



*In the Community to Serve<sup>®</sup>*

**2023  
Integrated Resource Plan**

**February 24, 2023**

**CASCADE NATURAL GAS CORPORATION**  
**2023 INTEGRATED RESOURCE PLAN**  
**TABLE OF CONTENTS**

---

<b><u>Chapter 1 – Executive Summary</u></b>	<b><u>Page</u></b>
• Introduction	1-2
• Progress Report	1-2
• Chapter 2: Company Overview	1-4
• Chapter 3: Demand Forecast	1-4
• Chapter 4: Supply Side Resources	1-5
• Chapter 5: Avoided Cost	1-7
• Chapter 6: Environmental Policy	1-8
• Chapter 7: Demand Side Management	1-9
• Chapter 8: Distribution System Planning	1-10
• Chapter 9: Resource Integration	1-11
• Chapter 10: Stakeholder Engagement	1-12
• Chapter 11: Two-Year Action Plan	1-13
<b><u>Chapter 2 – Company Overview</u></b>	
• Company Overview	2-2
• Pipeline and Basin Locations	2-4
• Core vs. Non-Core Service	2-4
• Equity Considerations	2-5
• Company Organization	2-8
<b><u>Chapter 3 – Demand Forecast</u></b>	
• Overview	3-2
• Demand Areas	3-2
• Weather	3-4
• Peak Day Methodology	3-6
• Wind	3-7
• Demand Overview	3-7
• Customer Forecast Methodology	3-8
• Use-Per-Customer (UPC) Forecast Methodology	3-11
• Price as a New Regressor	3-12
• Building Code Impacts	3-12
• Scenario Analysis	3-14
• Forecast Results	3-14
• System Load and Demand Side Management (DSM)	3-19
• Geography	3-21
• High and Low Growth Scenarios	3-22
• Non-Core Outlook	3-23
• Cross-Validation	3-24
• Methodology Changes From Previous IRPs	3-27
• Alternative Forecasting Methodologies	3-27

**CASCADE NATURAL GAS CORPORATION  
2023 INTEGRATED RESOURCE PLAN  
TABLE OF CONTENTS**

---

- Uncertainties 3-29
- Conclusion 3-29

**Chapter 4 – Supply Side Resources**

- Overview 4-2
- Gas Supply Resources 4-2
- Firm Traditional Supply Contracts 4-4
- Renewable Natural Gas 4-5
- Applicable Regulations 4-7
- Cascade Project Cost Effectiveness Evaluation Methodology 4-9
- RNG Projects 4-11
- Renewable Thermal Certificates 4-14
- Hydrogen 4-14
- RNG and Hydrogen Projections 4-16
- Storage Resources 4-17
- Capacity Resources 4-19
- GTN Express 4-20
- Natural Gas Price Forecast 4-22
- Age-Dampening Mechanism 4-24
- Development of the Basis Differential for Sumas, AECO and Rockies 4-25
- Pros and Cons of New Methodology 4-25
- Incremental Supply Side Resource Options 4-26
- Supply Side Uncertainties 4-32
- Financial Derivatives and Risk Management 4-33
- Portfolio Purchasing Strategy 4-36
- Physical Supply 4-37
- Financial Derivatives 4-38
- Conclusion 4-38

**Chapter 5 – Avoided Costs**

- Overview 5-2
- Costs Incorporated 5-2
- Understanding Each Component 5-3
- Application 5-6
- Avoided Cost Sensitivity Analysis 5-6
- Results 5-7

**Chapter 6 – Environmental Policy**

- Purpose 6-2
- Company Environmental Policy 6-3
- Overview 6-3

**CASCADE NATURAL GAS CORPORATION**  
**2023 INTEGRATED RESOURCE PLAN**  
**TABLE OF CONTENTS**

---

• Federal Regulation and Policy	6-5
• State Regulation and Policy	6-9
• Local Policy	6-21
• Natural Gas Industry Emissions	6-25
• Cascade Customer Emissions from Natural Gas Combustion	6-25
• Cascade Operational GHG Emissions and Emission Reductions	6-27
• Upstream Natural Gas Value Chain Emissions	6-31
• Conclusion	6-31

**Chapter 7 – Demand Side Management**

• Overview	7-2
• DSM Resources	7-3
• Cascade’s Washington Energy Efficiency Program	7-4
• Cascade’s Oregon Energy Efficiency Program	7-4
• Biennial Conservation Planning	7-5
• Conservation Potential Assessment	7-6
• Load Management Analysis and Planning Tool (LoadMAP)	7-6
• Energy Efficiency 20-Year Potential Forecast	7-9
• Progress to Plan	7-13
• Resource Innovations	7-14
• Third Party Measure Level EM&V	7-14
• Low Income	7-14
• Budget to Plan	7-15
• Energy Efficiency Programs Forecasted Savings	7-16
• Alternative Scenario Modeling	7-22
• Importance of Outreach and Cohesive Messaging	7-24
• Community Energy Program Partnerships	7-25
• Regional Efforts and Long-Term Benefits	7-25
• Adaptive Change Management	7-26
• Conclusion and Outlook for Two Year Plan	7-27

**Chapter 8 – Distribution System Planning**

• Overview	8-2
• System Dynamics	8-2
• Network Design Fundamentals	8-2
• Modeling Methodology	8-3
• Model Building Process	8-4
• Usage Per Customer	8-4
• Model validation	8-5
• Distribution System Planning	8-6
• Distribution System Enhancements	8-7

**CASCADE NATURAL GAS CORPORATION**  
**2023 INTEGRATED RESOURCE PLAN**  
**TABLE OF CONTENTS**

---

- Distribution System Enhancement Considerations 8-9
- Distribution System Enhancement Selection Guidelines 8-9
- Capital Budget Process 8-10
- Conclusion 8-12

**Chapter 9 – Resource Integration**

- Overview 9-2
- Supply Resource Optimization Process 9-2
- Planning and Modeling 9-7
- Stochastic Methodology Discussion 9-9
- Key Inputs 9-11
- Decision Making Tool 9-12
- Resource Integration 9-13
- Demand Forecast 9-13
- Long-Term Price Forecast 9-13
- Environmental Adder 9-15
- Transportation/Storage 9-15
- Demand Side Management 9-16
- Results 9-16
- Portfolios Evaluated 9-17
- Top-Ranking Candidate Portfolio 9-18
- Alternative Resources Selected 9-20
- Alternative Resources Not Selected 9-24
- Portfolio Evaluation: Additional Scenario/Sensitivity Analyses 9-25
- Conclusion 9-37

**Chapter 10 – Stakeholder Engagement**

- Overview 10-2
- Stakeholders 10-2
- Opportunity for Public Participation 10-3
- Company Commitments for Stakeholder Engagement 10-4
- TAG Meetings and Workshops 10-4
- Conclusion 10-6

**Chapter 11 – Two-year Action Plan**

- 2023 Action Plan 11-2
- Resource Planning and Environmental Policy 11-2
- Avoided Cost 11-2
- Demand 11-2
- Demand Side Management (Energy Efficiency) 11-3
- Distribution System Planning 11-4

**CASCADE NATURAL GAS CORPORATION  
2023 INTEGRATED RESOURCE PLAN  
TABLE OF CONTENTS**

---

**Chapter 12 – Glossary and Maps**

- Glossary of Definitions and Acronyms 12-2
- Citygate/Zone Cross Reference 12-17
- Maps of System Infrastructure 12-19

**Appendices**

- Appendix A - IRP Process
- Appendix B - Demand Forecast
- Appendix C - Regulatory Compliance Matrix
- Appendix D - Demand Side Management
- Appendix E - Current & Alternative Supply Resources
- Appendix F - Capacity Requirements & Peak Day Planning
- Appendix G - Weather & Price Uncertainty Analysis
- Appendix H – Avoided Cost
- Appendix I – Distribution System Planning
- Appendix J – Methodological Changes
- Appendix K – Bill Impact Analysis

## **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 two-year action plan provides the road map for future resource and planning activities.
- Load growth is forecasted to average 1.56% per year over the 20-year planning horizon.
- Cascade modeled Social Cost of Carbon as its main carbon forecast.
- The total avoided cost ranges between \$0.79/therm and \$1.09/therm over the 20-year planning horizon.
- Cascade projects 44 million therms of energy efficiency in Washington over the 20-year planning horizon.
- Cascade does not anticipate any near-term material upstream capacity deficiency in the 2023 IRP.
- This plan was informed by five Technical Advisory Group meetings, with active engagement by stakeholders.
- Cascade continues to be fully committed to the IRP process.

## Progress Report

As part of the 2020 IRP 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 for impact of legislation enacted in 2021, impacts of COVID-19 pandemic, peak day standards, impacts of climate change, upstream greenhouse gas emission accounting, avoided cost formula, impacts of electrification and natural gas "bans", renewable natural gas modeling and evaluation tool, validation of methods, and encouraging participation in the IRP Process by additional stakeholders. The progress from these recommendations are below:

Cascade has included the Climate Commitment Act (CCA) rules in Washington as well as the Climate Protect Program (CPP) in Oregon. Since Cascade is modeling the impacts of these rules, which go out to 2050. The impacts of these legislative



changes are described in Chapter 6 – Environmental Policy as well as Chapter 9 – Resource Integration.

Cascade has and will continue to monitor any impacts from COVID-19. Cascade has noted in Chapter 3 that despite significant 2020 impacts, COVID-19 itself does not appear to have any long-term economic impacts that would affect forecasts. Cascade had forecasted customer growth in the 2020 IRP to be approximately 1.5% in the near term and since 2020 Cascade was grown about 1.5%.

Cascade has made significant changes to weather for the demand forecast. Cascade ran 10,000 Monte Carlo draws and took the 99<sup>th</sup> percentile coldest HDD for the new peak day standard. Cascade also incorporated climate change impacts, which are described on page 3-5.

Staff made two suggestions around the upstream greenhouse gas emission accounting calculation. Staff suggested a change to the upstream emissions loss rate for the Rocky Mountain region as well as a different global warming potential (GWP). Cascade addressed these concerns by increasing the upstream emission loss rate from 1.00% to 1.43% and the GWP from 25 to 28. More information can be found in Appendix H – Avoided Cost.

Staff suggested that Cascade apply the 10 percent environmental adder to the Company's full avoided costs calculation, rather than just the commodity and carbon compliance portion. Cascade has made this change, which can be found in Chapter 5 – Avoided Cost.

Cascade has modeled an electrification scenario, which the results of that scenario can be found in Chapter 9 – Resource Integration. Within that scenario, there is a natural gas ban that impacts growth in the Bellingham area. More of this is described in several chapters throughout this IRP.

Cascade has significantly increased how renewable natural gas (RNG) is modeled and evaluated. Cascade added RNG to the Company's resource integration model in an effort to reduce emissions and meet CCA/CPP rules. In addition to RNG, hydrogen, allowances, offsets, and community climate investments (Oregon) are also included. More information can be found in several chapters throughout this IRP.

Cascade has continued to increase the cross-validation for the demand forecast and describes key takeaways from doing that analysis in Chapter 3 – Demand Forecast.

Cascade sought greater stakeholder participation prior to this IRP cycle and several new members participated in this IRP process. Due to COVID-19 concerns, Cascade continued to hold technical advisory group (TAG) meetings via Microsoft Teams. Cascade did increase other ways of communicating information

from TAG meetings such as recording the meetings and posting them on the Company's website. This allows anyone who is unable to attend meetings to watch the recordings after. More information on public involvement can be found in Chapter 10 – Stakeholder Engagement.

## **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 310,000 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.

## **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 citygate serving firm or uninterruptible service. These citygates were then 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 a unique customer forecast for each citygate/rate class by incorporating population and employment growth data from Woods and Poole as well as from internal market intelligence into a dynamic regression model.

Cascade developed a normal, or expected, future weather year by shaping 30 years of proprietary, historical weather data. 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 firm customers during extreme weather, the Company

tested a system weighted peak HDD (the system weighted coldest day in the last 30 years).

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

Load growth across Cascade's system through 2050 is expected to average 1.10% annually. Load growth is split between residential, commercial, and industrial customers. Residential and commercial customer classes are expected to grow at an annual rate near 1.21% and 0.94%, respectively, while industrial expects a growth rate of around 1.14%.

After determining system-wide demand over the planning period by multiplying the use per customer times the number of customers in the forecast, Cascade stress tested its results with high and low scenarios for varying future economic conditions.

In absolute numbers, system load under normal weather conditions is expected to grow annually at an average of 4.4 million therms. Residential customers are expected to grow from 53.3% of the total core load to 54.9% of the total core load by 2050.

Load across Cascade's two-state service territory is expected to increase 1.10% annually over the planning horizon, with the Oregon portion outpacing Washington at 1.43% versus 0.98%.

## **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 expects to add RNG to the supply portfolio beginning in Quarter 4 of 2024 when the Company plans to have Deschutes County Landfill come in service.

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 Liquefied 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 (NWPPCC), 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 with 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.

A carbon compliance cost forecast was added in anticipation of carbon legislation. Currently, Cascade models the market driven costs to start at \$83.13/metric ton CO<sub>2</sub>e in 2021 and rising to \$104.18/metric ton CO<sub>2</sub>e in 2042. 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 NWPPCC based on Federal legislation.

For the 2023 IRP, the nominal system avoided costs ranges between \$1.00/therm and \$6.52/therm over the 28-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 since Cascade's last IRP. 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<sub>2</sub> emission reductions. Since the previous IRP, 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 rule in late 2021.

Cascade monitors environmental regulatory requirements in progress nationally, regionally, and locally that have the 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 finalized in Oregon on December 16, 2021, 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 64.5 million therms systemwide through 2045; 48 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 like 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<sup>®</sup> 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. Also included were other options to meet carbon compliance such as hydrogen, 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, several portfolios were run 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. Basin prices in the model over the 28-year planning horizon 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 top-ranked portfolio. 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.

The top-ranked candidate portfolio is then run through several scenarios to stress test the model. These scenario's include reducing carbon to 0 by 2050, limited RNG, electrification, high customer growth, and high price interrupted supply.

The top-ranked candidate portfolio includes all existing resources, expected DSM, as well as allowances, offsets, CCIs, RNG, and hydrogen. A more detailed discussion regarding the Company's resource integration and the results can be found in Chapter 9, Resource Integration.

## **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 five public TAG meetings with internal and external stakeholders. Due to continued concerns around COVID-19, all meetings were held virtually using Microsoft Teams. 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, the League of Women Voters, 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: Two-Year Action Plan

Figure 1-1 on the following page shows Cascade’s Two-Year Action Plan. Further descriptions can be found in Chapter 12, Two-Year Action Plan.

Figure 1-1: Highlights of 2023 Action Plan

Functional Area	Anticipated Action	Timing
Resource Planning and Environmental Policy	<p>Cascade will:</p> <ul style="list-style-type: none"> <li>• Attend other regional LDC IRP meetings;</li> <li>• Continue to develop the Company’s new PLEXOS model.</li> <li>• Cascade will purchase the anticipated required offsets, allowances, or RNG to meet the carbon reduction goals laid out by the Climate Commitment Act.</li> <li>• Cascade will purchase the necessary amount of RNG for the Company’s voluntary RNG program.</li> <li>• Cascade will continue to investigate the cost and feasibility of a potential hydrogen plant as an alternative resource.</li> <li>• Continue to participate in the local climate community action plans around Cascade’s service territory.</li> </ul>	Ongoing, for inclusion in 2025 IRP.
Avoided Cost	<p>Cascade will:</p> <ul style="list-style-type: none"> <li>• investigate incorporating a separate avoided cost for transportation (non-core) customers. Cascade will also explore how environmental compliance costs from the CCA/CPD will impact the avoided cost calculation.</li> </ul>	Ongoing, for inclusion in 2025 IRP.
Demand	<p>Cascade will:</p> <ul style="list-style-type: none"> <li>• Incorporate end use forecasting into the load forecast model.</li> <li>• Incorporate income as an explanatory variable.</li> <li>• Incorporate Monte Carlo simulations for customer counts.</li> </ul>	Ongoing, for inclusion in 2025 IRP.
DSM (Energy Efficiency)	The Company will execute the Demand Side Management action items as described on page 11-3.	Ongoing, for inclusion in 2025 IRP.
Distribution System Planning	<p>Cascade will:</p> <ul style="list-style-type: none"> <li>• Implement various stages or review of the of the list of projects that require an increase in capacity for these projects: <ul style="list-style-type: none"> <li>○ Kitsap Phase V Pipeline Reinforcement</li> <li>○ Aberdeen HP Reinforcements</li> <li>○ Bellingham 6-inch HP Reinforcement –Meador Ave</li> <li>○ Richland HP Reinforcements</li> <li>○ South Kennewick Reinforcements</li> <li>○ Pasco 6-inch HP Reinforcement</li> <li>○ Burlington South Feed Reinforcement</li> <li>○ Wapato 4-inch HP Replacement</li> </ul> </li> </ul>	Ongoing over the next four to five years.

## Chapter 2

### Company Overview



## Company Overview

Cascade Natural Gas Corporation (CNGC or Cascade or Company) has a rich history that began over 65 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<sup>1</sup>. Cascade's headquarters moved from Seattle, Washington to Kennewick, Washington in 2010.

### Key Points

- Cascade serves diverse geographical territories across Washington and Oregon.
- Cascade's primary pipelines are NWP, GTN, and Enbridge, also known as WCT, 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 MDU Resources Group, Inc. based in Bismarck, North Dakota.

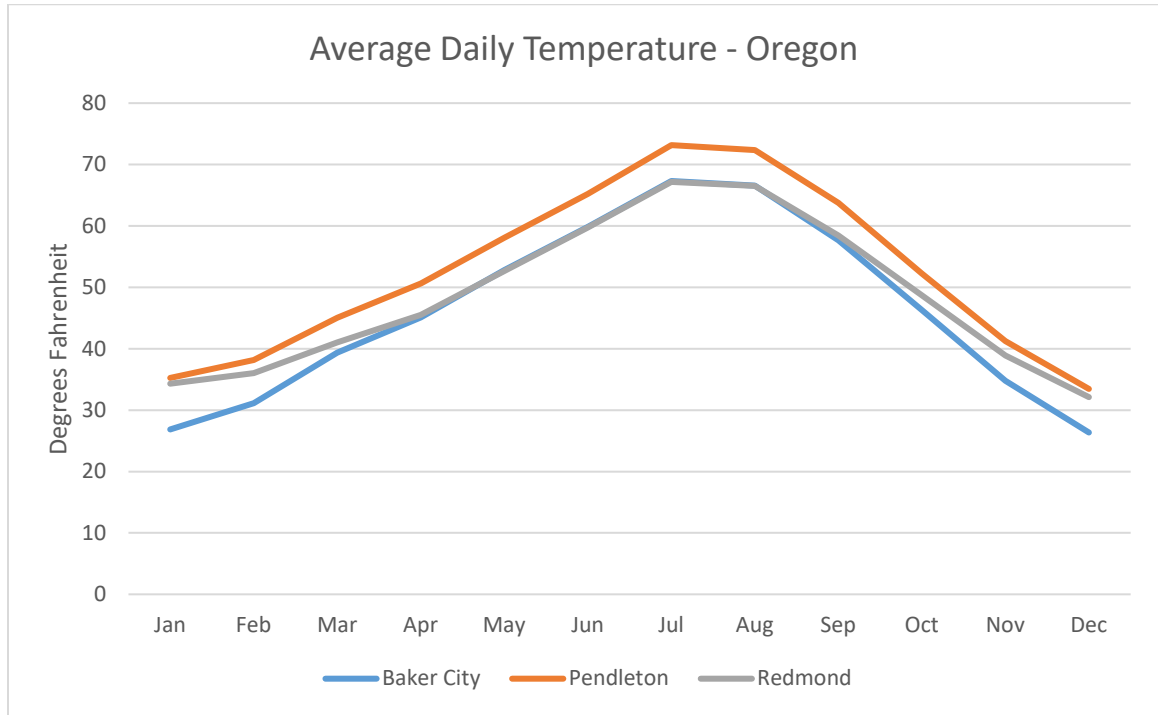
Today, Cascade's service territory covers about 32,000 square miles and extends over 700 highway miles from end to end, encompassing a diverse economic base as well as varying climatological areas. Cascade delivers natural gas service to more than 310,000 customers with approximately 80,000 customers in Oregon and 230,000 customers in Washington. The Company's customers reside in 95 communities--28 in Oregon and 67 in Washington. Cascade's service area consists of smaller, rural communities in central and eastern Oregon, as well as communities across Washington.

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 and central Oregon as well as eastern Oregon. All regions of Oregon have semi-arid climates with periods of arctic cold in the winter and heat waves in the summer.

---

<sup>1</sup> For more information about MDU, see <https://www.mdu.com>

Figure 2-1: Average Temperature by Oregon Region

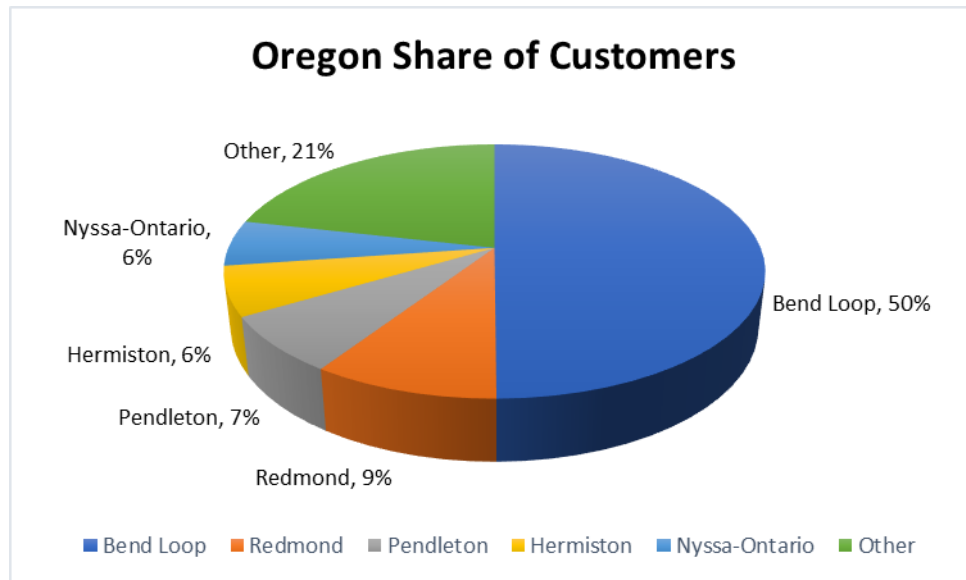


Below are some of the more populated towns within the regions Cascade provides distribution service:

- **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 citygate. 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 Citygate in Oregon



### 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.<sup>2</sup> 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 240 large volume customers who have elected 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 in Washington and the Climate Protection Plan in Oregon, non-core emissions are considered in Cascade's resource integration and compliance planning. Also, non-core demand is a consideration in Chapter 9, Distribution System Planning.

In 2021, Cascade's residential customers represent approximately 12% of the total natural gas delivered on Cascade's system, while commercial customers represent roughly 9%, and the core industrial customers account for around 1% of total gas throughput. The remaining non-core industrial customers represent the balance of the 78% of total throughput.

## Equity Considerations

In Docket UG-210755 Final Order 09, the Washington Utilities Commission (WUTC) approved Cascade's most recent multi-party settlement for Washington. In Final Order 09, the WUTC provided high-level policy guidance related to the Washington Legislature's expansion of the public interest standard to include equity considerations:

*The Commission's guidance in this Order is not comprehensive, and we will expand upon our discussion in future proceedings. However, we want to clearly express our expectation that the Company will integrate equity into each of its proposals going forward. Accordingly, we decline to provide specific programmatic guidance beyond the equity provisions we approve by this Order and retain our discretion to evaluate equity on a case-by-case basis.*

Although specific guidelines surrounding the integration of equity considerations in natural gas IRPs are still developing, Cascade understands that equity in the

---

<sup>2</sup> 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.



context of the utility sector focuses on energy/environmental justice, and the development of metrics to consider benefits and burdens of energy sources and infrastructure to Cascade's communities, as well as the impacts of energy affordability.

Although equity is a newer part of the IRP process in Washington, and began for electric investor-owned utilities, as introduced in the Clean Energy Transformation Act and other legislation or WUTC policies, it has been an important consideration for Cascade. The Company appreciates the opportunity to further articulate how Cascade applies an equity mindset to the Company's delivery of energy to Washington customers.

Cascade has long served as a champion of Energy Efficiency and the Low-Income Weatherization Assistance Program. These efforts represent a partnership between Cascade and the communities the Company serves to provide funds and support for lowering energy burden across the service area. Cascade has worked with AES Corporation<sup>3</sup> to identify portions of Cascade's service area with particular risk of energy burden (near, or at 60 percent of poverty or below) and are using this information to better understand how Cascade can deliver/target programs where they're most needed. Cascade has also provided communications on low-income weatherization services in both Spanish and English and have previously advertised these services on Spanish language radio stations. Cascade's partnership with weatherization agencies and energy services providers in the Company's communities has helped Cascade apply an equity lens in the approach to reaching traditionally underserved communities.

As part of Cascade's continued environmental commitment, Cascade Natural Gas – along with its three sister companies – also provides the Environmental Community Opportunity (ECO) Fund to support projects that enhance environmental education and stewardship in communities 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.

It is worth pointing out that in addition to equity, Docket UG-210755 references increased customer access to bill assistance. In Washington, funds are collected through the Schedule 593, Washington Energy Assistance Fund (WEAF) Program Cost Recovery charge to assist qualified low-income customers with utility bill assistance. Washington customers may apply for available funds

---

<sup>3</sup> Originally Applied Energy Services, originally founded in 1981. See [History of AES | AES Global](#)

through many Community Action Agencies (CAA)<sup>4</sup> for energy assistance. Some recent WEAFF changes that help achieve equitable outcomes also include:

- Raised the income eligibility threshold to 80 percent of area median household income or 200 percent of the federal poverty level, whichever is higher.
- Cascade’s Low-Income Advisory Group will annually review funding levels to ensure the WEAFF program has adequate funds available.
- The Company is in the process of establishing a “trusted messenger” community-based outreach program.

Cascade is also in the process of establishing an Equity Advisory Group (EAG). EAG members will advise the Company on equity issues. This includes but is not limited to, reducing barriers affecting vulnerable populations and highly impacted communities, equitable customer benefit development, data support and development, and recommendations regarding utility compliance approaches. While Cascade is in the early stages of developing the EAG, the Company envisions that members will bring their lived experience, expertise, and interest in the following areas:

- Tribal and Non-Tribal Community Engagement, Advocacy, and Outreach
- Economic, Environmental or Procedural Justice
- Public Health Advocacy
- Renewable Energy, Energy Efficiency

Cascade is excited to further expand and refine its efforts working with individuals and organizations to improve equitable distribution of energy benefits, reduce burdens to highly impacted communities and vulnerable populations, plus address public health, economic and environmental benefits, along with energy security and resiliency.

In addition, Cascade will be monitoring equity considerations included in other regional IRPs as well as further guidance from the Commission and its EAG to assist in the Company’s efforts to incorporate increased equity considerations in the 2025 IRP.

---

<sup>4</sup> [CAAs Contact Information](#)

## 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 in 43 states 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 2-4 shows the MDU Resources Electric and Natural Gas Services and Territory.

Figure 2-3: MDU Resources Services and Territory

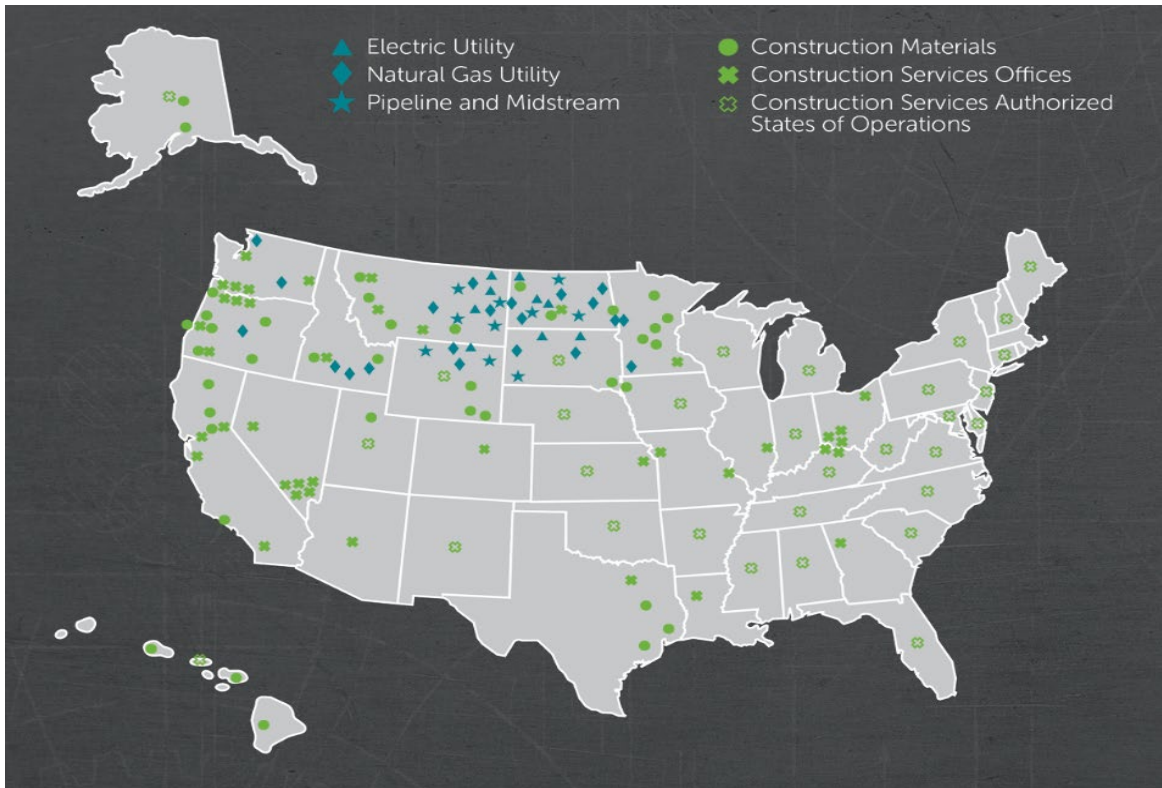
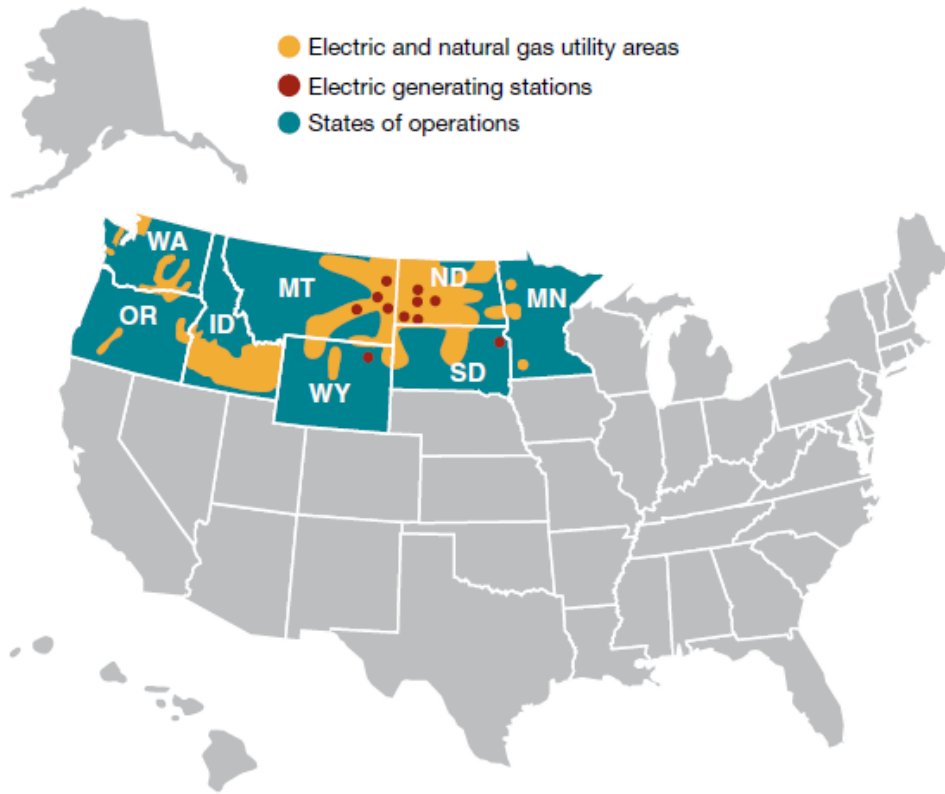


Figure 2-4: MDU Resources Electric and Natural Gas Services and Territory



## **Chapter 3**

### **Demand Forecast**

## Overview

Each year Cascade develops a 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. For this IRP, Cascade is extending its forecast to 28 years in order to better align with emissions modeling. Sources of this forecast include historic data, market intelligence (ie 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 low, expected, 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 2023-2050 planning horizon, Cascade continued to forecast at both the citygate and rate class levels. 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. Therefore, Cascade forecasts a total of 57 areas. Each of these areas contain multiple rate classes, resulting in approximately 200 individual dynamic regression models. Each citygate is assigned to a weather location. For this IRP, the Company assigned the citygates to the closest weather location by distance. The citygate results are rolled up into zones and districts which segregate Cascade’s system based on pipelines and weather, as shown in Appendix B. Figure 3-1 provides a cross reference for the demand areas.

**Cascade Natural Gas Corporation**  
**2023 (WA) Integrated Resource Plan**

**Figure 3-1: 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
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
OAK HARBOR/STANWOOD	East Stanwood Loop	WA	Bellingham	30-W

*Cascade Natural Gas Corporation  
2023 (WA) Integrated Resource Plan*

---

Citygate	Loop	State	Weather Location	Zone
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.<sup>1</sup>

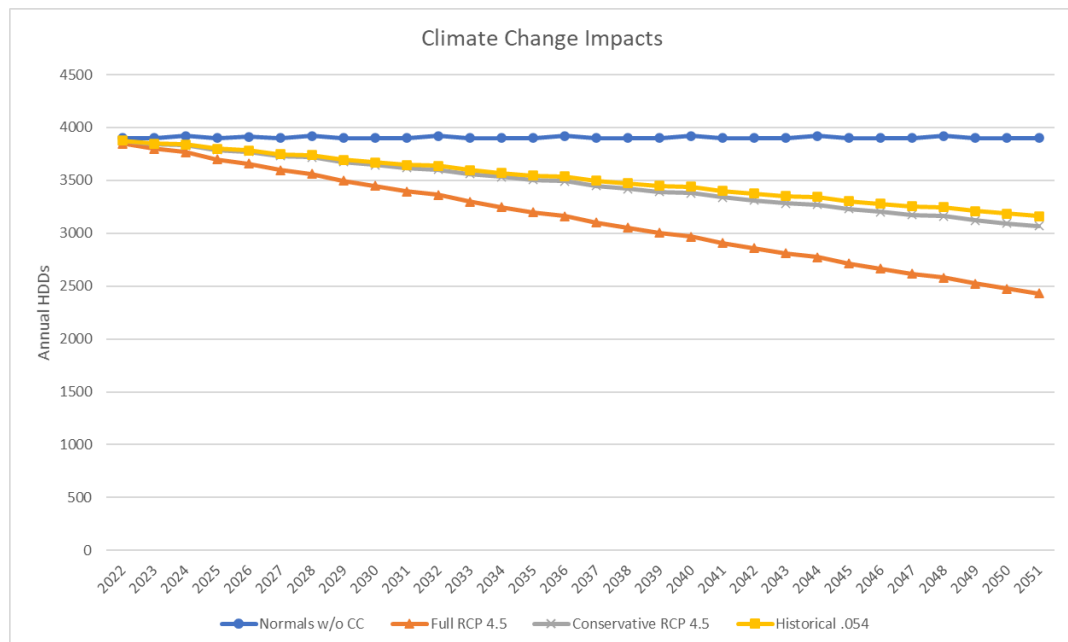
---

<sup>1</sup> 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.



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 NOAA (National Oceanic and Atmospheric Administration), but found many months/locations with missing data. The previous forecasts used 30 years of recent history as the normal or expected weather. For this IRP, Cascade has evolved its weather forecast with an analysis of climate change impacts and Monte Carlo peak day simulations. Cascade selected scenarios from the Intergovernmental Panel on Climate Change (IPCC). Figure 3-2 shows an annual HDD forecast comparison of Cascade’s previous weather normals methodology in blue compared to climate change scenarios selected from the IPCC.<sup>2</sup>

Figure 3-2: Climate Change Impacts



- Normals w/o CC: This represents 30 years of historical data projected forward as normal weather, or expected weather.
- Full RCP 4.5: This represents the Coupled Model Intercomparison Project Phase 4 (CMIP5) with the RCP 4.5 scenario which included 36 different models.<sup>1</sup>
- Conservative RCP 4.5: This represents the 18 most conservative models in the Full RCP 4.5 project.<sup>1</sup>
- Historical 054: This represents the Environmental Protection Agency’s noted historical temperature change (.54 F per decade since 1979).<sup>3</sup>

<sup>2</sup> <https://ipcc-browser.ipcc-data.org/browser/search?format>

<sup>3</sup> <https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-temperature>

Cascade chose the Conservative RCP 4.5 forecast as it best represents the Western North America emission goals and was labeled as the most probable baseline scenario.<sup>4</sup> This is incorporated into the forecast by replacing the normal HDDs that would have been used to forecast years 2023-2150 with the HDDs in the Conservative RCP 4.5 scenario. This allows Cascade to better capture climate change's effects on HDDs, rather than simply relying on historical HDDs.

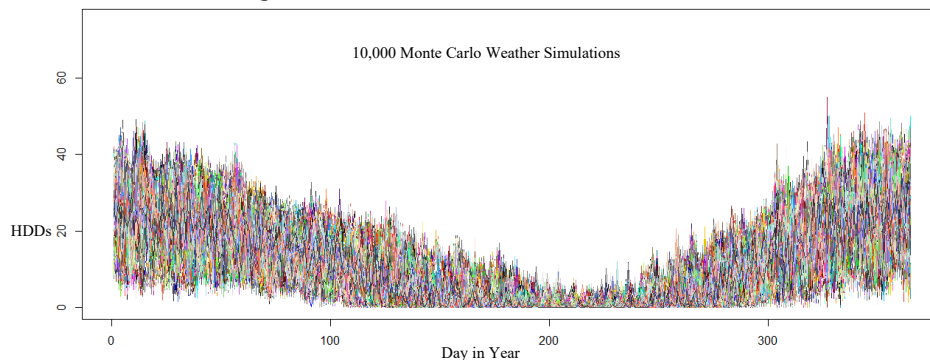
### Peak Day Methodology

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. Since the prior IRP, Cascade has 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 99<sup>th</sup> percentile peak day. This 99<sup>th</sup> 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 99<sup>th</sup> 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 9,900<sup>th</sup> draw as the 99<sup>th</sup> percentile to use in the demand forecast. Figure 3-3 displays all 10,000 draws graphed together.

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



---

<sup>4</sup> [https://en.wikipedia.org/wiki/Representative\\_Concentration\\_Pathway](https://en.wikipedia.org/wiki/Representative_Concentration_Pathway)

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

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

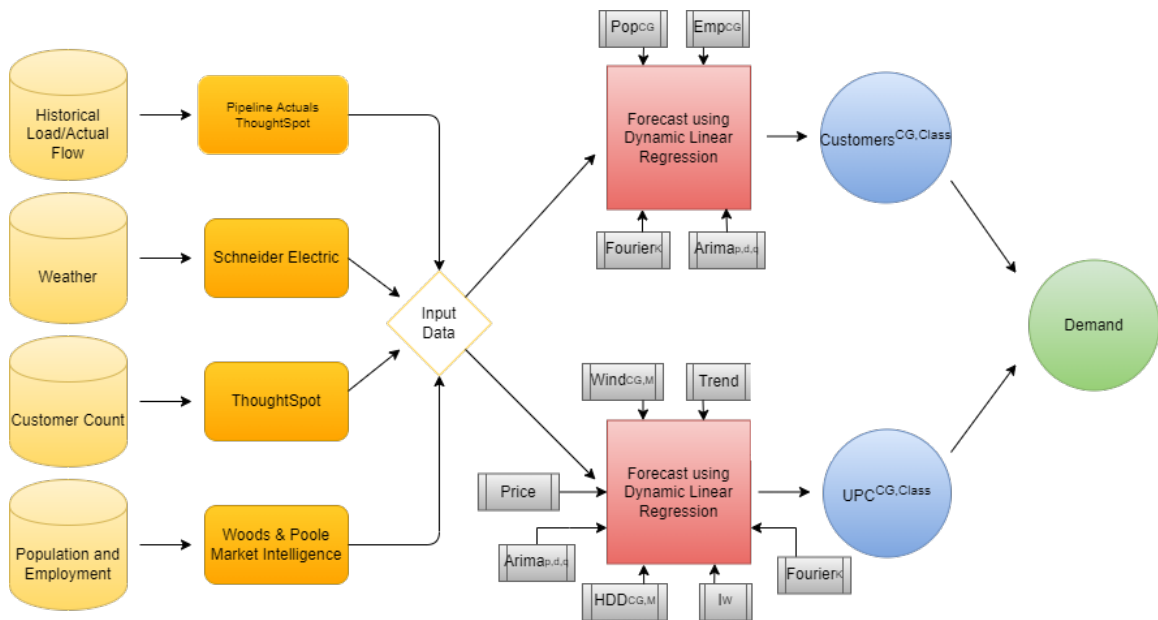
## **Wind**

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.

## **Demand Overview**

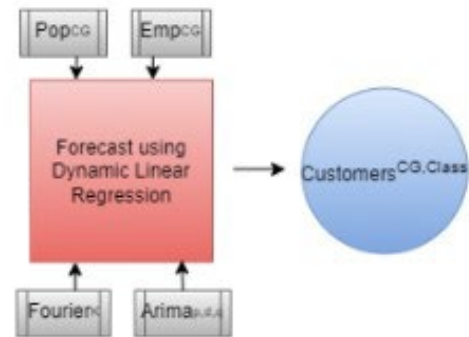
Figure 3-4 provides a roadmap for Cascade's demand forecast. The inputs are displayed along with their sources in yellow and gold. The customer forecast and use-per-customer (UPC) forecast are shown in red along with their respective inputs into the model. Finally, the customer forecast is multiplied by the use-per-customer forecast to create the final demand forecast.

Figure 3-4: Demand Forecasting Process Overview



### Customer Forecast Methodology

Customer count forecasts are designed to reflect both demographic trends and economic conditions both in the short- and long-term. Cascade uses population and employment growth data from Woods & Poole (W&P). Since the first quarter of 2020, Cascade has and will continue to monitor the COVID-19 impacts. Since Cascade relies on W&P for population and employment growth data, the Company is providing an update from W&P about the impacts of COVID-19 on those projections. W&P states “Despite significant 2020 impacts, COVID -19 itself does not appear to have made a quantifiable long-term economic impact that would affect forecasts: productive land area in the U.S. is still usable, productive capital (i.e. factories) are still in place, and the size of labor force has not been reduced significantly.”<sup>5</sup> W&P growth forecasts are provided at the county level. It should be noted that W&P forecasts are adjusted when the internal intelligence about a demand



<sup>5</sup> Woods & Poole’s 2020 State Profile: State and County Projections to 2020

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:

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

Model Notes:

- $C_{Class}^{CG}$  = Customers by Citygate by Class
- $Pop^{CG}$  = Population by Citygate
- $Emp^{CG}$  = Employment by Citygate
- *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 200 times to account for each customer class by citygate. The Company begins by testing seven different combinations of the regressors in both dynamic regression models and one Autoregressive Integrated Moving Average (ARIMA) model. The dynamic regression models test Fourier, Population, Employment, Population + Fourier, Employment + Fourier, and Employment + Population + Fourier. The last model is called an ARIMA model, which uses ARIMA terms and no regressors. Unlike the dynamic regression models, the 'ARIMA Only' model's ARIMA term is not strictly modeling the errors, but is used as a model for the entire data set. 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 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.

Customer count and therm forecasts are augmented by revisions to the base data and output to create a portfolio of potential scenarios. Low and high growth scenarios are created from the confidence intervals from the forecast model. These scenarios, along with the original, best-estimate, expected scenario encapsulate a range of most-likely possibilities given known data. The most recent W&P data indicates an average annual population growth of 0.81% between 2023 and 2050 for Cascade's service territory. The projected customer growth is provided in Appendix B. Based

on historical experience and given expected weather, Cascade expects system load will likely remain within a range bound by the low and high growth scenarios. Cascade locked in the forecast model in June of 2022 as it is a key input for several other aspects of this IRP.

Among other reasons, the Company believes that high projected growth in the following regions is supported by the provided quantitative analysis:

- Burbank Heights Loop is expected to see a year over year average growth of 2.34%. This loop consists of the Pasco, North Pasco, and Burbank Heights citygates. These are located in southeastern Washington. Pasco sits in one of the fastest growing counties in the state, Franklin County. Future job growth is optimistic.<sup>6</sup>
- Kennewick Loop is expected to see a year over year average growth of 2.38%. This loop consists of the Richland Y, Kennewick, and Southridge citygates. These are located in southeastern Washington. Many new developments are a direct result of high population growth rates and optimistic job outlooks.<sup>6</sup>
- Bend Loop is expected to see a year over year average growth of 2.06%. This loop consists of the Bend and South Bend citygates. Bend is located in central Oregon. Bend is seeing a population boom coupled with optimistic job growth estimates.<sup>6</sup>
- Prineville is expected to see a year over year average growth of 2.02%. Prineville is located in central Oregon and much like Bend, Prineville has seen growth even during the pandemic.<sup>7</sup>

According to the Census Bureau, there has been a nationwide shift from larger cities to mid-size and smaller ones with the increase in remote work. Cities like Bend have been referred to as “Zoom towns”, referring to the new work-from-home culture allowing people to live where they want.<sup>8</sup>

---

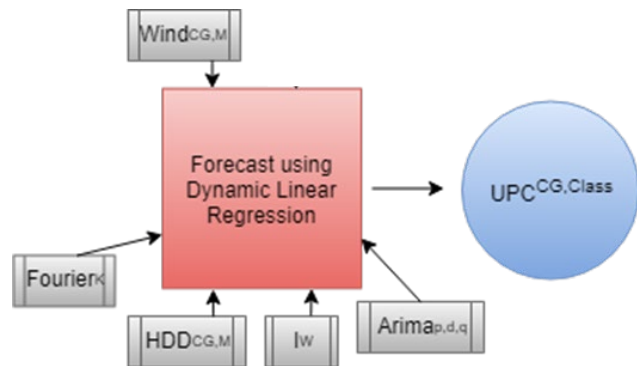
<sup>6</sup> See According to bestplaces.net, worldpopulationreview.com, and city-data.com

<sup>7</sup> See According to bestplaces.net, worldpopulationreview.com, and city-data.com

<sup>8</sup> See United States Census Bureau, <https://www.census.gov/newsroom/press-releases/2022/population-estimates-counties-decrease.html>

## Use-Per-Customer (UPC) Forecast Methodology

As previously mentioned, Cascade utilizes regression models for the UPC part of the demand forecast as well.<sup>9</sup> 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 Aligned energy transaction system which leaves only the daily core usage data. Then the daily data is allocated to a rate schedule for each citygate 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 citygate.

Below is the model used for the UPC forecast:

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

### Model Notes:

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

Cascade runs this model for each of the 57 citygates and citygate loops by customer class where applicable, resulting in approximately 200 models. Cascade begins each model with a simple linear model regressing on HDDs, wind, price, and

<sup>9</sup> 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.

weekend. If the residuals analyzed show structure, then the models are expanded to include ARIMA and Fourier terms.

### **Price as a New Regressor**

Price is a new regressor for this IRP.<sup>10</sup> Overall, price 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 0. Through the TAG process, specifically TAG 2, stakeholders suggested Cascade replace the price regressor with an income regressor in an attempt to better capture customer behavior. Cascade is excited to perform this analysis in the next demand forecast.

### **Building Code Impacts**

As the Washington State Energy Codes (WSEC) continue to progress and impact new construction for natural gas end use appliance, 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 homes 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 home/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 RCW 19.27A.020(2)(a), the enacting legislation resulted from 2009 SB 5854. Therefore, the 2012, 2015, 2018, and 2021 code cycles were all likely impacted by

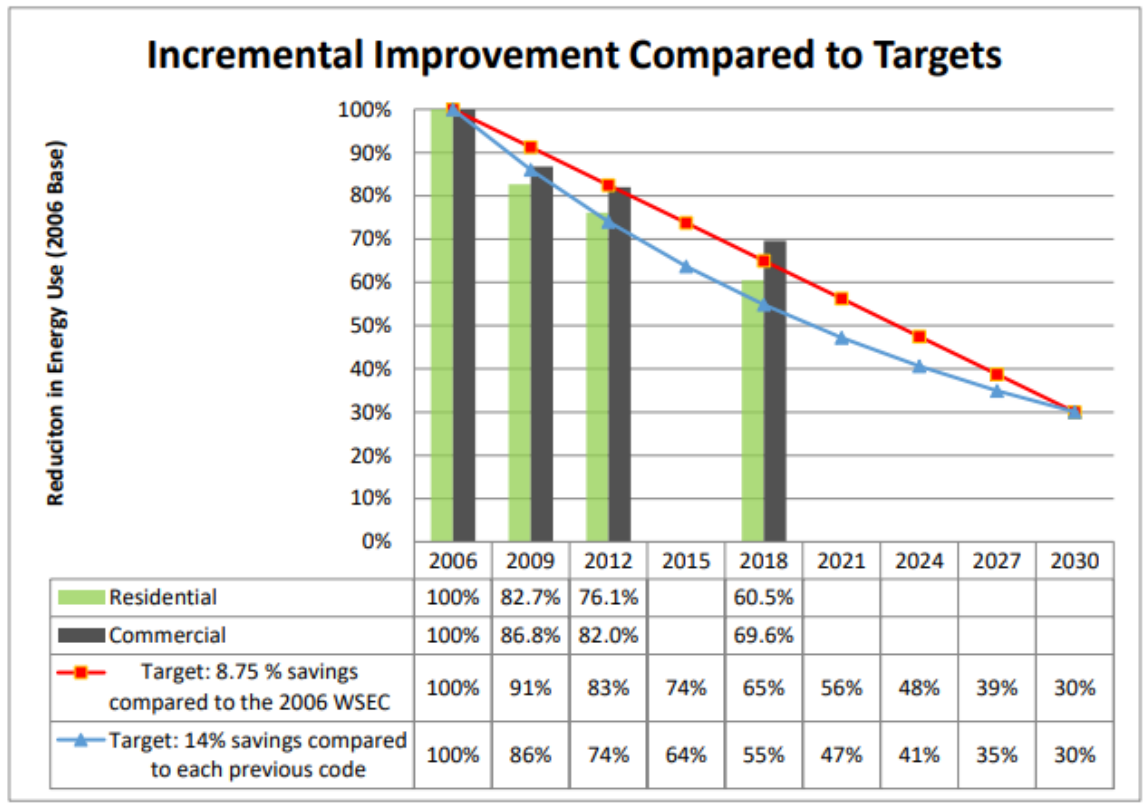
---

<sup>10</sup> A regressor is the name given to any variable in a regression model that is used to predict a response variable.



the legislation. Figure 3-5 provides an explanation of how the SBCC has addressed the more explicit legislative direction of RCW 19.27A.160.

Figure 3-5: Reduction Targets in Energy Use<sup>11</sup>



The most impactful measures were found in the 2018 and 2021 WSEC. For example, NEEA’s WA Residential Post Code Adoption Market Research Final Report<sup>12</sup> 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 showing significant changes. This study of the 2018 WSEC shows 87% electric water heating, while the 2015 WSEC study (CLEAResult 2020) 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<sup>13</sup> may provide some additional insight for commercial projects).

<sup>11</sup> Final Cost Benefit Analysis for the 2021 WSEC-R

<sup>12</sup> See [Washington Residential Post-Code Adoption Market Research \(neea.org\)](https://www.neea.org/)

<sup>13</sup> See [Northwest Energy Efficiency Alliance \(NEEA\) | 2018 Washington State...](https://www.neea.org/)

With the forthcoming 2021 WSEC (effective July 1, 2023), 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.

Cascade has been monitoring the building code changes and will continue to monitor the impacts the current and future building code changes have. Due to the COVID-19 Pandemic, the 2018 WSEC did not go into effect until February 1, 2021. Cascade had one year's worth, which is a relatively small sample size, of historical data included in the customer and load forecast models for this current IRP. In future IRPs, once Cascade has gathered more data regarding the impacts of the 2018 and 2021 WSEC, the Company will investigate the impact these building code changes will have on the load and customer forecast.

### **Scenario Analysis**

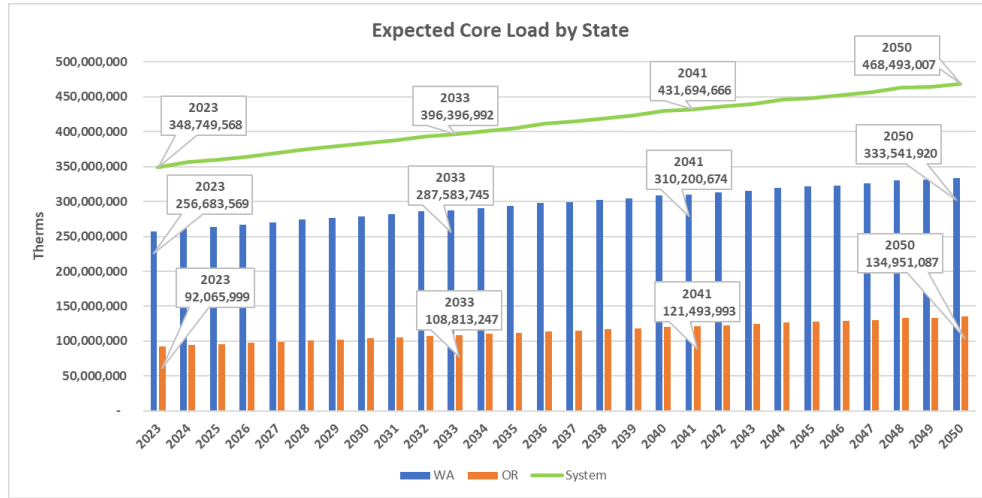
Cascade stress tests the load forecast in Plexos® by using alternative forecasting assumptions. These alternative forecasting assumptions refer to changing factors that influence demand. Alternative assumptions include high and low customer growth, and a stochastic study of weather using Monte Carlo simulations. These altered assumptions provide an effective tool for analyzing and stress testing the forecasts.

Cascade utilizes a low and high customer growth forecast to use in various Plexos scenarios. Also, as mentioned previously in the peak day section, Cascade developed a peak day weather assumption based on 10,000 Monte Carlo simulations for each weather zone. The base case contains expected weather, customer growth, and use per customer. The base case also has an annual peak day event for each weather zone. Expected weather is the Conservative RCP 4.5 forecast previously discussed in this chapter. High and low growth scenarios, discussed more on page 3-20, are developed by using modifiers to represent higher than expected growth and lower than expected growth. Cascade also performs a deep sensitivity analysis utilizing Monte Carlo runs for other variables such as price. Monte Carlo analysis is discussed further in Chapter 10, Resource Integration.

### **Forecast Results**

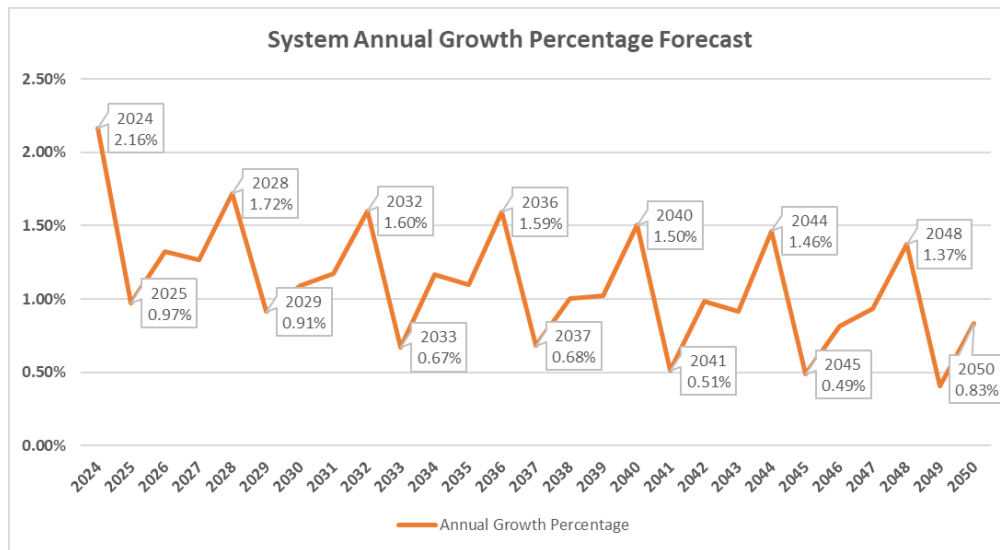
Load across Cascade's two-state service territory is expected to increase at an average annual rate of 1.10% over the planning horizon, with the Oregon portion outpacing Washington, 1.43% versus 0.98%. Figure 3-6 shows the expected core load volumes by state.

Figure 3-6: Expected Core Load by State (Volumes in Therms)



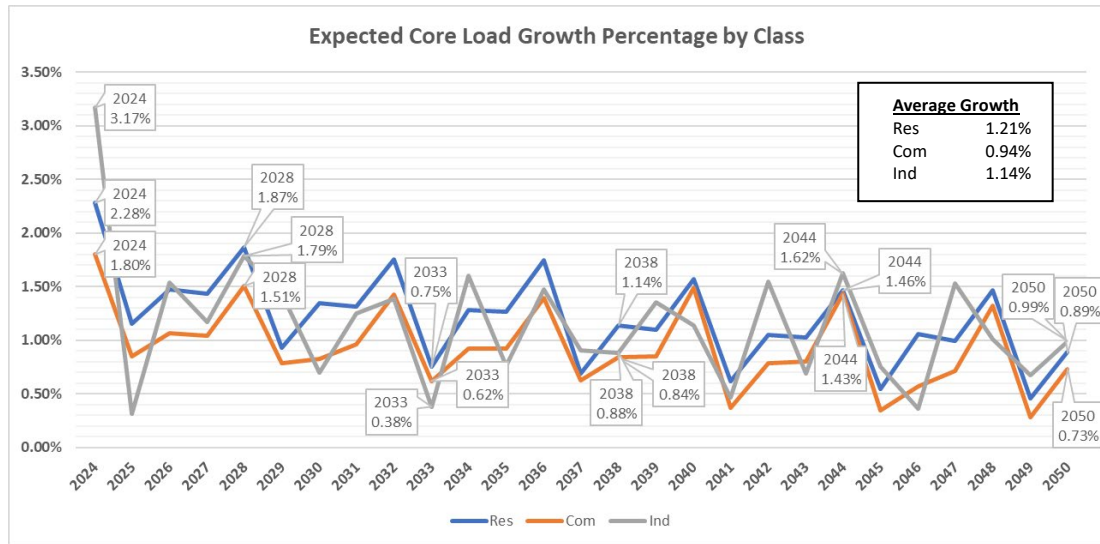
Load growth across Cascade’s system through 2050 is expected to fluctuate between 0.41% and 2.16% annually, accounting for leap years. Figure 3-7 illustrates the growth forecast for Cascade’s system load year over year, showing growth on Cascade’s system but at a declining rate.

Figure 3-7: System Annual Growth Percentage Forecast



Load growth is split between residential, commercial, and industrial customers. Residential and commercial customer classes are expected to grow annually at an average rate of 1.21% and 0.94%, while industrial expects a growth rate of approximately 1.14%. Figure 3-8 shows the percentage of core growth by class over the planning horizon.

Figure 3-8: Expected Core Load Growth Percentage by Class



In absolute numbers, system load is expected to grow annually at an average of 4.4 million therms. A majority of core load today is residential. Cascade projects the ratio between residential, commercial, and industrial to increase in favor of residential customers. Residential customers are expected to grow from 53.3% of the total core load to 54.9% of the total core load by 2050. Figure 3-9 compares the total system annual therm usage forecast of this IRP to past IRPs dating back to 2011. The differences in forecasts can be attributed to evolutions in methodology, customers changing between core and non-core, and having more data to forecast with. Figure 3-10 displays the relative percentage relationship of expected loads by class.

Figure 3-9: System Load Comparison to Previous IRPs (Volumes in Therms)

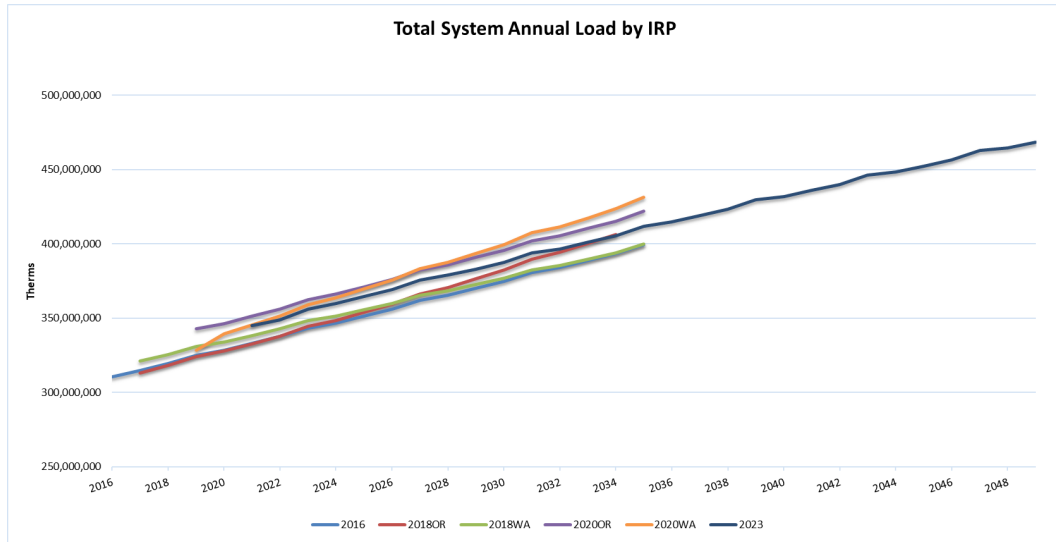
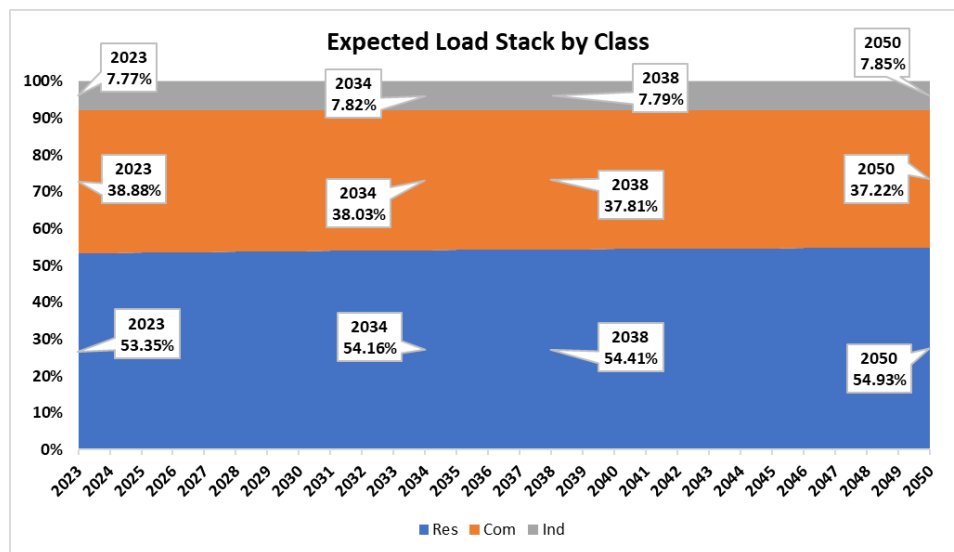
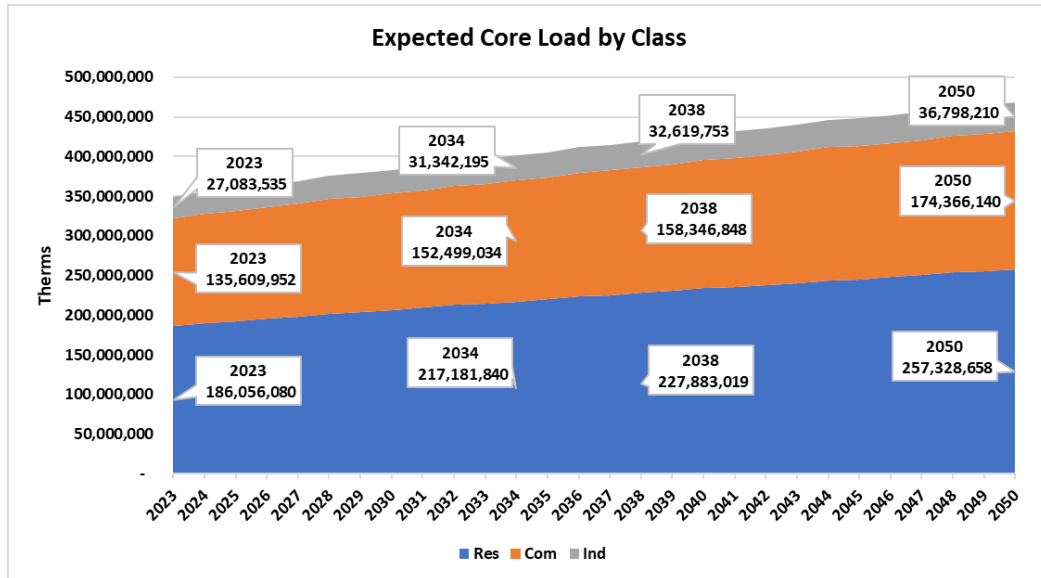


Figure 3-10: Expected Load Stack by Class



Cascade expects residential customers to increase load at an annual average growth of approximately 2.6 million therms and commercial core customers to increase load at an annual average growth of approximately 1.4 million therms over the 20-year planning horizon. Industrial customers are expected to increase load at an annual average growth of approximately 350,000 therms over the same period. Figure 3-11 displays the expected core load volumes by class.

Figure 3-11: Expected Load Growth by Class (Volumes in Therms)



Load growth is primarily a result of increased customer counts. The number of residential, commercial, and industrial customers is expected to increase at a slightly faster rate than therm usage. Figure 3-12 displays the expected customer counts by year and Figure 3-13 displays expected growth percentages by class.

Figure 3-12: Expected Customer Counts by Year

System	High	Base-Case	Low
2023	327,988	321,961	315,380
2030	393,099	364,076	334,873
2040	493,671	424,230	360,652
2050	602,450	484,386	384,533

WA	High	Base-Case	Low
2023	240,626	236,647	232,351
2030	283,937	264,754	245,475
2040	350,354	304,902	262,955
2050	421,696	345,032	279,239

OR	High	Base-Case	Low
2023	87,361	85,314	83,028
2030	109,162	99,322	89,398
2040	143,317	119,328	97,697
2050	180,754	139,354	105,293

Figure 3-13: Expected Customer Growth

System	High	Base-Case	Low
Residential	2.33%	1.56%	0.75%
Commercial	1.90%	1.28%	0.62%
Industrial	2.22%	1.47%	0.66%
<b>Total</b>	<b>2.28%</b>	<b>1.52%</b>	<b>0.74%</b>

WA	High	Base-Case	Low
Residential	2.12%	1.42%	0.69%
Commercial	1.95%	1.31%	0.64%
Industrial	1.87%	1.27%	0.58%
<b>Total</b>	<b>2.10%</b>	<b>1.41%</b>	<b>0.68%</b>

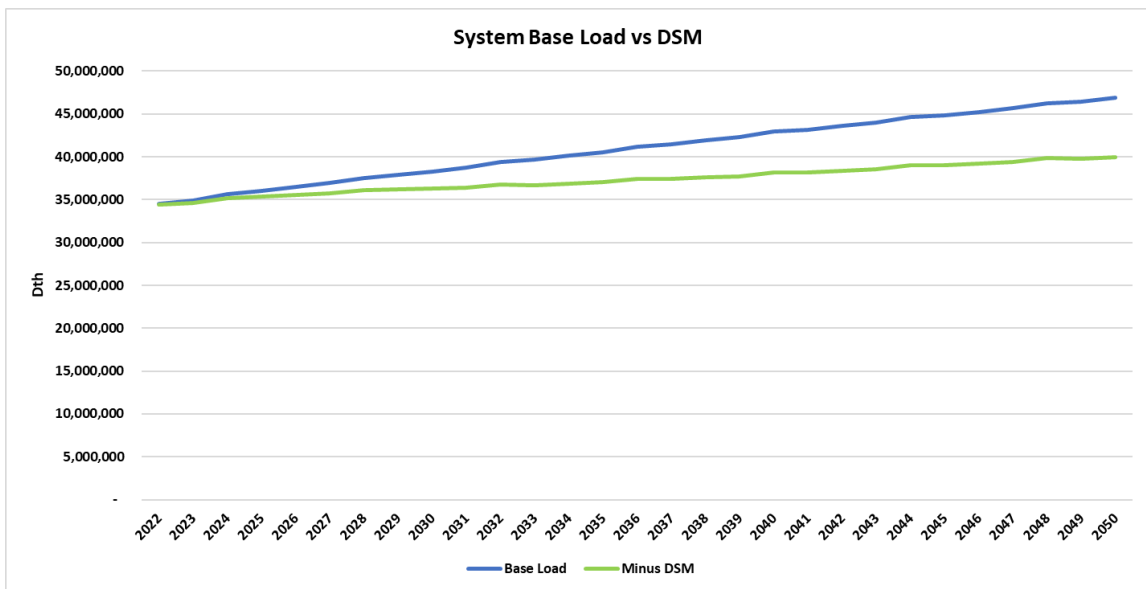
OR	High	Base-Case	Low
Residential	1.78%	1.19%	0.58%
Commercial	1.78%	1.19%	0.58%
Industrial	3.08%	2.02%	0.91%
<b>Total</b>	<b>2.73%</b>	<b>1.83%</b>	<b>0.88%</b>

### 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 3-14 displays total WA and OR DSM projected annual savings as it compares to Cascade’s system load forecast.

Figure 3-14: System Base Load vs DSM



With DSM projections factored in, Cascade’s anticipated system average annual growth rate drops from 1.10% to 0.54%. This represents an annual average DSM savings of 236,000 Dth, which when added cumulatively, has an important impact on overall system load.

Focusing on each individual state, Figures 3-15 and 3-16 display both OR and WA base load as it relates to projected DSM savings.

Figure 3-15 shows that with DSM projections factored in, Cascade’s anticipated OR average annual growth rate drops from 1.43% to 0.86%. This represents an annual average DSM savings of 71,000 Dth, graphed as a cumulative number.

Figure 3-15: OR Base Load vs DSM

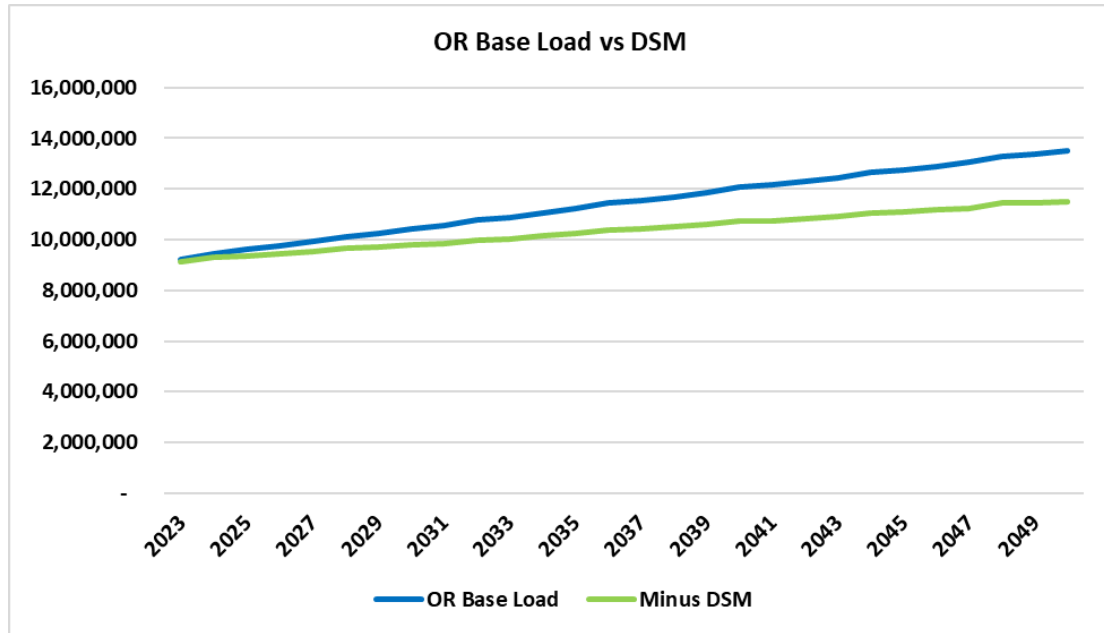
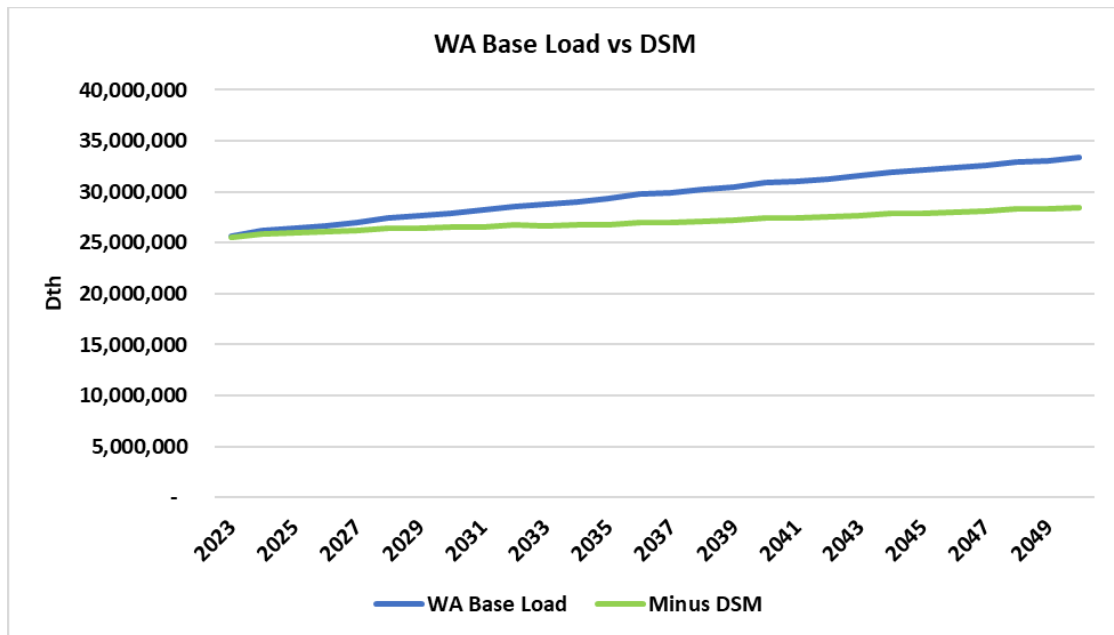


Figure 3-16 shows that with DSM projections factored in, Cascade’s anticipated WA average annual growth rate drops from 0.98% to 0.41%. This represents an annual average DSM savings of approximately 168,000 Dth, graphed as a cumulative number.

Figure 3-16: WA Base Load vs DSM





## Geography

Southeastern Washington and central Oregon are major drivers in Cascade’s growth. These areas have multiple citygates serving counties with large increases in growth rates. Zone 20 contains the Kennewick Loop, a fast-growing area while Zone GTN contains the Bend loop, another fast growing area. Figure 13-17 shows the locations of the faster growing citygates on a map. Figure 3-18 shows the annual system load by each of Cascade’s pipeline zones. Figure 3-19 shows the average annual percentage growth of load by each pipeline zone over the planning horizon. 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 3-19 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 3-17: System 28-Year Load by Pipeline Zone (Volumes in Therms)

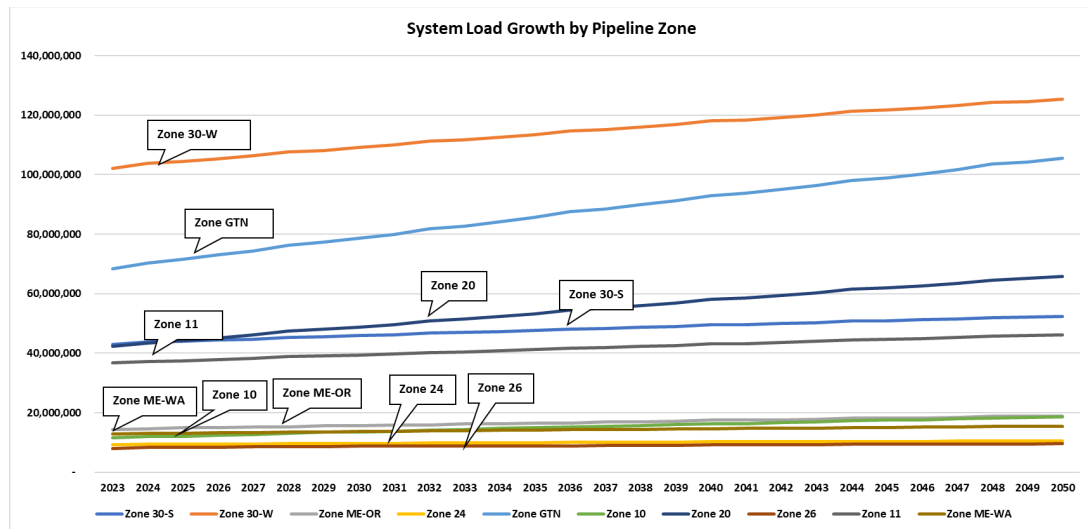
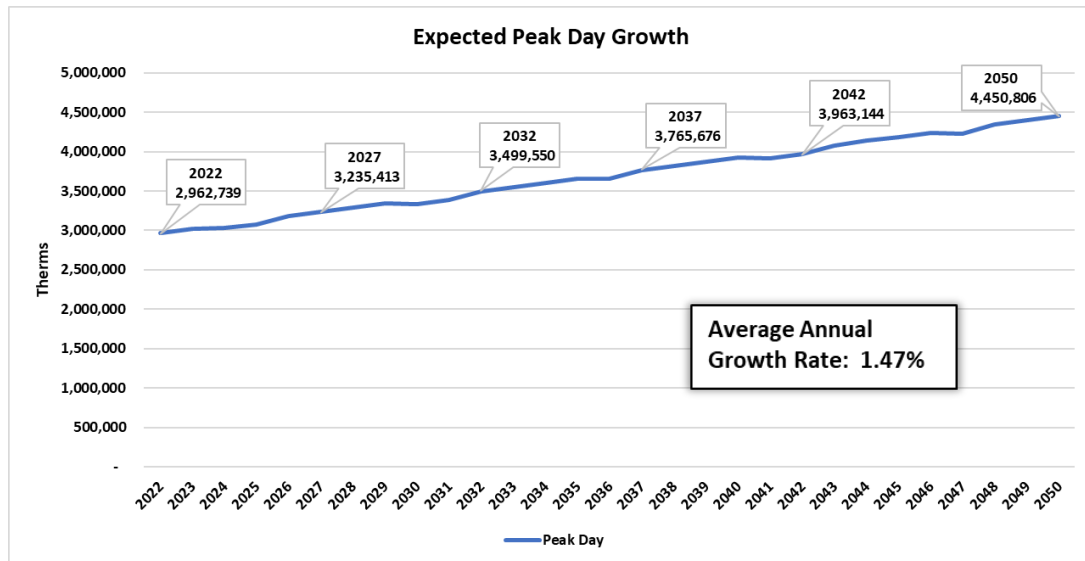


Figure 3-18: System 28-Year Average Load Growth by Pipeline Zone

Zone	Load Growth	Zone	Load Growth
Zone 10	1.79%	Zone 30-S	0.73%
Zone 11	0.86%	Zone 30-W	0.76%
Zone 20	1.65%	Zone GTN	1.62%
Zone 24	0.47%	Zone ME-OR	1.04%
Zone 26	0.71%	Zone ME-WA	0.67%

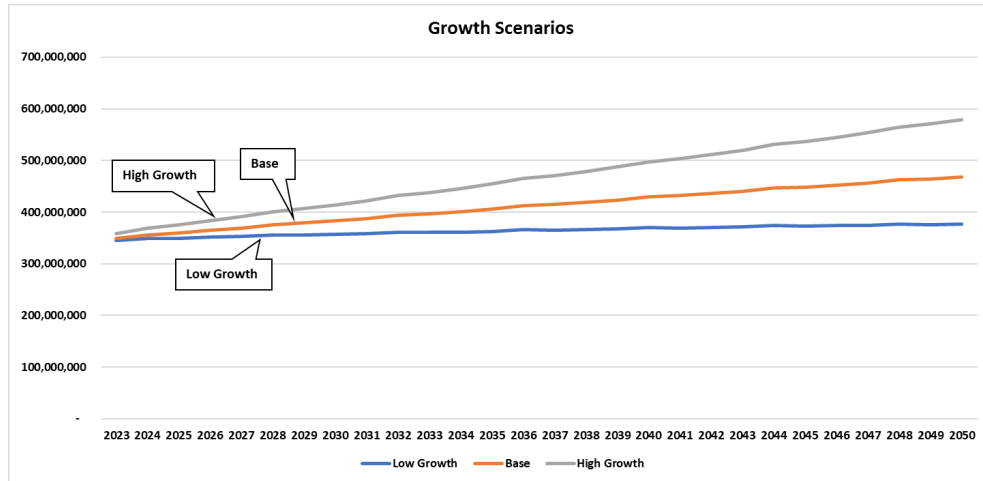
Figure 3-19: Expected System Peak Day Growth (Volumes in Therms)



### High and Low Growth Scenarios

In the previous IRP, the high and low growth scenarios were built from the confidence intervals of the customer growth forecast, which were approximately 5%. Cascade wanted a more robust scenario analysis and developed a methodology for better capturing realistic low growth and high growth scenarios. Cascade decided to analyze the slowest and fastest growth years of each citygate by comparing them to the average growth rate of each citygate. This gave a much more realistic idea of what a slow or rapid growth year might look like based on historical numbers. Cascade discovered that as a general rule, a slow growth year was about half the average growth rate whereas a fast growth year was about 1.5 times the average growth rate of a specific citygate. Figure 3-20 displays the total system load growth across the various growth scenarios.

Figure 3-20: Total System Load Growth Across Scenarios



Load growth under the low stochastic scenario is showing approximately 3 million less therms per year while load growth under the high stochastic scenario is showing approximately 3 million more therms per year than the stochastic All-in scenario. By analyzing historic slow growth and fast growth years, Cascade can assert with a high degree of certainty that these scenarios accurately encompass a potential range of load growth scenarios. Figure 3-21 shows the values for stochastic growth scenarios.

Figure 3-21: Stochastic Total System Load Growth Across Scenarios in Therms

Year	Low	Base	High
2023	345,673,078	348,749,568	358,789,712
2030	356,779,839	383,051,157	414,134,929
2040	369,855,291	429,497,908	497,686,804
2050	376,671,117	468,493,007	578,404,695

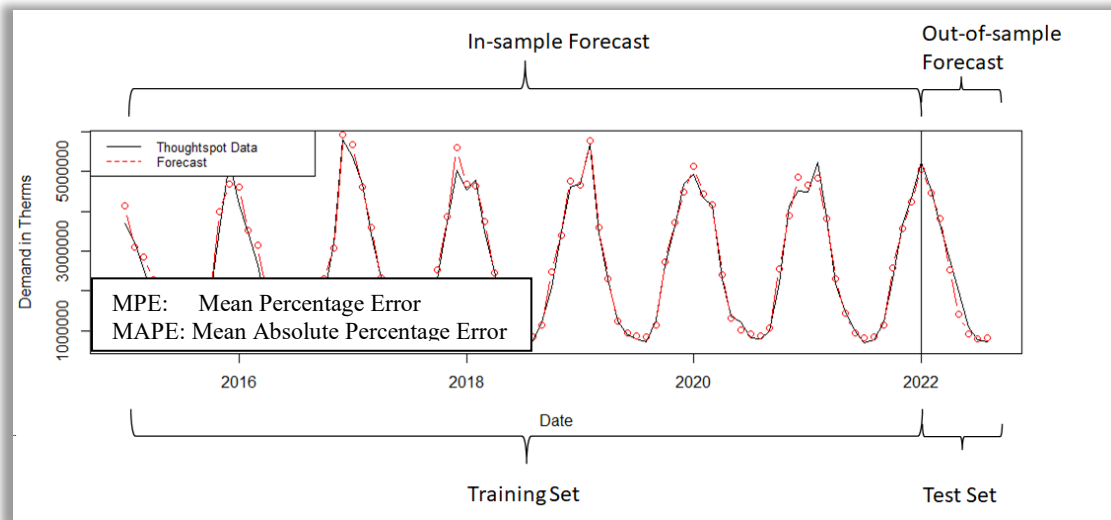
### Non-Core Outlook

Unlike the core, non-core (or transportation) customers are customers who schedule and purchase their own gas, generally through a marketer, to get gas to the citygate. The customer then uses Cascade’s distribution system to receive the gas. Cascade has approximately 244 transportation customers, with seven of those customers being electric generation customers. In both Washington and Oregon, the 2023 forecast for non-electric generation customers is approximately 518 million therms and that for electric generation customers is about 578 million therms for a total of 1.096 billion therms for the transportation customers. For information on the emissions for these customers, see Chapter 6 – Environmental Policy.

## Cross-Validation

Cascade continues to evolve and improve its forecasting methodologies. For this IRP, Cascade performed model validation analysis, called cross-validation, in order to validate the assumptions going into the models as well as the results coming out. This process is time intensive, so Cascade selected two citygates to perform this analysis. There are many ways to cross-validate a forecasting model such as hold-out validation, k-fold validation, and bootstrap validation. Each technique has its benefits and disadvantages when it comes to strength of validation and computational time.<sup>14</sup> Cascade chose the hold-out method as it contains the best combination of having strong validation results with low computation time in reference to the other methodologies. The steps of the hold-out method involve selecting a specific citygate and rate class, limiting the historical data, developing a model using the same methodology as the original model, and then comparing the forecasted results to actual data. This is called out-of-sample testing. Cascade chose one of its more volatile citygates, Sumas SPE Loop, and one of its more stable citygates, Yakima Loop, in order to maximize the value of the cross-validation results by using both ends of the usage spectrum. Figure 3-22 shows the breakdown between the in-sample and out-of-sample parts. Figures 3-23 through 3-25 show the Sumas SPE Loop residential, commercial, and industrial rate classes. Figures 3-26 through 3-28 show the Yakima Loop residential, commercial, and industrial rate classes. The figures show both these citygates' ThoughtSpot data (billing data) compared to a forecast of a model made from Jan, 2015 – March, 2022. The out-of-sample range is April, 2022 to August, 2022.

Figure 3-22: Sumas SPE Loop Cross-Validation



<sup>14</sup> <https://www.turing.com/kb/different-types-of-cross-validations-in-machine-learning-and-their-explanations>

Figure 3-23: Sumas SPE Loop Residential Cross-Validation

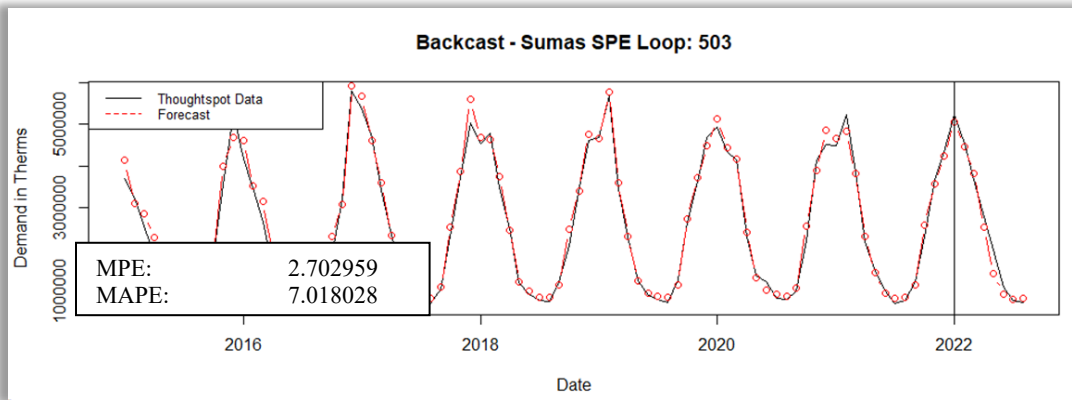


Figure 3-24: Sumas SPE Loop Commercial Cross-Validation

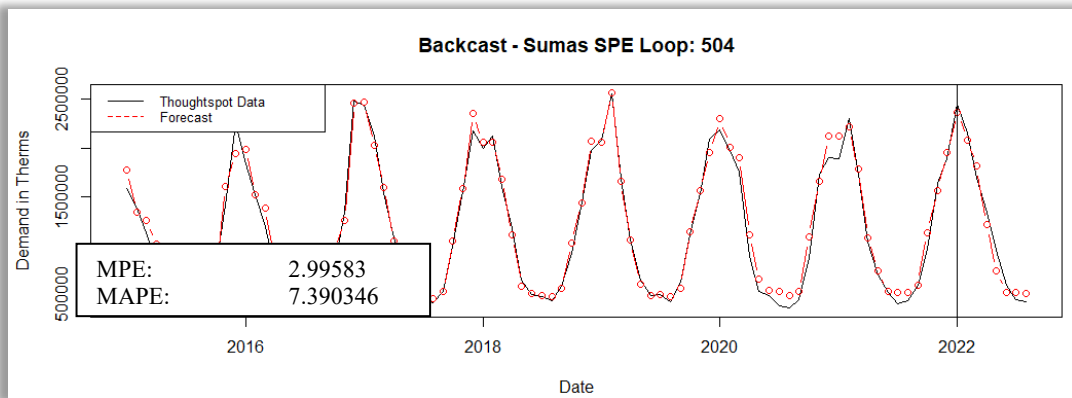


Figure 3-25: Sumas SPE Loop Industrial Cross-Validation

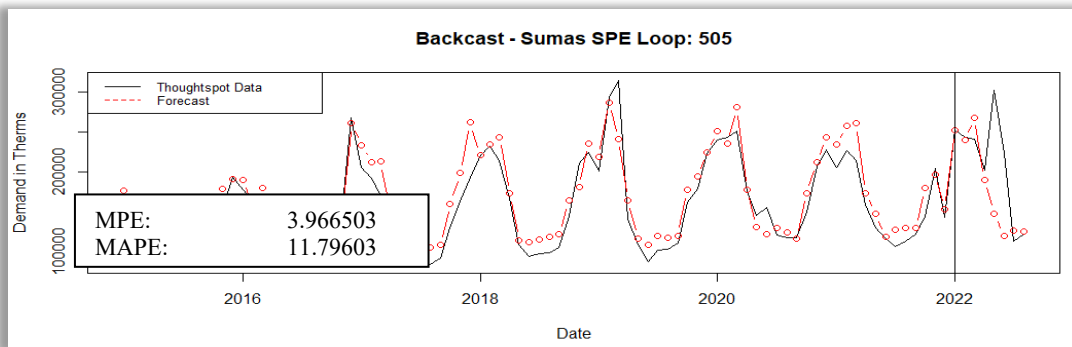


Figure 3-26: Yakima Loop Residential Cross-Validation

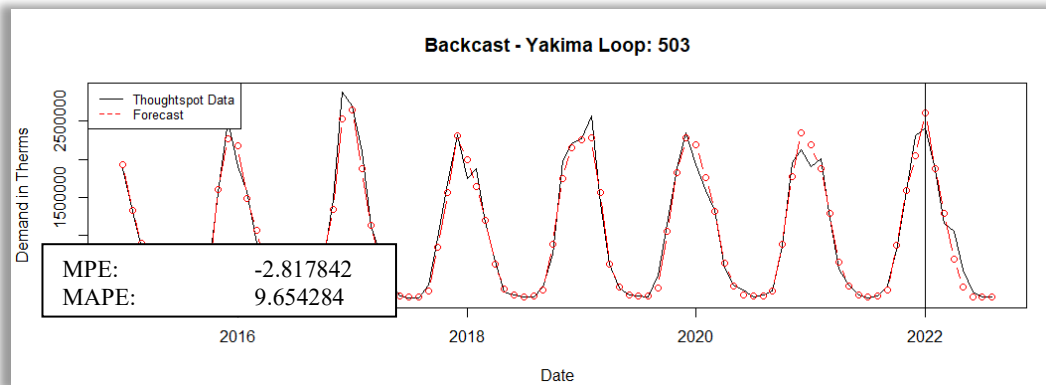


Figure 3-27: Yakima Loop Commercial Cross-Validation

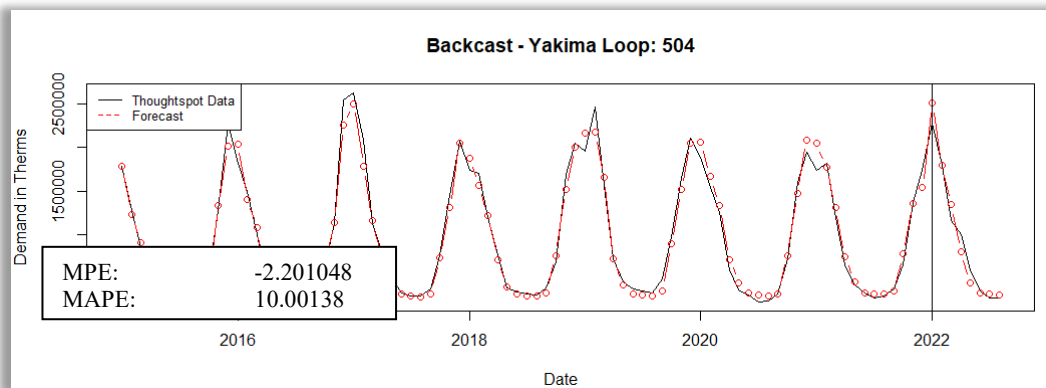
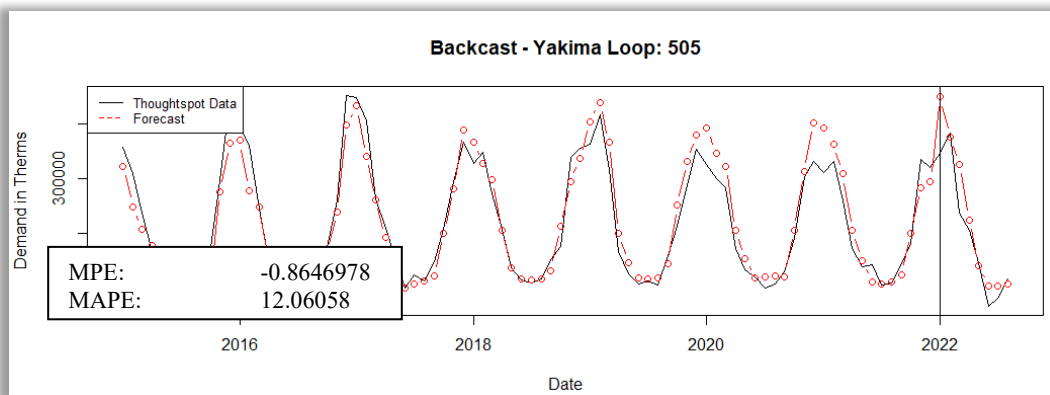


Figure 3-28: Yakima Loop Industrial Cross-Validation



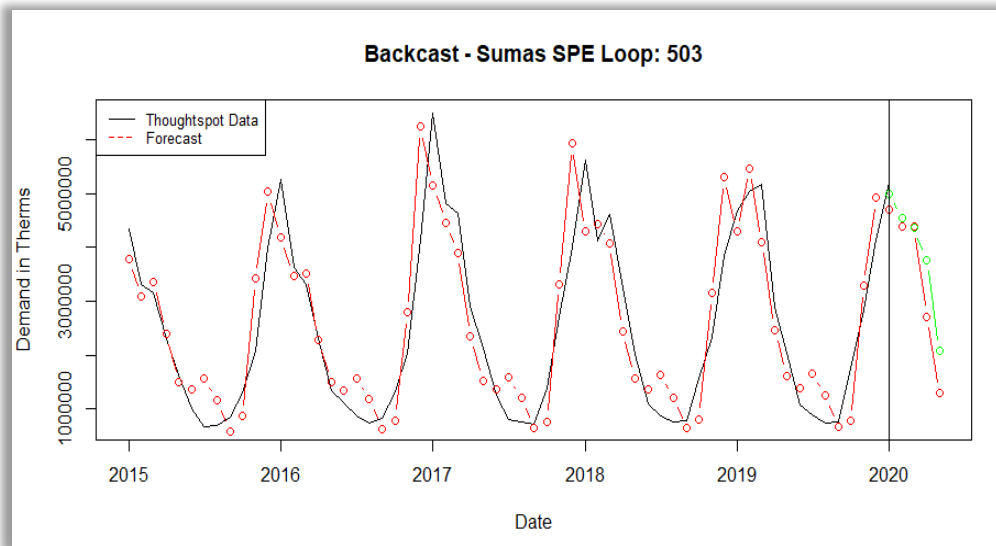
In the previous IRP, Cascade’s cross-validation results showed a need to lag the Thoughtspot billing data in order to better correlate with pipeline data. The above figures show that this change in the forecast methodology increased the forecast

accuracy significantly. The next section, Methodology Changes, provides more information about this change. For the next IRP, Cascade will investigate more ways to better forecast the industrial rate class and will investigate ways to make this process more efficient in order to validate more models, more often.

### Methodology Changes From Previous IRPs

As mentioned in the cross-validation section, Cascade made a shift to the Thoughtspot billing data before beginning the demand forecast. Figure 3-29 shows the cross-validation results for one of Cascade’s citygates from the last IRP.

Figure 3-29: Sumas SPE Loop Residential Cross-Validation



This identified that the forecast was consistently one month behind the actual pipeline flow data. After further examining the customer billing data, Cascade discovered customers on specific billing cycles should be shifted back one month to better account for the discrepancy between some billing receivables and pipeline data. After this shift, the forecasts’ accuracies were vastly improved.

Another methodology change is Cascade captured price sensitivity in its use-per-customer forecast for this IRP by introducing price as a regressor (as described earlier in this chapter in the section labeled “Price as a New Regressor”).

### Alternative Forecasting Methodologies

Cascade’s forecasting methodologies used in the customer forecast and the UPC forecast have remained consistent. Cascade continues to utilize Fourier terms and

ARIMA terms in its forecasting methods. Cascade utilizes R as its primary statistical analysis software and uses models that follow a dynamic regression methodology. The Company plans to continue improving the customer and demand forecast model through R to enhance the process' efficiency.

The Company is responsive to several regulatory principles in forecasting. These include:

- A desire for precision and a high degree of accuracy;
- A universal understanding that forecasts should mirror future realities but may have unanticipated swings in either direction;
- A disconnect between planning and operational functions, in that natural gas purchasing and dispatch will be based on immediate needs which, in actuality, are guaranteed to vary from the plan (per the previous bullet);
- An understanding that an increased cost of improved precision sometimes has decreasing customer benefits;
- A need to meet regulators' expectation that the Company show continual improvement because new tools are available. For example, the concept of "adaptive management" can be applied;
- The major differences in accounting treatment between the states regarding test years for ratemaking purposes (that is, for general rate case filings) and not necessarily for planning. At this time, Oregon uses future test year accounting while Washington employs a historic test year;
- The fuzziness of historic data that includes effects of energy efficiency, retail price (from annual PGA—purchased gas adjustment—changes and other rate changes), sometimes abnormal weather, new technology, and then-unique economic conditions (e.g., recession, interest rates, etc.). Cascade uses actual historic data. The term fuzziness is used in the context of basing forecasts on past-period data that includes many variables, any one of which may have increased or decreased in the intervening time between historical occurrence and forecasted periods. This causes difficulty for utilities trying to isolate primary factors for greater precision of long-term calculations.
- Unknown and uncertain future changes such as the assumptions around carbon policy and other environmental externalities; and
- A need to demonstrate support for assumptions such as growth in customers, use per customer and changes from previous forecasts, type of use (i.e., heating, manufacturing, etc.), to name a few.

The preceding subchapter illustrates the complexity of forecasting and highlights areas of stakeholder attention. Best efforts at appropriate reasonable cost distill these factors into a generally accepted forecast with recognition of inherent uncertainties.



## **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 10 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 presented 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.

## **Conclusion**

Cascade expects system load growth to average 1.10% per year over the 28-year planning horizon. 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 from 20 years to 28 years to better align with emissions modeling; analyzing peak day stochastically using 10,000 Monte Carlo simulated draws for each weather zone; adding a price 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 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) is included in this chapter.
- The long-term planning price forecast is based on a blend of futures market pricing along with long-term fundamental 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

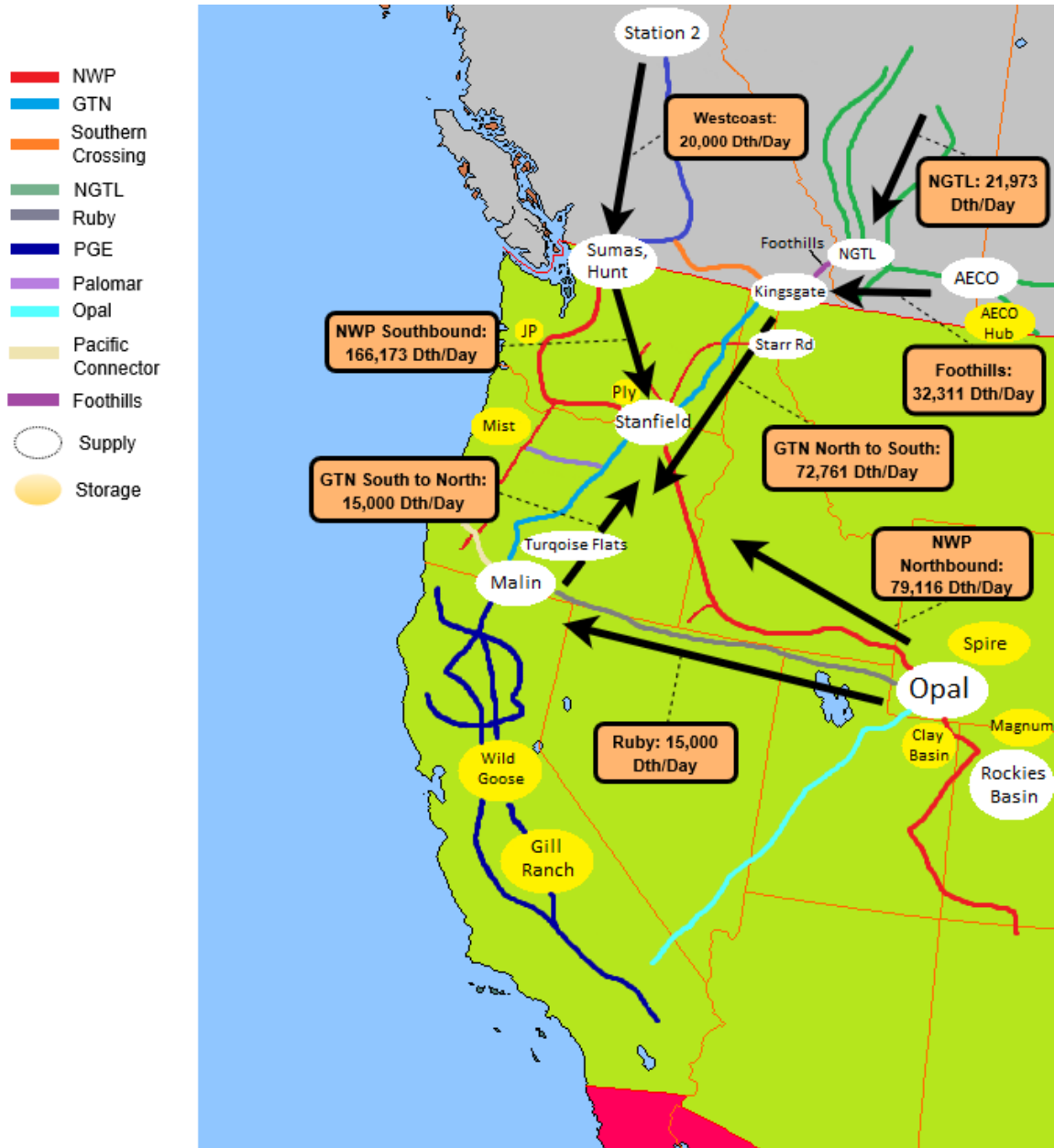
Gas supply options available to Cascade to meet the core market demand requirements generally fall into two groups: 1) Firm gas supplies on a short- or long-term basis, and 2) Short-term gas supplies purchased on the open market as needed in a particular month for one or more days. A third option, renewable natural gas, is emerging.<sup>1</sup> A separate and important source of gas supply is natural gas storage service, which is required to provide economical service to low load factor customers during seasonal and other high demand periods.

---

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

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.<sup>2</sup>

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



<sup>2</sup> This map does not reflect three contracts Cascade anticipates acquiring November 1<sup>st</sup>, 2023: 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 dths/day to quantities in excess of 10,000 dths/day. Blocks of 1,000, 2,500, 5,000 and 10,000 dths/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 (also called 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

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 made significant strides in analyzing, planning, and acquiring RNG. In this section and elsewhere in this IRP, issues unique to RNG are found in the inset box to the right.

### QUICK REFERENCE TO RNG LOCATIONS IN IRP

#### Page - Topic

4-5 - Description of RNG

4-7 - Applicable Regulations

4-9 - Cost Effectiveness Evaluation Methodology

4-12 - RNG Projects

4-15 - Renewable Thermal Certificates

4-15 - Hydrogen

Chapter 6 - Environmental Compliance

Chapter 8 - System Planning (re Connection and Reliability)

Chapter 9 - Resource Integration (re Modeling Results)

Chapter 10 - Stakeholder Engagement (re Communications)

Chapter 11 - Action Items (re Future Steps)

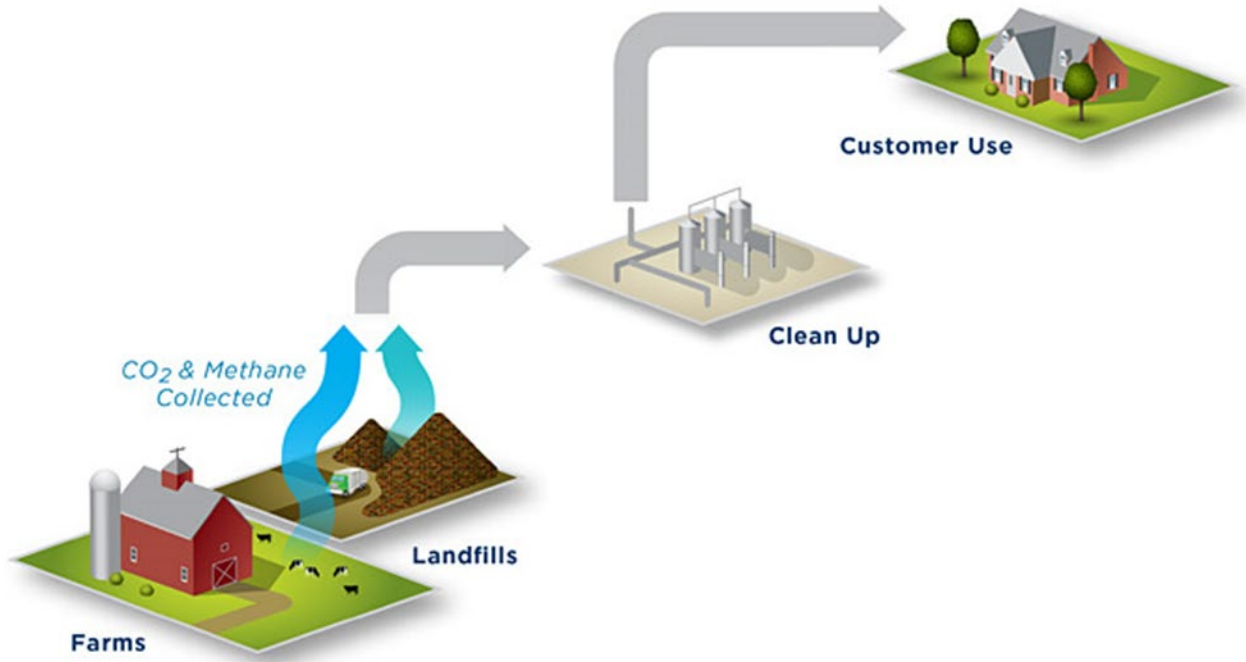
RNG, as defined in RCW 54.04.190,<sup>3</sup> is a gas consisting largely of methane and other hydrocarbons derived from the decomposition of organic material in landfills, wastewater treatment facilities, and anaerobic digesters. Cascade is committed to developing programs that allow the Company to acquire RNG under guidelines and rules stated in Washington HB 1257 and Oregon SB 98.

---

<sup>3</sup> See <https://app.leg.wa.gov/rcw/default.aspx?cite=54.04.190>

Figure 4-2,<sup>4</sup> 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



Renewable natural gas, 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.
- Renewable natural gas is biomethane upgraded to natural gas pipeline-quality standards so it can substitute or blend with conventional natural gas.<sup>5</sup>

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.
- Biogas from Livestock Operations
  - Collects animal manure and delivers to anaerobic digester.
- Biogas from Wastewater Treatment

---

<sup>4</sup> U.S. Department of Energy, Alternative Fuels Data Center, Renewable Natural Gas

<sup>5</sup> American Natural Gas.com

- Produced during digestion of solids that are removed during the wastewater treatment process.
- Other sources include organic waste from food manufacturers and wholesalers, supermarkets, restaurants, hospitals, and more.<sup>6</sup>

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.<sup>7</sup>

## 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<sup>8</sup> (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.

Following the adoption of HB 1257 into law,<sup>9</sup> 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

---

<sup>6</sup> U.S. Department of Energy, Alternative Fuels Data Center, Renewable Natural Gas.

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

<sup>8</sup> See <http://lawfilesexternal.wa.gov/biennium/2019-20/Pdf/Bills/House%20Passed%20Legislature/1257-S3.PL.pdf?q=20201020144814>.

<sup>9</sup> Signed by Governor Jay Inslee on May 13, 2019 with an effective date of July 28, 2019.



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 five percent 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, which Cascade discuss the projects that are either contracted for or very close beginning on page 4-11.

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 allow the Company to model the impact to retail customers in order to not exceed the five percent 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**

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

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

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.

## RNG Projects

Cascade is currently progressing with fourteen on-system RNG projects at varying stages of development. Seven of these projects are what Cascade refers to as Purchase Projects, where Cascade would on-board the RNG onto the Company's distribution system and purchase the environmental attributes to be utilized for voluntary RNG tariffs in Washington and Oregon. These types of RNG projects are Cascade's highest RNG priority.

The balance are projects where RNG is injected into its system and Cascade transports the customer's RNG so that they may market the environmental attributes to other parties (Transport Projects). Cascade cannot buy the environmental attributes on these projects because they are typically priced much higher than would be prudent for utility customers. One example of this is dairy projects where the current attribute values can be \$60-\$70/MMBtu. Some Transportation Projects also come to Cascade with the attributes pre-sold as a part of the financing package to fund the facility.

Of the Purchase Projects in development, four projects are either under contract or at very advanced stages of contracting as detailed below:

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

Status & Terms

- Under contract, engineering in progress
- 1,250,000 therm/yr
- 15-year term
- Projected in-service date late Q4 2023

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

Status & Terms

- Working through final contact terms with Deschutes County
- Plant engineering and design in progress
- 2,500,000 therm/yr
- 20-year term
- Projected in-service date Q4 2024

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

Status & Terms

- Resolving final contact terms with developer
- 3,400,000 therm/yr
- 20-year term
- Projected in-service date Q4 2024

**Industrial Food Waste RNG Project - Benton County Washington**

Source - Food waste from industrial food processor with existing digester

Scope of Cascade Work

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

Status & Terms

- In contract negotiations
- 715,000 therm/yr
- 10-year term
- Projected in-service date Q4 2023

The following two projects are Transportation Projects either under contract or at advanced stages of contracting as detailed below:

**Divert, Inc. RNG Project – Longview, Washington**

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

Scope of Cascade Work

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

Status & Terms

- Under contract, engineering in progress
- 1,800,000 therm/yr
- 10-year term
- Projected in-service date early Q1 2024

**Diary RNG Project – Snohomish County, Washington**

Source – Manure from 3,500 head dairy operation

Scope of Cascade Work

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

#### Status & Terms

- Interconnect Agreement terms reached, final contract draft in review
- 815,000 therm/yr
- 10-year term
- Projected in-service date early Q1 2024

### **Renewable Thermal Certificates**

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 Renewable Thermal Certificates (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 Climate Commitment Act (CCA) do not allow for environmental attributes, whereas the Climate Protect Program (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**

Hydrogen is believed to be a key component to achieving carbon compliance in the future. Hydrogen is being proven to be a safe, reliable option in specific applications and as a replacement option to traditional natural gas. Much research is underway to maximize understanding and reduce upstart costs. Currently, hydrogen is more cost prohibitive than other RNG options, but it is anticipated that costs will come down as hydrogen becomes a more viable option, which is further discussed later on in this chapter. Cascade is following various research projects that are underway.

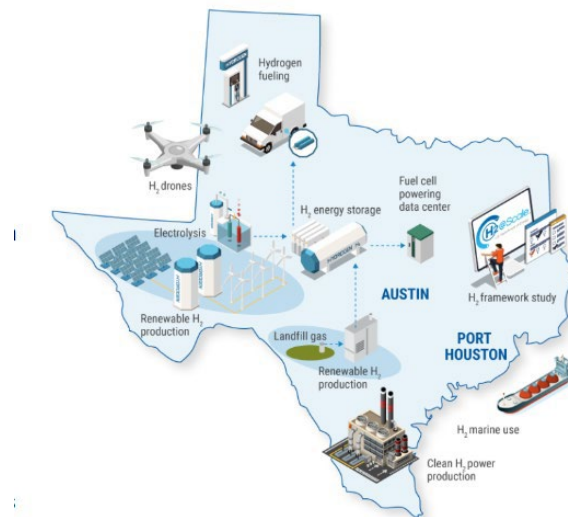
RNG and hydrogen will be critical in meeting the dual goals of decarbonizing energy pipelines while maintaining the benefits of reliability and resiliency provided by the Company's distribution system. One challenge from utilizing hydrogen is that it burns at a lower heating quality than traditional natural gas. A blend of 20% hydrogen by volume, which is Cascade's base case blending volume in the 2023 IRP, only equates to an offset of about 7.4% of traditional natural gas by energy. For both the CCA in Washington and the CPP in Oregon, the hydrogen quantities blended by energy are considered a one-for-one offset to traditional natural gas. While there are concerns about whether a blend of hydrogen and traditional natural gas would require a higher usage of this blended product, thus offsetting the emissions reduction savings of using hydrogen in the first place, Cascade is confident through conversations with various subject matter experts in this field that the blended

product would result in less than 1% loss of efficiency, creating a negligible need for additional use of the blend. That being said, the Company recognizes that thorough testing of hydrogen will still need to be performed before hydrogen can be utilized in Cascade’s system.

Cascade has been closely monitoring hydrogen research such as the Hydrogen Shot<sup>10</sup> (111 Goal), H2Hubs, Low-Carbon Resources Initiative<sup>11</sup>, and the Gas Technology Institute (GTI) Hydrogen Technology<sup>12</sup>. Hydrogen Shot was launched by the Department of Energy (DOE) and has a “111 goal,” which is to reduce the cost of clean hydrogen by 80% to \$1.00 per kilogram, down from \$5.00 per kg, in the next decade. The DOE has released a notice of intent<sup>13</sup> to fund the bipartisan infrastructure laws with an \$8 billion program to set up hydrogen hubs. Cascade’s sister company, Intermountain Gas, is a member of the GTI, which is a research organization made up of member companies. There are two sub organizations under GTI, where one researches topics related to operation of pipeline systems and the other looks at end use equipment, particularly, focusing on energy efficiency.

As an example, there is a joint venture between DOE, GTI, Frontier Energy, and the University of Texas to design, build, and operate one of the largest collections of renewable hydrogen production and induced technologies ever assembled at one site<sup>14</sup>.

Figure 4-3: H2@Scale in Texas and Beyond



<sup>10</sup> [Hydrogen Shot | Department of Energy](#)

<sup>11</sup> [Low-Carbon Resources Initiative \(epri.com\)](#)

<sup>12</sup> [Hydrogen Technology Center • GTI Energy](#)

<sup>13</sup> [DOE Launches Bipartisan Infrastructure Law's \\$8 Billion Program for Clean Hydrogen Hubs Across U.S. | Department of Energy](#)

<sup>14</sup> [H2@Scale Project Launched in Texas | Energy Institute | The University of Texas at Austin \(utexas.edu\)](#)



## RNG and Hydrogen Projections

Cascade is utilizing actual RNG projects that are described in the RNG Projects subsection, as well as actual RNG attribute offers Cascade has received for near term projections. For long term projections, Cascade is utilizing a 2019 ACF/ICF study on the potential of various feedstocks for Renewable Natural Gas supply<sup>15</sup>. Using this study, Cascade used a 50/50 blend of the High and Technical Resource Potential Scenario (Tables 39 and 40 of the study), since the Companies who are active in procuring RNG will have higher availability to RNG. Figure 4-4 shows the potential RNG volumes available to Cascade. The ACF/ICF study indicates that RNG potential may level off by 2040. On page 27 of the study, ICF says “the diversion of food waste from landfills may limit the long-term potential (post-2040) of landfill gas as a viable resource for RNG production.” For the 2023 IRP, Cascade has adopted this assumption that, while existing RNG projects will continue to generate gas through the planning horizon, no new RNG projects may be added to the portfolio beyond 2040. To model the pricing of RNG, the Company followed the example of another regional LDC in using a forecast that does not employ a traditional supply curve because of the “lumpy” nature of RNG projects coming online. To that end, prices are split into two tranches. The first tranche, covering the first 1/3<sup>rd</sup> of projected supply, is priced at \$13/dth, while the second tranche, covering the remaining 2/3<sup>rd</sup> of supply, is priced at \$19/dth. In scenarios where additional supply is modeled to be available, those are priced at a third tranche not shown in Figure 4-5, where the price for RNG would be \$26/dth. Green Hydrogen pricing comes from market intelligence based on an article from S&P Global<sup>16</sup>. There is a significant amount of uncertainty regarding the potential cost and quantity of these resources, as the markets for RNG and Hydrogen are still in very early stages. The Company recognizes that exogenous factors may lead to increased competition for these resources. To this end, Cascade addresses how its Top-Ranking Candidate Portfolio would perform under a number of scenarios related to reduce availability and increased prices for these resources. The result of these analyses can be found in Chapter 9, Resource Integration.

---

<sup>15</sup> [Renewable Sources of Natural Gas - American Gas Foundation](#)

<sup>16</sup> [Green hydrogen costs 'can hit \\$2/kg benchmark' by 2030: BNEF | S&P Global Platts \(spglobal.com\)](#)

Figure 4-4: RNG and Hydrogen Potential

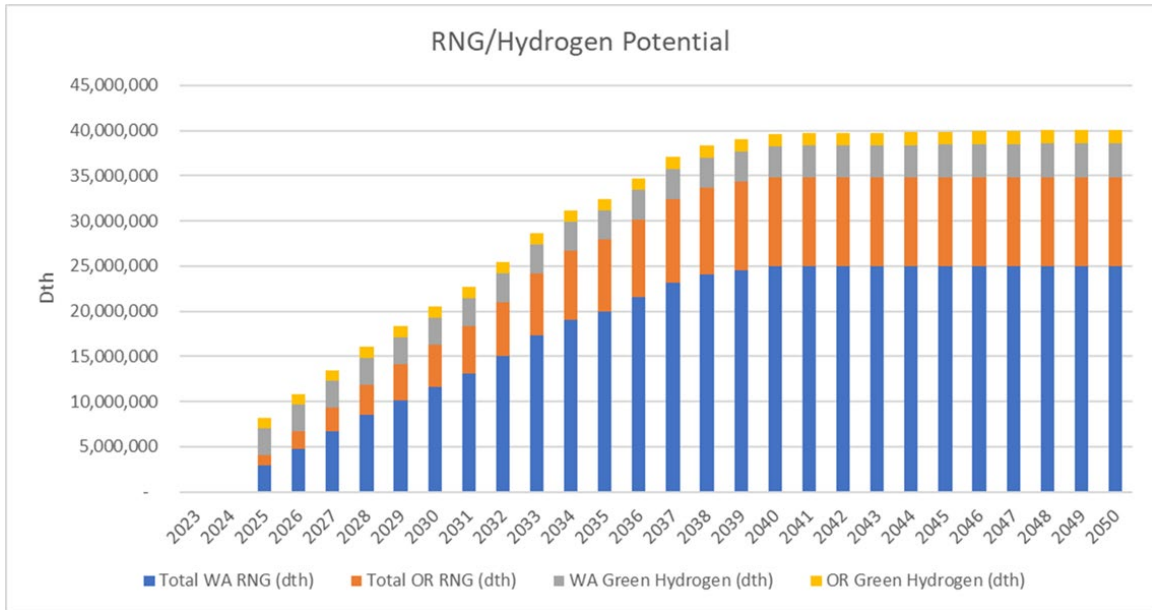
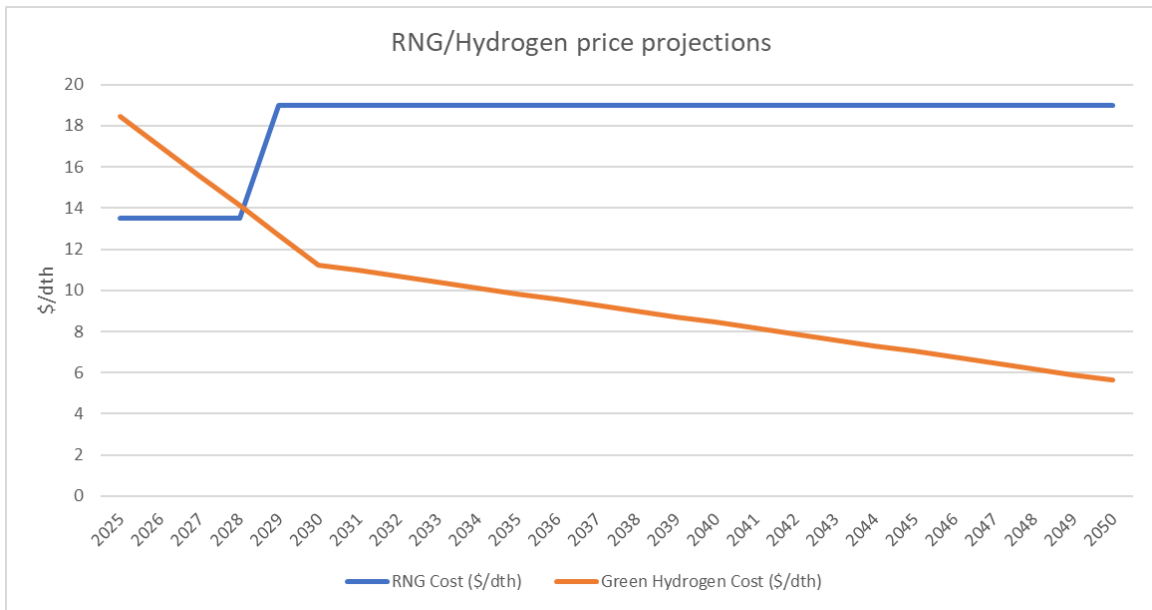


Figure 4-5: RNG and Hydrogen Price Projections



### 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 // or tanks under pressure as compressed natural gas (CNG) or cooled to a liquid state (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.<sup>17</sup> Puget is a one-third owner 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

---

<sup>17</sup> See: Jackson Prairie Underground Natural Gas Storage Facility, <https://www.pse.com/pages/energy-supply/natural-gas-storage>, as of February 2, 2021.

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.

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.

### GTN Express

In the 2018 IRP (LC 69), Cascade had identified an upstream shortfall along the GTN pipeline. A shortfall occurs when the Company's customer demand exceeds the maximum daily quantity a company has contracted for on an upstream pipeline. As seen in Figure 4-7, Cascade identified this shortfall beginning in 2020 and exceeding 20,000 dth in the early 2030's.

Figure 4-7: Oregon Load Centers with Potential Peak Day Unserviced Demand in Dekatherms – As Is Scenario

Area	2018	2020	2025	2030	2035	2037
Bend Loop	-	1,504	8,488	15,835	23,266	26,262
<b>Total</b>	-	<b>1,504</b>	<b>8,488</b>	<b>15,835</b>	<b>23,266</b>	<b>26,262</b>

Once Demand Side Management options were included, it delayed the first shortfall until 2023 and the time to reach 20,000 dth shortfall to the mid 2030's.

In the 2018 OR IRP Updated, Cascade gave an update to Action Item 11: *“Evaluate the cost of purchasing incremental GTN capacity now versus in 4 years. Confirm with GTN on the availability of upstream capacity either from Kingsgate to Malin or from Turquoise Flats to Kingsgate. At a minimum, on a quarterly basis analyze the potential availability and price of GTN capacity currently compared to at least four years out. Provide the results of this analyses to GSOC to determine actions necessary to meet Bend capacity shortfalls anticipated late in the upcoming decade.”*

Cascade's update stated: In the Oregon IRPs prior to the 2018 Oregon IRP, Cascade noted a potential shortfall along GTN. The 2016 WA IRP also noted a potential shortfall along GTN. During the 2018 OR IRP modeling period, Cascade

purchased 10,000 dths/day of GTN north to south forward haul on December 1st, 2017. Due to the timing, Cascade did not include this 10,000 dths in the modeling and instead included it in the solve for the GTN shortfall. The 2018 OR IRP showed a GTN shortfall beginning in 2019-2020 which was delayed until 2026-2027 because of the 10,000 dths/day that was already purchased.

The Company takes into account many different factors when it comes to evaluating the cost of purchasing incremental GTN capacity now versus in four years. These factors include, but are not limited to, cost of capacity, risk of availability of capacity, and risk around error in the Company forecast. Looking further into these factors Cascade found:

- The cost of acquiring the 20,000 dths of capacity now will more likely be cheaper than capacity four years from now.
- It is Cascade's understanding that GTN is near fully subscribed.
- Cascade's Bend growth forecast from 2018 to 2019 in the OR IRP was 2.44% but has actually seen a 3.33% increase from January 2018 to January 2019. In the 2018 WA IRP, which accounted for the higher growth rate, it was shown that the GTN shortfall started in 2023.

The factors listed above were provided to GSOC which determined that purchasing 10,000 – 20,000 dths/day would be the necessary action to meet Bend capacity shortfalls. Cascade signed a non-binding term sheet between GTN and the Company on April 18, 2019. The non-binding term sheet essentially stated Cascade would participate in an Open Season with an interest in 10,000 – 20,000 dths/day of GTN capacity, GSOC authorized Cascade to continue to monitor the situation and will keep the OPUC up to date through the PGA quarterly meetings.

On September 13, 2019, consistent with GSOC's authorization, Cascade executed a binding precedent agreement with GTN to acquire 20,000 dths/day of GTN capacity as part of the GTN Express project.

In the 2020 and 2023 IRP, Cascade included the 20,000 dth of GTN Cascade contracted for beginning November 1, 2023 in the modeling. Since this new contract was included in the modeling Cascade did not identify any shortfalls in the 2020 IRP and identified a small shortfall on GTN in the 2023 IRP, but not until late 2040's.

Further evidence that Cascade needs the expansion occurred when Cascade flowed approximately 66,000 dth of gas along GTN on December 22, 2022. On this day, Cascade experienced 52 HDD temperatures, which is approximately 18 HDDs warmer than what the Company models for peak day HDDs. Cascade's contracted capacity without the 20,000 dth is 72,603. Therefore, Cascade was about 6,000 dth from exceeding upstream pipeline contracted capacity while experiencing cold, but not peak day temperatures.

In this 2023 IRP, Cascade shows in the Demand Forecast chapter that the Company anticipates growth to continue to go rise even with the carbon compliance around the CPP. In the Resource Integration chapter, Cascade identifies ways the Company plans to meet CPP decarbonization goals even with an increasing customer base.

### **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 is still closely monitoring the market for long term impacts of COVID-19. Cascade did reach out to its hedging consultant, Gelber & Associates, who provided the following analysis in the Company's 2022 Hedge Plan:

“Excessively mild weather to begin the 2021/2022 winter caused prices to fall to a low of \$3.56/MMBtu. However, in late December, the US registered the coldest sustained winter period in January and early February of 2022 since the Polar Vortex of 2013/14. The brief advantage storage had built in winter’s mild early days was erased, with peak demand and freeze-off crippled production supporting natural gas price increases including the largest one-day percentage climb of the Henry Hub natural gas futures contract. Repeat bouts of cold and depleted storage inventories placed the market into a much more bullish position than would have been anticipated preseason. Russia’s invasion of Ukraine in late February served to compound tensions, maximizing the pull on US gas from overseas and sending oil prices above \$100/Bbls while NYMEX Henry Hub natural gas prices traded at \$5.00/MMBtu.”

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 (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 (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.

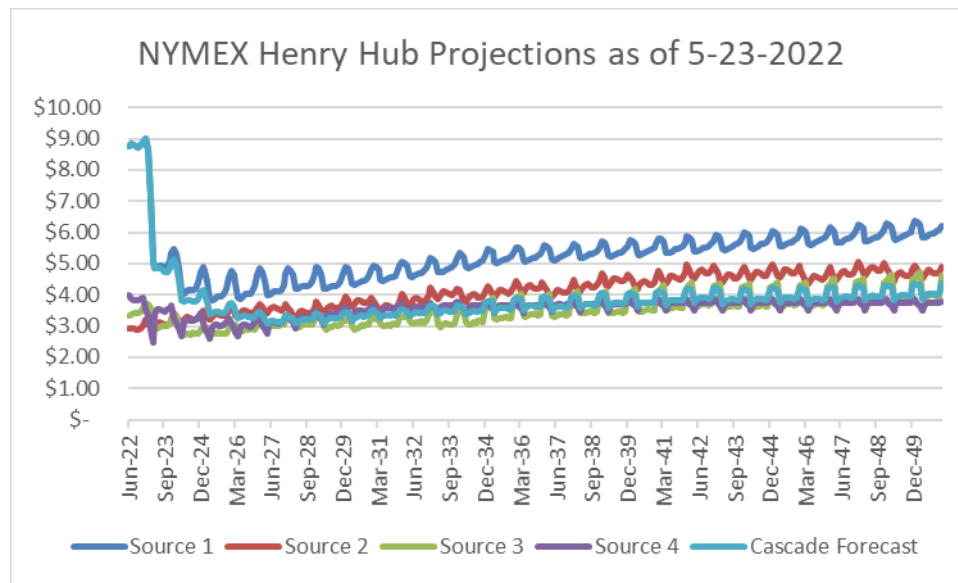
With a monthly Henry Hub price determined from the above sources, the Company assigned a weight to each source to develop the monthly Henry Hub price forecast for the 20-year planning horizon. These weights were derived by calculating the Symmetric Mean Absolute Percentage Error (SMAPE) of each source 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 May 23, 2022.



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%	7.986%	10.504%	6.510%
T+25	72.917%	8.173%	11.587%	7.324%
T+26	70.833%	8.272%	12.701%	8.193%
T+27	68.750%	8.353%	13.809%	9.088%
T+28	66.667%	8.505%	14.862%	9.966%
T+29	64.583%	8.841%	15.800%	10.776%
T+30	62.500%	9.425%	16.574%	11.501%
T+31	60.417%	10.226%	17.191%	12.167%
T+32	58.333%	11.213%	17.675%	12.779%
T+33	56.250%	12.348%	18.056%	13.346%
T+34	54.167%	13.577%	18.377%	13.880%
T+35	52.083%	14.834%	18.686%	14.397%
T+36	50.000%	16.044%	19.040%	14.915%

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 weights 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 (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 allow 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 over the planning horizon 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 current IRP.

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. Cascade is scheduled to pick up GTN North to South of 20,000 dth/day, 20,000 dth/day on NGTL,

and 10,000 dth/day on Foothills, which was shown in the 2018<sup>18</sup> and 2020<sup>19</sup> IRPs as needed resources to meet central Oregon capacity.

- **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.

---

<sup>18</sup> [UTC Case Docket Detail Page | UTC \(wa.gov\)](#)

<sup>19</sup> [UTC Case Docket Detail Page | UTC \(wa.gov\)](#)

- **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.<sup>20</sup> 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.

---

<sup>20</sup> 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 \$1.68/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 dths 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 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 dths of additional Mist capacity on February 1, 2021. The term of this additional Mist service is May 1, 2021 through April 30, 2026.

As the Company states throughout, the IRP is developed at a point in time. Unfortunately, Cascade had no advanced knowledge of the 2021 Mist RFP during the development of this IRP. Therefore, this latest Mist leased storage is 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 Dths/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 \$1.68/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 billion cubic feet (Bcf) of natural gas.<sup>21</sup> Magnum would be connected to the Kern River Gas Transmission and Questar

---

<sup>21</sup> See <https://www.wyopipeline.com/magnum-gas-storage-llc-western-energy-hub-project/>

Pipeline systems at Goshen, Utah. Incremental transport involving Questar and possibly Ruby would be necessary.

- **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-four year lead time.
- **Additional transportation realignments:** The Company's geographically widespread service territory gives Cascade great flexibility to utilize 316,994 Dths/day of delivery rights vs 205,123 Dths/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)<sup>22</sup> rulings that may impact the availability and cost of interstate pipeline transportation.

Cascade is examining design day reliability for distribution system operations of RNG on its system as part of Chapter Y.

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 is currently under construction. Coastal GasLink, once completed in 2023, 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, proposed expansions on the TransCanada pipelines in 2022 and 2023 may 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.

---

<sup>22</sup> 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 dths 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 leveled 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 (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 Gas Supply Oversight Committee (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% of annual requirements.
- Year two target set at 40% of annual requirements.
- Year three target set at 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.

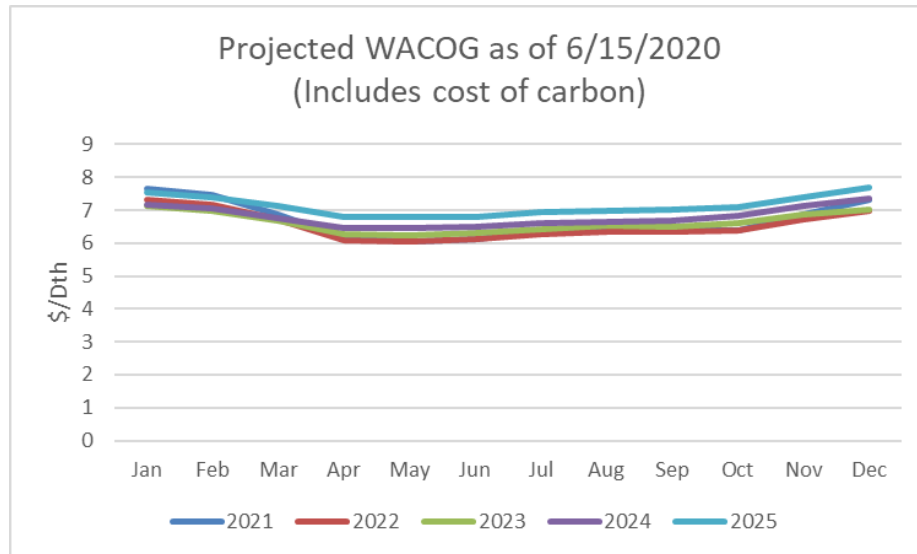
Cascade employs prudent risk management strategies within designated parameters to minimize the risk of operating losses or assumption of liabilities from commodity price increases because the price the Company pays for gas is subject to market conditions. Risk is associated with business objectives 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, 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 50%. 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. At the time the current procurement strategy was made, the forward price spread between the November 2019 through October 2020 period and the November 2022 through October 2023 period was less than 20%, which was deemed a reasonable and manageable spread given market intelligence available. Figure 4-10 provides a graph showing the Company’s projected weighted average cost of gas (WACOG), including the base case carbon adder, for the 2020 IRP.

Figure 4-10: Projected Cascade WACOG as of June 2020



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 2022 Annual Hedge Plan in Appendix E.

### **Portfolio Purchasing Strategy**

As stated earlier, GSOC oversees the Company's gas supply purchasing strategy. Based on current stable prices and a robust supply picture, the Company considers contracting physical supplies for up to three years (based on a warmer-than-normal weather pattern). 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 Supervisor of Gas Supply, under the leadership of the Manager of Gas Control & Supply for the Western Region. Either the Supervisor or Manager 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 Supply Resource Planning functions as compliance manager regarding the WUTC's UG-132019 policy statement. These teams are overseen by the Director, Gas Supply—Utility Group.

Under this procurement strategy, approximately 10% to 20% 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-priced 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 2020 Annual Hedge Plan in Appendix E.

## **Conclusion**

Cascade's 20-year supply side resource goal 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, renewable natural gas, 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 28 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 \$1.00 and \$6.52/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:  $\text{Avoided Cost} / (1 + \text{Discount Rate})^{\text{Years from the reference year}}$ .
- $TC_f$  = 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 (March 2022);
- The inflation rate used to scale the Social Cost of Carbon (SCC) from Real \$2007 to Real \$2021 uses the chain type price index for the Gross Domestic Product from the Bureau of Economic Analysis (BEA)<sup>1</sup>
- The discount rate of 5.06% (30-year fixed mortgage rate as of 6/08/2022).

### Understanding Each Component

- **Incremental Fixed Transportation Costs**

In the 2023 IRP, Cascade has not included any additional upstream capacity in its preferred portfolio for the 28-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

---

<sup>1</sup> 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 2023 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 28-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 \$2021 by using GDP data published by the BEA. For future iterations of the avoided cost, Cascade is exploring using the marginal abatement cost for emissions compliance in a given year, as opposed to the SCC, as this value may more accurately represent the Company's practical and specific cost for compliance, as reflected by the cost of the next most expensive resource for emissions reduction (RNG, Hydrogen, projection allowance price in auction.)

Cascade calculates the inflation adjusted SCC to start at \$83.13/Metric Ton CO<sub>2e</sub> in 2023, rising to \$104.18/Metric Ton CO<sub>2e</sub> in 2042. In Cascade's initial avoided cost calculation, these values were equivalent to \$4.49/dth in 2023, rising to \$5.94/dth in 2042. Overall, carbon compliance costs related to the SCC are a significant factor in Cascade's avoided cost calculation, accounting for as much as 49.22% 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 IRP process, Cascade is modifying its methodology for applying the 10% adder. In the Company's 2023 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.

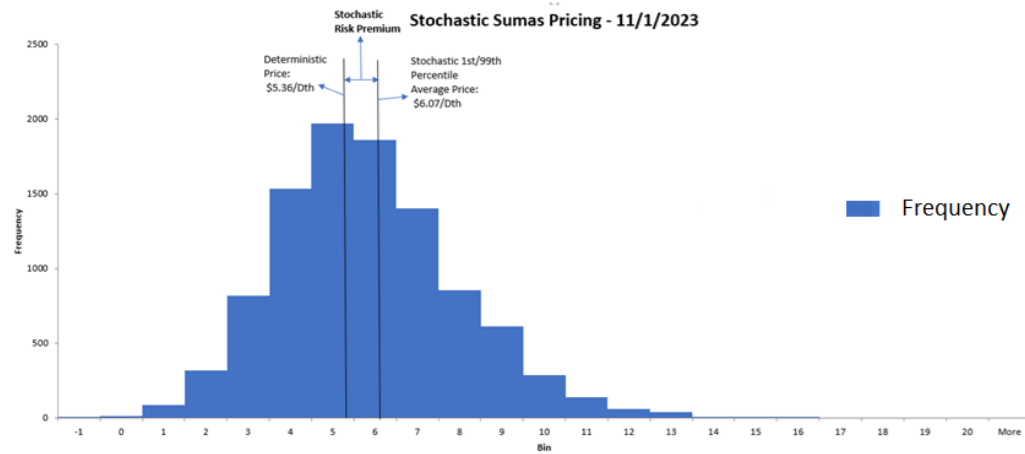
- **Distribution System Costs**

Distribution system costs capture the costs of sending gas from the citygate to Cascade's customers. For this IRP cycle, Cascade has 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 2023 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 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.

- **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 1<sup>st</sup> and 99<sup>th</sup> 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 11/1/2023



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

$$\text{Deterministic Price} * .75 + (((99\text{th Percentile Stochastic Price} + 1\text{st Percentile Stochastic Price}) / 2) * .25) - \text{Deterministic Price}$$

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

### Application

The 2023 IRP makes several enhancements in calculating and applying the avoided costs, specifically related to its application of the environmental adder, and enhancements to the distribution system cost calculation methodology. This cost metric becomes the foundation for prudence 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 2023 IRP is Cascade’s first Plan to incorporate 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 a number of variables that may impact Cascade’s compliance options. One sensitivity that the Company is evaluating is around the amount of energy efficiency that Cascade may need to

acquire. In scenarios where the Company may need more energy efficiency, Cascade models its avoided commodity cost as the projected cost of RNG/Green Hydrogen. In these scenarios, it is assumed the energy efficiency would not be competing with traditional natural gas, but rather emissions reducing resources, hence the use of these resources as the pricing counterpoint. 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 28-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 2023 IRP, nominal system avoided costs range between \$1.00/therm and \$6.52/therm, with the average avoided cost of \$1.78/therm.

As mentioned earlier, the avoided cost is based on the performance of the portfolio under expected conditions for the entire 28-year planning horizon. Overall, avoided costs for the 2023 IRP are higher than in the 2020 IRP. The main driver of this is the new distribution system cost methodology, which projects a higher avoided cost, particularly when peak day load growth is lower, with distribution system investments still to be expected. 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

	2010 IRP	2012 IRP	2014 IRP	2016 IRP	2018 IRP	2020 IRP	2023 IRP
Nominal \$/Therm	\$ 0.810	\$ 0.528	\$ 0.610	\$ 0.571	\$ 0.673	\$ 0.936	\$ 1.779

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
2023	\$1.218	\$1.471	\$1.355	\$1.387	\$1.387	\$ 1.315	\$1.358
2024	\$0.921	\$1.264	\$1.159	\$1.665	\$1.665	\$ 1.250	\$1.460
2025	\$2.393	\$1.220	\$1.063	\$1.068	\$1.068	\$ 1.079	\$1.078
2026	\$1.507	\$1.022	\$0.952	\$1.126	\$1.126	\$ 0.953	\$1.042
2027	\$2.442	\$1.149	\$1.001	\$1.047	\$1.047	\$ 1.030	\$1.040
2028	\$2.385	\$1.100	\$0.986	\$1.012	\$1.012	\$ 1.013	\$1.014
2029	\$2.607	\$1.250	\$1.051	\$1.022	\$1.022	\$ 1.085	\$1.056
2030	\$0.895	\$3.708	\$1.954	\$1.066	\$1.066	\$ 2.690	\$1.887
2031	\$2.672	\$1.239	\$1.074	\$1.133	\$1.133	\$ 1.107	\$1.121
2032	\$1.717	\$1.109	\$1.031	\$1.148	\$1.148	\$ 1.039	\$1.094
2033	\$2.811	\$1.415	\$1.160	\$1.096	\$1.096	\$ 1.197	\$1.148
2034	\$3.073	\$1.327	\$1.114	\$1.063	\$1.063	\$ 1.161	\$1.113
2035	\$2.902	\$1.322	\$1.141	\$1.073	\$1.073	\$ 1.179	\$1.127
2036	\$0.993	\$1.931	\$1.340	\$1.118	\$1.118	\$ 1.577	\$1.350
2037	\$1.859	\$1.230	\$1.126	\$1.168	\$1.168	\$ 1.130	\$1.149
2038	\$3.343	\$1.413	\$1.208	\$1.121	\$1.121	\$ 1.253	\$1.187
2039	\$3.304	\$1.413	\$1.212	\$1.138	\$1.138	\$ 1.257	\$1.198
2040	\$3.662	\$1.386	\$1.214	\$1.126	\$1.126	\$ 1.262	\$1.195
2041	\$1.064	\$1.072	\$5.998	\$1.163	\$1.163	\$ 11.790	\$6.527
2042	\$4.016	\$1.529	\$1.291	\$1.223	\$1.223	\$ 1.352	\$1.289
2043	\$4.117	\$1.567	\$1.323	\$1.253	\$1.253	\$ 1.386	\$1.321
2044	\$4.226	\$1.608	\$1.358	\$1.287	\$1.287	\$ 1.422	\$1.356
2045	\$4.344	\$1.653	\$1.396	\$1.323	\$1.323	\$ 1.462	\$1.394
2046	\$4.472	\$1.702	\$1.437	\$1.362	\$1.362	\$ 1.505	\$1.435
2047	\$4.608	\$1.754	\$1.481	\$1.403	\$1.403	\$ 1.551	\$1.479
2048	\$4.752	\$1.809	\$1.528	\$1.447	\$1.447	\$ 1.599	\$1.525
2049	\$4.905	\$1.867	\$1.577	\$1.494	\$1.494	\$ 1.651	\$1.574
2050	\$5.065	\$1.928	\$1.628	\$1.542	\$1.542	\$ 1.705	\$1.625

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
2023	\$1.218	\$1.471	\$1.355	\$1.387	\$1.387	\$ 1.315	\$1.358
2024	\$0.877	\$1.203	\$1.103	\$1.585	\$1.585	\$ 1.190	\$1.390
2025	\$2.168	\$1.105	\$0.963	\$0.968	\$0.968	\$ 0.978	\$0.976
2026	\$1.300	\$0.882	\$0.821	\$0.971	\$0.971	\$ 0.822	\$0.898
2027	\$2.004	\$0.943	\$0.822	\$0.859	\$0.859	\$ 0.845	\$0.854
2028	\$1.863	\$0.860	\$0.771	\$0.791	\$0.791	\$ 0.791	\$0.793
2029	\$1.939	\$0.929	\$0.782	\$0.760	\$0.760	\$ 0.807	\$0.785
2030	\$0.633	\$2.625	\$1.383	\$0.754	\$0.754	\$ 1.904	\$1.336
2031	\$1.801	\$0.835	\$0.724	\$0.763	\$0.763	\$ 0.746	\$0.755
2032	\$1.101	\$0.711	\$0.661	\$0.736	\$0.736	\$ 0.666	\$0.702
2033	\$1.716	\$0.864	\$0.708	\$0.669	\$0.669	\$ 0.731	\$0.701
2034	\$1.785	\$0.771	\$0.647	\$0.618	\$0.618	\$ 0.674	\$0.647
2035	\$1.605	\$0.731	\$0.631	\$0.593	\$0.593	\$ 0.652	\$0.623
2036	\$0.523	\$1.016	\$0.705	\$0.589	\$0.589	\$ 0.830	\$0.711
2037	\$0.932	\$0.616	\$0.564	\$0.585	\$0.585	\$ 0.566	\$0.576
2038	\$1.594	\$0.674	\$0.576	\$0.535	\$0.535	\$ 0.598	\$0.566
2039	\$1.500	\$0.642	\$0.550	\$0.516	\$0.516	\$ 0.571	\$0.544
2040	\$1.582	\$0.599	\$0.525	\$0.486	\$0.486	\$ 0.545	\$0.516
2041	\$0.438	\$0.441	\$2.467	\$0.478	\$0.478	\$ 4.849	\$2.684
2042	\$1.572	\$0.598	\$0.505	\$0.479	\$0.479	\$ 0.529	\$0.504
2043	\$1.534	\$0.584	\$0.493	\$0.467	\$0.467	\$ 0.516	\$0.492
2044	\$1.499	\$0.570	\$0.482	\$0.456	\$0.456	\$ 0.504	\$0.481
2045	\$1.466	\$0.558	\$0.471	\$0.447	\$0.447	\$ 0.494	\$0.471
2046	\$1.437	\$0.547	\$0.462	\$0.437	\$0.437	\$ 0.484	\$0.461
2047	\$1.409	\$0.536	\$0.453	\$0.429	\$0.429	\$ 0.474	\$0.452
2048	\$1.383	\$0.527	\$0.445	\$0.421	\$0.421	\$ 0.466	\$0.444
2049	\$1.359	\$0.517	\$0.437	\$0.414	\$0.414	\$ 0.457	\$0.436
2050	\$1.336	\$0.508	\$0.429	\$0.407	\$0.407	\$ 0.450	\$0.429



## **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 a 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.

Since the last IRP, 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 rule in late 2021. Oregon's rule establishes a cap on GHG emissions for certain sectors, including natural gas distribution customer emissions, and requires significant reductions between 2022 and 2050. The Federal Government has been re-evaluating GHG emissions rulemaking for electric generating units that is expected to be re-proposed in 2023, and laws have passed which incentivize development of lower or zero-carbon energy resources.

## Key Points

- State and federal agencies have issued GHG emission reduction regulations and are considered in the 2023 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.
- Cascade models carbon compliance costs as the SCC with a 2.5% discount rate, updated to real \$2021 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. DEQ released the final Climate Protection Program rule on December 16, 2021.
- 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.

## 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 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 to 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.

## Overview

Cascade monitors environmental regulatory requirements in progress nationally, regionally, and locally that have the 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 finalized in Oregon on December 16, 2021 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.

There have been no congressional bills or federal agencies proposing GHG reductions that would significantly impact natural gas distribution. Rather, on a federal level, there have been programs established to 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 was established by EPA in collaboration with oil and natural gas companies with Cascade participating as a founding partner of the program in March 2016 along with about 50 other companies. Partners in the program demonstrate their commitment and concern for the environment through voluntary methane emissions reductions.

In the last IRP and at the suggestion of WUTC, Cascade used the Social Cost of Carbon (SCC) with a two and one-half percent discount rate that 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. The SCC is estimated using different discount rates to develop a range of costs in dollars per ton of CO<sub>2</sub> that would represent the avoided cost of long-term damage from climate change caused by a ton of CO<sub>2</sub> emitted in a given year. Agencies, such as the EPA, have used the SCC in determining the cost of climate impacts from rulemakings. For this IRP, as suggested by WUTC and outlined in Docket U-190730, Cascade will use the same discount rate as the main CO<sub>2</sub> adder in modeling.

The Company has been involved in state-focused evaluation of renewable natural gas (RNG) opportunities in Washington and Oregon, and regionally. Cascade also monitors federal and regional RNG policy development through the Company's membership in trade organizations. Cascade provides discussion of RNG projects and additional procurement opportunities in Chapter 4, as RNG will be important to consider for Oregon and Washington GHG emission rule compliance.

There are community-driven efforts to achieve GHG emission reduction targets within, and adjacent to, Cascade's service areas. A significant measure impacting natural gas use was adopted in Bellingham this year. On February 7, 2022, the Bellingham City Council passed an ordinance on requiring electric space and water heating equipment for new commercial and large (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. Cascade is running sensitivity analyses in this IRP based on the City of Bellingham's limitations. The City of Bellingham continues to explore electrification measures for residential buildings within Bellingham. The City of Bend, Oregon has also adopted GHG reduction measures. Cascade continues to meet with the City ongoing regarding potential future partnership on RNG development and community-wide carbon offset programs and will soon be piloting energy assessments for Cascade's transportation customers in the Bend region to determine energy savings potential and compliance pathways consistent with OR Climate Protection Plan compliance. Cascade will continue engaging with these communities and working with them to

support GHG emission reduction targets and goals while supporting the triple bottom line of economics, equity, and sustainability.

Cascade examines the policies and regulatory activities mentioned above in 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 development that has 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**

### **1. Congressional Actions**

Cascade monitors congressional actions on clean energy and decarbonization matters and discusses them below.

#### **a. Infrastructure, Investment and Jobs Act (IIJA)**

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 eek 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 percent 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 Inflation Reduction Act (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 US GHG emissions by 10% relative to 2005 levels, with a main 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, focus on regional networks (hydrogen hubs), and reduce 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 in the regional clean hydrogen programs. Cascade will continue to monitor these decarbonization programs for opportunities where the Company can best participate and/or provide support.

**b. Inflation Reduction Act (IRA) of 2022**

The Inflation Reduction Act 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 Methane Emissions Reduction Program that applies fees to methane releases for certain oil and gas facilities that emit beyond 25,000 metric tons of carbon dioxide equivalent (CO<sub>2</sub>e) and incentivizes investments in reducing methane leaks from oil and gas infrastructure. These requirements do not apply to distribution systems. However, the cost of natural gas could increase as upstream emission fees may apply to upstream oil and gas segments starting in 2023 and additional emission reductions projects are would be implemented within the oil and gas value chain in future.

The IRA also incentivizes RNG development projects which could benefit Cascade and customers. 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.

### **a. US Department of Energy (DOE)**

The Department of Energy (DOE) establishes energy efficiency standards for many products used in residential, commercial, and industrial buildings and applications and is required to review and update these standards periodically. DOE considers in its rulemaking what is technically feasible and economically justified. In 2022, DOE began holding public meetings to gain input from stakeholders on rulemaking for commercial water heating equipment energy conservation standards. Cascade is monitoring this rulemaking as it may result in impacts to baseline equipment used to determine the Cascade's Energy Efficiency portfolio.

### **b. Environmental Protection Agency (EPA)**

The Environmental Protection Agency (EPA) released rulemaking on June 21, 2022, proposing amendments to 40 CFR Part 98 Subpart W (oil and gas segment) operational GHG emissions reporting. EPA has proposed emission factor updates and additional reporting of "other large release events" which are defined as unplanned, unexpected, and uncontrolled releases to the atmosphere of gas, liquids, or mixture thereof, from wells and/or other equipment that result in emissions for which there are no methodologies in the rule [§98.233] to appropriately estimate these emissions. A final rule is expected by late 2022 or early 2023, with the rule changes applicable to emissions in 2023 and reported in early 2024 and annually thereafter. Once the rule is final, Cascade will incorporate the amended requirements into the Company's emissions reporting.

EPA is promulgating new rule rulemaking for fossil fuel-fired electric generating units (EGUs) considering a U.S. Supreme Court decision this year. On June 30, 2022, the U.S. Supreme Court issued an opinion in *West Virginia v. EPA*, regarding the scope of EPA's authority under section 111(d) of the CAA for regulating EGUs. The Court did not call into question EPA's authority to regulate GHGs under the CAA. The Court concluded that 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.

Throughout the summer of 2022, EPA held stakeholder meetings to solicit input on how to structure standards for new and existing fossil fuel EGUs. EPA also sought input on the appropriateness of different control strategies for different subsectors of the fossil-fired EGU fleet, issues surrounding public health and environmental justice, and whether the agency should build the upcoming rules around a rate-based standard that places limits on the amount of pollution an EGU can release per unit of energy produced, among other rulemaking considerations.

On September 7, 2022, EPA announced the opening of a non-rulemaking docket for additional public input from stakeholders on the Agency’s efforts to reduce emissions of greenhouse gases from new and existing fossil fuel-fired EGUs. The docket will be open for public comment until March 27, 2023 and the agency is expected to release rule proposals shortly after the docket closes.

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

On March 21, 2022, the Securities and Exchange Commission (SEC) proposed rulemaking to enhance climate-related disclosures from publicly traded companies and is applicable to Cascade through Cascade’s parent company MDU Resources Group, Inc. The rule proposes to require disclosure of climate-related impacts to the company, applying methodologies based on the Taskforce on Climate-related Financial Disclosures (TCFD) framework which provides guidance on disclosing material climate-related risks and opportunities pertinent to business activities. The rule also proposes using methodologies from the GHG Protocol for measuring and reporting of scope 1 and 2 GHG emissions related to company operations and energy use and may also include scope 3 emissions related to value chains, as well as emissions mitigation actions.

Certain portions of these disclosures would require third-party auditing or attestation. There are also proposed disclosure requirements for companies that develop publicly established GHG reduction targets or goals, requiring a detailed description of the included emissions or operations, how a company intends to meet



those goals, a plan for tracking progress, and the time horizon for achieving the goals.

Rulemaking public comment initially closed on June 17. However, the SEC reopened comment on October 7, 2022, for an additional 14 days to provide comment to those whose comments may not have been received due to a technological error where some comments were not being received through the SEC's web form. The rule is expected to be finalized by end of the year or early 2023, with the rule requirements effective in 2024.

### **3. Social Cost of Carbon (SCC)**

The SCC is estimated using different discount rates to develop a range of costs in dollars per ton of CO<sub>2</sub> that would represent the avoided cost of long-term damage from climate change caused by a ton of CO<sub>2</sub> 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, Cascade modeled societal costs of CO<sub>2</sub> emissions resulting from customers' combustion of natural gas in the last IRP using the SCC with a two and one-half percent discount rate that was established by the U.S. Governmental Interagency Working Group (IWG) on Social Cost of Greenhouse Gases. In this IRP and in consideration of the 2019 Clean Buildings legislation HB 1257 adding further instruction within RCW 80.28 on conducting avoided cost calculations, Cascade is also applying the SCC with a two and one-half percent discount rate from the IWG's August 2016 SCC report, but now updated to real \$2021, as the carbon compliance adder in modeling impacts of a potential price that could be placed on CO<sub>2</sub> emissions from customers' usage of natural gas.

### **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 natural gas.

## 1. Washington

In July 2021, the Washington legislature passed the Climate Commitment Act (Act), codified at Chapter 70A.65 RCW. The Act 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 Act 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 Act'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 provides discussion on the main WAC 173-446 rulemaking below.

A few other important actions in Washington this year include State Building Code Council building code revisions impacting natural gas usage in new and retrofitted commercial building and new residential buildings, a 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 (CCA)

On September 29, 2022, the Washington Department of Ecology released a final Climate Commitment Act rule, WAC 173-446 (CCA), 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<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) from covered entities emitting 25,000 metric tons or more of CO<sub>2</sub>e 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 overtime 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<sub>2</sub>e 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 ton CO<sub>2</sub>e per year. Cascade's baseline customer emissions are projected to be about 1.8 million metric tons CO<sub>2</sub>e. 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<sub>2</sub>e per year.

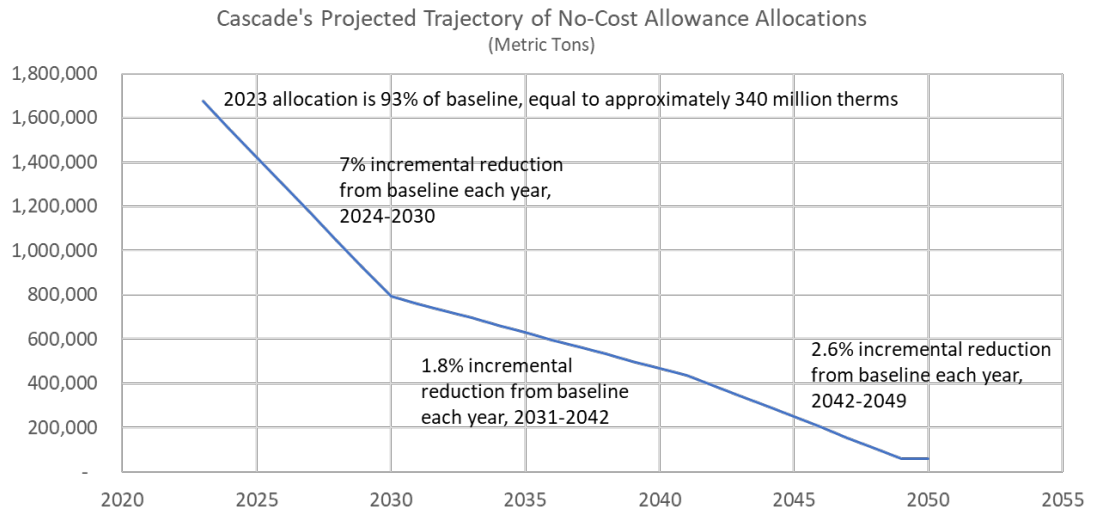
Excluded emissions for natural gas distribution companies include emissions from larger industrial customers who are covered entities themselves or customers who choose to opt-in to Ecology's program. Other excluded emissions are CO<sub>2</sub> from the combustion of biomethane or RNG purchased for natural gas customers. Ecology placed some geographic limitations for qualifying RNG outside of Washington for this exclusion within the WAC 173-441 GHG reporting rule and Cascade has placed limits on RNG accordingly as a compliance option in IRP modeling. Ecology received comment from natural gas distribution companies and other stakeholders on the geographic limitation during the CCA and reporting rule comment periods. When the final CCA rule was released, Ecology stated the agency's commitment to further dialogue with natural gas suppliers on this topic in the Ecology's Concise Explanatory Statement for Chapter 173-446 WAC Climate Commitment Act Program, Summary of Rulemaking and Response to Comments. Cascade will remain engaged with Ecology on this matter as RNG is important option in achieving emissions reductions and CCA compliance.

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. Emission reductions can also be achieved by replacing conventional natural gas supply with some limited RNG, hydrogen and through implementing energy efficiency and conservation programs to reduce customer use of natural gas.

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 are equivalent to 93 percent of the company’s baseline of 2015-2019 average emissions which is estimated to be in the range of 1.8 million metric tons of CO<sub>2</sub>e. Ecology is expected to release natural gas distribution company baseline values in late November 2022. The no-cost allowances decline annually by 7 percent of Cascade’s baseline, incrementally each year from 2024 to 2031, 1.8 percent annually from 2032 to 2041, and 2.6 percent annually from 2042 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**



To convert to dekatherms, divide by about 0.05306 metric tons CO<sub>2</sub> per 1 dekatherm combusted

No-cost allowances will be distributed to natural gas utilities for 2023 in two tranches; 35 percent will be distributed by July 1, 2023, and the remaining balance of no-cost allowances will be distributed on September 1, 2023. Annually thereafter, Ecology will distribute no-cost allowances by October 24 of the prior year. For example, 2024 no-cost allowances will be distributed by October 24, 2023.

Full compliance demonstrations must be made by November 1 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 period required by November 1 annually, where covered entities must demonstrate compliance with 30 percent of the prior years' emissions compliance obligation. For example, the first annual compliance demonstration will be November 1, 2024, to comply with 30 percent 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 by early December in order to complete the registration process for covered entity facilities and establish accounts in preparation of receiving allowance allocations and quarterly auction participation beginning in 2023. Cascade is currently registering account representatives within CITSS.

Covered entities will be assigned a holding account where purchased allowances are distributed to covered entities by Ecology after each quarterly auction 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 account 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.

Cascade is required to consign some of the Company's no-cost allowances. In 2023, 65 percent of Cascade's no-cost allowances must be consigned to auction. No-cost allowance consignment increases annually by five percent and by 2030 and thereafter, all no-cost allowances Cascade receives 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 customers in other ways, such as, investing in additional emissions reductions and/or providing bill credits to reduce customer cost impacts.

Cascade envisions utilizing 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, including Ecology’s budgeted allowances offered at quarterly auctions, other auction participant bidding, and allowance and other compliance instrument prices, Cascade expects to purchase additional allowances at auction for compliance. Compliance demonstrations can also include a limited amount of carbon offsets, such as forestry carbon sequestration offsets. Offsets are limited for use of up to eight percent of a covered entity’s compliance obligation in the first compliance period and six percent 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 and conservation programs, and RNG acquisitions. In the future, potential hydrogen 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.

Four general allowance auctions will be held each year on a quarterly basis commencing in 2023. 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 five percent 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 2023 at \$19.70 per ton, and 2024 prices will be released by Ecology in early December 2023.

There are detailed processes around auction allowance bidding, accepting/rejecting bids, awarding allowance bids, and determining the auction settlement price. At the close of the quarterly auctions, Ecology awards allowances from the highest bidder on down until no allowances in the auction are left. 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 annual general auctions, where a limited amount of future vintage allowances will be offered for sale to market participants.

Cascade is currently setting up processes to comply with the CCA and has hired a consultant, Guidehouse, to provide assistance and advice in setting up internal company processes for ongoing compliance demonstration and participation in allowance auctions. At the outset Cascade has been utilizing Resource Planning modeling tools for compliance planning and will be working with Guidehouse to develop shorter- and near-term planning tools which incorporate all types of compliance instrument options to best inform auction participation.

**b. Washington State Building Code Changes**

The Washington State Building Code Council (SBCC) approved new building and energy code this past year, impacting usage of natural gas for space and water heating in new and retrofitted commercial and residential buildings. On April 22, 2022, 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 is effective 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 become 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.

There are potential concerns for the codes revisions considering they result in significant changes for new residential and commercial construction statewide that becomes effective in an immediate timeframe. Depending on availability of supply for the heat pump technologies required to meet code requirements, especially as natural gas heat pump technology has not yet reached market availability, there is uncertainty in feasible implementation of the new code with electric heat pumps alone by the July 1, 2023 effective date. Cascade's modeling scenarios consider building code revisions limiting natural gas hookups to commercial construction in the city of Bellingham. Cascade also continues to incorporate the impact of code changes into the Company's future Conservation Plan.

**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 can 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.

Since May 27, 2022, the UTC has held approximately monthly public workshops and decarbonization advisory group meetings to obtain and share information on the study and Cascade has participated in this process as a member of the advisory group.

When published, the study will discuss how natural gas distribution utilities can decarbonize, impacts of increased electrification on the ability of electric utilities to deliver services to current natural gas customers reliably and affordably, the ability of electric utilities to procure and deliver electric power to reliably meet the load of increased electrification, impacts on regional electric system resource adequacy, and the transmission and distribution infrastructure requirements for such a transition, the costs and benefits to residential and commercial customers, including environmental, health, and economic benefits, equity considerations and impacts to low-income customers and highly impacted communities, and the potential regulatory policy changes to facilitate decarbonization of the services that gas companies provide while ensuring customer rates are fair, just, reasonable, and sufficient. The Climate Commitment Act requirements are modeled in this IRP and have some representation of natural gas system decarbonization. Cascade will consider the published study in the next IRP.

**d. Washington Department of Ecology (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 input 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 Climate Commitment Act 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. Ecology expects a draft GAP rule to be released for public review and comment sometime in 2023. Cascade will continue to monitor this regulatory action as it may impact future IRPs.

**e. Other Washington Legislative Activity**

Cascade is keeping apprised of additional legislation in Washington State with the intent to reduce GHG emissions. It is anticipated that several bills will emerge in the 2023 legislative session with potential impacts to the use of gaseous fuels. 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. It is also anticipated that proposals to further restrict the use of natural gas and all gaseous fuels may be seen in the coming session.

**2. Oregon**

Since the last IRP, no GHG cap and trade program legislation has passed. 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 is provided below.

**a. Executive Order (EO) No. 20-04**

In early 2020 Oregon Governor Kate Brown issued Executive Order 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 Department of Environmental Quality (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.

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

DEQ released the draft Climate Protection Program (CPP) rule for public comment on August 5, 2021, and issued the final CPP rule on December 16, 2021. The rule regulates GHG emissions from covered entities, including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) starting in 2022. Covered entities include fuel suppliers, such as petroleum fuel suppliers and natural gas distribution utilities, as well as large stationary emission sources that emit more than 25,000 metric tons of CO<sub>2</sub>e per year. GHG emissions resulting from natural gas use within the state reside with the natural gas distribution utility delivering the natural gas and are not the responsibility of the consumers of natural gas, such as large industrial facilities. Large industrial facilities are regulated under the CPP if their GHG process emissions and fuel combustion not otherwise regulated from a covered fuel supplier meet or exceed 25,000 metric tons of CO<sub>2</sub>e per year. Therefore, natural gas suppliers, such as Cascade, are regulated for the GHG emissions in OR associated with the Company's aggregated customers' combustion or oxidation of natural gas for all core and non-core (transport) customers. Further, the CPP does not regulate GHG emissions from electric generation facilities, and natural gas usage at electric generating plants with total nominal electric generating capacity of less than 25 megawatts would fall under the responsibility of a natural gas distribution utility delivering the natural gas.

The CPP emissions are capped starting in 2022 at a baseline emissions level equivalent to the average of 2017-2019 emissions from covered entities. The cap declines overtime to meet rule reduction targets of 50% below baseline emissions by 2035 and 90% below baseline emissions by 2050. DEQ allocates no-cost emissions

allowances to covered entities starting in 2022, with that year's allocation equivalent to an entity's baseline emissions. DEQ reduces allowance allocation each year proportionate to that year's emissions cap and DEQ will distribute no-cost allowances to covered entities annually by March 31. Allowances can be banked indefinitely. Cascade's 2022 allowance allocation is 743,707 metric tons CO<sub>2</sub>e, equivalent to the Company's baseline of 2017-2019 average emissions and Cascade projects the Company's 2022 emissions to be in the range of about 800,000 metric tons CO<sub>2</sub>e.

Excluded emissions for natural gas distribution companies include CO<sub>2</sub> 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 November 28 of the year following each three-year compliance period. The first three-year compliance period is from 2022 to 2024 and compliance must be demonstrated for this period by November 28, 2025. There are no interim period emissions compliance obligations as in the WA CCA. Compliance is demonstrated by surrendering no-cost emissions allowances to 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, as well as and through implementing energy efficiency and conservation programs to reduce customer use of natural gas.

Oregon CCP compliance is expected to be predominantly met with no-cost allowances and RNG purchases, and possibly some CCIs. A CCI can be used to offset one metric ton of CO<sub>2</sub>e emissions and provide a limited mechanism for demonstrating compliance beyond no-cost allowances. CCIs can be used to meet up to 10 percent of a covered entity's compliance obligation in the first compliance period, 15% in the second compliance period and 20% in the third compliance period and thereafter.

CCIs are generated and obtained by a covered entity when DEQ approves payments from covered entities to DEQ-approved CCI entities. 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. Covered entities can bank CCIs for two compliance periods only and cannot be traded or transferred to another covered entity. There are currently no CCI entities approved by DEQ, but could be in future. If no CCI entities are approved, no CCI can be generated.

The CCP 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 WA CCA and OR CPP in compliance planning to achieve any potential compliance planning efficiencies.

## **Local Policy**

In the past few years, Cascade has observed a heightened interest by local jurisdictions and municipalities in committing to the reduction of GHG emissions within a municipality, as well as some applying commitments community-wide. Those cities or counties establishing commitments are focusing on goals and aspirations 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. had been a party to the pact in 2015. In 2017, the U.S. withdrew from the Paris Climate Agreement under President Trump and in 2021, the U.S. rejoined the pact under President Biden.

Within Cascade's service areas, the City of Bellingham and Whatcom County in Washington, and the City of Bend, 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 in the next few years that encourage adoption of policies, programs, and practices in order to reduce GHGs, address climate change, protect public health, and preserve the natural environment within the county. Cascade is running sensitivity analyses in this IRP

that reflect new limitations applied to natural gas use in the City of Bellingham. Those limitations are discussed further below.

There are other areas adjacent to Cascade's service areas adopting similar commitments, such as Tacoma, Seattle, and Edmonds, Washington, Multnomah County and Portland, Oregon, and Vancouver, British Columbia. Cascade has also observed adoption of energy action plans to switch from gas to electric in the Cities of Ashland and Eugene.

### **1. City of Bellingham, Washington**

The City of Bellingham passed a GHG Reduction and Renewables Energy Targets resolution in March 2018 updating 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 in the resolution a target to reduce community-wide emissions 70% below 2000 levels by 2030, and 85% below 2000 levels by 2050. Specifically, the goals are to obtain energy from all renewable resources and remove use of fossil fuels by 2030 and 2035 within the city, including transportation.

The City created the Climate Action Task Force (CATF) to explore and recommend how the city and community can meet these new targets, taking into account technology, feasibility, possible accelerated targets, funding mechanisms, as well as costs and other impacts. The CATF included community members that have experience in renewable energy, energy conservation, land use, energy/resource economics, community engagement, transportation, and finance. Energy utility representation and public transportation representatives were identified. However, the City did not allow more than one utility representative at the table and Puget Sound Energy (PSE) was chosen by the City to represent utilities on the task force. Cascade worked together with PSE to include Cascade's input. Minimal input was accepted from Cascade, and efforts seemed primarily focused on electrification to the exclusion of other decarbonization strategies that utilize offsets and RNG as pathways to carbon reduction.

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. City staff reviewed the CATF's recommendations and narrowed them down to those most likely to be integrated successfully and discussed the results with the City Council. City staff used a tiered ranking system for this evaluation, considering such factors as whether the measure has already been implemented, needed further research and analysis, or tabled for future review. The measures

then went through a triple bottom line “plus” assessment before adding to the City’s Climate Action Plan (CAP) and the City determined which of the CATF’s recommendations should be integrated into the CAP. Ten recommendations were vetted, including encouraging the State to ban internal combustion engine vehicles, expanding weatherization efforts, and disallowing the use of natural gas in new homes and buildings.

On February 7, 2022, the Bellingham City Council passed an ordinance on 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 is running sensitivity analyses in this IRP based on the City of Bellingham’s limitations on use of natural gas in new buildings. Cascade pulled historical data from the 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.

## **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 about 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 engaged in supporting the development of a viable pathway forward that considers the essential balance between the City's economic vitality, reliability of its energy supply, and environmental goals. The CASC authored a plan recommending a set of strategies to guide both the City and the surrounding community in achieving its 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. Cascade was 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.

The City has determined to focus on four areas to meet their 2030 goal: energy supply, transportation, energy in buildings, and waste and materials. The City's current Environment and Climate Committee is also having preliminary discussions about the role of gaseous fuels as part of a decarbonized future and Cascade has begun meeting more regularly with the committee to discuss decarbonization pathways for natural gas distribution.

An 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 a RNG project at the Knott Landfill. Cascade, in partnership with an engineering firm, submitted a proposal to the County and were awarded



the project. Cascade and Deschutes County are currently developing a contract to implement the project. The project is expected to commence in 2023 and begin producing RNG by end of 2024 or early 2025. Cascade is exploring other RNG opportunities for the City, as well as providing an offset program to offset emissions. In addition, the Company will soon be piloting energy assessments for Cascade's transportation customers in the Bend region to determine energy savings potential and compliance pathways consistent with CPP requirements. This may lead to additional services and offerings in future in partnership with the Energy Trust.

### **Natural Gas Industry Emissions**

From review of EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2020, in 2020 the oil and gas sector was estimated to emit about 12.1% 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. EPA's emissions estimates indicate approximately four percent of oil and gas sector emissions are from distribution infrastructure.

Cascade is required to report annual facility GHG emissions to EPA, Department of Ecology, and the UTC. These emissions are described further below under the discussion on Cascade Operational GHG Emissions and Emission Reductions. Cascade's 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<sub>2</sub>e threshold for annual reporting to 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<sub>2</sub>e. 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.

**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 streamline their use of 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 and conservation programs and demand-side savings in Washington over the past three years have resulted in about 659,176 to 1,243,223 therm savings annually, or about 3,498 to 6,597 metric tons of CO<sub>2</sub>e/year.

Figure 6-2: Historical DSM Savings

Annual EE and Conservation/ DSM Savings	WA		OR	
	therms	MT CO <sub>2</sub> e	therms	MT CO <sub>2</sub> e
<b>2019</b>	760,956	4,038	499,135	2,648
<b>2020</b>	659,176	3,498	427,060	2,266
<b>2021</b>	1,243,223	6,597	525,372	2,788

An approximate two-fold increase in therm savings was achieved in 2021 compared with previous years to meet the increased focus on conservation programs implementation per HB 1257, including commercial program adoption to meeting increased conservation targets from that legislation. More emission reductions will be realized as the Company's programs mature and continue to grow. Please see Chapter 7, Demand Side Management, for additional details.

**b. Renewable Natural Gas and Hydrogen**

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 year and a half, 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. Cascade has recently executed agreements with developers and marketers for RNG and RNG environmental attribute purchases and is working with Deschutes County to develop an RNG project at the Knott Landfill near Bend, OR.

Cascade also continues to explore ways the Company can support technology development and pilot project opportunities to further explore distribution of hydrogen for customers on the gas distribution system. See more information on Cascade's RNG procurements and project involvement, as well 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 Climate Commitment Act (CCA) and are reported to EPA and Ecology. Reported GHG emissions include combustion emissions from Cascade's Mount Vernon compressor engine and fugitive methane emissions from distribution mains and service lines, and meter-regulating stations. Emissions from these sources total approximately 24,000 to 25,000 metric tons of CO<sub>2</sub>e per year. These emissions have been quantified since 2010 and have remained about the same 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 2021 report, Cascade's 2020 reported emissions to the UTC were 3,654 metric tons of CO<sub>2</sub>e and in the March 2022 report, 2021 reported emissions were 6,145 metric tons of CO<sub>2</sub>e. Cascade plans to use this data for evaluating emissions trends ongoing.

Cascade's other operational emissions (blowdowns, pressure relief/venting and routine maintenance, meters, and smaller combustion equipment) are also not required to be reported to the EPA or Ecology. However, the Company is compiling these emissions in a GHG inventory this year and have preliminarily estimated them to be in the range of about 10,000 to 15,000 metric tons of CO<sub>2</sub>e. Cascade is exploring the use of company specific data to compile these emissions as

accurately as possible. Cascade's approach to quantifying these emissions may also change in future with EPA's proposed emission factor changes and other proposed requirements in 40 CFR Part 98 Subpart W rule amendments. Cascade is committed to reducing operational emissions.

When considering all operational emissions above, Cascade's total operational emissions may be in the range of about 35,000 to 48,000 metric tons of CO<sub>2</sub>e. Comparing operational emissions with Cascade CCA-regulated customer emissions of approximately two million metric tons CO<sub>2</sub>e projected in 2023, Cascade's total operational emissions are a very small percentage. Operational emissions are projected to be in the range of about one to two percent of Cascades' total emissions regulated under the CCA.

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. Due to cost and time required to conduct actual monitoring of emissions, data demonstrating reductions is limited at this time. A more robust emissions inventory will be available in 2023 for Cascade's 2022 emissions and Cascade plans to use this comprehensive emissions inventory to evaluate emissions and trends, identify additional emissions reduction opportunities, and better quantify emissions reductions.

## **1. Fugitive Methane Emissions Reductions**

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.

### **c. 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 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 damages occur to company 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 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's methane emissions rate is estimated to be in the range of 0.06 and 0.10 percent (annual volume of methane emitted per total annual methane throughput volume). Although Cascade is not a member of One Future, the Company has been evaluating its emissions intensity and implementing emissions reductions for a number of years. Cascade's emission rate is close to the reported emission rate of 0.092 percent average achieved by One Future member natural gas distribution companies and is much lower than

One Future's emission rate goal for the natural gas distribution segment of less than 0.22 percent. 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.

### **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 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 1.00% and Cascade will also update the GWP of methane to 28 from 25. With the updated assumptions, the upstream emissions rate increases to a value of 4,680 CO<sub>2</sub>e g/MMbtu from a value of 3,541 CO<sub>2</sub>e 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**

There are new requirements impacting Cascade since the last IRP. 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. The new requirements impact this IRP and are including in resource and cost modeling.

To comply with the new CCA requirements, Cascade will be acquiring allowances at auction, carbon offsets, and exploring RNG opportunities for compliance with the CCA. 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 to inform the Company on regional energy and GHG emissions matters that may impact additional policy development.



## **Chapter 7**

### **Demand Side Management**

## Overview

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 2050 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 3.40% in 2020 to 5.06% in 2022. The average Avoided Cost per therm decreased from ~\$0.57 in 2020 to ~\$0.43 in 2022 representing an average decrease of ~24%. Average heating degree days also declined slightly compared to the 2020 forecast as future weather assumptions now include a warming climate scenario with gradually decreasing heating degree days over time.

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

## Key Points

- Washington projected energy efficiency of 48 million therms through 2045.
- This plan is informed by Cascade's Conservation Advisory Group (CAG).
- Cascade examines the Technical, Achievable 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.

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.

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. Energy conservation involves using less energy by adjusting behaviors and habits. Energy efficiency, on the other hand, involves a mix of technology and behavioral change using less energy to perform the same function.

Although Washington savings estimates extend to 2050, Oregon savings estimates have a time horizon of 2042 through Energy Trust's Resource Assessment model. Cascade targets the saving of approximately 60 million therms systemwide through this time horizon. Forty-eight million therms are forecasted in Washington and 12 million therms are forecasted 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 <sup>1</sup>
Oregon	Resource Assessment	2042

<sup>1</sup>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 (such as 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 1, 2021, Cascade filed its 2022-2023 BCP identifying the Company's two year acquisition target in Docket UG-210838<sup>1</sup>. This BCP was the Company's first biennial plan and was in response to Revised Code of Washington (RCW) 80.28.380 requiring all natural gas companies to establish a target every two years and demonstrate the target would result in the acquisition of all resources identified as available and cost-effective. The regional utilities, stakeholders and Commission staff negotiated a set of conditions in Attachment A of the Order, in short requiring the following<sup>2</sup>:

- “Continue to invest in regional studies and market transformation, in collaboration with funding from other parties and with other strategic market partners in this biennium, that complements Cascade’s energy efficiency programs, planning, services, and measures.
- Participate in the Northwest Energy Efficiency Alliance’s (NEEA) gas market transformation program through the end of NEEA’s 2020-2024 funding cycle.
- Retain sole responsibility for complying with RCW 80.28.380.
- Follow the Conservation Potential Assessment provisions.
- Follow the provisions for acquiring, planning, and reporting all conservation resources.
- Continue to use its advisory group, including notifying and consulting with the group in a variety of circumstances.
- Provide Annual Budgets in a detailed format including energy savings and a reasonable allocation towards pilot programs, research, and data collection.
- Maintain and provide specific program details in its conservation tariffs and notify Advisory Group of filings.
- Follow approved strategies for selecting and evaluating energy conservation savings.
- Follow program design principles.

---

<sup>1</sup> [UG-210838](#)

<sup>2</sup> Page 3, [UG-210838 Order 01](#)

- Use the modified Utility Cost Test (UCT).
- File recovery through a Gas Conservation Service Tariff.
- Demonstrate progress towards equitable distribution of nonenergy benefits.
- Consult with the Advisory Group to determine implementation of RCWs 80.28.260(2) and 80.28.300.”

### **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. Recently Cascade has filed 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 and to better inform the IRP through more recent model inputs and outputs.

The CPA process is outsourced to maintain impartial findings and 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. AEG is an industry leader who developed Cascade’s two 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 2021 and was updated in the summer of 2022 for Cascade.<sup>3 4</sup>

### **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.

---

<sup>3</sup> [CPA filing docket details](#)

<sup>4</sup> The Inflation Reduction Act, signed into law August 2022, will provide for expanded tax credits, rebates, and financial incentives for energy efficiency. These may enhance Cascade’s programmatic offerings and provide greater energy savings. However, the underlying details will not be known until 2023 and will be reflected in future filings, as appropriate.

- 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.
- 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<sup>5</sup>:

***“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 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*

---

<sup>5</sup> [CPA Phase 2 Final Report](#)

*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 2022 update from Phase 2 of the CPA filed in June 2021. The 2022 update involved select updates as directed by Commission staff to align inputs with the rest of this IRP.

These updates included:

- Updates in Avoided Costs to be consistent with Chapter 5
- Long term discount rate increased from 3.40% to 5.06%
- A warming climate assumption with decreasing heating degree days over time
- Decreased customer counts for a select gas ban scenario
- Calibration to calendar year actuals
- Model engine files to reflect the current AEG versions

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 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 (NWPCC) 2021 Power Plan.
- Comprehensive updates to all measure characterizations
- Update non-energy impacts (NEIs) and values and evaluate 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.

*"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.”<sup>6</sup>*

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.

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 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.

---

<sup>6</sup> 2018 IRP, Appendix D

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.

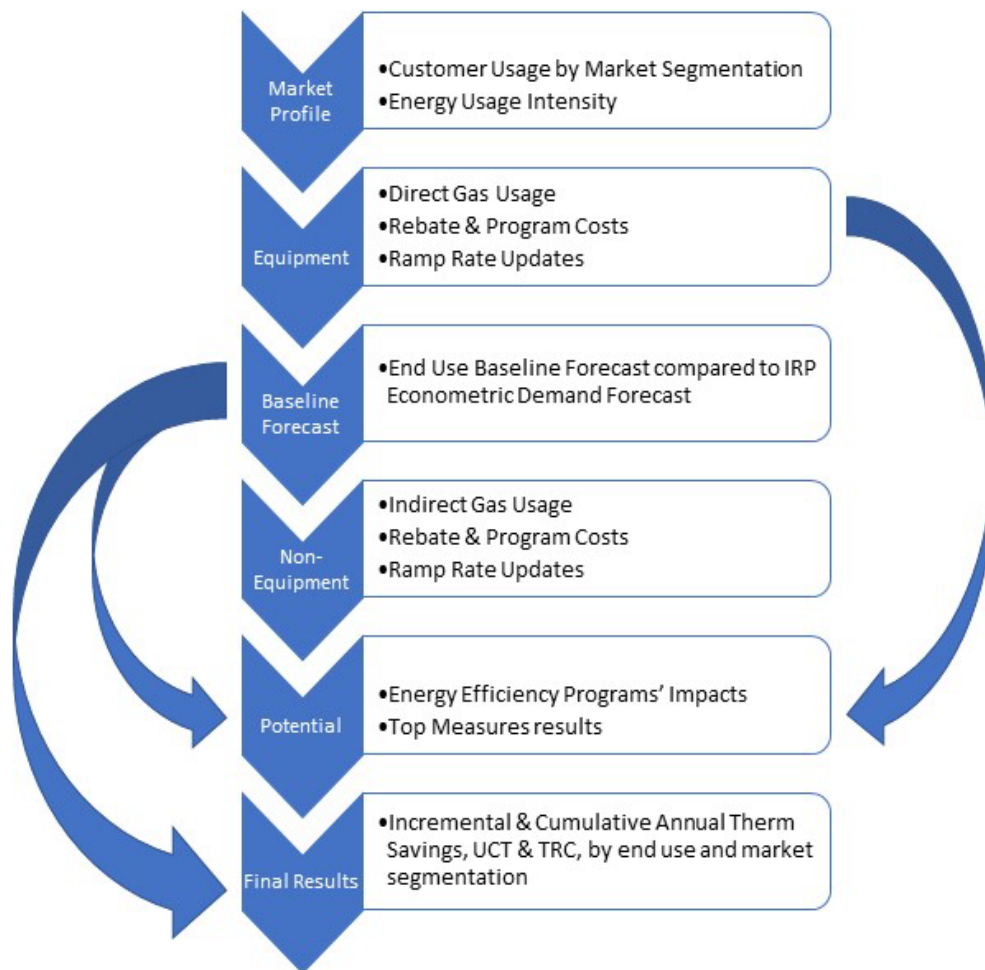
Commercial market segmentation includes: Office, Retail, Restaurant, Grocery, Education, Healthcare, Lodging, Warehouse, and a "Miscellaneous" category.

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 NWPCC 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 2022 as an update to Phase 2 of the 2021 CPA.

Company therm savings achievements for the past five IRP's compared to the 2022 IRP 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 from one biennium IRP to the next.

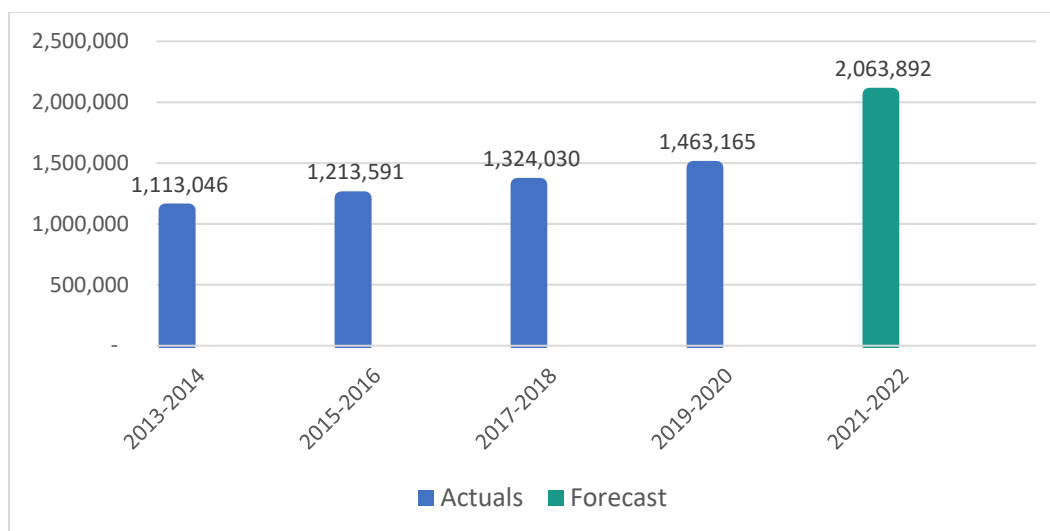
Figure 7-3: Historical IRP Goal to Actual Therm Accomplishments

Years	Biennium	Goals	Actuals	Difference	Growth
2013	<b>2012 IRP</b>	1,076,661	1,113,046	<b>3%</b>	<b>-9%</b>
2014					
2015	<b>2014 IRP<sup>1</sup></b>	1,496,969	1,213,591	<b>-19%</b>	<b>9%</b>
2016					
2017	<b>2016 IRP</b>	1,456,143	1,324,030	<b>-9%</b>	<b>9%</b>
2018					
2019	<b>2018 IRP</b>	1,419,636	<b>1,463,165</b>	<b>3%</b>	<b>11%</b>
2020					
2021	<b>2020 IRP</b>	2,063,892	<b>TBD</b>	<b>TBD</b>	<b>45%</b>
2022					

<sup>1</sup>2014 goals were not acknowledged by the WUTC

Figure 7-4 shows the actual historical performance and short-term biennium forecast.

Figure 7-4: Incremental Portfolio Biennium Actuals + Forecast



## **Resource Innovations**

As the Company moves into 2023, the “iENERGY DSM Central” software product from Resource Innovations (RI) Inc. remains Cascade’s tool for processing Residential and Low Income (LI) projects and assisting with management of the TA program. In 2018 the Company implemented a joint effort to design an interim solution to internal EM&V (Evaluation, Measurement, and Verification) on the RI software platform. For the software design, development and testing cycles, RI required Cascade to serve as thought leaders (as beta testers) during the development process, helping to shape the capabilities of the software. The product allows the Company access to advanced reporting through limited internal measurement and verification to develop plans on areas to concentrate efforts. While it does not take the place of external EM&V it does allow for some independent verification of savings.

## **Third Party Measure Level EM&V**

Cascade is in the process of seeking a vendor to conduct perpetual independent third-party evaluation, measurement, and verification of claimed program savings as required within the BCP Conditions document. The results of this EM&V process will verify the level at which claimed energy savings have occurred, evaluate the existing internal review processes, and suggest improvements to the measures and savings within the program and inform ongoing EM&V processes as well as the end of the biennium EM&V study which will be completed by June 2024.

The Company has outlined the plan to conduct this process and has dispersed a request for proposal for these services. Implementation of the efforts should begin in Q4 2022 or early Q1 2023.

## **Low Income**

Cascade is committed to increasing participation from Community Action Agencies to serve more customers through the Company’s combined Weatherization Incentive Program (WIP) and Enhanced Weatherization Incentive Program (E-WIP).

In Phase II of the CPA, AEG worked with Cascade to characterize the “low-income” demographic for the purpose of better understanding customer end use and to establish alignment between LI and Residential program potential. AEG relied on two data sources to inform the LI analysis:

1. The American Community Survey to estimate the share of Cascade’s residential customers that fall above and below the defined low-income threshold. These percentages were used to apportion Cascade’s total residential customer population into these two groups within the LoadMAP model.

2. The 2016-2017 Residential Building Stock Assessment (RBSA) to inform differences in building characteristics (e.g., home size, number of water fixtures, existing insulation levels), equipment efficiency, and saturations of energy efficient technologies for homes above and below the defined low-income threshold. This information allowed AEG to develop separate market profiles for, and more accurately assess, the remaining energy efficiency potential of low-income homes.

AEG updated the existing LoadMAP segmentation to separate LI and non-LI residential customers in each of Cascade's climate zones; base-year market profiles were developed for each of the segments, beginning with the market profiles from Phase 1 of the CPA, and on the results of the RBSA analysis as well as actual customer consumption.

The Company now has the opportunity to work with AEG to perform a deemed measure review of the current LI program against the CPA results. This review is set to begin at the end of 2022.

In addition to the deemed measure review the Company will be working with the agencies and its Conservation Advisory Group to review current program reporting requirements in an attempt to streamline the process and encourage additional uptake.

## **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 7-5 for the goals and budgets for 2022 and 2023 (rounded to the nearest dollar) for reference. These were used in development of the last Biennial Plan. The next BCP will cover budgets for the 2024-2025 Biennium and will be developed based on updated Avoided Costs. The 2024-2025 budget draft will be submitted to the CAG by September 2023 per the 2022-2023 BCP conditions document.

Figure 7-5: Program Goals & Budgets at a Glance 2022 & 2023 Biennium

	Calendar Year 2022				Calendar Year 2023				Biennial Totals
	Residential	C/I	Low Income	1st year Total	Residential	C/I	Low Income	2nd year Totals	
<b>Cascade Admin Budget<sup>1</sup></b>	\$1,257,715	\$1,394,623	\$63,252	\$2,715,591	\$1,404,670	\$1,609,349	\$67,296	\$3,081,314	<b>\$5,796,905</b>
<b>Therm Targets<sup>2</sup></b>	429,213	419,461	17,859 <sup>3</sup>	866,533	507,695	537,858	19,665 <sup>3</sup>	1,065,218	<b>1,931,751</b>
<b>NEEA Natural Gas Market Transformation</b>				\$182,975				\$348,908	<b>\$531,883</b>
<b>Regional Technical Forum</b>				\$31,300				\$31,300	<b>\$62,600</b>
<b>Evaluation, Measurement &amp; Verification</b>				\$70,000				\$70,000	<b>\$140,000</b>
<b>Conservation Potential Assessment</b>								\$160,000	<b>\$160,000</b>

<sup>1</sup> Note budgets in this table are estimates and refer to administrative costs for program implementation, not rebate payments

<sup>2</sup> Therm targets from this graph have been developed through LoadMAP.

<sup>3</sup> Represents only Cascade staff salary and outreach costs associated with weatherization program delivery that are not part of payments to agencies

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

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 market growth and weather assumptions which now assume declining heating degree days over time as opposed to flat normal weather throughout the forecast horizon.

These opposing trends create a net decline in potential savings compared to the Company's most recent CPA models. For example, the increased customer forecast based market growth trends increases opportunities for strongly cost-effective measures like residential furnaces, water heaters, and fireplaces. However, lower Avoided Costs



and declining weather-sensitive use over time have cut cost-effective potential in most measures as marginal segments struggle with cost effectiveness.

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 7-6 shows the Residential, Commercial, Industrial cumulative DSM forecast by Technical, Achievable Technical and both UCT/TRC Achievable Economic Potentials for scenario A.

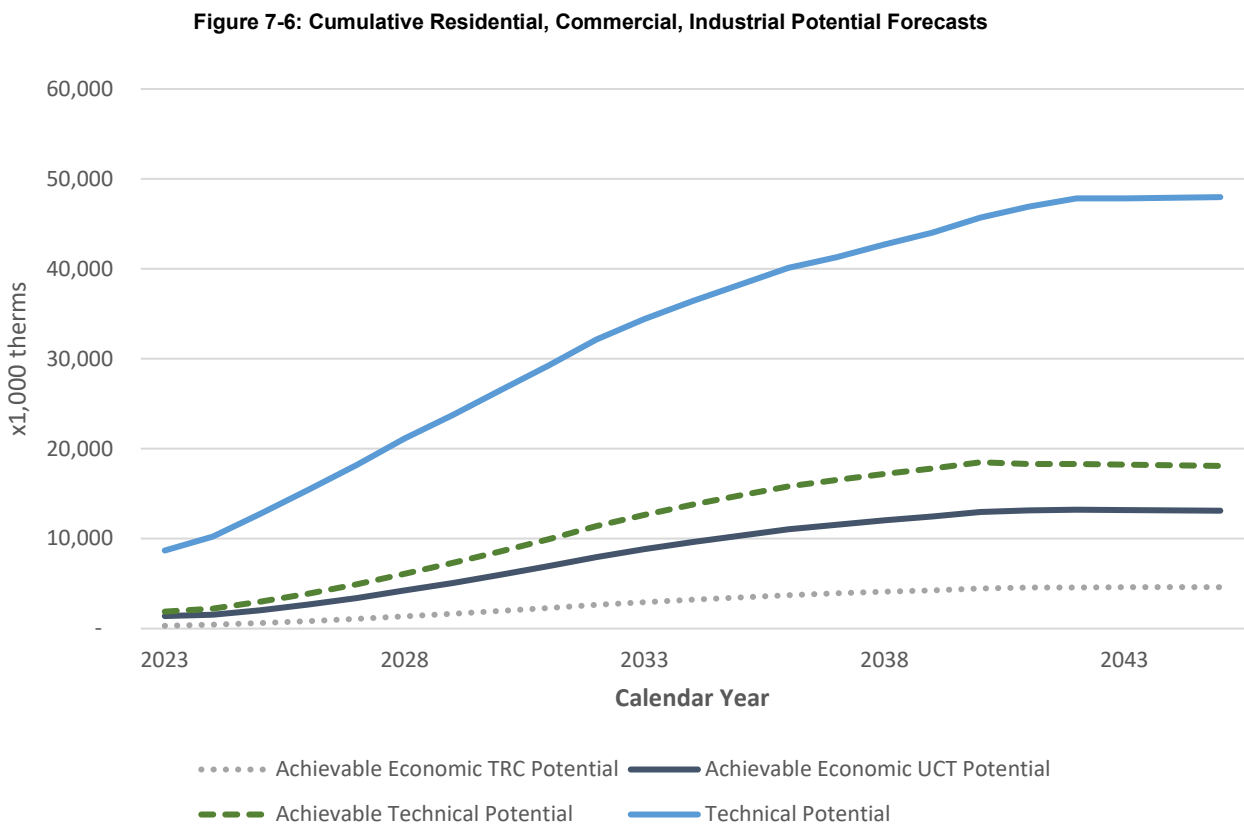


Figure 7-7 shows cumulative savings potential for the Industrial program through 2045.

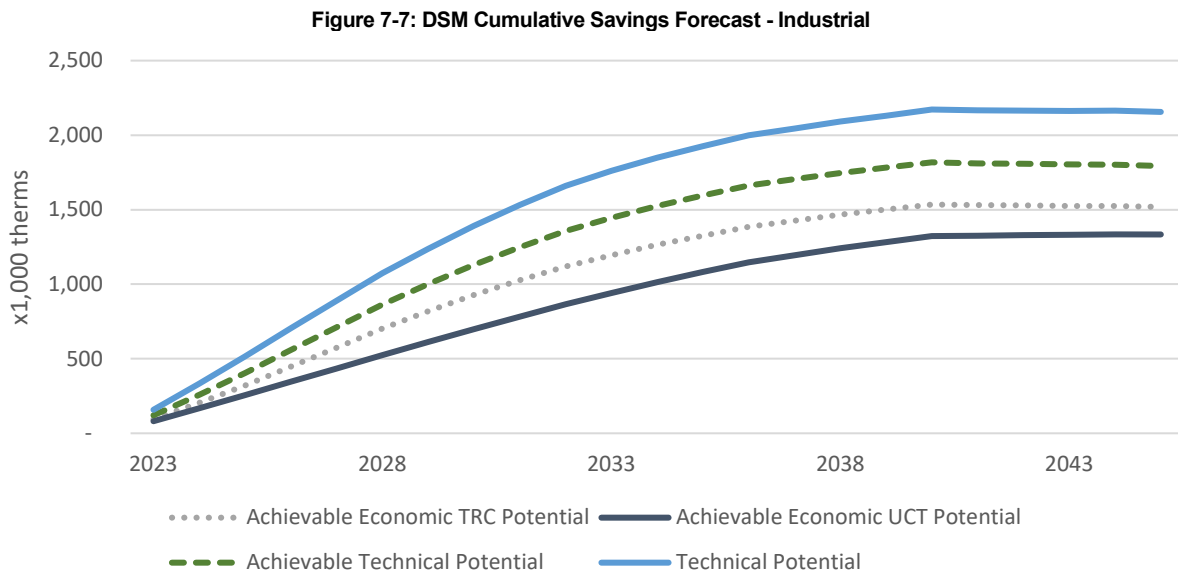


Figure 7-8 shows the Commercial cumulative DSM forecast by Technical, Achievable Technical and both UCT/TRC Achievable Economic Potentials for scenario A.

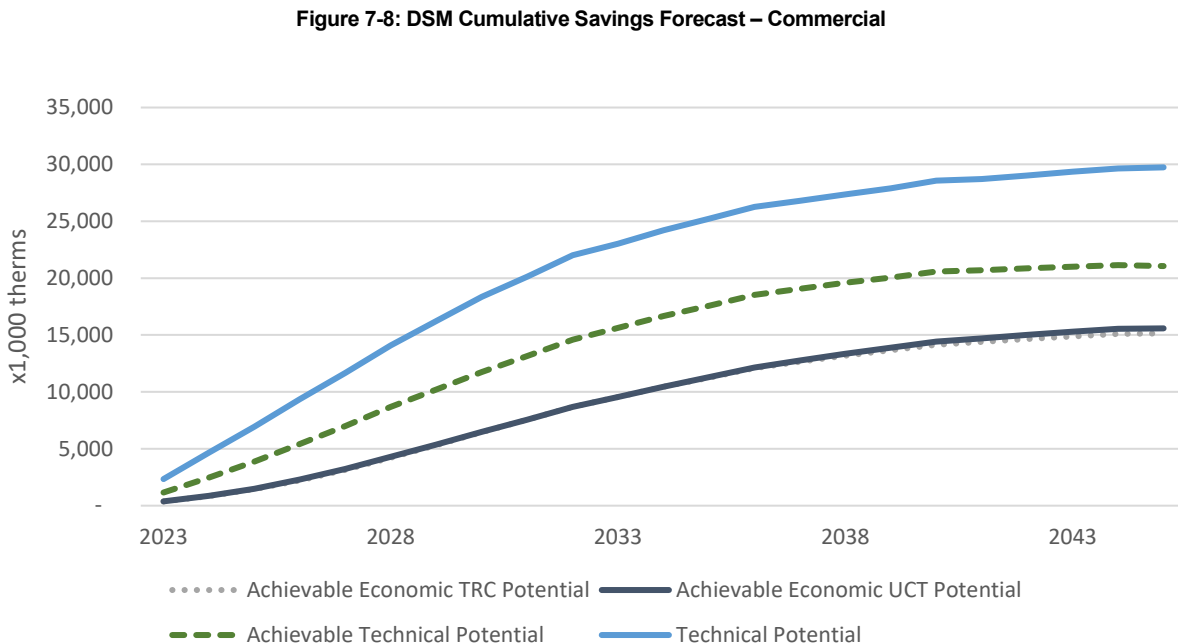
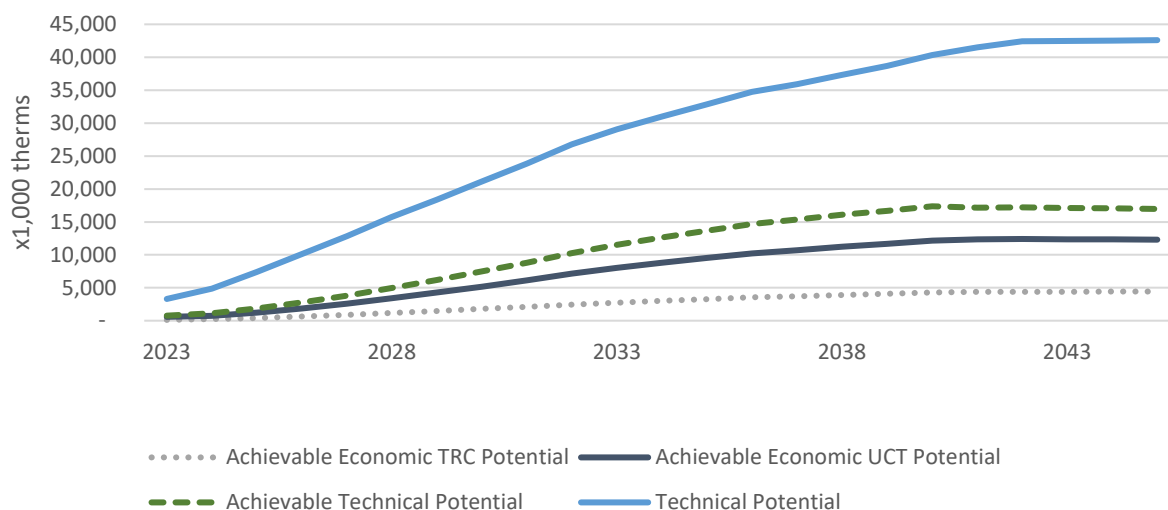


Figure 7-9 shows the Residential cumulative DSM forecast by Technical, Achievable Technical and both UCT/TRC Achievable Economic Potentials for scenario A.

Figure 7-9: DSM Cumulative Savings Forecast – Residential



Figures 7-10, 7-11, and 7-12 show the top 10 measures by sector for scenario A with the most potential for 2023. Top ten measures account for more than 90% of all potential across the Industrial and Residential segments.

Figure 7-10 shows 2023 top ten UCT measures for the Industrial program.

Figure 7-10: 2023 Top Ten UCT Industrial Measures

Rank	Measure / Technology (Ranked by 2023 Potential)	2023	% Total Savings
1	Industrial - Strategic Energy Management	20,542	25.2%
2	Industrial - Process - Insulate Heated Process Fluids	10,778	13.2%
3	Industrial - Gas Boiler - Insulate Hot Water Lines	9,703	11.9%
4	Industrial - Gas Boiler - Stack Economizer	9,556	11.7%
5	Industrial - Process Heat Recovery	5,148	6.3%
6	Industrial - Gas Boiler - Insulate Steam Lines/Condensate Tank	4,744	5.8%
7	Industrial - Gas Boiler - Hot Water Reset	4,563	5.6%
8	Industrial - Gas Boiler - High Turndown	3,759	4.6%
9	Industrial - Gas Boiler - Maintenance	3,091	3.8%
10	Industrial - Unit Heater	2,431	3.0%

Figure 7-11 shows 2023 top ten UCT measures for the Commercial program

Figure 7-11: 2023 Top Ten UCT Commercial Measures

Rank	Measure / Technology (Ranked by 2023 potential)	2023	% Total Savings
1	Commercial - Insulation - Roof/Ceiling	53,388	14.2%
2	Commercial - Water Heater	32,064	8.5%
3	Commercial - Gas Boiler - Insulate Hot Water Lines	26,824	7.1%
4	Commercial - Insulation - Wall Cavity	25,027	6.6%
5	Commercial - Fryer	20,018	5.3%
6	Commercial - Boiler	19,899	5.3%
7	Commercial - Hydronic Heating Radiator Replacement	19,784	5.3%
8	Commercial - Water Heater - Ozone Laundry	18,807	5.0%
9	Commercial - Furnace	16,887	4.5%
10	Commercial - Gas Boiler - Hot Water Reset	15,082	4.0%

Figure 7-12 shows 2023 top ten UCT measures for the Residential program

Figure 7-12: 2023 Top Ten UCT Residential Measures

Rank	Measure / Technology (Ranked by 1st year potential)	2023	% Total Savings
1	Residential - Furnace - Direct Fuel	224,866	37.7%
2	Residential - Water Heater <= 55 gal.	95,501	16.0%
3	Residential - ENERGY STAR Connected Thermostat	79,577	13.4%
4	Residential - Insulation - Ceiling, Installation	43,181	7.2%
5	Residential - ENERGY STAR Clothes Washers	26,259	4.4%
6	Residential - Fireplace	26,073	4.4%
7	Residential - Insulation - Basement Sidewall	13,741	2.3%
8	Residential - Ducting - Repair and Sealing	13,311	2.2%
9	Residential - Gas Boiler - Pipe Insulation	8,093	1.4%
10	Residential - Thermostat - Programmable	7,909	1.3%

Based on the Company's experience, legislative trends, work with AEG, and current technologies, the EE team updated key measure assumptions and added new measure permutations in the 2022 update of Phase 2 of the 2021 CPA. These measures included:

Commercial:

- C/I Boilers: Tier at 85% AFUE (lower incentives, lower therm savings) and a tier at 90% (higher incentives, higher therms)
- Commercial tankless water heaters
  - Updating savings assumptions

Residential:

- Furnaces:
  - Rebate tier at 98% AFUE (lower incentives, lower therm savings) and a tier at 95% AFUE
- Windows – add 2<sup>nd</sup> tier to support efficient window installs
  - Windows: two tiers, \$5/sq. ft. for U Factor 0.30 and \$9/sq. ft. for U Factor 0.22
- Prescriptive air sealing
  - Requires attic insulation
- Whole Home Air Sealing
  - Minimum 400 CFM50 reduction using pre/post blower door testing
- Insulation: duct, wall, floor and attic/roof/ceiling
- Residential tankless Water Heater
  - Units must meet or exceed 0.91 UEF
- Existing and New Home Bundles
  - Existing home bundles by tier.

Further details around new measure inclusion and research are available in the Company's most recent BCP as Exhibit 1.

The Company develops its rebate offerings with the objectives to:

1. Maximize the inclusiveness of viable, industry-acknowledged conservation measures.
2. Set incentive levels as meaningful price signals to consumers to upgrade to high-efficiency natural gas equipment and energy saving measures.
3. Remain cost effective at the Company's most recently acknowledged Avoided Costs.

## Alternative Scenario Modeling

Cascade has re-run the LoadMAP model from the most recent CPA to include additional future scenarios with assumptions on renewable natural gas (RNG) availability and potential for increased local gas bans such as those currently seen in Bellingham, Washington. As mentioned previously, the Current LoadMAP model fully runs these alternative scenarios through 2045 then utilizes annual savings averaged 2040-2045 to estimate savings for years 2046-2050.

Scenario B assumes a future scenario with more RNG usage leading to comparatively higher Avoided Costs. Residential Furnaces and Water Heaters gain significant ground as more segments clear cost effectiveness testing, but there is little impact on other measures compared to scenario A. This results in total potential similar to Phase 2 of the 2021 CPA model and higher than scenario A.

Scenario C also uses the RNG Future Avoided Costs but modifies the customer projections to include existing and expected local bans on new natural gas connections. This decreases the available opportunities and resulting potential significantly, resulting in overall potential similar to Scenario A.

Keep in mind, the Company can only forecast for known local or municipal natural gas use restrictions and the LoadMAP model was not initially intended to account for these types of load use restrictions. At this time the Company and AEG are accounting for the one territory with a commercial new construction gas ban at time of writing and will continue to gather information to gain a clearer indication in the future to allow for a more nuanced approach to forecast impact on baseline and savings potential.

To simulate the effects of proposed and in-place state and local legislation regarding new connections to Cascade's natural gas system, the CPA models were run with an alternative customer forecast reflecting CNGC's best estimate of the forward-looking impacts of the reduced customer connections. This change in baseline customer growth in turn reduces the opportunities for potential interventions throughout the model.

Figures 7-13 and 7-14 compare the portfolio cumulative achievable UCT potential of scenario A, B, and C compared to the original Phase 2 of the 2021 CPA. Select data series have been truncated due to the Phase 2 CPA forecast horizon of 2040.

Figure 7-13: Cumulative Achievable UCT Potential Scenario Comparison

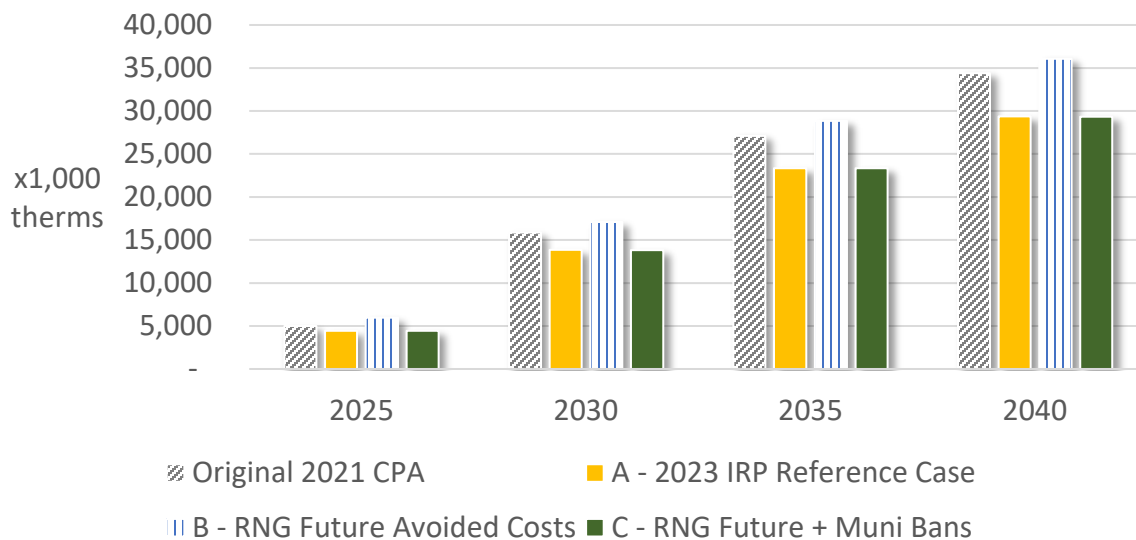


Figure 7-14: Cumulative Achievable UCT Potential Scenario Comparison

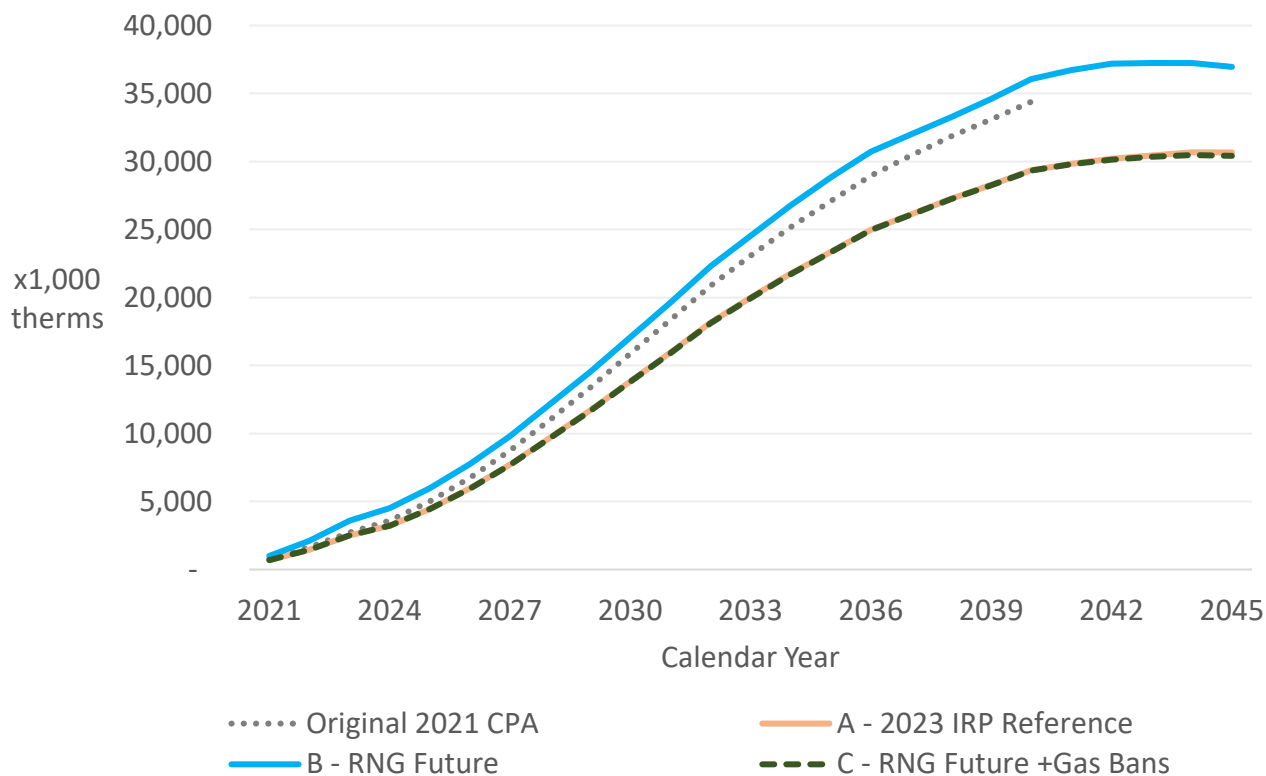


Figure 7-15 provides a comparison of savings potential for these three scenarios against the most recent CPA.

Figure 7-15: Cumulative UCT Potential Scenario Comparison

Original Results (Phase 2 Models) <sup>1</sup>	2021	2022	2023	2024	2025	2030	2040
<b>Reference Baseline</b>	246,225	248,892	251,569	255,494	256,840	268,912	292,401
Achievable UCT Savings (mTherms)	773	1,645	2,719	3,589	5,011	15,872	34,398
% of Baseline	0.3%	0.7%	1.1%	1.4%	2.0%	5.9%	11.8%

**Scenario A – Updated to 2023 IRP Reference Baseline & Avoided Costs**

	2023	2024	2025	2030	2035	2040	2045
<b>Baseline</b>	<b>243,965</b>	<b>247,595</b>	<b>247,199</b>	<b>253,812</b>	<b>259,582</b>	<b>266,336</b>	<b>272,292</b>
Achievable UCT Savings (mTherms)	1,044	1,764	2,994	12,378	21,901	27,902	29,209
% of Baseline	0.4%	0.7%	1.2%	4.9%	8.4%	10.5%	10.7%

**Scenario B – RNG Future Avoided Costs**

<b>Baseline</b>	<b>243,965</b>	<b>247,595</b>	<b>247,199</b>	<b>253,812</b>	<b>259,582</b>	<b>266,336</b>	<b>272,292</b>
Achievable UCT Savings (mTherms)	1,479	2,398	3,855	14,973	26,733	33,951	34,843
% of Baseline	0.6%	1.0%	1.6%	5.9%	10.3%	12.7%	12.8%

**Scenario C – RNG Avoided Costs plus Municipal Gas Bans**

<b>Baseline</b>	<b>243,814</b>	<b>247,281</b>	<b>246,725</b>	<b>252,549</b>	<b>257,553</b>	<b>263,559</b>	<b>268,795</b>
Achievable UCT Savings (mTherms)	2,503	3,209	4,439	13,810	23,327	29,332	30,414
% of Baseline	1.0%	1.3%	1.8%	5.5%	9.1%	11.1%	11.3%

<sup>1</sup> Note variance in time horizon compared to subsequent scenarios

## 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



- 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
- Home Builder's Association directories, Tours of Homes and Home and Garden Show participation
- 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
- Targeted magazine and newspaper advertising

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 Annual Conservation Achievement report<sup>7</sup>.

### **Community Energy Program Partnerships**

Cascade partners with local community-based energy programs to support their energy reduction efforts and leverage the opportunity to promote the EEIP to the public. The Company will continue to seek partnerships and support EE efforts throughout its service territory.

In line with Cascade's commitment to community engagement and the desire to increase awareness of its conservation programs, Cascade personnel also partners with the Western Washington University Institute for Energy Studies to provide guest lectures on DSM and energy efficiency, internships, and supports mentoring networks.

### **Regional Efforts and Long-Term Benefits**

Cascade is a funding 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.

---

<sup>7</sup> [CY 2021 Energy Efficiency Achievement Report](#)

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.

The Natural Gas Alliance is well into its second cycle and business and strategic planning are underway for the next cycle. As savings become more impactful the Company coordinates with its CAG on how cost allocations associated with the NEEA efforts should be determined as savings are accrued and reportable. Per the BCP Conditions document the Company is required to fund NEEA through 2024 and will work with WUTC staff and the Advisory Group on participation after 2024. Company investment in NEEA is shown in Figure 7-14.

Figure 7-14: CNGC NEEA Financial Commitment Schedule

Year	CNGC Washington Commitment at 9.3% for Cycle 5 & 9.2% for Cycle 6
2015	\$145,872
2016	\$244,996
2017	\$313,174
2018	\$452,285
2019	\$548,804
<b>Cycle 5 Total</b>	<b>\$1,705,130</b>
2020	\$348,908*
2021	\$348,908*
2022	\$348,908*
2023	\$348,908
2024	\$348,908
<b>Cycle 6 Total</b>	<b>\$1,744,542</b>

\*Note Cascade pays quarterly - Q4 2020 through Q3 2022 were reduced due to cycle 5 credit

To further support the Company's engagement in these efforts, Cascade, as well as Northwest Natural Gas are members of the Board of Directors. Cascade's representative is also the current Chair of NEEA's Natural Gas Board committee and is charged with leading the natural gas discussions on behalf of the Board of Directors and gas funders for the organization.

## Adaptive Change Management

The current economic model isn't able to fully address the impacts as the economy transitions out of the pandemic and the subsequent economic downturn. Currently, the programs are trending below goal due to a variety of reasons including supply chain and labor issues and impacts are likely to carry into 2023. The EE team has employed an

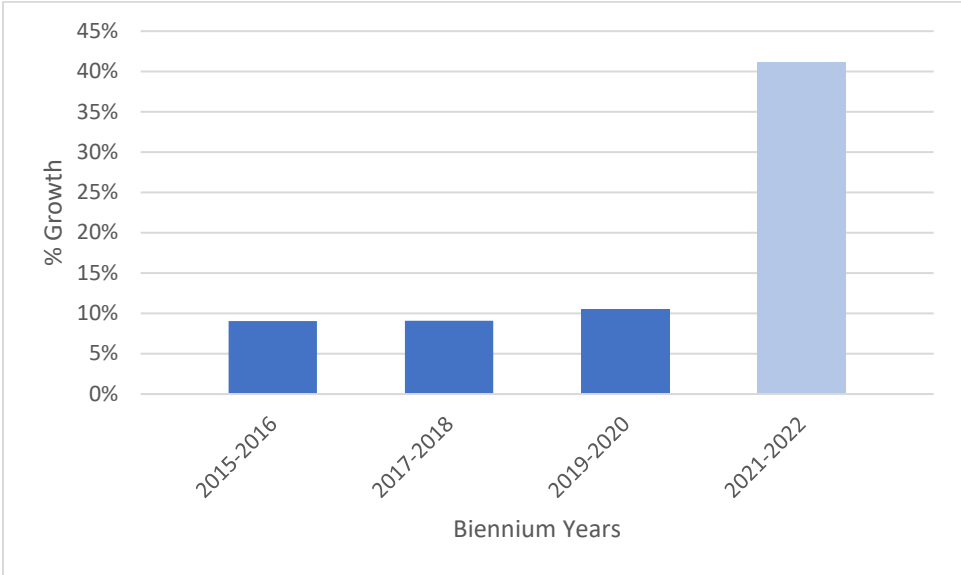
adaptive management strategy to respond to the ever-changing economic landscape. Additionally, Carbon legislation and local gas bans that have not yet been realized have an impact on savings potential when enacted so Cascade will work with the CAG on potential alternative scenarios and inputs for LoadMAP (or a future forecast model with the next CPA beginning in 2023) to accommodate some of the unknowns and address issues in real time to remain flexible and responsive to customer needs.

### Conclusion and Outlook for Two Year Action Plan

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, 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 financial incentives from the Inflation Reduction Act.

Figure 7-15 highlights the portfolio level biennium over biennium growth DSM has seen dating back to the 2014 IRP. Therm savings growth in the first three biennium were 9%, 9%, and 11% respectively. The target for the current biennium 2021-2022 constitutes a significant increase of 45% compared to the previous biennium, requiring Cascade to aggressively enhance the program’s offerings while still meeting portfolio cost effectiveness.

Figure 7-15: Portfolio level Biennium over Biennium Growth



To assist with increasing its capacity to capture energy savings, Cascade is in process of developing an internal rebate software solution 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, particularly in the new home arena with code changes arising throughout the service territory.

An enhanced focus will be placed upon growing the LI program through revisions in measure offerings and fine-tuning energy savings assumptions. The Company is also looking to build upon the successes found within the commercial custom rebate program by incorporating a custom residential rebate tailored to the service territory. Additionally, the Company is exploring and starting pilot efforts including behavioral savings efforts through home energy reporting and advanced air sealing options to name a few.

These focuses along with other improvements in the adaptive change management process sets the program up for increasing capacity to manage higher rebate submissions starting in 2023.

The program has proven itself adaptable to changes in code and technology advancement. Scenarios B & C represent a subset of continued forecasting in the RNG and municipal gas code spaces. Cascade currently recognizes a shortcoming of information in the industry surrounding natural gas use restrictions and the impact of code changes on the future gas market. The Company's internal code expert will be engaged as a resource to assist in development of the next CPA.

The CPA developed in 2023 will target an earlier delivery date than historical precedent to better match the deliverable timetable of other utilities in the area and accommodate upcoming code and local discussions. This will be a concerted effort and will require coordination with the CAG and WUTC to accommodate. Ultimately this timetable will allow Cascade to better inform deliverables reliant on conservation potential including the BCP and IRP.

## **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 capacity deficits. If a capacity deficit is identified reinforcement alternatives are compared and final 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 alternatives to address deficits, reviews and selects reinforcement alternatives 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 4,893 miles of distribution and 170 miles of transmission in Washington and 1,710 miles of distribution and 107 miles of transmission in Oregon. Cascade system is also composed of facilities including regulator stations, valve stations, odorizers, heaters and compressors.

In general Cascade's distribution systems begin at a citygate station connected to an interstate pipeline. At gate stations Cascade takes custody of the gas and regulates and odorizers the gas to serve its distribution and transmission pipelines. Typically, high pressure or transmission pipelines are downstream of the gate to transport gas to regulator stations or large volume industrial customers. Regulator station reduce pressure to serve residential or commercial customers.

## **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. Equal pressures throughout a closed pipeline system indicate that neither gas flow nor demand exist 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 in an attempt to equalize the 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 maximum flow velocities at which the gas is allowed to travel through the pipeline and related equipment.

Due to the nature of fluid mechanics there is a finite amount of natural gas that can flow through a pipe of a certain size 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.

In order 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 or not 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. 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 GL, 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 and compressor stations and 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, 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 completely rebuilt every three years and are 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 2020 and are scheduled for rebuild in 2023.

### **Usage Per Customer**

The IRP planning 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 weather and geographic location.

Cascade utilizes a Customer Management Module (CMM) software product, provided by DNV GL 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 weather and the physical location of each customer. The weather 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 weather information has been correlated to each meter read, a base load and weather dependent load are calculated for each customer through



regression analysis over the historical usage period. DNV GL 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 weather independent, and a heat load that is multiplied by a weather 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 GL.

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 determined 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 time and day, and will then set the model to the temperature experienced to see how the model is performing to determine if the usage per custom is reasonable. 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 weather 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 (°F)
Aberdeen	46	14
Bellingham	47	13
Bend	71	-11
Bremerton	46	14
Eastern Oregon	73	-13
Kennewick	65	-5
Longview	46	14
Mt Vernon	47	13
Pendleton	67	-7
Walla Walla	66	-6
Wenatchee	65	-5
Yakima	65	-5

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 sizing of pipe and facilities, long term planning, model growth predictions, identify system deficits, determine system reliability, 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 are limiting

capacity include pipeline bottleneck, 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 every two years 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 will update the five-year budget as needed based upon new information that impacts the five-year planning. If a deficit is predicted the system is evaluated and a reinforcement will be proposed and selected based on alternative analysis criteria. 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 coordinators, Energy Services representatives, and district management to assure the system is safe and reliable. As towns develop, the need for pipeline expansions and reinforcements increases. 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 Cascade has planned over the next 5 years, see Appendix I.

### **Distribution System Enhancements**

Once a deficit has been identified on a system Engineering will propose enhancement solutions to address the deficit. Distribution enhancements can include:

- pipeline reinforcement such as replacements
- pipeline loops and back feeds
- pressure increases
- uprates
- facility upgrades,
- additional regulator station feeds,
- compressor stations
- demand side management strategies

Each of Cascade's systems are unique in pipeline dynamics and will be optimized using different enhancement solutions.

Pipeline solutions consist of looping, upsizing, and uprating. 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 loss down the pipeline 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 upsizing involves replacing existing pipe with a larger size pipe. The increased pipe capacity relative to surface area results in less friction, larger flow capacity, and therefore, a lower pressure drop. This option is usually pursued when a pipe is damaged or has integrity issues. If the existing pipe is otherwise in satisfactory condition, looping augments existing pipe, which remains in use.

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 line pressure may produce leaks and other pipeline damage creating costly repairs and or may not reach the proposed uprate pressure. 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 citygate stations, district regulator stations, farm taps, and customer services. Regulator stations provide additional capacity to an area since regulator stations are fed by high pressure laterals than can deliver more gas to the distribution system. Utilization and strategic positioning of new 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 higher 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 very reliable compressors. These smaller compressor stations are well suited for areas where gas demand is growing at a relatively slow and steady pace, so that purchasing and installing these less expensive compressors over time allow a pipeline to serve growing customer demand into the future.

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

Targeted demand side management is another approach to address distribution system deficits. Cascade is currently pursuing a pilot program in Oregon to see if demand side management can delay or eliminate a distribution system enhancement that has been identified. For targeted demand side management to be considered the deficit predicted must be reasonable obtained through demand side management goals and must have time for the program to be effective. Per Energy Trust of Oregon, they recommend that a project has 3 to 5 years to be implemented and be able to see if the results of the demand side management is effective at addressing 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 alternative selection process with consideration to scope, cost, timing, system benefits/long term planning and feasibility. For any project over 1 million dollars 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 were considered.

### **Distribution System Enhancement Selection Guidelines**

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

- Non pipe alternatives including:

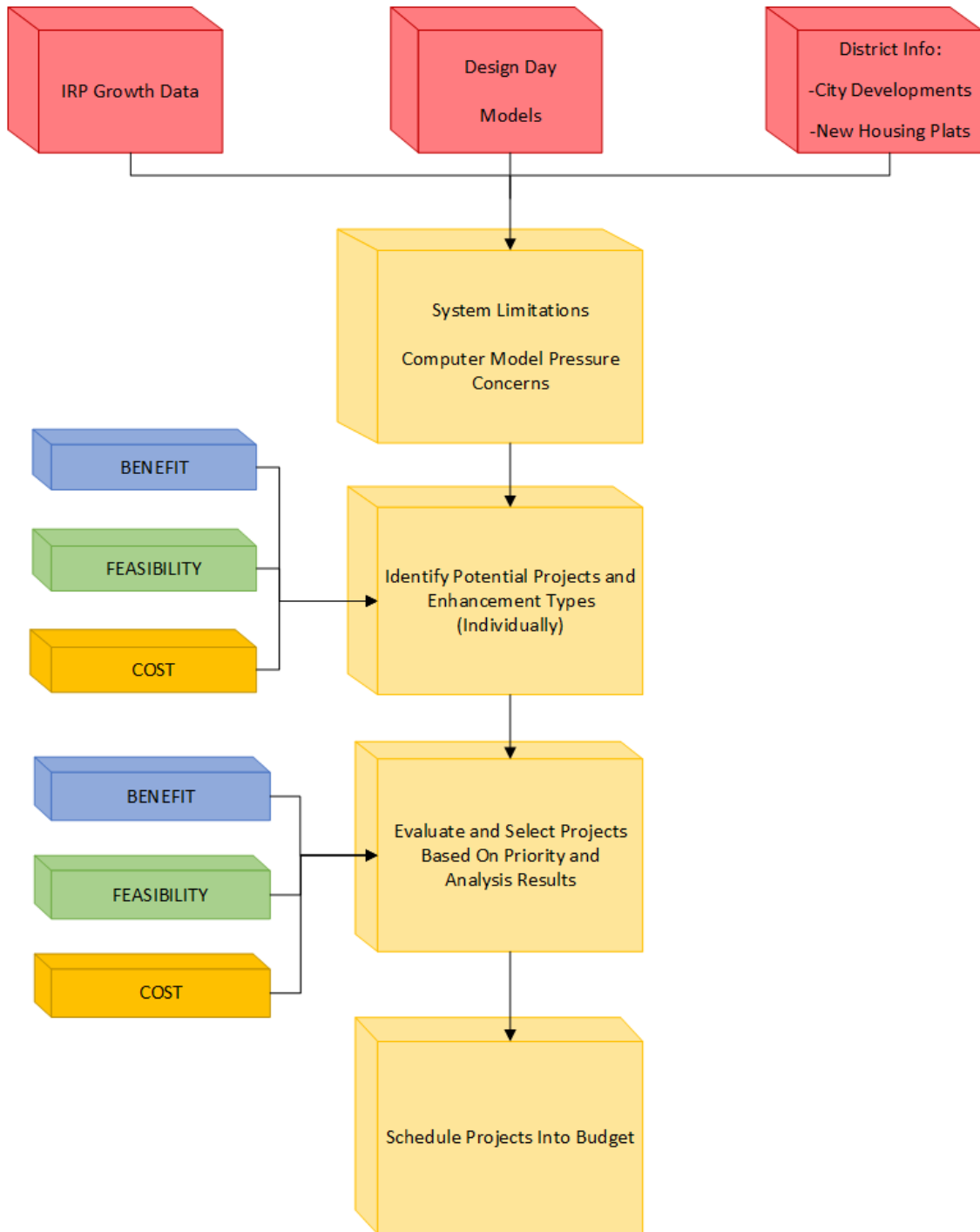
- Pressure Increases/Uprates if feasible
  - Demand side management if load reduction will eliminate need for reinforcement and the Company has time to see impacts.
  - Compressor Stations if permitting (emission/zoning, etc.) is favorable and land is available and cost effective for project.
- 
- The shortest segment(s) of pipe that addresses the deficit.
  - The segment of pipe with the most favorable construction conditions that supports long term operations and maintenance activities, i.e. access, existing easements or traffic issues.
  - Minimizes environmental concerns, i.e. avoid water crossings, wetlands and environmental sensitive areas.
  - Minimizes impacts to the community., i.e. road closures or city road moratoriums.
  - The segment of pipe that provides opportunity to add additional customers.
  - Total construction costs including restoration.

Once a project/reinforcement is identified, engineering, field operations, or energy services representative begins a more thorough investigation by surveying the route and filing for permits. This process may uncover additional impacts such as moratoriums on road excavation, underground hazards, discontent among landowners, permitting concerns, etc., resulting in another iteration of the above project/reinforcement selection criteria.

### **Capital Budget Process**

Cascade annually goes through the 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 process 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 time for projects to be designed and constructed to address deficits in time. 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 coming onto Cascade's systems, targeted demand side management, electrification, 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.

## Supply Resource Optimization Process

The process for optimizing supply resources is summarized in the following six steps and is shown graphically in Figure 9-2 on page 9-4.

### Key Points

- Cascade utilizes PLEXOS® to find the optimal solve for forecasted resource deficiencies, as well as alternative portfolios.
- Once a solution is found under expected conditions, the candidate portfolio is stress-tested through stochastic and deterministic scenarios.
- The Top-Ranked Candidate portfolio includes all existing resources, acquisition of RNG, Hydrogen, Compliance Instruments, plus incremental DSM.
- Cascade forecasts shortfalls beginning in 2038 in Washington and 2034 in Oregon without DSM, and 2049 in Washington and 2046 in Oregon, with On-System RNG being identified as the resource to solve these shortfalls.
- For the 2023 IRP, Cascade evaluates five scenarios plus a base case scenario, with robust qualitative and quantitative analysis of the results of these scenarios.
- The Preferred Portfolio is Cascade’s least cost, least risk solution to how to serve its customers over the planning horizon.

- **Step 1: As-Is Analysis**

- Cascade began its optimization process by running a deterministic analysis of its existing resources with a three-day peak event. This allowed the Company to uncover the timing and quantity of resource deficiencies, both in terms of inability to serve customers and inability to hit emissions reductions targets. Once the resource need was identified, Cascade utilized its market intelligence to identify all potential options to solve for the projected shortfall.

- **Step 2: Identify Portfolios**

- Once shortfalls were identified, Cascade utilized PLEXOS® to derive a diverse selection of potential portfolios to eliminate the deficiency. This was done through a deterministic analysis of the alternative resources. For the 2023 IRP, Cascade tested seven potential portfolios. Figure 9-1

groups these portfolios by the source of each resource. Further details regarding the components of each candidate portfolio can be found in Appendix G.

Figure 9-1: Breakdown of Candidate Portfolios

	Incremental Renewable Natural Gas	No Incremental Renewable Natural Gas
Incremental Natural Gas	-All-In -All-In Less DSM	-Incremental Transport
No Incremental Natural Gas	-RNG Only -Hydrogen Only -Renewables only	-Offsets Only

- **Step 3: Analysis of All Portfolios**
  - Once Cascade selected its portfolios, each portfolio will be run through the PLEXOS optimizer with expected conditions. The portfolios will be evaluated under deterministic and stochastic analyses, and the timing and quantity, if applicable, of unserved demand and emissions reductions shortfalls will be recorded. Cascade will also record the risk-adjusted total system cost of each portfolio.
  
- **Step 4: Ranking of Portfolios**
  - The Top Ranking Candidate Portfolio will be the portfolio that is able to serve all forecasted demand over the planning horizon while hitting all emissions reductions goals. In the case of multiple portfolios accomplishing this, the portfolio that does it with the lowest risk-adjusted total system cost will be the Top-Ranking Candidate Portfolio. Portfolios were ranked based on a risk-adjusted total system cost metric, which gives 75% weight to the total system cost under deterministic conditions for a given portfolio, and 25% weight to the costs under stochastic conditions. Cascade believes the top ranked portfolio is the one with the most reasonable least cost and least risk mix of reliable energy supply resources, emissions reduction resources, and energy efficiency for Cascade and its customers. This is now deemed to be the Top Ranked Candidate Portfolio, a term that Cascade will use often in this chapter to represent the portfolio that appears to be optimal under expected conditions. It is important to note that it is still just a Candidate Portfolio until it has passed a rigorous scenario analysis, after which point it will become the Preferred Portfolio for Cascade over the 28-year planning horizon.
  
- **Step 5: Scenario Analysis of Candidate Portfolio**
  - The Top Ranking Candidate Portfolio is re-run through the Plexos optimizer under five scenarios. These scenarios, which are explained further in Figure 9-3, will provide sensitivity testing of customer growth, energy efficiency, RNG, hydrogen, Natural Gas bans, and Natural Gas pricing. The timing/quantity if applicable of unserved demand and emissions

reductions shortfalls will be recorded. Cascade will also record the risk-adjusted total system cost of each portfolio.

- **Step 6: Evaluation of Candidate Portfolio**

- Cascade performs a qualitative and quantitative review of Top-Ranking Candidate Portfolio's ability to serve demand, hit emissions targets, and the risk-adjusted total system cost of the portfolio under the scenarios evaluated. The results of this review are presented later in this chapter. If there are concerns about the portfolio's ability to hit these metrics, or the cost of hitting these metrics, the Company may loop back to Step 5 with a new portfolio that might be more insulated against identified risks. Otherwise, the portfolio is named Cascade's Preferred Portfolio. Figure 9-2 displays this process as a flowchart.

Figure 9-2: Supply Resource Optimization Process Flow Chart

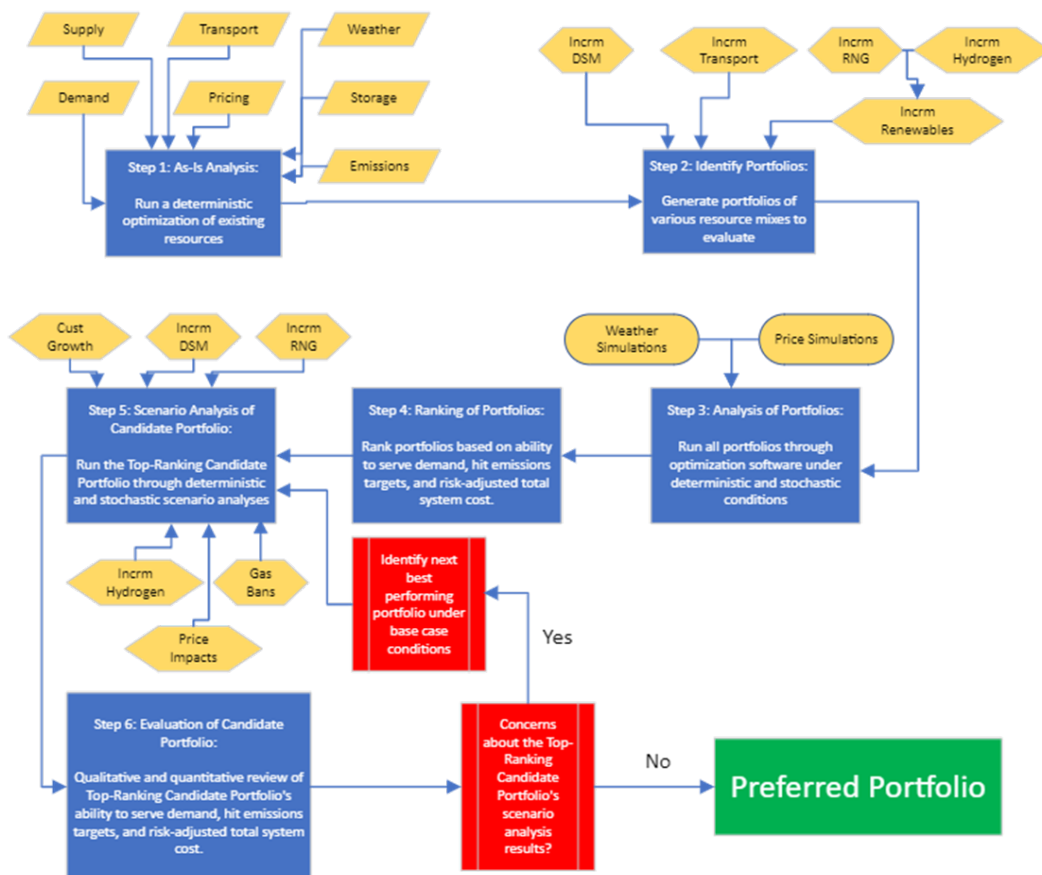


Figure 9-3: Breakdown of Scenarios Modeled

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

While Chapter 13 includes a full glossary, terms related to Figure 9-3 are shown below for convenience.

### Terms Used in Figure 9-3

**Customer Growth: Current Expectations** – Customer growth is modeled to follow base-case customer growth forecast as discussed in Chapter 3, Demand Forecast.

**Customer Growth: No new customers after 2030** – Customer growth in Cascade’s residential and commercial rate classes gradually slows to zero growth in 2025 and afterwards, residential and commercial customer count reduced to 10% by 2050.

**Customer Growth: High Customer Counts** – Customer growth is modeled to follow high customer growth forecast as discussed in Chapter 3, Demand Forecast.

**Energy Efficiency: CPA Projections** – Savings from demand side management programs modeled to follow the base-case projections from Cascade’s internal conservation potential assessment in Washington, and from projections provide by the Energy Trust of Oregon in Oregon.

**Energy Efficiency: Scenario 2 CPA Projections** – Savings from demand side management programs modeled to follow a high commodity cost projection in the avoided cost as discussed in Chapter 5, Avoided Cost. Results come from Cascade’s internal conservation potential assessment in Washington, and from projections provide by the Energy Trust of Oregon in Oregon.

**Renewable Natural Gas: Expected Availability** – Maximum available RNG used as the upper constraint of the PLEXOS model is derived from a Cascade weighted share of a blend of the high and technical RNG potential as outlined in a 2019 ACF/ICF study. This calculation is discussed further in Chapter 4, Supply Side Resources.

**Renewable Natural Gas: High Availability**– Maximum available RNG used as the upper constraint of the PLEXOS model is derived from a Cascade weighted share of a blend of the technical RNG potential as outlined in a 2019 ACF/ICF study. This calculation is discussed further in Chapter 4, Supply Side Resources.

**Renewable Natural Gas: Low Availability** Maximum available RNG used as the upper constraint of the PLEXOS model is derived from a Cascade weighted share of a blend of the low RNG potential as outlined in a 2019 ACF/ICF study. This calculation is discussed further in Chapter 4, Supply Side Resources.

**Hydrogen: Expected Availability** – Maximum Hydrogen blending constraint of the PLEXOS model in this scenario is 20% of delivered gas by volume.

**Hydrogen: High Availability** – Maximum Hydrogen blending constraint of the PLEXOS model in this scenario is 30% of delivered gas by volume.

**Hydrogen: Low Availability** - Maximum Hydrogen blending constraint of the PLEXOS model in this scenario is 5% of delivered gas by volume.

**Natural Gas Bans: Current Bans** – This scenario accounts for all current gas bans in Cascade’s service territory as discussed in Chapter 6, Environmental Policy.

**Natural Gas Bans: Additional Bans** – This scenario accounts for all current and proposed gas bans in Cascade’s service territory as discussed in Chapter 6, Environmental Policy.

**Natural Gas Price: Expected Price** – Price of natural gas is modeled to follow the base-case price forecast as discussed in Chapter 4, Supply Side Resources.

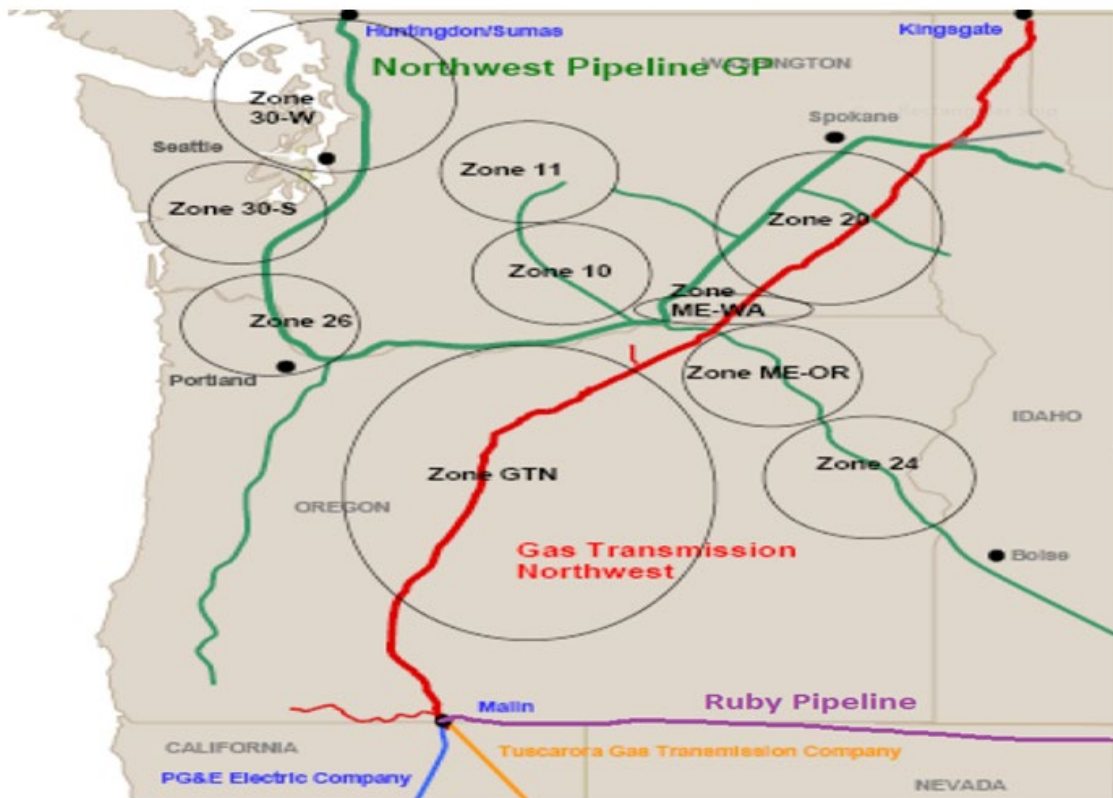
**Natural Gas Price: Adjusted Price** – Price of natural gas is modeled to follow to include an adjusted of 10% either higher or lower as appropriate. Lower price is used in Scenarios 2 and 4 while higher price is used in scenario 5. Scenarios 2 and 5 also include a higher priced tranche of RNG for volumes above the expected availability, prices at \$26/dth.

**Natural Gas Price: High Price** – Price of natural gas is modeled to follow the base-case price forecast as discussed in Chapter 4, Supply Side Resources, except during a stochastic incident. When an incident occurs, prices at all basins spike to the 99<sup>th</sup> percentile results of pricing at the impacted basin, regressing back to the price forecast linearly over a two-year period.

## Planning and Modeling

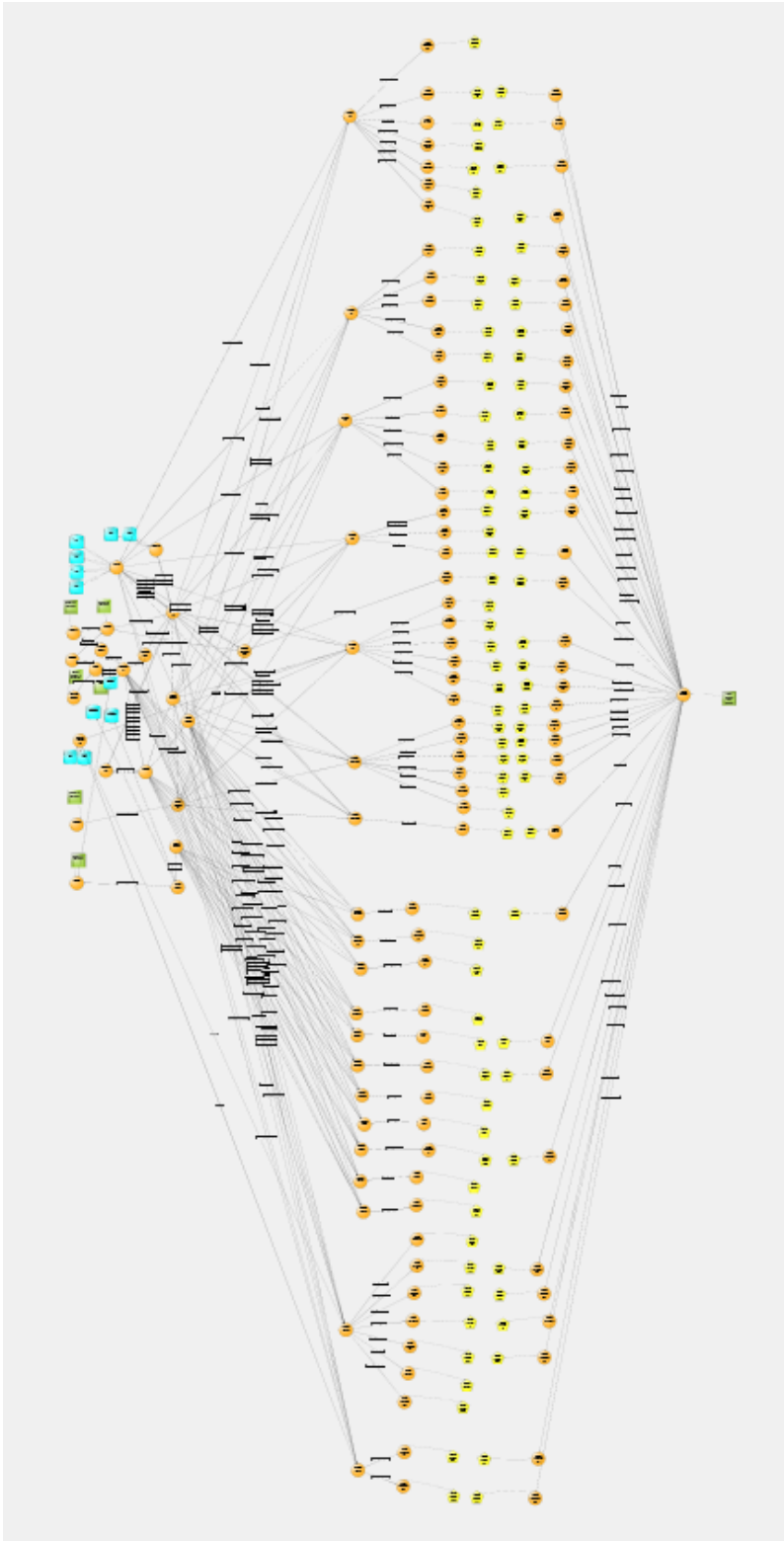
PLEXOS® has broad capabilities that allow the Company to develop supply and demand relationships that closely mirror Cascade’s existing operations. Figure 9-4 shows the location of these pipeline zones. These pipeline zones reflect Cascade’s customers being served from either Northwest Pipeline LLC (NWP) or Gas Transmission Northwest (GTN) interstate pipeline facilities.

Figure 9-4: 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 more of a citygate 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 9-5. 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 9-5: Network Diagram of Cascade's System





## **Stochastic Methodology Discussion**

Cascade runs its Monte Carlo simulations on all candidate portfolios, which are used to create the risk-adjusted metrics discussed in Step 4 of Cascade's supply resource optimization process. The rationale behind this is to use the deterministic results to capture the intrinsic value of each portfolio, while the stochastic results capture the extrinsic value of the portfolios. Cascade chose to weight these with a 75/25 split, as the Company believes this mix properly assigns value to results under expected conditions versus results under unexpected conditions. Additionally, this follows the regional best practices.

The Company is continuing to use its own Monte Carlo simulation engine, built in R, to generate stochastic results. 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, Cascade runs a 200 draw Monte Carlo simulation on price and weather. This is a change from the Company's process in the 2020 IRP process, where Cascade ran 10,000 draw Monte Carlo simulations. While there are valid concerns about the validity of sample size of a 200-draw simulation, the Company is now running portfolios through all draws of the simulation as opposed to just identifying the nth percentile draw and analyzing that one draw. This allows Cascade to analyze stochastic long term success probabilities, and identify when shortfall 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 follow a desired distribution. In Cascade's case, this allows for correlations between weather zones to be included when drawing or sampling data distributions for Monte Carlo runs. Figure 9-6 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 9-6: 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. 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. 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.

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.

The optimization process compares a portfolio of resources against a specific demand requirement. PLEXOS® generates a daily demand forecast by combining base load and temperature sensitive usage factor inputs with a specified daily temperature pattern input. For IRP purposes usage factor inputs were specifically developed under high, medium, or low demand profiles culled from Cascade's in-house LFM. Daily temperature patterns are available as either design or average weather. Due to the complexity of the PLEXOS® application, the model has some combined demand areas compared to the LFM. Therefore, both usage factor and temperature pattern inputs from the LFM may be slightly adjusted within PLEXOS® on an area specific basis without creating any material difference in the load demand.

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 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, 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 28-year, most reasonably priced reliable portfolio.

## **Demand Forecast**

Load growth across Cascade's system through 2050 is expected to fluctuate between 0.41% and 2.16% annually, accounting for leap years. Load growth is split between residential, commercial, and industrial customers. Residential and commercial customer classes are expected to grow annually at an average rate of 1.21% and 0.94%, while industrial expects a growth rate of approximately 1.14%. Load across Cascade's two-state service territory is expected to increase at an average annual rate of 1.10% over the planning horizon, with the Oregon portion outpacing Washington, 1.43% versus 0.98%.

## **Long-Term Price Forecast**

In Chapter 4, Supply Side Resources, Cascade discusses how the 28-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 usually at a discount 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 9-7 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.

Figure 9-7: Historical Regional Pricing for Past Ten Years

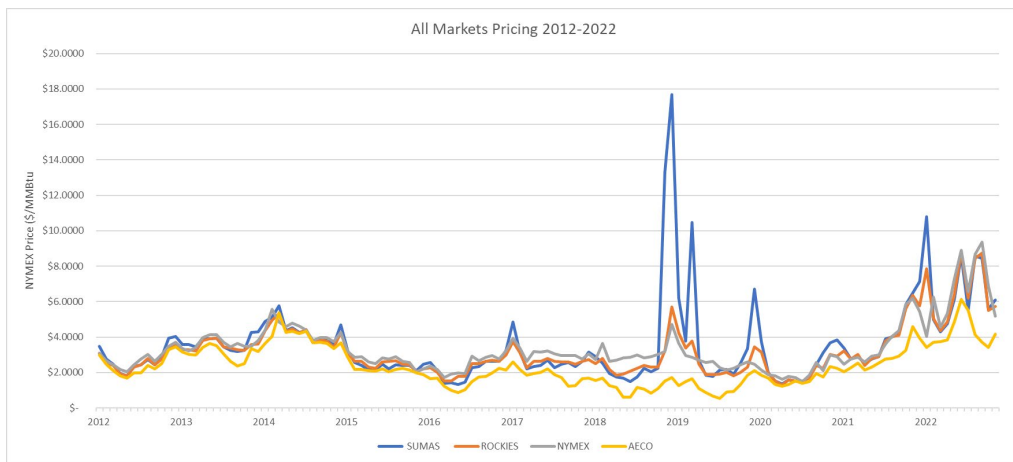
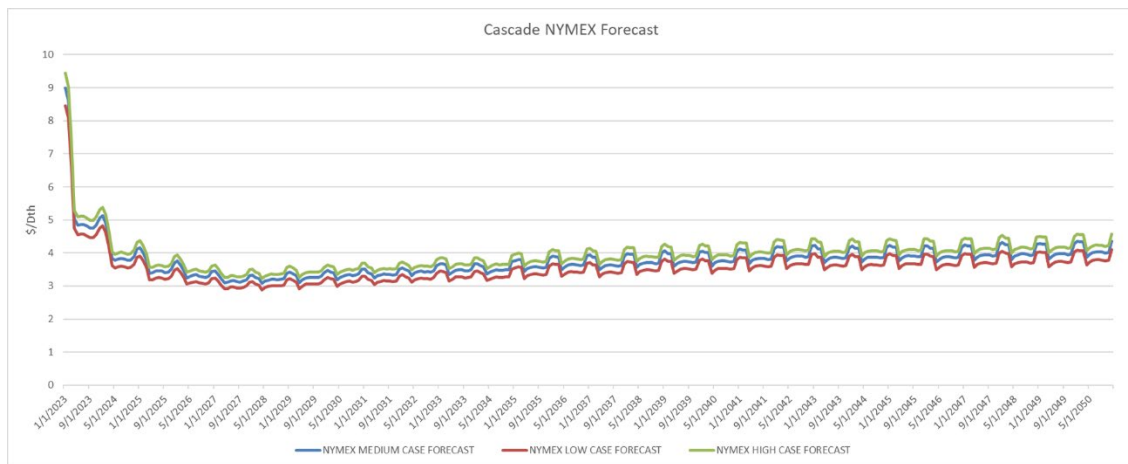


Figure 9-8 shows the comparison of ranges of NYMEX pricing for the planning horizon, including the expected low, medium, and high price.

Figure 9-8: NYMEX Annual Price Comparison



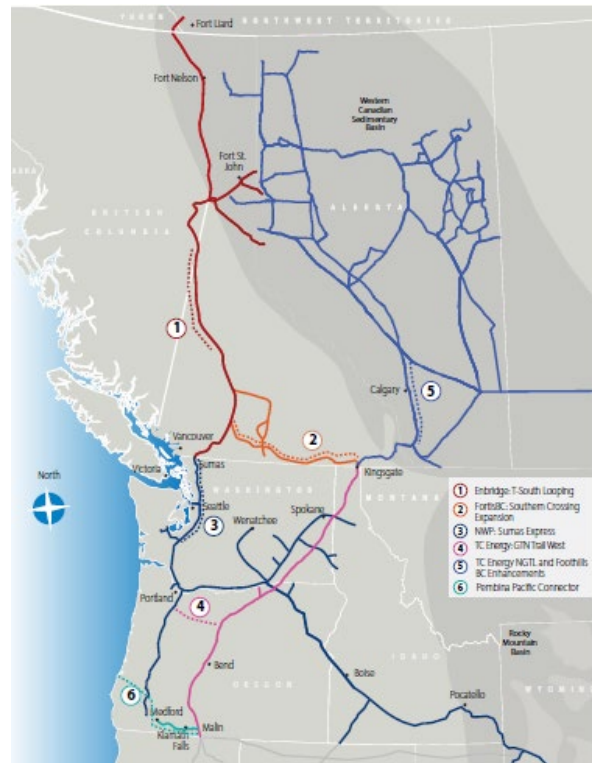
## Environmental Adder

As discussed in Chapter 5, Avoided Cost, Cascade included a 10% environmental adder in its 2023 IRP's 28-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 9-9, 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 (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 28-year integrated resource portfolio.

Figure 9-9: Alternative Transportation Resources<sup>1</sup>



<sup>1</sup> 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 2023 IRP the nominal system avoided costs ranges between \$1.00/therm and \$6.52/therm over the 28-year planning horizon. Through the cost-effective use of conservation 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 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. For the purpose of the 2023 IRP, this modeling exercise assumed no RNG, no Hydrogen, and no utilization of compliance instruments like allowances in Washington and CCIs and Oregon, as Cascade does not have any of these resources at the time that modeling has been finalized for this IRP cycle. This portfolio was also evaluated with and without incremental DSM resources, to evaluate the impact of DSM on reducing demand shortfalls. With no DSM, Cascade first forecasts shortfalls in Washington in 2034 and Oregon in 2038, with the largest projected shortfall being 7,570 dth in Washington and 20,390 dth in Oregon. Adding DSM to the model delays the shortfalls to 2046 in Washington, and 2049 in Oregon, with the largest projected shortfalls being 1,430 dth in Washington and 3,600 dth in Oregon. There are no significant results to discuss regarding emissions compliance with this portfolio, as Cascade will not be able to meet its emissions reduction requirements without the resources discussed earlier in this subsection.



## Portfolios Evaluated

For the 2023 IRP, Cascade elected to evaluate seven 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. The Company selected these seven portfolios after discussions with various stakeholders throughout its technical advisory group process. In future IRPs, Cascade will consider evaluating additional portfolios.

Figure 9-9 outlines the key components of each portfolio identified in Figure 9-1. PLEXOS® deterministically selects the optimal quantity of each resource based on its Resource Mix functionality. These quantities, which are provided in Appendix E, are then tested stochastically, and ultimately ranked on their ability to serve load and meet emissions goals in a least cost, least risk manner.

Figure 9-9: Resource Composition of All Evaluated Portfolios

	All-In	All-In Less DSM	Incremental Transport	RNG Only	Hydrogen Only	Renewables Only	Offsets Only
Incremental NGTL							
Incremental GTN N-S							
NWP I-5 Mainline EXP							
Incremental Ruby							
NWP Wen lateral EXP							
Incremental Foothills							
NWP Z20 lateral EXP							
T-South-So Crossing							
Trails West (Palomar)							
Spire Storage							
Gill Ranch Storage							
Wild Goose Storage							
Aeco Hub Storage							
Magnum Storage							
Clay Basin Storage							
DSM							
Renewable Natural Gas							
Hydrogen							
Offsets							
Allowances							
Community Climate Investments							

Legend	
	Selected resource for the portfolio
	Considered but not selected resource
	Not considered for the portfolio

Figure 9-12 ranks the candidate portfolios based on the earliest shortfall, total system costs, and stochastic probability of long-term success in serving all of Cascade’s customers while complying with emissions reduction requirements. The Top-Ranking Candidate Portfolio is the one that serves all customers at the lowest cost with the lowest risk of failure. Additionally, a portfolio must be able to serve all customers and

meet emissions reductions goals under deterministic conditions to be eligible to become the Preferred Portfolio. For the 2023 IRP, the Company is combining stochastic loss of load probability and emissions reduction compliance into one metric: Long-Term Success Probability. This value represents the likelihood that Cascade will be able to meet both its demand and emissions reduction requirements. In future IRPs the Company will break these two values out into separate metrics.

Figure 9-12: Final Ranking of Portfolios – Mean and VaR

Portfolio	Deterministic		Stochastic			Risk Adjusted Results
	Year of First Shortfall	Total System Cost (\$000)	Long-Term Success Probability	First Compliance Period Failure	99th Percentile Total System Cost	Risk Adjusted Total System Cost
All-In	N/A	12,928,647	98.50%	2049-2051	13,071,203	12,964,285.63
All-In Less DSM	N/A	14,132,960	82%	2049-2051	14,311,565	14,177,611.45
Offsets Only	2027	9,474,555	0%	2023-2026	9,645,876	9,517,384.90
Incremental Transport	2023	3,728,934	0%	2023-2026	3,778,886	3,741,422.09
Hydrogen Only	2023	4,839,885	0%	2023-2026	4,866,004	4,846,414.49
RNG Only	2023	8,434,560	0%	2023-2026	8,502,091	8,451,442.41
Renewables Only	2023	8,940,046	0%	2023-2026	9,011,442	8,957,895.21

### Top-Ranking Candidate Portfolio

Using input from the alternative resources selected, the All-In portfolio was selected as the least cost, least risk solution for Cascade’s system over the planning horizon. This portfolio is now defined as the Top-Ranking Candidate Portfolio. This portfolio provides guidance as to what resources should be considered to eliminate unserved demand and meet emissions reduction targets with the least cost mix of all the alternatives that the Company has considered. Furthermore, this portfolio was derived deterministically assuming average weather with a peak day event, Cascade’s average price forecast, and expected growth system-wide. The projected impact of these resources on total system costs, bill impacts to the residential 503 rate schedule, and the Company’s projected resource stacks are shown in Figures 9-12 through 9-15. Full bill impact analysis can be found in Appendix K.

Figure 9-12: Top-Ranking Candidate Portfolio -Totally System Cost by Year

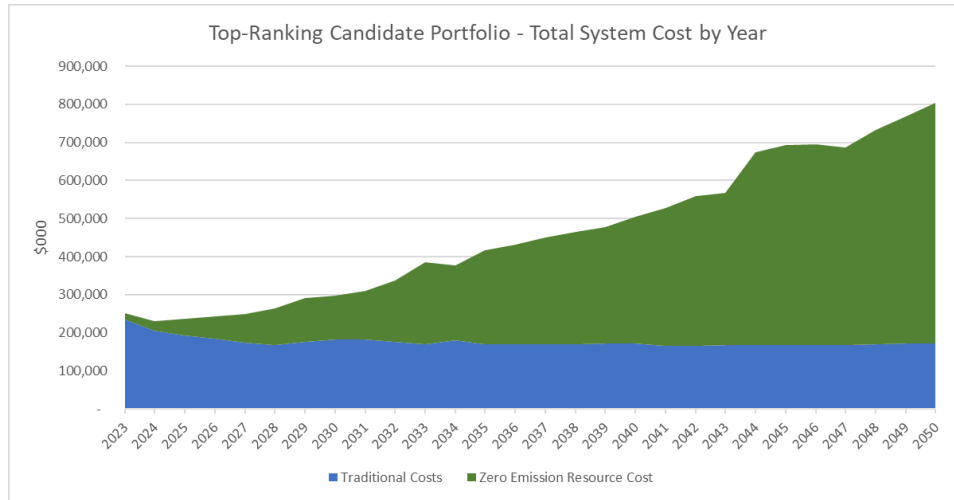


Figure 9-13: WA 503 (Residential) Rate Class Bill Impact Analysis

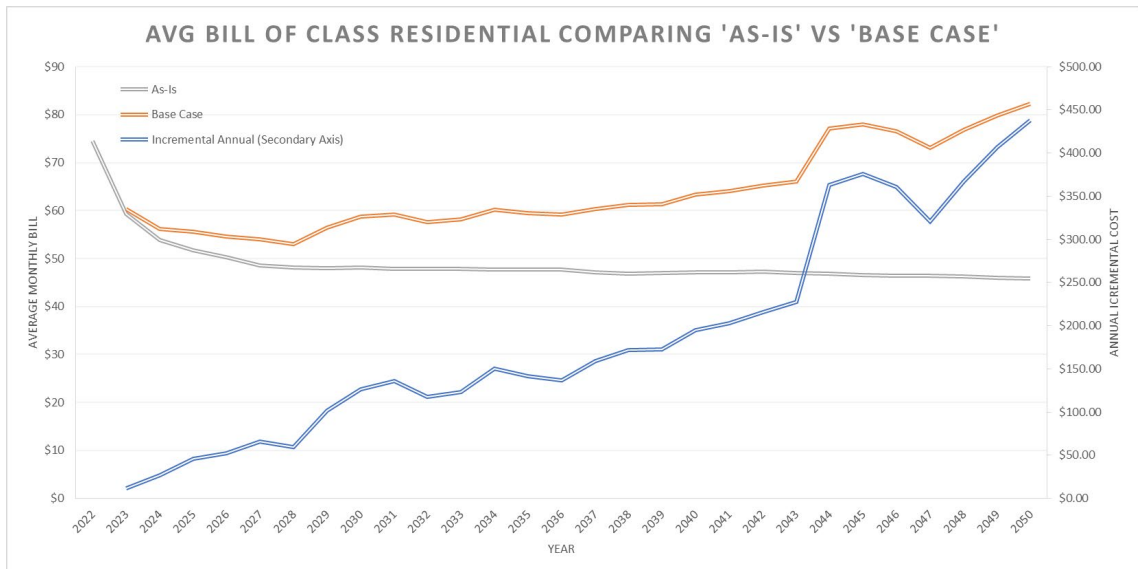


Figure 9-14: WA Projected Resource Stack for CCA Compliance

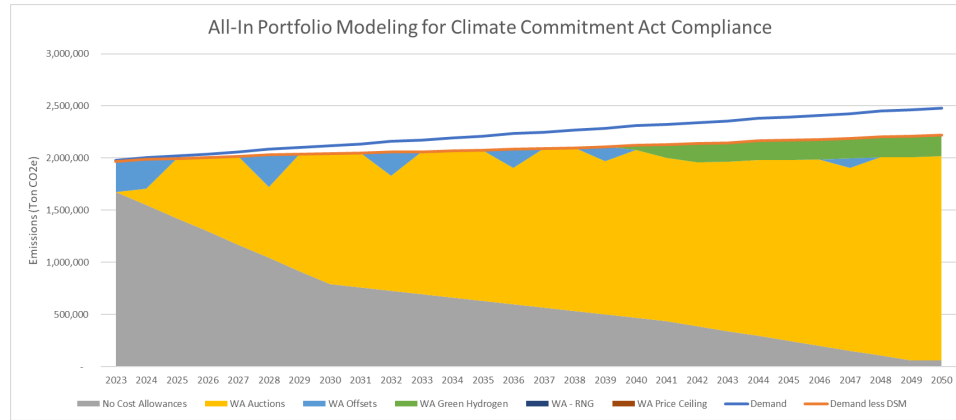
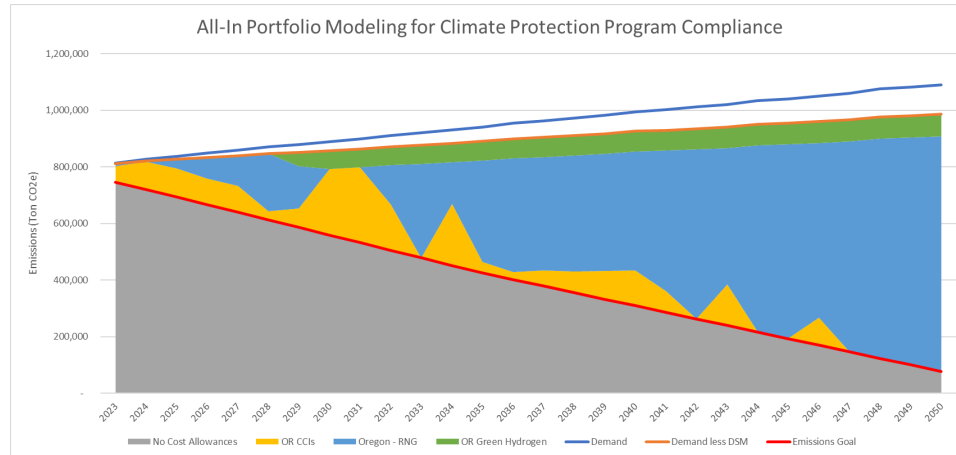


Figure 9-15: OR Projected Resource Stack for CPP Compliance



## Alternative Resources Selected

The primary resources in the Top-Ranking Candidate Portfolio were allowances from auction in WA and RNG in OR. RNG is a particularly important resource because it solves for both shortfalls identified in as-is modeling. It has already been discussed how RNG reduces Cascade's emissions, but on-system RNG projects that be injected directly into the Company's distribution system are able to eliminate the need for incremental upstream transportation that would otherwise have solved Cascade's upstream capacity shortfalls in 2046 in Washington and 2049 in Oregon.

### WA Auction Allowances

As discussed earlier, a successful auction participation strategy will be pivotal to the Company's success in complying with the Climate Commitment Act in Washington. Even at the higher end of projected allowance prices, this resource is expected to be more cost-effective than

other options, particularly in early year while technology around resources like green hydrogen are still in a nascent stage. That being said, there will be many challenges that Company in its endeavor to successfully navigate the auction marketplace, including but not limited to predicting the behaviors of other participants, securing funding to meet the bid guarantee levels required to participate in the auction, and training Company staff to accurately utilize the Compliance Instrument Tracking System Service (CITSS) to execute planned strategies. To this end, Cascade has hired Guidehouse, a consulting firm with experience working with entities in other North American Cap and Trade/Invest programs implementing new regulations, including in California, Ontario, and Quebec. The Company is excited for this partnership, as it believes Guidehouse will give Cascade the tools to acquire these allowance resources in a least cost, least risk manner. More information about allowances can be found in Chapter 6, Environmental Compliance.

### **WA Offsets**

Offsets present Cascade with an additional tool to reduce emissions by investing in Washington communities performing actions related to carbon sequestration. While it has not yet been finalized what amount of investment will equate to an offset of 1 MTCO<sub>2e</sub>, the Company does believe that it will be an attractive resource to include in its resource stack. There are limitations to the number of offsets that can be used to demonstrate CCA compliance, up to eight percent of a covered entity's compliance obligation in the first compliance period and six percent thereafter. More information about offsets can be found in Chapter 6, Environmental Compliance.

### **OR CCIs**

Similar to Washington, Oregon has a mechanism in place where, through investment in the communities of Oregon, Cascade can reduce its emissions towards compliance with the CCA. CCIs can be used to meet up to 10 percent of a covered entity's compliance obligation in the first compliance period, 15% in the second compliance period and 20% in the third compliance period and thereafter. CCIs are a significant part of Cascade's early compliance strategy in Oregon as they are a cost-effective tool to hit compliance goals while RNG and green Hydrogen technologies are still developing. In later years, as CCIs become significantly more expensive, this resource is eventually phased out for the most part, to be replaced by RNG and Hydrogen in the resource stack. More information about CCIs can be found in Chapter 6, Environmental Compliance.

## Green Hydrogen

As discussed in Chapter 4, Supply Side Resources, Cascade is excited by the opportunity to utilize green Hydrogen as a long-term part of the Company's emissions compliance strategy in both WA and OR. Hydrogen is a bountiful and clean resource that has potential to be very cost-effective in the long term if investment in its use continues. Hydrogen is a smaller molecule than Methane and does not have the same heating value as traditional natural gas, which does present challenges related to safety and quality that must be addressed before it can be part of Cascade's resource stack. From a modeling perspective, this is addressed by constraining the volume of hydrogen that can be blended with traditional natural gas and renewable natural gas to 20% of the volume. This number comes from a 2013 NREL study, where it was concluded that "If less than 20% hydrogen is introduced into distribution system, the overall risk is not significant for both distribution mains and service lines." While this works for theoretical modeling, Cascade recognizes that it will have to perform its own research before implementing Hydrogen in practice. The Top-Ranking Candidate Portfolio does come within one percent of this constraint until 2046 in Washington, and 2030 in Oregon.

## RNG

As discussed in Chapter 6, Environmental Policy, there are challenges to using RNG as a compliance resource in Washington. Ecology placed some geographic limitations for qualifying RNG outside of Washington for this exclusion within the WAC 173-441 GHG reporting rule and Cascade has placed limits on RNG accordingly as a compliance option in IRP modeling. In Oregon, DEQ has taken a more favorable perspective towards the utilization of RNG produced outside of the Pacific Northwest, leading to RNG being the most significant mid-to-long-term resource in compliance with the CPP. One challenge with modeling RNG is trying to derive constraints for the maximum amount of RNG that the Company believes it can acquire over the planning horizon that is both aggressive to reflect Cascade's position that it needs to be competitive in RNG markets, while also plausible to keep modeling results prudent. To do this, Cascade used a 50/50 split of the high and technical RNG potential identified in a 2019 ACF/ICF study to establish the potential amount of total RNG available for acquisition. From there, the Company calculated the ratio of its 2020 total sales to the EIA published figures for total 2020 US natural gas consumption (the most current information available at the time of calculation) and multiplied this ratio by the potential volumes identified in the ACF/ICF study to set the upper limit for RNG constraints in the PLEXOS® model. It is important to note that, similar to with green Hydrogen, just because the model has these upper limits does not mean that it will maximize the utilization of

RNG if it is not cost effective. In fact, in the short-term (pre-2030) the highest RNG saturation is about 30.20% of the maximum constraint, while in later years the highest saturation is 44.86%, aligning with the Company's goal of aggressive but also prudent planning.

### **Incremental DSM**

As discussed early in this chapter, incremental DSM is vital resource for delaying the need for incremental upstream capacity. DSM is also a key cost-effective resource for mitigating Cascade's emissions, reducing the need for the most expensive supply side measures discussed above. The most powerful element of DSM is its cumulative impact, as measured installed in year one will have impacts far into the rest of the planning horizon, while measures installed in the next year will see their impacts added to those already installed in year one. This can be visually in the widening gap between the blue and orange lines in Figures 9-14 and 9-15. Quantitatively, DSM reduces emissions in Washington by only .5% in 2023, but as high as 10.50% in 2050. More information about DSM can be found in Chapter 7, Demand Side Management.

### **Marginal Abatement Cost Curves**

Marginal abatement cost curves (MACC) are a valuable tool for visualizing the relationship between the resources selected in the Top-Ranking Candidate Portfolio under a common metric: The cost to remove 1 MTCO<sub>2e</sub> from the Company's emissions. Figure 9-16 shows how the curves changes every five years of the planning horizon to illustrate how some resources like Hydrogen become more cost effective over time, while others like price ceiling allowances become cost prohibitive. Figure 9-17 is a more traditional MACC, showing the relationship between resources selected in 2050 to meet emissions reduction requirements, including the cost as represented by the Y-axis and the volumes utilized as represented by the width of the various columns. Additional MACCs can be found in Appendix K.

Figure 9-16: Washington Marginal Abatement Cost Curves – By Resource

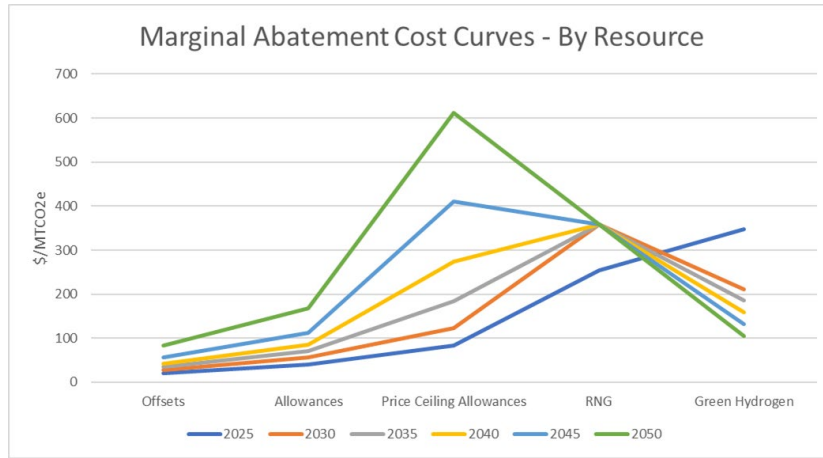
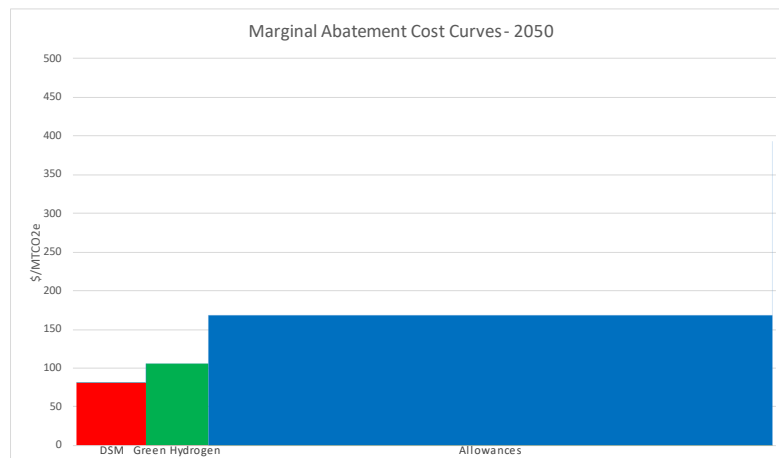


Figure 9-17: Washington Marginal Abatement Cost Curves – 2050



### Alternative Resources Not Selected

The PLEXOS<sup>®</sup> model did not select the following resources for the Top-Ranking Candidate Portfolio:

#### Upstream Transport

Typically, additional upstream transportation will be identified as an optimal element of the Top-Ranking Candidate Portfolio when it is able to either solve for a forecasted shortfall or lower the Total System Cost of the portfolio by enabling access to a more cost-effective supply at a cost that is lower than the cost of acquiring said transportation. For the 2023 IRP transportation contracts were not an optimal means of solving for the shortfalls identified in the As-Is analysis because they do not provide a means for lowering emissions in the same way that on system RNG is able to. Additionally, PLEXOS<sup>®</sup> did not identify any



cost arbitrage opportunities for accessing lower cost supplies, so no incremental upstream transportation was selected as part of this IRP's Top-Ranking Candidate Portfolio.

### **Supply**

- Opal Incremental – Since PLEXOS® determined there was no need for incremental Ruby capacity, there is no need to purchase additional gas to move along Ruby.
- Pacific Connector - Cascade's market intelligence determined that at this time, the Pacific Connector would not create a significant enough impact on liquidity at Malin to impact Cascade's modeling.

### **Storage**

Gill Ranch, Clay Basin, Wild Goose, AECO Hub, Spire Storage– No incremental storage was selected. None of these storage facilities modeled were cost effective or led to an increase in served demand or lowered emissions. The primary reason appears to be that each storage facility modeled required long-term incremental transportation.

## **Portfolio Evaluation: Scenario Analyses**

As discussed earlier in this Chapter, Cascade modeled five scenarios in addition to its base case scenario. The objective of these scenarios is capturing a wide range of externalities related to the availability and cost of supply and demand side resources, growth, and environmental policy compliance. For each scenario, Cascade will present the impact to total system cost over the planning horizon, bill impacts for Washington residential customers, and projected emissions reduction compliance resource stacks for Washington and Oregon. A qualitative analysis will follow with key takeaways from review of the results.

### **Scenario 2: Carbon Neutral by 2050**

This scenario models Cascade theoretically adopting a policy of going carbon neutral by 2050. As a caveat, this means the Company would be considered carbon neutral under the framework of the CCA in Washington and CPP in Oregon, so tools like auction-based allowances and CCIs are allowed to be utilized towards the objective of zero emissions by 2050. In this scenario, growth is assumed to follow the base 2023 IRP Load Forecast, including all expected regional gas bans, while DSM inputs come from the high CPAs discussed earlier in this chapter. The constraint for RNG availability is calculated the same way as discussed earlier in the Top-Ranking Candidate Portfolio Alternative Resources Selected, except the ratio of Cascade's load

to nationwide consumption multiplied by only the technical potential in the ACF/ICF Study. That being said, any volumes selected above and beyond the base case availability are priced at a higher tranche of \$26/dth. The constraint on Hydrogen is also increased to 30% of supply by volume to test if additional Hydrogen would be desirable in conjunction with a carbon neutral strategy. If so, such a volume would have to be heavily tested before it could be implemented in practice. Finally, the price of traditional natural gas is modeled to be 10% lower than base case modeling, as it is assumed Cascade would be joining a regional effort toward carbon neutrality in this scenario, which could result in bearish pressure towards gas prices as demand would be lower across the board.

Figure 9-18: Base Case Vs. Scenario 2 -Total System Cost by Year

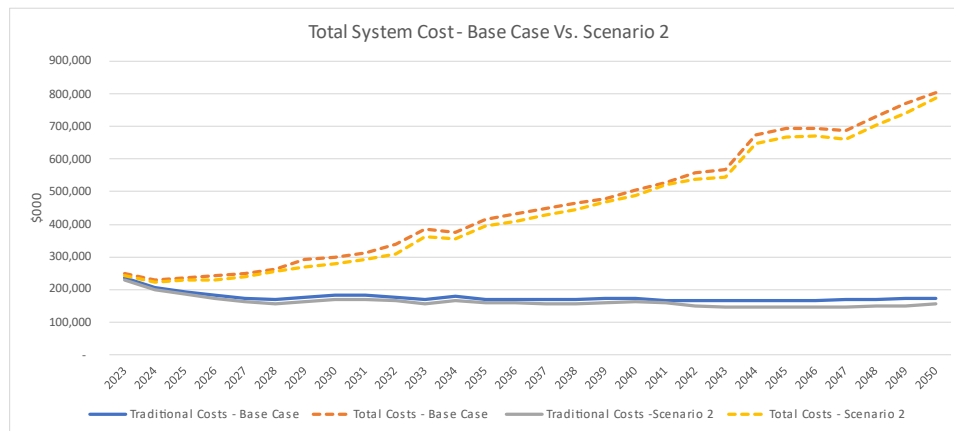


Figure 9-19: Scenario 2 WA 503 (Residential) Rate Class Bill Impact Analysis

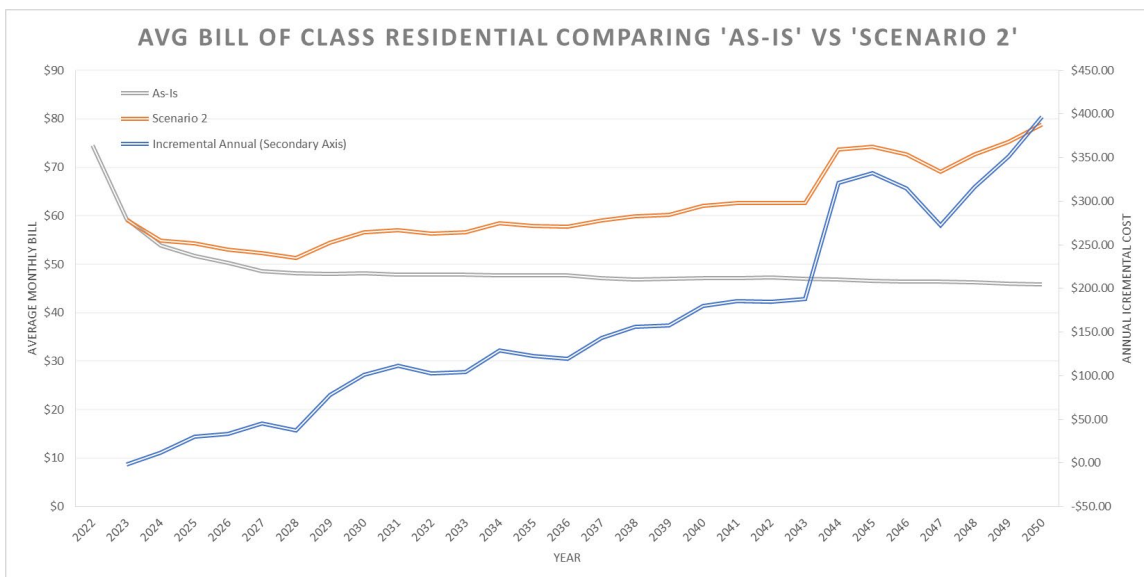


Figure 9-20: Scenario 2 WA Projected Resource Stack for CCA Compliance

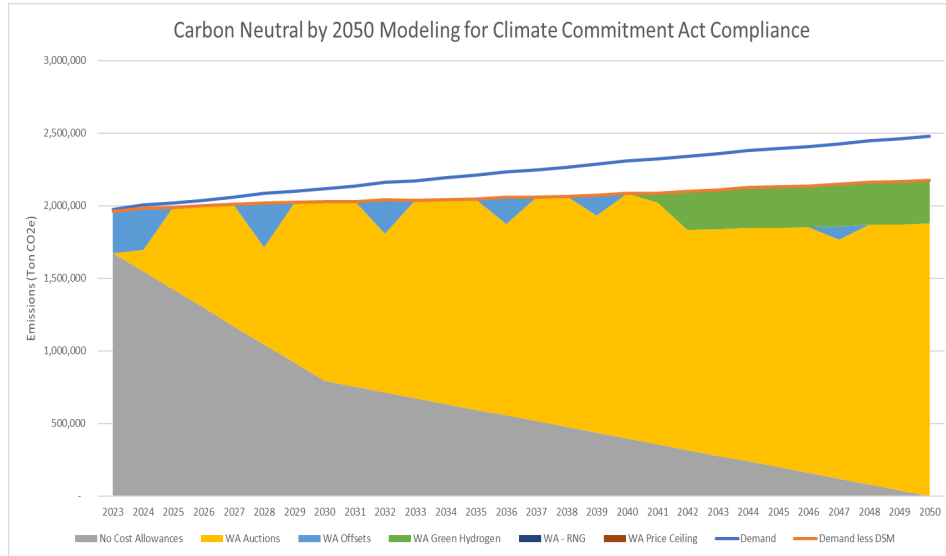
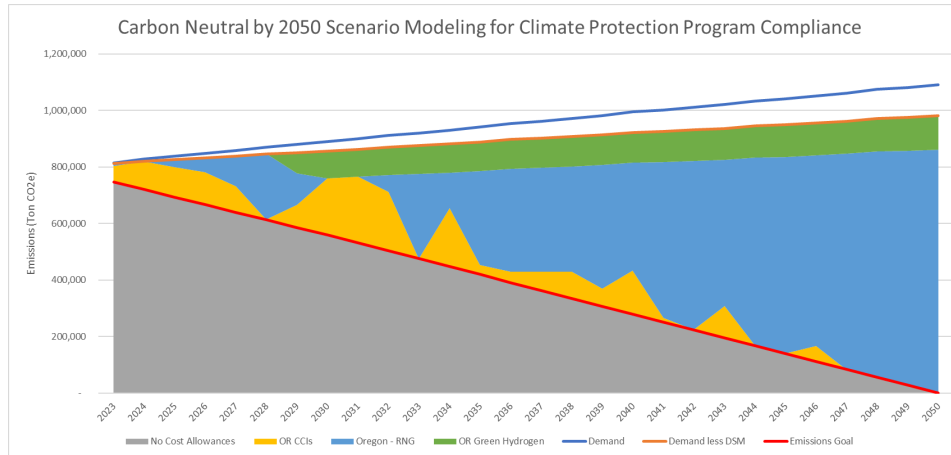


Figure 9-21: Scenario 2 OR Projected Resource Stack for CPP Compliance



## Scenario 2: Key Takeaways

The primary takeaway from this scenario is that the Company is confident it would be able to serve its customers and meet carbon reduction goals under deterministic conditions even with an aspirational goal of being carbon neutral by 2050. That being said, an important resource in achieving this goal in a cost-effective manner is the increased utilization of green Hydrogen. Similar to the Company’s base case modeling, Hydrogen is within 1% of maximum utilization in Washington by 2046, and in Oregon by 2030. This would put the Company well over the currently theorized safe threshold of a 20% blend by volume. This does not mean that Cascade would be engaging in unsafe practices, but rather emphasizes

that research into ways to effectively utilize hydrogen in safe manner, including the potential need for investing in future technologies to facilitate higher blending limits, or potentially even independent Hydrogen distribution systems, are expected to be needed as part of a cost-effective strategy to hit carbon neutrality. Finally, an encouraging result of this modeling was the fact that total costs fluctuate between approximately 1.29% and 8.90% lower in this carbon neutral scenario when compared to base case costs. This reduction is driven by two assumptions: Access to more green Hydrogen, which is a significantly more cost-effective resource in later years, and the general 10% reduction to the price of traditional natural gas modeled in these scenarios. While it would not be prudent to conclude that going carbon neutral would automatically be a more cost-effective pathway, it is fair to say that if market conditions were to lead to the realization of those two assumptions, cost would not be a significant barrier to carbon neutrality.

### **Scenario 3: Limited RNG Availability**

This scenario models a world where higher than expected competition for RNG, coupled with stagnation in technological developments related to RNG and Hydrogen, leads to a constraint of a limited amount of RNG and Hydrogen available for acquisition. In this scenario, growth is assumed to follow the base 2023 IRP Load Forecast, including all expected regional gas bans, while DSM inputs come from the high CPAs discussed earlier in this chapter. The constraint for RNG availability is calculated the same way as discussed earlier in the Top-Ranking Candidate Portfolio Alternative Resources Selected, except the ratio of Cascade's load to nationwide consumption multiplied by only the low potential in the ACF/ICF Study. The constraint on Hydrogen is also decreased to 5% of supply by volume to model the impact of a need to be more conservative in Hydrogen blending limits due to technological limitations. Finally, the price of traditional natural gas is modeled to be the same as in the base case.

Figure 9-22: Base Case Vs. Scenario 3 -Total System Cost by Year

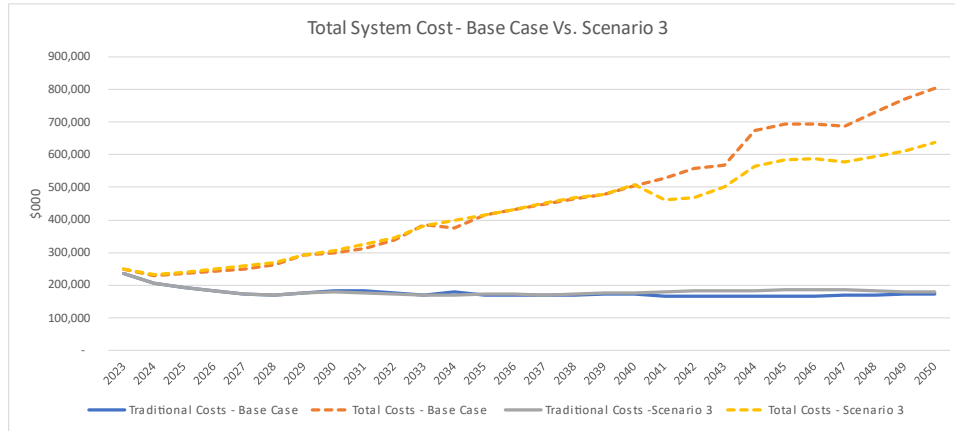


Figure 9-23: Scenario 3 WA 503 (Residential) Rate Class Bill Impact Analysis

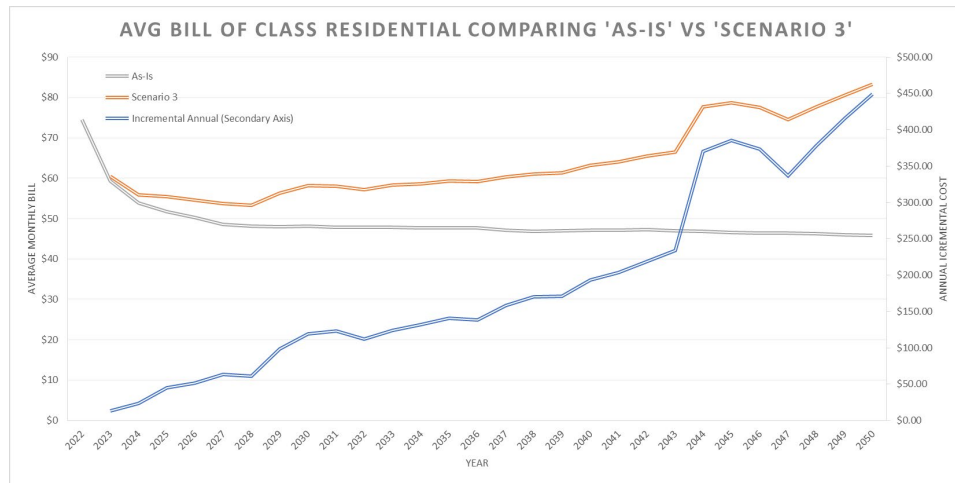


Figure 9-24: Scenario 3 WA Projected Resource Stack for CCA Compliance

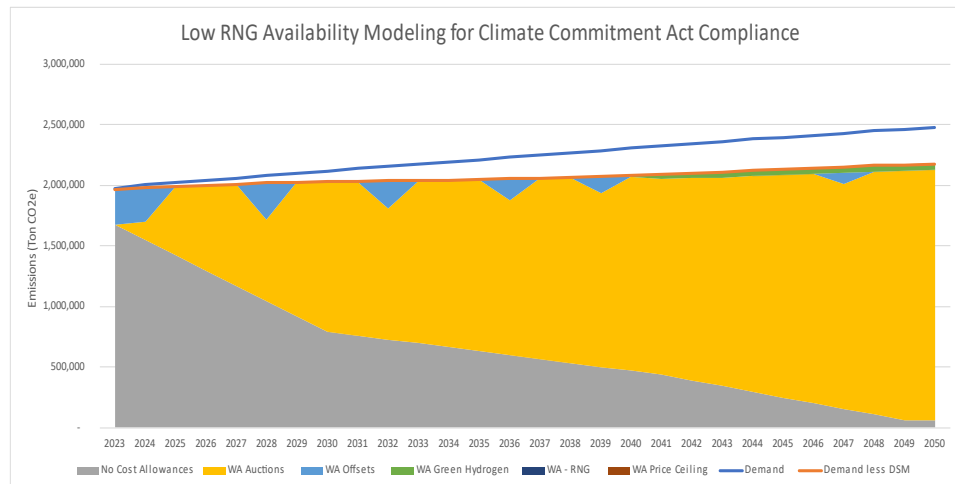
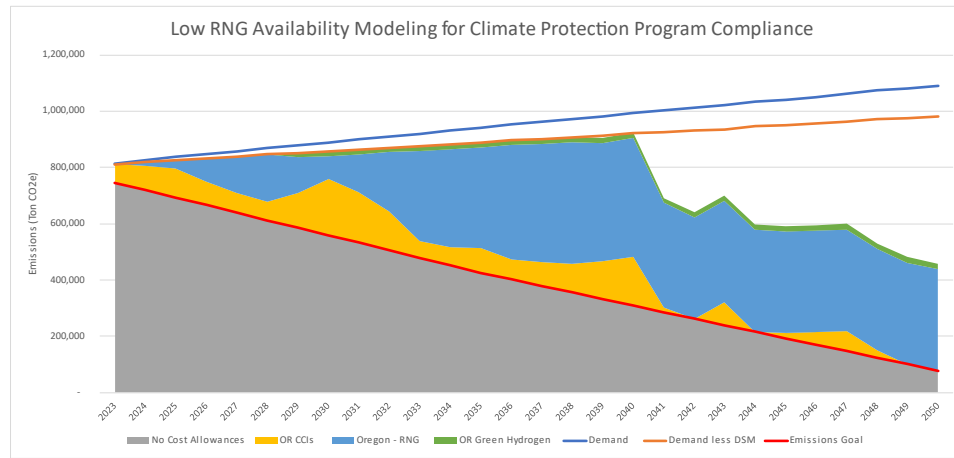


Figure 9-25: Scenario 3 OR Projected Resource Stack for CPP Compliance



### Scenario 3: Key Takeaways

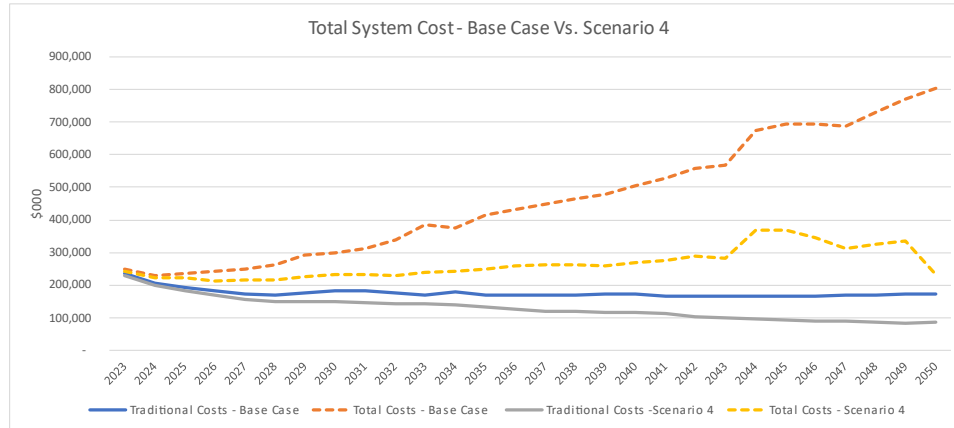
The primary takeaway from this scenario is that, while the Company is confident in its ability to meet emissions reduction goals with reduced availability of RNG and Hydrogen, Cascade will have difficulty reaching its goals in Oregon. These results forced the Company to reevaluate the Top-Ranking Candidate Portfolio (Step 6 of the Supply Resource Optimization Process) to consider alternative portfolios and restart the Scenario evaluation process. Ultimately it was determined that no other portfolio would have more success meeting emissions reduction goals under a limited RNG/Hydrogen scenario, so rather than reject the Top-Ranking Candidate Portfolio, the Company has elected to use these results to reaffirm its position that aggressive pursuit of RNG will be vital to Cascade’s successful compliance with the CPP in Oregon. Additionally, while costs were higher while Cascade was in compliance in this low RNG scenario, costs were never more than six percent higher than base case projected costs, which the Company deems a tolerable level of variance.

### Scenario 4: Increased Electrification

This scenario models lower than expected load growth projections due to both discretionary electrification and increased regional bans on natural gas. In this scenario, customer growth in Cascade’s residential, and commercial rate classes gradually slows to zero growth in 2025 and afterwards, residential and commercial customer count reduced to 10% by 2050. This incorporates all expected and proposed regional gas bans. DSM inputs come from the high CPAs discussed earlier in this chapter, as aggressive energy efficiency efforts would be complimentary to any electrification efforts. The constraints for RNG and Hydrogen availability are calculated the same way as discussed earlier in the Top-Ranking Candidate Portfolio Alternative Resources Selected. Finally,

the price of traditional natural gas is modeled to be 10% lower than base case modeling, as it is assumed that electrification efforts would impact all regional utilities, which could result in bearish pressure towards gas prices as demand would be lower across the board.

**Figure 9-26: Base Case Vs. Scenario 4 -Total System Cost by Year**



**Figure 9-27: Scenario 4 WA 503 (Residential) Rate Class Bill Impact Analysis**

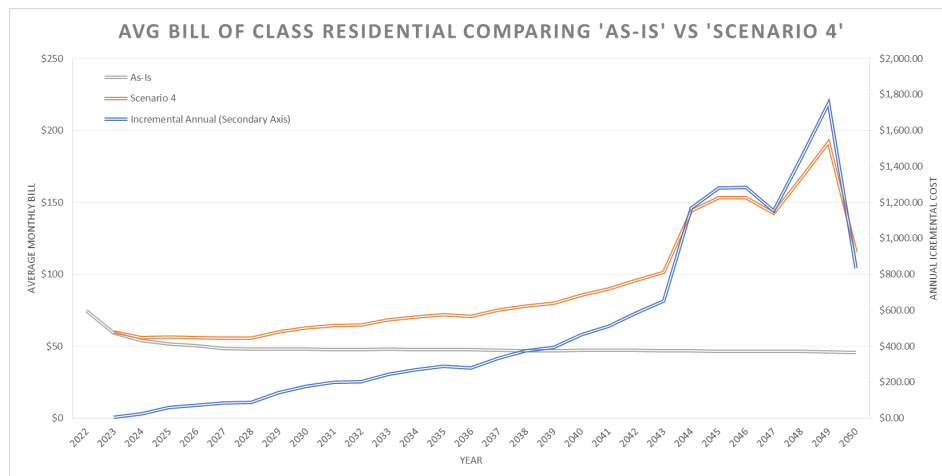


Figure 9-28: Scenario 4 WA Projected Resource Stack for CCA Compliance

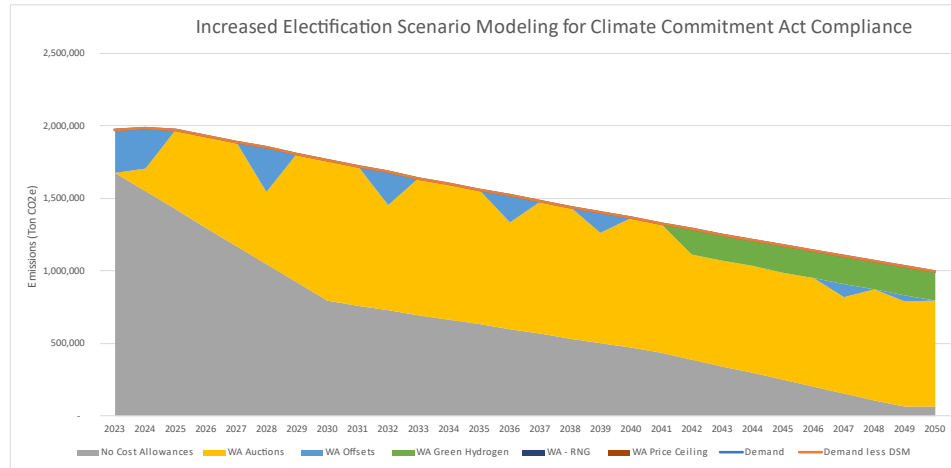
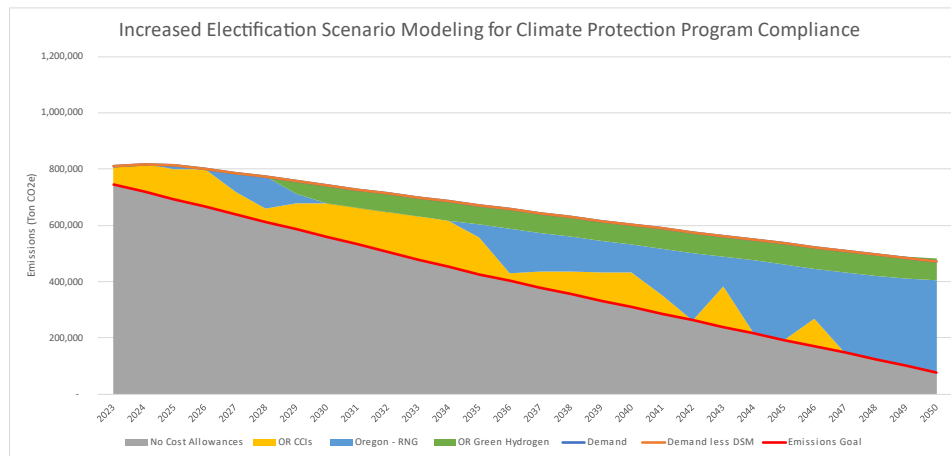


Figure 9-29: Scenario 4 OR Projected Resource Stack for CPP Compliance



### Scenario 4: Key Takeaways

The primary takeaway from this scenario is that while Total System Costs for Cascade appear to be significantly lower in an electrification scenario, the impact to residential customer bills is alarming. At its peak, residential bills in this scenario will go approximately 318%, as opposed to just 80% in base case modeling, while the average annual increase in the electrification scenario is 91% versus only 33% in base case modeling. This alarming difference reaffirms the Company’s position that any efforts to undertake a dramatic move toward electrification must not be done without a detailed understanding of the regional impact of such a shift of load. While Cascade’s cost may be lower, this comes at the consequence of a significant load increase to regional electric utilities, with all of the risks associated with the ability to serve such a dramatic influx of customers. Additionally, those utilities are presumably already utilizing their lowest cost, lowest risk resources to serve their existing customers. The costs to



add these new customers may force those utilities to explore higher cost resource for electricity generation and their own emission mitigation. This does not even account for the significant cost to customers to replace existing gas units with their electric counterparts, a cost that will need to be accounted for in a regional electrification analysis before any action should be undertaken.

### Scenario 5: High Customer Growth

This scenario models a world when customer growth is higher than Cascade’s forecasts, leading to higher-than-expected emissions that will need to be accounted for in compliance with the CCA and CPP. In this scenario, growth is assumed to follow the high growth 2023 IRP Load Forecast, including all expected regional gas bans, while DSM inputs come from the high CPAs discussed earlier in this chapter. The constraint for RNG availability is calculated the same way as discussed earlier in the Top-Ranking Candidate Portfolio Alternative Resources Selected, except the ratio of Cascade’s load to nationwide consumption multiplied by only the technical potential in the ACF/ICF Study. That being said, any volumes selected above and beyond the base case availability are priced at a higher tranche of \$26/dth. The constraint on Hydrogen is also increased to 30% of supply by volume to test if additional Hydrogen would be desirable to supply higher than expected growth. If so, such a volume would have to be heavily tested before it could be implemented in practice. Finally, the price of traditional natural gas is modeled to be 10% higher than base case modeling, as it is assumed that high growth would not be isolated to Cascade’s service territory but rather a regional phenomenon, which could result in bullish pressure towards gas prices as demand would be higher across the board.

Figure 9-30: Base Case Vs. Scenario 5 -Total System Cost by Year

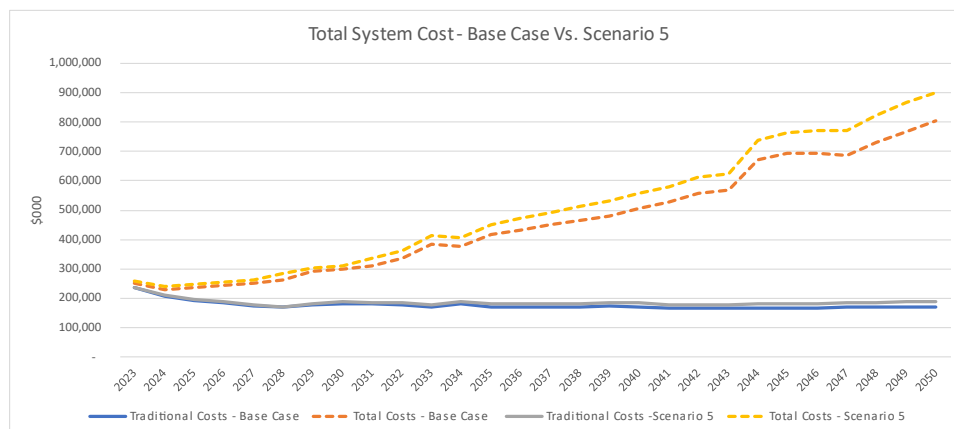


Figure 9-31: Scenario 5 WA 503 (Residential) Rate Class Bill Impact Analysis

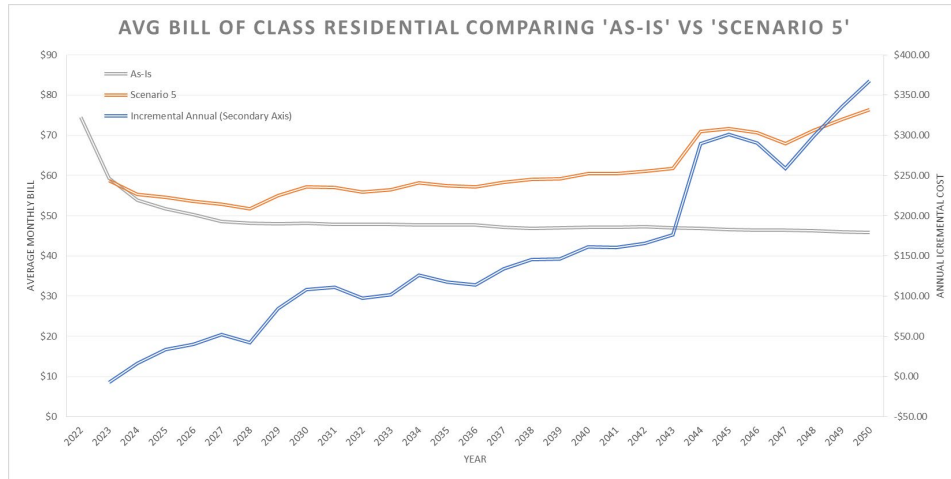


Figure 9-32: Scenario 5 WA Projected Resource Stack for CCA Compliance

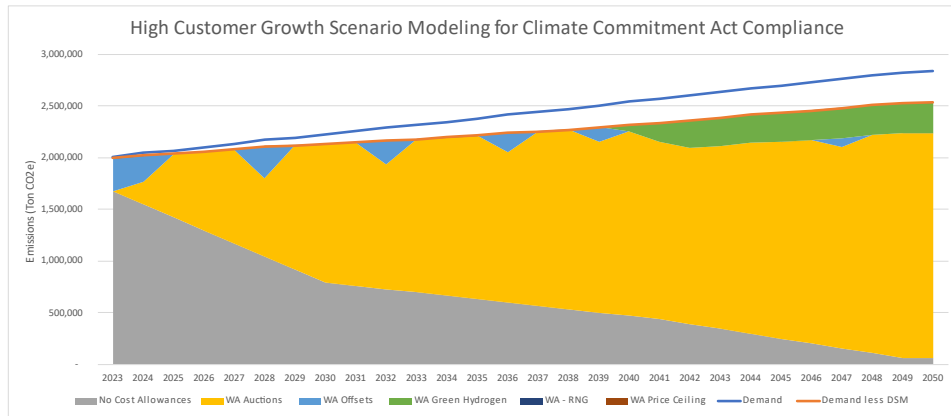
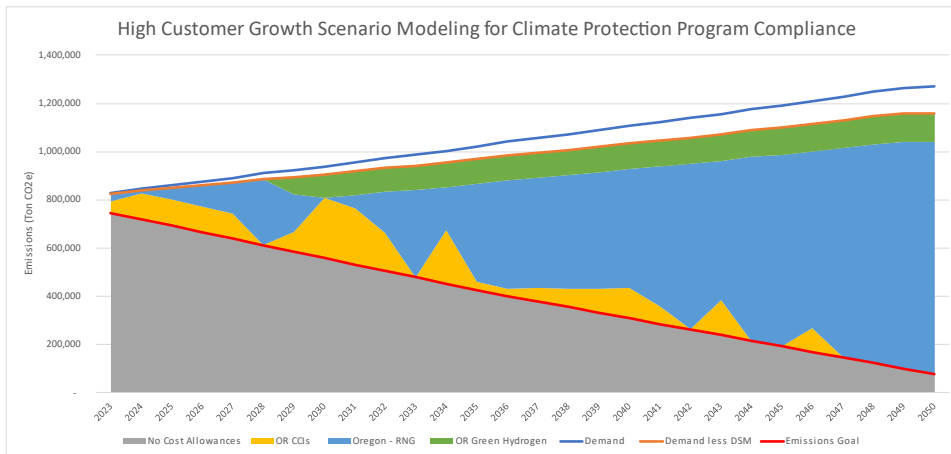


Figure 9-33: Scenario 5 OR Projected Resource Stack for CPP Compliance



### **Scenario 5: Key Takeaways**

The primary takeaway from this scenario is that the Company is confident it would be able to serve its customers and meet carbon reduction goals under a high customer growth scenario. That being said, an important resource in achieving this goal in a cost-effective manner is the increased utilization of green Hydrogen. Similar to the Company's base case modeling, Hydrogen is within 1% of maximum utilization in Washington by 2046, and in Oregon by 2030. This would put the Company well over the currently theorized safe threshold of a 20% blend by volume. This does not mean that Cascade would be engaging in unsafe practices, but rather emphasizes that research into ways to effectively utilize hydrogen in safe manner, including the potential need for investing in future technologies to facilitate higher blending limits, or potentially even independent Hydrogen distribution systems, are expected to be needed as part of a cost-effective strategy to hit carbon neutrality. This scenario also sees an increased utilization of auction allowances in Washington and CCIs in Oregon, which emphasizes the importance of Cascade working with a consultant like Guidehouse for assistance in with participating in these programs. Guidehouse is currently working with Cascade on developing internal strategies related to variance in customer growth, along with other externalities, so the Company will be prepared to optimally acquire these resources even if actual market conditions manifest differently from deterministic planning. Finally, this scenario presents the highest increase in total system cost relative to base case planning, with a forecasted increase of 12.87% at the highest point. This is largely driven by the modeled increase in natural gas pricing resulting from higher regional demand, as well as the need to acquire more compliance instruments and higher priced RNG to meet emissions reduction goals. Cascade is confident that it will be able to mitigate the impact of traditional natural gas pricing to some extent through its hedging strategies discussed in Chapter 4, Supply Side Resources, while the remaining increase, while significant, is not large enough to consider rejecting the Top-Ranking Candidate portfolio under these conditions.

### **Scenario 6: High Price – Interrupted Supply**

This scenario models Cascade having to navigate three unique partial interruptions to its traditional natural gas supply basins. While the Company is not attempting to predict how these interrupts may manifest, it may be helpful to think of these incidents in terms of recent events that have impacts supply, such as the Enbridge explosion that limited Sumas supplies in 2018 or the recent Freeport LNG explosion that impact importers of US LNG. Theoretically, these incidents could also be related

to geopolitical strife, where an international conflict could potentially impact Cascade’s ability to access a basin that Company expects to utilize to serve demand. In this scenario, growth is assumed to follow the base 2023 IRP Load Forecast, including all expected regional gas bans, while DSM inputs come from the Company’s base case CPAs. The constraint for RNG and Hydrogen availability is calculated the same way as discussed earlier in the Top-Ranking Candidate Portfolio Alternative Resources Selected. Finally, the price of traditional natural gas is modeled to be follow the Company’s base case modeling until an incident occurs, at which point prices spike to the 99<sup>th</sup> percentile of stochastic pricing of the basin where the incident occurs, with other basins experiencing correlated increases. For this scenario, it is modeled that an incident occurs at the Rockies basin on 10/1/2028, where supply is reduced to seventeen percent of expected availability, at the Sumas basin on 4/1/2034, where supply is also reduced to seventeen percent of expected availability, and at the AECO basin on 9/1/2046, where supply is reduced to 33% of expected availability. For incidents, supply comes back on line linearly over the course of two years until it returns to 100% capacity.

Figure 9-34: Base Case Vs. Scenario 6 -Total System Cost by Year

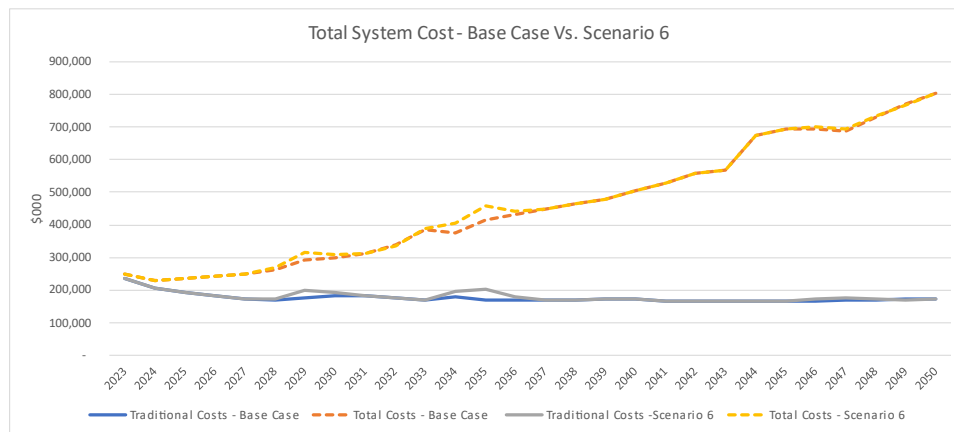


Figure 9-35: Scenario 6 WA 503 (Residential) Rate Class Bill Impact Analysis

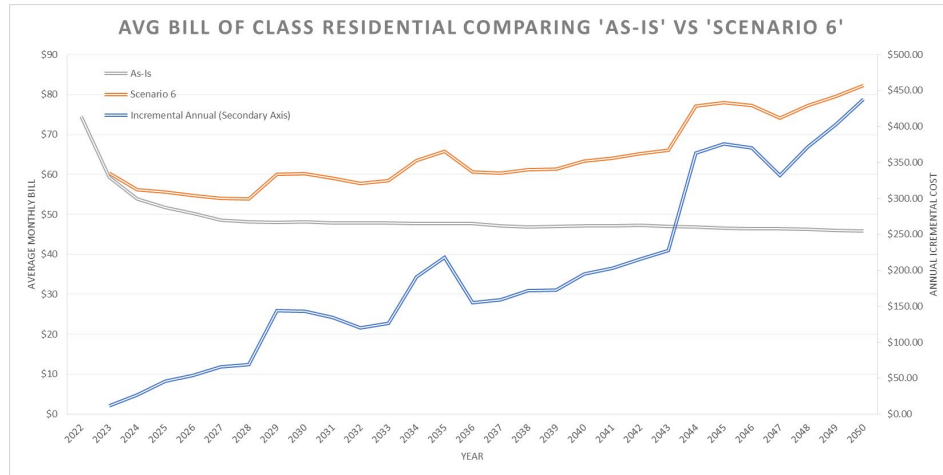


Figure 9-36: Scenario 6 WA Projected Resource Stack for CCA Compliance

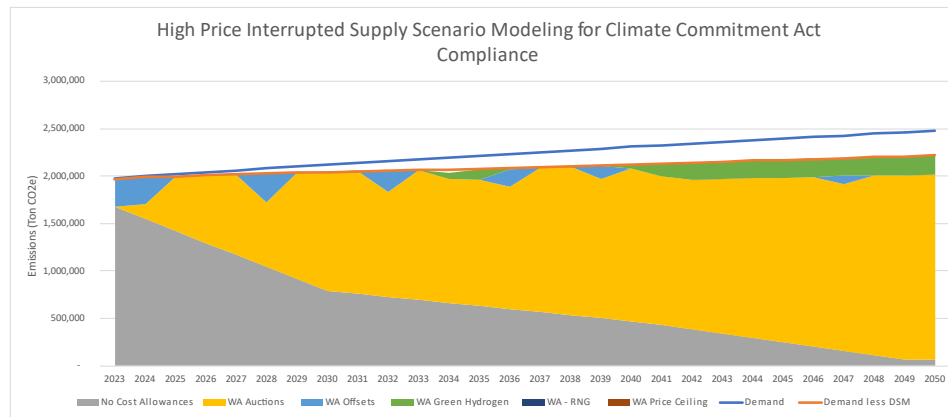
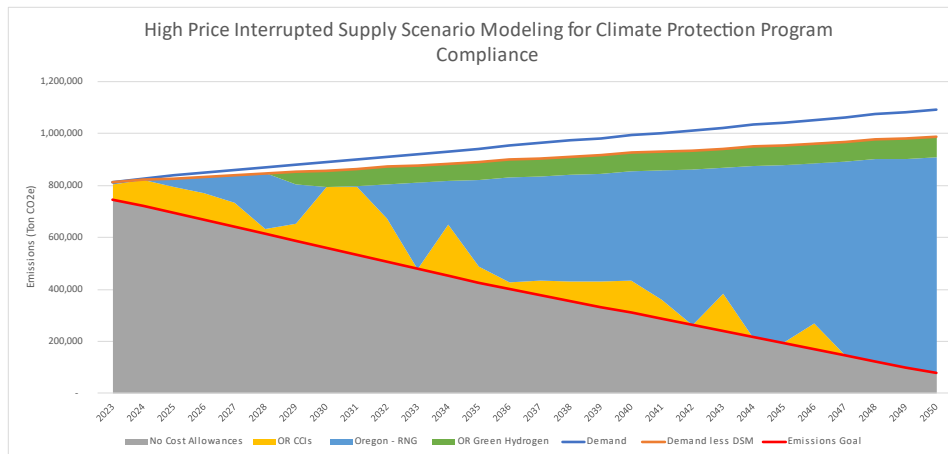


Figure 9-37: Scenario 6 OR Projected Resource Stack for CPP Compliance



## Scenario 6: Key Takeaways

The primary takeaway from this scenario is that the Company is confident it would be able to serve its customers and meet carbon reduction goals under deterministic conditions even with intermittent shocks to supply basin availability. Even though Cascade's PLEXOS® modeling identifies that the Company would not be able to fully serve demand during the modeled Sumas incident in 2034, Cascade can draw on the actual Sumas incident of 2018 as an example of how human interactions can sometimes override modeled conclusions that cannot account for said human elements. Another interesting conclusion is that the timing of Cascade's entrance into Hydrogen markets could be impacted by incidents like the ones modeled in this scenario. In base case modeling, Cascade does not forecast utilization of green Hydrogen to start until 2040, but in this scenario, the model identifies Hydrogen as a cost-effective resource starting in 2034, with utilization of the 20% maximum getting as high in the mid-term as approximately 67% utilization by 2035. This introduces an additional benefit of exploring Hydrogen as a long-term resource: Insulation against potential price and availability shocks in the traditional natural gas marketplace.

## Conclusion

Cascade's All-In portfolio includes all existing supply side resources as discussed in Chapter 4, all projected DSM savings discussed in Chapter 7, and all incremental resources discussed in this chapter. The All-In portfolio passed extensive scrutiny in the scenario analysis portion of the Supply Resource Optimization Process. This allows Cascade to deem this to be the Preferred Portfolio, which is the lowest cost and risk mix of resources to serve demand and meet emissions reductions goals when considering all alternate supply and demand side resources. This is primarily due to Cascade's geographical spread across the region. The Company's existing long-term transportation contracts, coupled with robust supply basins, provide a base foundation to meet the load needs of Cascade's core customers. However, Cascade's unique geographical reach also creates particular challenges as the system is non-contiguous, often requiring the Company to hold transportation capacity on multiple upstream pipelines to feed the single upstream pipeline that is connected to a particular citygate.

Scenario analyses allowed Cascade to identify a number of threats to its ability to successfully meet customer demand over the 28-year planning horizon, including the need to identify safe blending limits for hydrogen, aggressively acquire RNG when cost effective, prepare strategies for participation in Washington's auction marketplace and Oregon's CCI program, and continue to advocate for robust analysis of the regional costs and impacts of electrification. Cascade has determined

that this portfolio solves for resource deficiencies at an acceptable cost. Many events could occur between now and when resource needs materialize, so Cascade will employ adaptive management to be prepared. The Company will continue to monitor and analyze system demand through reconciling and comparing forecast to actual customer counts and will continually update and evaluate all demand side and supply-side alternatives.

## **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

- Six TAG meetings were held. Cascade continued COVID-19 protocols with all TAG meetings held virtually.
- 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](http://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, the League of Women Voters, 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 2023 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.<sup>1,2</sup>

Cascade notifies these segments in several ways, including:<sup>3</sup>

- Social media
- Meetings throughout service territory<sup>4</sup>
- Invite to docket distribution lists relevant to the IRP
- Web page
- Commission web page

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.<sup>5,6</sup>

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

---

<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> 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.

<sup>4</sup> On August 14, 2019, Cascade held a TAG meeting in Bend, Oregon. Despite notification to the community, no customer attended.

<sup>5</sup> See: <https://www.cngc.com/rates-services/rates-tariffs/oregon-integrated-resource-plan>

<sup>6</sup> See: <https://www.cngc.com/rates-services/rates-tariffs/washington-integrated-resource-plan>

personnel to address any related issues. Additionally, Cascade hosts the 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."

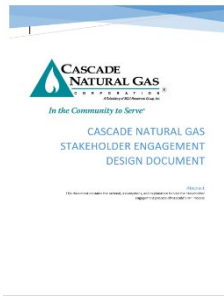
In the past decades, "rules of the road" for participation in utility advisory groups and collaboratives have ranged from full informality to specific charters. The latter has taken significant time for crafting and agreement by all parties. Cascade's Stakeholder Design Document attempts to capture the 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**

Cascade held six public TAG meetings with internal and external stakeholders. Due to the COVID-19 pandemic, all meetings were held as virtual meetings only. In previous cycles, the Company held in-person meetings at various locations in its service territory to be more easily accessible, recognizing its IRP stakeholders are widely spread geographically. Cascade held a TAG 6 meeting after the draft IRP was distributed and comments returned to Cascade, which helped inform the TAG 6 material.

Information about each meeting date and major agenda items are provided below as well as in Appendix A.



**2023 IRP TAG 1 Meeting** – Wednesday, March 30, 2022

Microsoft Teams Only from 9 am to 2 pm

- IRP Timeline
- Process
- Regional Market Outlook
- Plan for dealing with issues raised in 2020 IRP

**2023 IRP TAG 2 Meeting** – Wednesday, May 18, 2022

Microsoft Teams Only from 9 am to noon

- Demand and Customer Forecast
- Forecast Results
- Pipeline Presentations

**2023 IRP TAG 3 Meeting** – Wednesday, June 29, 2022

Microsoft Teams Only from 9 am to noon

- Distribution System Planning
- Planned Scenarios and Sensitivities
- Price Forecast
- Avoided Cost

**2023 IRP TAG 4 Meeting** – Wednesday, August 10, 2022

Microsoft Teams Only from 9 am to 3 pm

- Carbon Impacts
- Energy Efficiency
- Renewable Natural Gas
- Preliminary Resource Integration

**2023 IRP TAG 5 Meeting** – Thursday, October 20, 2022

Microsoft Teams Only from 9 am to noon

- Final Integration Results
- Finalization of plan components
- Proposed new 4-year Action Plan

**2023 IRP TAG 6 Meeting** – Wednesday, February 1, 2023

Microsoft Teams Only from 1 pm to 2:30 pm

- Customer Bill Impact Analysis
- Stochastic Analysis Results
- Building Code Impacts

## **Conclusion**

Cascade submits 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**

### **Two-Year Action Plan**

## 2023 Action Plan

The IRP Action Plan demonstrates Cascade's commitment to implementing the Company's Integrated Resource Plan and creating a portfolio of resources with the reasonable least cost mix of energy supply resources and conservation.

### Key Points

Cascade's 2023 Action Plan focuses on:

- Resource Planning
- Environmental Policy
- Avoided Cost
- Demand Side Management
- Renewable Natural Gas
- Distribution System Planning
- IRP Process

## Resource Planning and Environmental Policy

Cascade recognizes the importance of gathering best practices from other jurisdictional LDCs. To that end, the Company will continue to participate in the IRP process of at least three regional utilities over the course of the next two years with the objective of incorporating aspects that may enhance Cascade's IRP. Cascade will also attempt to get additional stakeholder involvement through convening the IRP TAG meetings in various locations within Cascade's territory, updates to Company website, and/or other means.

Cascade will also:

- Continue to develop the Company's new PLEXOS model.
- Cascade will purchase the anticipated required offsets, allowances, or RNG to meet the carbon reduction goals laid out by the Climate Commitment Act.
- Cascade will purchase the necessary amount of RNG for the Company's voluntary RNG program.
- Cascade will continue to investigate the cost and feasibility of a potential hydrogen plant as an alternative resource.
- Continue to participate in the local climate community action plans around Cascade's service territory.

## Avoided Cost

Cascade will investigate incorporating a separate avoided cost for transportation (non-core) customers. Cascade will also explore how environmental compliance costs from the CCA/ CPP will impact the avoided cost calculation.

## Demand

Cascade will look into incorporating end use forecasting into the load forecast model. With the increase in building code changes, Cascade will need to gain a better understanding on usage by end use and how the building code changes will impact future demand. Cascade will also look into incorporating income as an explanatory

variable. Finally, the Company will incorporate Monte Carlo simulations on customer counts in future IRP iterations.

### **Demand Side Management (Energy Efficiency)**

To assist with increasing its capacity to capture energy savings, Cascade is in process of developing an internal rebate software solution 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, particularly in the new home arena with code changes arising throughout the service territory.

An enhanced focus will be placed upon growing the LI program through revisions in measure offerings and fine-tuning energy savings assumptions. The Company is also looking to build upon the successes found within the commercial custom rebate program by incorporating a custom residential rebate tailored to the service territory. Additionally, the Company is exploring and starting pilot efforts including behavioral savings efforts through home energy reporting and advanced air sealing options to name a few.

These focuses along with other improvements in the adaptive change management process sets the program up for increasing capacity to manage higher rebate submissions starting in 2023.

The program has proven itself adaptable to changes in code and technology advancement. Scenarios B & C represent a subset of continued forecasting in the RNG and municipal gas code spaces. Cascade currently recognizes a shortcoming of information in the industry surrounding natural gas use restrictions and the impact of code changes on the future gas market. The Company's internal code expert will be engaged as a resource to assist in development of the next CPA.

The CPA developed in 2023 will target an earlier delivery date than historical precedent to better match the deliverable timetable of other utilities in the area and accommodate upcoming code and local discussions. This will be a concerted effort and will require coordination with the CAG and WUTC to accommodate. Ultimately this timetable will allow Cascade to better inform deliverables reliant on conservation potential including the BCP and IRP.



## Distribution System Planning

The Company will address the following Action Items for Distribution System Planning.

- Implement various stages or review of the of the list of projects that require an increase in capacity as shown in Appendix I.

Figure 11-1 on the following page highlights specific activities of the 2023 Action Plan.

Figure 11-1: Highlights of 2023 Action Plan

Functional Area	Anticipated Action	Timing
Resource Planning and Environmental Policy	<p>Cascade will:</p> <ul style="list-style-type: none"> <li>• Attend other regional LDC IRP meetings;</li> <li>• Continue to develop the Company's new PLEXOS model.</li> <li>• Cascade will purchase the anticipated required offsets, allowances, or RNG to meet the carbon reduction goals laid out by the Climate Commitment Act.</li> <li>• Cascade will purchase the necessary amount of RNG for the Company's voluntary RNG program.</li> <li>• Cascade will continue to investigate the cost and feasibility of a potential hydrogen plant as an alternative resource.</li> <li>• Continue to participate in the local climate community action plans around Cascade's service territory.</li> </ul>	Ongoing, for inclusion in 2025 IRP.
Avoided Cost	<p>Cascade will:</p> <ul style="list-style-type: none"> <li>• investigate incorporating a separate avoided cost for transportation (non-core) customers. Cascade will also explore how environmental compliance costs from the CCA/CPD will impact the avoided cost calculation.</li> </ul>	Ongoing, for inclusion in 2025 IRP.
Demand	<p>Cascade will:</p> <ul style="list-style-type: none"> <li>• Incorporate end use forecasting into the load forecast model.</li> <li>• Incorporate income as an explanatory variable.</li> <li>• Incorporate Monte Carlo simulations for customer counts.</li> </ul>	Ongoing, for inclusion in 2025 IRP.
DSM (Energy Efficiency)	The Company will execute the Demand Side Management action items as described on page 11-3.	Ongoing, for inclusion in 2025 IRP.
Distribution System Planning	<p>Cascade will:</p> <ul style="list-style-type: none"> <li>• Implement various stages or review of the of the list of projects that require an increase in capacity for these projects: <ul style="list-style-type: none"> <li>○ Kitsap Phase V Pipeline Reinforcement</li> <li>○ Aberdeen HP Reinforcements</li> <li>○ Bellingham 6-inch HP Reinforcement –Meador Ave</li> <li>○ Richland HP Reinforcements</li> <li>○ South Kennewick Reinforcements</li> <li>○ Pasco 6-inch HP Reinforcement</li> <li>○ Burlington South Feed Reinforcement</li> <li>○ Wapato 4-inch HP Replacement</li> </ul> </li> </ul>	Ongoing over the next four to five years.

## **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 an 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.

Cascade Natural Gas Corporation  
2023 (WA) Integrated Resource Plan

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
DEHANN'S 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

Cascade Natural Gas Corporation  
 2023 (WA) Integrated Resource Plan

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	SO LONG	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

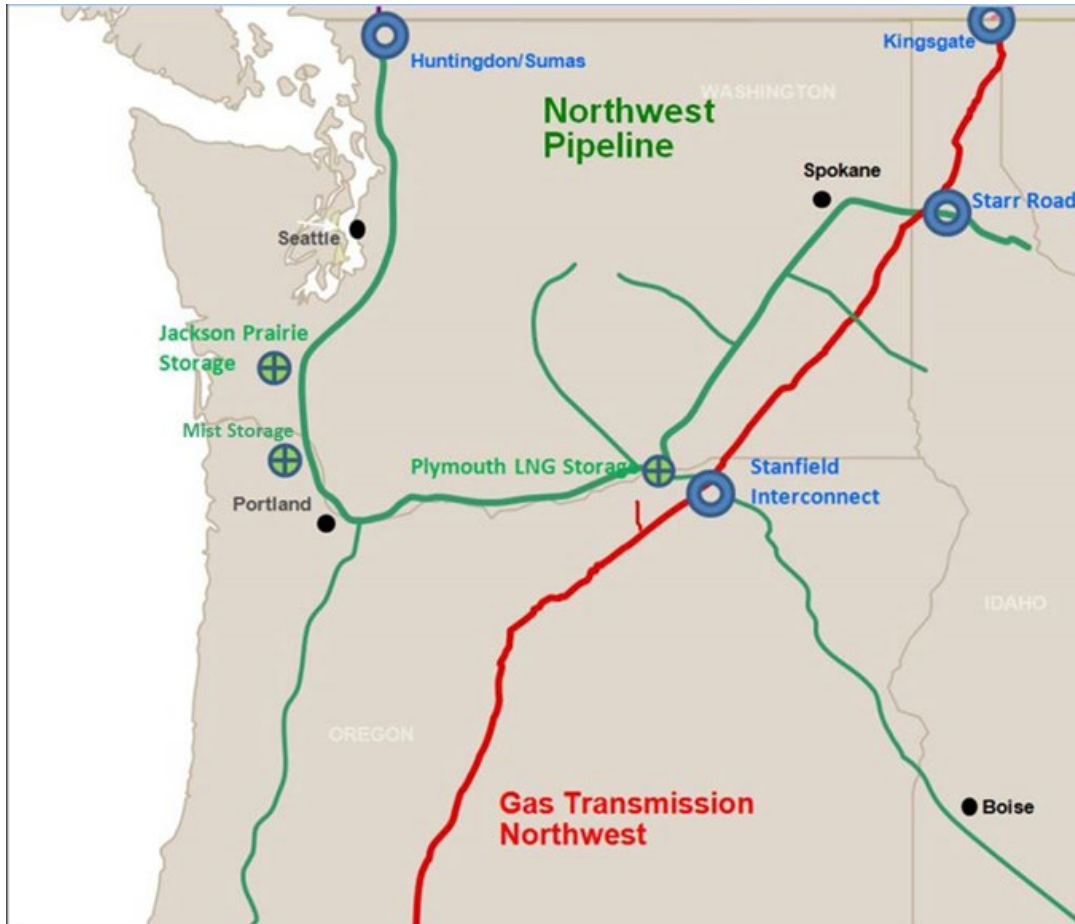


Figure 12-4: Map – Foothills-British Columbia Map

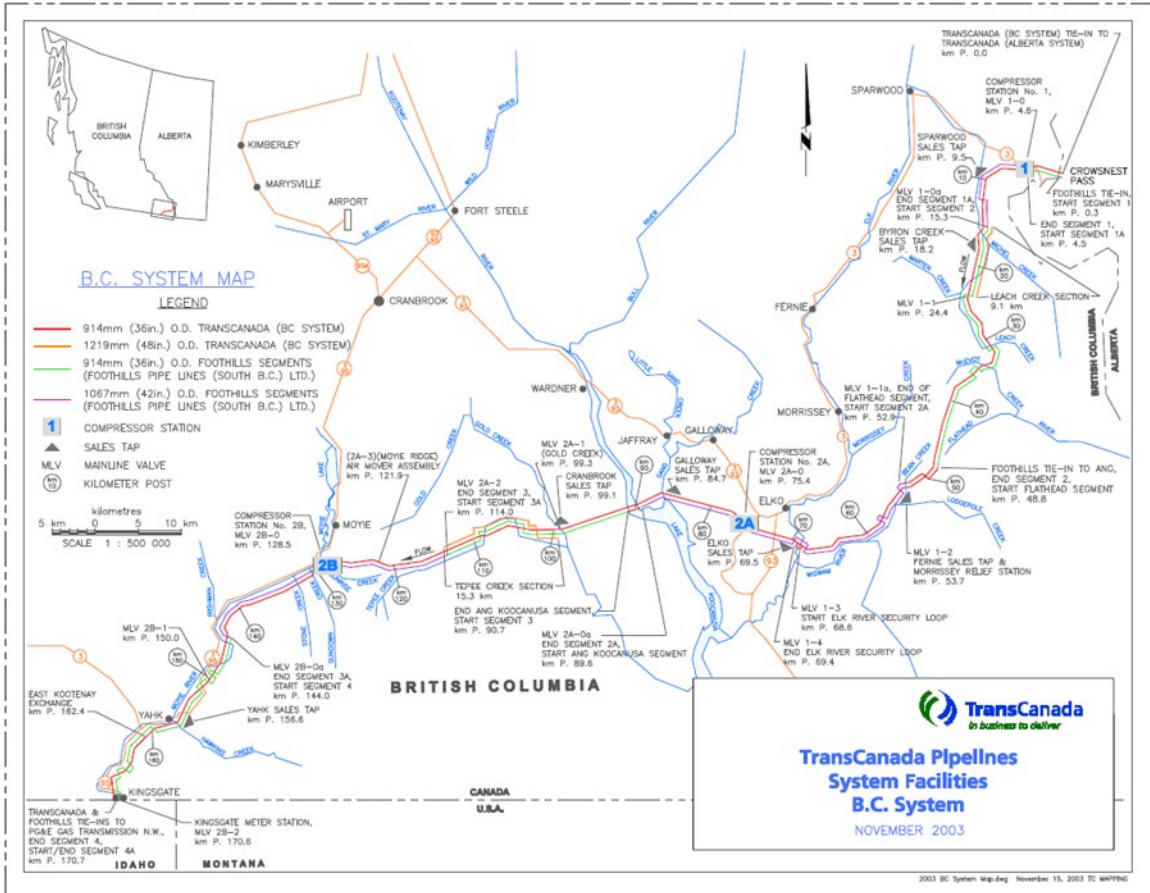


Figure 12-5: Map – Foothills-Full System

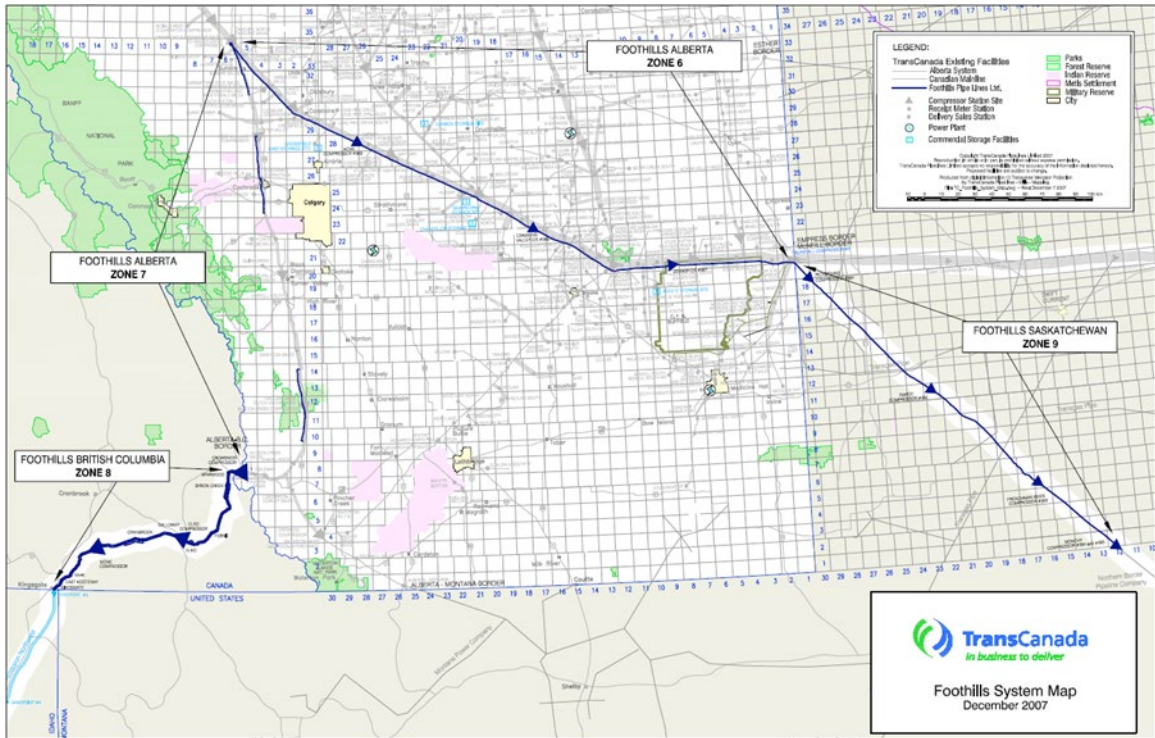




Figure 12-6: Map – GTN System Map

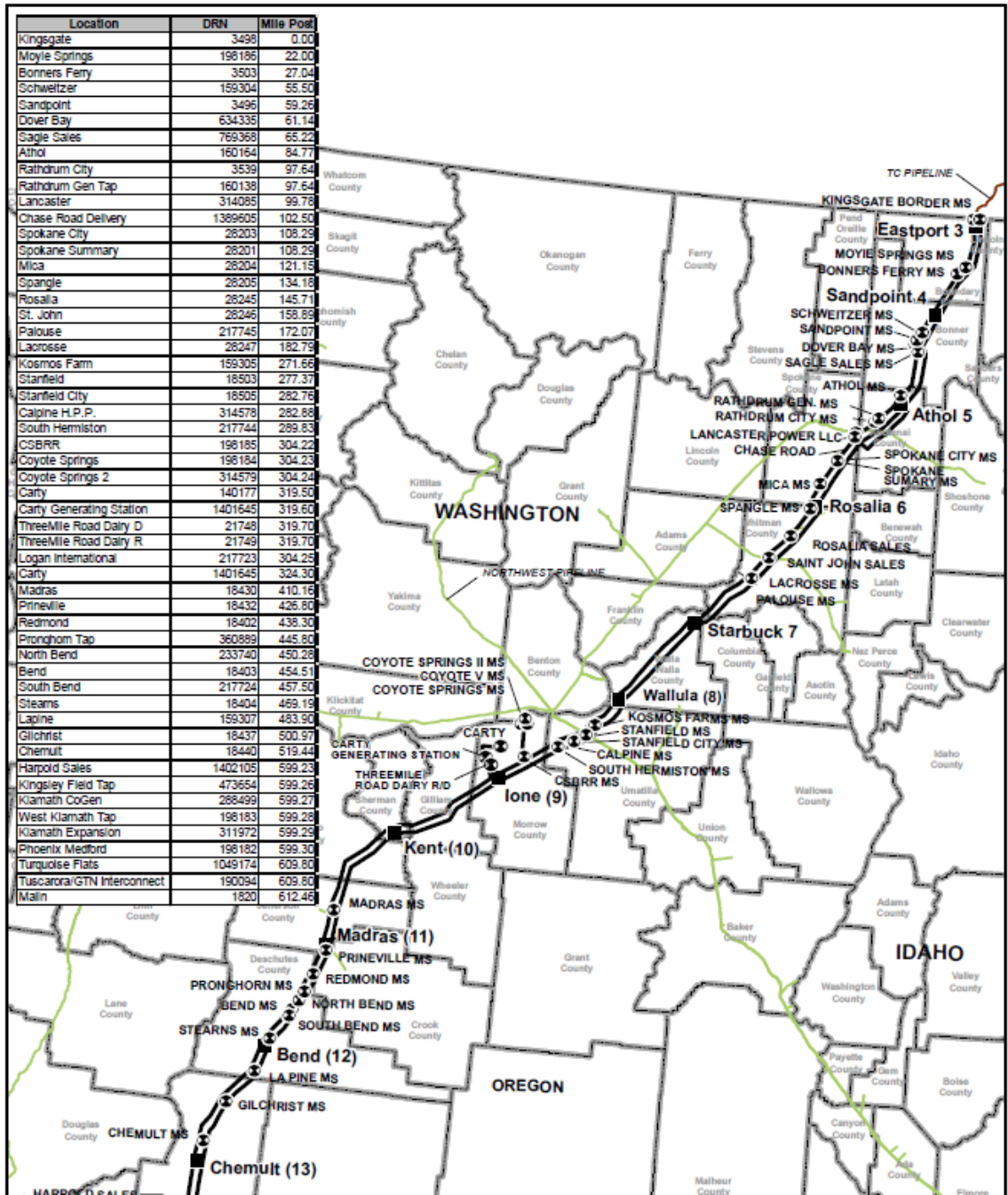
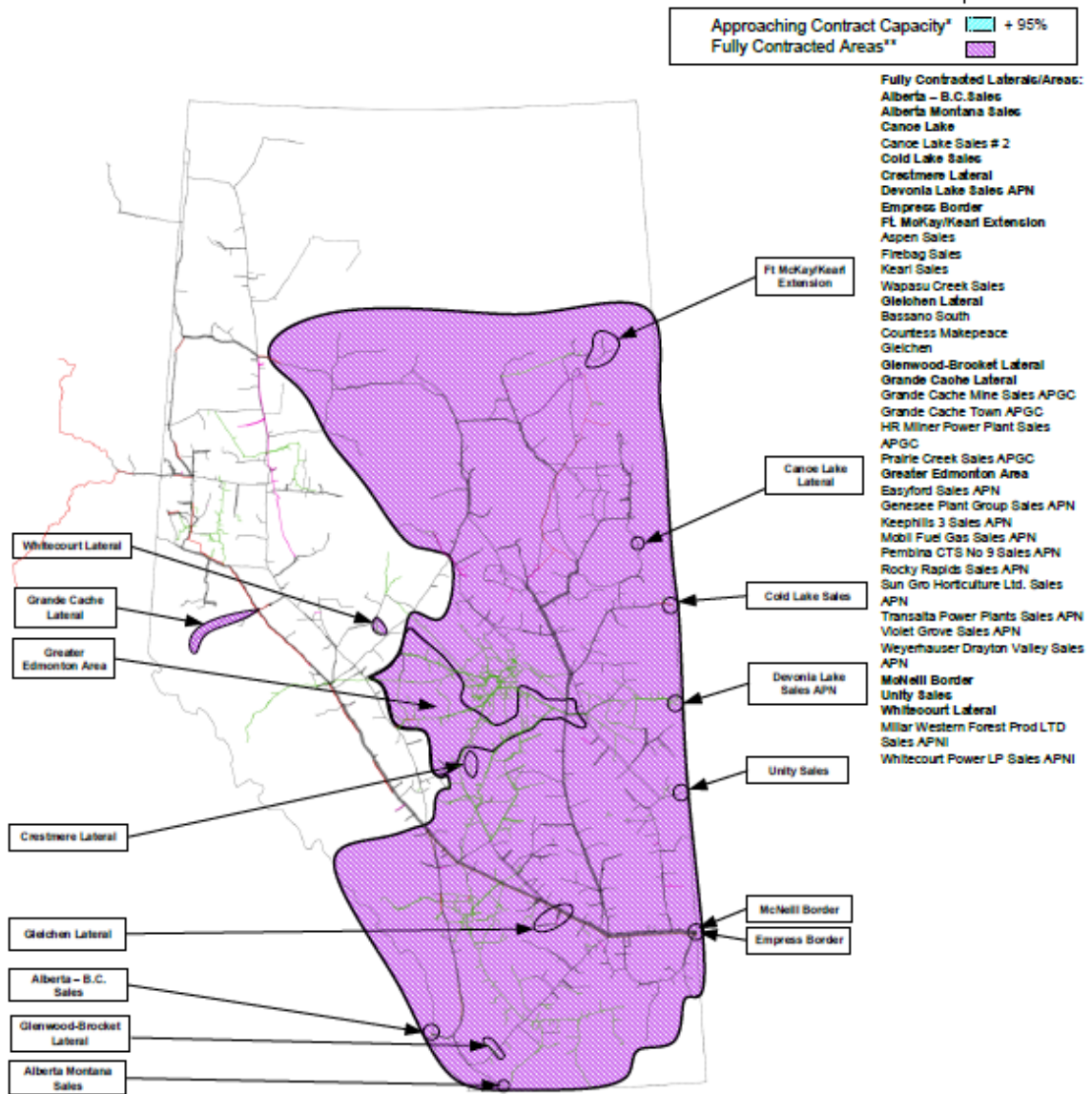


Figure 12-7: Map – NGTL Delivery System Map

### 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.

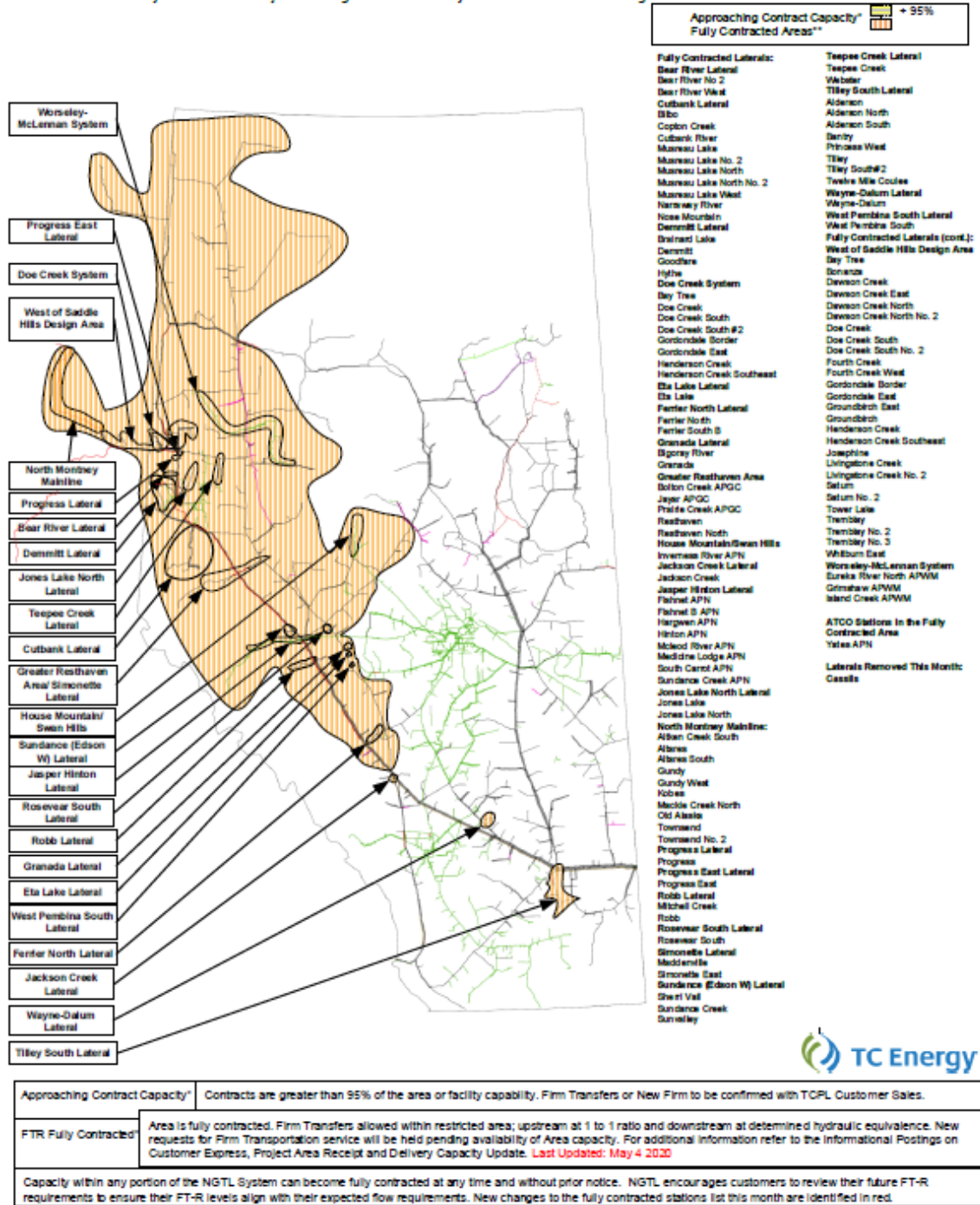


Approaching Contract Capacity*	Contracts are greater than 95% of the area or facility capability. It is recommended that Firm Transfers or New Firm Contracts be confirmed with TCPL Customer Sales.
Fully Contracted**	Area is fully contracted. Firm Transfers allowed within restricted area; upstream at 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. <b>Last Updated: May 4 2020</b>
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 FT-D requirements to ensure that their FT-D levels align with their expected flow requirements.	

Figure 12-8: Map – NGTL Receipt 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.



Cascade Natural Gas Corporation  
 2023 (WA) Integrated Resource Plan

Figure 12-9: Map – NWP North System Map

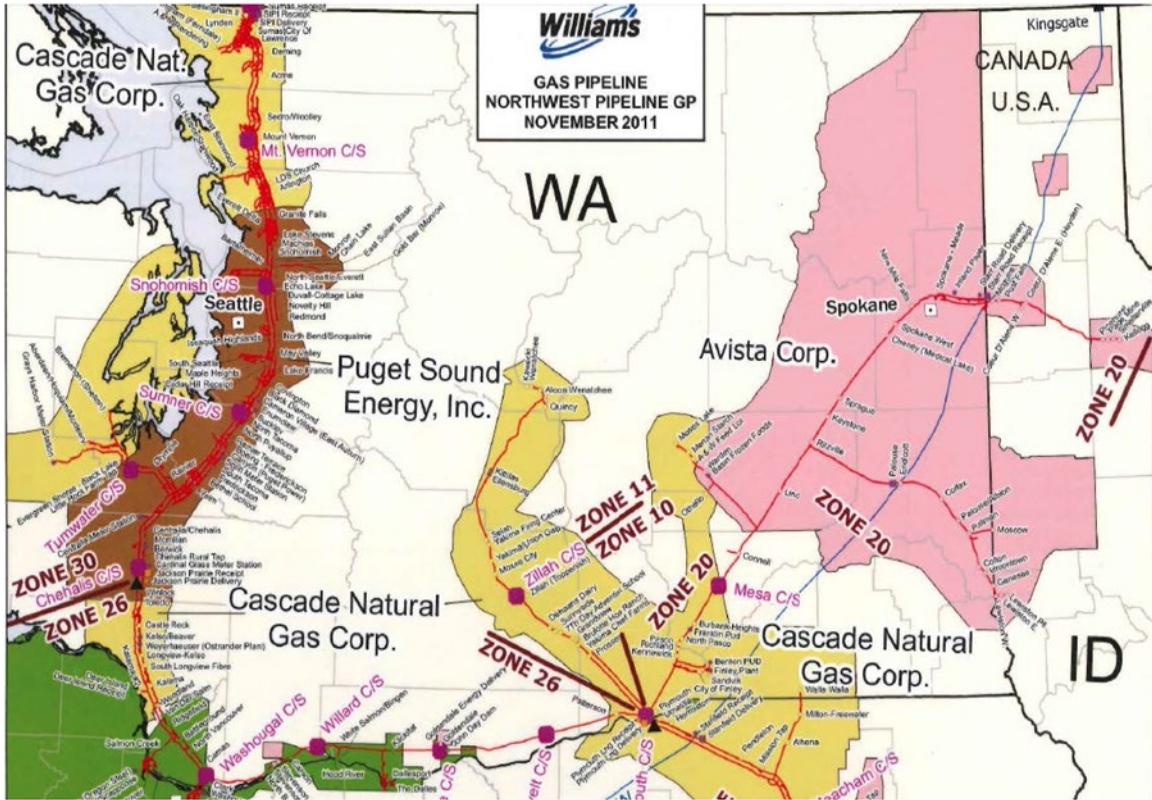


Figure 12-10: Map – NWP South System Map

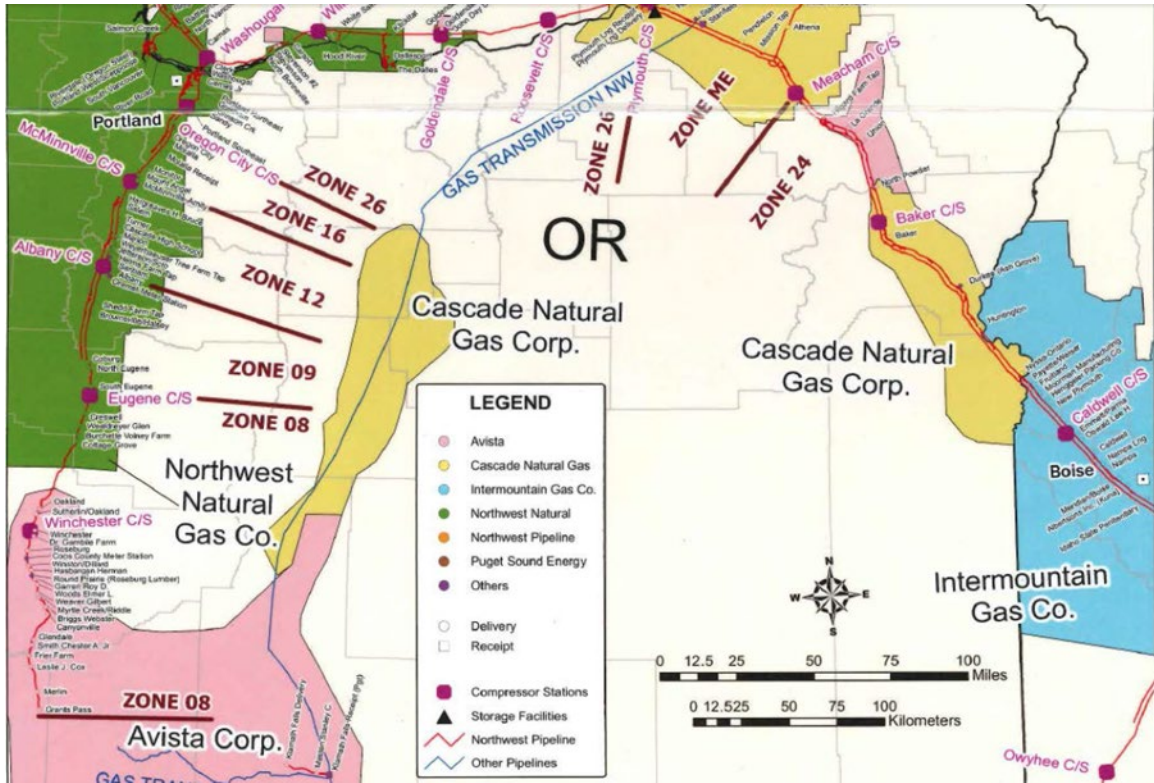


Figure 12-11: Map – Westcoast Sectional Map

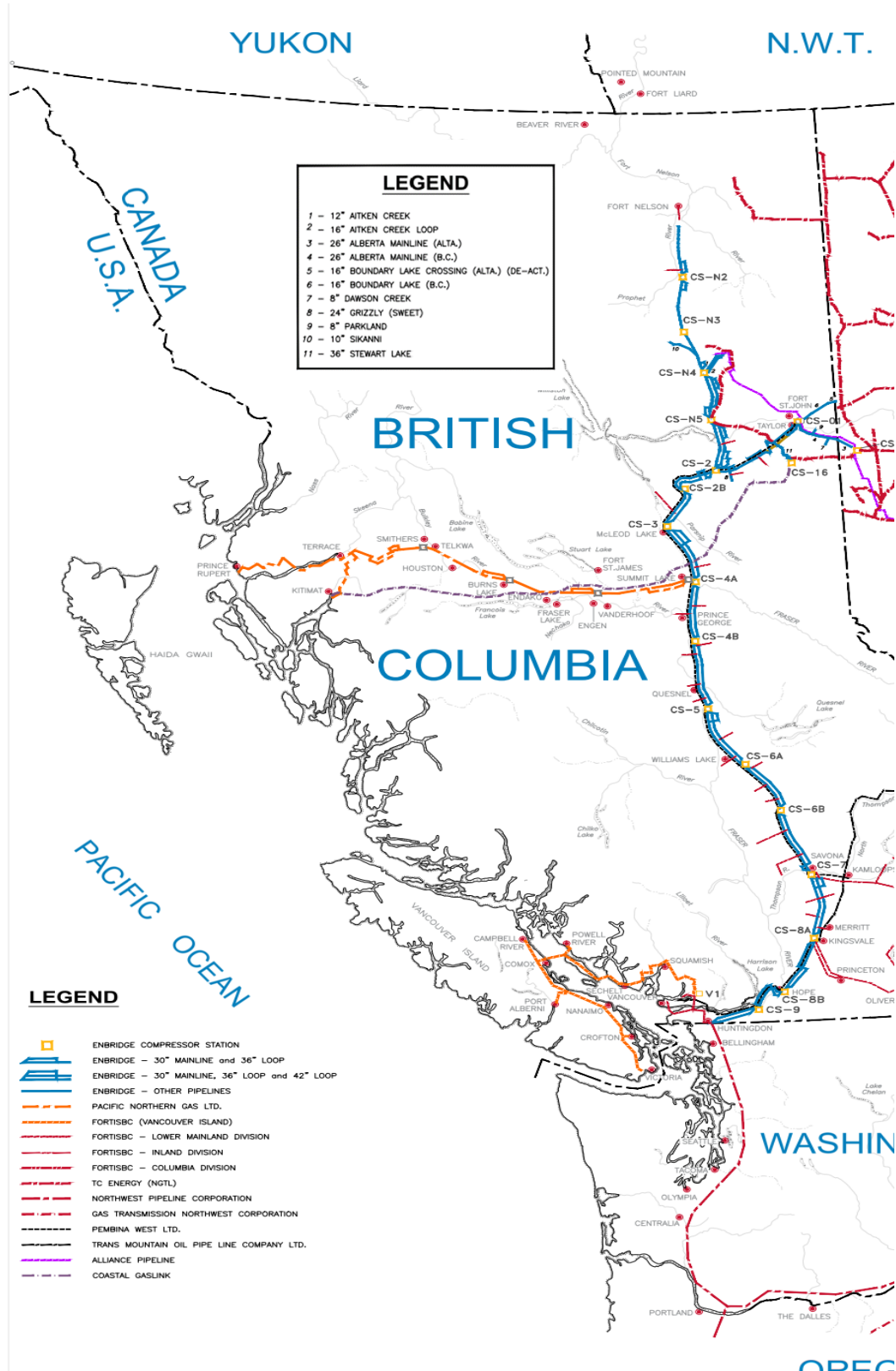


Figure 12-12: Map – Western U.S. and Canadian Pipeline Map

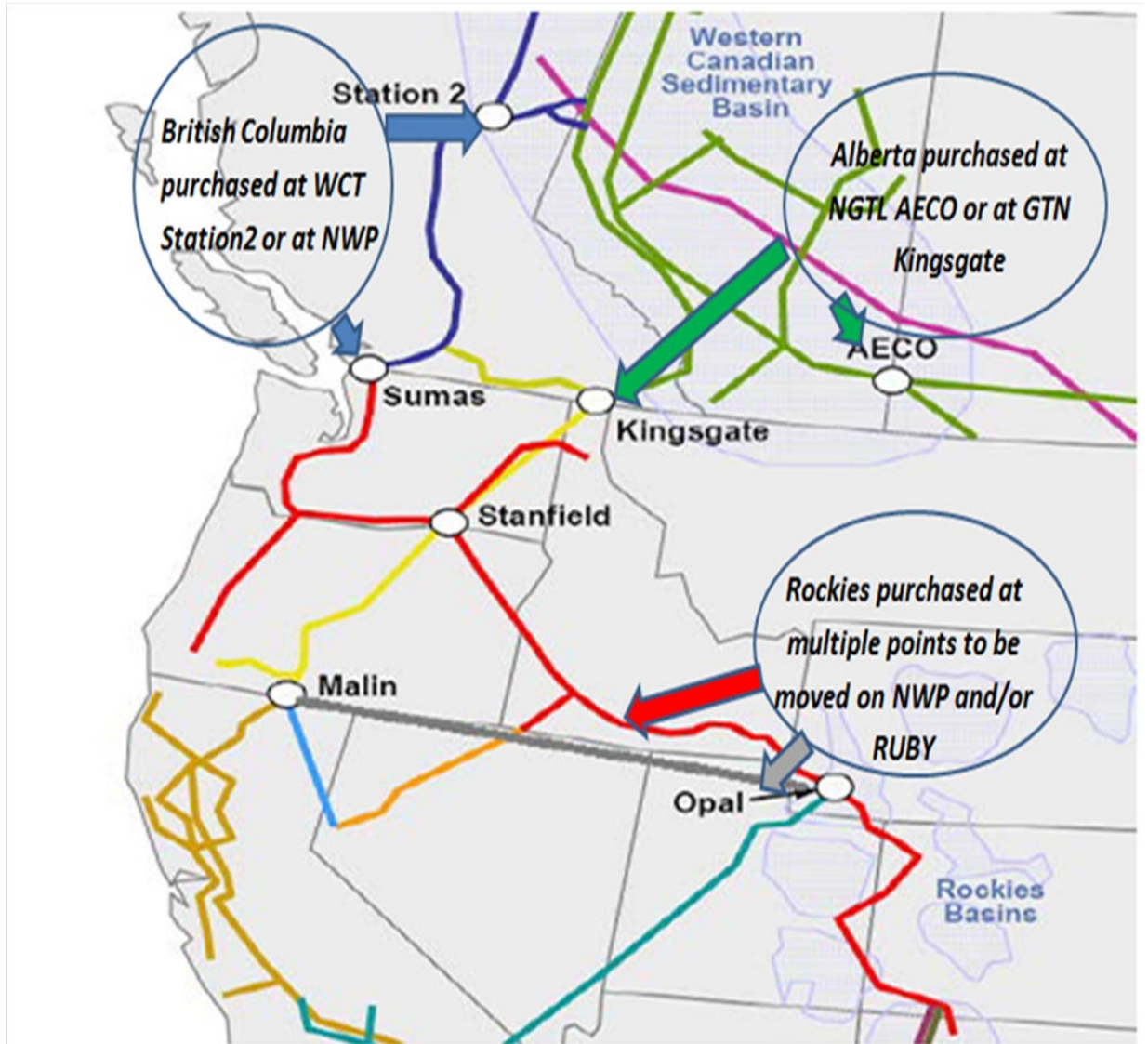
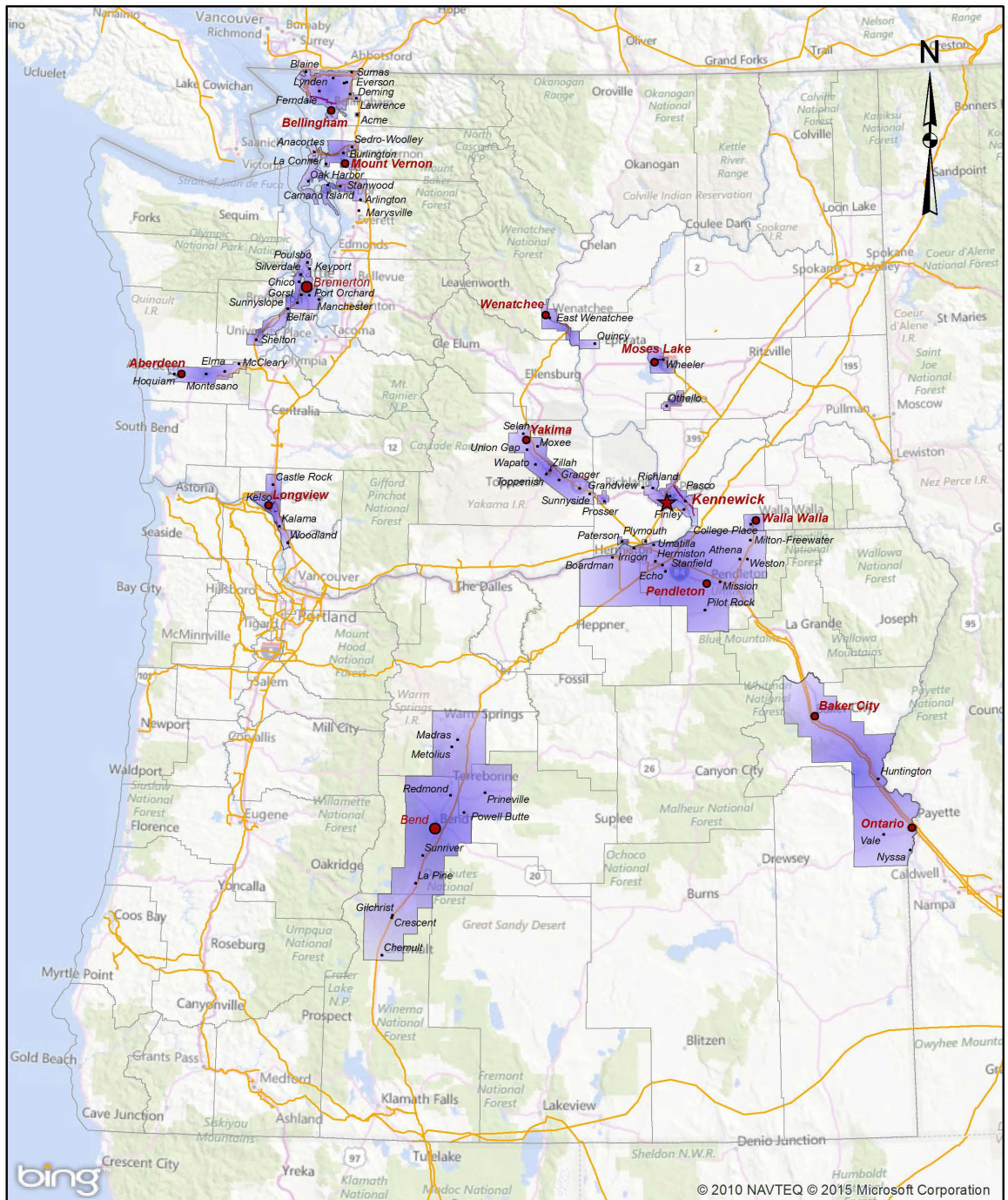


Figure 12-13: Map – Certificated Service Areas as Specified in RCW 80.28.190



# Service Boundaries

- Communities
- District Office
- Region Office
- ★ General Office

Document Path: G:\Dept\Mapping\SYSTEM MAPS\System Map.mxd /Date: 11/13/2015



Figure 12-14: Map – Pipeline Transportation Capacity Usage

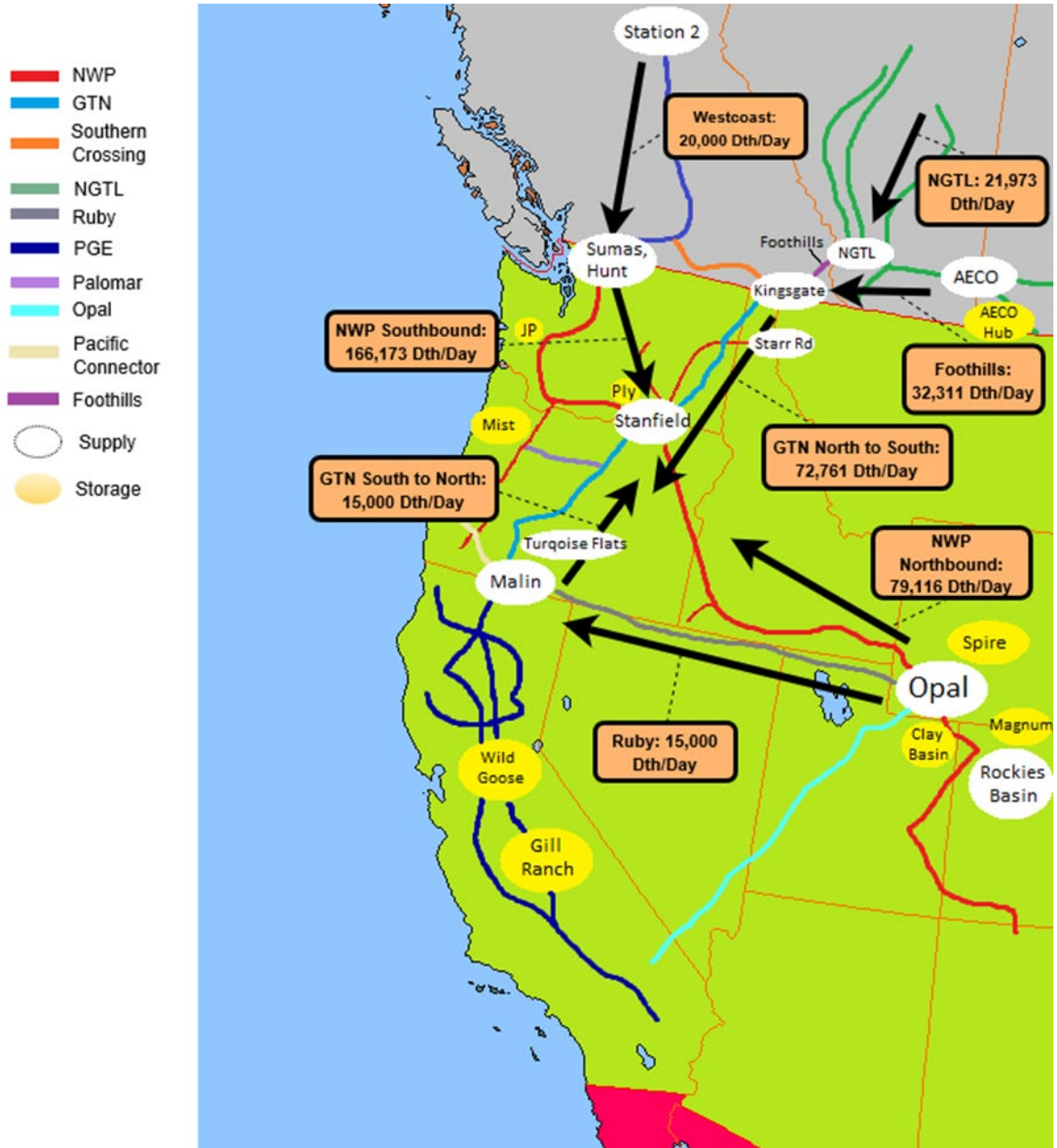


Figure 12-14: Map – Washington Conservation Zones



Figure 12-15: Locations of Faster Growing Citygates

