance demonstrations. Natural gas and electric utilities are also provided limited-use accounts where no-cost allowances, required to be consigned at auction, have been transferred from holding accounts. Ecology places limits on the number of allowances that can be held within compliance accounts and holding accounts. There is no holding limit placed on a limited use account. Also, except for the holding limits here, an allowance can be banked indefinitely. For reports and other information on auctions, accounts, and auction performance, please see Ecology's webpage: *Auctions & market - Washington State Department of Ecology*.

Cascade is required to consign some of the Company's no-cost allowances. In 2024, 70% of Cascade's no-cost allowances had to be consigned to auction. The no-cost allowance consignment increases by 5% annually. Starting in 2030, all no-cost allowances received by Cascade must be consigned to auction.

Revenues from allowance consignment must be managed and used for the benefit of customers with oversight from the UTC. The rule states, "All proceeds from the auction of allowances consigned by natural gas utilities shall be used for the benefit of customers, as determined by the utilities and transportation commission for investor-owned natural gas utilities, including at a minimum eliminating any additional cost burden to low-income customers from the implementation of the Climate Commitment Act." Remaining revenue can be used under the oversight of the UTC for the benefit of customers in other ways, such as investing in additional emissions reductions and/or providing bill credits to reduce customer cost impacts.

Under oversight from the UTC, Cascade may use no-cost allowances that are not consigned at auction for compliance demonstrations up until 2030, when all no-cost allowances would need to be consigned. Depending on many factors, Cascade may need to purchase additional allowances for compliance. This can be done at auction or through secondary allowance markets.

Compliance demonstrations can also include a limited amount of carbon offsets, such as forestry carbon sequestration offsets. Offsets are limited to the use of up to 8% of a covered entity's compliance obligation in the first compliance period and 6% thereafter. Ecology will make reductions to the program's annual allowance budgets commensurate with the number of offsets covered entities use for compliance. The need for allowance and offset purchases at the outset of the program will be informed by Cascade's projected demand, demand side management, conservation programs, and RNG acquisitions. In the future, potential hydrogen and other low carbon alternative fuels acquisition would be considered.

If a covered entity would reach the end of a four-year compliance period and was not able to purchase sufficient instruments for compliance, the rule allows for covered entities to request Ecology to issue higher priced "price ceiling units" to address the shortfall. There are penalties that would apply for noncompliance with requirements of the rule, including not meeting an emissions compliance obligation demonstration.

Auctions are typically held on a quarterly basis. Allowances offered at auction decline over time with the cap. Auction floor allowance prices, Allowance Price Containment Reserve (APCR) allowance prices, and "price ceiling unit" prices are set by Ecology per the rule in 2023 and increase annually by 5% plus inflation. These prices are published by the first business day of December of the year prior to the auctions where the prices will apply. For example, Ecology set the allowance floor price for 2024 allowances at $24.02 per ton.

The settlement price for all participants in the auction is the bid price where the last allowance from the auction is awarded. Also, there are two auctions each year, in parallel with two of the other general auctions, where a limited amount of future vintage allowances are offered for sale to market participants. APCR auctions would be held if the settlement price in a general auction reaches Ecology's published APCR Tier I allowance price.

The CCA is planning to "link" with California and Quebec carbon markets for efficiencies with similar carbon cap-and-trade programs, structure, and goals consistent with 2024 law SB 6058. California and Quebec have been linked since 2014, as they share a common interest in reducing GHG emissions. Ecology notes that linking these carbon markets can benefit emission reductions with immediate collaborative action. California-Quebec expressed their interest in linking with WA as Ecology is drafting potential new language to incorporate linkage. Ecology recently requested public comment on establishing an agreement with the other carbon market and if the three jurisdictions enter an agreement, updates to regulations are expected to be adopted and similar by each jurisdiction. Ecology anticipates an agreement will not be finalized until 2025 or later.

At the outset, Cascade has been utilizing Resource Planning modeling tools for compliance planning and worked with a consultant, Guidehouse, in late 2022 to mid-2024 to develop shorter- and near-term planning tools which incorporate all types of compliance instrument options to best inform compliance instrument procurements.

There were two ballot initiatives in the 2024 Washington state general election that had potential impacts to the CCA and other major initiatives affecting the energy industry, Washington Initiative 2117 and Washington Initiative 2066.

Initiative 2117, which did not pass, would have repealed the CCA and prohibited any state agencies from implementing a cap-and-trade style program.

Initiative 2066, which did pass, prohibits state and local governments from restricting access to natural gas; prohibits the state building code council from discouraging or penalizing the use of natural gas in any building; requires gas companies to provide natural gas to any person or corporation even if other energy services or sources are available; and prohibits the WUTC from approving any multiyear rate plan requiring or incentivizing a natural gas company or utility company to terminate natural gas service or implement requirements that would make access to natural gas service cost-prohibitive.

Initiative 2066 went into effect on December 5th following certification of the November general election. However, the State Building Code Council (SBCC) has not adjusted energy codes based on the initiative’s passing. As a result, the Building Industry Association of Washington (BIAW) filed a suit on December 6th in an attempt to force SBCC and other government agencies at the state and local level to comply. The state filed a motion of dismissal, which was granted on February 14th. It’s anticipated the litigation will be re-pursued under the Administrative Procedure Act.

Cascade will continue to monitor the impacts from passage of this initiative, the subsequent response from the SBCC, and associated litigation.

b. Washington State Building Code Changes

On April 20, 2022, the Washington SBCC approved building and energy codes, impacting usage of natural gas for space and water heating in new and retrofitted commercial and residential buildings. The SBCC approved changes significantly limiting the use of natural gas in new and retrofitted commercial buildings through the revised Washington State Energy Code-Commercial (WSEC-C). The revised WSEC-C went into effect on July 1, 2023, and stipulates new commercial construction may not include natural gas equipment for space or water heat, with a few exceptions. The use of natural gas equipment, other than natural gas space and water heating equipment in commercial buildings, has not been restricted as part of the revised WSEC-C. However, electric receptacles must also be installed next to certain natural gas appliances in dwelling units within new multifamily buildings.

On November 4, 2022, the SBCC voted 9-to-5 to approve two new residential code provisions for space and water heating, which went into effective on July 1, 2023. 21-GP2-065 requires installation of heat pump (electric or gas) space heaters for space conditioning in new residential buildings except for dwellings with small heat loads for supplementary heating needs and 21-GP2-066 requires heat pump (electric or gas) water heaters for domestic hot water heating in new residential buildings except for small water heaters, small dwelling units, supplemental water heating systems, and some renewable energy systems. These code revisions are expected to significantly limit the use of conventional natural gas equipment for primary space and water heating in new residential construction statewide.

A SBCC executive session in November 2024 discussed the implications of Initiative 2066 to the gas-restrictive building codes currently in effect. A proposal was drafted that would direct SBCC to consider off-cycle (but not emergency) rulemaking to evaluate the 2021 WA State Energy Code (WSEC) for compliance with Initiative 2066, EPCA, and state rules for efficiency. It was discussed that considerations would also be made during the 2024 WSEC development. The SBCC has opened a proposal period from

February 10th to April 7th, 2025, to take code proposals relating to I-2066 for the 2021 WSEC.

It is unclear at this point when, and to what extent, the SBCC intends to make substantive adjustments to the building code in compliance with Initiative 2066, and how the newly passed ballot initiative will be integrated and complied with at a state and local level. Cascade will continue to monitor the situation and potential impacts to the use of gas in Washington.

c. SB 5092 – WUTC Natural Gas Decarbonization Study

The legislature passed SB 5092 in 2021 which directs the WUTC to conduct a study examining feasible and practical pathways for investor-owned electric and natural gas utilities to contribute their share to greenhouse gas emissions reductions for Washington to achieve emissions reduction targets in RCW 70A.45.020, and the impacts of energy decarbonization on residential and commercial customers and the electrical and natural gas utilities that serve them. The WUTC contracted with Sustainability Solutions Group (SSG) to support the UTC with examining decarbonization pathways with privately owned energy utilities in Washington and created Docket U-210553 to manage information about the study and keep stakeholders informed. The UTC was allowed to utilize $251,000 of funding in 2022 and $199,000 in 2023 to complete this study, with a final report due to the legislature by June 1, 2023.

The UTC held public workshops and decarbonization advisory group meetings in 2022 to obtain and share information on the study and Cascade participated in this process as a member of the advisory group, providing comment at workshops and when opportunities were available to submit written comments on the proposed decarbonization pathways and dashboard developed throughout 2023. A final report was published in October 2023 and the UTC uploaded the report and associated documents on May 30, 2024, that had been submitted to the legislature.

d. Washington Department of Ecology - GHG Assessment for Projects (GAP)

At the end of 2019, Governor Inslee directed Ecology to adopt a rule by Sept 1, 2021, to consider GHG emissions in environmental assessments for major industrial projects and major fossil fuel projects with significant environmental impacts. Ecology announced rulemaking commencement on April 30, 2020, and began receiving feedback from stakeholders to obtain input for drafting a proposed rule planned for late 2020. In 2021, Ecology decided to pause this rulemaking as the agency is implementing the CCA and Clean Fuel Standard. Ecology will consider public input received on these rules and evaluate any potential intersections with the new rules and the GAP rule before proceeding. The GAP rulemaking is currently on hold. Cascade will continue to monitor this regulatory action as it may impact future IRPs.

e. Thermal Energy Networks Bill

On March 5, 2024, House Bill 2131 was approved by the Washington State Legislature and passed into law. HB 2131 enables gas and electric utilities to own or operate TENs. “Thermal energy” means piped noncombustible fluids used for transferring heat into and out of buildings. A thermal energy system does not produce onsite GHG emissions as part of the heating and cooling processes. The systems can provide comfort heating and cooling, domestic hot water, and refrigeration, and can improve energy efficiency.

HB 2131 allows gas companies and other energy providers to pursue TENs opportunities. It also provides specific opportunities to local distribution companies to pursue TENs pilots and receive potential grant funding from the Department of Commerce to offset the gas company’s costs required to build and operate the pilot project, pending approval from the UTC and Commerce.

Cascade has onboarded a dedicated Thermal Energy Networks manager and is actively assessing TENs pilot opportunities consistent with HB 2131 and the provisions of Commerce and the WUTC. The Company is now actively pursuing potentially viable TENs opportunities across our Washington service area.

f. Other Washington Legislative Activity

Cascade is keeping apprised of additional legislation in Washington State with the intent to reduce GHG emissions. Such proposals may include support for innovations in the gas sector, such as tools to support Climate Commitment Act compliance, and to empower renewable natural gas, hydrogen, and other decarbonization technologies that can be paired with pipeline infrastructure. Cascade is also actively monitoring a TENs 2.0 bill that sets the table for nongas entities delivering TENs efforts in Washington to be regulated under the WUTC and would encourage additional TENs related planning requirements for investor owned utilities. Cascade is also monitoring legislation that would protect information associated with sensitive infrastructure including infrastructure associated with natural gas.

2. Oregon

Since the last IRP, no GHG cap-and-trade program legislation has been passed in Oregon. In early 2020, Governor Brown released an Executive Order (EO) for state agencies to implement GHG reductions within their authority. Discussion of this EO and the Department of Environmental Quality's subsequent Climate Protection Program rulemaking and reinstatement is provided below.

a. Climate Protection Program

In early 2020 Oregon Governor Kate Brown issued EO 20-04, directing state commissions and agencies to facilitate achievement of new GHG emissions goals of at least 45% below 1990 levels by 2035, and at least 80% below 1990 levels by 2050. The order specifically directed the Environmental Quality Council (EQC) and the DEQ to take actions necessary to cap and reduce GHG emissions. EO 20-04 is also intended to build on EO 17-20, Accelerating Efficiency in Oregon's Built Environment to Reduce Greenhouse Gas Emissions and Address Climate Change.

EO-20-04 included 13 directives to multiple state agencies, establishing reporting requirements and deadlines for implementing GHG reductions. Specifically, the EO directed the EQC and DEQ to take actions necessary to cap and reduce GHG emissions, consistent with the new GHG emissions goals from large stationary sources, transportation fuels, and other liquid and gaseous fuels, including natural gas. Since the EQC and DEQ do not have the authority to implement a market-based cap-and-trade type system, it was anticipated that a rule would be developed to cap emissions at a baseline emissions value with a limited number of allowances distributed to regulated entities and reduce allowance allocations over time. The EO directed DEQ to commence cap and reduce program options no later than January 1, 2022.

The DEQ published a report describing the EQC's legal authority to cap and reduce GHG emissions and proposed a process for rulemaking. In 2020, the DEQ was directed by the EO to propose rulemaking and sought input from the public to inform the agency's rulemaking approach and design. Throughout the DEQ's process, Cascade engaged in public meetings and provided input.

The DEQ issued the original CPP rule on December 16, 2021. On March 18, 2022, industry filed lawsuits challenging the CPP rule. Litigants included Cascade, along with Avista Utilities and Northwest Natural. On December 21, 2023, the Oregon Court of Appeals ruled that the DEQ did not comply with certain disclosure requirements for rulemaking and invalidated the program. The DEQ did not appeal the decision, and on January 22, 2024, gave notice that the agency would proceed with rulemaking to reinstate the CPP. The rulemaking process was conducted in the spring and summer of 2024. Cascade participated as a member of the Rulemaking Advisory Committee (RAC) and provided written comment throughout the process. The DEQ released the draft CPP rule for public comment on July 30, 2024, and the EQC approved the final CPP rule on November 21, 2024. The reinstated CPP is effective January 1, 2025.

The 2024 final CPP rule regulates GHG emissions from covered entities, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Covered entities still include fuel suppliers, such as petroleum fuel suppliers and natural gas distribution utilities, as well as large stationary emission sources. Under the reinstated rule, the DEQ made a change to regulate EITE industries emitting more than 15,000 metric tons of CO_2e separately under their own emissions cap and removed EITE usage of natural gas from natural gas suppliers' compliance obligations. The DEQ identified six of Cascade's transport customers that are designated as EITE and are to be regulated separately. Cascade's regulated emissions include core customer emissions and emissions from non-EITE transport customers. Further, the CPP does not regulate GHG emissions from electric generation facilities.

The CPP emissions are capped at a baseline emissions level equivalent to the average of 2017-2019 emissions from fuel suppliers and at 2022-2023 average emissions for EITE entities. The cap declines over time to achieve emission reduction targets of 50% below baseline emissions by 2035 and 90% below baseline emissions by 2050.

The DEQ allocates no-cost emissions allowances to fuel suppliers starting in 2025, with that year's allocation approximately equivalent to an entity's baseline emissions. The DEQ reduces allowance allocation each year proportionate to that years' emissions cap and DEQ will distribute no-cost allowances to covered entities annually by June 30th. Allowances can be banked indefinitely. Cascade is currently evaluating DEQ's calculation for determining allowance allocations for planning compliance.

Excluded emissions for natural gas distribution companies include CO_2 from the combustion of biomethane or RNG purchased for natural gas customers and GHG emissions from natural gas delivered to electric generating plants with a total nominal electric generating capacity of greater than or equal to 25 megawatts. Cascade delivers natural gas to electric generating plants having total electric generating capacities greater than 25 megawatts and does not currently deliver to plants with total nominal capacity lower than 25 megawatts.

The CPP requires compliance to be demonstrated by December 9th of the year following the end of each compliance period. The first compliance period is three years, from 2025 to 2027. The second compliance period and thereafter are 2-year compliance periods. There are no interim period emissions compliance obligations as in the Washington CCA.

Compliance is demonstrated by surrendering no-cost emissions allowances to the DEQ for retirement, purchasing and retiring allowances that may potentially be offered for trade by other covered entities, and a limited amount of Community Climate Investment (CCI) credits (described further below). Emission reductions for natural gas distribution utilities can also be achieved by replacing conventional natural gas supply with RNG and hydrogen, and through implementing energy efficiency and conservation programs to reduce customer use of natural gas.

Oregon CPP compliance is expected to be predominantly met with no-cost allowances and RNG purchases, and possibly some CCIs depending on availability. A CCI can be used to offset one metric ton of CO_2e emissions and provide a limited mechanism for demonstrating compliance beyond no-cost allowances. CCIs can be used to meet up to 15% of a covered entity's compliance obligation in the first compliance period and 20% in the second compliance period and for each compliance period thereafter.

CCIs are generated and obtained by a covered entity when the DEQ approves payments from covered entities to DEQ-approved CCI entities. The DEQ expects CCI entities to achieve GHG emissions reductions through funding from the payments from covered entities. The cost of each CCI credit is equal to the carbon dioxide social cost of carbon and is adjusted for inflation annually. Adjusted for inflation, a CCI is projected to cost about $133 in 2025. Covered entities can bank CCIs for two compliance periods only and cannot trade or transfer CCIs to another covered entity. There are currently no CCI entities approved by the DEQ but there could be in future. If no CCI entities are approved, no CCIs can be generated.

The CPP rulemaking does not have a direct impact on the WA IRP and is provided for general understanding of regulatory activities occurring in Cascade service areas in the neighboring state of Oregon. However, Cascade will consider both the Washington CCA and Oregon CPP in compliance planning to achieve any potential compliance planning efficiencies.

Local Policy

Local jurisdictions and municipalities continue to express interest in reducing GHG emissions. Such interest may involve cities or counties establishing commitments or targets (whether formal or aspirational) in the range of 80% GHG reductions relative to 1990 levels by 2050, consistent with the Paris Climate Agreement. For background, the Paris Climate Agreement was a pact made by many countries across the globe, responding to concerns regarding climate change. In the pact, countries committed to GHG reductions to limit increasing global temperatures and fund response to impacts of climate change. The U.S. has previously been a party to the pact, but recently withdrew following President Trump taking office on January 20, 2025. The United Nations acknowledged the Trump Administration’s request to withdraw the U.S from the agreement, and the U.S. will effectively be removed from the agreement on January 27, 2026.

Within Cascade’s service areas, the City of Bellingham and Whatcom County in Washington, and the City of Bend in Oregon have developed GHG reduction goals. A summary of those commitments is provided below. Also, Snohomish County, which overlaps Cascade’s service area, created an ad hoc Climate Advisory Committee in 2019 to provide recommendations that encourage adoption of policies, programs, and practices to reduce GHGs, address climate change, protect public health, and preserve the natural environment within the county. These recommendations have led the community to start development on a community-wide Climate Resiliency Plan. This climate adaptation effort will formally begin in Spring 2025 and will conclude in Winter 2025.

There are other areas adjacent to Cascade’s service areas adopting similar commitments, such as Tacoma, Seattle, and Edmonds in Washington, Multnomah County and Portland in Oregon, and Vancouver in British Columbia.

1. City of Bellingham, Washington

The City of Bellingham passed a resolution pertaining to GHG Reduction and Renewable Energy Targets in March 2018. The resolution updated emission reduction targets for municipal facilities and operations to reduce emissions 85% below 2000 levels by 2030, and 100% below 2000 levels by 2050, making the city facilities and operations carbon-neutral. Bellingham also included a target to reduce community-wide emissions 70% below 2000 levels by 2030, and 85% below 2000 levels by 2050. Specifically, the goal is to obtain energy from all renewable resources and remove the use of fossil fuels within the city, including transportation.

The City created the Climate Action Task Force (CATF) to explore and recommend how the city and community could meet these new targets. The CATF first met on September 5, 2018, and continued to meet regularly through late 2019. On December 2, 2019, the task force finalized a report of GHG reduction recommendations. On February 7, 2022, the Bellingham City Council passed an ordinance requiring electric space and water heating equipment for new commercial and large (4-plus story) multifamily buildings. The ordinance also requires incremental improvements in energy efficiency (building envelope, lighting, insulation) and solar installation or readiness in new buildings. The electric-only mandate for space and water heating does not apply to single family construction, detached houses, duplexes, townhomes or row houses. The ordinance took effect on August 7, 2022.

Cascade ran sensitivity analyses in the previous IRP based on the City of Bellingham’s limitations on use of natural gas in new buildings. Cascade pulled historical data from 2017-2021 to see which customers would have been affected if this ban took place earlier and determined this impacted approximately 50 customers per year. Cascade decremented commercial customer counts by 50, cumulatively, each year for the forecast for this sensitivity. However, it should be noted that the changes to Bellingham’s allowed uses of natural gas are redundant to the state energy code that was later passed by SBCC, therefore, Cascade is not running a separate sensitivity analysis on just Bellingham in this IRP. It is unclear at this time if such limitations to the use of natural gas will be maintained given the passage of Washington Initiative 2066, which prevents the SBCC and other state and local entities from banning natural gas. Cascade will continue to monitor ongoing litigation against I-2066, as well as the code proposal process which the SBCC has opened to take code proposals relating to I-2066 and the 2021 WSEC. This process will be open from February 10th to April 7th, 2025. Cascade will continue to monitor potential outcomes and impacts as they develop.

2. Whatcom County, Washington

Whatcom County, in which the City of Bellingham is situated, has committed to the “Ready for 100” campaign that the Sierra Club is advocating and has established goals through a county ordinance. The “Ready for 100” campaign website recommends a goal of 100% renewable electricity by 2035 and 100% renewable for all other energy sectors by 2050, but participants can target less stringent goals. Whatcom County has chosen to commit to 100% renewable electricity for county operations by 2035 and has also applied the goal within the larger Whatcom County community.

Whatcom County established a Climate Impact Advisory Committee, which provides review and recommendations to the Whatcom County Council and Executive on issues related to the preparation and adaptation for, and the prevention and mitigation of, impacts of climate change. On July 27, 2021, Whatcom County voted to ban the construction of new refineries, coal-fired power plants and other fossil fuel-related infrastructure. These new requirements do not constitute a gas ban but may potentially impact Cascade’s plans for distribution system enhancement projects in Whatcom County. The Climate Impact Advisory committee continues to meet monthly on climate and energy policy.

3. City of Bend, Oregon

The City Council of Bend, Oregon passed Resolution 3044 in 2016 establishing voluntary GHG emission reduction goals for City facilities and operations of 40% reduction of 2010 baseline year emissions by 2030 and 70% reduction of 2010 baseline year emissions by 2050. The City Council passed another resolution, Resolution 3099, which created a Climate Action Steering Committee (CASC). The CASC provided recommended actions to the City Council that encourage and incentivize businesses and residents, through voluntary efforts, to reduce GHG emissions and fossil fuel use considering the voluntary goals.

Cascade was appointed to the CASC, and actively supported the development of decarbonization pathways that balanced the City’s economic vitality, reliability of its energy supply, and environmental goals. On December 4, 2019, the Bend City Council approved the Climate Action Steering Committee’s (CASC) recommendations concerning a pathway to reducing its fossil fuel use by 40% by 2030, and by 70% by 2050.

Cascade publicly supported the recommendations presented to the City and engaged with Bend City staff and other members of the community to identify ways to help the City meet its targets. Possible pathways identified at that time included partnerships on the integration of biogas (e.g. biodigester) and possible carbon offset programs. Since that time, Cascade has moved forward with pursuit of a renewable natural gas project at the Knott Landfill in Bend and has received recent regulatory approval for a voluntary renewable natural gas tariff in Oregon. More information on these and other projects can be found later in this section.

The City's current Environment and Climate Committee (ECC) has begun the work of exploring the role of gaseous fuels as part of a decarbonized future. Preliminary ECC recommendations shared with City Council include:

- Enacting regulations to limit gas piping in the right of way for new construction.
- Pursuing a nitrogen oxides standard for new appliances for new buildings and phasing in new appliances for existing buildings.
- Developing new construction building permit fee for buildings that connect to and install natural gas appliances that is scaled based on expected gas use and the social cost of carbon.
- Creating a navigator program to provide personalized support for residents to make an upgrade plan, identify incentives and financing, and connect with contractors.
- Building relationships, educating and partnering with local trades and developers and developing an education and outreach program including programming on how to build all-electric, considerations for retrofits, and heat pump best practices.
- Developing a fund that can be used to support incentive pilots to encourage and reduce barriers to electrification retrofits in rentals and low- and moderate-income households.
- Raising the licensing fee for the gas utility to help support these incentives, and other programs that also work to reduce gas use such as the navigator and community and workforce education and outreach programs.

Short term actions the City is exploring include:

- Committing to state-level advocacy.
- Developing an incentive pilot program to fund retrofits for low-income households.
- Raising the licensing fee for the gas utility.
- Developing and launching outreach and education programs

The City has already taken action in its resolution to build fossil fuel free city buildings.

On February 24, 2025, The Environment & Climate Committee (ECC), Bend Economic Development Advisory Board (BEDAB), and Affordable Housing Advisory Committee (AHAC) conducted a joint meeting regarding electrification policy.

During this meeting, a proposed work plan was discussed with the following deadlines and objectives:

1) Launch outreach and education initiatives (planning funding for as part of budget)
    a. Website/social media/outreach events- spring launch
    b. Energy Navigator Program- summer/fall launch
    c. Builder education- TBD

2) Develop incentive/disincentive to encourage electrification (Fall 2025-Winter 2026)
    a. Uses a stakeholder group with representatives for industry, impacted parties, utilities, and other stakeholders
    b. Determine *what* and *how* to incentivize electrification
    c. Discuss revenue source, if needed (e.g. fee)

3) Monitor regulatory pathways for restricting gas (Ongoing)
    a. Update on legal context at end of year

Some stakeholders indicated an interest in potentially accelerating this timeline. Cascade staff was present at this meeting and will continue to monitor and engage in discussions around electrification and potential decarbonization pathways.

Cascade has previously had the opportunity to meet with City staff regarding preliminary ECC proposals, and to provide feedback on potential decarbonization and electrification pathways. It is Cascade's understanding that City staff has also met with other stakeholders in the energy, economic, and environmental sectors. We appreciated their continued efforts to gather feedback on their positions.

While this planning is taking place, Cascade continues to actively review opportunities to support the City in reducing the carbon intensity of our delivered fuels. Cascade has also held discussions with various members of Bend government, business, and labor to help determine viable decarbonization pathways for natural gas distribution.

Consistent with Cascade's commitment to explore this option for the City, the Company is pleased to have officially filed a Voluntary RNG tariff in the State of Oregon to allow eligible customers seeking to reduce their carbon emissions the ability to choose to purchase one or more Program blocks, where each block is equivalent to four (4) therms of renewable thermal credits (RTCs) derived from RNG and retired on the customer's behalf. This program is effective as of November 1, 2024, and available to Bend customers on our Residential and Commercial Rate Schedules. Cascade looks forward to coordinating with the City of Bend to help determine how this program can best serve their needs.

Cascade is also in the process of pursuing a hybrid-system pilot in Bend which will pair electric heat pumps with existing natural gas furnaces in the homes of 24 Cascade customers. The pilot will help the Company better understand the interaction of these technologies for carbon reduction and demand response. Pilot implementation is planned for 2025 heating season through 2026. On February 21, 2025, Cascade submitted two filings regarding this pilot to the OPUC. One filing was a request for the OPUC to allow Cascade to implement the pilot and the other was an application to defer the costs associated with planned decarbonization pilot programs.

An additional opportunity for Cascade to assist with area natural gas distribution decarbonization came about in late 2021 when Deschutes County announced an opportunity for interested parties to submit bids for developing an RNG project at the Knott Landfill. Cascade, in partnership with an engineering firm, submitted a proposal to the County and was awarded the project. The project is expected to begin producing RNG by winter 2025/2026. Cascade is exploring other RNG opportunities for the City as well.

Finally, Cascade has been invited to participate in discussions pertaining to the development of a potential Oregon Thermal Energy Network (TEN) bill to be explored during the 2025 Legislative Session. Cascade is in process of reviewing the early draft language of this proposal and looks forward to continuing our engagement.

Natural Gas Industry Emissions

From a review of EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2022, in 2022 the oil and gas sector emitted about 14% of the total GHG emissions from all industries. Natural gas distribution facilities and operations contribute to GHG emissions generally through fugitive methane emissions and leaks from pipeline infrastructure, as well as from combustion of fuel used in compressors. The EPA's emissions estimates indicate approximately 4% of oil and gas sector emissions are from natural gas distribution infrastructure.

Cascade is required to report annual facility GHG emissions to the EPA, the Department of Ecology, and the UTC. These emissions are described further below, under the discussion on Cascade Operational GHG Emissions and Emission Reductions. Cascade began reporting Oregon facility and infrastructure GHG emissions to the Oregon Department of Environmental Quality in 2021. However, Oregon emissions do not meet the 25,000 metric ton CO_2e threshold for annual reporting to the EPA.

Cascade Customer Emissions from Natural Gas Combustion

GHG emissions are generated by Cascade's customers due to combustion of natural gas. Over time, the Company's sales of natural gas have grown to accommodate customers' demand for natural gas, and therefore, GHG emissions have increased from customers' combustion of natural gas.

The total annual emissions from Cascade's core customers are in the range of about 1.3 million metric tons of CO_2e. Emissions from non-core customers have totaled in the range of about 3.5 times higher than total emissions from core customers, depending on the year and whether customers switch from non-core to core customer rate arrangements. Note that these total emissions are slightly different than Cascade's CCA compliance obligations since some large customer EITEs have their own compliance obligations and military facility emissions are exempt.

a. Energy Efficiency Program Greenhouse Gas Emission Reductions

Cascade's conservation programs help reduce GHG emissions by providing incentives to customers for a comprehensive set of prescriptive and custom energy efficiency upgrades designed to more efficiently use natural gas, thus reducing their overall carbon footprint. Space, water heating, and weatherization incentives drive lowered energy consumption and positive energy behavior in customers' homes and businesses. This leads to lowered demand, bill reductions, and overall GHG emission reductions in the communities.

As seen in Figure 6-2, Cascade's energy efficiency, conservation programs, and demand-side savings in Washington over the past three years have resulted in about 627,941 to 1,243,223 therm savings annually, equivalent to about 3,459 to 6,597 metric tons of CO_2e /year. Savings in Oregon, through a partnership with Energy Trust of Oregon, have saved over half a million therms and 2,966 metric tons of CO_2e /year on average since 2021.

Figure 6-2: Historical DSM Savings

Annual EE and Conservation/	WA		OR	
	Therms	mT CO_2e	Therms	mT CO_2e
2021	1,243,223	6,597	525,372	2,788
2022	627,941	3,459	508,067	2,799
2023	912,782	5,028	601,036	3,311

Washington conversation targets are set biennially in collaboration with the UTC and a Conservation Advisory Group through a Conservation Potential Assessment. Cascade strives to continue maximizing cost-effective conservation savings through continual process improvements, community outreach, customer education, and enhancing the portfolio of DSM offerings. The Company is poised to adaptively manage as state goals and savings opportunities evolve alongside technological improvements and consumer behavior in the industry. Please see Chapter 7, Demand Side Management, for additional details.

b. Renewable Natural Gas and Hydrogen

Low carbon fuels, such as renewable natural gas and hydrogen, will be critical in meeting the dual goals of decarbonizing the energy pipelines while maintaining the benefits provided by our distribution system. Renewable natural gas and hydrogen supply are other methods of reducing emissions associated with the Company's customer use of natural gas. In the past few years, Cascade has expanded the Company's internal and external resources to support development of RNG options for its customers and to comply with decarbonization requirements in Washington and Oregon. Under the Trump administration, funding for clean hydrogen initiatives has been paused. This action was formalized through Executive Order 13990, titled "Unleashing American Energy", issued on January 20, 2025. The order mandates an immediate suspension of funds appropriated under the Inflation Reduction Act of 2022 (Public Law 117-169) and the Infrastructure Investment Act and Jobs Act (Public Law 117-58). Cascade is not involved in hydrogen projects; however, we are following various projects that are underway in case they provide opportunities in the future.

Cascade also continues to explore ways the Company can support technology development and pilot project opportunities to further explore delivery of hydrogen for customers on the gas distribution system. See more information on Cascade's RNG procurements and project involvement, as well as discussion of hydrogen as a future energy resource for customers, in Chapter 4.

Cascade Operational GHG Emissions and Emission Reductions

Certain operational emissions from Cascade's operations and infrastructure in Washington are subject to emissions reduction requirements through the CCA and are reported to the EPA and Ecology. Reported GHG emissions include combustion emissions from Cascade's Mount Vernon compressor engine and fugitive methane emissions from distribution mains, service lines, and meter-regulating stations. Emissions from these sources totaled just over 27,000 metric tons of CO_2e for the 2023 reporting year. These emissions have been quantified since 2010 and have remained fairly consistent over time as default nation-wide emissions factors are required to quantify most of the emissions.

Emissions not required to be reported to Ecology in the values above include methane emissions from excavation damage, natural force damage and other outside force damage, corrosion, and equipment/weld issues. However, per HB 2518, these emissions are required to be reported to UTC annually and have been reported since 2021 (2020 calendar year emissions). In the March 2023 report, Cascade's 2022 reported emissions to the UTC were 4,186 metric tons of CO_2e and in the March 2024 report, the 2023 reported emissions were 1,721 metric tons of CO_2e. These reductions were accomplished by implementing company procedures that accelerated the timeline for fixing leaks and no longer allowing Grade 3 leaks to continue to leak indefinitely.

Cascade's other operational emissions (blowdowns, pressure relief/venting and routine maintenance, meters, and smaller combustion equipment) are not required to be reported to the EPA or Ecology but are compiled for our corporate GHG emissions inventory. Cascade is also exploring the use of advanced mobile leak detection (AMLD) technology to help quantify methane emissions as well as to identify leaks and help prioritize company repair efforts. Cascade is committed to reducing operational emissions.

Cascade has realized GHG emissions reductions in implementing operational changes and capital projects required through federal Pipeline and Hazardous Materials System Administration (PHMSA) regulatory requirements as well as through changes in field operations procedures. The Company is anticipating utilizing the AMLD technology mentioned above to help quantify these emissions reductions going forward.

1. **Fugitive Methane Emissions Reductions**

The EPA has focused on reducing fugitive methane emissions from the oil and gas sector but has not applied emission reduction requirements specifically to the natural gas distribution segment. Instead, the agency has focused on sponsoring voluntary programs to encourage commitments to reduce methane emissions from gas distribution companies.

a. EPA Natural Gas Star Methane Challenge Program.

Cascade became a Founding Partner of the EPA's Natural Gas Star Methane Challenge Program in March 2016. As a Founding Partner, Cascade chose to participate in the program under the Best Management Practice (BMP) Commitment – Excavation Damages Prevention within the natural gas distribution sector. The BMP Commitment entails a Partner's commitment to company-wide implementation of BMPs to reduce methane emissions. Involvement in this program also provides a forum for companies to share knowledge on successfully implementing BMPs and methane emissions reductions. During this commitment, Cascade has conducted incident analyses on excavation damages and reported the relevant data to the EPA.

Specifically, Cascade demonstrates its commitment to this program through implementation of BMPs to promote leak reductions. Cascade has a public awareness and damage prevention manager and coordinators who assist in providing public outreach that focuses on damage prevention and further reducing potential releases of methane from excavation damages. The public awareness and damage prevention department and local utility management and staff also engage directly with contractors and excavators with face-to-face interactions in the field, and through meetings and training events. By proactively engaging with these third parties, Cascade aims to achieve a decreasing trend in overall excavation damages and excavation damage rates, as well as an increase line location requests.

Cascade conducts investigations when damage occurs to the Company's natural gas distribution pipeline and infrastructure. Key information, such as location, root cause, type of excavator, type of equipment used and type of work performed, is collected to analyze and trend on a quarterly basis. This data is used to assess ways to mitigate risks associated with excavation and, along with effectiveness surveys, helps utilities assess the success of their programs, outreach strategies and messaging.

Some examples of utility companies' outreach efforts include annual direct mailers to public officials, emergency response organizations, excavators, customers, schools and individuals who live along Cascade's distribution lines; participation in a variety of general public outreach events; development of materials that deliver multifaceted education campaigns, including campaigns via television, radio, online, newspapers, magazines, social media and billboards. Utility companies provide publications in up to eight languages to align with the demographics of their jurisdictions. The Companies also sponsor community events, such as golf tournaments, chamber of commerce events, county fairs and rodeos, and sporting events, where pipeline safety and Call 811 information is displayed and distributed to attendees. The utilities also provide excavation safety and emergency response training upon request.

Additionally, Cascade actively participates in 811, Common Ground Alliance, local underground utility coordinating councils, and damage complaint programs in Washington and Oregon. Cascade continues to explore other voluntary actions which could reduce methane emissions resulting from excavation damage.

Beyond Cascade's commitment to reduce methane emissions from excavation damages, Cascade has completed operational and infrastructure changes to comply with federal requirements which have resulted in lowering methane emissions, and therefore lower GHG emissions in the State of Washington. This has mainly been realized through pipeline replacement projects where newer pipeline materials, such as polyethylene and steel, are used to replace older materials. Since 2012, Cascade has replaced nearly 98 miles of early vintage steel pipe in Washington with new steel or polyethylene pipe, ranging from service lines up to 12-inch mains. Also, Cascade has no unprotected steel pipe and no leak-prone cast iron pipe in its systems.

In 2020, Washington enacted HB 2518, the Natural Gas Transmission bill, requiring natural gas distribution companies to expedite mitigation of hazardous leaks and reduce as practicable nonhazardous leaks, and providing utilities rate recovery to mitigate these leaks. Cascade collaborated with other Washington natural gas distribution companies on implementing methodology for compiling data and estimating emissions. The Company submitted the first annual report in March 2021 to the Washington Utilities and Transportation Commission. Internal tracking to compile data reports for HB 2518 is completed annually ongoing and shows few open leaks on the system and those are scheduled for repair according to Cascade's expedited leak management program. Although companies are permitted by code to monitor smaller leaks for a period of time before addressing, Cascade has instituted a policy to repair all identified leaks as quickly as possible and with a goal to eliminate even the smallest non-hazardous leaks within 15 months of discovery. By expediting leak mitigation, Cascade has reduced leak emissions within the system.

Cascade became a member of the One Future Coalition in 2024 and has been working with them to understand their protocol. This protocol is more robust, and Cascade is reevaluating the Company's methane intensity with One Future.

Cascade continues to explore additional ways to reduce methane releases that occur within normal operations, including the use of technology that could be used to capture and reinject natural gas from one section of pipe into an adjacent section during pipeline maintenance. By using this technology, Cascade would be able to isolate a section of pipe scheduled for maintenance and minimize the amount of natural gas released to atmosphere from blowdowns.

Cascade is currently piloting an emissions survey using Picarro's AMLD technology in Washington. By using AMLD, Cascade is looking to identify and fix super emitter leaks within its system, as well as identify potential problem areas and prioritize company repair efforts. Cascade also believes that by using AMLD technology to directly measure emissions, it will have a better idea of what Cascade's actual emissions are. On August 27, 2024, the EPA released a request for information asking for comments and information regarding methane quantification technology and its potential use for quantifying methane emissions under Subpart W. Cascade plans to support these efforts.

Upstream Natural Gas Value Chain Emissions

Cascade developed an upstream methane emissions factor for the state of Washington that was used in the 2020 Integrated Resource Plan (IRP) for calculating avoided cost. This has been updated for the 2023 IRP through input of UTC directly and the technical advisory group made up of interested parties, the public, and Commission Staff. UTC Staff provided feedback on the findings and forecasts for the new resource acquisitions in Cascade's 2020 IRP. In the feedback, the staff commented on the methodology assumptions applied in the upstream emissions factor calculation, requesting clarity on certain aspects and additional rigor on others.

In response to the feedback, and as part of the in-progress 2023 IRP planning cycle, Cascade reviewed this calculation, and associated assumptions, against industry standards to determine changes to the assumptions to better align it with current best practices. The review resulted in an update to the upstream U.S. Rockies emissions rate to 1.43% from 1% and Cascade has updated the GWP of methane to 28 from 25. With these updated assumptions, the upstream emissions rate increases to a value of 4,680 CO_2e g/MMbtu from a value of 3,541 CO_2e g/MMbtu in the 2020 IRP, or a 32% increase. Cascade will continue to evaluate upstream emissions rate assumptions and new methane emissions tracking methodology as it is released to support methodology development in future IRP processes. Additional detail on Cascade's review approach and results can be found in Appendix H.

Conclusion

The predominant requirements impacting Cascade are the Climate Commitment Act which regulated customer and operational GHG emissions, State Building Code Council revisions limiting natural gas usage for space and water heating in new and retrofitted commercial and residential buildings, and a City of Bellingham ordinance requiring electric space and water heat for new commercial buildings and larger multi-family dwellings. These requirements impact the IRP and are included in resource and cost modeling.

To comply with the CCA requirements, Cascade is purchasing allowances and exploring carbon offsets and low carbon fuel opportunities. Cascade continues the Company's commitment in reducing fugitive methane emissions and reducing GHG emissions from customer combustion of natural gas through implementation of energy efficiency and conservation programs.

The Company will continue to monitor and engage in Cascade's service area community-driven efforts in adopting GHG emission reduction targets. As state and federal GHG emissions policy and regulatory activity are updated, Cascade will evaluate and incorporate these potential impacts into the Company's IRP process. Cascade will also continue reviewing the Northwest Power and Conservation Council's (NWPCC) Power Plan updates when they are available to inform the Company on regional energy and GHG emissions matters that may impact additional policy development.

Chapter 7

Demand Side Management

Overview

> **Key Points**
>
> - Washington projects energy efficiency savings of 23 million therms through 2045.
> - This plan is informed by Cascade's Conservation Advisory Group (CAG).
> - Cascade examines the Technical and Achievable Economic Potential of DSM programs through the LoadMAP model.
> - LoadMAP generates targets for the Biennial Conservation Plan (BCP), based on therm savings potential.
> - Programs are based on incentives, research, information, outreach, and engagement of key parties – and are designed and implemented to achieve DSM savings targets.

Demand Side Management (DSM) refers to the reduction of natural gas consumption through the installation of energy efficiency measures such as insulation or more efficient gas-fired appliances, or through other load management programs such as demand response efforts that shift gas consumption to off-peak periods. The Company's primary means for reducing load is through energy efficiency programs that provide customers with financial incentives to install energy efficiency measures or appliances. The Company's energy efficiency programs in Washington and Oregon offer incentives to homeowners, commercial customers, industrial customers, and builders to invest in energy efficiency measures. Because the customer must ultimately make the decision to invest in an energy efficiency measure, DSM is unlike other supply side resources which the Company can independently secure. This Chapter presents the methodology used to determine the Company's DSM supply curve through the planning period ending in 2045 and outlines the Company's overall energy efficiency program savings goals and performance.

Chapter 5 outlines the Avoided Cost of natural gas which is the estimated cost to serve the next unit of demand with a supply side resource option at a point in time. This incremental cost serves to represent the cost that could be avoided through energy efficiency programs. The long-term discount rate, tied to the average 30-year mortgage rate, increased from 5.06% in 2022 to 6.09% in 2024. The average nominal system Avoided Cost per therm increased from ~$0.94 in 2020 to ~$1.78 in 2024 representing an average increase of ~47%.

The Company's Energy Efficiency (EE or demand side) resources are acquired from individual customers in the form of unused energy. This chapter is responsive to the Washington Utilities and Transportation Commission's (WUTC or Commission) requirement that natural gas utilities consider cost-effective DSM resources in their energy portfolio on an equal and comparable basis with supply side resources.

In the natural gas industry, DSM resources are EE measures that include, but are not limited to; ceiling, wall, and floor insulation; higher efficiency natural gas appliances, insulated windows and doors, ventilation heat recovery systems and other commercial/industrial equipment. By influencing customers through energy efficiency outreach to reduce their individual demand for gas, Cascade can reduce the need to purchase additional gas supplies, displace or delay contracting for incremental pipeline capacity, and possibly negate or delay the need for reinforcements on the Company's distribution system.

Energy efficiency involves a mix of technology and behavioral change using less energy to perform the same function. Energy conservation, on the other hand, involves using less energy by adjusting behaviors and habits. By incentivizing efficiency from customers versus conservation to reduce overall system load, the Company can more accurately track load reduction and does not solely depend on customer behavioral change.

Although Washington savings estimates extend to 2050, Oregon savings estimates have a time horizon of 2044 through the Energy Trust of Oregon's (ETO) Resource Assessment model. Cascade targets the saving of approximately 39.5 million therms systemwide through 2045; 23 million therms in Washington and 16.5 million therms in Oregon.

Figure 7-1 provides the forecast horizon per state due to limitations of the current forecasting models.

Figure 7-1: Forecast Horizon by State

Service State	Forecast Model	Time Horizon
Washington	LoadMAP	2050[1]
Oregon	Resource Assessment	2044

[1]For 2046-2050, the average annual savings from 2040-2045 is used as a proxy.

DSM Resources

There are two basic types of demand side resources: base load resources and weather-dependent resources. Base load resources offset gas supply requirements throughout the year, regardless of weather conditions. Base load DSM resources include equipment such as high-efficiency water heaters and higher efficiency cooking equipment. Weather dependent DSM resources are measures whose therm savings increase during cold weather. For example, a high-efficiency furnace will lower therm usage in the winter months and will provide little to no savings in the summer months. These types of weather dependent measures for space heating offset some peaking or seasonal gas supply resources and are typically more expensive than base load supplies (e.g., water heating).

Energy efficiency is delivered to Cascade customers through a portfolio of services in Washington and Oregon.

Cascade's Washington Energy Efficiency Program

Cascade delivers energy efficiency services to its Washington core customers through the Company's EE department for the Residential program and a third-party implementer, TRC Companies, for Commercial/Industrial (C/I).

Cascade manages the following Washington Residential incentive programs:

- Residential (Existing and New Home Construction, and some Multifamily)
    - Single family, moderate income, manufactured homes.
    - Weatherization, HVAC & water heating equipment.
    - Low income.

TRC Companies manage the following Washington C/I programs on Cascade's behalf:

- Commercial (Existing and New Construction)
    - Retail, offices, schools, groceries & other associated market segments.
        - Weatherization, controls, HVAC & water heating equipment.
- Industrial & Agriculture (core customers).
    - Manufacturing facilities, greenhouses.
        - Process improvements, HVAC & water heating equipment, operations and maintenance.

Cascade's Oregon Energy Efficiency Program

Energy efficiency programs for the Company's Oregon customers are offered through the Energy Trust of Oregon with program planning developed through the Cascade Oregon IRP cycle. (This subsection regarding Oregon DSM is included for informational purposes only to describe different program delivery in Oregon, although with similar methodologies.)

Energy Trust administers the following EE programs in Oregon on Cascade's behalf:

- Residential (Existing and New Home Construction)
    - Single family, moderate income, manufactured homes.
        - Weatherization, Heating Ventilation and Air Conditioning (HVAC) & water heating equipment.
- Commercial (Existing, New and Multifamily)
    - Retail, offices, schools, groceries & other associated market segments.
        - Weatherization, controls, HVAC & water heating equipment.
- Industrial & Agriculture (Core Sites)
    - Manufacturing facilities, greenhouses.
        - Process improvements, HVAC & water heating equipment, operations and maintenance.

Biennial Conservation Planning

On November 15, 2023, Cascade filed its 2024-2025 Biennial Conservation Plan (BCP) identifying the Company's two-year acquisition target in Docket UG-230937.[1] This plan aligns with requirements established as part of House Bill -1257 within RCW 80.28.380 which include:

1. Gas companies must identify and acquire all conservation measures that are available and cost-effective.
2. In addition, each company must establish an acquisition target every two years and must demonstrate the target will result in the acquisition of all resources identified as available and cost-effective.
3. The cost-effectiveness analysis required by this section must include the costs of greenhouse gas emissions established in RCW 80.28.395.
4. These targets must also be based on a Conservation Potential Assessment (CPA) prepared by an independent third party and approved by the Commission to become effective as of 2024.

In the BCP, Cascade focuses on near-term conservation and energy efficiency program development as it addresses items noted in the 2023 IRP. Cascade identifies and acquires conservation opportunities through the CPA filed with the Washington Utilities and Transportation Commission.

The BCP also contains program implementation considerations, Washington state energy and building code impacts, an evolution in the program's point-of-sale incentive offering, and outreach plans. Additionally, results of savings potential are presented for the Company's Washington (WA) service territory through 2050 via its Load Management Analysis and Planning (LoadMAP) model tool developed by AEG.

Conservation Potential Assessment

Cascade performs a Conservation Potential Assessment (CPA) biennially. The CPA consists of estimates of potential reductions in annual energy usage for natural gas customers in the Cascade service territory from energy efficiency. Cascade has been filing a new CPA with the Commission in the summer of odd years. Cascade is in the process of adjusting the cadence of future CPAs to move up this delivery date towards alignment with local electric utilities to better inform the IRP through more recent model inputs and outputs.

The CPA process is outsourced to maintain impartial findings and to leverage industry experience and best practices in measure and savings assumptions. Cascade employs a third-party firm, currently Applied Energy Group (AEG), for the development of its CPA.

[1] UG-230937

AEG is an industry leader who developed Cascade's three most recent CPAs and who works with other regional utilities on their assessments. The conservation potential for this IRP is calculated through AEG's forecasting model from a CPA performed in spring of 2023 and was updated in the fall of 2024 for Cascade.[2]

Load Management Analysis and Planning Tool (LoadMAP)

AEG's LoadMAP model is separated into three results modules:

- LoadMAP Baseline takes a units-based approach to stock turnover, tracking equipment installations in each year;

- LoadMAP Potential forecasting module calculates potential savings relative to the baseline projection developed in the previous module. This model begins with the detailed stock accounting results from the LoadMAP Baseline analysis but converts all measures to single line-items for transparency and ease of review; and

- LoadMAP Results summarizes modeling outputs from the two prior modules at both a high level and in measure-by-measure detail. This module does not perform any potential estimation calculations but is instead intended to serve as a centralized location for reviewing model outputs and summarizing results.

The model then forecasts efficiency potential in terms of:

- Technical Potential;
- Achievable Technical Potential;
- Achievable Economic Utility Cost Test (UCT) Potential; and
- Achievable Economic Total Resource Cost (TRC) Potential.

AEG's forecasting term definitions for the CPA and LoadMAP:

> ***"Baseline Projection****: Projection of baseline energy consumption under a naturally occurring efficiency case, described at the end-use level. The LoadMAP models were first aligned with actual sales and Cascade's official, weather-normalized econometric forecast and then varied to include the impacts of future federal standards, the 2018 Washington State Energy Code on new construction, which took effect starting in 2021, and future technology purchasing decisions."*
>
> ***"Technical Potential*** *is defined as the theoretical upper limit of EE potential. It assumes customers adopt all feasible measures regardless of their cost. At the time of existing equipment failure, customers replace their equipment with*

[2] CPA filing docket details

the most efficient option available. In new construction, customers and developers also choose the most efficient equipment option.

Technical potential also assumes the adoption of every other available measure, where technically feasible. For example, it includes the installation of high-efficiency windows in all new construction opportunities and furnace maintenance in all existing buildings with installed furnaces. These retrofit measures are phased in over a number of years to align with the stock turnover of related equipment units, rather than modeled as immediately available all at once."

***"Achievable Technical** Potential refines technical potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and other factors that affect market penetration of conservation measures. The customer adoption rates used in this study were based on the ramp rates developed for the Council's 2021 Plan and adjusted to reflect differences between electric and natural gas energy efficiency resources and Cascade's program experience."*

***"UCT Achievable Economic** Potential further refines achievable technical potential by applying an economic cost-effectiveness screen. In this analysis, primary cost-effectiveness is measured by the UCT, which assesses cost-effectiveness from the utility's perspective. This test compares lifetime energy benefits to the costs of delivering the measure through a utility program, excluding monetized non-energy impacts. These costs are the incentive, as a percent of incremental cost of the given efficiency measure, relative to the relevant baseline course of action (e.g. federal standard for lost opportunity and no action for retrofits), plus any administrative costs that are incurred by the program to deliver and implement the measure."*

Note: Cascade prioritizes the evaluation of cost-effectiveness at the portfolio level permitting diversity in measure offerings across climate zones. The individual measure cost-effectiveness threshold at 0.9 functions as a proxy for cost-effectiveness measures seen as attractive but not individually cost-effective (e.g. February 1, 2021, 0.30 windows were offered at a UCT value of 0.75). Similarly, certain climate zones may have an overall cost-effectiveness below 1.0, but measures may still pass so long as the portfolio remains above this threshold. These examples demonstrate Cascade's response to market forces that require consideration of all portfolio possibilities.

***"TRC Achievable Economic** Potential is similar to UCT achievable economic potential in that it refines achievable technical potential through cost-effectiveness analysis. The TRC test assesses cost-effectiveness from a combined utility and participant perspective. As such, this test includes full measure costs but also includes non-energy impacts realized by the customer if quantifiable and monetized."*

The current LoadMAP model does have some limitations, most notably being originally designed for a 20-year forecast horizon. This falls short of the designated 2050 target year for the Company's sustainability planning and carbon compliance goals which were not originally in scope at the time of LoadMAP implementation. The forecast model for future CPAs will take this extended forecast window into consideration.

AEG was able to modify the LoadMAP model under updated inputs through 2045 with minor adjustments, but these adjustments were unable to be utilized for 2046-2050. For 2046-2050, the average annual savings from 2040-2045 is used as a proxy. Washington specific information in the following sections of this chapter will be truncated to 2045 for this reason.

Energy Efficiency 2050 Horizon Potential Forecast

This IRP provides Cascade's Washington service territory therm savings potential as calculated by AEG in the 2023 CPA filed in June 2023. The 2023 CPA LoadMap model has been updated from the 2020 Phase 2 CPA to align inputs with the rest of this IRP.

These updates included:

- Updates in Avoided Costs to be consistent with Chapter 5.
- The long-term discount rate increased from 3.40% to 5.06%.
- A warming climate assumption with decreasing heating degree days over time.
- Assumptions developed regarding building codes and appliance standards.
- Trends in fuel shares and equipment saturations.

Large scale updates to the model when completing a new CPA are intended to build upon an improved level of transparency and granularity to the Company's planning processes.

These updates by AEG often include:

- Residential annual equipment consumption data based on most recent U.S. Department of Energy (DOE) data.
- Measure achievability ramp rates to improve model alignment with achieved program results.
- Natural gas forecasting methods that work in parallel with the electric-focused Northwest Power and Conservation Council (NPCC) 2021 Power Plan.
- Comprehensive updates to all measure characterizations.
- Update non-energy impacts (NEIs) and values for evaluating potential under the UCT and TRC.
- Reviewed and updated incentives for measures currently active in CNGC programs.

The forecast is categorized by the three customer classes: Residential, Commercial and Industrial. The forecast for each class includes individual savings assumptions, market segmentations, and end-uses (Residential weather dependent measures have different savings potential by climate zone). The demand planning assumptions were provided by Cascade's Resource Planning Team (RPT) and, thereafter, the efficiency potential forecast outcome was delivered to the RPT for integration into the IRP demand forecast model.

AEG employs a modeling tool called the "Load Management Analysis and Planning" model, described as follows.

> *"Load Management Analysis and Planning (LoadMAP™) tool was developed in 2007 and was first used for the EPRI National Potential Study. Since that time, LoadMAP has been used to develop end-use forecasts and perform dozens of energy efficiency (EE) potential studies. The LoadMAP model provides forecasts of energy use by sector, segment, end-use and technology for existing and new buildings. It can also be used to isolate and estimate savings from DSM measures and programs. LoadMAP was developed by Global Energy Partners, LLC (GEP) under the direction of Ingrid Rohmund. EnerNOC acquired GEP and the LoadMAP model in 2011. In June 2014, AEG acquired EnerNOC's Utility Solutions Consulting Group and the LoadMAP model. AEG supports ongoing enhancements to the model."*[3]

This modeling tool provides the ability to run multiple scenarios and re-calculate potential savings based on variable inputs, such as the customer and demand forecasts, IRP long term discount rate, heating degree days, transmission loss rate and Avoided Costs. Recent annual program performance and measure data collected through energy efficiency programs are incorporated to establish incremental costs reflective of Cascade's service territory. This model provides transparency to all assumptions and calculations for estimating market potential.

Avoided costs are a key input to the potential model. They are variable costs for a unit of energy, or capacity, or both that are avoided through energy efficiency adoption. There is a direct correlation between variable energy costs and savings potential. The higher the variable energy costs, the greater the savings potential when those costs are avoided allowing for more robust energy efficiency options to be offered as cost-effective opportunities. These per therm avoided costs flow through the forecast and are the primary factor in calculating efficiency potential. Average avoided costs have historically followed an increasing trend most recently driven by the inclusion of the Social Cost of Carbon.

The economic merits of the portfolio are gauged through standard industry cost-effectiveness tests. Each test compares the benefits of the energy efficiency savings to their costs defined in terms of net present value of future cash flows.

[3] 2018 IRP, Appendix D

While Technical and Achievable Technical potential are both theoretical limits to efficiency savings, Achievable Economic potential embodies a set of assumptions about decisions consumers will make regarding the cost and benefits of the equipment they purchase. Based on Pacific Northwest regional standard practice, Cascade's EE planning adopts the Achievable Economic UCT potential to set goals under an array of possible future conditions.

Cascade applies the UCT for evaluating the Benefit Cost ratio across its programs. The Benefits in the UCT calculation are the avoided energy capacity costs for the lifetime of the measure; the costs in this test are the program administrator's incentive costs and administrative costs.

In addition, LoadMAP concurrently runs all scenarios under the TRC for comparison. The cumulative long-term potential under the UCT remains higher at the programmatic level than the TRC, whereas this may not always be the case in the short-term.

Washington Market Segmentation & End-Use

An important first step in calculating Cascade's energy efficiency potential estimates is to establish baseline energy usage characteristics and disaggregate the market by sector, segment, and end-use.

The Residential market has three Climate Zone segments for Single family and some Multi Family housing stock, resulting in six market segments.

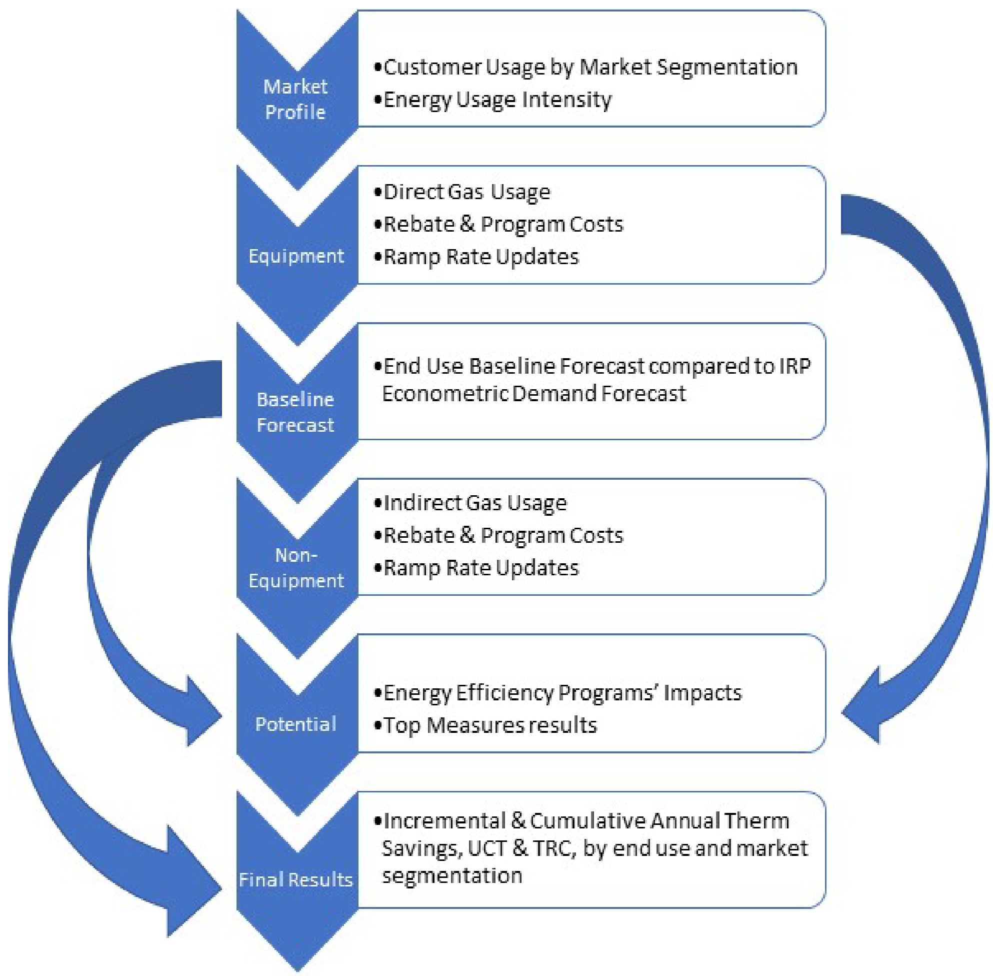
Commercial market segmentation includes: Office, Retail, Restaurant, Grocery, Education, Healthcare, Lodging, Warehouse, and a "Miscellaneous" category.

The industrial market is segmented by: Food Processing, Agriculture, Primary Metals, Stone/Clay/Glass, Petroleum, Paper & Printing, Instruments, Wood & Lumber Products, and an "Other" category.

End-use categories include: Space Heating, Water Heating, Secondary Heating, Food Preparation, Appliances, Process Heating, and miscellaneous. All of these are ultimately categorized into baseline and peak load.

Figure 7-2 illustrates the LoadMAP efficiency potential process.

Figure 7-2: Savings Potential Process in LoadMAP



There are six separate workbooks that make up the full DSM forecast for each customer class. These all follow the same order of operation, starting with the Market Profile, which feeds into the Equipment workbook. The Equipment then feeds into the Baseline, which feeds into Non-Equipment. When running the Potential model, the Equipment, Baseline, and Non-Equipment are all imported. The Final Results import the Potential results and the Baseline.

AEG also provides advice on how to update ramp rates based on the NPCC methodology and industry best practices.

Progress to Plan

The Company's DSM efforts for this cycle and associated incorporation into the IRP provides context on the current potential as calculated by AEG in the 2023 CPA.

Company therm savings achievements for the past four biennium compared to the gas conservation targets approved for Cascade Natural Gas Corporation pursuant to RCW 80.28.380 are shown in Figure 7-3. The *Difference* column represents the percent change from goal to actual and the *Growth* column represents the percent change in actual therm savings from one biennium to the next.

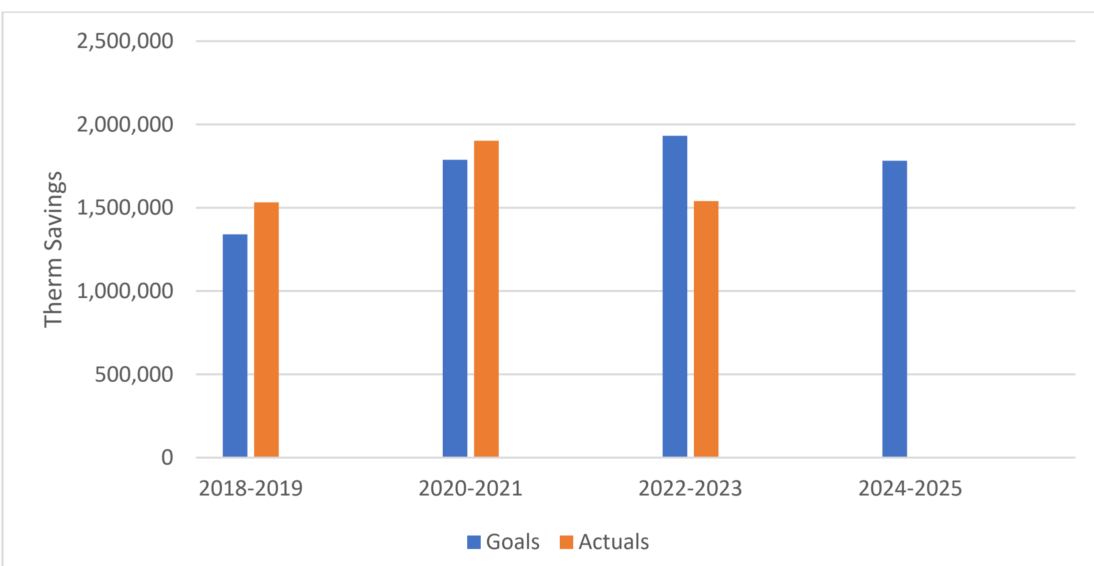
Figure 7-3: Historical Goal to Actual Therm Accomplishments

Biennium	Goals	Actuals	Difference	Growth
2018-2019	1,340,278	1,532,775	**14%**	**37%**
2020-2021	1,788,452	1,902,399	**6%**	**19%**
2022-2023*	1,931,751	**1,540,723**	**-20%**	***-23%***
2024-2025	1,782,212	**TBD**	**TBD**	***TBD***

*2023 Actuals awaiting WUTC Approval

Figure 7-4 visualizes the actual historical performance and the Biennial Conservation Goals.

Figure 7-4: Portfolio Biennium Goals + Actuals



Processing Software

The Company has historically used the "iENERGY DSM Central" software product from Resource Innovations (RI) Inc. as a tool for processing Residential and Low Income (LI) projects and assisting with management of the Trade Allies (TA) program. In 2023, Intermountain Gas Company officially deployed the Enterprise Rebate Application (ERA) for rebate processing. This software solution was designed and programmed through a collaborative effort with MDU's Enterprise Information Technology team and IGC's EE team. Cascade will be migrating over to the ERA for residential rebate processing in 2025 in alignment with Intermountain Gas.

Third Party Measure Level EM&V

In August of 2022, Cascade distributed a Request for Proposals (RFP) for third-party measure level Evaluation, Measurement, and Verification (EM&V) of the program to build on historic internal evaluation efforts as outlined in Section 9c of the Condition's Documents for Docket UG-21083813. CNGC has worked with ADM Associates, Inc. on all filed EM&V and on in-progress studies.

Cascade intends to follow the EM&V schedule, below:

Spring 2023: Commercial Program Impact EM&V.
Spring 2024: Residential Equipment Impact EM&V, Full Program Process EM&V.
Spring 2025: Residential Envelope Impact EM&V.
Spring 2026: Low Income & Full Program Process EM&V.

An impact review for commercial program offerings kicked off the first-year schedule of EM&V activities. The final report was delivered and filed under Docket UG-210838 on September 15, 2023. ADM evaluated CNGC's custom, space heating, water heating, envelope, and food service measures between program years 2018 and 2022. Results were very positive. The total verified savings amounted to 1,557,895 therms, showing the program achieving a 94.47% realization rate. This means that for every 100 therms projected, 94.47 therms were estimated to be saved by the program through statistical billing analysis. These verified savings were calculated with 10% precision at the 90% confidence level. This means there is no statistical deviation from a true 100% realization rate. The greatest savings were achieved through Custom projects, Space Heating, and Envelope measures.

The residential equipment impact EM&V along with the program process EM&V were filed under UG-210838 on 9/13/2024. The program process EM&V provided recommendations that will be considered to improve outreach, communication with partners and CAP agencies, along with future incentive offerings.

Once again, results were very positive. The residential equipment impact EM&V showed CNGC had a 121.1% realization rate between the years of 2018-2022, with five measures having a realization rate of over 100%. ADM also provided multiple program improvement opportunities which will be considered during the upcoming 2025 CPA.

Work has begun on the residential envelope evaluation study that will be filed in 2025. The results of these evaluations will be used to inform future CPA studies along with improving the program.

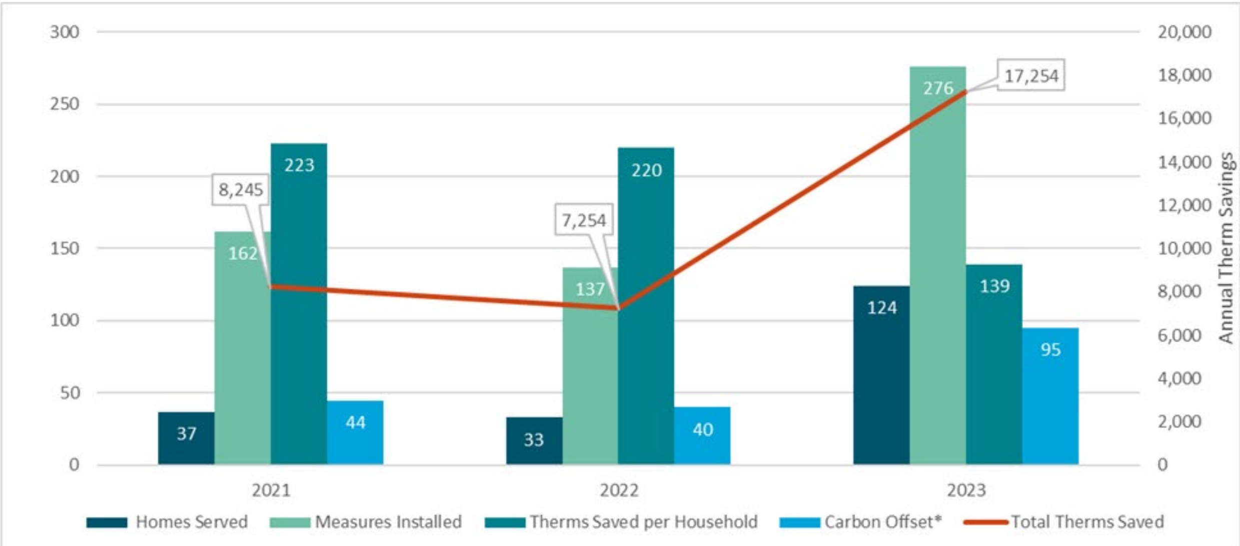
Low Income

Cascade is committed to increasing participation from Community Action Agencies (agencies) to serve more customers through the Company's Weatherization Incentive Program (WIP).

The WIP provides funds to agencies based on the avoided cost of tariff-eligible weatherization measures installed in a customer's home. Agencies receive 100% reimbursement for all eligible weatherization measures installed. Installed cost includes incidental repair work necessary to the installation of a qualified measure, Incidental cost is a major contributor to Agencies' project deferral. WIP has been instrumental in the agency's ability to continue to serve households who would otherwise go unserved in energy justice communities.

On January 1, 2024, revisions to the WIP/EWIP program took effect, increasing per-project coordination payment by 10%. As a result, Agencies receive 30% per-project coordination and 10% for indirect rate for a total of 40% reimbursement of total project cost. In addition, the Enhanced Weatherization Incentive Program (EWIP) was consolidated with WIP. Under EWIP, participating Agencies were also eligible to receive a rebate designed to bridge the gap between the avoided cost payment and the total installed cost of the approved weatherization measure. Installed cost includes incidental repair work necessary to the installation of a qualified measure, Incidental cost is a major contributor to Agencies project deferral. EWIP has been instrumental in the agency's ability to continue to serve households who would otherwise go unserved in energy justice communities. EWIP is removed as the offering and referenced as WIP for ease of communicating the program as well as for simplified program administrations, both rebates will be offered simultaneously through WIP.

Figure 7-5: Weatherization Incentive Program Participation Levels and Savings by Year



Overall, the WIP program is operating as intended, with increased engagement by the agencies that deliver weatherization services in Cascade's service territory. Though Agencies continue to face supply chain issues and labor shortages, we have seen a steady increase post COVID-19.

Budget to Plan

Cascade sets its administrative budget based on Avoided Costs in place at time of development. Since therm savings offset the costs of administrative investment, the greater the achievement, the more cost-effective the programs. See Figure 7-6 for the goals and budgets for 2024 and 2025 (rounded to the nearest dollar) for reference. These were used in the development of the last Biennial Plan. The next BCP will cover budgets for the 2026-2027 Biennium and will be developed based on updated avoided costs and 2025 CPA results. The 2026-2027 budget draft will be submitted to the CAG by September 2025 per the 2024-2025 BCP conditions document.

Figure 7-6: Program Goals & Budgets at a Glance 2024 & 2025 Biennium

	Calendar Year 2024				Calendar Year 2025				Biennial Totals
	Residential	C/I	Low Income	1st year Total	Residential	C/I	Low Income	2nd year Totals	
Cascade Admin Budget[1]	$1,708,246	$1,351,913	$459,191	$3,519,350	$1,742,411	$1,453,405	$517,391	$3,713,207	$7,232,557
Therm Targets[2]	426,621	368,700	19,522	814,843	502,044	443,760	21,565	967,369	1,782,212
NEEA Natural Gas Market Transformation				$348,908				$651,234	$1,000,142
Regional Technical Forum				$31,300				$58,421	$89,721
Evaluation, Measurement & Verification				$183,660				$94,340	$278,000
Conservation Potential Assessment								$160,000	$160,000

[1] *Budgets in this table are estimates and refer to administrative costs for program implementation, not rebates.*
[2] *Therm targets have been developed with LoadMAP through the 2023 CPA Phase*

LoadMAP generated targets are acknowledged in the BCP and programs are managed to ensure cost-effectiveness is maintained. If the budget or therm savings upon which the portfolio is built are unrealistic, the Company risks developing a scale-dependent portfolio unable to maintain cost-effectiveness.

Energy Efficiency Programs Forecasted Savings – Alternative Modeling

Cascade has re-run the LoadMAP model from the most recent CPA to include additional future scenarios with assumptions on alternative demand forecasts and updated inputs to align with the rest of this IRP. These updates included:

- Updates in avoided costs to be consistent with Chapter 5 including the addition of the Social Cost of Carbon;
- The long-term discount rate increased from 5.06% to 6.09%;
- A warming climate assumption with decreasing heating degree days over time; and
- Updated inflation rate and distribution system loss.

Cascade utilizes the UCT to measure the program's cost-effectiveness. The UCT Test is the optimal vehicle for valuation of these measures since it is a straightforward and clean calculation of the utility's investment in DSM and does not penalize customers for making independent determinations regarding the cost-benefit of an EE upgrade. The UCT instead treats the rebate from utility run natural gas efficiency programs as a leveraged partnership that drives positive market change and the installation of measures with the potential for long-lived and deeper energy savings.

As recommended by the WUTC, Cascade has input updated avoided costs figures into the LoadMAP model for this IRP due to broad market economic changes since Cascade's

CPA was last completed. Additional assumption updates include updates to Customer Demand Forecasts, Heating degree days, inflation rate and distribution system loss.

Therms savings are directly influenced by projected consumption, and the lower demand from the flat growth rate in the reference case forecast creates a net decline in potential savings compared to the Company's most recent CPA models. For example, the lower customer forecast based market growth trends decreases opportunities for strongly cost-effective measures like residential furnaces, water heaters, and fireplaces. However, higher Avoided Costs have increased cost-effective potential in most measures, particularly for lower income customers in the prescriptive residential program which would allow more measures to qualify for the incentive program.

This scenario is referred to as Scenario A in the following summary graphs and tables. Additional scenarios have also been run as outlined in the subsequent "Alternative Modeling Scenarios" section.

Figure 7-7 shows the Residential, Commercial, Industrial cumulative DSM forecast by Technical, Achievable Technical and both UCT/TRC Achievable Economic Potentials for scenario A.

Figure 7-7: Cumulative Residential, Commercial, Industrial Potential Forecasts

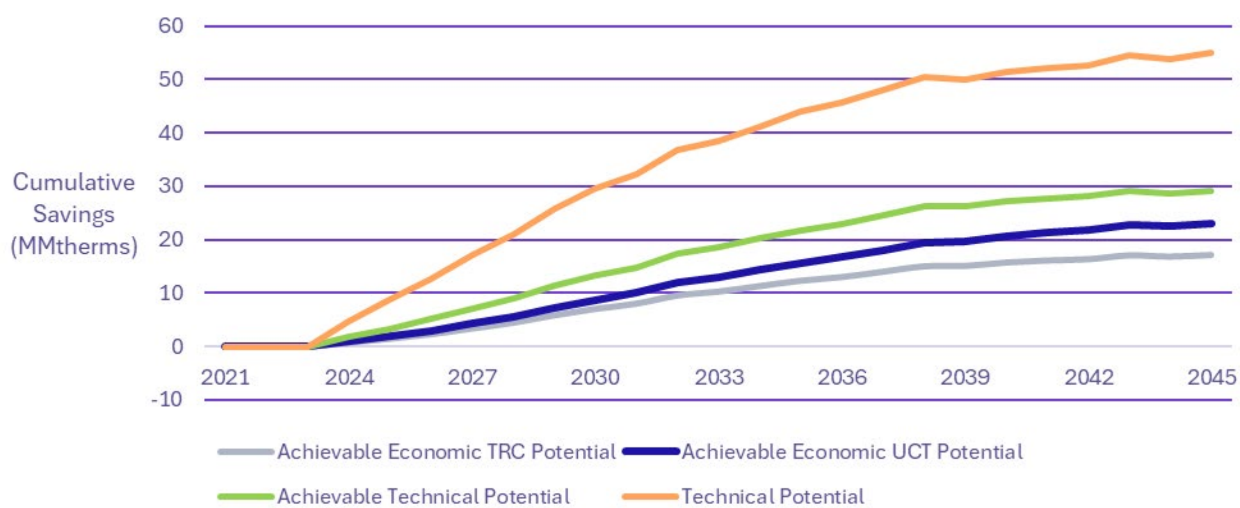


Figure 7-8 shows cumulative savings potential for the Industrial program through 2045.

Figure 7-8: DSM Cumulative Savings Forecast - Industrial

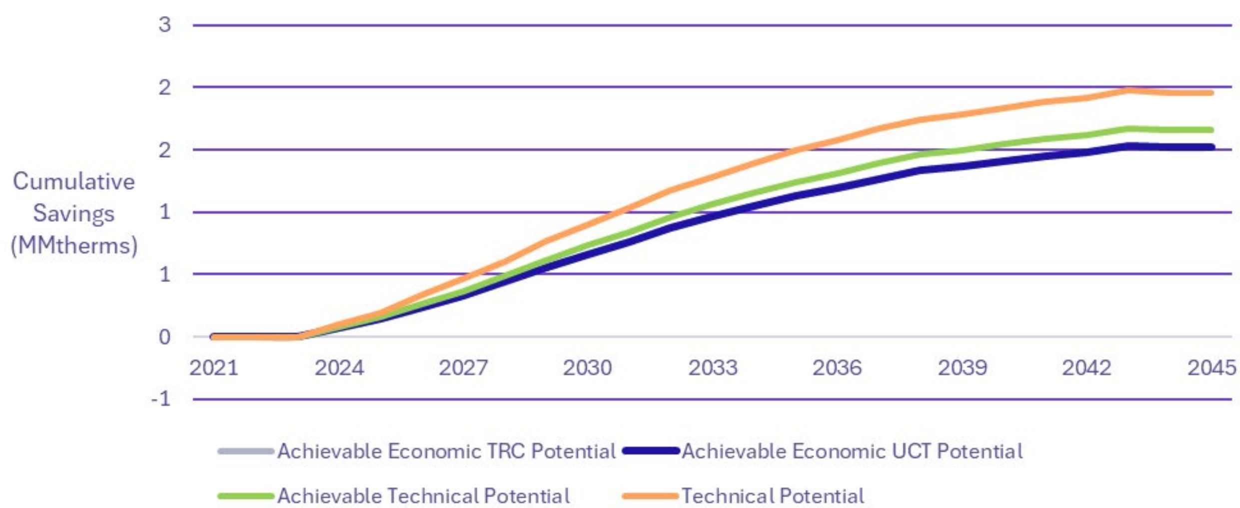


Figure 7-9 shows the Commercial cumulative DSM forecast by Technical, Achievable Technical and both UCT/TRC Achievable Economic Potentials for scenario A.

Figure 7-9: DSM Cumulative Savings Forecast – Commercial

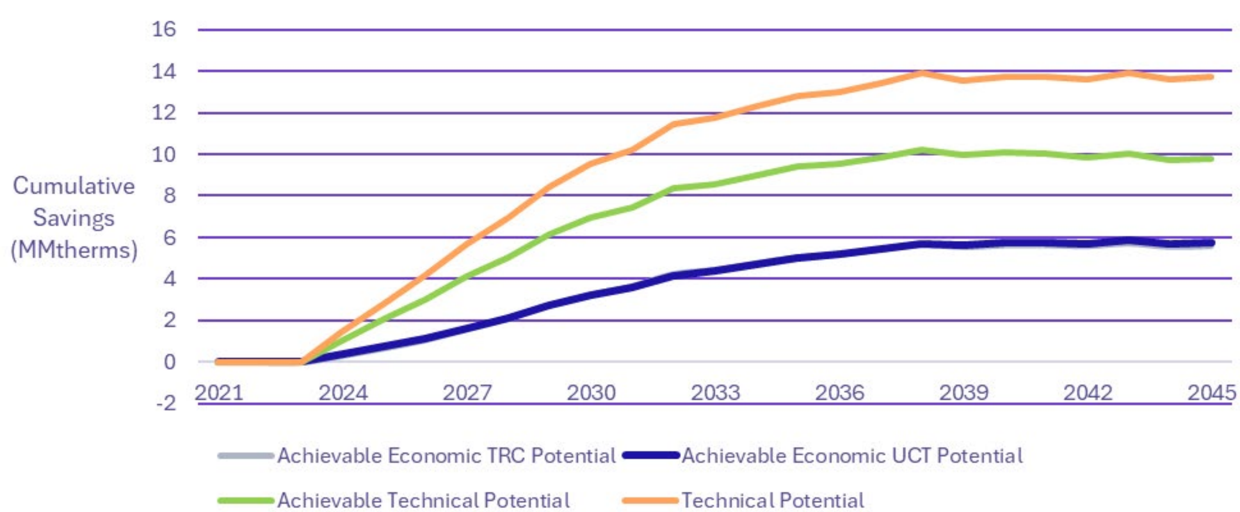
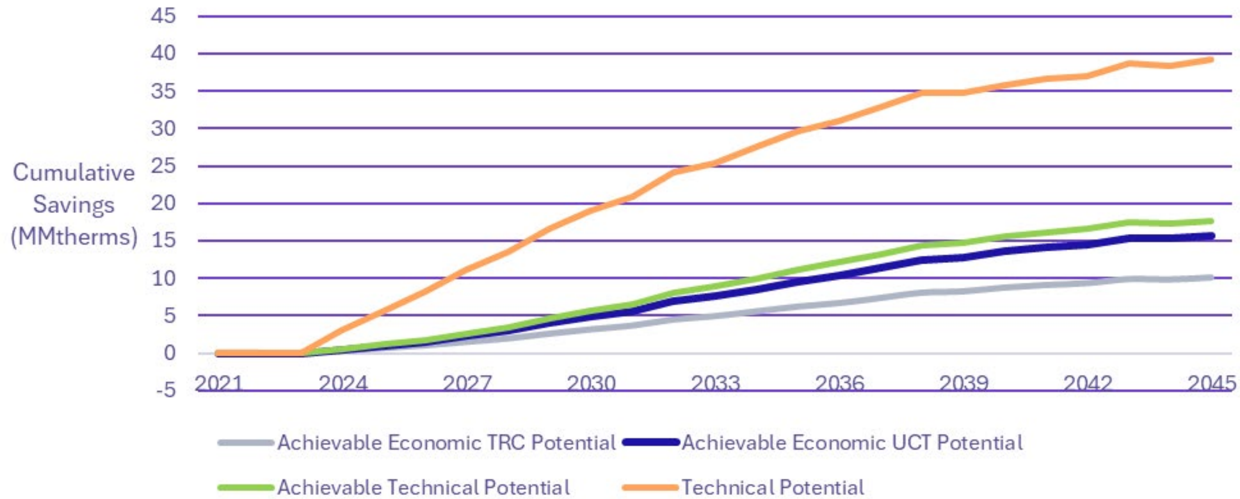


Figure 7-10 shows the Residential cumulative DSM forecast by Technical, Achievable Technical and both UCT/TRC Achievable Economic Potentials for scenario A.

Figure 7-10: DSM Cumulative Savings Forecast – Residential



Figures 7-11, 7-12, and 7-13 show the top 10 measures by sector for Scenario A with the most cumulative potential through 2045. Top ten measures account for more than 90% of all potential across the Industrial and Residential segments.

Figure 7-11 shows the top ten UCT measures for the Industrial program.

Figure 7-11: Top Ten 2045 Cumulative UCT Industrial Measures

Rank	Measure / Technology	Savings (mTherms)
1	Strategic Energy Management	349
2	Insulation - Roof/Ceiling	206
3	Gas Boiler - Insulate Hot Water Lines	186
4	Unit Heater	106
5	Process - Insulate Heated Process Fluids	104
6	Building Automation System	100
7	Gas Boiler - Insulate Steam Lines/Condensate Tank	91
8	Gas Boiler - Stack Economizer	83
9	Gas Boiler - Hot Water Reset	77
10	Gas Boiler - Burner Control Optimization	51

Figure 7-12 shows the top ten UCT measures for the Commercial program.

Figure 7-12: Top Ten 2045 Cumulative UCT Commercial Measures

Rank	Measure / Technology	Savings (mTherms)
1	Insulation - Roof/Ceiling	950
2	Unit Heater	861
3	Insulation - Wall Cavity	739
4	Boiler	366
5	ENERGY STAR Connected Thermostat	330
6	Furnace	237
7	Broiler	236
8	Gas Boiler - Insulate Hot Water Lines	222
9	Range	198
10	HVAC - Demand Controlled Ventilation	192

Figure 7-13 shows top ten UCT measures for the Residential program.

Figure 7-13: Top Ten 2045 Cumulative UCT Residential Measures

Rank	Measure / Technology	Savings (mTherms)
1	Furnace - Direct Fuel	4,449
2	Water Heater <= 55 gal.	2,414
3	Insulation - Ceiling, Upgrade	1,824
4	Fireplace	1,270
5	Insulation - Basement Sidewall	1,004
6	Insulation - Wall Cavity, Installation	995
7	Insulation - Ceiling, Installation	618
8	Ducting - Repair and Sealing	527
9	Insulation - Ducting	414
10	Water Heater - Pipe Insulation	283

As mentioned previously, the current LoadMAP model fully runs these alternative scenarios through 2045. Scenario B assumes a future scenario with high demand growth while Scenario C assumes a future scenario with low demand growth. The 2025 IRP Demand Forecast is lower overall than the 2023 CPA, even in Scenario B, the high demand growth scenario. The exception is in the Industrial sector, where the 2025 demand forecast is higher than in the 2023 CPA, which results in slightly higher Industrial potential in all scenarios. Scenario C, the low demand growth scenario is the only case in which there is a decline for Industrial savings by 2045.

The 2025 IRP has higher avoided costs than the 2023 CPA. This is also coupled with a higher discount rate which blunts some of the impact, particularly for longer-lived measures. In most cases this is insufficient to offset the drop in savings from the decrease in demand. Low Income residential is an exception here – many measures struggled with cost-effectiveness in 2023 CPA due to the lower consumption per home in those segments. The higher avoided costs are sufficient to cause more measures to pass, which offsets the population change and leads to higher energy savings potential for lower income participants in the residential prescriptive EE program in all three scenarios compared to the 2023 CPA.

Important to note, the updated IRP Reference case and the Alternative Scenario Models reflect any known changes to federal codes and standards that may have occurred since the 2023 CPA. These forecasts also include known local or municipal natural gas use restrictions at the time of the study. Cascade and AEG will continuously review these items in the upcoming 2025 CPA to continue improving forecasted baseline and savings estimates.

Figure 7-14 compares the portfolio cumulative achievable UCT potential of Scenarios A, B, and C compared to the original 2023 CPA.

Figure 7-14: Cumulative Achievable UCT Potential Scenario Comparison

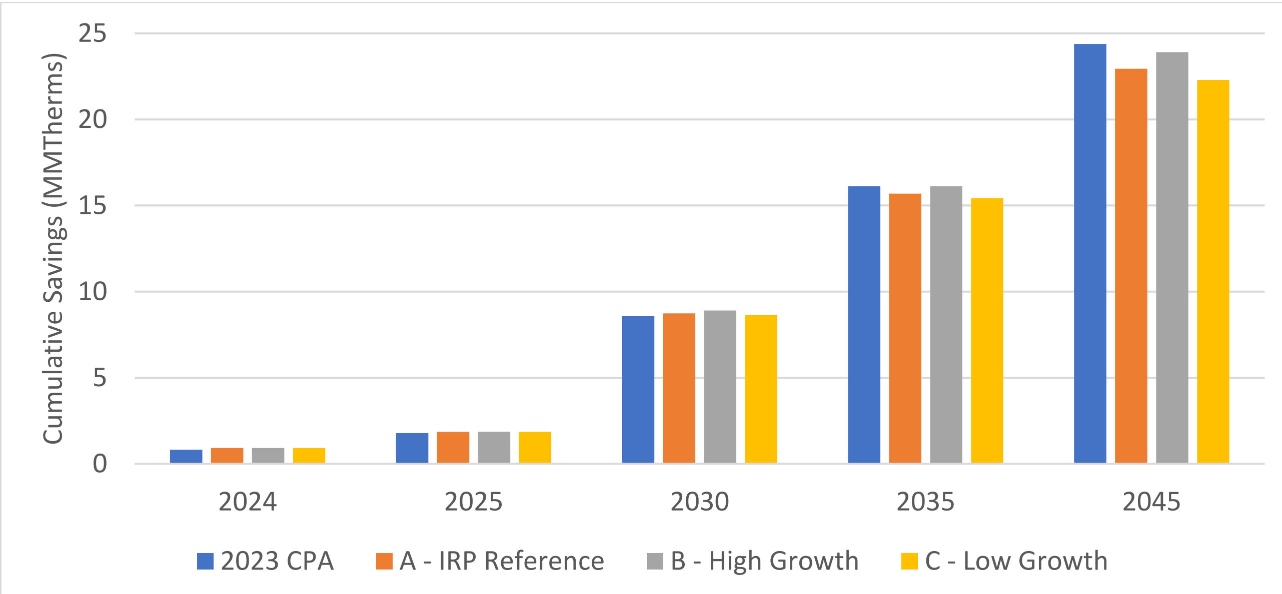


Figure 7-15 provides a comparison of savings potential for these three scenarios against the most recent CPA.

Figure 7-15: Cumulative UCT Potential Scenario Comparison

Scenario	Group	Sector	Sum of 2025	Sum of 2030	Sum of 2035	Sum of 2040	Sum of 2045
2023 Original	**Regular Income**	Residential	341.4	1,863.5	4,264.8	6,520.1	8,036.8
	Moderate Income	Residential	595.2	2,784.3	5,248.5	7,137.4	7,962.4
	Low Income	Residential	33.2	193.6	457.5	688.8	826.5
	Commercial	Commercial	670.3	3,128.5	5,099.4	5,979.6	6,128.6
	Industrial	Industrial	142.1	614.2	1,057.7	1,326.2	1,429.9
2023 Original Total			**1,782.2**	**8,584.1**	**16,127.9**	**21,652.0**	**24,384.3**
Reference - 2025 IRP	**Regular Income**	Residential	347.5	1,863.1	4,071.9	6,122.2	7,425.5
	Moderate Income	Residential	592.1	2,736.1	4,924.3	6,623.0	7,264.2
	Low Income	Residential	48.5	259.3	565.4	831.9	981.1
	Commercial	Commercial	733.0	3,219.1	5,005.3	5,728.6	5,747.3
	Industrial	Industrial	141.3	663.1	1,127.8	1,409.9	1,523.4
Reference - 2025 IRP Total			**1,862.4**	**8,740.8**	**15,694.8**	**20,715.6**	**22,941.6**
Low Growth	**Regular Income**	Residential	346.3	1,833.6	3,987.9	5,968.7	7,196.6
	Moderate Income	Residential	589.5	2,690.8	4,824.1	6,459.6	7,054.0
	Low Income	Residential	48.3	255.6	554.4	811.8	951.6
	Commercial	Commercial	734.6	3,259.2	5,057.3	5,753.5	5,748.6
	Industrial	Industrial	141.5	600.6	1,011.0	1,253.3	1,341.2

Low Growth Total			**1,860.2**	**8,639.9**	**15,434.6**	**20,246.9**	**22,291.9**
High Growth	**Regular Income**	Residential	347.5	1,895.0	4,183.0	6,337.4	7,761.7
	Moderate Income	Residential	592.1	2,781.2	5,049.1	6,842.0	7,573.7
	Low Income	Residential	48.5	263.4	580.2	860.5	1,025.0
	Commercial	Commercial	734.5	3,303.7	5,184.0	5,961.8	6,018.8
	Industrial	Industrial	141.3	663.1	1,127.8	1,409.9	1,523.4
High Growth Total			**1,864.0**	**8,906.4**	**16,124.2**	**21,411.5**	**23,902.7**

Importance of Outreach and Cohesive Messaging

Outreach and community engagement remains an integral tool to reduce energy use and increase program uptake. The EE department frequently reaches out to customers through the various media including:

- Bill inserts to all qualifying Washington rate schedule customers;
  - These are both hard copy and electronic with topics ranging from LI weatherization availability, high-efficiency water heating, whole home weatherization, commercial rebate availability, low cost/no cost savings recommendations, furnaces, combination units, etc.
- Radio campaigns highlighting Trade Ally contractors in select territories to promote the incentive program and general low cost/no cost options for reducing natural gas consumption. Outreach is provided in both English and Spanish;
- Leveraged messaging with community organizations and other utilities;
- Community project engagement;
  - When able the EE Department works with local nonprofit groups including Clean Air Agencies to promote more efficient use of natural gas over alternative heating fuels like uncertified wood burning fireplaces.
- The Company has also expanded its social media, and video streaming outreach in a remote environment;
- Business exposition tabling, community events and exhibitions;
- Targeted direct mail and email efforts;
- Virtual videos and event participation; and
- Targeted magazine and newspaper advertising incorporating QR codes for data gathering.

In addition to the standard practices, the Company provides specific details as part of its BCP where additional efforts above and beyond standard messaging are underway to help increase program participation. Examples of outreach can be found in the Company's Biennial Conservation Achievement Report.[4]

[4] 2022-2023 Biennial Conservation Achievement Report

Regional Efforts and Long-Term Benefits

Cascade is a founding member of the Northwest Energy Efficiency Alliance (NEEA) which provides additional efficiency savings by joining with other regional utilities. This consortium of funding utilities and energy efficiency stakeholders shares a common goal to increase market adoption of energy efficient natural gas products and practices in the future through market transformation, with longstanding effects on future therm saving opportunities.

Community engagement efforts in tandem with regional endeavors like the NEEA Natural Gas Market Transformation Collaborative have longstanding effects on future therm saving opportunities. The goal is to increase market adoption of energy efficient natural gas products and practices in the future.

Cascade's participation with the Alliance continues with efforts specifically centered on the Natural Gas Advisory Committee (NGAC), along with the Natural Gas Committee of the Board and the Board of Directors workshops and meetings. Company investment in NEEA is shown in Figure 7-16.

Figure 7-16: CNGC NEEA Financial Commitment Schedule

Year	CNGC Washington Commitment
2020	$348,908
2021	$348,908
2022	$348,908
2023	$348,908
2024	$348,908
Cycle 6 Total	**$1,744,540**
2025	$651,234
2026	$651,234
2027	$651,234
2028	$651,234
2029	$651,234
Cycle 7 Total	**$3,256,170**

Additionally, Cascade participates with NEEA on the Regional Building Stock Assessment (RBSA) reports as well as the Commercial Building Stock Assessment (CBSA). These assessments utilize existing building stock to account for regional differences such as climate, building practices and fuel choices and are frequently referenced in the CPA.

Adaptive Management

Economic impacts from COVID-19 are easing as access to labor and equipment improves for both residential and business customers in 2024. However, supply chain shortages and building material costs remain critical for decisions on high-efficiency equipment installations.

The previous biennium involved significant review of Washington state energy code, building requirements, and outlook on the future of energy efficiency in the Pacific Northwest. Cascade committed to staying abreast of environmental headwinds, building standards, and codes which disincentivize natural gas use as a focus of decarbonization efforts. The position of building code specialist was created and filled within the external affairs department to provide the Company with a dedicated code expert. Additionally, Cascade formed the EE West Department, integrating with Montana Dakota Utility Group's Intermountain Gas Company. This collaboration has focused on strengthened program delivery, outreach and education, commission relationships, and customer support which will be of great benefit in 2025 and beyond.

Conclusion

The LoadMAP modelling tool developed by AEG provides a detailed forecast of EE potential. Cascade's EE Department develops strategies to capture this savings potential across its service territory through implementation of programs, outreach, Trade Ally (TA) partnerships, Point of Sale Instant Rebate Program (POS), and the use of its third-party implementer TRC Companies for C/I program delivery. Cascade draws on years of experience to adaptively manage its DSM services and will continue to explore all options to actively capture savings to provide value to CNGC's customers, including potential enhancements resulting from contemplated tax credits, rebates, and new state and Federal incentives.

Cascade will begin implementing an internal rebate software solution in 2025 to improve rebate processing by leveraging information across the utility group. The goal of this software solution is to expedite the processing timeline and reduce friction in the rebate submittal and data storage processes. Additionally, Cascade has placed a continued focus on the TA network, and the POS Program, as these project streams constitute a significant opportunity for the program in the upcoming biennium.

The Commercial/Industrial Program is emerging from a period of supply chain slowdowns and decision delays which pushed project completion dates later than anticipated. The program has placed an emphasis on customer education and outreach to engage in conversations about high-efficiency gas use and the opportunities that are available to C/I customers under current codes and local legislation. There is a strong pipeline of projects going into 2025 with a positive outlook of meeting or exceeding therm savings goals for the program.

An enhanced focus will also be placed upon growing the LI program through revisions in measure offerings and fine-tuning energy savings assumptions. These initiatives along with other improvements in the adaptive management process sets the Residential, Commercial/Industrial, and Low-Income Weatherization programs up for success in the upcoming biennium.

Chapter 8

Distribution System Planning

Overview

Cascade strives to provide safe and reliable service to its customers. As part of Cascade's distribution planning process, Cascade reviews its systems for predicted growth and will identify and address future capacity deficits related to growth. If a capacity deficit is identified, reinforcement alternatives are compared, and the optimized reinforcement is selected and budgeted within Cascade's five-year budget with consideration to cost, system benefits, and long-term planning.

This section will cover how Cascade models its distribution systems, identifies deficits, proposes reinforcement options to address deficits, reviews and selects reinforcement options, and how projects are put into the capital budget.

System Dynamics

Cascade operates a diverse system through Oregon and Washington over a range of pipeline diameters and operating pressures. Cascade's natural gas distribution system consists of approximately 5,083 miles of distribution and 170 miles of transmission in Washington and 1,768 miles of distribution and 107 miles of transmission in Oregon. Cascade's system is also composed of facilities including regulator stations, valve stations, odorizers, heaters and compressors.

In general, Cascade's distribution systems originate at a gate station connected to an interstate pipeline. At the gate station, Cascade takes custody of the natural gas and provides odorization and pressure control to serve downstream distribution and transmission pipelines.

Network Design Fundamentals

A natural gas pipeline is constrained by the laws of fluid mechanics which dictate that a pressure differential must exist to move gas from a source to any other location on a system that has a demand. Equal pressures throughout a closed pipeline system indicate that neither gas flow nor demand exists within that system. When gas is removed from some point on a pipeline system, typically during the operation of natural gas equipment, then the pressure in the system at that point becomes lower than the supply pressure in the system. This pressure differential causes gas to flow from the supply pressure to the point of gas removal to equalize pressure throughout the distribution system. The same principle keeps gas moving from interstate pipelines to Cascade's distribution systems. It is important that engineers design a distribution system in which the beginning pressure sources, which could be from interstate pipelines, compressor stations or regulator stations, have adequately high pressure and the transportation pipe specifications are designed appropriately to create a feasible and practical pressure differential when gas consumption occurs on the system. The goal is to maintain a system design where load demands do not exceed the system capacity, which is constrained by minimum pressure allowances at a determined point, or points, along the distribution system, and/or maximum flow velocities at which the gas is allowed to travel through the pipeline and related equipment, and/or maximum volumetric flow through facilities.

Due to the nature of fluid mechanics, there is a finite amount of natural gas that can flow through a pipe of a certain diameter and length within specified operating pressures; the laws of fluid mechanics are used to approximate this gas flow rate under these specific and ever-changing conditions. This process is known as "pipeline system modeling". Ultimately, gas flow dynamics on any given pipeline lateral and distribution system can be ascertained for any set of known gas demand data. The maximum system capacity is determined through the same methodology while calculating customer usage during a peak heating degree day.

To evaluate intricate pipeline structures, a system model is created to assist Cascade's engineering team in determining the flow capacity and dynamics of those pipeline structures. For example, before a large usage customer is incorporated into an existing distribution system the engineer must evaluate the existing system and then determine whether there is adequate capacity to maintain that potential new customer along with the existing customers, or if a capacity enhancement is required to serve the new customer, and which capacity enhancement option is optimal. Modeling is also important when planning new distribution systems. The correct diameter of pipe must be designed to meet the requirements of current customers and reasonably anticipated future customer growth.

Modeling Methodology

Cascade utilizes a hydraulic gas network modeling and analysis software program called Synergi Gas, distributed and supported by DNV (software provider), to model all distribution systems and pipeline flow scenarios. The software program was chosen because it is reliable, versatile, continually improving and able to simultaneously analyze very large and diverse pipeline networks. Within the software program, individual models have been created for each of Cascade's various distribution systems including transmission and high-pressure laterals, regulator stations, compressor stations, distribution system networks and large diameter service connections.

Each system's model is constructed as a group of nodes and facilities. Cascade defines a node as a point where gas either enters or leaves the system, or a beginning and/or ending location of pipe and/or non-pipe components, a change in pipe diameter or an interconnection with another pipe. A facility is defined in the system as a pipe, valve, regulator station, or compressor station; each with a user-defined set of specifications. Cascade's distribution systems are broken into 12 models for ease of use and to reduce the time requirements during a model run analysis.

Synergi can analyze a pipeline system at a single point in time or the model can be specifically designed to simulate the flow of gas over a specified period of time, which more closely simulates real life operation utilizing gas stored in pipelines as line pack. While modeling over time an engineer can write operations that will input and/or manipulate the gas loads, time of gas usage, valve operation and compressor simulations within a model, and by incorporating the forecasted customer growth and usage provided within this integrated resource plan Cascade can determine the most likely points where future constraints may occur. Once these high priority areas are identified, research and model testing are conducted to determine the most practical and cost-effective methods of enhancing the constrained location.

Model Building Process

Cascade's models are rebuilt every three years and are regularly maintained between rebuilds. To rebuild the models, Cascade exports current GIS data to create the spatial models and exports historical billing data from CC&B to bring into the Customer Management Module (CMM) to create an updated demands file. Cascade's models were rebuilt in early 2024 and are scheduled for rebuild in 2027.

Usage-Per-Customer

The IRP process utilizes customer usage as an essential calculation to translate current and future customer counts into estimated demands on the distribution system and total demand for gas supply and interstate transportation planning. The calculated usage-per-customer is dependent upon temperature and geographic location.

Cascade utilizes a Customer Management Module (CMM) software product, provided by DNV as part of their Synergi Gas product line, to analyze natural gas usage data and to predict usage patterns on the individual customer level.

The first step in operating CMM is extensive data gathering from the Company's Customer Information System (CIS), CC&B. CC&B houses historical monthly meter read data for each of Cascade's customers, along with daily historical temperature and the physical location of each customer. The temperature data is associated with each customer based on location and then related to each customer's monthly meter read according to the date range of usage.

After the correct temperature information has been correlated to each meter read, a base load and temperature dependent load are calculated for each customer through regression analysis over the historical usage period. DNV states that it uses a “standard least-squares-fit on ordered pairs of usage and degree day” regression. The result is a customer specific base load that is temperature independent, and a heat load that is multiplied by a temperature variable, to create a custom regression equation.

Should insufficient data exist to adequately predict a customer’s usage factors, then CMM will perform factor substitution. Typically, the average usage of customers in the same geographical location and in the same customer rate class can be used to substitute load factor data for a customer which lacks sufficient information for independent analysis.

With all the structural shifts in historical data, and the significantly increased quantity of data utilized for regression, Cascade has selected a five-year time series to develop the usage-per-customer equations for model rebuilds. The selected time series is aligned with the recommended time study from DNV.

The Company recognizes that there could be significant differences in the way its customers use natural gas throughout its geographically and economically diverse service territory. Being sensitive to areas that may require capital improvements to keep pace with demand growth, Cascade separates customers by districts and then determines specific usages per customer for each.

Model Validation

To check the usage-per-customer, Cascade validates the models for a specific temperature event. To validate the model, Cascade will gather all pressures and flow data available on its system for a specific date and time and will then set the model to the temperature experienced to see how the model is performing. During model validation pressures and flows in the model are compared to actual pressure and flow data. Comparing the model results to actuals pressures and flows allow the Company to validate the model and have confidence that the usage-per-customer from CMM is accurate when compared to temperature and flow data in each geographic area.

Once a model is validated it is then ramped up to its peak degree day, based on 30 years of historical temperature data, to create a design day model. Cascade’s peak heating degree days by district are shown in Figure 8-1.

Figure 8-1: Peak Heating Degree Day

District	HDD	Avg Daily Temperature (ºF)
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

As can be seen from Figure 8-1, Cascade operates in diverse regions that range from coastal to desert, which is why the models are broken down by district. Cascade heating degree day calculations are based on customers turning on their heat when temperatures drop below 60 degrees Fahrenheit. The heating degree day is calculated by subtracting the average daily temperature from 60 degrees Fahrenheit.

Distribution System Planning

Cascade spends significant time and resources on building and maintaining its design day models. Cascade uses its design day models to review large customer requests, model renewable natural gas injection onto Cascade's systems, design and size pipe and non-pipe facilities, long term planning, model growth predictions, identify system deficits, determine system reliability, generate emergency plans during large system outages and line breaks, optimize enhancement options and support cold weather action plans.

A system deficit is defined as a critical system that has reached or exceeded the capacity to serve customer demands. Critical system examples that limit capacity include pipeline diameter restrictions (a.k.a. bottlenecks), below minimum inlet pressure to a regulator station or high pressure system to meet a downstream operating pressure, not meeting a required customer delivery pressure, or a physical component that is limiting capacity like a regulator which has a rated flow capacity for the specific conditions that the regulator is operating under as published by the manufacturer.

As part of the IRP process, Cascade completes a comprehensive review of the distribution system models to ensure that the Company can maintain reliable service to customers during design day events. Cascade also completes annual reviews of its distribution system models as part of the annual budgeting process and continually updates the five-year budget, as needed, based upon new information that impacts the five-year plan. If a deficit is predicted, the system is evaluated, and reinforcement options are reviewed, with an optimized reinforcement selected. The selected reinforcement will then be placed into the capital budget based on the timing needs of the predicted deficit.

The Engineering Services department works closely with Field Operations, Energy Services, and district management to assure the system is safe and reliable. As towns develop, the need for pipeline expansions and reinforcements increase. The expansions are historically driven by new city developments or new housing plats. Before expansions and installation can be constructed to serve these new customers, engineering analysis is performed. As new groups of customers seek natural gas service, the models help engineers determine how best to serve them reliably. To review distribution system plans over the next 5 years, see Appendix I.

Distribution System Enhancements

Once a deficit has been identified, Engineering will propose enhancement solutions to address the deficit. Each of Cascade's systems are unique in pipeline dynamics and will be optimized using different enhancement solutions.

Distribution enhancements typically include:

- Pipeline reinforcements;
- Pipeline loop and/or back feed;
- Operating pressure increase;
- Uprate;
- Facility upgrade;
- Additional regulator station or gate station supply;
- Compressor station; and/or
- Demand side management strategies.

Pipeline looping is the most common method of increasing capacity in an existing distribution system. It involves installing new pipe parallel to an existing pipeline that has, or may become, a constraint point. Constraint points inhibit flow capacities downstream of the constraint creating inadequate pressures downstream during periods of high demand. When the parallel line connects to the system, this alternative path allows natural gas flow to bypass the original constraint and bolsters downstream pressures. Looping can also involve connecting previously unconnected mains. The feasibility of looping a pipeline depends upon the location where the pipeline will be constructed. Installing gas pipelines through private easements, residential areas, existing asphalt, environmentally sensitive areas, and steep or rocky terrain can increase the cost to a point where alternative solutions are more cost-effective.

Pipeline replacement involves replacing existing pipe with a larger diameter pipe. The increased pipe diameter relative to surface area results in less friction loss, larger flow capacity, and therefore, a lower pressure drop. This option is usually pursued when a pipe is damaged or has potential integrity issues. If the existing pipe is otherwise in satisfactory condition, the pipeline looping option is typically optimal, as it continues to utilize existing pipe.

Pipeline uprating increases the maximum allowable operating pressure of an existing pipeline. This enhancement can be a quick and relatively inexpensive method of increasing capacity in the existing distribution system instead of constructing more costly additional facilities. However, safety considerations and pipe regulations may prohibit the feasibility, or lengthen the time before completion of this option. Also, increasing pipeline pressure may produce leaks and other pipeline damage, creating costly repairs, or prohibiting the proposed uprate altogether. A thorough facility review is conducted to ensure pipeline integrity before an uprate is conducted.

Pressure regulators or regulator stations reduce pipeline pressure at various stages in the distribution system. Regulation provides a specified and constant outlet pressure before natural gas continues its downstream travel to a city's distribution system, a customer's property, or a natural gas appliance. Regulators also ensure that flow requirements are met at a desired pressure regardless of pressure fluctuations upstream of the regulator. Regulators are at gate stations, district regulator stations, high pressure service sets, farm taps, and customer meters. Utilization and strategic positioning of new regulator stations can be very helpful in increasing system reliability and capacity

Compressor stations present a capacity enhancing option for pipelines with significant natural gas flow and the ability to operate at elevated pressures. For pipelines experiencing a relatively high and constant flow of natural gas, a large volume compressor installation along the pipeline will boost downstream pressure, which will increase the downstream capacity of the pipeline.

A second option is the installation of smaller compressors located close together or strategically placed along a pipeline. Multiple compressors accommodate a large flow range and use smaller and reliable compressors. These smaller compressor stations are well suited for areas where gas demand is growing at a relatively slow and steady pace, so the purchase and installation of these less expensive compressors over time allows a pipeline to serve growing customer demand into the future.

Compressors can be a cost-effective option to resolve system constraints; however, land constraints, regulatory and environmental approvals, along with engineering and construction, can be significant deterrents. Adding compressor stations typically involves considerable capital expenditure along with long-term operations and maintenance costs for the life of the facility.

Targeted demand side management is another approach to address distribution system deficits. For targeted demand side management to be considered, the deficit predicted must be reasonably obtained through demand side management goals and must have time for the program to effectively reduce demand. Per the Energy Trust of Oregon, they recommend that a DSM project has 3 to 5 years to be implemented and determine if results of the DSM project is effectively remediating the distribution system deficit. If demand side management is not effective in the timeline predicted, Cascade will move forward with completing the distribution system enhancement to avoid the predicted deficit.

Distribution System Enhancement Considerations

Each distribution system enhancement option is analyzed during the selection process with consideration to scope, cost, timing, system benefits, long-term planning and feasibility. For any project over $1 million there is a more robust analysis for the project and supporting documentation, and engineers work collaboratively with management and directors to examine pipeline alternatives to ensure all alternatives are considered.

Distribution System Enhancement Selection Guidelines

Engineers work collaboratively with managers and directors to select the most favorable enhancement solution to address potential deficits. Engineering uses the following criteria to select distribution system enhancements:

- Non-pipe options, including:
    - Pressure Increases/Uprates, if feasible;
    - Demand side management if load reduction will eliminate need for reinforcement and the Company has time to see impacts; and
    - Compressor Stations if permitting is favorable, land is available, and the

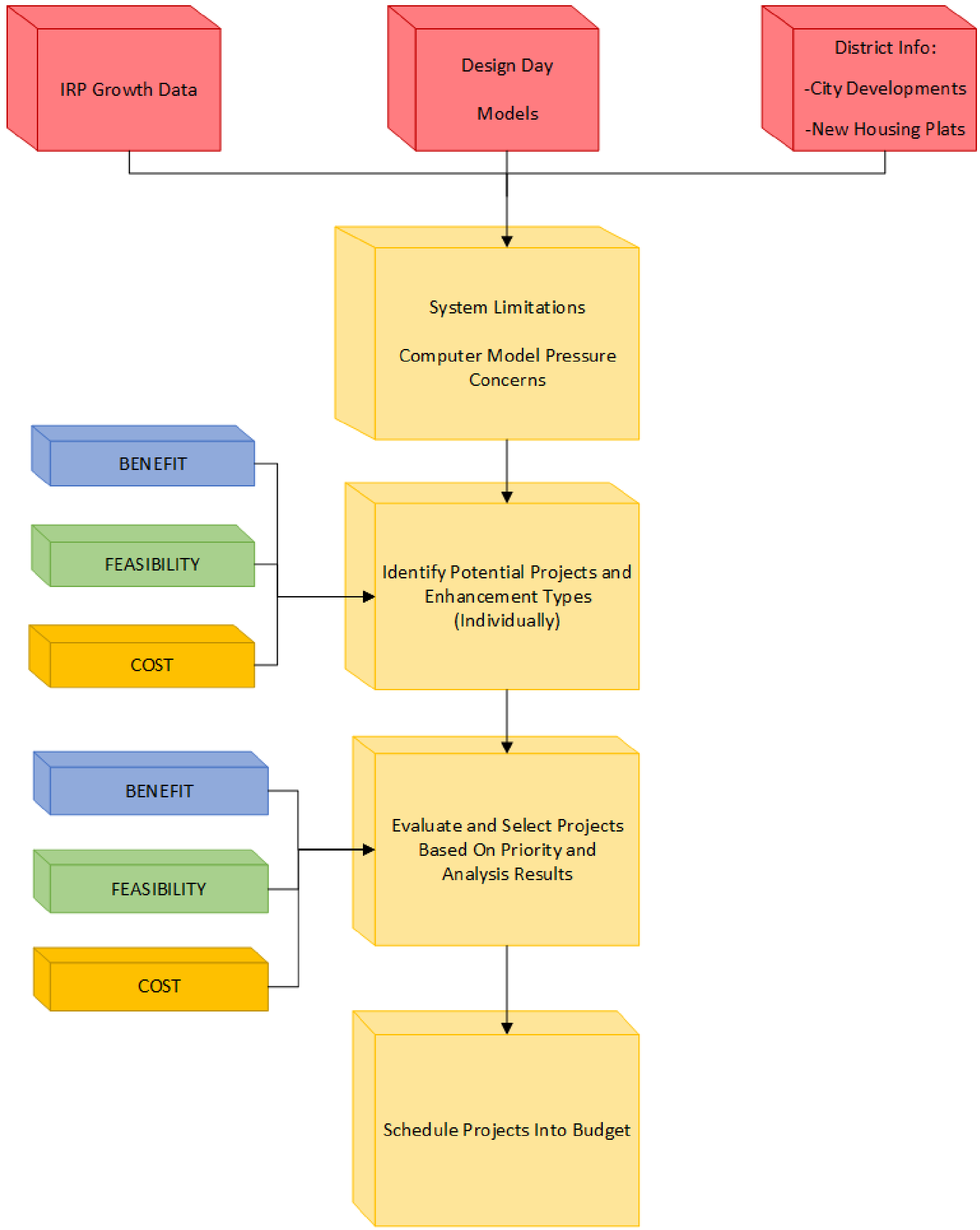
project is cost-effective.

- Pipe options:
  - The shortest segment(s) of pipe that addresses the deficit;
  - The segment of pipe with the most favorable construction conditions that support long term operations and maintenance activities;
  - Route selection that minimizes environmental concerns;
  - Route selection that minimizes impact to the community;
  - Route selection that provides opportunity to add additional customers;
  - Identify community vulnerabilities;
  - Resources to community, i.e. provide disaster preparedness, response, and mitigation resources in the event of environmental risk; and
  - Total construction costs including restoration.

Capital Budget Process

Cascade annually goes through a capital budget process to approve a five-year capital budget. Cascade's annual budget process begins in June and will typically go through three to five revisions before it is accepted and approved in late November by the board of directors. Engineers support the capital budgeting process by submitting distribution system enhancement projects to the budget. Engineers will work collaboratively with managers and directors to prioritize projects in the budget based on predicted timings needs with the goal of minimizing risk to ensure that the Company can continue to provide safe and reliable service to Cascade's customers. Figure 8-2 provides a schematic representation of the distribution system selection process to the capital budget.

Figure 8-2: Distribution System Planning Process Flow



Cascade's budget goes through several revisions and reviews at all levels in the organization to make sure that projects are properly justified and necessary. Every year as part of the capital budget procress Cascade projects are re-reviewed and revisions will be made to the projects, as needed, as new information becomes available as part of the iterative IRP process.

Conclusion

Cascade's goal is to maintain a reliable natural gas distribution system in order to cost-effectively deliver natural gas to every core customer. This goal relies on Cascade being proactive in addressing current and future system deficits. Cascade's five year capital budgeting process allows time for projects to go through alternative analysis considerations, and allows extended design and construction timelines required for large projects. The iterative process of Cascade's IRP and capital budgeting process will allow Cascade the ability to adapt to the changing dynamics of the natural gas industry. These dynamics include renewable natural gas supply options, targeted demand side management, electrifican, building code changes, energy efficiency programs and hydrogen blending.

Chapter 9

Resource Integration

Overview

Resource integration is the last step in Cascade's IRP process. It involves finding the reasonable least cost and least risk mix of reliable demand and supply side resources to hit emissions targets while serving the forecasted load requirements of the core customers. The tool used to accomplish this task is a computer optimization model known as PLEXOS®.

PLEXOS® is very powerful and complex. It operates by combining a series of existing and potential demand side and supply side resources and optimizing their utilization at the lowest net present cost over the entire planning period for a given demand forecast. PLEXOS® permits the Company to develop and analyze a variety of resource portfolios quickly, to determine the type, size, and timing of resources best matched to forecast requirements.

Key Points

- Cascade utilizes PLEXOS® to find the optimal solve for forecasted resource deficiencies, as well as alternative portfolios.
- Cascade has modeled several portfolios around growth scenarios, analyzing the impacts of deterministic and stochastic results of low carbon alternative fuels.
- Cascade modeled electrification from a utility cost perspective as well as a consumer perspective.
- Under a relatively flat or declining growth, Cascade will be seeking opportunities to temporarily or permanently release capacity.
- Cascade will add storage in 2029 to maintain flexibility, price arbitrage opportunities, and reliability to best serve customer's needs.
- Cascade will utilize allowances in near- to mid-term to meet carbon compliance requirements with an eye on carbon capture and Renewable Thermal Certificates in the long-term.

Supply Resource Optimization Process

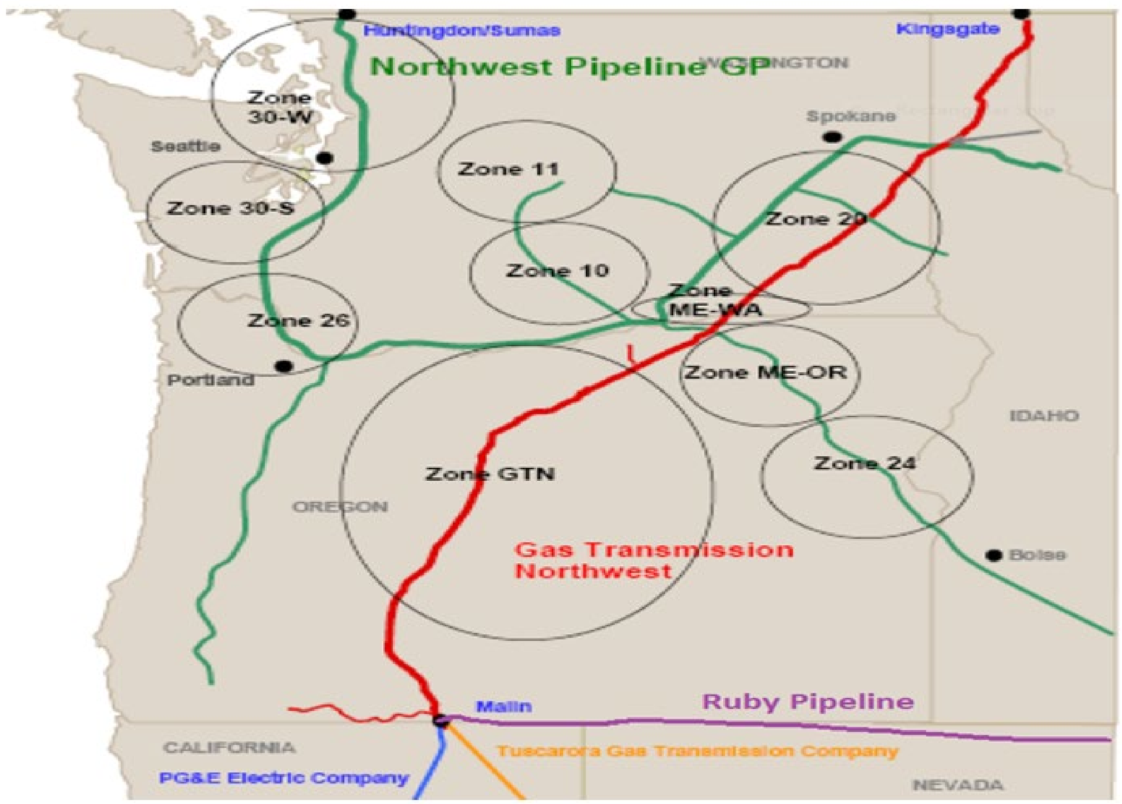
To effectively meet customer needs, Cascade must have a clear understanding of future demand. This involves analyzing various factors such as population growth, economic trends, public policies, and seasonal variations. By understanding demand profiles, the utility can ensure a reliable supply of natural gas, avoiding shortages during peak times and minimizing excess supply during periods of low demand. This foresight is crucial for maintaining customer satisfaction and operational efficiency.

Cascade's portfolios are strategically designed to address different growth scenarios: low, flat, and high. As mentioned in Chapter 3, Demand Forecast, the low growth portfolio prepares for declining demand. The flat growth portfolio maintains steady demand levels. Meanwhile, the high growth portfolio anticipates increases in demand. Additionally, electrification is considered as an alternative to low carbon alternative fuels in these scenarios. This would involve transitioning from natural gas to electric-powered systems, which could help reduce greenhouse gas emissions and align with broader decarbonization goals. By planning for these varied scenarios, Cascade can adapt to changing conditions and continue to meet customer needs effectively.

Planning and Modeling

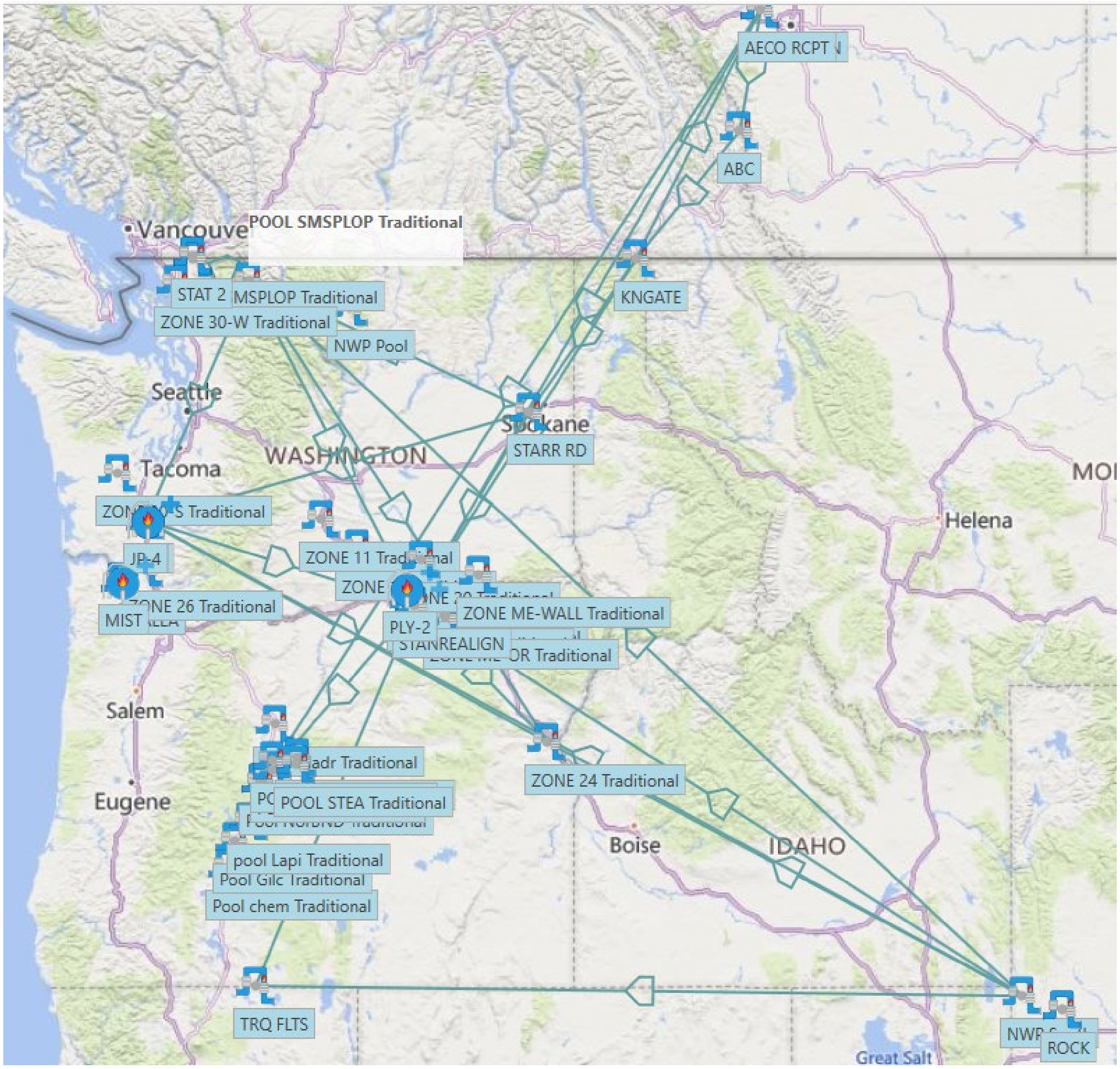
PLEXOS® has broad capabilities that allow the Company to develop supply and demand relationships that closely mirror Cascade's existing operations. Figure 9-1 shows the location of these pipeline zones. These pipeline zones reflect Cascade's customers being served from either Northwest Pipeline LLC (NWP) or Gas Transmission Northwest (GTN) interstate pipeline facilities.

Figure 9-1: Pipeline Zones Used in this IRP



With the in-house load forecast model (LFM) application, which is discussed in detail in Chapter 3, Demand Forecast, modeling dives into an even more granular level. This IRP takes a pipeline zonal and rate schedule view, which allows Cascade to take a deeper view of capacity shortfalls and potential constraints. A copy of the network diagram is shown in Figure 9-2. The network diagram is provided for illustrative purposes to emphasize the difficulties in configuring the model to best replicate Cascade's complex system rather than being provided for its readability.

Figure 9-2: Network Diagram of Cascade's System



Risk

Managing risk is a critical aspect for Cascade Natural Gas as it aims to serve customers with the least cost option. One significant risk factor is accurately predicting demand. Fluctuations in demand can be influenced by various factors such as economic conditions, population growth, and seasonal changes. If demand is underestimated, Cascade may face shortages during peak times, leading to customer dissatisfaction and potential financial losses. Conversely, overestimating demand can result in excess supply and wasted resources. Therefore, an accurate understanding of demand is essential to balance supply and demand effectively.

Another major risk involves evolving policies around building codes and decarbonization efforts, particularly under the Climate Commitment Act (CCA) in Washington and the Climate Protection Program (CPP) in Oregon. These regulations require Cascade to reduce greenhouse gas emissions, which may involve significant investments in infrastructure upgrades or transitioning to low-carbon alternative fuels. The cost and supply of these alternative fuels, such as renewable natural gas or hydrogen, can be unpredictable and may pose financial risks. Additionally, policies favoring electrification over natural gas could reduce demand for natural gas, impacting Cascade's revenue and operational strategies.

The reliability of the natural gas supply and its impact on the electric grid also present substantial risks. Cascade must ensure a consistent and reliable supply to avoid disruptions, especially during extreme weather events or geopolitical tensions that can affect supply chains. Moreover, as electrification increases, the demand on the electric grid will rise, potentially leading to higher peak loads and the need for additional infrastructure investments. Balancing the reliability of natural gas supply while supporting the electric grid's stability is crucial for maintaining customer trust and meeting energy needs efficiently. The largest risk currently is the cost and supply of low carbon alternative fuels. Stochastic analysis of these low carbon alternative fuels will be important to understanding the risk impacts and developing robust strategies to mitigate them.[1]

Stochastic Methodology Discussion

Cascade runs its Monte Carlo simulations on several different aspects of the IRP.[2] Most notably, Monte Carlo simulations are used to create different weather profiles for annual and peak day demand. The Company is continuing to use its own Monte Carlo simulation engine, built in R, to generate stochastic results.[3] This tool allows Cascade to be more detailed by running Monte Carlo simulations on daily data and creating multiple weather patterns. Utilizing R to run stochastic analysis allows Cascade to be transparent on each step of the stochastic analysis process. Using historical data for weather and gas prices, along with Cholesky decomposition matrices,[4] Cascade runs a 200 draw Monte Carlo simulation on price and weather to identifying the nth percentile draw and analyzing that one draw.[5] This allows Cascade

[1] Stochastic refers to the property of being well-described in modeling by a random probability distribution.
[2] Monte Carlo simulations are computational algorithms based on repeated random sampling to obtain numerical results.
[3] R is a programming language for statistical computing written primarily in C, Fortran, and R itself.
[4] Cholesky Decomposition is a tool in the context of multivariate statistics and linear algebra that simplifies computational techniques, particularly in optimization, numerical solutions of differential equations, and simulation.
[5] Nth denotes an unspecified member of a series of numbers

to analyze stochastic long-term success probabilities and identify when shortfalls may occur under extreme conditions.

The Cholesky decomposition matrix is a positive-definite covariance matrix. This matrix is used to draw or sample random vectors from the N-dimensional multivariate normal distribution that follows a desired distribution. In Cascade's case, the Cholesky decomposition matrix allows for correlations between weather zones to be included when drawing or sampling data distributions for Monte Carlo runs. Figure 9-3 shows Cascade's historical correlations between weather stations for the month of January. A realistic Monte Carlo draw would show similar correlations between weather stations, which Cascade manages to accomplish with the Cholesky Decomposition Matrix. By correlating random variables, there is always the potential issue of overfitting and not allowing for enough randomness between each draw. Also, Cascade is aware of the possibility of introducing bias into its models. Cascade is monitoring this by constantly evaluating and cross validating the results.

Figure 9-3: January Historical Correlations between Weather Stations

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

Stochastic analysis of price presents a different set of challenges. Cascade performs its Monte Carlo simulation on each of its basins, correlating the simulation results to each other similar to how weather is correlated. Prices also follow a different distribution from weather, which adds a layer of complexity. Heating Degree Days (HDDs) have historically shown to be distributed normally, which allows for the use of Gaussian distributions in weather stochastic analysis, and while the month-to-month percentage changes in gas prices are shown to be normally distributed, gas prices tend to follow a more lognormal distribution. Practically speaking, prices appear to be just as likely to move up or down month over month, but the dollar impact of these movements is greater for price increases. For example, with a starting price of $2/Dth, five straight months of 10% gains result in an increase of $1.22/Dth, while five straight months of 10% losses result in a loss of $0.82/Dth.

Cascade models these price movements with a Geometric Brownian motion stochastic process.[6] For each of its 200 draws, the month over month price change is determined by two elements: a drift term and a shock term. The drift term is the expected movement of the basin pricing, derived from the Company's price forecast. The shock term is the main stochastic element, which takes the month over month return variance and multiplies it by a random normal variable to create a normal distribution of price movements for a given month, and a lognormal distribution of prices as illustrated above.

As mentioned in Chapter 4, Supply Side Resources, Cascade is leveraging the expertise of the consulting firm ICF to explore and implement low-carbon alternative fuels, such as renewable natural gas and hydrogen. This collaboration is crucial as it helps Cascade align with the Climate Commitment Act in Washington and the Climate Protection Program in Oregon, both of which mandate significant reductions in greenhouse gas emissions. By utilizing ICF's insights and modeling, Cascade can better understand the feasibility, costs, and supply dynamics of these alternative fuels. This knowledge is essential for developing strategies that ensure a reliable and sustainable energy supply while meeting regulatory requirements and supporting broader decarbonization goals

A more in-depth breakdown of the data justifying this new methodology, including the monthly present value revenue requirement (PVRR) calculations of a sampling of stochastic draws, can be found in Appendix G.

Key Inputs

Individual transportation segments, storage, supply and demand side resources, both existing and potential, are targeted to demand segments representing the citygates connected to the system and the various classes of core customers behind those gates. This level of precision allows PLEXOS® to consider each resource on an individual basis within the portfolio while also recognizing where physical system limitations exist. Resource characteristics such as a supply contract's daily delivery capability, minimum take requirements, maximum daily transport capability by individual segment, storage inventory limitations and withdrawal, and injection curve characteristics are part of each resource's basic model inputs. The ability to model resources in this fashion allows PLEXOS® to tailor the optimization within envisioned constraints and ensures that the model's optimal solution can work under anticipated operating conditions.

In PLEXOS®, each supply contract requires a Maximum Daily Quantity (MDQ) input to establish its specific delivery capabilities. Review of the daily, annual, monthly, or

[6] A geometric Brownian motion is a continuous-time stochastic process, important for satisfying a stochastic differential equation

seasonal minimum utilization of the contract is required. Maximum take quantities can also be established on either an annual, monthly, or seasonal basis. The commodity rate input can reflect either a known price, in the case of a fixed cost contract, or index prices, if the user has established a representative index as a separate input item. Several fixed and variable cost rate inputs are also available for establishing separate contract cost items, if necessary. Most of the gas supply options discussed above are also available as transportation inputs.

Penalty rates on an annual, seasonal, monthly, or daily basis are needed if either minimum or maximum utilization requirements are required or desired. The penalty rate can be any amount desired or a specific amount if known. The intent of the penalty option is to direct PLEXOS® to adhere to whatever minimum or maximum characteristic is specified.

Resource mix is one of the more powerful and highly desirable input tools available in the model. By toggling on resource mix and providing an MDQ maximum and minimum, the analyst directs PLEXOS® to appraise the supply contract, on a total cost basis, against all other supply resources available within the portfolio. Under resource mix, PLEXOS® will determine whether the resource is desirable within the portfolio and at what MDQ size, within the MDQ maximum and minimum, the resource should be made available within the portfolio. This aspect of PLEXOS® is crucial to the evaluation of potential resources, as the Company conducts its resource planning, appraisal, and acquisition activities.

In addition to most of the items discussed above, storage resources have additional input considerations. Instead of MDQ inputs, the analyst establishes inventory maximums and/or minimums. If monthly inventory levels are to change over the years or within a year, PLEXOS® allows the analyst to establish that target. Injection and withdrawal capability, as well as the period within the year that each is available, are also input decisions.

A unique feature of PLEXOS® storage input is the Storage Volume - Dependent Deliverability (SVDD) Tables. This input item allows the analyst to tailor injection and withdrawal rates as either a line or step function based upon whether the facility has varying operating pressure constraints as the injection or withdrawal activity is conducted. The analyst can also establish whether inventory exists at the beginning of the planning period, and whether various prices and specific quantities exist at that time. PLEXOS® provides the analyst with five separate volume and price levels to reflect existing inventories.

Finally, PLEXOS® allows for input of a penalty rate for unserved demand. Cascade uses this functionality to give PLEXOS® a way to prioritize which rate tariff to serve when demand is higher than the resources available to serve that demand. These penalties are always higher than the cost of any incremental resources, as PLEXOS® configured to always elect to purchase these resources versus leaving demand unserved. Residential customers are always assigned the highest penalty. This tells PLEXOS® to prioritize serving these customers above all others. Commercial customers have the next highest penalty, followed by commercial/industrial customers, and finally industrial customers. It is important to note the customers on an interruptible tariff do not have a penalty assigned to leaving their demand unserved. This allows PLEXOS® the flexibility to serve the demand of these customers, when possible, while making sure not to purchase additional resources if they will only be used to serve interruptible demand.

Decision Making Tool

Analysis of optimization model results and other operational and contractual constraints allows Cascade to make more informed resource decisions. The IRP optimization model output and Monte Carlo simulation analysis provide the quantifiable output from numerous model inputs. The model does not prescribe the ultimate resource portfolio. It can only calculate the least cost set of resources given their specific pricing and quantifiable constraint characteristics. However, many other resource combinations may be available over the planning horizon. Therefore, Cascade must include subjective risk judgments about unquantifiable and intangible issues related to resource selections. These include future flexibility, supplier deliverability risk, pipeline(s) risk, financial risk to the utility and its customers, operational constraints, regulatory risk, electrification risk, etc. The risk judgments are combined with the quantitative IRP analyses to form the actual resource decisions.

Resource Integration

The following subchapters summarize the preceding chapters bringing together the demand forecast, existing supply and demand side resources and potential alternative resources to develop the 26-year, most reasonably priced reliable portfolio.

Demand Forecast

Load across Cascade's two-state service territory is expected to be relatively flat to slightly declining. Load growth through 2050 across Cascade's system is expected to fluctuate due to the Plan accounting for leap years and the inclusion of retail rates in the customer growth and the load forecast models. Specifically, Washington load growth is expected to fluctuate between -0.09% and -0.06% annually. When Demand Side Management (DSM) projections are included, the anticipated average annual growth rate in Washington drops from -0.09% to -0.42%, representing approximately 22 million therms saved by 2050. Load growth is split between residential, commercial, and industrial customers. Cascade's reference case forecast anticipates flat customer counts, with a decline in use per customer. System core peak day average annual growth over the planning horizon is expected to be approximately 0.11%.

Long-Term Price Forecast

In Chapter 4, Supply Side Resources, Cascade discusses how the 25-year price forecast is based on a blend of current market pricing along with long-term fundamental price forecasts. Since pricing on the market is heavily influenced by Henry Hub prices, the Company closely monitors this market trend. The fundamental forecasts of Wood Mackenzie, the Energy Information Administration, the Northwest Power and Conservation Council, and trading partners are resources for the development of Cascade's blended long-range price forecast. Since the Company's physical supply-receiving areas (Sumas, AECO, and Rockies) are at a discount or premium compared to Henry Hub, the Company utilizes the basis differential from Wood Mackenzie's most recently available update and compares that to the future markets' basis trading as reported in the public market.

Natural gas prices had stabilized for a period after dramatic fluctuations over the course of the last fifteen years. Figure 9-4 shows the history of regional and Henry Hub prices over the past ten years. The shale boom, environmental concerns around carbon, conservation efforts, and improvements in renewable energy had led to a market with prices as low as they have been in recent history. Recently, volatility has reentered the markets, starting at the end of 2018 with the Enbridge pipeline explosion. The inability to move gas from British Columbia to the U.S. Pacific Northwest created extreme upward pricing pressure across the region, and specifically at the Sumas basin. Once the pipeline was repaired, pricing stabilized by the summer of 2019 for a period. Recently, uncertainty regarding recovery from the COVID-19 pandemic, geopolitical threats, and an increase in exports from the US have created a period of short-term high volatility, through Cascade does not expect these bullish forces to be sustained in the long term. Cascade's price forecast does not include a tariff impact for two reasons; the forecast was locked in prior to the tariff and its uncertain how long import tariff's may last.

Figure 9-4: Historical Regional Pricing for Past Ten Years

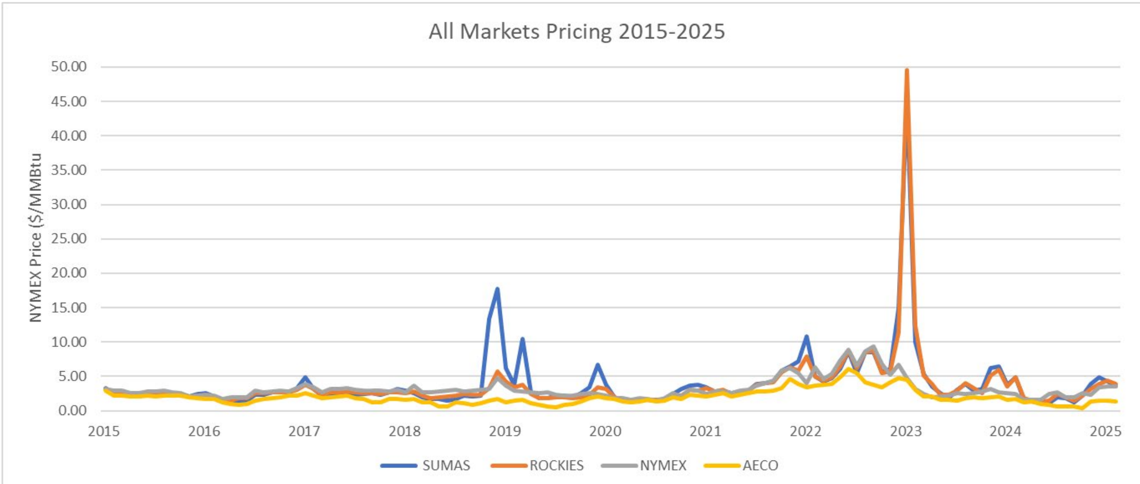
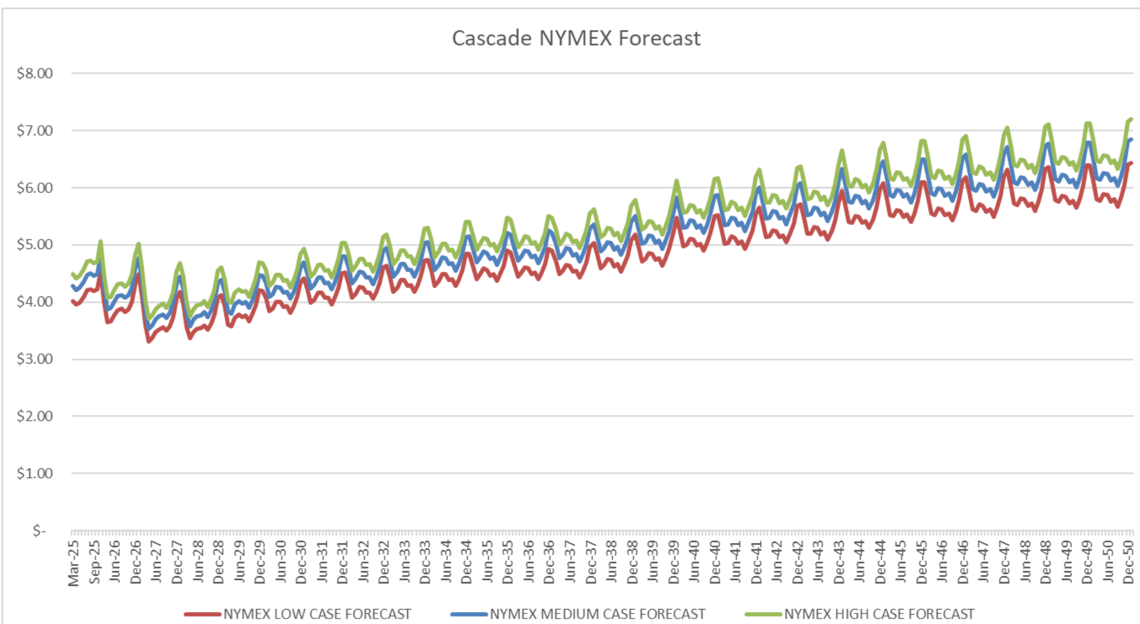


Figure 9-5 shows the comparison of ranges of NYMEX pricing for the planning horizon, including the expected low, medium, and high price.

Figure 9-5: NYMEX Annual Price Comparison



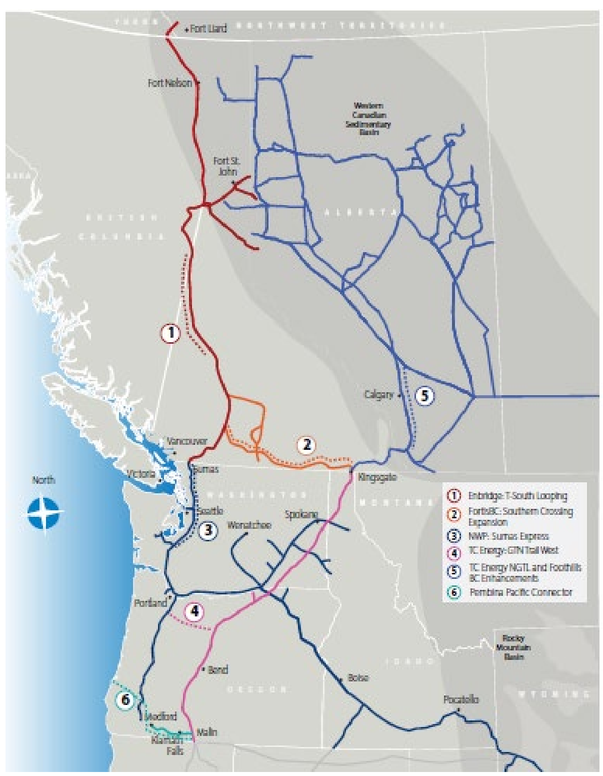
Environmental Adder

As discussed in Chapter 5, Avoided Cost, Cascade included a 10% environmental adder for non-quantifiable environmental benefits as recommended by the Northwest Power and Conservation Council in its 2025 IRP's 25-year price forecast.

Transportation/Storage

Chapter 4, Supply Side Resources, describes the range of current upstream pipeline transportation capacity and storage services under contract to serve core customers. Additionally, the Company identified several proposed transportation resources, as seen in Figure 9-6, such as a potential expansion of NWP along the I-5 corridor and acquiring currently unsubscribed GTN capacity that can be used to meet customer growth and address potential capacity shortfalls. The Company also continues to work with NWP to look at re-aligning Cascade's contracted delivery rights (i.e. Maximum Daily Delivery Obligations or MDDOs) to citygates with potential peak day capacity shortfalls. The Company also uses segmenting pipeline capacity as a way to maximize the utilization of Cascade's capacity. These resources, plus leasing incremental storage at several regional facilities, were all considered as a resource mix of possibilities to form the Company's 26-year integrated resource portfolio.

Figure 9-6: Alternative Transportation Resources[7]



[7] Northwest Gas Association (NWGA) 2020 Pacific Northwest Gas Market Outlook 2020

Demand Side Management

Chapter 7, Demand Side Management, describes the methodology used to identify energy efficiency potential and the interactive process that utilizes avoided cost thresholds for determining the cost-effectiveness of energy efficiency measures on an equivalent basis with supply side resources. For the 2025 IRP the nominal system avoided costs ranges between $1.38/therm and $2.54/therm over the 25-year planning horizon. Through the cost-effective use of energy efficiency programs, the Company is able to reduce the load and emissions that otherwise must be met by more costly resources, such as a pipeline capacity expansion or renewable natural gas (RNG).

Cascade's DSM forecast is incorporated into its optimization modeling by converting the heat and base load forecasts into a peak and non-peak DSM factor. The peak day factor is the ratio of forecasted peak day demand to annual demand, while the non-peak factor is equal to one divided by the number of days in that year. These values are then allocated to the pipeline zonal level and loaded into PLEXOS® to model the impact of conservation on resource acquisition needs. From a technical standpoint this is done by creating a must-take resource that acts like a supply at the zonal level equal to the peak and non-peak DSM values. While it is not actually a supply, this methodology tells PLEXOS® to use DSM to decrement demand by the forecasted energy efficiency quantities before any resource acquisition decisions are made.

Results

After incorporating these inputs into the PLEXOS® model, Cascade began its analysis by running an "As-Is" portfolio under low, reference, and high growth. For the purpose of the 2025 IRP, this modeling exercise assumed only known RNG, no Hydrogen, and no utilization of incremental compliance instruments like allowances in Washington and community climate investments (CCIs) in Oregon. This portfolio was also evaluated with DSM and was utilized to gain an understanding of resource needs to meet customer demand and carbon compliance goals.

Portfolios Evaluated

In previous IRPs, Cascade elected to evaluate multiple potential portfolios. These portfolios represent a wide variety of potential solutions for meeting the Company's obligation to serve in a least cost, least risk manner while complying with emissions reduction requirements. Similar to electric utilities, who have a variety of options for power generation (hydro, wind, solar, etc.), Cascade is evaluating a mix of various traditional and renewable-based resources to serve its customers. Cascade is reimaging how it does portfolio modeling. While previous iterations allowed for insight, there were instances where a portfolio had a clear result prior to being optimized, such as a transport only portfolio. Cascade's goal is to reduce the number of portfolios, while increasing the stochastic analysis to gain a better understanding of risks.

Cascade's reference case uses the information that best represents the likeliest future with currently known policies in place. The reference case inputs include:

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

The other portfolios are built off different combinations of scenarios which could impact different futures. Again, the low and high customer growths are an example. Cascade also analyzed different electrification costs after Cascade gained an understanding of compliance costs under different growth futures. Originally, Cascade planned to analyze different carbon compliance futures with modeling a social cost of carbon only scenario, but with Washington's Initiative 2117 being defeated and the Climate Protection Program being reinstated, Cascade is modeling those futures. With that said, Cascade does include the social cost of carbon within the CCA/CPP portfolio.

Results

The results of Cascade's various growth portfolios—low, flat, and high—will be instrumental in developing a preferred portfolio. By analyzing the outcomes of each scenario, Cascade can identify the most effective strategies for ensuring a reliable and cost-efficient natural gas supply. This comprehensive analysis will consider factors such as demand fluctuations, regulatory requirements, and the integration of low-carbon alternative fuels. The preferred portfolio will be designed to balance these elements, providing a robust framework that meets customer needs while adhering to environmental and economic goals.

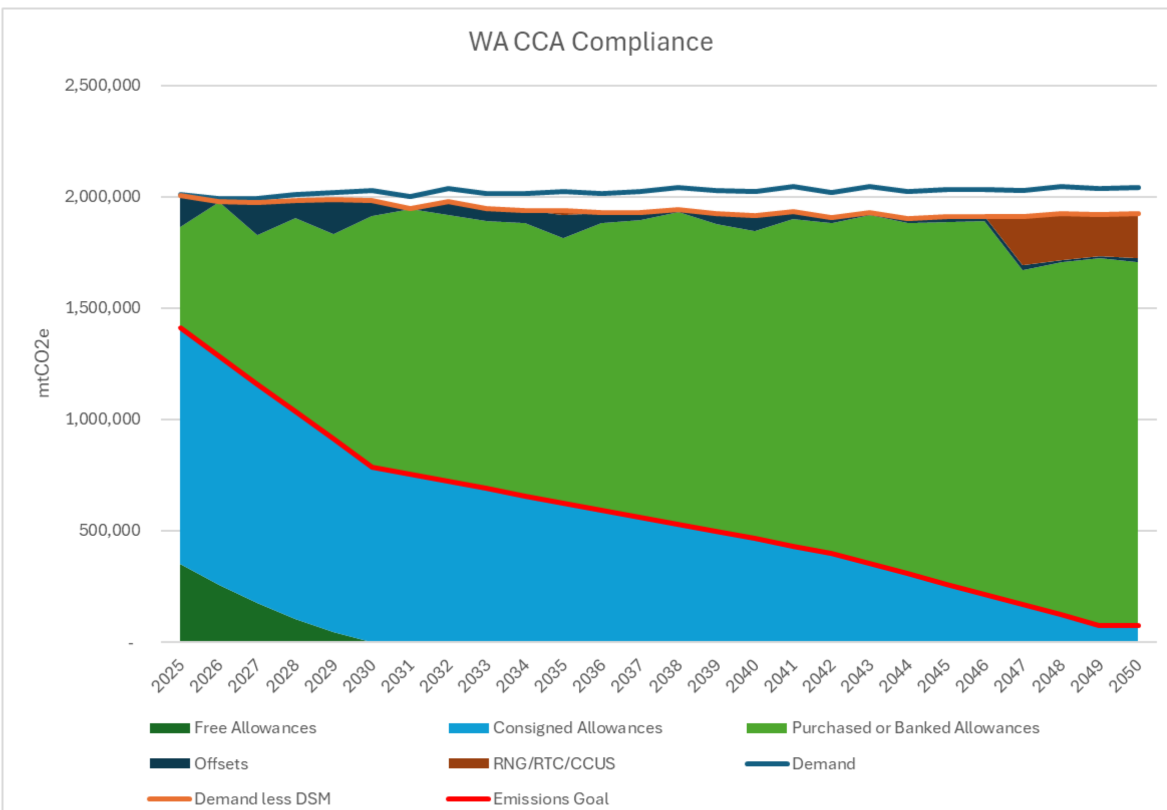
Additionally, the preferred portfolio will incorporate insights from stochastic analysis to better understand and mitigate risks. This approach will help Cascade anticipate potential challenges and uncertainties, such as changes in public policy, market dynamics, and supply chain disruptions. By leveraging these detailed analyses, Cascade can create a flexible and resilient plan that adapts to evolving conditions, ensuring long-term sustainability and customer satisfaction.

Under the reference case, Cascade not only doesn't anticipate a need for any additional upstream transportation, but the Company is considering a capacity release. Cascade added additional capacity on NOVA, Foothills, and GTN in 2024. With the recent drop in growth rates, the need for capacity has been delayed, allowing the Company to investigate options to reduce costs to customers.

Cascade is adding additional storage capacity beginning in 2029. As discussed in Chapter 4, Cascade has storage at Jackson Prairie, Plymouth, and Mist. However, the Mist contract is recallable beginning in 2029 with an end term of 2032 if it reaches full term. Even with this storage capacity, Cascade continues to lag regional peers in storage availability and flexibility, leaving the Company susceptible to large price swings during operational constraints.

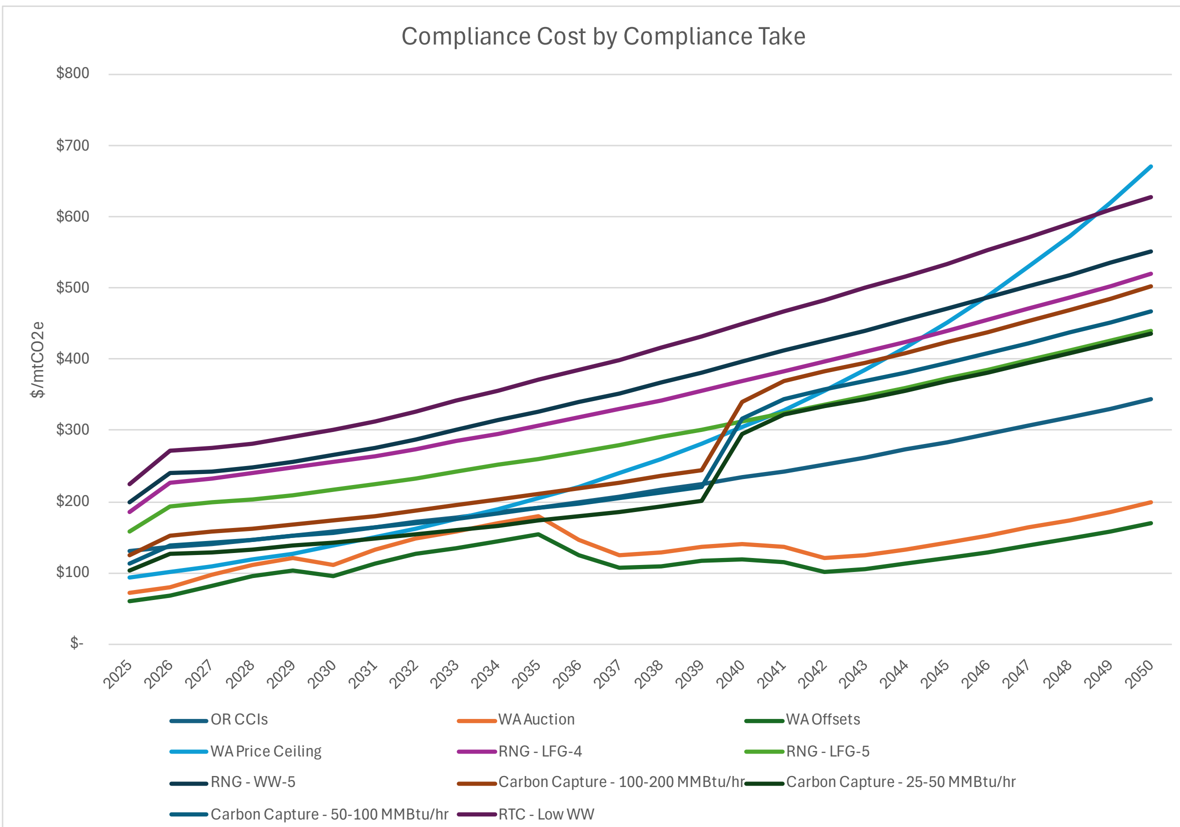
Cascade anticipates meeting the Climate Commitment Act goals in the near- to mid-term with auction allowances and offsets. Figure 9-7 describes how Cascade will meet the projected load under the reference case forecast (blue line). The orange line, or demand less DSM, is the demand Cascade must plan for after reductions of demand side management programs such as energy efficiency. The Company is provided allowances through the CCA, in which those must be consigned in at an increasing rate over time until all allowances must be consigned in 2030. Cascade's modeling indicates the Company will re-purchase those allowances as well as additional allowances.

Figure 9-7: Reference Case CCA Carbon Compliance Results



The justification for using allowances and offsets to meet the carbon compliance goals under the Climate Commitment Act (CCA) primarily revolves around cost-effectiveness. Figure 9-8 shows the compliance take for each of the compliances that were taken over the planning horizon. As can be seen, allowances and offsets under the CCA are expected to be the lowest cost option. Even in a scenario where allowance costs are at the price ceiling price, allowances would be the cheapest option through 2030. Cascade anticipates other low carbon alternative fuels such as carbon capture and RNG/RTCs could become cost-effective towards the end of the planning horizon. It's important to note that these are the results utilizing deterministic or expected pricing.[8]

Figure 9-8: Compliance Cost by Compliance Take

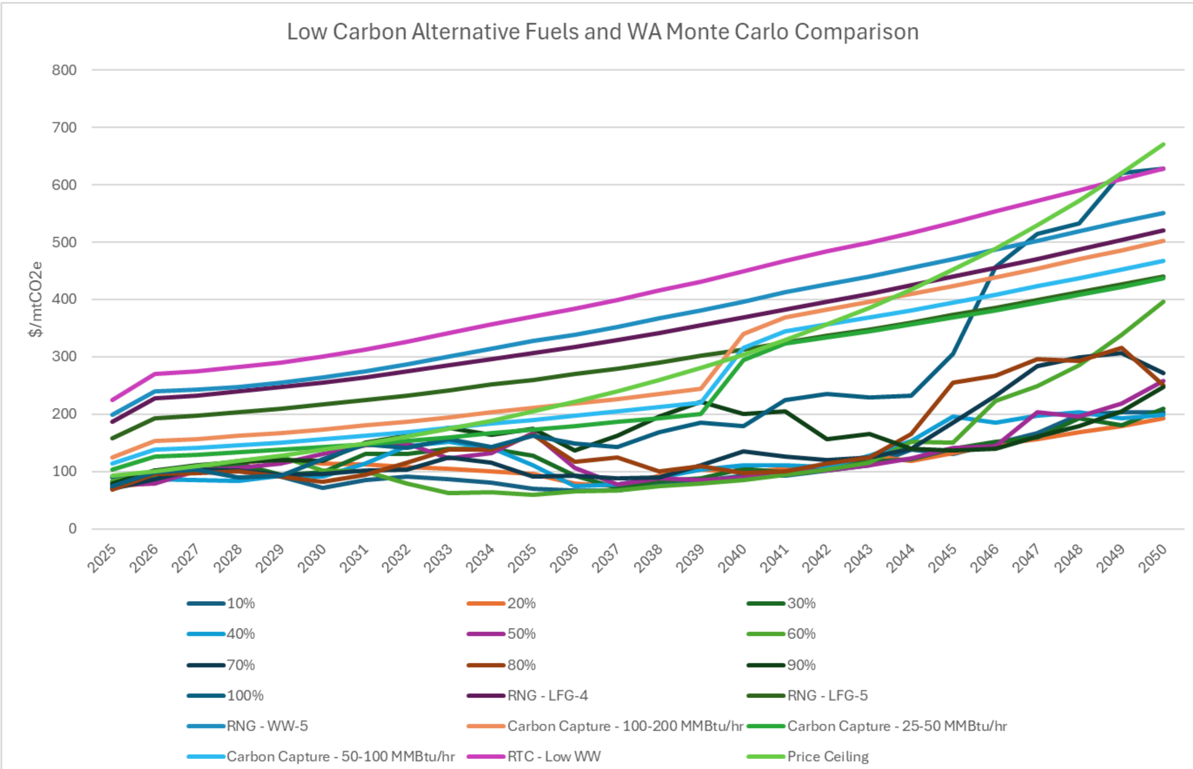


When analyzing stochastic results, there is more uncertainty around potential outcomes. Figure 9-9 shows Monte Carlo results on allowance pricing stacked up with the deterministic pricing of other low carbon alternative fuels seen in Figure 9-8. The percentiles were determined by the total cost over the entire planning horizon. There can be instances where the 90th percentile has a higher cost than the 100th percentile in a certain year, like 2039 for example. Using the 100th percentile allowance pricing, or the highest one in 200 draw, allowance prices become more expensive than carbon capture and RNG beginning around 2045-2046. Under the 90th percentile, some carbon capture projects rival the price of allowance in the

[8] A deterministic system is a system in which no randomness is involved in the development of future states of the system.

2030s. Therefore, it's important to not only analyze the entire planning horizon, but also intermittent timeframes of the planning horizon to understand when low carbon alternative projects may be cost-effective.

Figure 9-9: Low Carbon Alternative Fuel Costs and Allowance Monte Carlo Comparison



The results of the Monte Carlo simulations can provide information on a range of when low carbon alternative fuels could be cost-effective. Figure 9-10 is a table that shows the earliest a compliance option was taken and the latest a compliance option was taken (any blank cells indicate a compliance option wasn't taken) using the Company's 200 Monte Carlo draws. Cascade will note that much of the Landfill Gas (LFG), Waster Water (WW), and Blue Hydrogen were utilized to meet Climate Protection Program compliance goals in Oregon. Figure 9-11 shows the volumes in dekatherms taken for LFG-5 over the 200 Monte Carlo simulations from 2028 to 2050. The amount could vary based on resource availability or cost in comparison to other compliance options.[9]

[9] Full Compliance Take results can be found in Appendix XX.

Figure 9-10: Timing of Compliance Take

Compliance Option	Earliest	Latest
RNG - LFG-3	2049	
RNG - LFG-4	2034	2034
RNG - LFG-5	2028	2031
RNG - WW-5	2047	2050
Blue Hydrogen	2030	
Carbon Capture - 100-200 MMBtu/hr	2047	2047
Carbon Capture - 25-50 MMBtu/hr	2032	2047
Carbon Capture - 50-100 MMBtu/hr	2034	2047
RTC - Low WW	2048	

Figure 9-11: LFG-5 Stochastic Results

Year	Minimum	Maximum
2028	-	749
2029	-	842
2030	-	934
2031	890	1,033
2032	953	1,133
2033	1,015	1,233
2034	1,078	1,333
2035	1,140	1,433
2036	1,175	1,512
2037	1,204	1,586
2038	1,233	1,660
2039	1,263	1,734
2040	1,292	1,808
2041	1,298	1,859
2042	1,300	1,904
2043	1,302	1,950
2044	1,303	1,996
2045	1,305	2,042
2046	1,296	2,074
2047	1,284	2,103
2048	1,272	2,132
2049	1,260	2,161
2050	1,248	2,190

The results of the reference case model as well as the Monte Carlo simulations are analyzed by their total system cost. The total system cost provides the Company with an idea of customer bill impacts. Figure 9-12 provides the range of total system costs, in thousands of dollars, for the deterministic run as well as the Monte Carlo results.

Figure 9-12: Total System Cost Results ($000)

	Reference Case Results	Reference Case Monte Carlo Results		
Year	Deterministic ($000)	Mean ($000)	Min ($000)	Max ($000)
2025	$ 175,148	$ 160,190	$ 129,977	$ 183,074
2030	$ 238,449	$ 193,910	$ 139,679	$ 241,822
2035	$ 255,103	$ 229,693	$ 191,537	$ 333,924
2040	$ 340,190	$ 310,498	$ 281,979	$ 441,122
2045	$ 429,629	$ 440,054	$ 384,745	$ 577,490
2050	$ 403,409	$ 415,870	$ 355,417	$ 531,878

Cascade also ran this on high and low customer growth profiles to gain an understanding of resource needs. Figure 9-13 provides a graph of the resource need under the high portfolio while Figure 9-14 provides a graph of the resource need under the low growth portfolio. Cascade's modeling shows the Company acquiring more RNG/RTCs in the low scenario. This is due to the fact that the lower cost options such as LFG-4 are not being fully acquired by Cascade in Oregon under the CPP, therefore, are still available for the CCA in Washington.

Figure 9-13: High Growth CCA Carbon Compliance Results

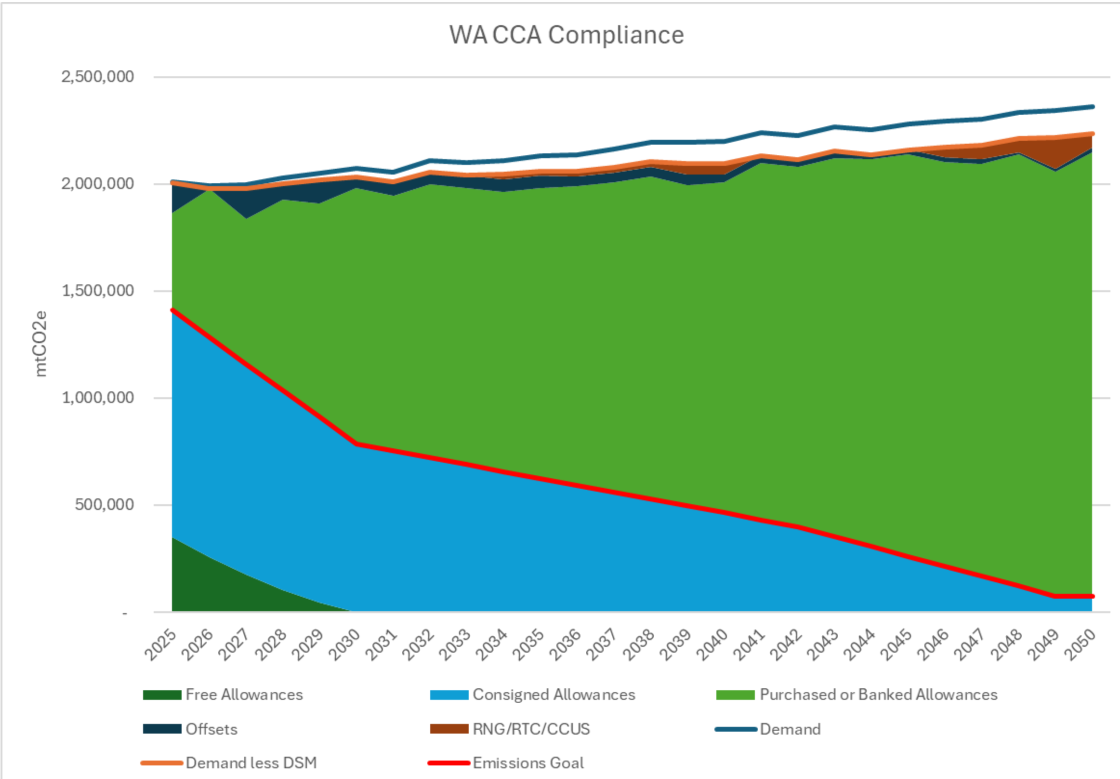
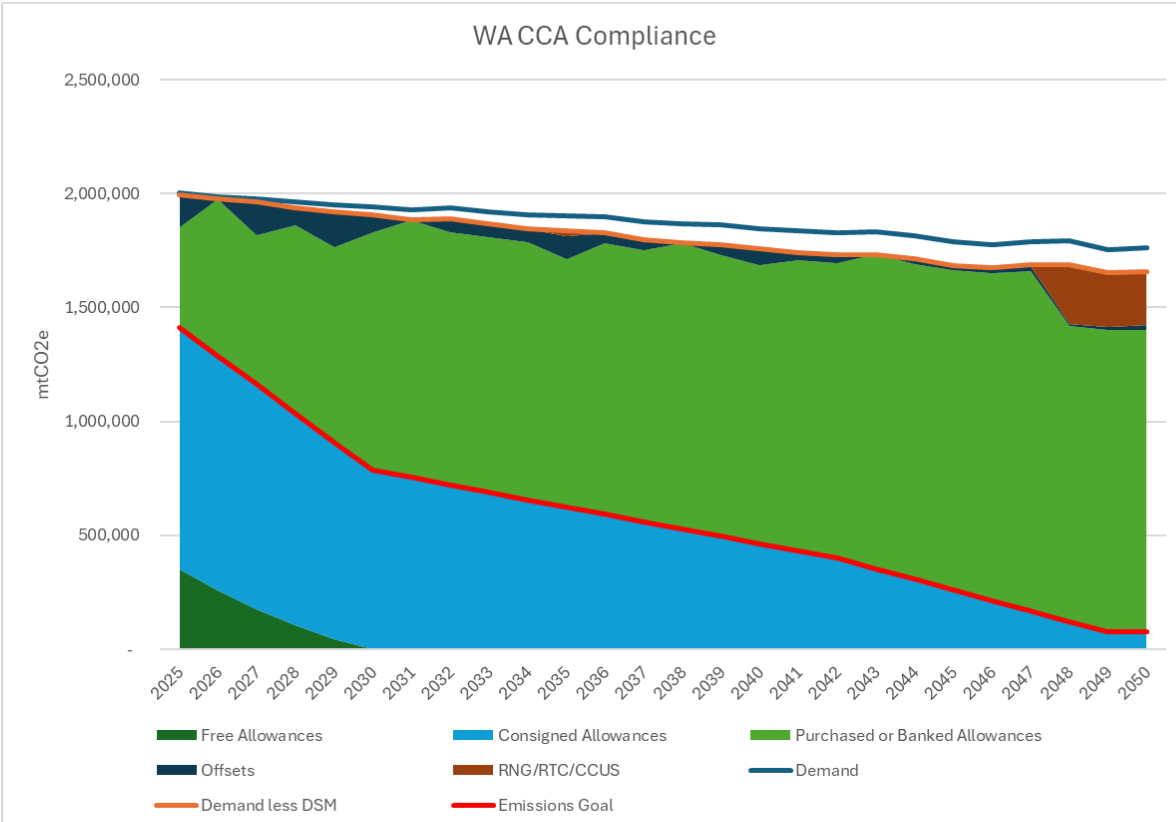


Figure 9-14: Low Growth CCA Carbon Compliance Results



Bill Impacts

Utilizing the results from Plexos®, Cascade can estimate the impact to customers when including cost of compliance. Figure 9-15 shows the impact to residential customers on an average monthly basis, and a total annual increase over current rates. Cascade anticipates costs to nearly double over current rates over the planning horizon, which is only slightly greater than an inflation rate of 2.5% per year over 25 years.[10] Figure 9-16 shows the residential customer bill impact from the Monte Carlo simulations. The Company's analysis of the reference case growth shows that the bill impacts could vary up to $40 on a monthly average bill. This may be less than the increase customers would see in their electric bills in a scenario of electrification.[11]

[10] An $80 monthly bill in 2025 would be $148 in 2050 at an inflation rate of 2.5%.
[11] As of this writing, electric utilities' IRPs have not been released which would provide this data.

Figure 9-15: Residential Customer Bill Impact from Reference Case

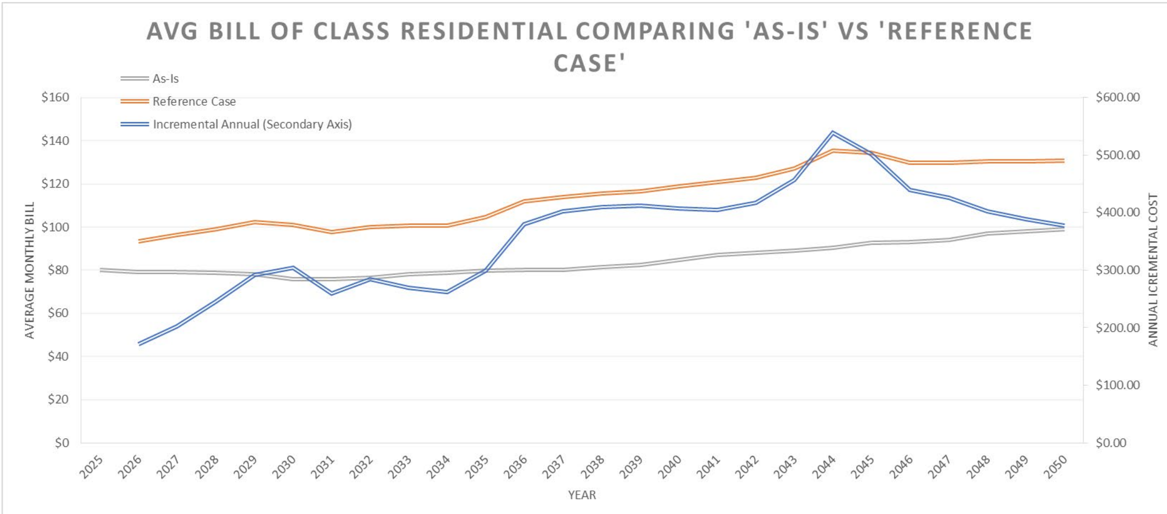
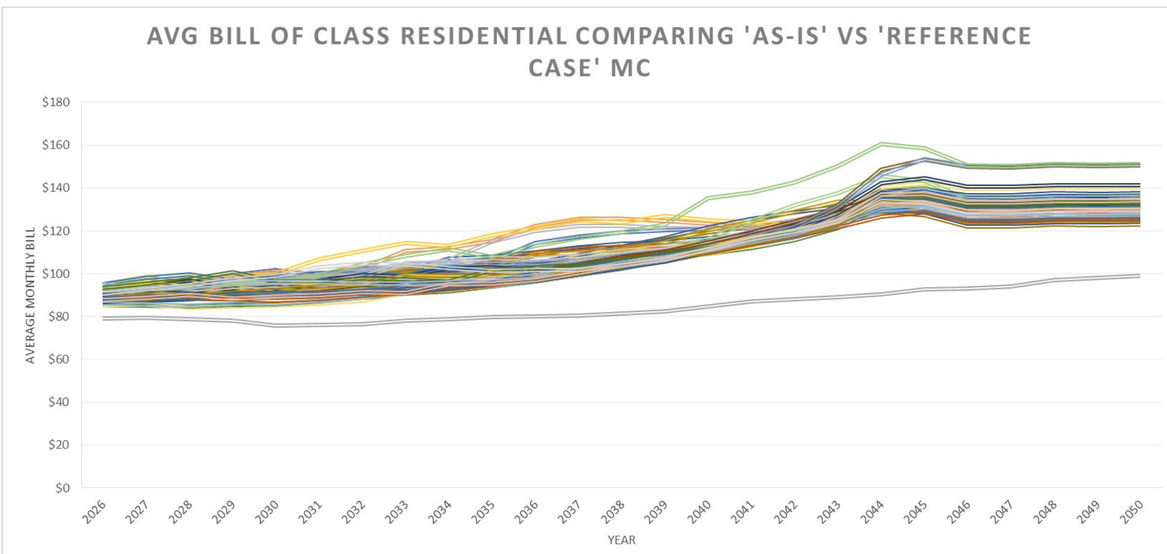


Figure 9-16: Residential Customer Bill Impact from Reference Case Monte Carlo



Cascade also performed customer bill analysis on the low customer growth and the high customer growth, both deterministically and stochastically. Figures 9-17 and 9-18 include the high growth results, while Figures 9-19 and 9-20 include the low growth results, respectively.

Figure 9-17: Residential Customer Bill Impact from High Growth

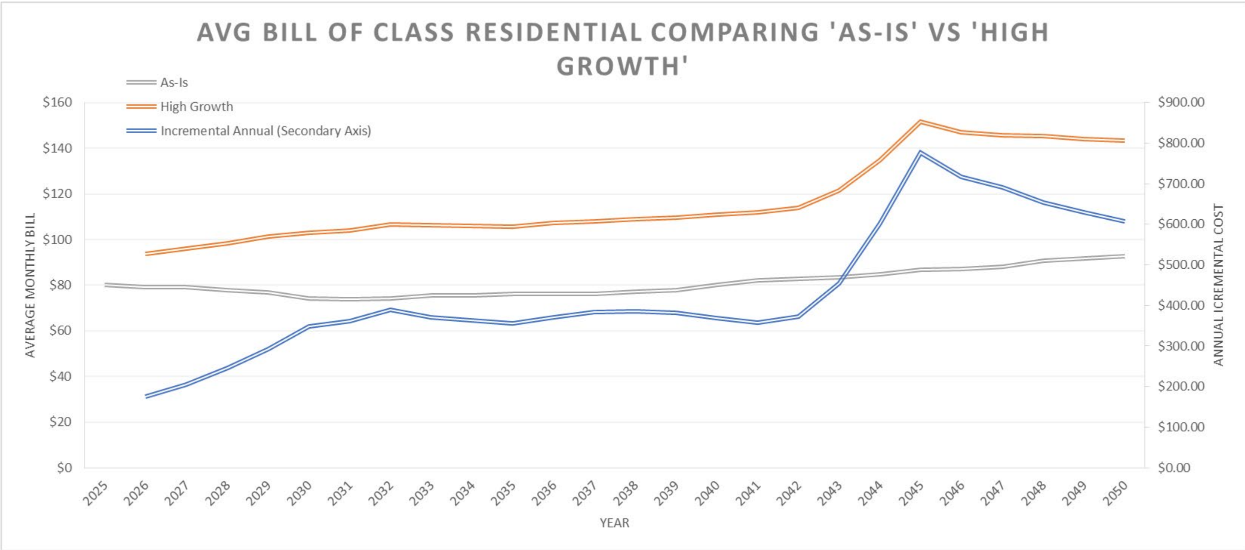


Figure 9-18: Residential Customer Bill Impact from High Growth Monte Carlo

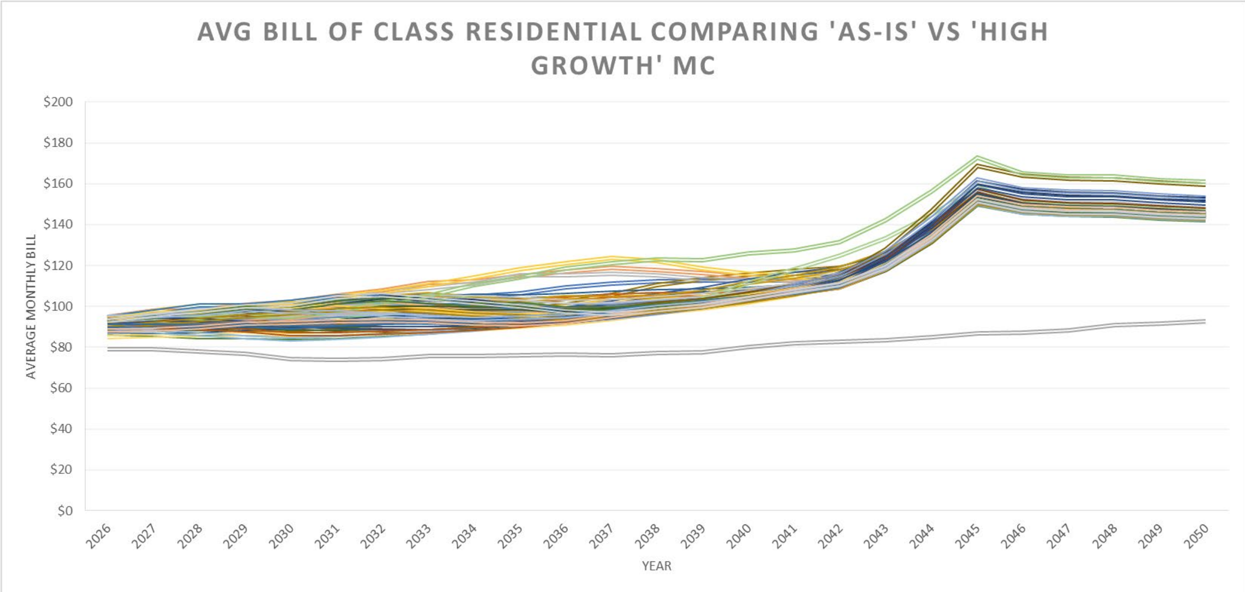


Figure 9-19: Residential Customer Bill Impact from Low Growth

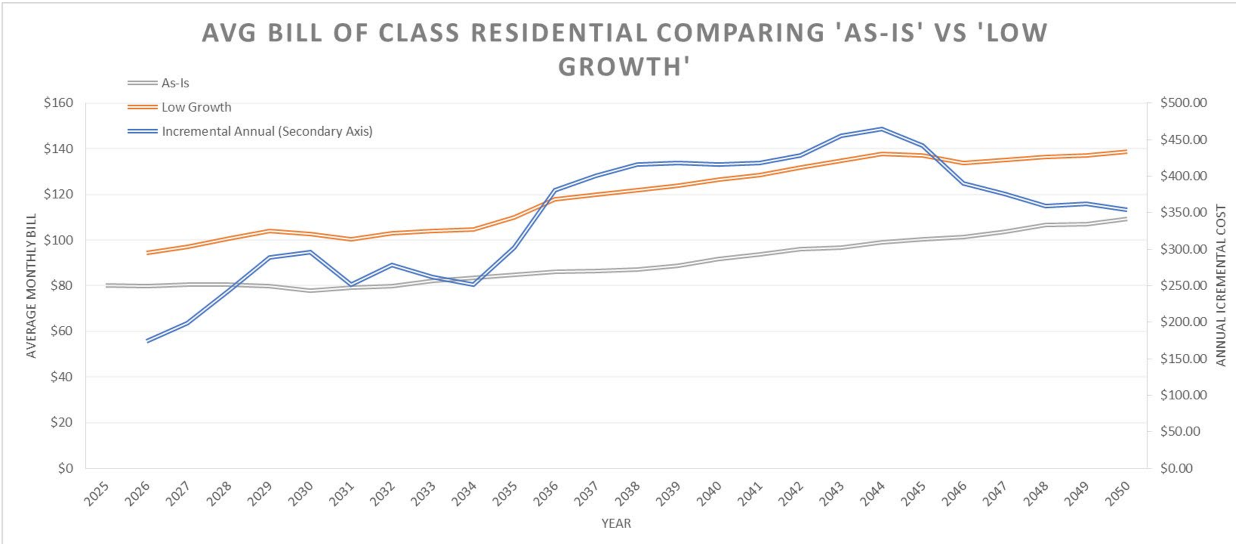
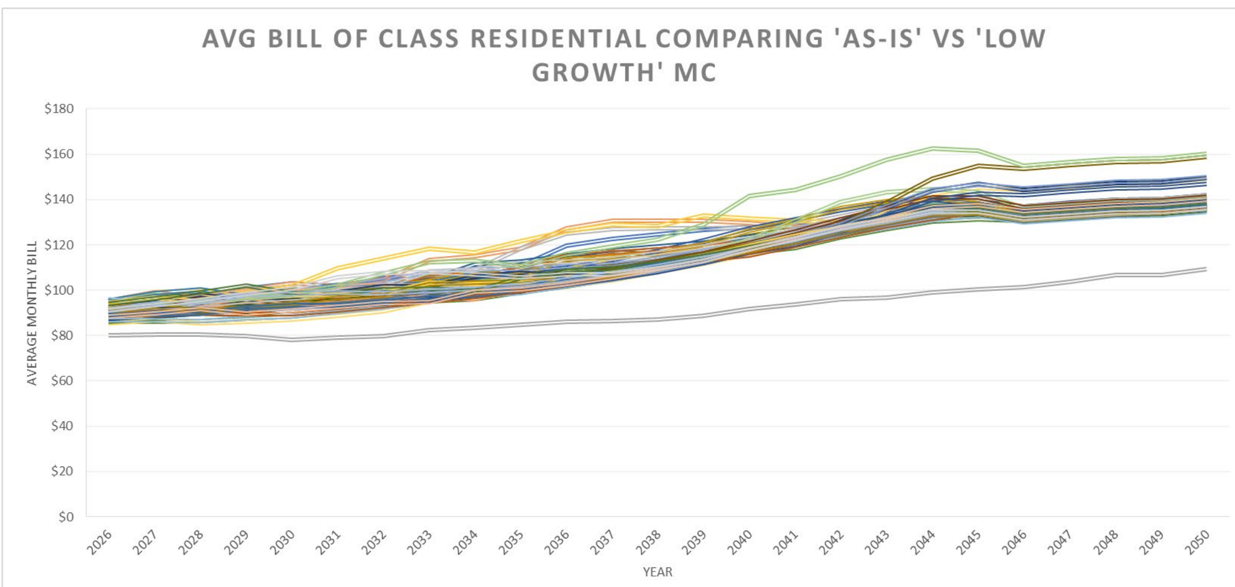


Figure 9-20: Residential Customer Bill Impact from Low Growth Monte Carlo



In both cases, Cascade anticipates bills to increase by nearly double current average bills, although this approximates the level of a 2.5% inflation rate. The reason for this is even though the high growth scenario has higher costs for compliance, it is spread out over a larger customer base. While vice versa, even though the low growth scenario has lower compliance costs than the reference case, it is spread out over a smaller customer base. In the 2023 IRP, Cascade's electrification scenario showed the impact under the low growth to be exponential. The reason Cascade does not see that same impact is due to having a smaller drop off in customers under the low growth scenario compared to the 2023 IRP electrification scenario.

Electrification Model

After estimating the bill impacts of various scenarios, Cascade uses this modeling to mitigate potential financial burdens on both the company and its customers. By analyzing different electrification strategies, Cascade can attempt to forecast the economic implications and develop plans that balance environmental goals with cost-effectiveness. This ensures the transition to cleaner energy sources is financially viable, minimizing the impact on customer bills while still achieving significant emissions reductions. Through this comprehensive modeling, Cascade aims to create a sustainable energy future that aligns with both regulatory requirements and customer affordability

Electrification modeling for a gas utility such as Cascade presents several challenges. One significant difficulty is the lack of clear visibility into the efforts by many of the electric utilities in planning for building electrification. Cascade shares service territories with approximately 25 different Investor-Owned Utilities (IOUs), Municipalities, Public Utility District (PUDs), and Cooperatives. Without a comprehensive understanding of the specific measures and technologies needed, it becomes challenging to create accurate and effective models. This lack of clarity can hinder Cascade's ability to prepare for the increased load on the electrical grid, potentially impacting reliability. For this IRP, Cascade has focused on whole home electrification modeling. Cascade has made a "best effort" to outline key attributes of future electrification and has attempted to initiate associated intra-utility collaboration in lieu of no statewide entity coordinating meetings and analyses. More specifically, Cascade has sought input from Washington IOUs and publicly owned electric utilities including some neighboring PUDs to seek data and potential partnering.[12] The coordination between gas and electric utilities is crucial, and Cascade looks forward to continuing to work with electric utilities in future IRPs.

The electrification modeling required key inputs and assumptions. Cascade gathered installation costs for appliances from the American Council for an Energy-Efficient Economy report.[13] Cascade included impacts of the Inflation Reduction Act (IRA) for the Home Energy Rebate program, which totals $165 million through 2031 for Washington.[14] Based on feedback Cascade received during the TAG process, Cascade is also including the State Home Energy Assistance Program (SHEAP) program, which is estimated to receive $35 million per year.[15] The electrification model also analyzed customers based on income levels as the IRA and SHEAP provide rebates and incentives based on income level. Low income is defined as earning less than 80% of area median income under both the IRA and SHEAP. The

[12] For example, Puget Sound Energy has filed a request with the Washington Commission to address the electrification scenario in its next ISP cycle in 2027.

[13] *See:* https://www.aceee.org/press-release/2024/05/report-electrifying-us-homes-can-save-96-billion-energy-costs-if-done

[14] *See:* DOE confirms WA request for higher IRA Home Rebates – Washington State Department of Commerce

[15] *See:* State Home Energy Assistance Program (SHEAP) – Washington State Department of Commerce

IRA also provides incentives for those between 80% and 150%, which can cover up to 50% of the cost. Figure 9-21 gives a breakdown of the IRA rules.

Figure 9-21: IRA Rules

Program	Eligibility	Rebate/Tax Credit Amount	Details
HEEHRA - Electrification Rebates	Low- and moderate-income households	Up to $14,000	Covers high-efficiency electric equipment and appliances. Low-income households can receive up to 100% of project costs; moderate-income households up to 50%.[1]
HEEHRA - Efficiency Rebates (HOMES)	Low- and moderate-income households	Varies by energy savings	Provides rebates for whole-house energy-saving retrofits. Amount depends on the percentage of energy savings achieved.[1]
IRA Tax Incentives - Energy Efficiency Improvements	All households and businesses	Up to 30% of project costs	Tax credits for energy-efficient improvements like heat pumps, solar panels, and insulation. Average tax credit ranges from $2,000 to $5,000.[1]
IRA Tax Incentives - Renewable Energy	All households and businesses	Up to 30% of project costs	Tax credits for renewable energy installations, such as solar panels and wind turbines.[1]

Cascade has gathered current residential rates for each electric entity that Cascade shares service territories with and has weighted them by customer counts for each pipeline zone. Figure 9-22 provides the rates Cascade utilized for the 2025 IRP. These zones are defined in Chapter 3 on page 3-4.

Figure 9-22: Pipeline Zone Electric Rates

Zone	Res Rate
10	$ 0.085
11	$ 0.088
20	$ 0.074
24	$ 0.073
26	$ 0.081
30-S	$ 0.112
30-W	$ 0.113
GTN	$ 0.051
ME-OR	$ 0.074
ME-WA	$ 0.092

One key assumption the Company had to make was analyzing the type of heat pump. As there are numerous different brands and manufacturers to choose from, Cascade decided to keep this consistent with regional LDCs electrification models and is using the GREE Ultra Heat GMV6 Mini. The performance specifications of this heat pump are provided in Figure 9-23.

Figure 9-23: Performance Specs of Selected Heat Pump

Performance Specs

Heating / Cooling	Outdoor Dry Bulb	Indoor Dry Bulb	Unit	Min	Rated[+]	Max
Cooling	95°F	80°F	Btu/h[+]	19,200	48,000	57,600
			kW	1.3	4.17	5
			COP	4.33	3.37	3.38
Cooling	82°F	80°F	Btu/h[+]	19,200	-	57,600
			kW	1	-	4.3
			COP	5.63	-	3.93
Heating	47°F	70°F	Btu/h[+]	19,200	48,000	50,000
			kW	1.3	3.52	3.75
			COP	4.33	4	3.91
Heating	17°F	70°F	Btu/h[+]	19,200	30,000	48,000
			kW	1.9	3.38	6.04
			COP	2.96	2.6	2.33
Heating	5°F	70°F	Btu/h[+]	19,200	33,600	45,600
			kW	2.3	4.48	6.3
			COP	2.45	2.2	2.12
Heating	-22°F	70°F	Btu/h[+]	19,200	-	32,000
			kW	4	-	6.6
			COP	1.41	-	1.42

Other assumptions include the size of the home, the efficiency of the natural gas appliances in the home, and the climate zone. For purposes of this electrification model, Cascade assumed a 2,000-square-foot home with 80% efficiency. The climate zone Btu per square foot was determined by the 2021 International Energy Conservation Code.[16] These assumptions will continue to be examined for greater clarity. For example, the costs and efficacy of split heat pumps (as contrasted with ductless heat pumps) in average- to large-sized houses are in question for cold climates. Auxiliary heat for cold snaps in three season climates are not cost prohibitive for shorter durations. However, unique space heating requirements exist in four-season climates. Cold climate split heat pumps are proportionally more expensive as would be providing service to electric auxiliary heating options during a region's "fourth season" peak periods. Moreover, consumer preferences may vary. Some customers, particularly in four-season climate zones, may opt for natural gas service in new buildings regardless of cost. Renovations and remodels can maintain existing natural gas service under various electrification scenarios. Some customers may elect to install natural gas appliances regardless of current

[16] *See:* Climate Zone Map from IECC 2021 | Building America Solution Center

building code costs due to required offsets (e.g., solar). This could occur if the differential between future natural gas prices and electricity prices is exacerbated.

The Coefficient of Performance (COP) is a measure of the efficiency of a heating or cooling system. It is defined as the ratio of useful heating or cooling provided to the energy consumed by the system. The COP can vary depending on the temperature. Figure 9-24 provides the COP of the chosen heat pump. Figure 9-25 provides a cost per hour at different temperatures for that heat pump to operate. Figure 9-26 shows the heat pump efficiency of the chosen heat pump, and Figure 9-27 shows the amount of Btus needed at different HDD levels.

Figure 9-24: Coefficient of Performance

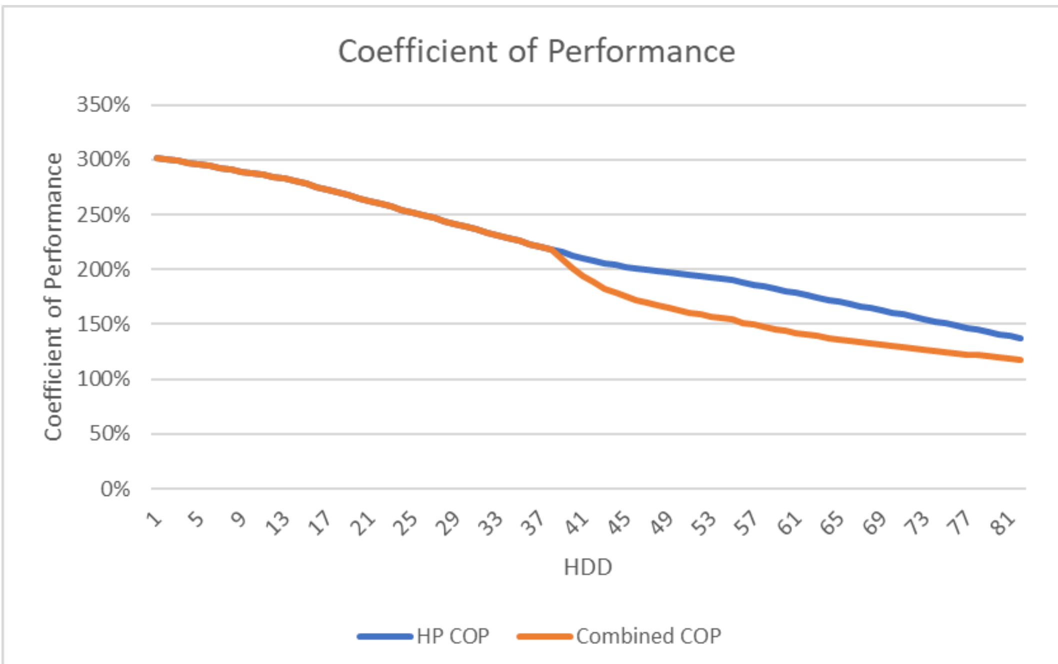


Figure 9-25: Heat Cost per Hour

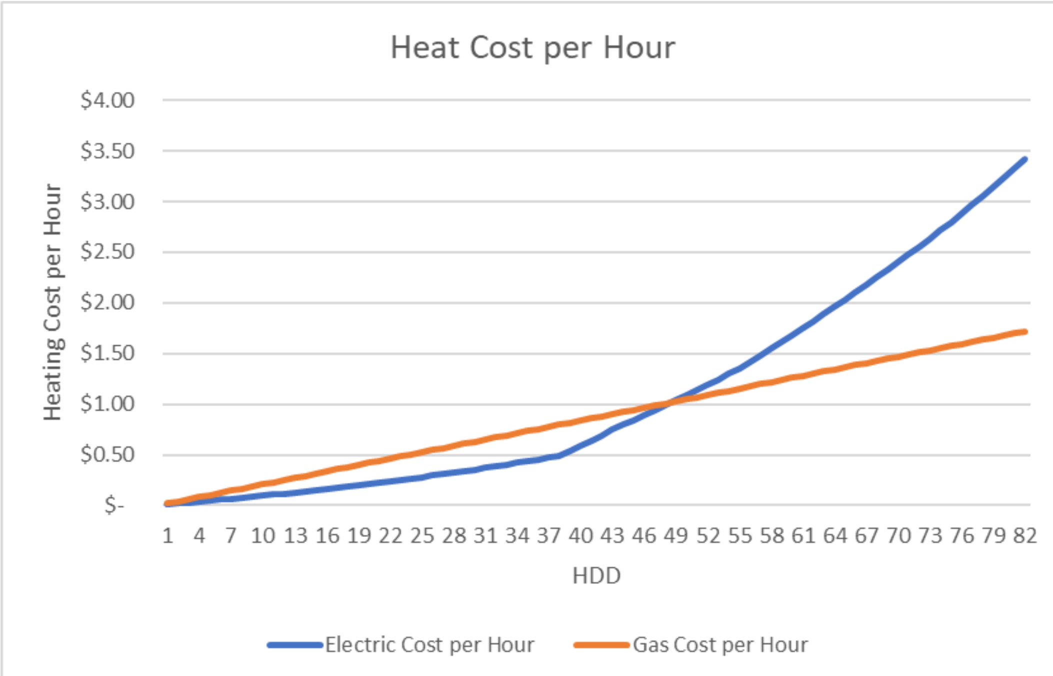


Figure 9-26: Heat Pump Efficiency

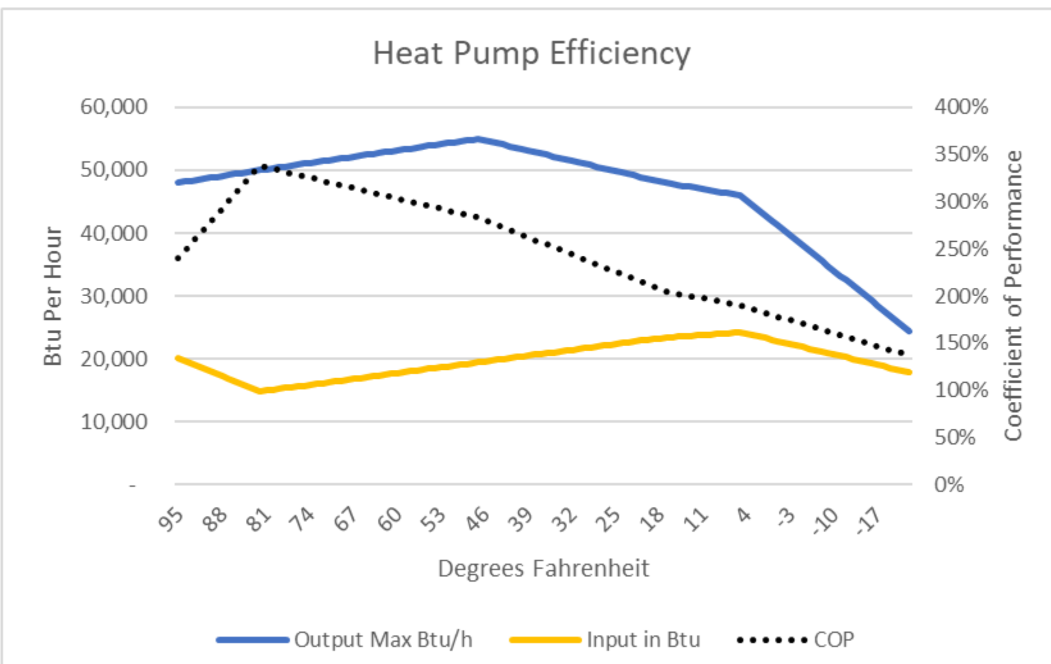
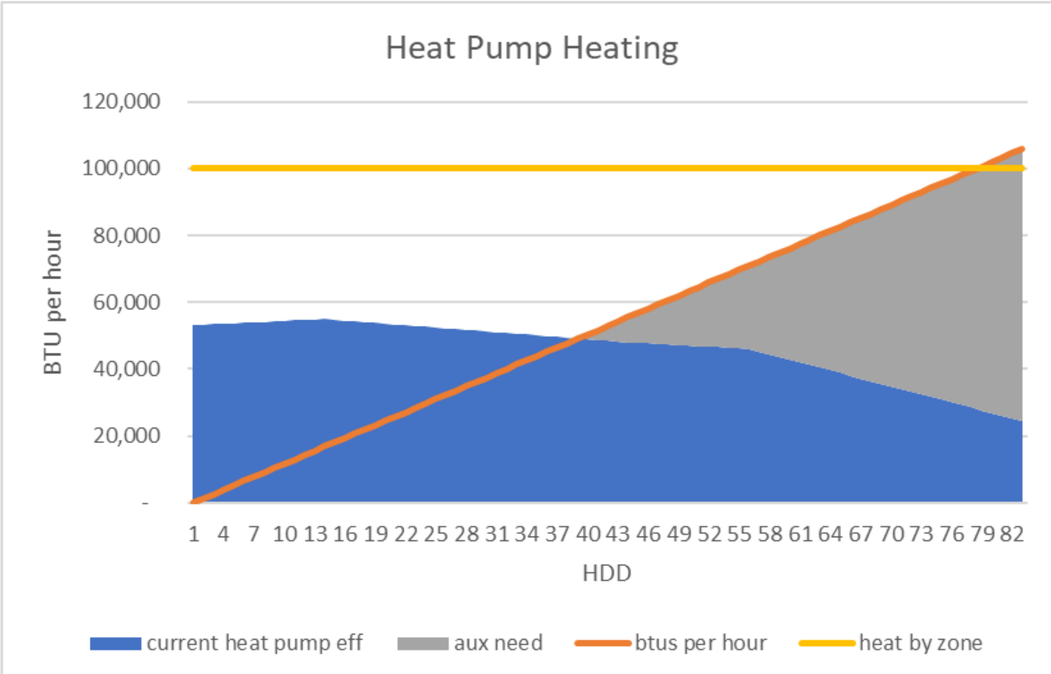


Figure 9-27: Heat Pump Heating



Results

Cascade is analyzing electrification in two manners. The first is through a utility cost test, where the Company focuses on the costs and benefits to the utility itself. The second is through a consumer viewpoint, where Cascade will analyze electrification including marginal costs, which is the difference in cost between installing a heat pump rather than a gas furnace. Cascade found that under the utility cost test, due to operation and installation costs, mainly, it may not be cost-effective to electrify customers. Figure 9-28 provides the average monthly cost for pipeline zone 20. Figure 9-29 provides the net present value 15-year levelized average monthly cost for pipeline zone 20. The jump in 2032 is due to the fact that the IRA funds are only available through 2031.[17] The difference in the cost for low-income customers and non-low-income customers post 2032 is because Cascade is assuming the SHEAP will still be available for low-income customers. Pipeline zone 20 (Tri Cities area per Figure 9-1) was chosen for illustrative purposes as it has the lowest electric rates in Cascade's service territory. The charts for the remaining pipeline zones can be found in Appendix K.

[17] Cascade's modeling assumes IRA funding in the period of the two-year Action Plan. However, this is in question as of the time of this writing due to the IRA funds being temporarily paused with Trump's executive order "Unleashing American Energy". *See:* Unleashing American Energy – The White House. The two-year cycle for IRPs allows for this to be addressed in the next IRP rendition. As data accumulates in the coming cycle(s), then the 20-year time horizon with related risks and mitigation may be better modeled.

Figure 9-28: Average Monthly Cost by Year for Pipeline Zone 20 (Utility Cost Perspective)

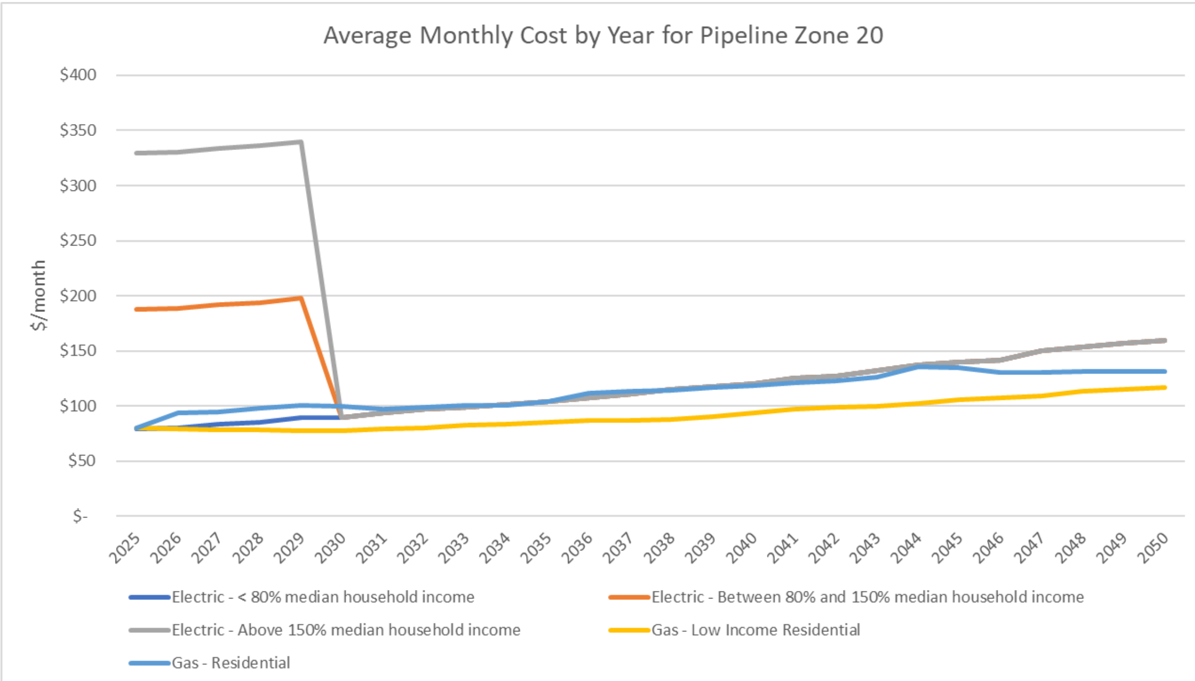
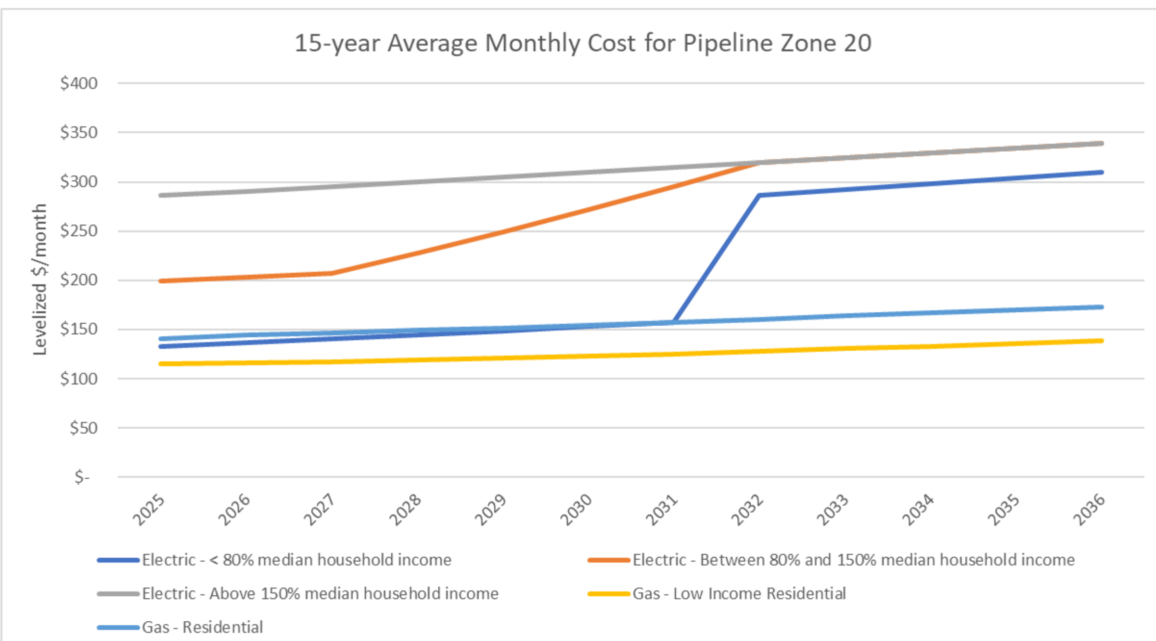


Figure 9-29: Net Present Value 15-Year Levelized Cost by Year for Pipeline Zone 20 (Utility Cost Perspective)



When analyzing this from a consumer perspective, where the marginal cost of installing a heat pump vs a gas furnace was included, Cascade found that it may be cost-effective for low-income customers to electrify in some of Cascade's service territory. Figures 9-30 and 9-31 outline the average monthly installation and operational costs as well as the 15-year levelized costs.

Figure 9-30: Average Monthly Cost by Year for Pipeline Zone 20 (Consumer Perspective)

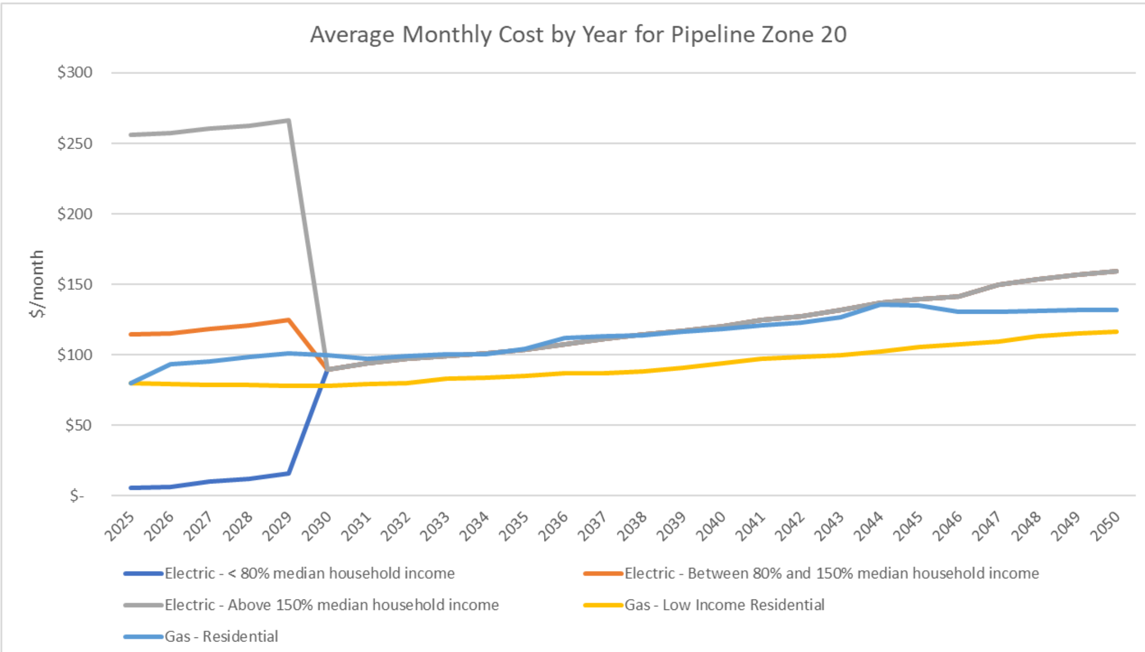
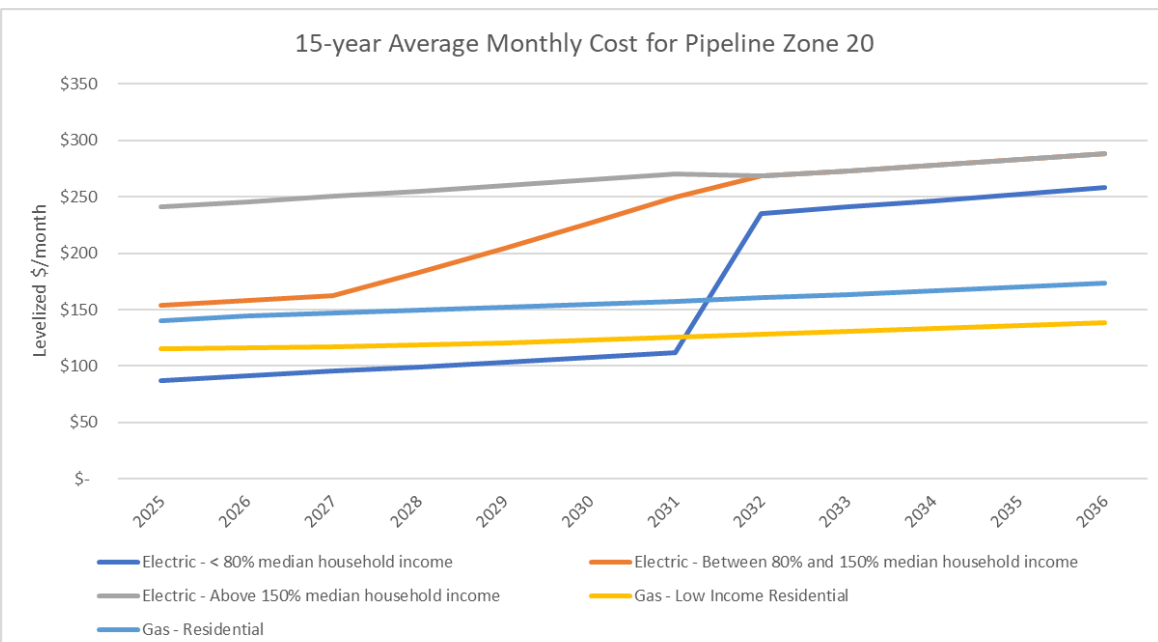
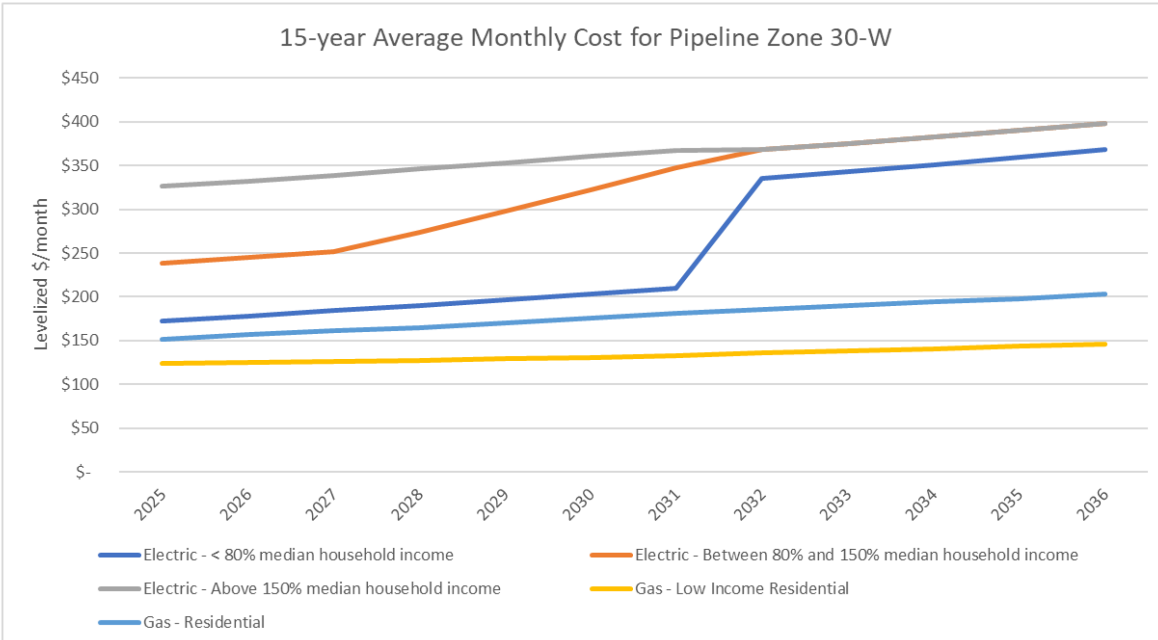


Figure 9-31: Net Present Value 15-Year Levelized Cost by Year for Pipeline Zone 20 (Consumer Perspective)



Cascade found that, under the consumer view, it may be cost-effective to electrify in pipeline zones 20 and 26 (Longview area) in Washington. Figure 9-32 is the 15-year levelized cost for pipeline zone 30-W (Bellingham area), which has the highest electric rates in Cascade's service territory.

Figure 9-32: Net Present Value 15-Year Levelized Cost by Year for Pipeline Zone 30-W (Consumer Perspective)



Under the high and low growth portfolio, Cascade found similar results. Although the bill impacts increased under both the high and low portfolio, the increase was not significant enough to change the results of the electrification model. Figure 9-33 provides a look at the utility cost for the low growth portfolio on a monthly average cost. Figure 9-34 provides the results for the net present value 15-year levelized cost for the low growth.

Figure 9-33: Average Monthly Cost by Year for Pipeline Zone 20 Under Low Growth (Utility Cost Perspective)

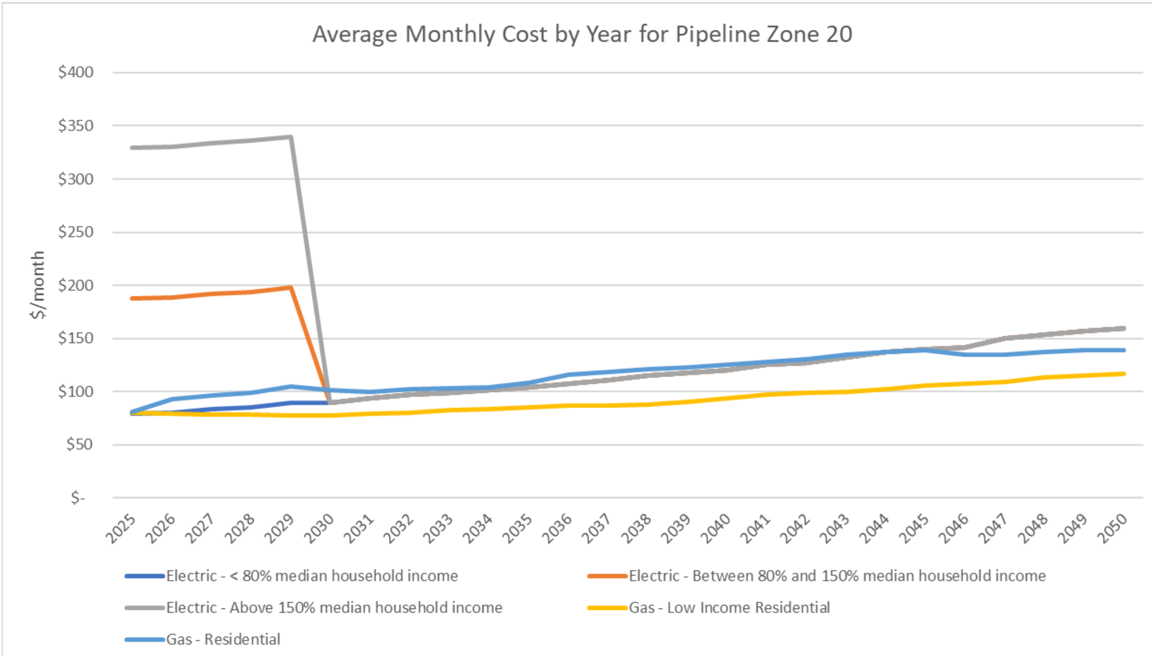


Figure 9-34: Net Present Value 15-Year Levelized Cost by Year for Pipeline Zone 20 Under Low Growth (Utility Cost Perspective)

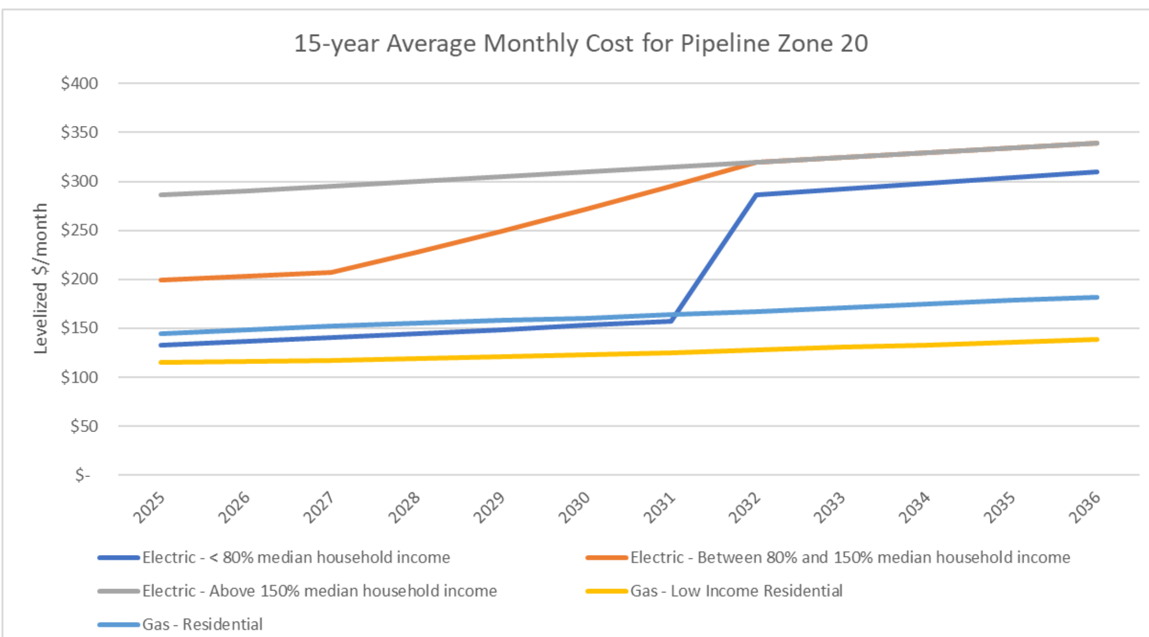


Figure 9-35 provides a look at the consumer view for the low growth portfolio on a monthly average cost. Figure 9-36 provides the results for the net present value 15-year levelized cost for the low growth.

Figure 9-35: Net Present Value 15-Year Levelized Cost by Year for Pipeline Zone 20 Under Low Growth (Utility Cost Perspective)

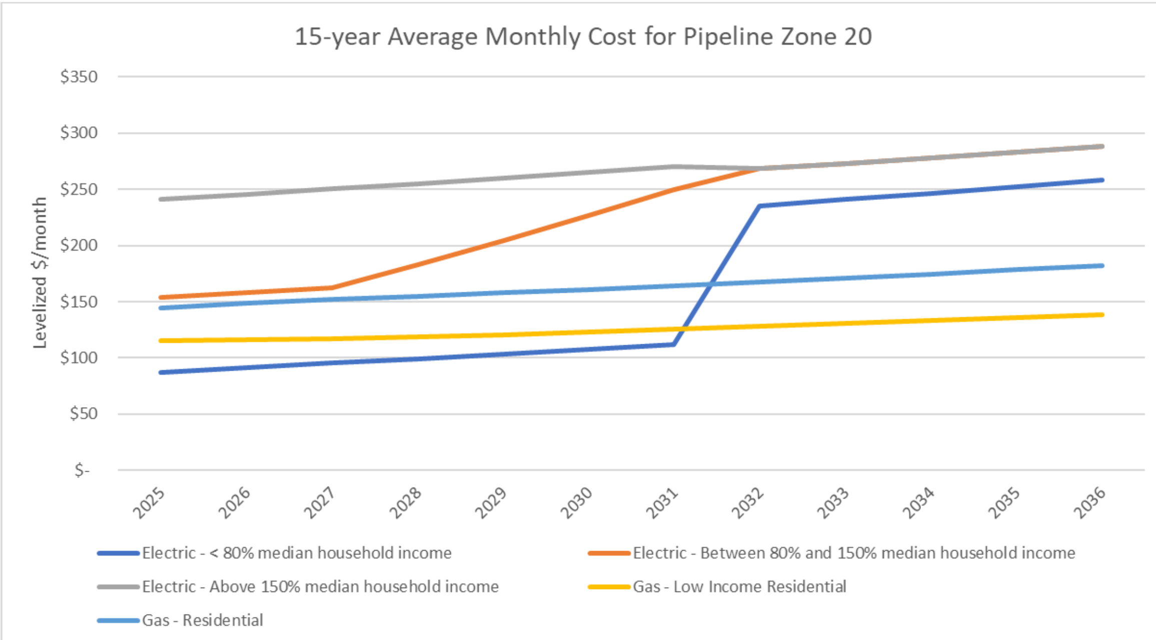


Figure 9-36: Average Monthly Cost by Year for Pipeline Zone 20 Under Low Growth (Consumer Perspective)

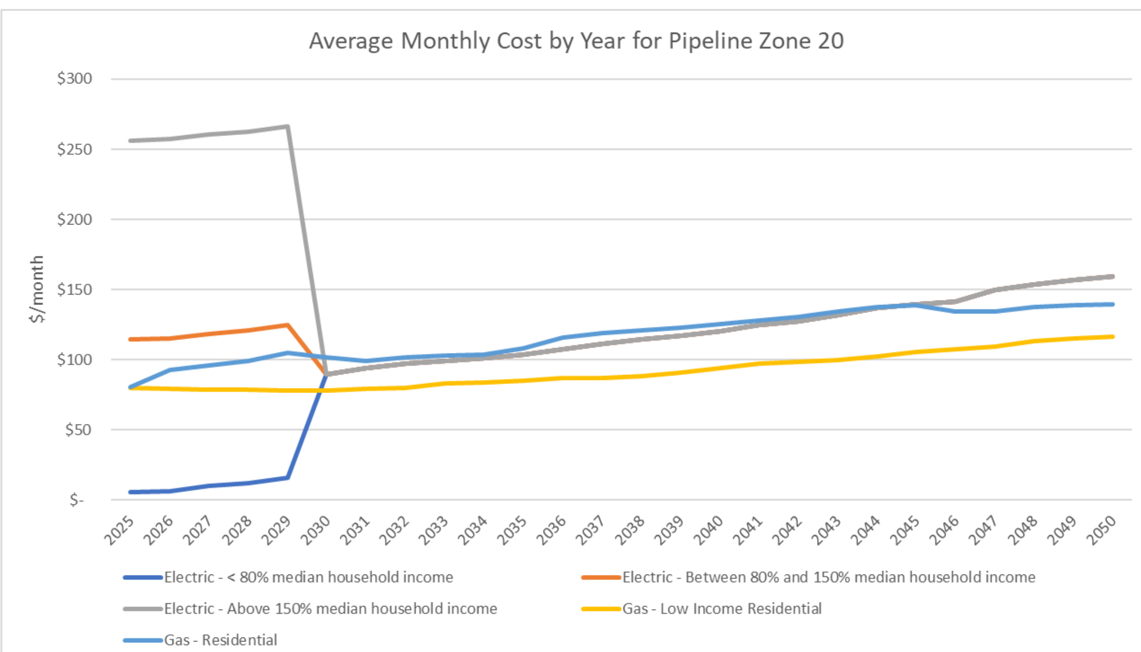


Figure 9-37 provides a look at the utility cost for the high growth portfolio on a monthly average cost. Figure 9-38 provides the results for the net present value 15-year levelized cost for the high growth.

Figure 9-37: Net Present Value 15-Year Levelized Cost by Year for Pipeline Zone 20 Under High Growth (Utility Cost Perspective)

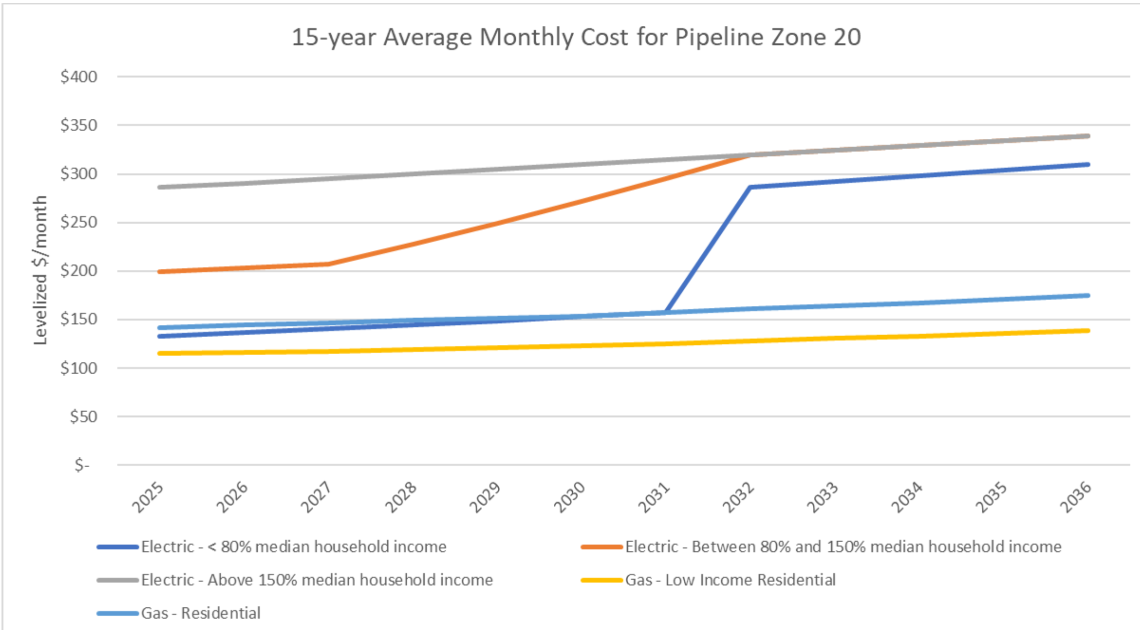


Figure 9-38: Average Monthly Cost by Year for Pipeline Zone 20 Under High Growth (Utility Cost Perspective)

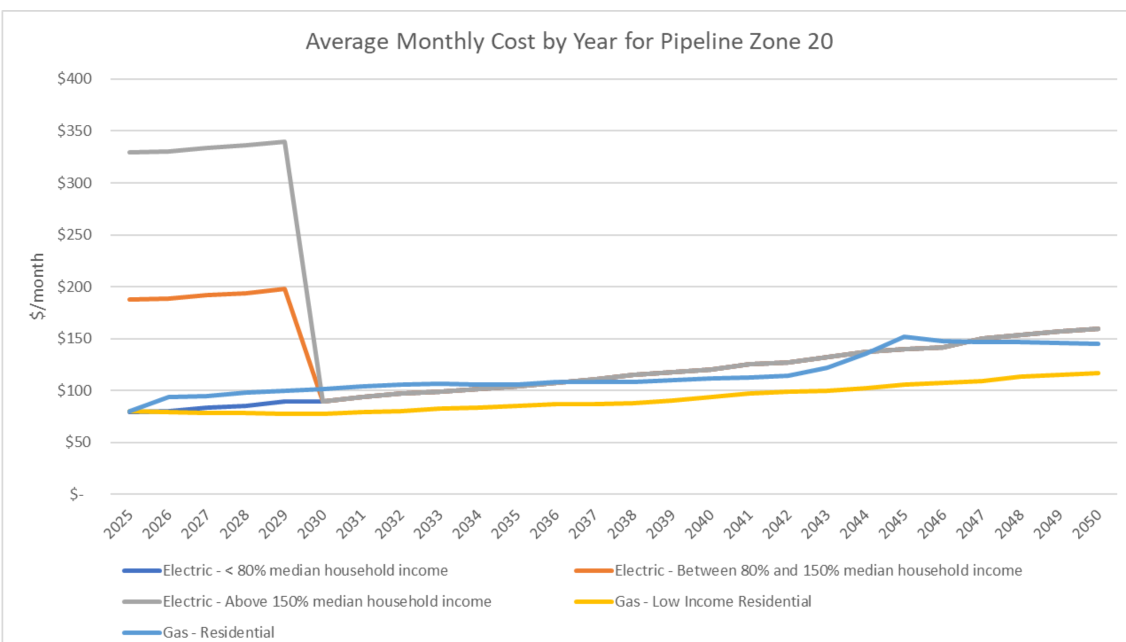


Figure 9-39 provides a look at the consumer view for the high growth portfolio on a monthly average cost. Figure 9-40 provides the results for the net present value 15-year levelized cost for the high growth.

Figure 9-39: Net Present Value 15-Year Levelized Cost by Year for Pipeline Zone 20 Under High Growth (Consumer Perspective)

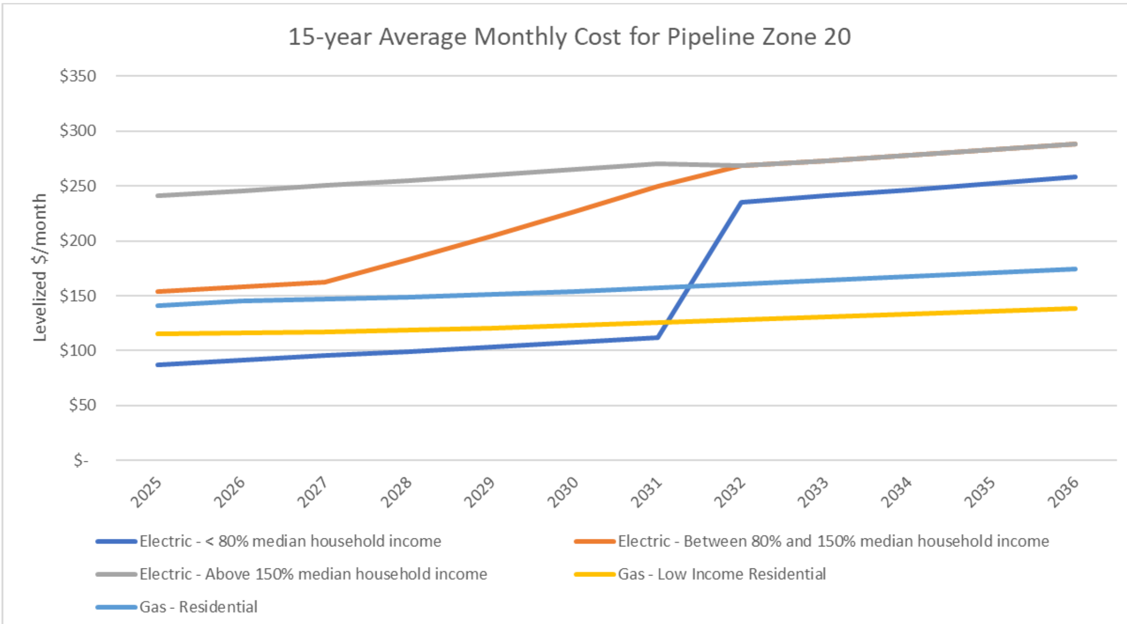
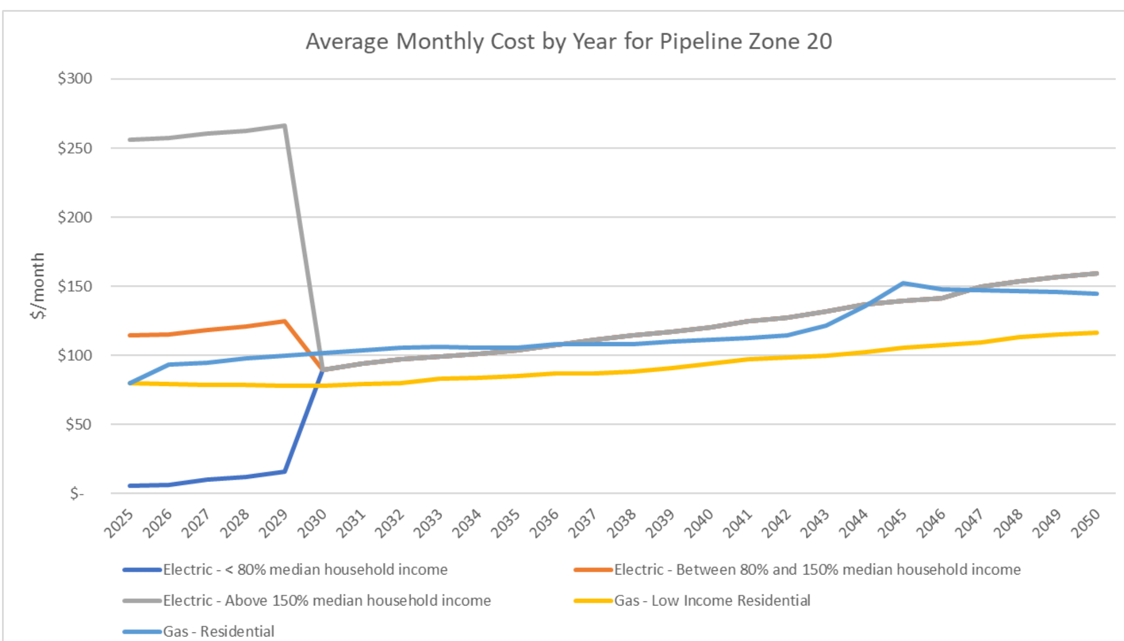


Figure 9-40: Average Monthly Cost by Year for Pipeline Zone 20 Under High Growth (Consumer Perspective)



As mentioned earlier, Cascade has completed bill impact analysis stochastically as well. Cascade took the highest average bill impact from the stochastic analysis, indicated by the green line in Figure 9-16, and input it into the electrification model as the rates for natural gas. The results were similar in that Cascade didn't find it to be cost-effective under the utility perspective, see Figure 9-41, but did find it cost-effective for low income under the consumer perspective, see Figure 9-41.

Figure 9-39: Net Present Value 15-Year Levelized Cost by Year for Pipeline Zone 20 Monte Carlo Highest Bill Impact (Utility Perspective)

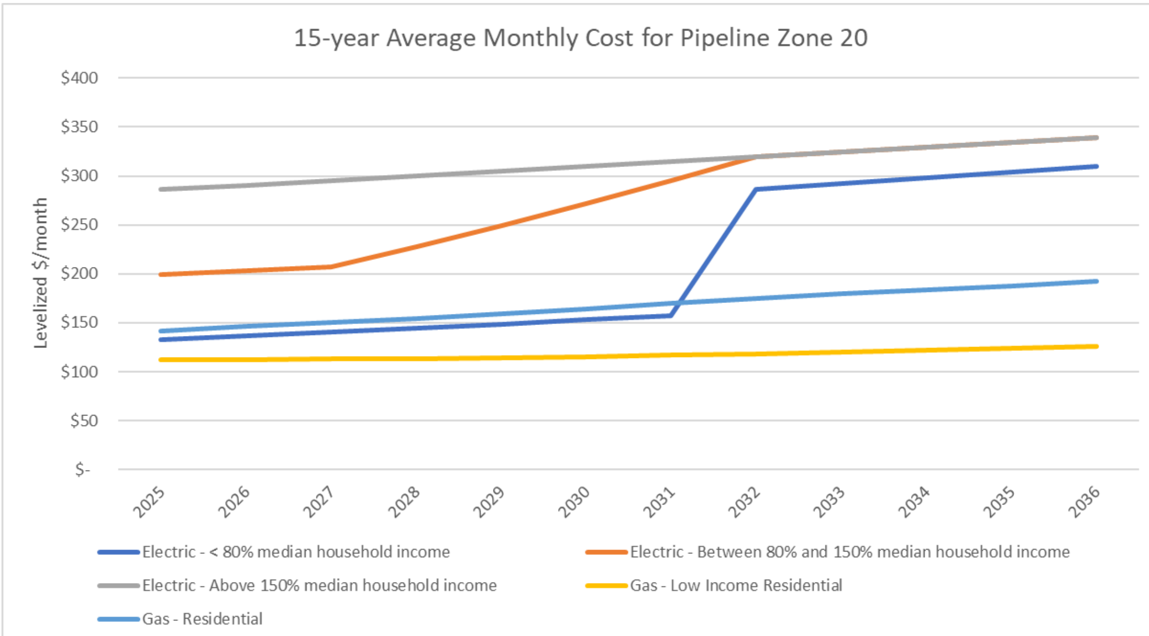
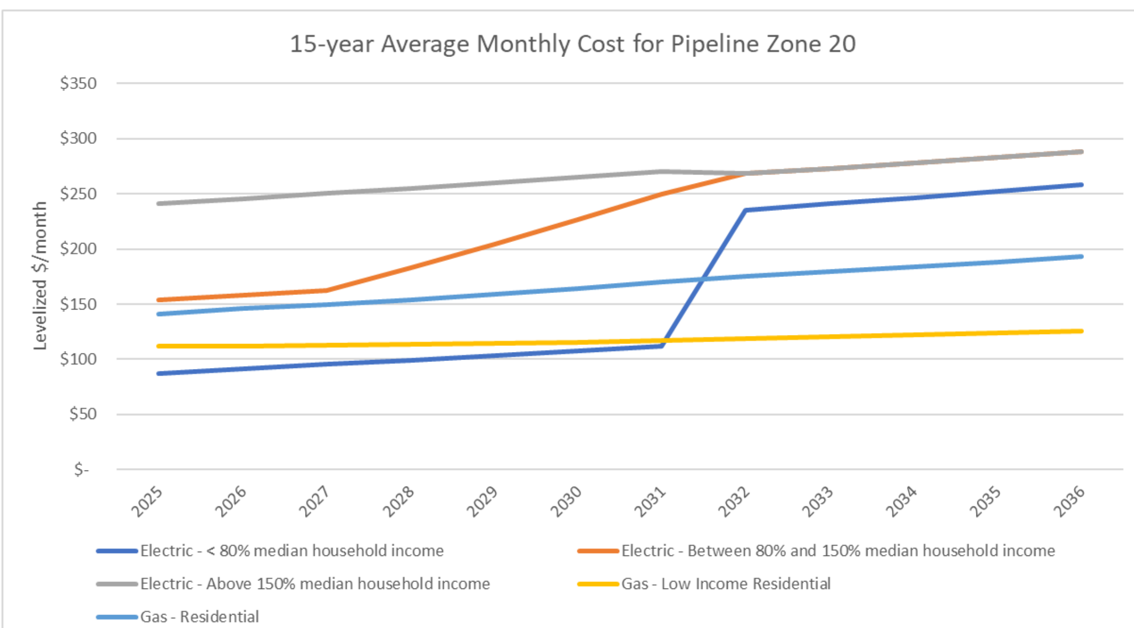


Figure 9-39: Net Present Value 15-Year Levelized Cost by Year for Pipeline Zone 20 Monte Carlo Highest Bill Impact (Consumer Perspective)



Cascade Natural Gas's electrification modeling revealed that while electrification was not cost-effective under a utility cost test, it showed promise from a consumer perspective for low-income customers. Specifically, when considering the marginal cost of a furnace, the consumer view highlighted potential savings and benefits that were not apparent in the utility cost analysis. This discrepancy underscores the importance of evaluating electrification from multiple angles to fully understand its economic impact.

However, there remains significant uncertainty around electrification modeling. Factors such as the type of equipment, equipment costs, and fluctuating electric rates can all influence the outcomes of such models. To further support electrification modeling and to gather more comprehensive data, Cascade is pursuing a Hybrid Heat Pump pilot in Oregon.[18] Although the pilot is in Oregon, Cascade's expectation is that the results can also be applied in Washington. This initiative aims to provide valuable insights and refine the understanding of electrification's feasibility and cost-effectiveness in various scenarios.[19] The Hybrid System Pilot (Pilot) proposal is a demonstration project in Bend, Oregon. Bend was selected because the climate is representative of Cascade's cold weather service territory, Hybrid systems, also known as dual fuel systems, combine a natural gas furnace with an electric heat pump and include control technology to switch between the units, traditionally based on a set outdoor temperature. Advanced control technologies have the potential to expand the way these systems can be used. This Pilot will investigate how the pairing of hybrid systems with advanced controls can maximize reductions in energy system-wide (gas and electric) GHG emissions and natural gas throughput, while measuring impacts on customer energy bills. The Pilot will also explore the potential to use these systems as a non-pipe alternative. If the Pilot shows that hybrid systems with advanced controls are a cost-effective way to secure the Pilot objectives, Cascade will work to develop programs based on the results.

An Observation on Resource Integration[20]

As Cascade aspires to provide a "best practices" IRP, the Company monitors national natural gas resource planning. A third-party paper describing best practices regarding emissions and related uncertainty may be instructive regarding Cascade's planning processes. "A Regulator's Blueprint for 21st Century Gas Utility Planning" prepared by Strategen dated December 2023 lays out the key

[18] *See:* State of Oregon: Public Utility Commission of Oregon
[19] Filed February 21, 2025, with the Oregon Public Utility Commission
[20] As context, Washington and Oregon are at a higher benchmark nationally for natural gas IRPs at this time than other public utility commissions. The WUTC is seen by many as a leader in IRPs as the Commission was the first PUC to implement Least Cost Planning in 1986 by a general rate case order (Cause No. U-85-36). Over time, Washington and Oregon LDC's IRPs have evolved into robust planning processes.

components of a natural gas plan and provides recommendations for strengthening existing plans as natural gas utilities transition to changing emissions requirements including process and metrics.

After explaining the benefits of cost and risk mitigation (from a customer perspective), transparency, compliance with climate goals, and intra utility coordination, the paper describes five process requirements. These process requirements are filing cadence, planning horizon, stakeholder involvement, draft and final plans, and Commission review. Cascade has fully met these process requirements.

Thereafter, the Strategen paper outlines eleven analytical features to further accomplish the benefits. These are shown in Figure 9-40. Cascade has performed significant analyses of the first six items, from its short-term action plan through identification of preferred portfolio. In this IRP, the Company has provided the basis for capital investment forecast, bill impact analysis, equity analysis, coordination with the electric sector, and mapping.[21] Each of these, by nature of available data and uncertainties are in different stages of analysis. For example, coordination with the electric sector is at its beginning and is ongoing. To assist with transparency, Cascade has offered access to its PLEXOS© modeling platform.

Figure 9-40: Strategen Analytics

Analytical Features:

- Short-term action plan
- Load forecasting
- Scenario and sensitivity analysis
- RNG and hydrogen consideration
- Non-pipeline alternatives
- Identification of preferred portfolio
- Capital investment forecast
- Bill impact analysis
- Equity Analysis
- Coordination with electric sector
- Mapping

Conclusion

Cascade's modeling and analytics for varying emission scenarios is based on currently available best practices and data. The Company is committed to enhancing its resource integration strategy by exploring capacity releasing transportation options. Additionally, Cascade is planning to add storage facilities by 2029, which will provide greater flexibility, price arbitrage opportunities, and reliability in meeting customer demand.

Since Cascade's results did not vary between the different growth portfolios, whether deterministically or stochastically, Cascade's plan to meet carbon compliance will be to utilize allowances in the near- and mid-term. In the long-term, Cascade will consider implementing carbon capture technologies and Renewable Thermal Certificates (RTCs) to further reduce its carbon footprint and support sustainability goals. As a reminder, Cascade's IRP is not a set it and forget it plan. For example,

[21] Capital investment forecast estimates can be found in Appendix I

the timing of carbon capture and RTCs will be dependent on the cost of allowances and offsets, among many other factors.

Furthermore, Cascade anticipates there may be a growing interest among low-income customers in electrification options. Cascade is dedicated to addressing these evolving needs and will continue to actively investigate electrification modeling further.

With two-year IRP planning cycles, modifications will occur as uncertainties resolve, new technology becomes apparent, and public policy is solidified. The 20-year view is illustrative, but is subject to change, as the future brings greater clarity to electrification initiatives, among other planning parameters.

CHAPTER 10

STAKEHOLDER ENGAGEMENT

Overview

Input and feedback from Cascade's Technical Advisory Group (TAG) are an important resource for ensuring the IRP includes perspectives beyond the Company's and is responsive to stakeholders' concerns. After listing attending stakeholders, this section covers three distinct areas: public participation outreach, stakeholder engagement during this IRP cycle, and meetings and workshops.

Key Points

- Eight targeted Technical Advisory Group meetings and four regular TAG meetings were held.
- Multiple opportunities for public participation and stakeholder engagement were available, including access to the Company's Resource Planning Team through phone discussions and email.
- TAG meeting agendas, minutes, and presentations are available at www.cngc.com.

Stakeholders

The Company encourages public participation in the IRP process. Participants invited to these public meetings include customers, regional upstream pipelines, Pacific Northwest Local Distribution Companies and other utilities, Commission Staff, stakeholder representatives such as the Northwest Gas Association, Oregon Department of Ecology, Washington Public Counsel, Oregon Citizens' Utility Board, the Alliance of Western Energy Consumers, the Northwest Energy Coalition, and the Green Energy Institute. Attendees for each meeting are shown in Appendix A.

Internally, the Cascade IRP stakeholders and participants are from the following departments:

- Resource Planning;
- Gas Supply/Gas Control;
- Regulatory Affairs;
- Operations/Engineering;
- Business Development
- Energy Efficiency;
- Finance/Accounting;
- Information Technology; and
- Executive group.

Additionally, Cascade contracted the services of an IRP consultant, Bruce W Folsom Consulting LLC, to assist the Company with meeting the 2025 IRP schedule.

In its IRP, Cascade presents policy and technical information in a variety of formats ranging from thumbnail overviews in each chapter to an Executive Summary to descriptive narratives in each chapter with accompanying charts, graphs, and tables to highly technical information in the appendices of the IRP. This presentation style is intended to cover the broad range, and meet each unique needs, of stakeholders.

Opportunity for Public Participation

Cascade is fully committed to ensuring the public is invited to participate in its IRP process. The Company notifies five general segments of stakeholders through a variety of means. The five segments are: Commission Staffs, Customer representatives, Community-based organizations, the Expert public, and the General public.[1,2,]

Cascade has notified these segments in the past in several ways, including:[3]

- Social media;
- Meetings throughout service territory;[4]
- Invite to docket distribution lists relevant to the IRP;
- Web page;
- Commission web page;
- Equity Advisory Group; and
- Bill Inserts to customers as well as LI programs with Mid Valley Providers Consortium and DSHS.

Cascade has a dedicated Internet webpage where customers and interested parties can view the IRP timeline, TAG presentations and minutes, as well as current and past IRPs.[5,6] Cascade's webpage is also available in multiple language.

The Company believes that customers and interested parties were made aware of Cascade's IRP meetings, opportunity to participate, as well as availability of CNGC personnel to address any related issues. Additionally, Cascade hosts the

[1] Solid participation has come from Commission Staffs, customer representatives, and some community-based organizations (depending on their staffing and adjacency to their core mission). The General Public has been represented by all three.
[2] Utilities have attempted a multitude of efforts to attract the Expert and General Public to the IRP process, including media advertisements, newspaper articles, and town hall meetings. Over the past 30 years, these by themselves, have resulted in negligible turnout.
[3] Moreover, customers know how to gain information for energy efficiency and other customer-specific utility options. Additionally, utilities host ongoing advisory groups for specific issues (e.g., energy efficiency), town hall meetings (e.g., by electric utilities for transmission siting), and other options for specific issues.
[4] On August 14, 2019, Cascade held a TAG meeting in Bend, Oregon. Despite notification to the community, no customer attended.
[5] *See:* https://www.cngc.com/rates-services/rates-tariffs/oregon-integrated-resource-plan
[6] *See:* https://www.cngc.com/rates-services/rates-tariffs/washington-integrated-resource-plan

Conservation Advisory Group (CAG) to receive regular input on energy efficiency issues.

Company Commitments for Stakeholder Engagement

For attendance at meetings, in an effort to further clarify roles and responsibilities for the Company as well as stakeholders, Cascade follows a Stakeholder Engagement Design Document, which can be found in Appendix A. Cascade recognizes that involvement in the Company's TAG represents a material time commitment. As stated in the Design Document at page 1: "Cascade seeks to employ best industry practices and recognizes external participation can add incremental improvements. … Cascade recognizes stakeholders have a multitude of projects before them. This Design Document is intended to assist in optimizing participation by interested parties to yield a solid IRP to the benefit of customers and the Company."

In the past decades, "rules of the road" for participation in utility advisory groups and collaboratives have ranged from full informality to specific charters. The latter has taken significant time for crafting and agreement by all parties. Cascade's Stakeholder Design Document attempts to capture the best from each approach.

The Company appreciates the investment of time attendees provide to this process by reviewing multiple documents and making subsequent suggestions. This IRP has benefited from the focus of the engaged stakeholders.

TAG Meetings and Workshops

New to this IRP, Cascade held eight public Targeted TAG meetings and four public regular TAG meetings with internal and external stakeholders. The Targeted TAG meetings focused on singular topics with a focus on methodology. The regular TAG meetings focused on the results of modeling with the updated methodologies discussed in the Targeted TAG meetings.

Information about each meeting date and major agenda items are provided below as well as in Appendix A.

Figure 10-1: Input Opportunities

Eight Targeted TAG meetings:

- What is an IRP
- Avoided Cost
- Energy Efficiency
- Equity in the IRP
- Customer/Load Forecast
- CCA/Compliance Modeling
- System Distribution Planning
- Resource Integration

2025 IRP Targeted TAG 1 Meeting – Thursday, January 25, 2024
Microsoft Teams Only – 9 AM PST to 10 AM PST

- What is an IRP and how to get involved.

2025 IRP Targeted TAG 2 Meeting – Thursday, February 15, 2024
Microsoft Teams Only – 9 AM PST to 10 AM PST

- Avoided Cost.

2025 IRP Targeted TAG 3 Meeting – Wednesday, March 6, 2024
Microsoft Teams Only – 9 AM PST to 10 AM PST

- Energy Efficiency.

2025 IRP Targeted TAG 4 Meeting – Thursday, March 28, 2024
Microsoft Teams Only – 9 AM PST to 10 AM PST

- Equity in the IRP.

2025 IRP Targeted TAG 5 Meeting – Thursday, April 11, 2024
Microsoft Teams Only – 9 AM PST to 10 AM PST

- Customer/Load Forecast.

2025 IRP Targeted TAG 6 Meeting – Thursday, April 25, 2024
Microsoft Teams Only – 9 AM PST to 10 AM PST

- CCA/Compliance Modeling.

2025 IRP Targeted TAG 7 Meeting – Thursday, May 16, 2024
Microsoft Teams Only – 9 AM PST to 10 AM PST

- Distribution System Planning.

2025 IRP Targeted TAG 8 Meeting – Thursday, May 30, 2024
Microsoft Teams Only – 9 AM PST to 10 AM PST

- Resource Integration.

2025 IRP Regular TAG 1 Meeting – Thursday, September 12, 2024
Microsoft Teams – 9 am to noon PT

- Process;
- Key Points;
- IRP Team;
- Timeline;
- Regional Market Outlook;
- Planned Scenarios and Sensitivities;
- Stakeholder Engagement;
- Demand and Customer Forecast and Non-Core Outlook; and
- Drilling down into segments of demand forecast.

2025 IRP Regular TAG 2 Meeting – Thursday, October 24, 2024
Microsoft Teams – 9 am to noon PT

- 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; and
- Preliminary Resource Integration Results.

2025 IRP Regular TAG 3 Meeting – Wednesday, January 8, 2025
Microsoft Teams – 9 am to noon PT

- Respond to TAG 2 feedback;
- Low Carbon Alternative Fuels; and
- Electrification Modeling.

2025 IRP Regular TAG 4 Meeting – Wednesday, February 5, 2025
Microsoft Teams – 9 am to noon PT

- Respond to TAG 2 feedback;
- Final Integration Results;
- finalization of plan components; and
- Proposed new 2- to 4-year Action Plan.

Conclusion

Cascade submits that it has adequately sought public participation for its IRP process and has implemented best practices for stakeholder engagement. The Company has assertively sought, at all junctures, to fully and efficiently work with stakeholders to optimize their input while being cognizant of busy workloads.

Chapter 11

Short-Term Action Plan

2025 Short-Term Action Plan

The IRP Short-Term Action Plan demonstrates Cascade's commitment to implementing the Company's Integrated Resource Plan and creating a dynamic portfolio of resources with the lowest reasonable cost mix of resources determined through a detailed and consistent analysis of a wide range of commercially available sources. This Short-term plan will outline specific actions that will be taken by the utility in implementing the long-range integrated resource plan during the two years following submission.

Key Points

- Cascade's 2023 Action Plan focuses on short-term actions that are flexible for long-term planning.
- Acquire all estimated potential energy efficiency savings.
- Investigate carbon capture technologies for potential inclusion in the mid- to long-term plan.
- Perform a Hybrid Heat Pump Pilot.
- Continue to develop a distributional equity analysis (DEA).
- Look for opportunities to permanently or temporarily capacity release transportation contracts.
- Develop Distribution Enhancements for six locations.

2025 WA IRP Short-Term Action Plan Details

- Acquire all estimated potential energy efficiency savings of 1,782,212 therms in 2025 and 2,909,133 therms in 2026;
- Acquire all offsets or allowances to comply with the Climate Commitment Act (CCA);
- Investigate carbon capture technologies for potential inclusion in the mid- to long-term plan;
- Perform a Hybrid Heat Pump Pilot to explore non-conventional means to reduce GHG emissions and overall throughput while remaining mindful of customer affordability and energy burden. This research could also be an effective non-pipe alternative, as reduced throughput should reduce the need for new or additional pipeline infrastructure;
- Continue to develop a distributional equity analysis (DEA) to gauge the impacts a Company decision, such as a new or modified pipeline, may have on vulnerable communities;
- Look for opportunities to permanently or temporarily capacity release transportation contracts if Cascade's customer counts continue to experience low, flat, or declining growth; and
- Develop Distribution Enhancements for six locations:
    - Kitsap Phase V Pipeline Reinforcement;
    - Aberdeen 8-inch HP – Wishkah Rd;
    - Richland HP Reinforcements;
    - Pasco 6-inch HP Reinforcement;
    - Burlington South Feed Reinforcement; and
    - Elma Gate.

Chapter 12

Glossary and Maps

Glossary of Definitions and Acronyms

The glossary is provided to allow the reader to maintain a location of definitions and acronyms for the content provided in this Integrated Resource Plan. Definitions and Acronyms can be found on pages 12-2 through 12-16. Cascade's citygates and the zone and pipeline each gate is associated with are listed on pages 12-17 through 12-18. Pipeline maps of gas systems that Cascade utilizes are provided on pages 12-19 through 12-33.

ABB™
Add-in product to the SENDOUT® model that facilitated the ability to model gas price and load uncertainty (driven by weather) into the future. ABB™ brings a Monte Carlo approach into the linear programming approach utilized in SENDOUT®. Cascade has since replaced SENDOUT® with PLEXOS®.

ACEEE
American Council for an Energy-Efficient Economy.

ACHIEVABLE POTENTIAL
Represents a realistic assessment of expected energy savings, recognizing and accounting for economic and other constraints that preclude full installation of every identified conservation measure.

AECO INDEX
Alberta Canada natural gas trading price.

AKAIKE INFORMATION CRITERION (AIC)
A measure of the relative quality of statistical models for a given set of data. Given a collection of models for the data, AIC estimates the quality of each model, relative to each of the other models. Hence, AIC provides a means for model selection.

ALLOWANCES
An authorization to emit up to one metric ton of carbon dioxide equivalent.

ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE)
Thermal efficiency measure of combustion equipment like furnaces, boilers, and water heaters.

ANNUAL MEASURES
Conservation measures that achieve generally uniform year-round energy savings independent of weather temperature changes. Annual measures are also often called base load measures.

ARIMA MODELING
Autoregressive integrated moving average. A time series analysis technique

employed by Cascade in its demand and customer forecast.

ASSET MANAGEMENT AGREEMENT (AMA)
An arrangement that a local distribution company (LDC) may enter into with a marketing company to assist with transportation and storage assistance.

AVOIDED COST
Marginal cost of serving the next unit of demand, which is saved through conservation efforts.

BASE LOAD
As applied to natural gas, a given demand for natural gas that remains fairly constant over a period of time, usually not temperature sensitive.

BASE LOAD MEASURES
Conservation measures that achieve generally uniform year-round energy savings independent of weather temperature changes. Base load measures are also often called annual measures.

BIO NATURAL GAS (BNG)
Typically refers to a gas produced by the biological breakdown of organic matter in the absence of oxygen.

BRITISH THERMAL UNIT (BTU)
The amount of heat required to raise the temperature of one pound of pure water one-degree Fahrenheit under stated conditions of pressure and temperature; a therm of natural gas has an energy value of 100,000 BTUs and is approximately equivalent to 100 cubic feet of natural gas.

CANADIAN ENERGY REGULATOR (CER)
The Canadian equivalent to the Federal Energy Regulatory Commission (FERC). The CER replaced the National Energy Board (NEB) on August 14, 2019.

CHOLESKY DECOMPOSITION
A positive-definite covariance matrix. This matrix is used to draw or sample random vectors from the N-dimensional multivariate normal distribution that follow a desired distribution. This allows for correlations between weather zones to be included when drawing or sampling data distributions for Monte Carlo runs.

CITYGATE (ALSO KNOWN AS GATE STATION OR PIPELINE DELIVERY POINT)
The point at which natural gas deliveries transfer from the interstate pipelines to Cascade's distribution system.

CITYGATE LOOP
Two or more citygates that transfer natural gas from the interstate pipeline to the same distribution system. Citygates are combined into a loop for modeling purposes because it is difficult to distinguish which citygate feeds a certain distribution system.

CLEAN AIR RULE (CAR)
Greenhouse gas emissions standards codified in WAC 173-442. Invalidated Dec. 15, 2017.

COEFFICIENT OF PERFORMANCE (COP)
The coefficient of performance or COP of a heat pump, refrigerator or air conditioning system is a ratio of useful heating or cooling provided to work required. Higher COPs equate to lower operating costs.

COMPRESSION
Increasing the pressure of natural gas in a pipeline by means of a mechanically driven compressor station to increase flow capacity.

COMPRESSOR
Equipment which pressurizes gas to keep it moving through the pipelines.

CONSERVATION MEASURES
Installations of appliances, products, or facility upgrades that result in energy savings.

CONSUMER PRICE INDEX (CPI)
As calculated and published by the U.S. Department of Labor, Bureau of Labor Statistics.

CONTRACT DEMAND (CD)
The maximum daily, monthly, seasonal, or annual quantities of natural gas, which the supplier agrees to furnish, or the pipeline agrees to transport, and for which the buyer or shipper agrees to pay a demand charge.

CORE CUSTOMERS
Residential, firm industrial and commercial gas customers who require utility gas service.

COST EFFECTIVENESS
The determination of whether the present value of the therm savings for any given conservation measure is greater than the cost to achieve the savings.

CUSTOMER CARE & BILLING (CC&B)
Internal billing data system for Cascade Natural Gas.

DAY GAS
Gas that can be purchased as needed to cover demand in excess of the base load.

DEKATHERM (DTH)
Unit of measurement for natural gas; a dekatherm is 10 therms, which is 1000 cubic feet (volume) or 1,000,000 BTUs (energy).

DEMAND SIDE MANAGEMENT (DSM)
The activity pursued by an energy utility to influence its customers to reduce their energy consumption or change their patterns of energy use away from peak consumption periods.

DEMAND SIDE RESOURCES
Energy resources obtained through assisting customers to reduce their demand or use of natural gas. Also represents the aggregate energy savings attained from installation of conservation measures.

ELECTRONIC BULLETIN BOARD (EBB)
Online communication systems where one can share, request, or discuss information on just about any subject.

ENERGY INFORMATION ADMINISTRATION (EIA)
The U.S. Energy Information Administration (EIA) is a principal agency of the U.S. Federal Statistical System responsible for collecting, analyzing, and disseminating energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. EIA programs cover data on coal, petroleum, natural gas, electric, renewable and nuclear energy. EIA is part of the U.S. Department of Energy.

ENTITLEMENTS
Flow management tool used by upstream pipelines, in conjunction with operational flow orders.

EXTERNALITIES
Costs and benefits that are not reflected in the price paid for goods or services.

FEDERAL ENERGY REGULATORY COMMISSION (FERC)
The government agency charged with the regulation and oversight of interstate natural gas pipelines, wholesale electric rates and hydroelectric licensing; the FERC regulates the interstate pipelines with which Cascade does business and determines rates charged in interstate transactions.

FIRM SERVICE OR FIRM TRANSPORTATION
Service offered to customers under schedules or contracts that anticipate no interruptions; the highest quality of service offered to customers.

FIRST OF THE MONTH PRICE (FOM)
Supply contracts entered into on a short-term basis to cover expected demand for that month.

FORCE MAJEURE
An unexpected event or occurrence not within the control of the parties to a contract, which alters the application of the terms of a contract; sometimes referred to as "an act of God;" examples include severe weather, war, strikes, pipeline failure, and other similar events.

FOURIER TERMS
An alternative to using seasonal dummy variables, especially for long seasonal periods, is to use Fourier terms. Fourier terms consist of a series of sine and cosine terms of frequencies that can approximate any periodic function. These terms can be used for seasonal patterns with great advantage over seasonal dummy variables.

FUEL-IN-KIND (FUEL LOSS)
A statutory percent of gas based on the tariff from the pipeline that is lost and unaccounted for from the point where the gas was purchased to the citygate.

FUGITIVE METHANE EMISSIONS
Natural gas that escapes the system during drilling, extraction, and/or transportation and distribution of gas.

GAS MANAGEMENT SYSTEM (GMS)
A transactional and reporting system to consolidate natural gas nominations, contracts, balancing and pricing data.

GAS SUPPLY OVERSIGHT COMMITTEE (GSOC)
Oversees the Company’s gas supply purchasing and hedging strategy. Members of GSOC include Company senior management from Gas Supply, Regulatory, Accounting & Finance, Engineering, and Operations.

GAS TRANSMISSION NORTHWEST (GTN)
A subsidiary of TransCanada Pipeline which owns and operates a natural gas pipeline that runs from the Canada/U.S. border to the Oregon/California border. One of the six natural gas pipelines Cascade transacts with directly.

GAUSSIAN (NORMAL) DISTRIBUTION
A distribution of many random variables that form a symmetrical bell-shaped graph.

GEOMETRIC BROWNIAN MOTION (GBM)
A continuous-time stochastic process in which the log of the randomly varying quantity follows a random shock combined with a drift element.

GREENHOUSE GAS (GHG)
A greenhouse gas is a gas that absorbs and emits radiant energy within the thermal infrared range. Increasing greenhouse gas emissions cause the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide and ozone.

HEATING DEGREE DAY (HDD)
A measure of the coldness of the weather experienced, based on the extent to which the daily average temperature falls below 60 degrees Fahrenheit; a daily average temperature representing the sum of the high and low readings divided by two.

HENRY HUB (NYMEX)
The physical location found in Louisiana that is widely recognized as the most important pricing point in the United States. It is also the trading hub for the New York Mercantile Exchange (NYMEX).

INJECTION
The process of putting natural gas into a storage facility or biomethane into the distribution system.

INTEGRATED RESOURCE PLAN (IRP)
The document that explains Cascade’s long-range plans and preparations to maintain sufficient resources to meet customer needs at a reasonable price.

INTERRUPTIBLE SERVICE
A service of lower priority than firm service, offered to customers under schedules or contracts that anticipate and permit interruptions on short notice; interruption occurs when the demand of all firm customers exceeds the capability of the system to continue deliveries to all firm customers.

INTERSTATE PIPELINE
A federally regulated company that transports and/or sells natural gas across state lines.

JACKSON PRAIRIE
An underground storage facility jointly owned by Avista Corp., Puget Sound Energy, and NWP. The facility is a naturally occurring aquifer near Chehalis, Washington, which is located some 1,800 feet beneath the surface and capped with a very thick layer of dense shale.

LINEAR PROGRAMMING
A mathematical method of solving problems by means of linear functions where the multiple variables involved are subject to constraints; this method is utilized in the SENDOUT® Gas Model.

LIQUEFIED NATURAL GAS (LNG)
Natural gas that has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit at atmospheric pressure. It is liquefied to reduce its volume and thereby facilitate bulk storage and transport.

LOAD FACTOR
The average load of a customer, a group of customers, or an entire system, divided by the maximum load factor that can be calculated over any time period.

LOAD FORECAST
A forecast, an estimate, or a prediction of how much gas will be needed for residences, companies, and other institutions.

LOAD MANAGEMENT
The reduction of peak demand during specific, limited time periods by temporarily curtailing usage or shifting usage to other time periods. Load management reduces system peak demand very well, but can have little or no effect on total energy use. Its effects are temporary and of short duration.

LOAD PROFILE
The pattern of a customer's gas usage, hour to hour, day to day, or month to month.

LOADMAP
Microsoft Excel-based modeling tool developed by AEG to determine the Technical/Economic/Achievable Potential savings of various proposed DSM programs

LOCAL DISTRIBUTION COMPANY (LDC)
LDCs are regulated utilities involved in the delivery of natural gas to consumers within a specific geographic area.

LOOPING
The construction of a second pipeline parallel to an existing pipeline over the whole or any part of its length, thus increasing the capacity of that section of the system.

LOWEST REASONABLE COST (LRC)
LRC methodology is used when evaluating alternatives to determine the optimal solution to a given problem.

MCF
A unit of volume equal to 1,000 cubic feet.

MDDO
Maximum daily delivery obligation.

MDQ
Maximum daily quantity.

MDT
Thousands of dekatherms.

MEMORANDUM OF UNDERSTANDING (MOU)
A memorandum of understanding (MOU) is a nonbinding agreement between two or more parties outlining the terms and details of an understanding, including each parties' requirements and responsibilities. An MOU is often the first stage in the formation of a formal contract.

MONTE CARLO ANALYSIS
A type of stochastic mathematical simulation which randomly and repeatedly samples input distributions (e.g. reservoir properties) to generate a results distribution.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)
A United States environmental law that promotes the enhancement of the environment and established the President's Council on Environmental Quality (CEQ). The law was enacted on January 1, 1970.

NATURAL GAS
A naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geologic formations beneath the earth's surface, often in association with petroleum; the principal constituent is methane, and it is lighter than air.

NEEDLE PEAKING RESOURCE
Utilized during severe or “arctic” cold weather.

NEW YORK MERCANTILE EXCHANGE (NYMEX)
An organization that facilitates the trading of several commodities including natural gas.

NGV
Natural gas vehicles.

NOMINAL
Discounting method that does not adjust for inflation.

NOMINATION
The scheduling of daily natural gas requirements.

NON-COINCIDENT PEAK
The sum of two or more peak loads on individual systems that do not occur in the same time interval. Meaningful only when considering loads within a limited period of time, such as a day, week, month, a heating or cooling season, and usually for not more than one year.

NON-CORE CUSTOMER
Large customers who contract with a third party for supply and upstream pipeline capacity. Cascade provides distribution services only. Typical customers include large commercial, industrial, cogeneration, wholesale, and electric generation customers.

NORTH AMERICAN ENERGY STANDARDS BOARD (NAESB)
Serves as an industry forum for the development and promotion of standards which will lead to a seamless marketplace for wholesale and retail natural gas and electricity, as recognized by its customers, business community, participants, and regulatory entities.

NORTHWEST BUILDER OPTION PACKAGES (NWBOP)
A prescriptive method for labeling new homes as ENERGY STAR. BOPs specify levels and limitations for the thermal envelope (insulation and windows), HVAC and water heating equipment efficiencies for the Pacific Northwest. BOPs require a third-party verification, including testing the leakage of the envelope and duct system, to ensure the requirements have been met.

NORTHWEST GAS ASSOCIATION (NWGA)
A trade organization of the Pacific Northwest natural gas industry. The NWGA's members include six natural gas utilities serving communities throughout Idaho, Oregon, Washington and British Columbia; and three natural gas transmission pipelines that transport natural gas from supply basins into and through the region.

NORTHWEST PIPELINE CORPORATION (NWP)
A principal interstate pipeline serving the Pacific Northwest and one of six natural gas pipelines Cascade transacts with directly. NWP is a subsidiary of The Williams Companies and is headquartered in Salt Lake City, Utah.

NORTHWEST POWER AND CONSERVATION COUNCIL (NWPCC)
NWPCC consists of two members from each of the four Northwest states- Oregon, Washington, Idaho and Montana- who develop a plan for meeting the region's electric demand.

NOVA GAS TRANSMISSION (NOVA or NGTL)
See TransCanada Alberta System.

OFF-SYSTEM
Any point not on or directly interconnected with a transportation, storage, and/or distribution system operated by a natural gas company within a state.

OPAL (OPAL HUB)
Natural gas trading hub in Lincoln County, Wyoming.

OPERATIONAL FLOW ORDER (OFO)
A mechanism to protect the operational integrity of the pipeline. Upstream pipelines may issue and implement System-Wide or Customer-Specific OFOs in the event of high or low pipeline inventory. OFOs require shippers to take action to balance their supply with their customers' usage on a daily basis within a specified tolerance band. Shippers may deliver additional supply or limit supply delivered to match usage. Violations or failure to comply with an OFO can result in the pipeline assessing penalties to offending shippers.

OREGON PUBLIC UTILITY COMMISSION (OPUC)
The chief electric, gas and telephone utility regulatory agency of the government of the U.S. state of Oregon. It sets rates and establishes rules of operation for the state's investor-owned utility companies. The OPUC's official name is Public Utility Commission of Oregon.

PACIFIC CONNECTOR GAS PIPELINE PROJECT (PCGP)
A proposed 232-mile, 36-inch diameter pipeline designed to transport up to 1 billion cubic feet of natural gas per day from interconnects near Malin, Oregon, to the Jordan Cove LNG terminal in Coos Bay, Oregon, where the natural gas will be liquefied for transport to international markets

PEAK DAY
The greatest total natural gas demand forecasted in a 24-hour period used as a basis for planning peak capacity requirements.

PEAK DAY GAS
Gas that is purchased in a peak day situation to serve demand that cannot be satisfied by base or day gas.

PERFORMANCE TESTED COMFORT SYSTEMS (PTCS)
Northwest regional programs with a focus on improving HVAC system comfort and increasing savings. They promote contractor training for properly sealing ducts and installing high-efficiency heat pumps, with a focus on sizing, commissioning, and setting controls. Technicians must complete a BPA-approved training to be certified to perform work in this program. These programs are supported by BPA and Northwest Public Utilities.

PLEXOS®
Natural gas planning system from Energy Exemplar™; a linear programming model used to solve gas supply and transportation optimization questions.

POUNDS PER SQUARE INCH (PSI)
The standard unit of measure when determining how much pressure is being applied when gas is flowing through a pipe.

PREFERRED PORTFOLIO
Cascade's term of art for the optimal mix of resources to solve for forecasted shortfalls in the 20-year planning horizon.

PRESENT VALUE OF REVENUE REQUIREMENT (PVRR)
The annual revenues required by the firm to cover both its expenses and have the opportunity to earn a fair rate of return. The annual costs to provide safe and reliable service to the company's customers that the company is allowed to recover through rates. The present value a future sum of money or stream of cash flows given a specified rate of return. Future cash flows are discounted at the discount rate, and the higher the discount rate, the lower the present value of the future cash flows.

PRICE ELASTICITY
Economic concept which recognizes that customer consumption changes as prices rise or fall.

R
A programming language and free software environment for statistical computing and graphics supported by the R Foundation for Statistical Computing.

REAL
Discounting method that adjusts for inflation.

RECOURSE RATE
Cost-of-service based rate for natural gas pipeline service that is on file in a pipeline's tariff and is available to customers who do not negotiate a rate with the pipeline company. Also see negotiated rate. (Source: FERC https://www.ferc.gov/resources/glossary.asp#R)

REFERENCE CASE
Average annual demand from the forecast results without peak day.

REGASIFICATION RESOURCE
Process by which LNG is heated, converting it to a gaseous state. Designed for vaporizing LNG where and when it will be used.

REGULATOR STATION
A point on a distribution system responsible for controlling the flow of gas from higher to lower pressures.

RENEWABLE FUEL
A power source that is continuously or cyclically renewed by nature, i.e. solar, wind, hydroelectric, geothermal, biomass, or similar sources of energy.

ROCKIES INDEX
Natural gas trading price near the Rocky Mountains.

SATELLITE LNG FACILITIES
A facility for storing and vaporizing LNG to meet relatively modest demands at remote locations or to meet short-term peak demands. LNG is usually trucked to such facilities.

SEASONAL PEAKING SERVICE
The delivery of gas, firm or interruptible, sold only during certain times of the year, generally when system demands are not high.

SENDOUT®
Natural gas planning system from ABB™; a linear programming model used to solve gas supply and transportation optimization questions.

SERVICE TERRITORY
Territory in which a utility system is required or has the right to provide natural gas service to ultimate customers.

SPOT MARKET GAS
Natural gas purchased under short-term agreements as available on the open market; prices are set by market pressure of supply and demand.

STANDBY
Support service that is available, as needed, to supplement a consumer, a utility system, or to another utility to replace normally scheduled energy that becomes unavailable.

STORAGE
The utilization of facilities for storing natural gas which has been transferred from its original location for the purposes of serving peak loads, load balancing, and the optimization of basis differentials. The facilities are usually natural geological reservoirs such as depleted oil or natural gas fields or water-bearing sands sealed on the top by an impermeable cap rock. The facilities may be man-made or natural caverns. LNG storage facilities generally utilize above ground insulated tanks.

SUMAS INDEX
Natural gas trading price near the city of Sumas, which is on the Washington/Canadian border approximately 25 miles from the Pacific Ocean.

SWAP
A financial instrument where parties agree to exchange an index price for a fixed price over a defined period.

SYNERGI®
Engineering software used to model piping and facilities to represent current pressure and flow conditions, while also predicting future events and growth.

TARIFF
A published volume of regulated rate schedules plus general terms and conditions under which a product or service will be supplied.

TECHNICAL ADVISORY GROUP (TAG)
Industry, customer, and regulatory representatives that advise Cascade during the IRP planning process.

TECHNICAL POTENTIAL
An estimate of all energy savings that could theoretically be accomplished if every customer that could potentially install a conservation measure did so without consideration of market barriers such as cost and customer awareness.

THERM
A unit of heating value used with natural gas that is equivalent to 100,000 British thermal units (BTU); also, approximately equivalent to 100 cubic feet of natural gas.

THROUGHPUT
The total of all natural gas volume moved through a pipeline system, including sales, company use, storage, transportation, and exchange.

TOTAL RESOURCE COST (TRC)
Measures the net costs of a demand side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs. The test is applicable to conservation, load management, and fuel substitution programs.

TRANSCANADA ALBERTA SYSTEM
Previously known as NOVA Gas Transmission (NGTL); a natural gas gathering and transmission corporation in Alberta that delivers natural gas into the TransCanada BC System pipeline at the Alberta/British Columbia border; one of six natural gas pipelines Cascade transacts with directly.

TRANSCANADA BC SYSTEM

Also known as Foothills Pipeline. Previously known as Alberta Natural Gas; a natural gas transmission corporation of British Columbia that delivers natural gas between the TransCanada-Alberta System and GTN pipelines that runs from the Alberta/British Columbia border to the United States border; one of six natural gas pipelines Cascade transacts with directly.

TRANSPORTATION GAS
Natural gas purchased either directly from the producer or through a broker, and used for either system supply or for specific end-use customers, depending on the transportation arrangements; NWP and GTN transportation may be firm or interruptible.

TRANSPORTATION SERVICE AGREEMENT (TSA)
A transportation services agreement is a contract made between goods providers and those who offer transportation for those goods. In the context of the IRP, this refers to shippers and upstream pipelines.

TURN-BACK CAPACITY
When natural gas shippers, upon expiration of their contract(s) for pipeline capacity do not renew capacity rights, in whole or in part, with the original pipeline, return said capacity rights back to the pipeline.

UPSTREAM PIPELINE CAPACITY
The pipeline delivering natural gas to another pipeline at an interconnection point where the second pipeline is closer to the consumer. In the context of the IRP this refers to any transmission pipeline that is upstream of the Cascade distribution system.

VALUE AT RISK (VaR)
A metric used to quantify uncertainty into a tangible number.

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION (WUTC)
A three-member commission appointed by the governor and confirmed by the state senate. The Commission's mission is to protect the people of Washington by ensuring that investor-owned utility and transportation services are safe, available, reliable and fairly priced.

WINTER GAS SUPPLIES
Gas supply purchased for all (base gas) or part (day gas) of the heating season.

WITHDRAWAL
The process of removing natural gas from a storage facility, making it available for delivery into the connected pipelines; vaporization is necessary to make withdrawals from an LNG plant.

WOODS & POOLE (W&P)
An independent firm that specializes in long-term county economic and demographic projections.

ZONE
A geographical area. A geological zone means an interval of strata of the geologic column that has distinguishing characteristics from surrounding strata.

ZONE - IRP
For modeling purposes, Cascade's distribution system is divided into several zones. These zones are generally organized by the location of compressor stations on upstream pipelines or by specific weather areas. Where appropriate, the Zone-IRP is separated by state. Please see the chart on the next page that references the citygate/location to the appropriate IRP zone.

DESCRIPTION	METER	ZONEID	PIPELINE
7TH DAY ADVENTIST FARM TAP	ADVENSCH	ZONE 10	NWP
A & M RENDERING	AMRENDER	ZONE 30-W	NWP
A & W FEED LOT FARM TAP	AWFEED	ZONE 20	NWP
ABERDEEN/HOQUIAM/MCCLEARY	ABRNDHOQ	ZONE 30-S	NWP
ACME	ACME	ZONE 30-W	NWP
ALCOA, WENATCHEE	ALCOA	ZONE 11	NWP
ARLINGTON	ARLINGTN	ZONE 30-W	NWP
ATHENA/WESTON	ATHENA	ZONE ME-OR	NWP
BAKER	BAKER	ZONE 24	NWP
BELLINGHAM II	BLLINGII	ZONE 30-W	NWP
BELLINGHAM/FERNDALE	BLHAM	ZONE 30-W	NWP
BEND TAP	BEND	ZONE GTN	GTN
BREMERTON (SHELTON)	BREMERTON	ZONE 30-S	NWP
BRULOTTE HOP RANCH	BRULOTTE	ZONE 10	NWP
BURBANK HEIGHTS	BURBANKH	ZONE 20	NWP
CASTLE ROCK	CASTLERK	ZONE 26	NWP
CHEMICAL LIME	CHEMLIME	ZONE 24	NWP
CHEMULT	CHEM	ZONE GTN	GTN
DEHANNS DAIRY FARM TAP	DEHANDRY	ZONE 10	NWP
DEMING	DEMING	ZONE 30-W	NWP
EAST STANWOOD	EAST STANWOOD	ZONE 30-W	NWP
FINLEY	FINLEY	ZONE 20	NWP
GILCHRIST TAP	GILC	ZONE GTN	GTN
GRANDVIEW	GRDVEW	ZONE 10	NWP
GREEN CIRCLE FARM TAP	GRENCIRL	ZONE 26	NWP
HERMISTON	HERMSTON	ZONE ME-OR	NWP
HUNTINGTON	HTINGTON	ZONE 24	NWP
KALAMA FARM TAP	KALAMA	ZONE 26	NWP
KALAMA NO. 2	KALAMA2	ZONE 26	NWP
KAWECKI, WENATCHEE	KAWECKI	ZONE 11	NWP
KENNEWICK	KENEWICK	ZONE 20	NWP
KOMOS FARMS TAP	KOMO	ZONE GTN	GTN
LA PINE TAP	LAPI	ZONE GTN	GTN
LAMBERT'S HORTICULTURE	LAMBERTS	ZONE 10	NWP
LAWRENCE	LAWRENCE	ZONE 30-W	NWP
LDS CHURCH FARM TAP	LDSCHURC	ZONE 30-W	NWP
LONGVIEW-KELSO	LONGVIEW	ZONE 26	NWP
LYNDEN	LYNDEN	ZONE 30-W	NWP
MADRAS TAP	MADR	ZONE GTN	GTN
MENAN STARCH	MEMANSTR	ZONE 20	NWP
MILTON FREEWATER	MILFREE	ZONE ME-OR	NWP
MISSION TAP	MISSION	ZONE ME-OR	NWP
MOSES LAKE	MOS LAKE	ZONE 20	NWP
MOUNT VERNON	MTVERNON	ZONE 30-W	NWP
MOXEE CITY	MOXEE	ZONE 11	NWP
NORTH BEND	NBEND	ZONE GTN	GTN
NORTH PASCO METER STATION	NPASCO	ZONE 20	NWP
NYSSA-ONTARIO	NYSSA	ZONE 24	NWP
OAK HARBOR/STANWOOD	OAKHAR	ZONE 30-W	NWP
OTHELLO	OTHELLO	ZONE 20	NWP
PASCO	PASCO	ZONE 20	NWP

PATERSON	PATERSON	ZONE 26	NWP
PENDLETON	PENDLETN	ZONE ME-OR	NWP
PLYMOUTH	PLYMTH	ZONE 20	NWP
PRINEVILLE TAP	PRVL	ZONE GTN	GTN
PRONGHORN TAP	PRONGHORN	ZONE GTN	GTN
PROSSER	PROSSER	ZONE 10	NWP
QUINCY	QUINCY	ZONE 11	NWP
REDMOND TAP	REDM	ZONE GTN	GTN
RICHLAND	RICHLAND	ZONE 20	NWP
SANDVIK, KENNEWICK	SANDVIK	ZONE 20	NWP
SEDRO/WOOLLEY ET AL.	SEDRO	ZONE 30-W	NWP
SELAH	SELAH	ZONE 11	NWP
SOUTHRIDGE	STHRDG	ZONE 20	NWP
SOUTH BEND	S BEND	ZONE GTN	GTN
SOUTH HERMISTON TAP	SHRM	ZONE GTN	GTN
SOUTH LONGVIEW FIBRE	SOLONG	ZONE 26	NWP
STANFIELD CITY TAP	STTAP	ZONE GTN	GTN
STEARNS TAP	STEA	ZONE GTN	GTN
SUMAS, CITY OF	SUMASC	ZONE 30-W	NWP
SUNNYSIDE	SUNSIDE	ZONE 10	NWP
TOPPENISH ET AL. (ZILLAH)	TOPENISH	ZONE 10	NWP
U & I SUGAR, MOSES LAKE	UI SUGAR	ZONE 20	NWP
UMATILLA	UMATILLA	ZONE ME-WA	NWP
WALLA WALLA	WALLA	ZONE ME-WA	NWP
WALULA	WALULA	ZONE ME-WA	GTN
WENATCHEE	WENATCHE	ZONE 11	NWP
WOODLAND WA	WOODLAND	ZONE 26	NWP
YAKIMA CHIEF FARMS	YAKCHFRM	ZONE 11	NWP
YAKIMA FIRING CENTER	YAKFIRCR	ZONE 11	NWP
YAKIMA/UNION GAP	YAKIMA	ZONE 11	NWP

Maps of System Infrastructure

Figure 12-1: Map – AECO Hub Storage

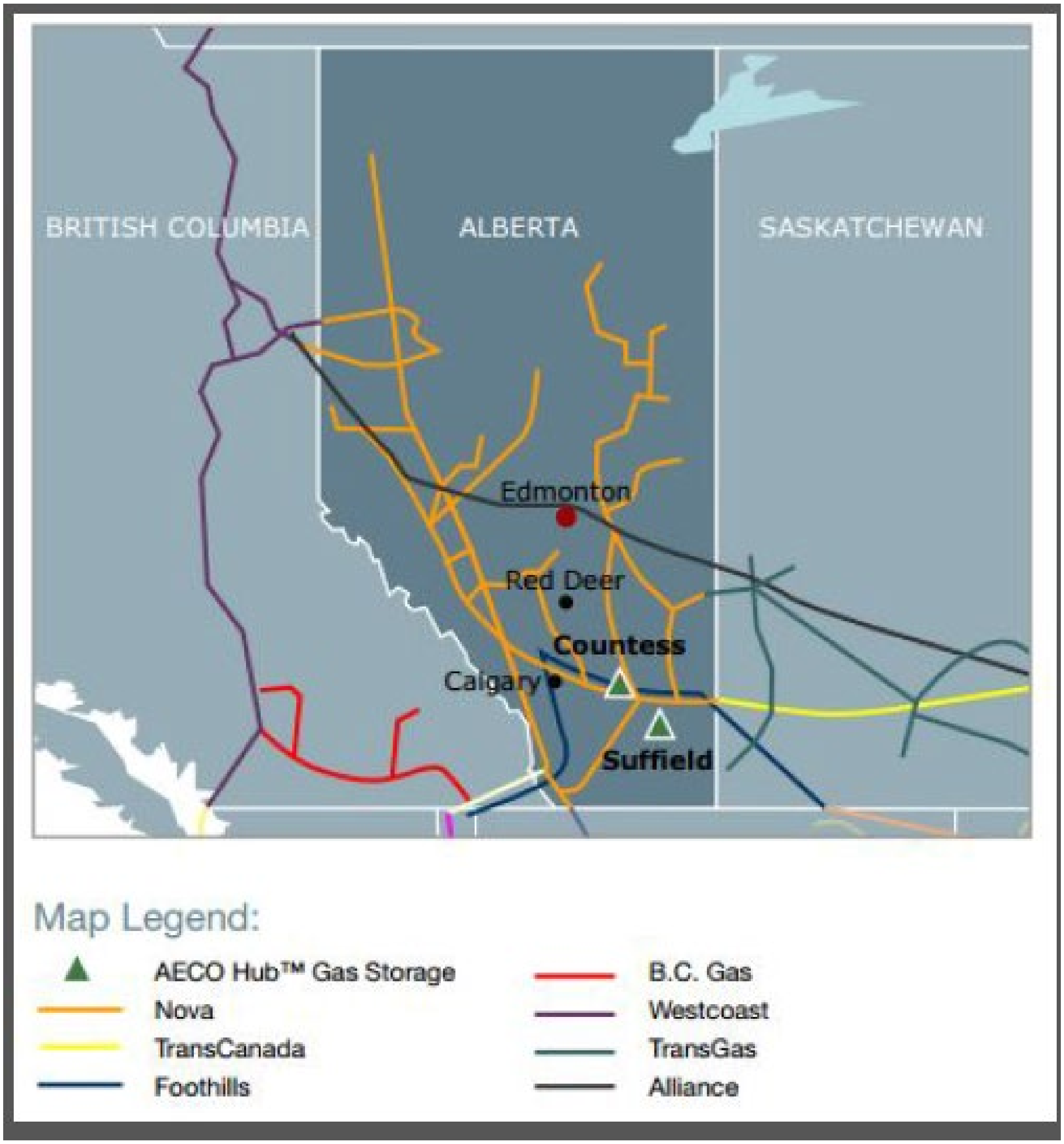


Figure 12-2: Map – California Storage Map

Figure 12-3: Map – Cascade Natural Gas Pipeline System

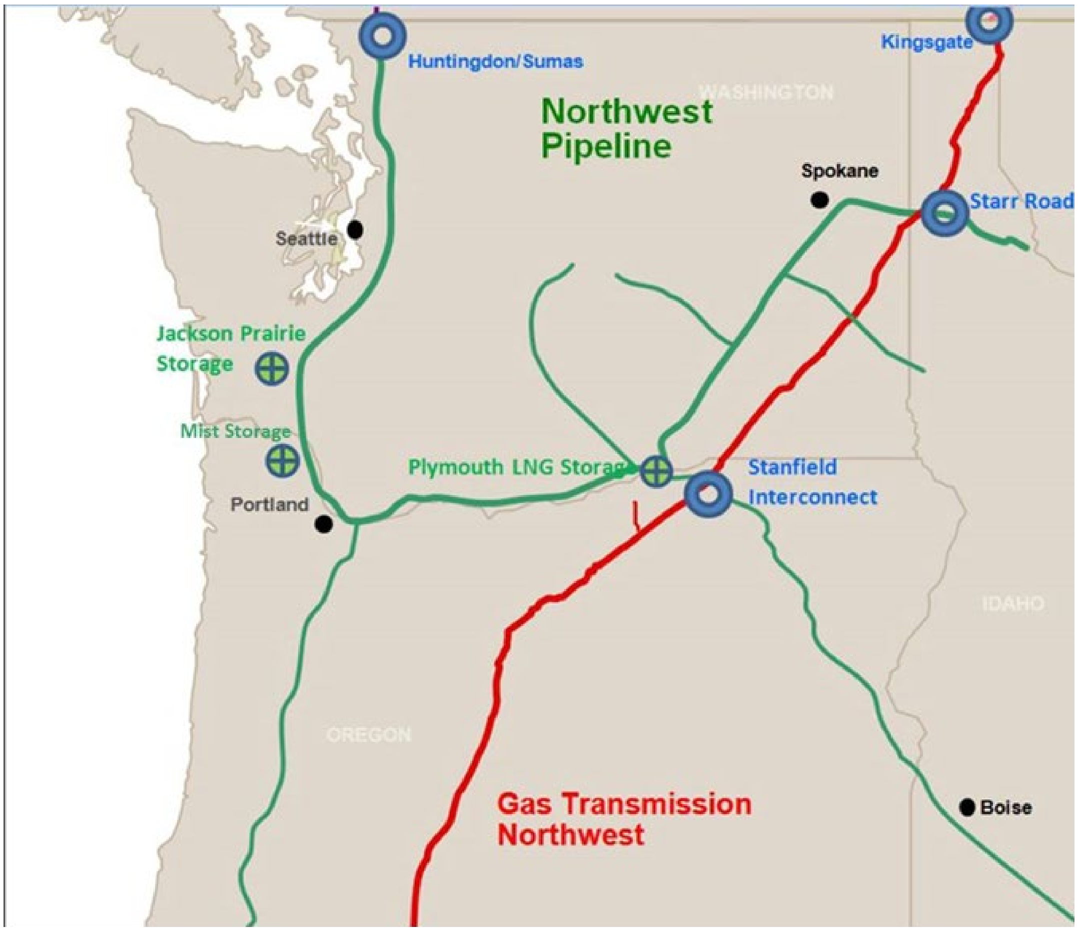


Figure 12-4: Map – Foothills-British Columbia Map

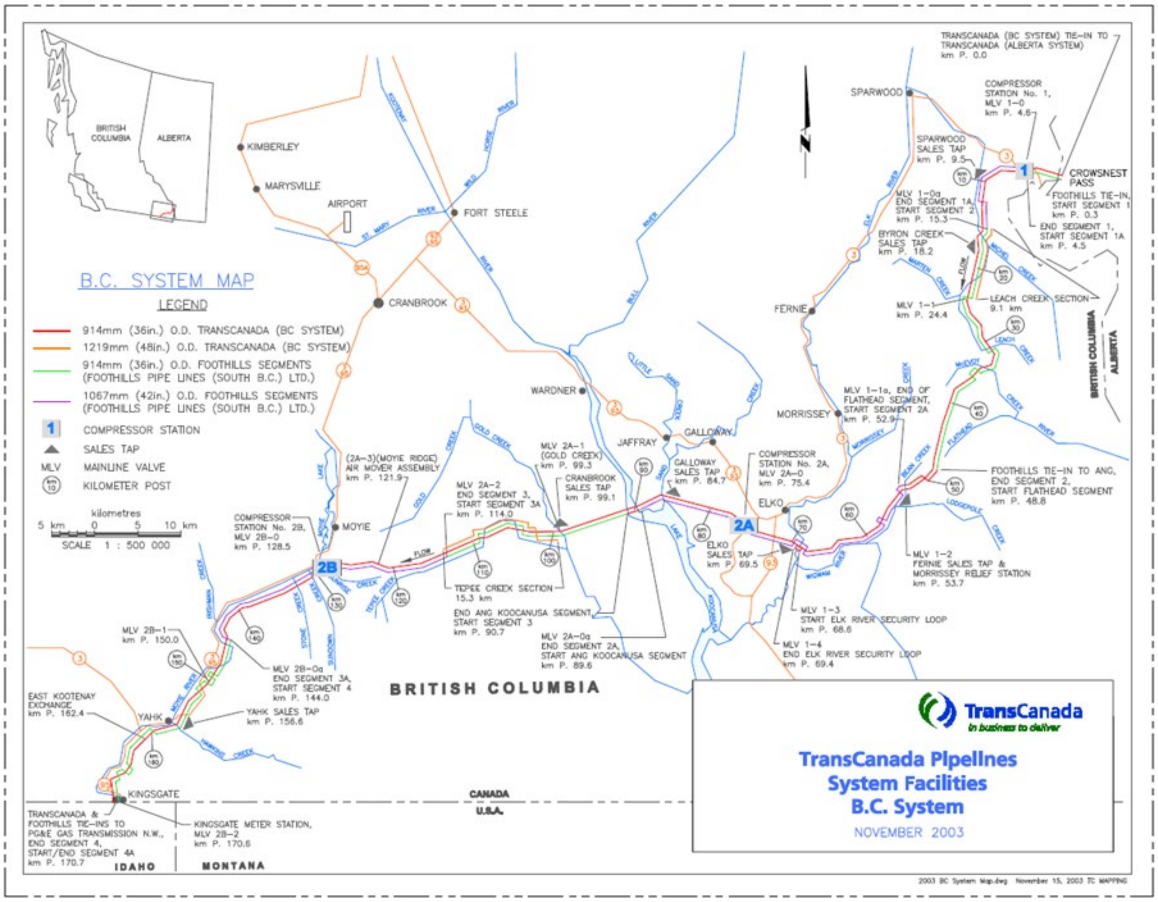


Figure 12-5: Map – Foothills-Full System

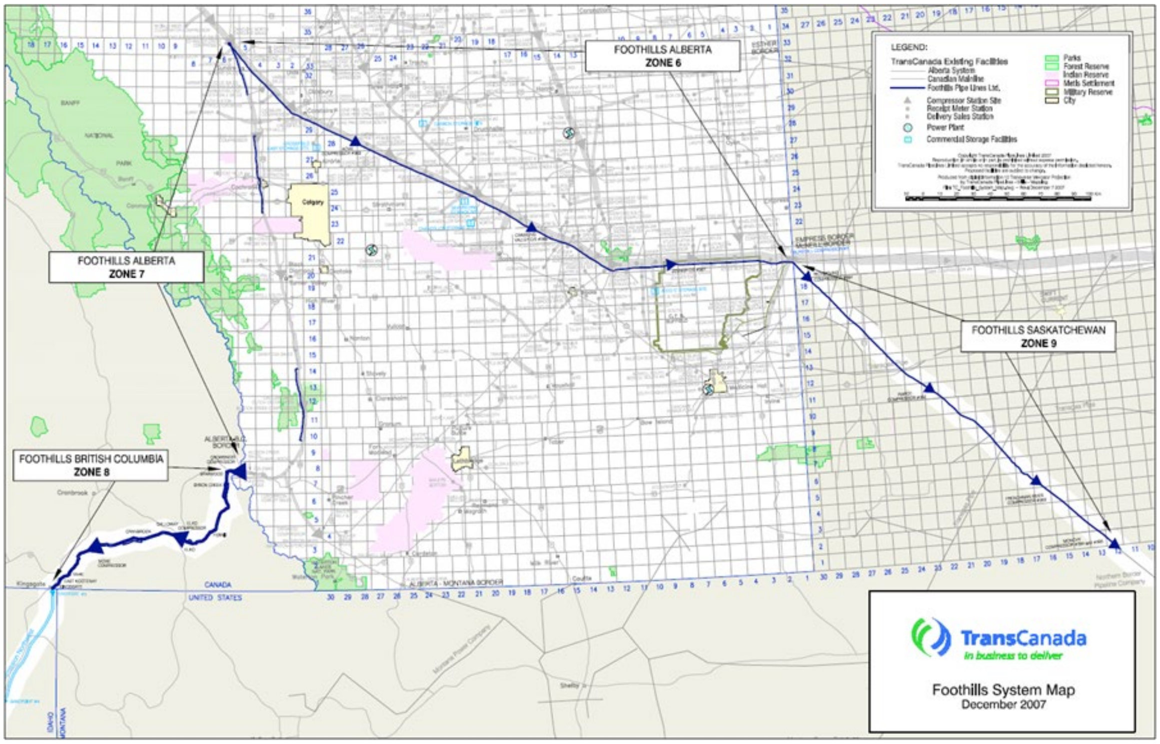
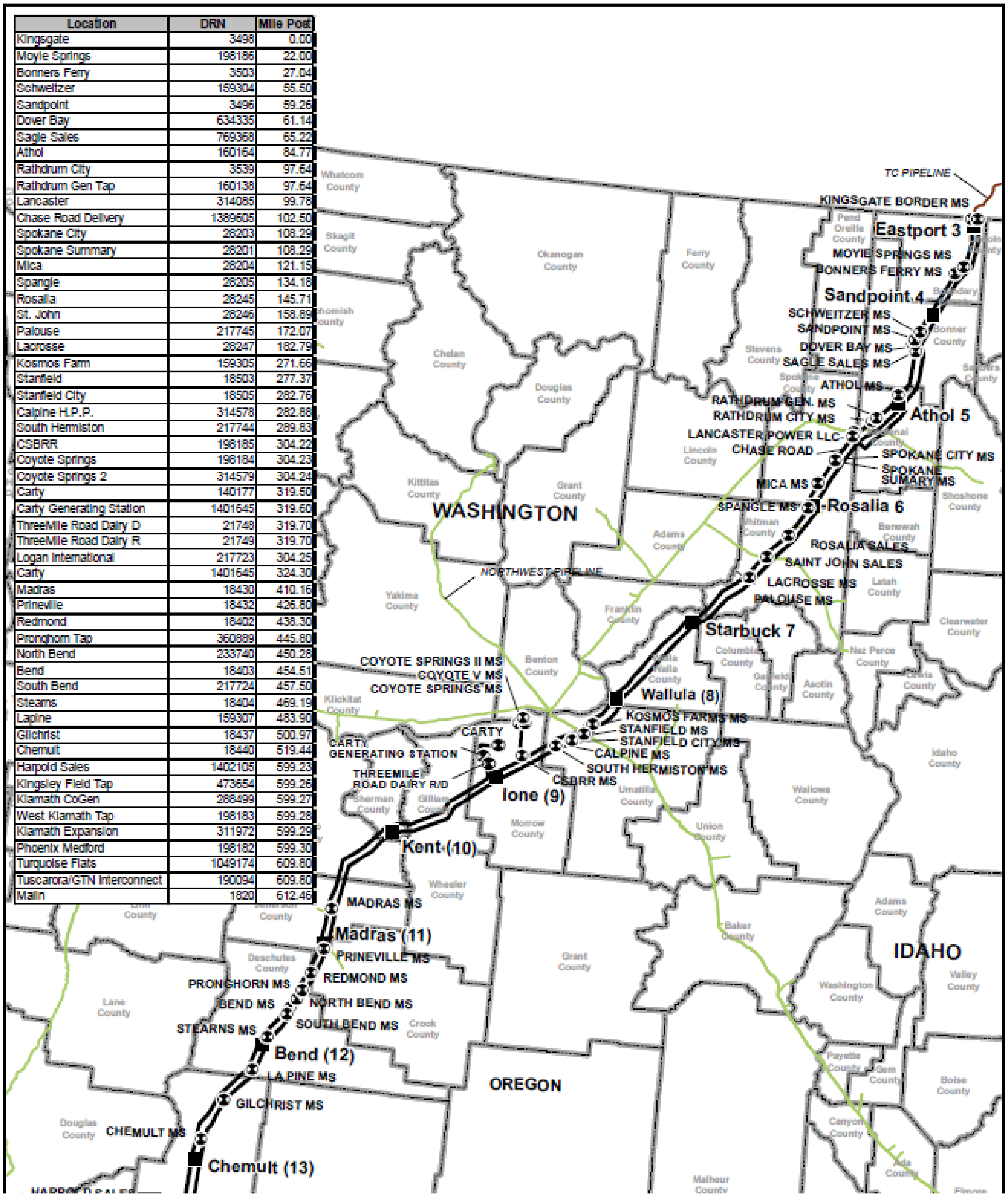


Figure 12-6: Map – GTN System Map

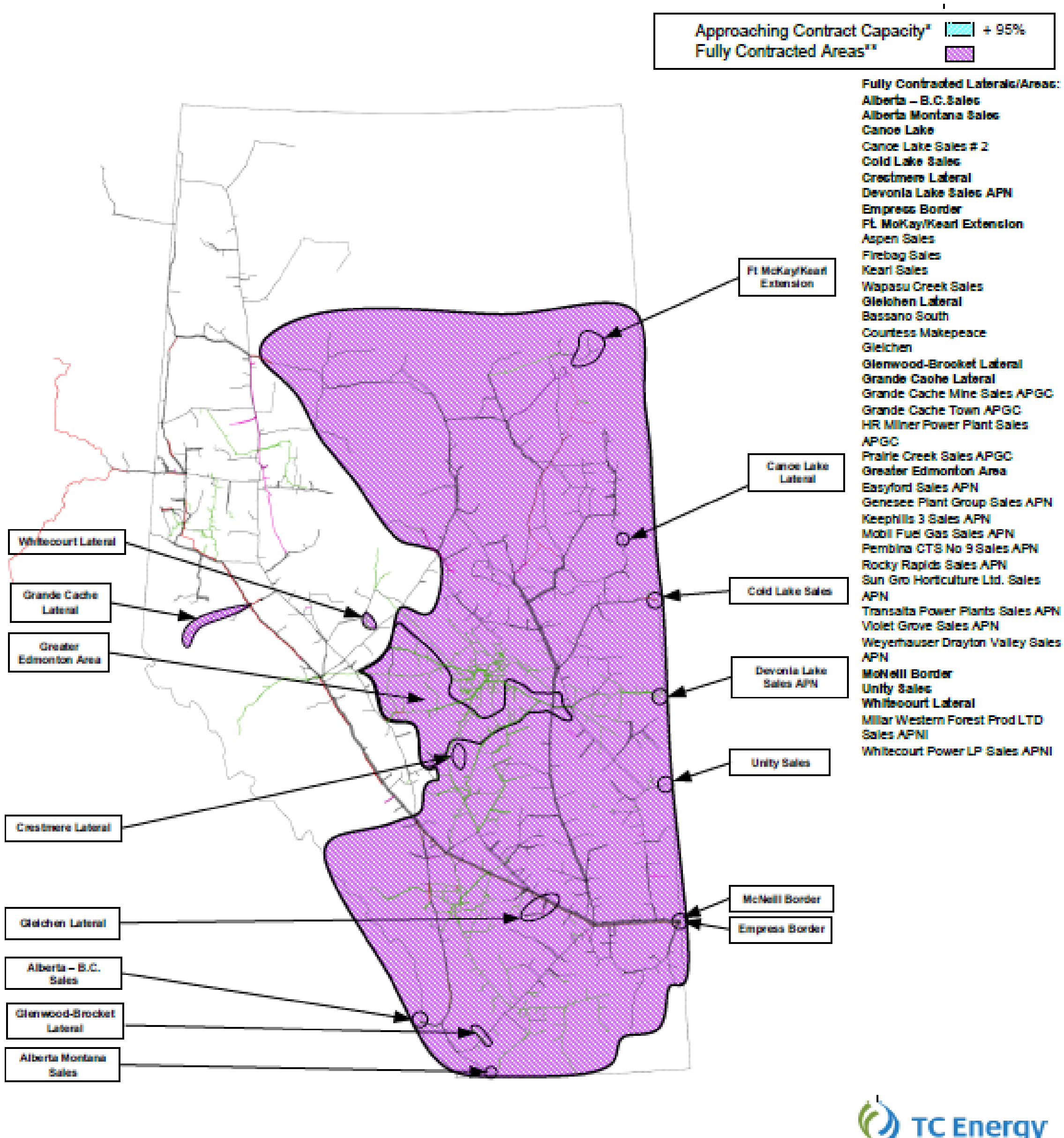


Location	DRN	Mile Post
Kingsgate	3498	0.00
Moyie Springs	198186	22.00
Bonners Ferry	3503	27.04
Schweitzer	159304	55.50
Sandpoint	3496	59.26
Dover Bay	634335	61.14
Sagle Sales	769368	65.22
Athol	160164	84.77
Rathdrum City	3539	97.64
Rathdrum Gen Tap	160138	97.64
Lancaster	314085	99.78
Chase Road Delivery	1389605	102.50
Spokane City	28203	108.29
Spokane Summary	28201	108.29
Mica	28204	121.15
Spangle	28205	134.18
Rosalia	28245	145.71
St. John	28246	158.89
Palouse	217745	172.07
Lacrosse	28247	182.79
Kosmos Farm	159305	271.66
Stanfield	18503	277.37
Stanfield City	18505	282.76
Calpine H.P.P.	314578	282.88
South Hermiston	217744	289.83
CSBRR	198185	304.22
Coyote Springs	198184	304.23
Coyote Springs 2	314579	304.24
Carty	140177	319.50
Carty Generating Station	1401645	319.60
ThreeMile Road Dairy D	21748	319.70
ThreeMile Road Dairy R	21749	319.70
Logan International	217723	304.25
Carty	1401645	324.30
Madras	18430	410.16
Prineville	18432	426.80
Redmond	18402	438.30
Pronghorn Tap	360889	445.80
North Bend	233740	450.28
Bend	18403	454.51
South Bend	217724	457.50
Stearns	18404	469.19
Lapine	159307	483.90
Gilchrist	18437	500.97
Chemult	18440	519.44
Harpold Sales	1402105	599.23
Kingsley Field Tap	473654	599.26
Klamath CoGen	288499	599.27
West Klamath Tap	198183	599.28
Klamath Expansion	311972	599.29
Phoenix Medford	198182	599.30
Turquoise Flats	1049174	609.80
Tuscarora/GTN Interconnect	190094	609.80
Malin	1820	612.46

Figure 12-7: Map – NGTL Delivery System Map

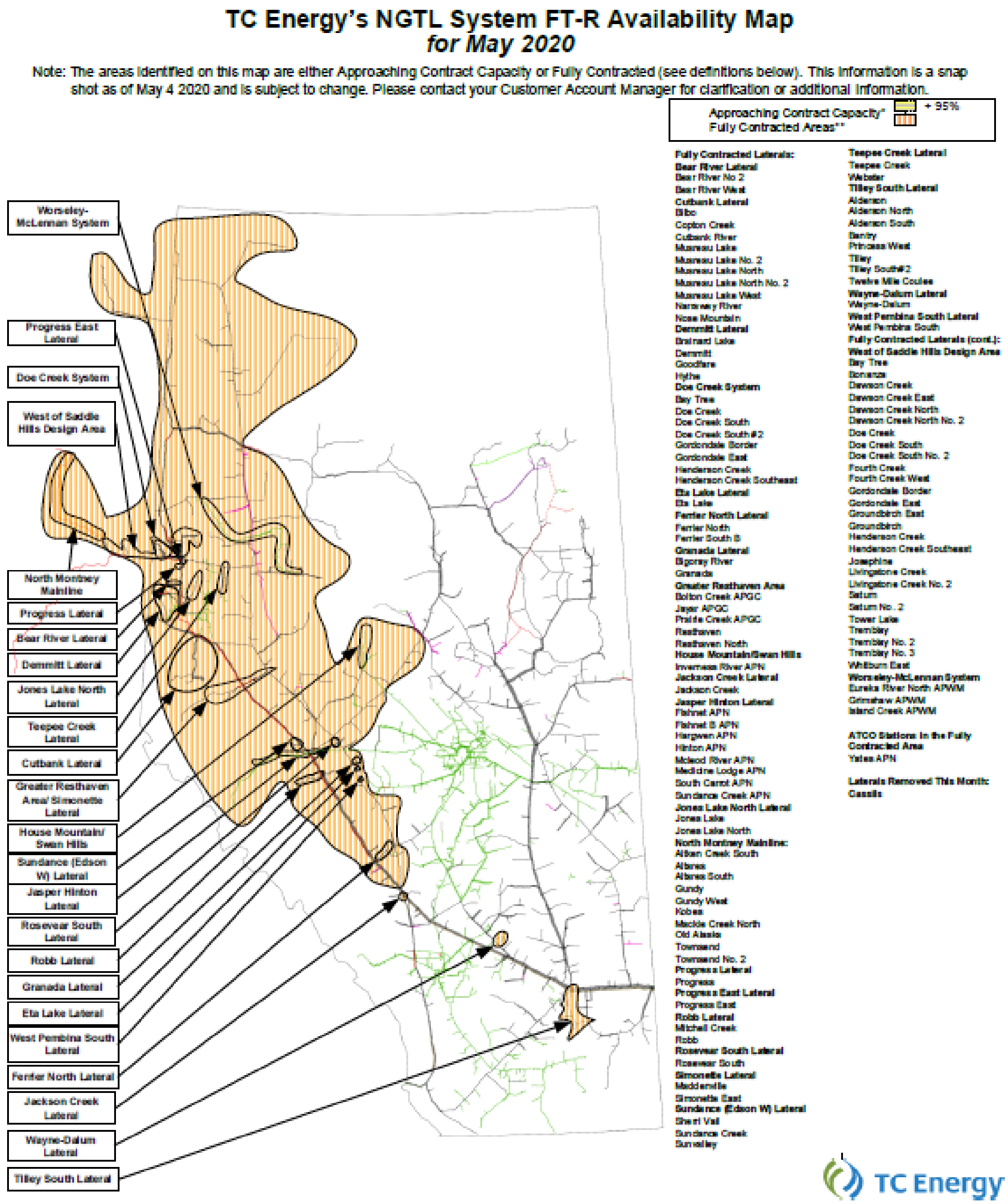
TC Energy's NGTL System FT-R Availability Map *for May 2020*

Note: The areas identified on this map are either Approaching Contract Capacity or Fully Contracted (see definitions below). This information is a snap shot as of May 4 2020 and is subject to change. Please contact your Customer Account Manager for clarification or additional information.



Approaching Contract Capacity*	Contracts are greater than 95% of the area or facility capability. It is recommended that Firm Transfers or New Firm Contracts be confirmed with TCPL Customer Sales.
Fully Contracted**	Area is fully contracted. Firm Transfers allowed within restricted area; upstream at 1 to 1 ratio and downstream at determined hydraulic equivalence. New requests for Firm Transportation service will be held pending availability of Area capacity. For additional information refer to the Informational Postings on Customer Express, Project Area Receipt and Delivery Capacity Update. Last Updated: May 4 2020
Capacity within any portion of the NGTL System can become fully contracted at any time and without prior notice. NGTL encouages customers to review their FT-D requirements to ensure that their FT-D levels align with their expected flow requirements.	

Figure 12-8: Map – NGTL Receipt System Map



Approaching Contract Capacity*	Contracts are greater than 95% of the area or facility capability. Firm Transfers or New Firm to be confirmed with TCPL Customer Sales.
FTR Fully Contracted**	Area is fully contracted. Firm Transfers allowed within restricted area; upstream at 1 to 1 ratio and downstream at determined hydraulic equivalence. New requests for Firm Transportation service will be held pending availability of Area capacity. For additional information refer to the Informational Postings on Customer Express, Project Area Receipt and Delivery Capacity Update. Last Updated: May 4 2020

Capacity within any portion of the NGTL System can become fully contracted at any time and without prior notice. NGTL encourages customers to review their future FT-R requirements to ensure their FT-R levels align with their expected flow requirements. New changes to the fully contracted stations list this month are identified in red.

Figure 12-9: Map – NWP North System Map

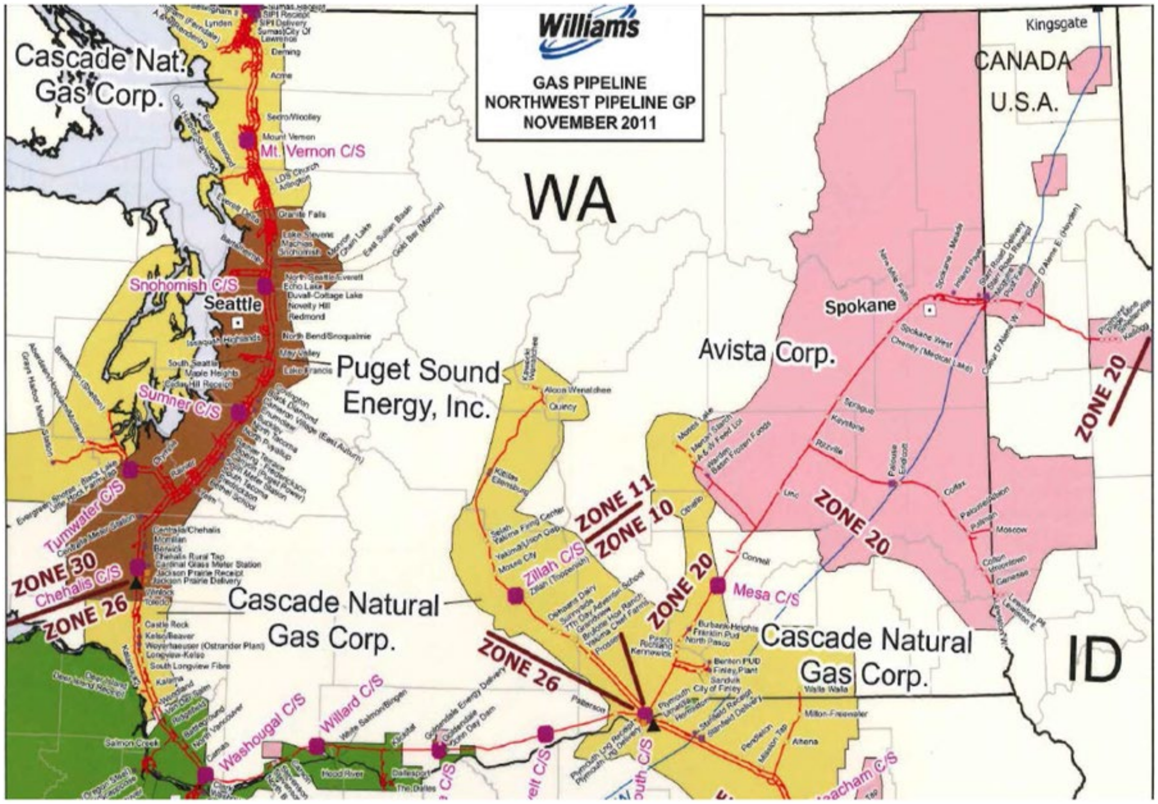


Figure 12-10: Map – NWP South System Map

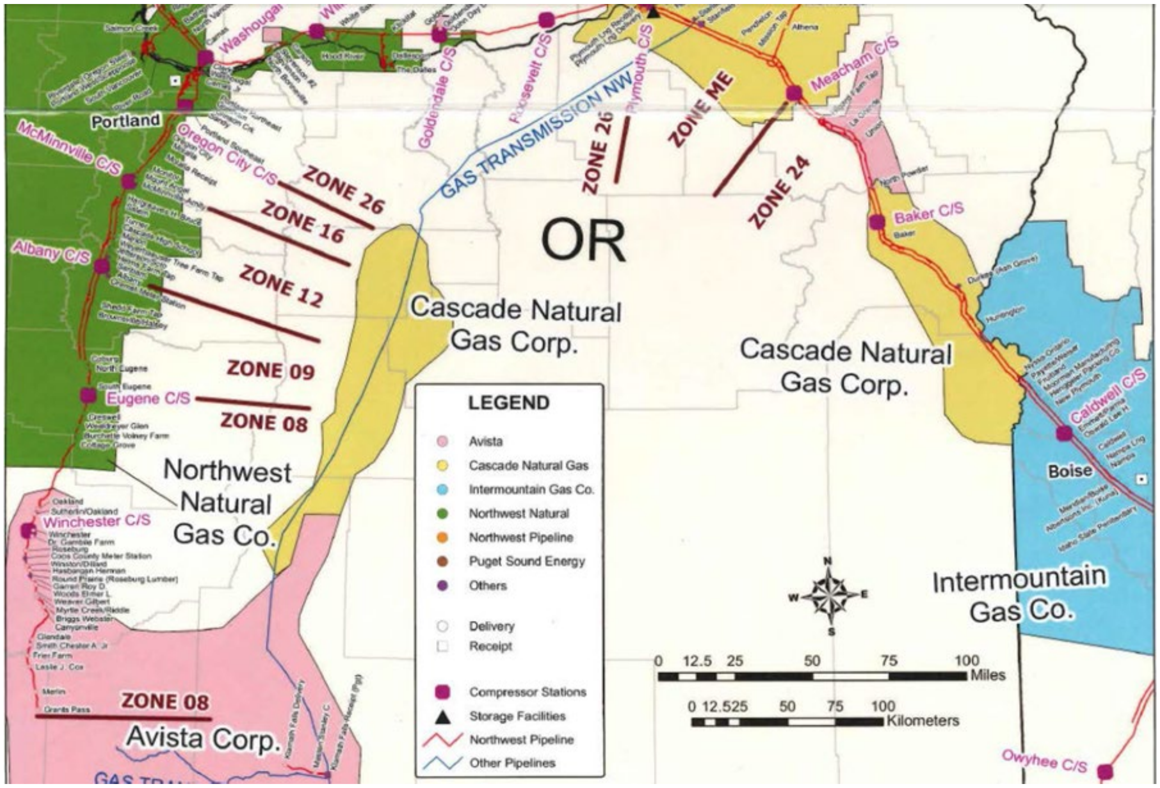


Figure 12-11: Map – Westcoast Sectional Map

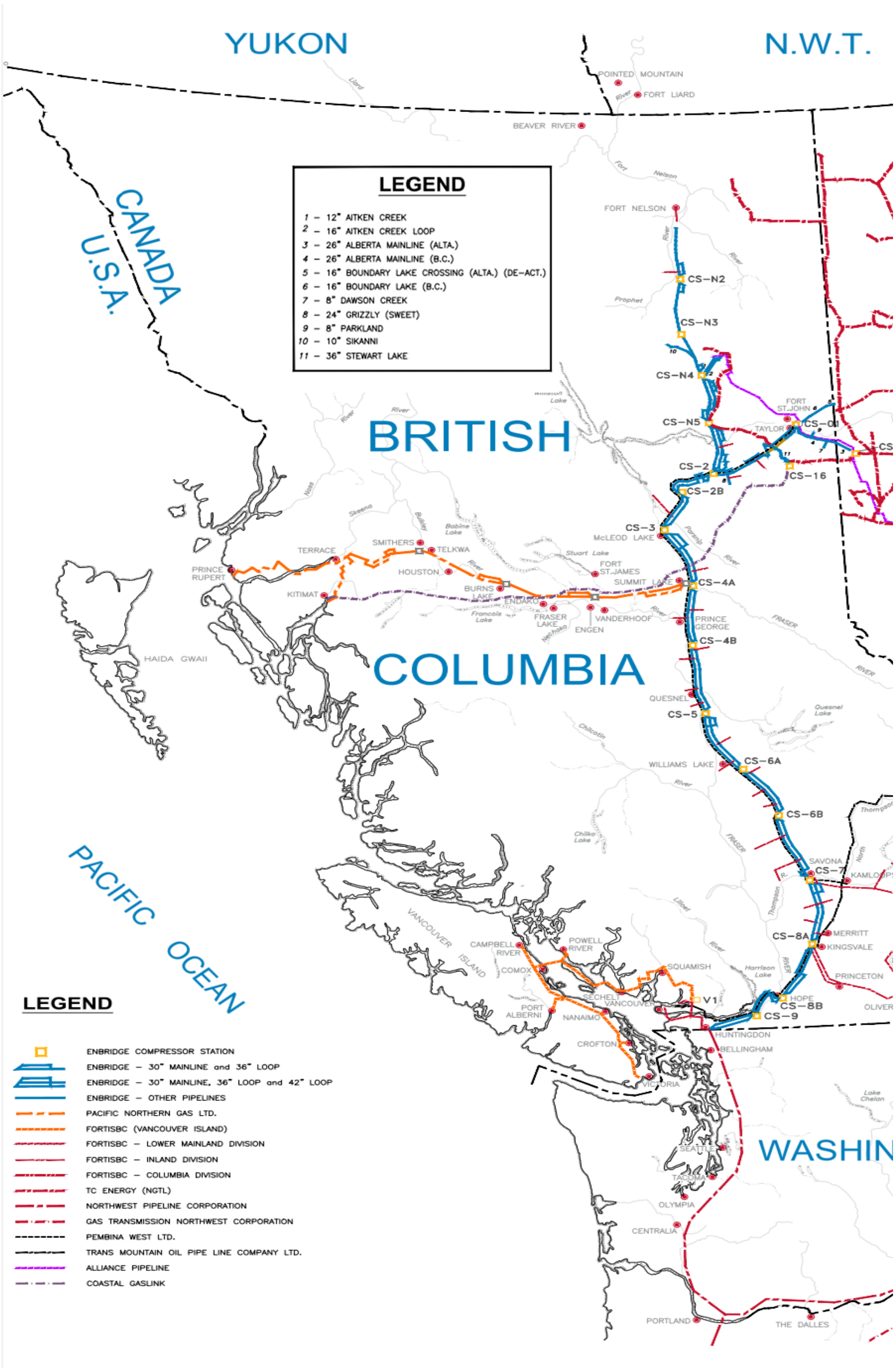


Figure 12-12: Map – Western U.S. and Canadian Pipeline Map

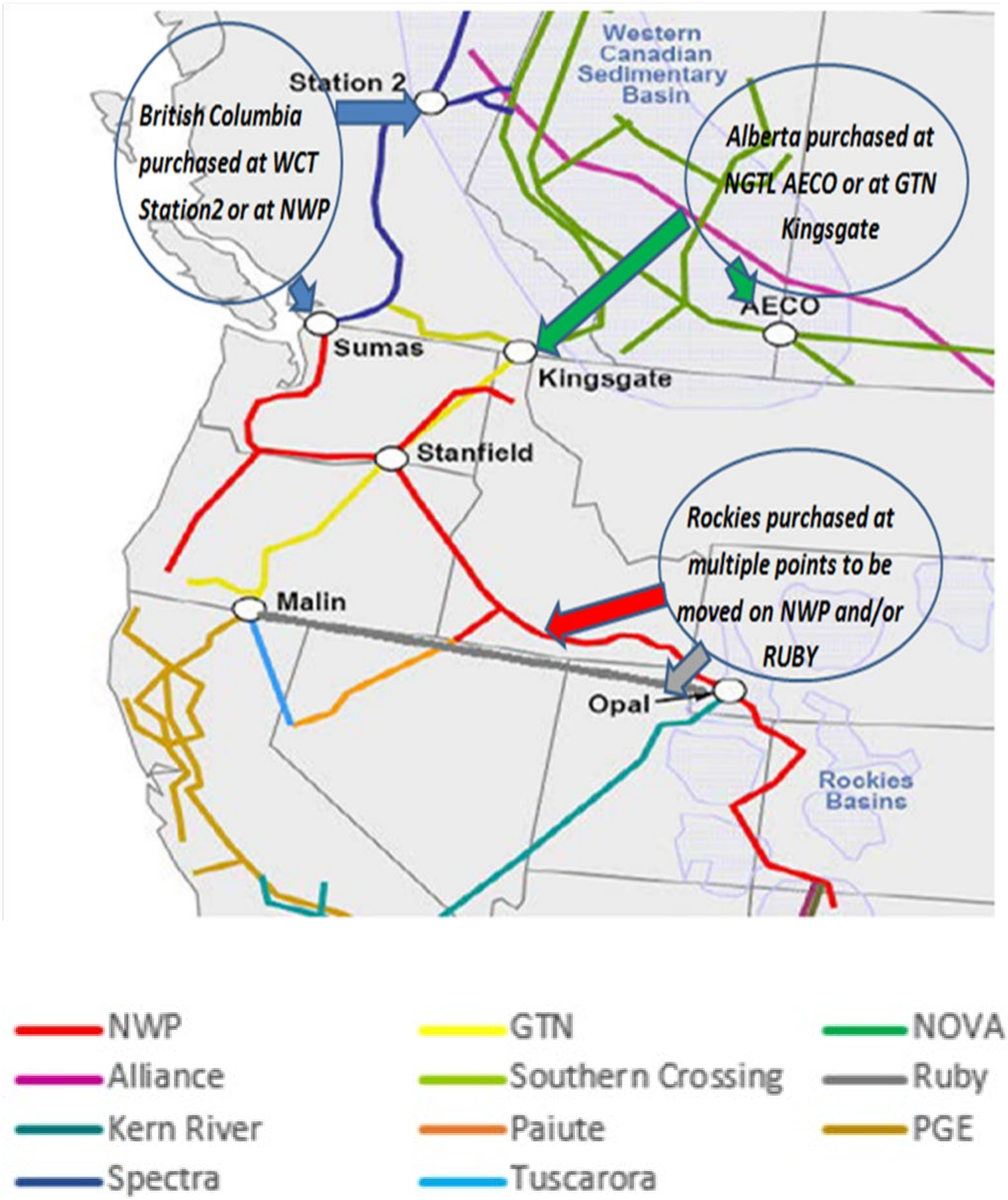
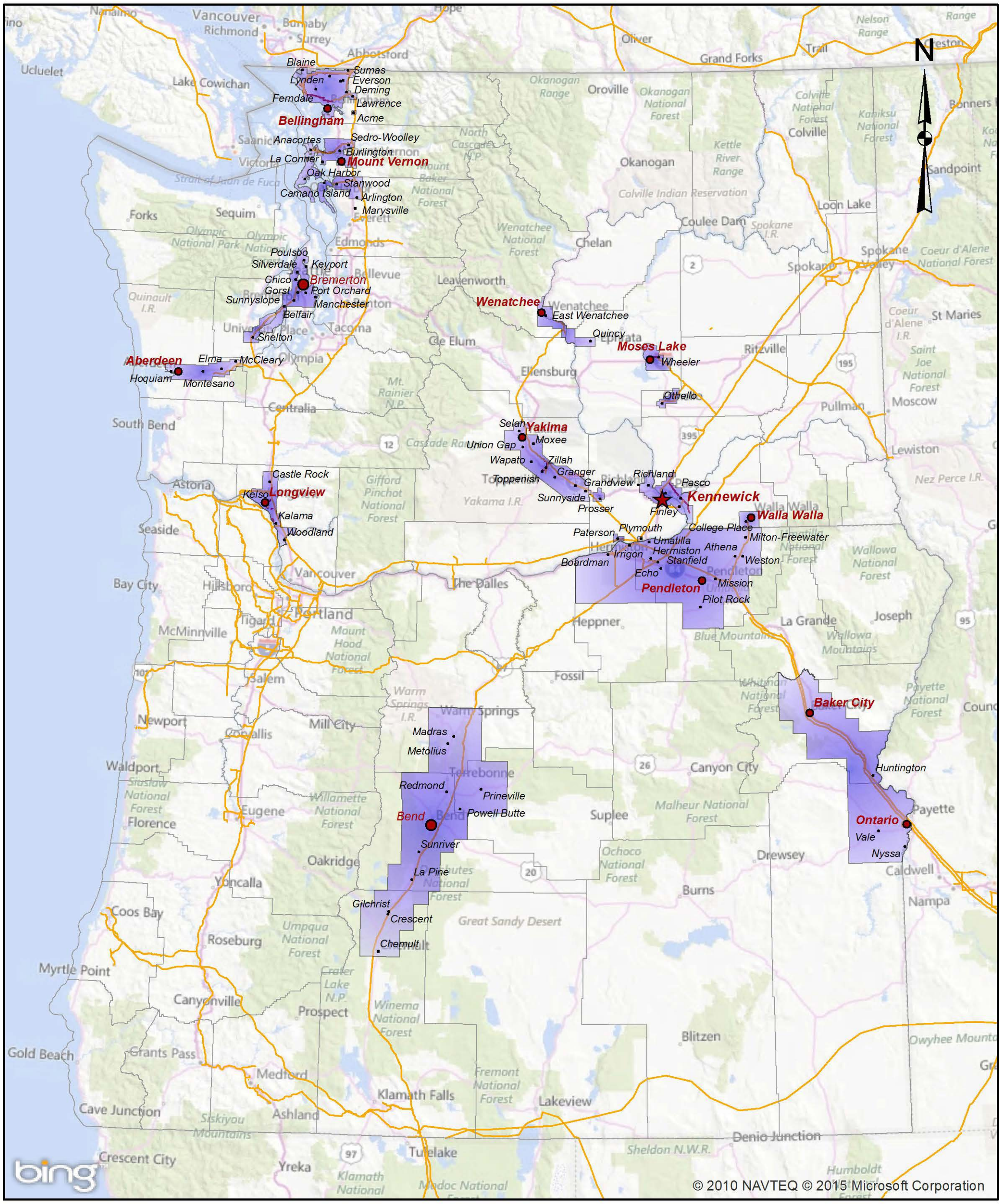


Figure 12-13: Map – Certificated Service Areas as Specified in RCW 80.28.190



CASCADE NATURAL GAS CORPORATION
A Subsidiary of MDU Resources Group, Inc.
In the Community to Serve

Service Boundaries

Communities
- N
- District Office
- Region Office
- General Office

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Figure 12-14: Map – Pipeline Transportation Capacity Usage

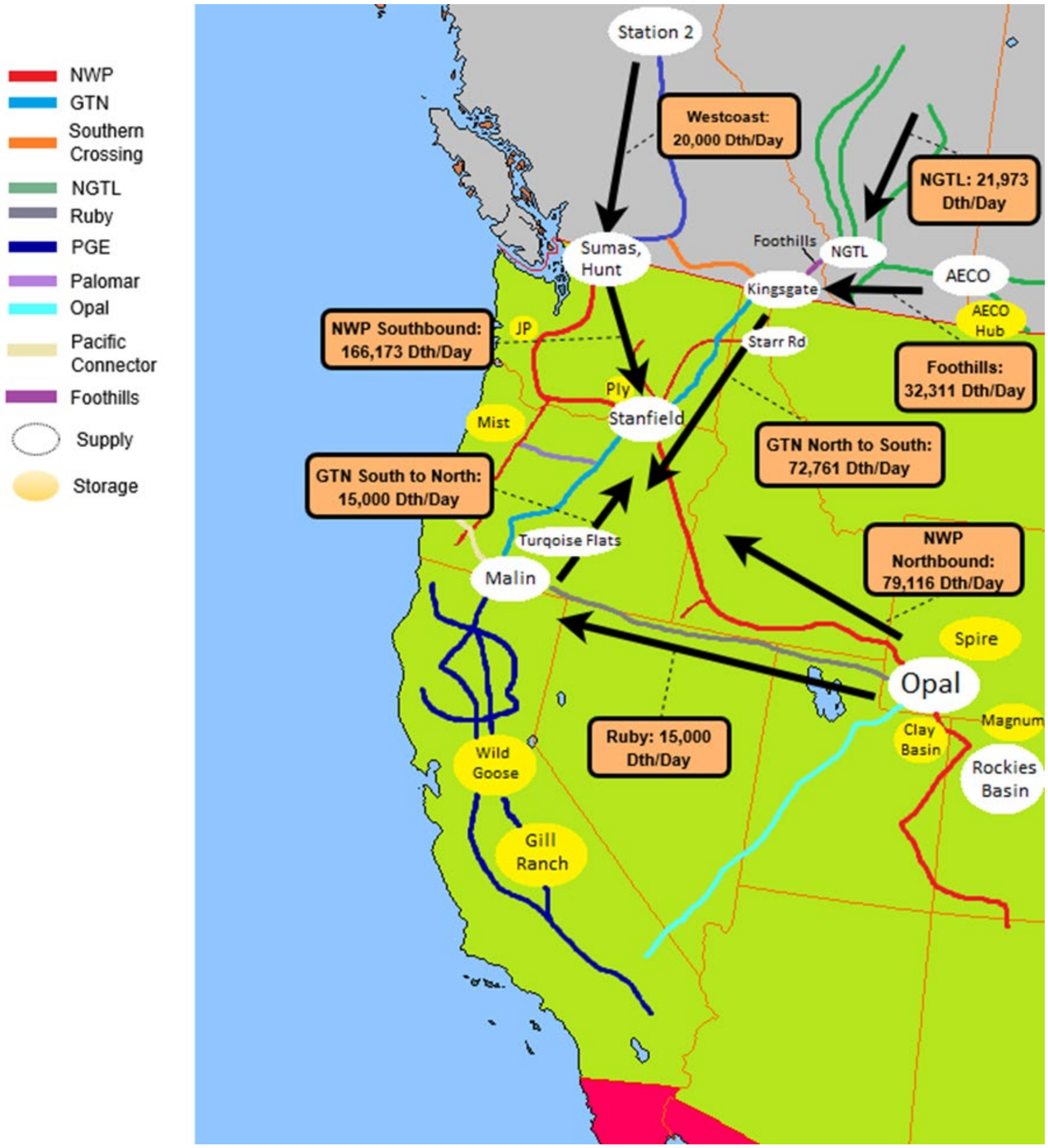

Figure 12-14: Map – Washington Conservation Zones

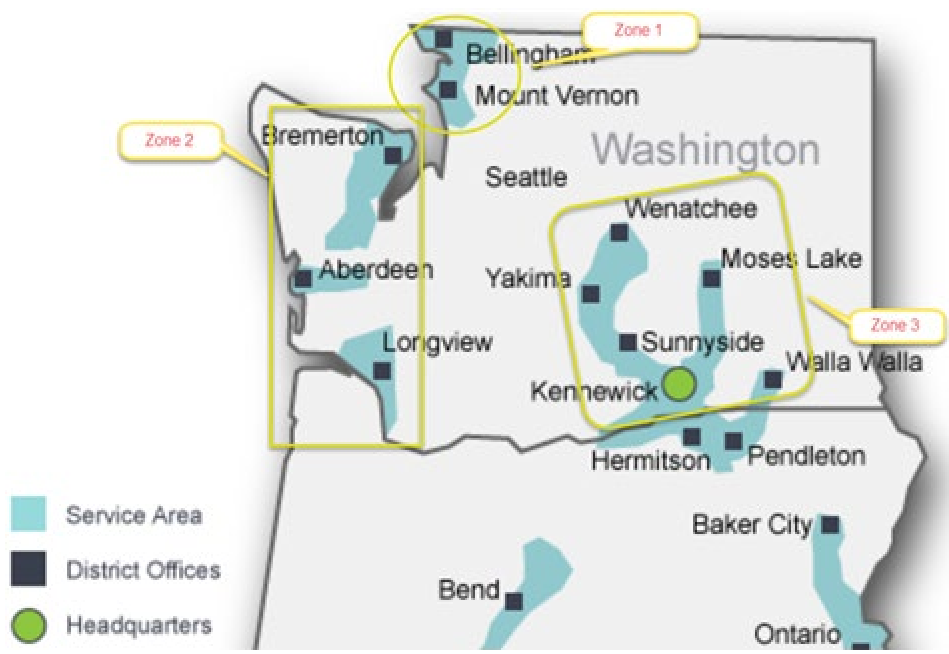

Figure 12-15: Locations of Faster Growing Citygates