2024

Pacific Northwest Gas Market Outlook

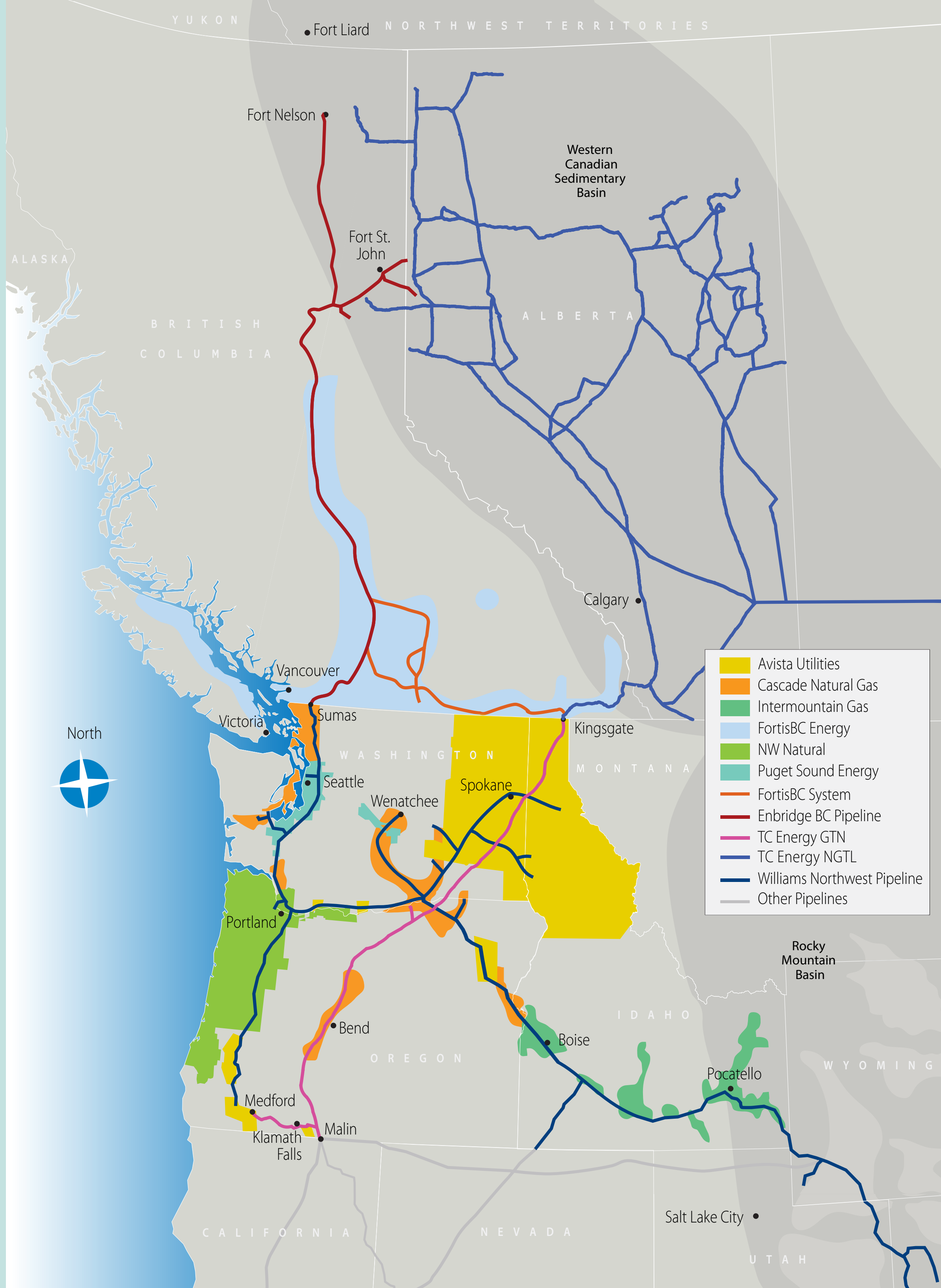
Natural Gas Supply, Prices, Demand and Infrastructure Projections through October 2033

This report, compiled by the Northwest Gas Association (NWGA), provides a consensus industry perspective on the current and projected natural gas supply, prices, demand and delivery capabilities in the Pacific Northwest through the 2032/33 heating year (Nov-Oct).

For purposes of this report, the Pacific Northwest includes British Columbia (BC), Idaho, Oregon and Washington.

Additional information can be found at www.nwga.org.

NWGA
Northwest Gas Association



Introduction

The Value of Natural Gas in the Pacific Northwest

As our climate warms, energy policies are increasing targeting ways to reduce greenhouse gas (GHG) emissions. But the devil is in the details. Rather than policies that prioritize a single solution (e.g., renewable forms of electricity) for all possible uses, we advocate for a more thoughtful, affordable and reliable solution that employs ever-cleaner natural gas in the mix, using already established, extensive and valuable infrastructure.

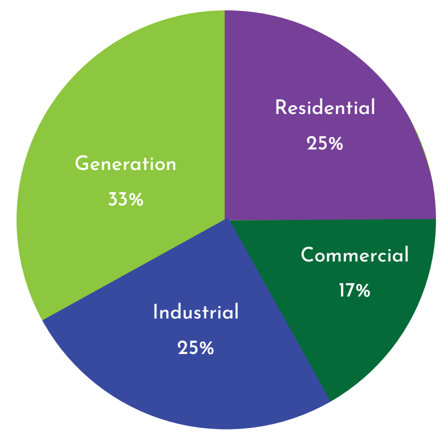
Let's consider how natural gas systems currently benefit our region, by providing:

- ***Warmth and comfort*** to 10 million people.
- ***Efficient and affordable*** space heating, water heating, and heat for cooking and laundry (gas heat is about *one-third* the cost of electric heat).
- ***More than half of the total energy consumed*** in the region – either used directly for space and water heat or in industrial processes, or as gas-generated electricity. (Excludes transportation uses.)
- ***A low carbon footprint*** – natural gas used for space and water heat in 3.5 million homes and more than 350,000 non-industrial businesses accounts for about 8% of the region's total carbon emissions, according to national, state and provincial emissions inventories. Industrial use accounts for 6%.
- ***128,000 miles of installed pipeline infrastructure*** that safely and reliably delivers energy, supplemented by underground and above-ground storage facilities capable of delivering up to 40% of required energy during the coldest days.
- ***An invaluable input to some industrial processes*** for which there are currently no suitable substitutes, including glass recycling and the manufacture of perlite (a common soil additive), steel and aluminum, paper products and food processing, among many others.
- ***An alternate fuel source*** for medium and heavy-duty vehicles that is both more economical and cleaner than diesel engines.
- ***Reliable 24/7 electricity production*** to replace retired coal plant generation and balance the region's growing sources of intermittent renewable power, such as wind and solar.

And our source of natural gas is increasingly renewable itself – market forces and government policy are driving the development of renewable natural gas (RNG), which transforms human and agricultural waste into useful energy, and development of renewable hydrogen, which uses excess wind, solar or hydroelectric power to separate water molecules into hydrogen and oxygen, with the hydrogen then being injected in natural gas pipelines. This provides even greater prospects for a cleaner mix of natural gas resources to contribute to our energy and environmental future.

How Natural Gas is Used in the Pacific Northwest

About 25% of natural gas delivered to regional consumers is used in the industrial sector, providing energy for everything from mining minerals to processing food. Generating electricity consumes about 33% (although British Columbia (BC) uses almost no gas to produce electricity). Another 17% is used in the commercial market, for heating and cooling office buildings, hospitals, schools, and for cooking in restaurants. Most of the remaining amount – about 25% – is used in the residential market, providing energy for home heating, hot water, cooking, clothes drying and air conditioning.



Executive Summary

IN THIS REPORT, *we examine the dynamics (supply, prices, demand, capacity, and decarbonization efforts) affecting Pacific Northwest natural gas companies and consumers.* ***Regional demand*** *and* ***capacity*** *data are drawn from NWGA member companies' planning processes, including those companies' most recent Integrated Resource Plans (IRPs) filed with utility commissions throughout the region. (Details of individual IRPs can be found in the appendices.) Historical data and forecasts for* ***North American natural gas supply*** *and* ***prices*** *are pulled primarily from external, publicly available resources, most notably the U.S. Energy Information Administration's (EIA) Annual Energy Outlook 2023 and the Canadian Energy Regulator's Canada's Energy Future 2023.*

New in this 2024 Outlook is a section detailing our members' ongoing, extensive efforts to reduce GHG emissions: see ***Delivering Decarbonization*** *on p. 12. This joins our regular sections:* ***Market Fundamentals*** *(discussing supply and prices),* ***Leaning on Gas*** *(demand), and* ***Capacity is Critical.***

Supply: North American natural gas supply is projected to remain abundant for the foreseeable future, with a growing share coming from renewable sources. The supply basins on which the Pacific Northwest depends have vast resources that will serve generations to come. (See page 3.)

Natural gas will be amply available to produce and deliver to homes and businesses for generations to come.

Prices: Regional natural gas spot prices are projected to remain below $5/dekatherm (Dth) through at least 2040; depending on the location, some prices are forecast to remain below $4/Dth through 2050. However, near-term volatility is possible due to supply/demand dynamics, including high demand for LNG exports, low storage levels, prices of other energy sources, and geopolitical tensions. (See page 5.)

Economical operations allow production to continue at low prices.

Demand: Forecast regional demand for natural gas across all sectors is 1.2%/yr., a slight increase from the 2022 Outlook (0.2%/yr.). Residential, commercial and generation sectors' annual demand will grow or decline slowly (0.8%, 0.3%, and -0.5%, respectively), while industrial demand is expected to increase 3.5%/yr. due to increased LNG exports. (See page 7).

End-use demand (residential, commercial) is projected to grow slowly and generation demand will decline slowly, while industrial demand will grow at a faster rate to serve a new LNG export facility.

Capacity: NWGA members are constantly evaluating whether there is enough regional pipeline capacity to transport natural gas from where it is produced (hundreds of miles away) to where it is needed and whether we have enough storage capacity to serve loads during the coldest weather. Currently, capacity is sufficient as long as infrastructure is operating at its maximum capacity and storage levels are high. However, an LNG export facility being built in BC will boost capacity needs by 2027; as a result, several pipeline expansion projects are moving through regulatory processes. (See page 10.).

Recent experience demonstrates that pipeline and storage capacity operates at maximum capacity during extreme weather events. Storage and pipeline upgrades and expansions will be necessary to serve growing industrial demand and for gas-fired generation during periods of peak demand.

Decarbonization: Regional GHG emissions from direct use of natural gas (BC and states of Washington and Oregon; residential, commercial and industrial customers) account for 14% of total regional emissions. The transportation sector (gasoline- and diesel-powered trucks, fleets, personal vehicles, public transit, etc.) produces the largest share of regional emissions (39%). Power generation and other uses contribute 18% and 16%, respectively. Increased proportions of RNG in our supply, as well as other decarbonization efforts by our members, will continue to reduce these percentages. (See page 12.)

Emissions from direct natural gas usage currently make up about 14% of total regional emissions, which are expected to decline as renewable sources are increasing integrated into our supply.

Regional Economic Outlook

Dr. Grant Forsyth, Chief Economist, Avista Corp

The U.S. and Canada enter 2024 after avoiding a much-anticipated recession in 2023. In addition, both countries enjoyed significant gains in lowering inflation. There are now a growing number of forecasters predicting a soft-landing in North America with the likely end of interest rate increases by the Federal Reserve (the Fed) and Bank of Canada (BOC). However, even with a soft-landing, the consensus is for modest growth in 2024, reflecting the slower than expected impact of the central banks' monetary tightening.

It's worth noting that the Fed's own forward guidance from its December 2023 meeting signals the possibility for up to three rate cuts in 2024, probably starting in the spring or summer. Although the BOC does not provide detailed forward guidance on interest rates, at the time of this writing, futures markets in Canada are also betting on multiple rate cuts in 2024, also starting in the spring or summer.

Turning to the larger macroeconomic picture, the U.S. had 2.5% GDP growth (advanced estimate) in 2023, while Canada saw GDP growth just over 1%. For consumer inflation, the U.S. saw CPI inflation at 4.1% in 2023, with Canada following closely at 3.8%. Averaging across forecasters, 2024 expectations are for higher GDP growth in the U.S. compared to Canada, with U.S. growth at 1.7% and Canada at 1%. Both countries, however, are expected to see CPI inflation around 2.5% in 2024. After 2024, the majority of forecasters see the U.S. and Canada returning to the pre-pandemic norm of about 2% annual growth in both GDP and inflation.

In 2023, the U.S. Pacific Northwest (Idaho, Oregon, and Washington) generated employment growth similar to the U.S at 2.3%. Individually, Idaho was the best performer with 3.1% employment growth, followed by Oregon at 2.5% and Washington at 2.1%. Turning to Western Canada, British Columbia's (BC's) 1.6% employment growth in 2023 was notably lower than Alberta's 3.5% growth and Canada's overall 2.4% growth. Looking across forecasters, Canada and BC are both expected to see 2024 employment growth around 1%, with Alberta near 2%. In the U.S., national and Pacific Northwest employment growth rates are also expected to be around 1%.

Although forecaster sentiment has shifted towards a soft-landing in the U.S. and Canada, the possibility of a North American recession in 2024 cannot be dismissed. With wars in the Ukraine and Israel; another contentious U.S. presidential election; a divided and directionless U.S. Congress; and large-country geopolitical tensions, there are plenty of events that could derail growth. Another challenge facing the Pacific Northwest and Western Canada is the risk of a low snowpack in some areas going into another potentially warmer than average summer. As of March 2024, the snowpack in key upper Northwest water basins was 60% to 75% of normal. This raises the possibility of another tough fire season that could disrupt regional economic growth.

Sources: *Bank of Canada, Bank of Montreal; BC Stats; Bloomberg; Business Council of BC; CBC; Chicago Mercantile Exchange; CIBC; Department of Finance Canada; The Economist; S&P Connect; International Monetary Fund; Organization for Economic Cooperation and Development; Oregon Employment Department; Scotiabank, Statistics Canada; RBC; Reuters; T.D. Economics; U.S. Bureau of Labor Statistics; U.S. Census; U.S. Federal Reserve; Washington Employment Security; Washington Economic and Revenue Forecast Council; and Wall Street Journal.*

Market Fundamentals

*This section discusses the sources **(supply)** and **prices** of natural gas resources serving the Pacific Northwest, as well as how these diverse sources provide supply redundancy and pricing options for regional consumers.*

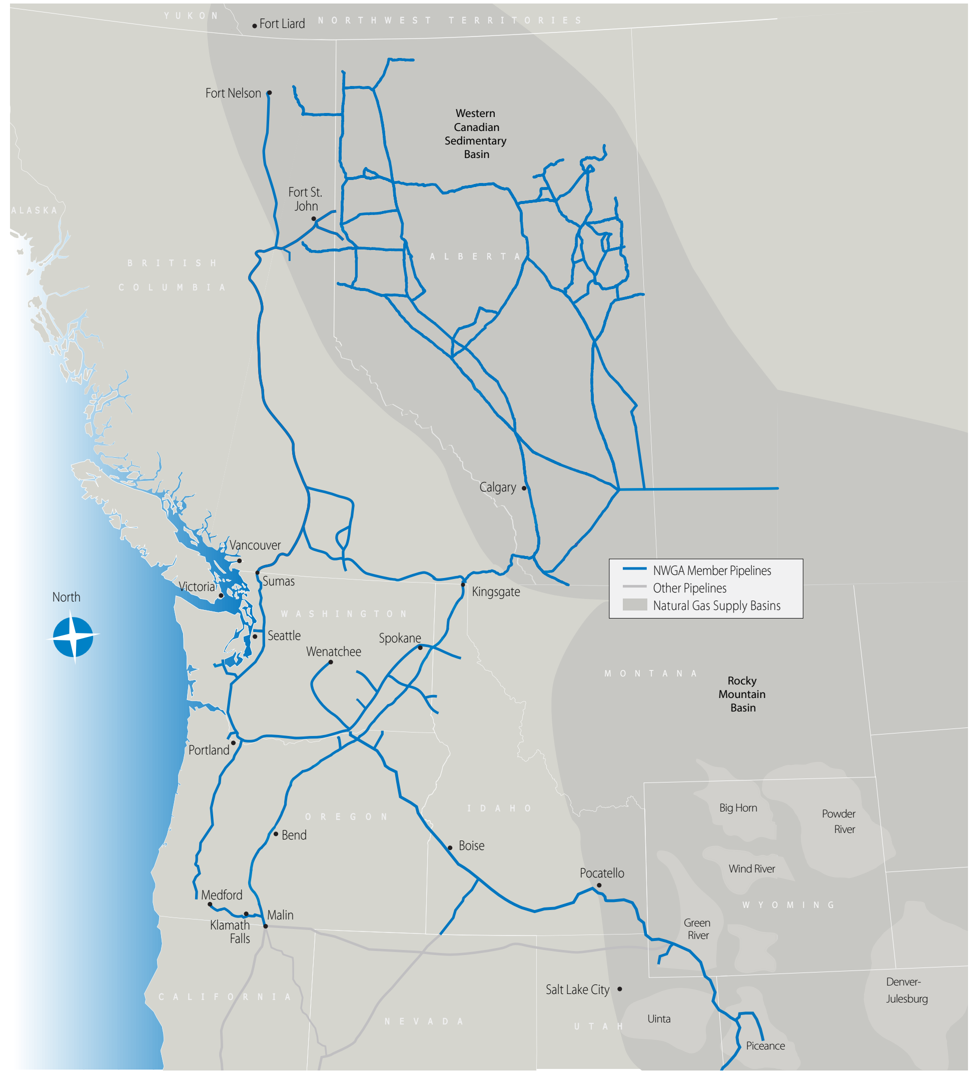
SUPPLY

The Pacific Northwest is located adjacent to two prolific gas producing regions: The Western Canada Sedimentary Basin (WCSB) spanning BC and Alberta, and the U.S. Rocky Mountain states (see Figure 1). More than two-thirds of the natural gas consumed in the region is sourced from Canada. The supply optionality resulting from our connection to these basins is shown in Figure 2.

Like most of North America, regional consumers continue to benefit from advances in drilling techniques that allow access to extensive gas and oil shale plays. In its latest biennial assessment of U.S. natural gas resources, the Potential Gas Committee (PGC) found the nation's future gas supply totals 3,978 trillion cubic feet (Tcf) in 2022, an increase of 3.6% since 2020. Technically recoverable resources of natural gas, those in the ground but not yet recovered, total 3,352 Tcf. An independent assessment of proven reserve volumes of 625 Tcf brings total future supply to the highest level assessed in the 59-year history of the PGC.[1] This represents more than 100 years of gas supply.

Canada is estimated to have 1,368 Tcf of natural gas resources, and proven reserves of 83 Tcf as of 2022,[2] equal to more than 200 years' supply at current consumption rates.

FIGURE 1. Source of Natural Gas for the Pacific Northwest

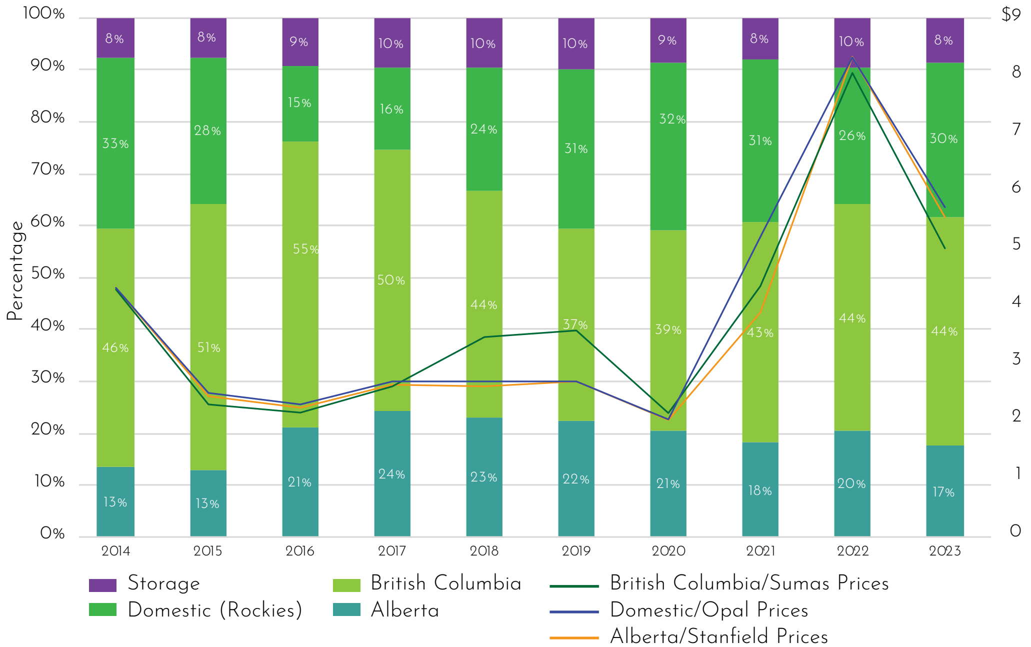


Source: *NWGA*

[1] https://www.aga.org/wp-content/uploads/2023/09/PGC-2022-Report-Executive-Summary.pdf

[2] https://www.cga.ca/natural-gas-statistics/natural-gas-facts/; https://www.eia.gov/international/analysis/country/CAN

FIGURE 2. Connection to Three* Basins Provides Supply & Price Optionality**



* For purposes of this chart, the Alberta and BC portions of the WCSB are depicted separately, hence "three" basins instead of two.

** Volumes on Northwest Pipeline only. Does not include volumes of Alberta-sourced gas shipped to the region via FortisBC's Southern Crossing pipeline or served directly by TC Energy's Gas Transmission Northwest (GTN) pipeline.

NOTES: Figure 2 (showing consumption, not capacity) illustrates the benefits the region derives from having access to multiple sources of natural gas. The pricing anomaly shown in 2018 reflects a pipeline rupture that temporarily constrained BC supply and raised prices at the Sumas trading hub. There continues to be constraints at the Sumas market hub due to occasionally tight capacity, which again became apparent when cold weather in winter 2022-23 caused price spikes. (See the *Capacity is Critical* section for further discussion of constraints and proposed solutions.)

Prices

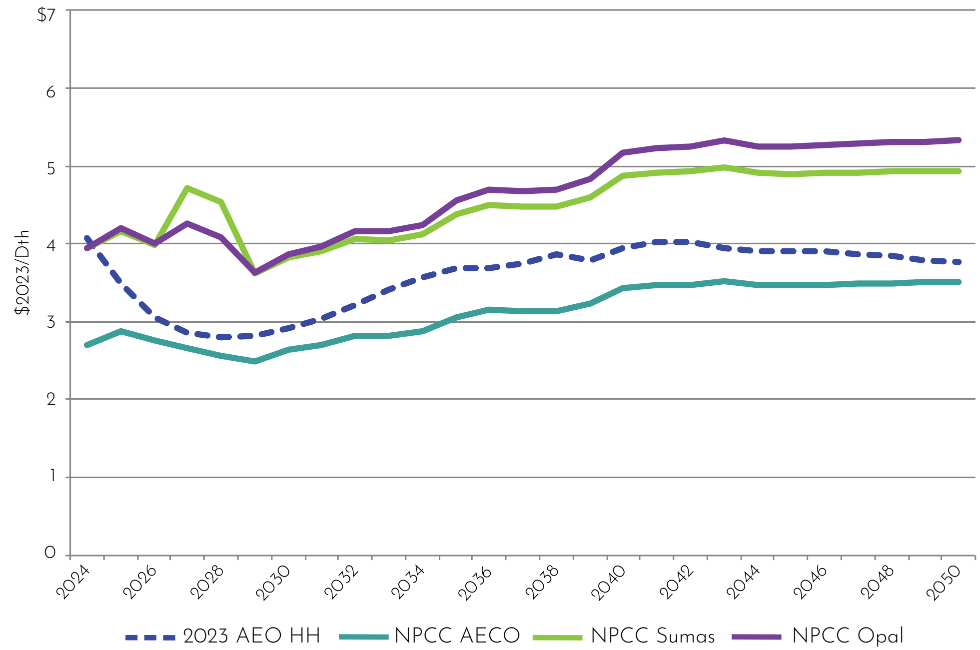
The commodity cost of natural gas has plummeted with the surge in supply over the last decade (see Figure 3), saving regional consumers across all economic sectors hundreds of millions of dollars. According to the EIA, electricity delivered to consumers in our region is two or three times more costly than natural gas for the same unit of energy (Dth). Natural gas is also significantly more affordable than several other residential energy sources for the same amount of energy.

Commodity prices are expected to remain below $5/Dth through at least 2040; in some cases below $4/Dth, depending on the location (see Figure 4). High demand coupled with infrastructure constraints may periodically cause short-lived regional price volatility, as can global events (pandemics, geopolitical tensions) and other domestic market dynamics (such as storage levels). Figure 3 shows how the Covid pandemic affected prices short-term (look to the right of the black vertical line). The price of natural gas also remains significantly advantageous relative to other transportation fuels (see Figure 5 in the NGV sidebar).

FIGURE 3. Historic Natural Gas Prices

Source: *U.S. EIA Natural Gas Wellhead Prices at Henry Hub. (Henry Hub is a trading point in Louisiana that serves as a benchmark for North American natural gas pricing.)*

FIGURE 4. Natural Gas Price Forecast Comparisons



Sources: *EIA 2023 Annual Energy Outlook; NPCC Fuel Price Forecast, December 2023 Update*

NOTES: The Northwest Power and Conservation Council (NPCC) forecasts natural gas prices at trading hubs where the Pacific Northwest sources its gas: AECO[3] and Sumas for natural gas originating in Alberta and British Columbia, and Opal for gas produced in the U.S. Rocky Mountain states of Colorado, Utah and Wyoming.

In the near term (through 2024): Regional gas prices will remain lower than Henry Hub (HH) prices, under the EIA's 2023 AEO forecast (dashed blue line in Figure 4).

In the long-term (2025 and after): HH prices will drop below those of Sumas and Opal, reflecting the ongoing expectation for robust U.S. natural gas supplies throughout the forecast period (through 2033) and beyond. HH prices will then slowly increase, per the EIA, driven by steady demand growth in the U.S. industrial (primarily LNG exports) and power generation sectors, but remain below those of Sumas and Opal. Prices at these hubs, and at AECO, are also forecast to increase slowly. The temporary spike in Sumas prices in 2027 reflects the onset of operations of a BC LNG export facility; planned pipeline expansions will ease the expected constraints if built in a timely manner.

[3] The price differential between Henry Hub and AECO is explained here: https://open.alberta.ca/dataset/3b7ec04e-fd07-4518-bfde-d8cb857d9587/resource/896c312a-7efb-442f-8f9a-5b62bb46e1c0/download/19-explaining-gas-price-differentials.pdf

NGVs Offer Both Environmental and Economic Benefits

The economic and emissions benefits of natural gas are perhaps most notable in the transportation industry. As illustrated in Figure 5, natural gas offers substantial economic value now and in the future relative to other transportation fuels. According to the American Gas Association (AGA), natural gas is projected to be half to one-third the price of other fuels through at least 2050. Based on fuel savings alone, natural gas vehicles (NGVs) have a much shorter payback period than new technology diesel engines.

The engines in NGVs also produce superior environmental performance (e.g., reduced greenhouse gas (GHG) emissions) compared to gasoline and diesel engines. This is especially true for production of such pollutants as nitrous and sulfur oxides (NOx, SOx), which can cause serious health issues. Given the transportation sector accounted for 29% – the largest portion – of total U.S. GHG emissions in the U.S. in 2021, according to the U.S. EPA, emissions reductions in this sector can have a huge impact. (In the Pacific Northwest, that number is closer to 40%.)

GHG emissions from natural gas engines can be from 5% to 100% lower than diesel and gasoline engines depending on the source (see table). Even when compared to electric vehicles, natural gas vehicles (NGVs) come out ahead, with fewer total GHG emissions from energy production through end-use (also called "full fuel cycle").

Natural Gas Source	GHG Reduction
Compressed Natural Gas (CNG)[4]	5-15%
RNG sourced from landfill	40-50%
RNG sourced from municipal wastewater treatment plant	75-85%
RNG generated from animal manure	100%

Contemporary natural gas engines operate well below the EPA threshold for NOx emissions of 0.2 grams/brake horsepower (0.2g/bhp) even while idling. And while the newest diesel engine technology can achieve the EPA standard, it only does so when it is operating at about 40 miles per hour. This means emissions largely remain over the EPA threshold, given the stop-and-go driving patterns typical of heavy trucks and buses operating in urban areas, where vulnerable populations often live. (Click here to see the NWGA's NGV Emissions Brief).

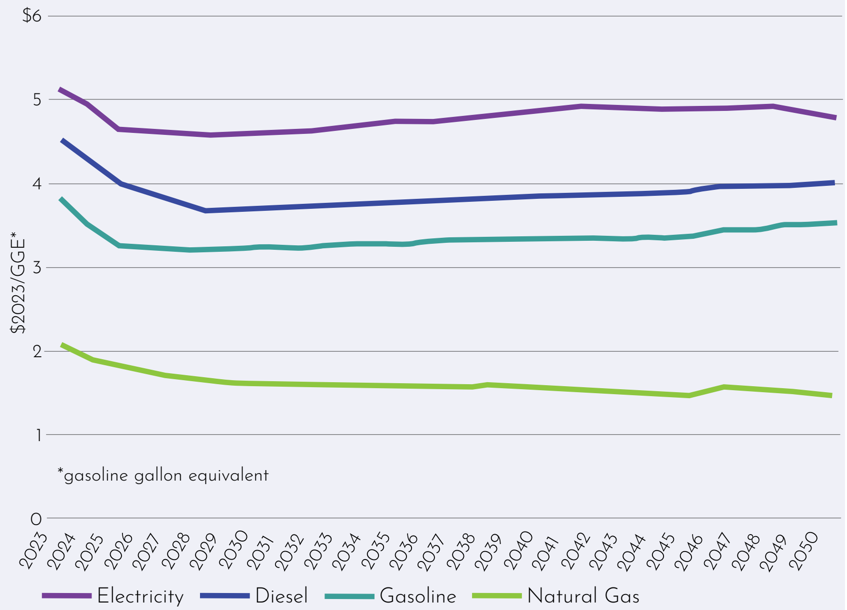
Natural gas trucks also provide more NOx reduction per dollars spent than their electric counterparts and don't have the drawbacks of electric trucks: limited horsepower, requiring light loads, and limited range. Natural gas can also fuel a range of vehicles including light- and medium-duty work vehicles, police vehicles, school and transit buses and shuttles, refuse trucks, construction equipment—even marine vessels, forklifts and locomotives.

In short, converting to natural gas engines is the only commercially- and technologically viable way to decarbonize heavy-duty fleets.

To assist companies interested in fleet conversions, the Northwest Alliance for Clean Transportation (Alliance) has an interactive "Conversion Calculator" that allows users to enter customized variables and view approximate costs. A consortium of pipeline operators, gas utilities, fleet owners, truck manufacturers and other stakeholders, the Alliance was created to promote NGVs as an environmentally friendly, sustainable transportation solution. (For more information on the Alliance and to access the calculator and assistance with using it, visit www.nwalliance.net.)

Many gas utilities also offer expert assistance and incentives, including NW Natural in Oregon (https://www.nwnatural.com/business/for-your-business/natural-gas-vehicles).

FIGURE 5. Transportation Fuel Price Forecast



Source: *2023 AEO: Fuels Delivered to Transportation Sector/Table 3, Energy Prices Delivered by Source and Sector*

NOTES: Forecast prices for transportation fuels include the commodity cost and all costs associated with delivery to the station (transport, distribution) and dispensing to the vehicle (pumping). As Figure 5 shows, at 2023 prices, natural gas currently costs $2.04 per gasoline gallon equivalent (GGE), compared to about $3.89 per gallon for gasoline and $4.57 per gallon of diesel. The equivalent amount of energy from electricity costs $5.06.

According to the EIA, prices for natural gas as a transportation fuel are expected to decline over the forecast period because:

1) In the near term, prices reflect mostly CNG purchased and delivered by utilities (higher commodity cost), and at a higher capital cost per unit of fuel dispensed (smaller stations with lower utilization).

2) Over time, it is expected that more heavy-duty vehicles (freight carriers and marine vessels) will transition to LNG purchased directly from the spot or futures markets (lower commodity cost) and dispensed through stations with greater economies of scale (lower capital costs per unit of fuel dispensed).

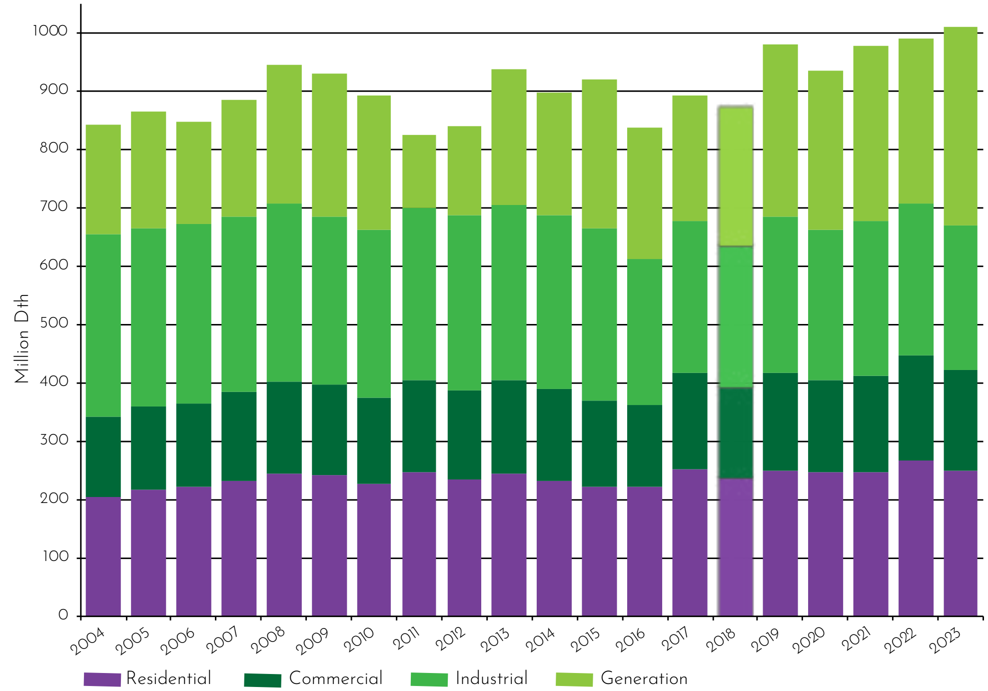
[4] Two forms of natural gas are currently used in vehicles: compressed natural gas (CNG) and liquefied natural gas (LNG). CNG is produced by compressing natural gas to less than 1% of its normal volume and is used in light-, medium-, and heavy-duty applications. LNG is produced by purifying natural gas and super-cooling it to -260°F to turn it into a liquid and is typically used in medium- and heavy-duty vehicles that require longer ranges, because liquid is denser than gas. According to the U.S. DOE Alternative Fuels Data Center, when comparing the lifecycle emissions of the two types of natural gas, CNG and LNG are nearly identical.

Leaning on Gas

Overall demand for natural gas in the Pacific Northwest is forecast to grow 1.2% per year (or a total of 11.8% cumulative growth over the 10-year forecast window), based on the expected case. Annual growth ranges from 0% to 1.8% under low and high cases. End-use demand by residential and commercial sectors, and demand for natural gas to generate electricity, will change (grow or decline) less than 1% annually in the expected case. Industrial demand, however, will rise an estimated 3.5% per year over the next decade, reflecting operations of a BC LNG export facility expected to come online in 2027.

In this section, Figure 6 (at right) shows how actual regional demand has fluctuated over the past two decades. Table 1 (on the next page) shows forecast demand growth by sector in the expected case. On the following page, Figure 7 compares demand growth rates under low, expected and high cases, while Figure 8 compares the expected case data from Table 1 for both the 2022 and 2024 Outlooks. Figure 9 provides a snapshot of how much we rely on natural gas in the region.[1]

FIGURE 6. Historic Regional Demand by Sector



NOTES: On average, natural gas satisfies almost 50% of the annual non-transportation end-use energy demand in the region. Regional residential and commercial consumption varies with the weather but has generally seen modest growth over the last two decades. The region has lost significant industrial loads over the same time frame.

Demand for natural gas to fuel electricity generation has grown steadily as economics and public policy have prompted the closure of other on-demand generation resources. According the the Northwest Power and Conservation Council, natural gas-fired generation makes up 18% of the U.S. Northwest's generating capability, and in 2020 it fueled 16% of the electricity produced in the region. Because it can be relied upon when needed, natural gas-fired generation is complementary to intermittent renewable generation resources like wind and solar and can also fill the gaps left when the region's hydropower system runs low on water.

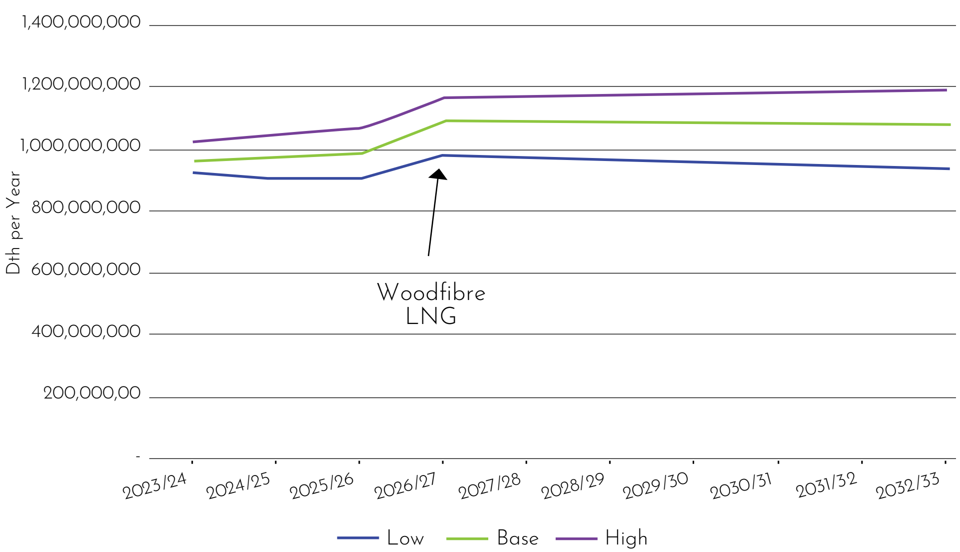
The source of all charts and tables in this section is NWGA. Demand forecasts are based on member companies' filed Integrated Resource Plans (IRPs).

TABLE 1. Forecast Annual and Cumulative* Demand Changes for Expected Case

2024	Expected	
	Annual Rate	Cumulative
TOTAL	**1.2%**	**11.8%**
Residential	0.8%	7.2%
Commercial	0.3%	2.9%
Industrial	3.5%	36.7%
Generation	-0.5%	-4.5%

** Through 2032/2033*

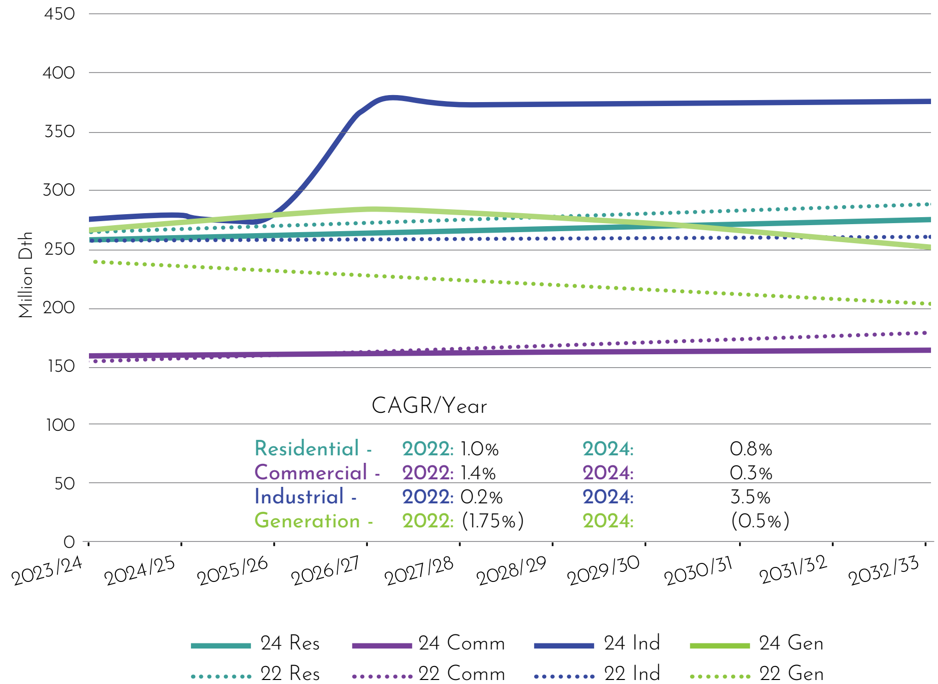
FIGURE 7. Comparison of Demand Growth Rates under Low, Expected and High Cases



NOTES: Compared to the expected case, the low and high demand cases are driven by a variety of economic and policy factors, including regional growth, commodity cost, cost of carbon, and LNG exports. Figure 7 shows a jump in demand when the Woodfibre LNG export facility near Squamish, BC, comes online. The project, in which Enbridge is a 30% investor, will produce an estimated 0.28 billion cubic feet (Bcf) per day at full build out. Expected to be the first net zero LNG facility in the world, Woodfibre LNG will expand global access to natural gas, displacing coal used for power generation in other countries.

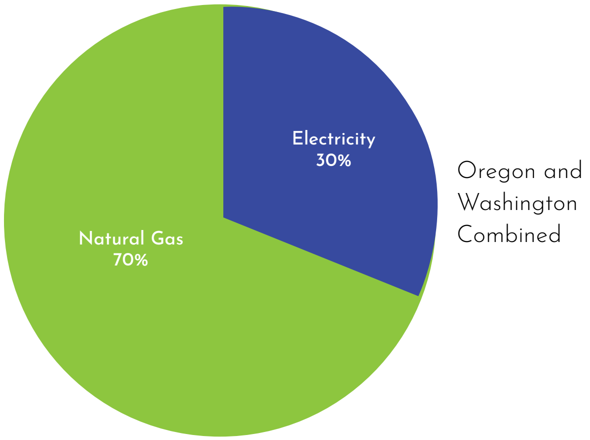
See Appendix B for forecast assumptions used by several regional utilities.

FIGURE 8. Expected Case Forecast by Economic Sector – 2022 to 2024 Comparison



NOTES: Residential demand for natural gas is expected to grow at about the same rate as forecast in the last Outlook, while commercial demand is slightly lower. This reflects several factors, including expected economic and population growth, and implementation of decarbonization policies enacted across the region. Future Outlooks may see further dampening of end-use demand as new policies and codes affecting consumer appliance choices have been enacted since the data for this Outlook was collected. Demand to serve generation, while still declining over time, is higher than the 2022 forecast as utilities have recognized they need natural gas-fueled generation to replace power from decommissioned regional coal plants and to balance intermittent renewable sources. Industrial demand (solid blue line in Figure 8) will increase markedly beginning in 2027, when Woodfibre LNG begins operation.

FIGURE 9. Share of OR/WA Demand Served During Peak Hour (Jan 14, 2024, 9-10am)



NOTES: The natural gas system is vitally important and never more so than during extreme weather. During the coldest weather, it delivers heat to keep homes and businesses warm. During the hottest weather, the system delivers fuel to generate the electricity that powers the air conditioners keeping homes and businesses cool. Figure 9 provides an example of how much we rely on natural gas in the Pacific Northwest during an extreme weather event. During one of the coldest hours of the regionwide cold snap in January 2024 (Jan. 14, 9-10 a.m.), electricity consumption was less than a third (30%, totaling 27 Gigawatt hours (GWh) or 92,829 Dth) of total end-use energy consumed in Oregon and Washington, while the natural gas system delivered more than twice that (70%, totaling 64 GWh or 218,546 Dth). (This does not include liquid fuels or the gas used to generate electricity.) The proportions of energy delivered for end-use consumption via the gas system and the electricity grid were similar in BC.

It is no surprise that efforts to electrify a large share of these natural gas uses requires significant investments in electricity transmission and distribution infrastructure. (See Gas and Electricity Systems Both Needed for Net Zero on p. 16.)

Capacity is Critical

The region's system of natural gas pipelines and storage facilities safely and reliably delivers energy to more than 3.5 million homes and 350,000 businesses across the Pacific Northwest (see Figure 9 and Table 2). Average utilization of the region's interstate pipeline system has exceeded 95 percent over the last five years and is expected to grow during normal winters over the next few years (see Figures 10 and 11), making storage a critical regional asset. Beginning in 2027, when a BC LNG export facility becomes operational, utilitization of current capacity would exceed 100%; however, the market has anticipated this, with several pipeline expansions proposed. Given that the system is already at or very near capacity during the winter months and the long lead times required to develop infrastructure (five or more years), ongoing evaluation of capacity needs remains critical.

FIGURE 10. Pacific Northwest Natural Gas Infrastructure and Capacities (MDth/day)

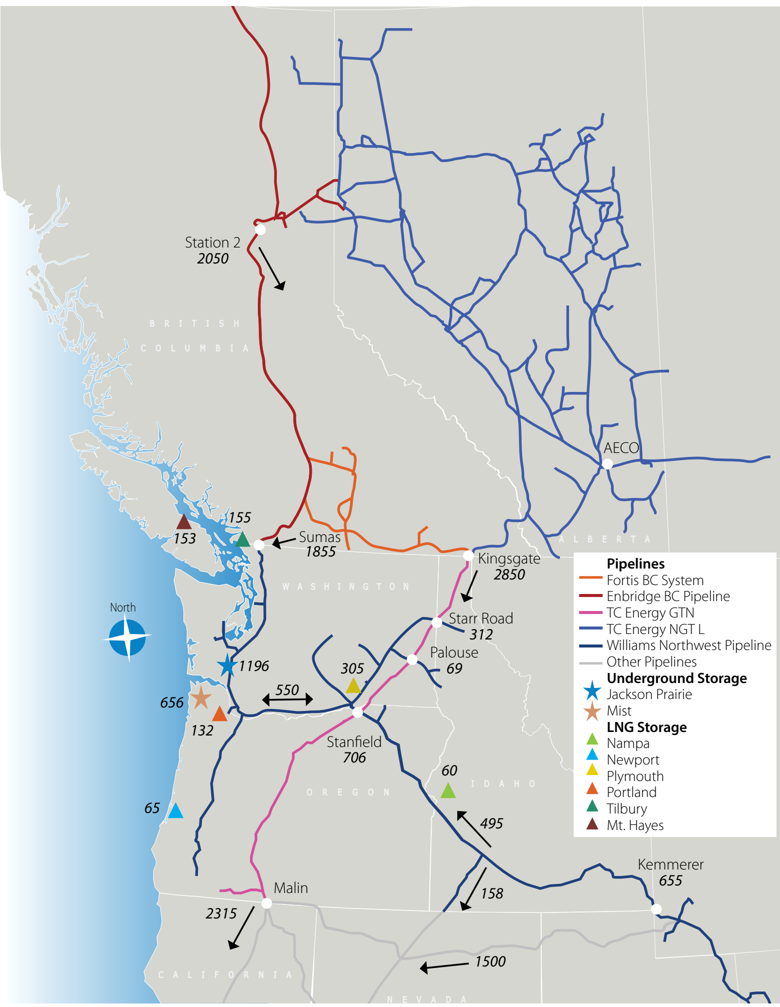


TABLE 2. Regional Storage Facilities

Facility	Owner	Type	Capacity (MDth)⁺	Max Withdrawal (MDth/day)⁺⁺
Jackson Prairie, WA	Avista, PSE, NW Pipeline	Underground	25,448	1,196
Mist, OR⁺⁺⁺	NW Natural	Underground	21,385	641
	Underground Subtotal		**46,833**	**1,837**
Plymouth, WA	NW Pipeline	Peak (LNG)	2,296	305
Tilbury, BC	FortisBC Energy	Peak (LNG)	1,634	155
Mt. Hayes, BC	FortisBC Energy	Peak (LNG)	1,530	153
Portland, OR	NW Natural	Peak (LNG)	500	131
Newport, OR	NW Natural	Peak (LNG)	968	65
Nampa, ID	Intermountain Gas	Peak (LNG)	600	60
Tacoma LNG⁺⁺⁺⁺	PSE	Peak (LNG)	538	85
Gig Harbor, WA	PSE	Peak (LNG)	11	3
	Peak Storage Subtotal		**8,077**	**957**
TOTAL STORAGE			**54,910**	**2,794**

⁺ Working gas capacity; gas that can be used to serve the market.

⁺⁺ Start of season or full rate; underground storage withdrawal rates decline as working gas volumes decline.

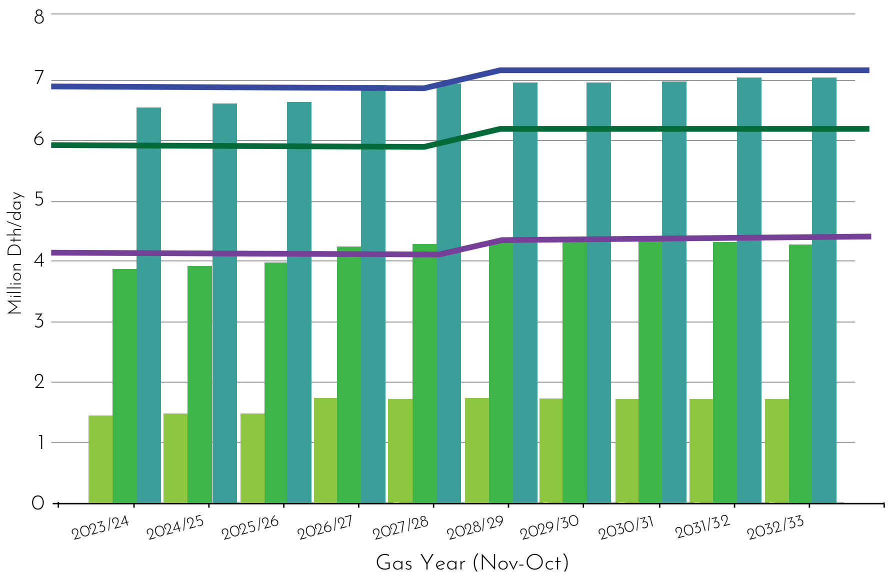
⁺⁺⁺ Mist capacity and deliverability include the North Mist Expansion in service May 2019.

⁺⁺⁺⁺ Tacoma LNG is designed to deliver 85 MDth/day, although the distribution system is currently able to receive 69 MDth/day.

NOTES: Storage facilities are an essential component of the region's delivery system, providing flexibility to serve demand when the weather gets cold. For shorter duration events, underground storage is a more cost-effective solution than building pipelines to serve seasonal, cold weather loads. Above ground storage, usually LNG, is designed to serve the last measure of demand on the very coldest days of the year.

The source of all charts and tables in this section is NWGA.

FIGURE 11. Peak and Average Day Supply/Demand Balance



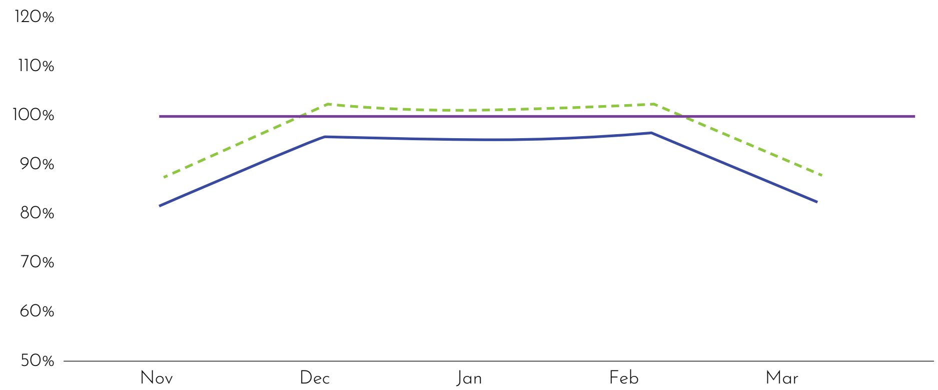
**Peak day values represent firm sales and transportation customers only.*

NOTES: Natural gas utilities are obligated to serve their firm sales customers at all times, even during coldest weather conditions. Consequently, they design their systems to accommodate extreme, but plausible, conditions called peak or design days (see Appendix B for a comparison of NWGA member company weather design standards). Figure 11 aggregates the projected design day volumes of NWGA members across the region and plots them against available capacity. The chart reflects increases in pipeline and peak storage capacities around 2028 due to expansions to the Enbridge Westcoast (BC) pipeline and Swarr Station Propane facility.

One can see that the region's delivery system has very little excess capacity to serve peak loads, which can be challenging during an extended, region-wide, cold weather event, such as one that occurred in February 2019. While Figure 11 assumes that all delivery infrastructure is operating at maximum first-of-season (November) deliverability, the 2019 cold snap demonstrated the limitations of that assumption. In fact, when combined with unplanned infrastructure curtailments and depleted underground storage inventories, the prolonged, extremely cold weather proved a severe test of the region's deliverability. More recently, a January 2024 cold snap provided another example of the system operating at its limits because of unanticipated, though short-lived, disruptions.

While the Pacific Northwest endured these late-season cold weather events with little disruption, the situation demonstrated how close the region is to exceeding deliverability capacity during severe weather events. Getting through both events required exercising strict discipline and demand response mechanisms on the gas system via interruptible sales and transportation contracts. (Buyers and shippers with interruptible contracts receive significantly discounted shipping rates in exchange for agreeing to supply disruptions whenever necessary to maintain system pressures.)

FIGURE 12. Regional Pipeline Capacity Utilization



Note: *Historical utilization factors based on the average daily demand and pipeline supply capacity which does not include storage supply.*

NOTES: Another way to think about deliverability is to consider capacity utilization. Figure 12 depicts historic utilization factors based on average daily demand and pipeline suppy capacity, which does not include storage supply. The blue line shows that the December through February (generally the coldest winter months) utilization factor has averaged 95 percent, while the dashed green line indicates a potential capacity deficiency during that period when demand from the Woodfibre LNG export facility in BC is added to average winter demand (expected beginning in 2027). The region's existing storage assets would not be able to make up the 90-day capacity deficiency if the region experiences a cold winter. And the Sumas market hub, already constrained, would become much more so, leading to negative impacts on existing demand. To address this regional capacity shortage, the market is exploring a number of pipeline and storage solutions. One is nearing certification: Enbridge's WestCoast Sunrise Expansion Project.[5]

Another approved pipeline capacity project is TC Energy's GTNXpress, designed to serve existing and growing demand in Southern Idaho, Central Oregon and beyond. GTNXpress is awaiting final certification by FERC.[6]

[5] https://www.enbridge.com/projects-and-infrastructure/projects/sunrise-expansion-program.
[6] https://www.tcenergy.com/operations/natural-gas/gas-transmission-northwest-xpress-project/

Delivering Decarbonization

Reducing GHG emissions is crucial to our planet. But how we approach decarbonization requires informed decision-making. In particular, it requires understanding that a diversified energy system — including both natural gas and electricity infrastructure — gives us the best chance of success.

In the Pacific Northwest, the natural gas industry is committed to supporting GHG abatement targets while also continuing to provide its customer with choices and solutions at reasonable and predictable costs. To that end, NWGA members are making investments in:

- Energy efficiency and demand-side management programs.
- Exploring opportunities for low-carbon energy technologies and infrastructure (such as renewable natural gas (RNG) and hydrogen) across the value chain. (See sidebars on RNG and hydrogen later in this section.)
- Safe and reliable delivery of natural gas to support efficient gas-fired generation facilities and end users.
- An ever tighter natural gas delivery system.
- Strengthening our approach to sustainability through environmental, social, and governance (ESG) opportunities.
- Pursuing extreme carbon reduction by 2050 or before.

These actions will help maintain a healthy and diversified energy system across our region, ensuring system reliability and continuing to put North America's abundant, low-priced natural gas supply and robust infrastructure to good use, while still allowing opportunities to drive emissions lower through innovation.

Here is a look at the actions already being taken by our members to reduce their carbon footprint (beyond incorporating increasing quantities of RNG, which is covered in the following sidebar). Click on the company name for more information.

Avista (WA, OR, ID) — Avista has set an aspirational goal for its natural gas systems to be carbon neutral by 2045. Avista's approach to reducing natural gas emissions includes investing in new technologies, reducing consumption via conservation and energy efficiency, and improving infrastructure.

Cascade (WA, OR) — Cascade's priority is helping the communities it serves to meet their GHG emissions reduction targets, while maintaining a system that is reliable and affordable for its customers. To that end, Cascade provides rebates to customers in support of high efficiency technologies and supports other innovations through partnerships with community and climate action groups, among other solutions.

Enbridge (throughout Canada and U.S.) — Enbridge is committed to a cleaner energy future by innovating across its entire value chain, with a goal of net zero emissions by 2050. It is also ramping up its efforts to adopt low-carbon solutions, including carbon capture and storage (CCS) technology.

FortisBC (BC) — FortisBC is pursuing multiple paths to support BC's lower-carbon future, from advancing energy-efficient technologies and offering rebates to encourage adoption, funding hydrogen research, and expanding low-carbon transportation options by partnering with courier services like UPS.

Intermountain Gas Company (ID) — Intermountain recognizes its role in securing a lower carbon future for Idaho. While working to minimize its own emissions, Intermountain leads or participates in several programs to help ensure a sustainable environment, including supporting research on new technologies, and provides rebates to customers adopting energy efficient technologies and building practices.

NW Natural (OR) — NW Natural has set a voluntary goal of 30% carbon savings by 2035. Steps to reach that goal include lowering energy use through aggressive energy efficiency and conservation efforts and reducing the carbon intensity of conventional gas across its value chain. By 2022, the company had achieved 42% of its carbon-savings goal.

Puget Sound Energy (WA) — PSE aspires to reach net zero carbon emissions for natural gas used in customer homes and businesses by 2045, with an interim target of a 30% emissions reduction by 2030. Beyond its direct emissions, PSE is also committed to working with customers and industry to further reduce carbon across sectors and the state through various programs and initiatives.

TC Energy (throughout Canada, the U.S. and Mexico) — TC Energy is a leader in the safe, responsible and sustainable delivery of energy as well as the advancement of a cleaner energy future through investments in innovation and modernization to lower emissions. The company's highly integrated North American asset base helps support a path to net zero by 2050.

Williams Northwest Pipeline (WA, OR, ID) — Williams has reduced its companywide GHG emissions by 43% since 2005, making considerable progress toward its 2030 goal of a 56% reduction and "net zero" aspiration by 2050. The company is advancing its long-term climate commitment through continued operational optimization and asset modernization, along with the development of decarbonization projects by its New Energy Ventures group.

Now let's broaden our look at the industry's GHG emissions reduction progress by parsing national and regional data.

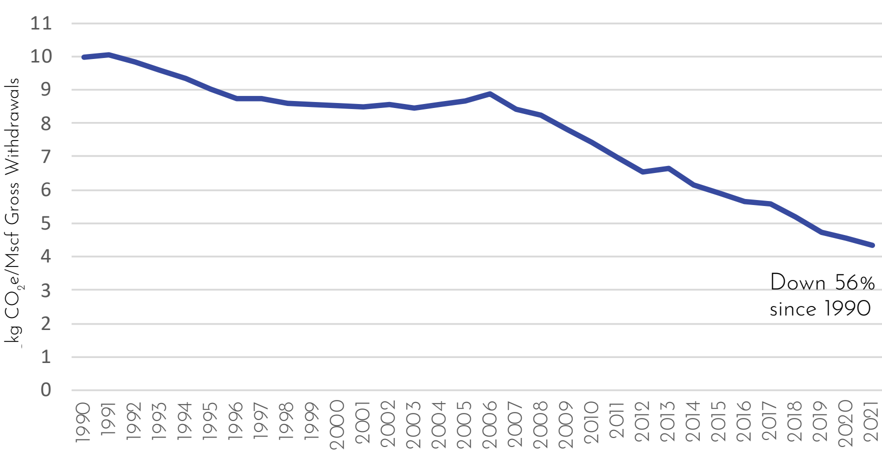
Industry-wide Natural Gas Emissions are Low and Declining

A better understanding of methane emissions released from natural gas production and delivery systems helps clarify how the proper deployment of natural gas can deliver significant environmental benefits. Let's take a look at the numbers.

The U.S. Environmental Protection Agency (EPA) made further updates to its estimates of CH_4 emissions in its Inventory of U.S. Greenhouse Gas (GHG) Emissions and Sinks: 1990-2021 ("Inventory"), released in 2023. The Inventory incorporates new data available from studies on emissions as well as the EPA's own Greenhouse Gas Reporting Program (GHGRP).

The Inventory found that industry-wide[7] CH_4 emissions across all U.S. natural gas systems have declined 16% from 1990 to 2021. (Total GHGs (methane, carbon dioxide and nitrous oxide) declined 12%.) During those same three decades, U.S. dry gas production increased by 94%. When emissions are expressed as a ratio per unit of natural gas produced, they show a decline of 56% since 1990, according to the EPA (see Figure 13). (In Canada in 2020, the transmission, distribution and storage of natural gas produced around 10 metric tonnes (Mt) CO_2eq emissions, representing 1.5% of total Canadian GHG emissions, according to the Canadian Gas Association.)

FIGURE 13. U.S. Methane Emissions per Mcf of Gas Produced

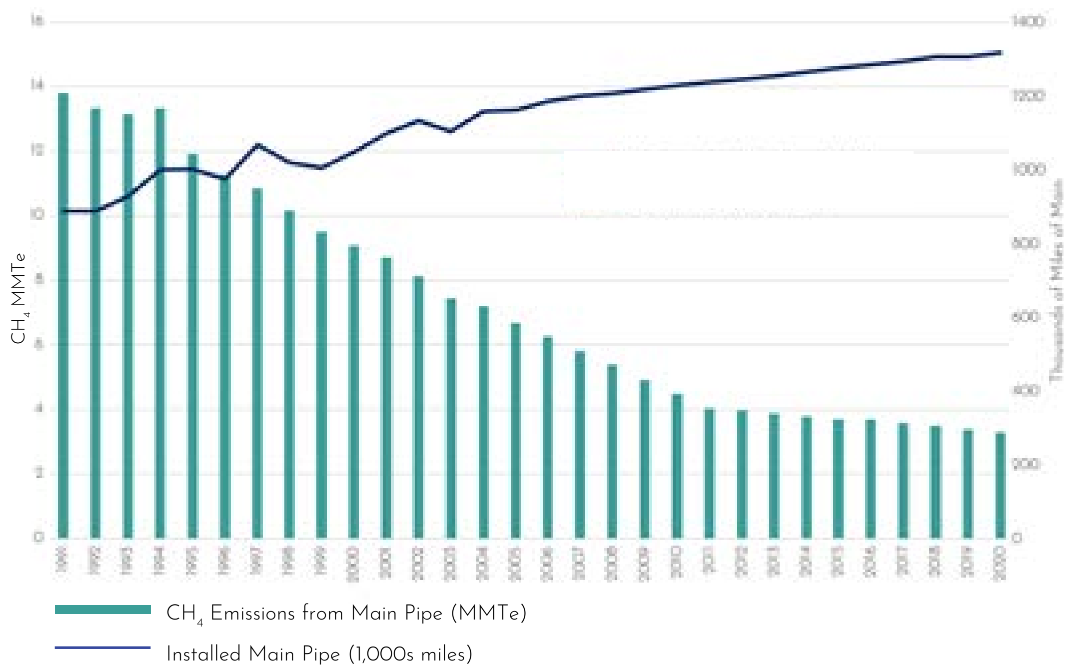


Source: *AGA, based on EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*

The Inventory also confirmed that natural gas distribution systems have a small emissions footprint that continues to decline. Distribution system CH_4 emissions in 2021 were 70% lower than 1990 levels and 1% lower than 2020 emissions (see Figure 14), even as distribution system pipeline mileage increased 57% or by nearly 831,000 miles. Annual CO_2 emissions from this segment are less than 0.1 million metric tons of CO_2-equivalent (MMTe) across the time series.

The bottom line: New control technologies, replacement of old cast iron and bare steel pipes, and better industry practices have contributed to significant emissions reductions, even as annual natural gas production and consumption have hit record highs.

FIGURE 14. U.S. Methane Emissions from Natural Gas Distribution Systems



Source: *EPA Inventory, 1990-2021; courtesy of AGA*

[7] Industry-wide or "lifecycle" emissions, as defined by the EPA, include natural gas field production, processing, transmission, storage, and distribution.

Regionally, Emissions are Already Lower and Expected to Decline Even Faster

In the basins from which the Pacific Northwest sources most of its natural gas, policy-makers and regulators have taken action to further decrease CH_4 emissions from upstream operations. Effective January 2020 in BC, the source of about two-thirds of our region's natural gas, the BC Oil and Gas Commission (BC OGC) committed to reducing CH_4 emissions from upstream oil and gas operations by 45% by 2025 relative to 2014 levels, targeting everything from compressor seals to storage tanks. The BC approach is expected to reduce CH_4 emissions by 10.9 megatonnes (10.9 MMt) of CO_2 equivalent over a 10-year period, the equivalent of taking 390,000 cars off the road each year.[8] In addition, BC's natural gas transmission sector is expected to reduce its emissions by 40-45% below 2012 levels by 2050 under the Canadian federal Methane Regulation, which also came into force in January 2020. Like the BC OGC, the federal Methane Regulation is focused on reducing fugitive emissions and emissions associated with venting.

In 2014, Colorado (which provides much of our region's Rockies' gas — about one-third of our supply) approved the first CH_4 regulations in the U.S., requiring energy companies to reduce CH_4 emissions from oil and natural gas operations by routinely checking their oil and natural gas wells — both new and existing — statewide, and immediately addressing any leaks. In 2019, the state tightened its rules further to require semiannual leak detection, tank controls, and performance standards for transmission. And in December, 2021, the state's Air Quality Control Commission adopted even stricter regulations centered on an "emissions intensity" program allowing operators the flexibility to reduce emissions proactively and innovatively.[9] These regulations go well beyond those of the EPA, according to the Environmental Defense Fund, which helped craft Colorado's regulations.

By 2016, field surveys of oil and gas equipment by the Colorado Department of Public Health and Environment (CDPHE) found a 75% drop in the number of sites where CH_4 leaks were detected compared to similar surveys conducted prior to the regulations taking effect, said Will Allison, former director of the department's Air Pollution Control Division. CDPHE projects a further reduction of 44% in GHG emissions between 2020 and 2025, with additional reductions expected in 2030 and beyond.[10]

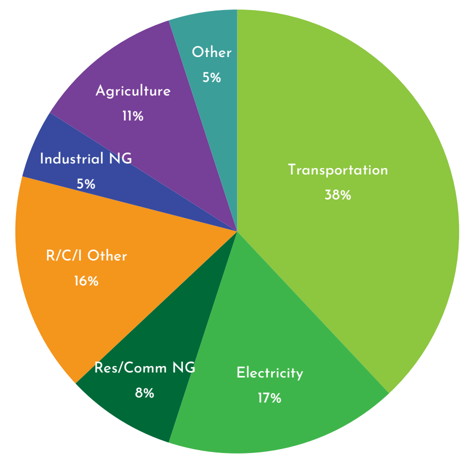
Pipeline and natural gas utilities serving the Pacific Northwest have also made individual commitments to reduce their emissions. Williams Northwest Pipeline, for example, has set a measurable goal of 56% absolute reduction from 2005 levels in companywide GHG emissions by 2030, with the ultimate goal to reach net zero by 2050. (Since 2005, Williams has cut emissions 44%.) Likewise, in 2021, NW Natural released its Vision 2050: Destination Zero report, which presents multiple scenarios, using currently available technologies, toward a carbon neutral future.

So another bottom line: gas pipelines serving the Northwest have a competitive emissions profile and will continue to improve.

Regional Natural Gas Emissions are Small Relative to Other Sectors

Overall, GHG emissions from direct use of natural gas in the Pacific Northwest (BC and states of Washington and Oregon; residential/commercial and industrial customers) account for 13% of total regional GHG emissions, or nearly the same as agriculture (11%). (See Figure 15). The transportation sector (gasoline- and diesel-powered trucks, fleets, personal vehicles, public transit, etc.) produces the largest share of regional emissions (38%). Power generation and emissions from non-gas residential/commercial/industrial activities (the"R/C/I other" category) contribute 17% and 16%, respectively. (Examples of the 5% "other" emissions include waste streams like landfills and wastewater treatment plants, and oil and natural gas extraction in BC.)

FIGURE 15. Emissions by Source in the Pacific Northwest (BC, OR, WA)



Sources: *Washington State Greenhouse Gas Emissions Inventory: 1990-2019, (https://apps.ecology.wa.gov/publications/documents/2202054.pdf);*
State of Oregon Department of Environmental Quality, Greenhouse Gas Sector-Based Inventory, 1990-2021 Inventory Data (https://www.oregon.gov/deq/FilterDocs/ghg-sectordata.xlsx);
BC Provincial Greenhouse Gas Inventory, 1990-2021 (https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-inventory).

[8] For details from the BC Oil and Gas Commission, see https://www.bcogc.ca/public-zone/reducing-methane-emissions.

[9] https://coloradosun.com/2021/12/20/greenhouse-gas-reduction-oil-gas-colorado/

[10] A research paper entitled "Downward Trend in Methane Detected in a Northern Colorado Oil and Gas Production Region Using AIRS Satellite Data," published by Earth and Space Science in 2022, provides details on how emission reductions are verified. https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2022EA002609.

Bottom line: Policies aimed at "electrifying" home heating and other natural gas uses by residential, commercial and industrial customers will not produce significant emissions reductions,[11] particularly when it is also likely to increase power generation emissions. The emissions savings from electrification would also come at great cost to consumers.

Steps toward a Low-Emissions, Diversified Energy Future

The path to deep decarbonization is complex. We don't have all of the answers today, but with the right combination of technologies, policies, and partnerships, we can get there. One thing we do know, however, is that it makes considerably more sense to keep our options open in the future — by maintaining a mix of energy sources and employing each where it is most efficient and cost-effective — while continuing to innovate and reduce emissions no matter the energy source.

And residents in our region agree. In late 2021, a survey conducted by DHM Research for NW Natural showed that 73% of Oregon and Southwest Washington voters believed they should have a choice of energy options to meet their needs and not have those choices mandated by their local government. They also (78%) support local government efforts to encourage the use of RNG.

[11] According to a 2018 American Gas Association study, aggressive policy-driven residential electrification could reduce GHG emissions across the U.S. by only 1-1.5% by 2035. More recently, in July 2022, the cities of Portland and Eugene in Oregon both issued analyses of potential GHG emissions reductions from banning natural gas in all new construction, and arrived at the same or lower conclusions. Portland found a 1% emission savings by 2050, while Eugene found 0.1% of emissions reductions from the residential sector and 1.7% reductions from the commercial sector by 2037. This assumes 100% renewable sources for electricity.

Gas and Electricity Systems Both Needed for Net Zero

By FortisBC

Getting to net zero is no small task and there are no simple solutions. Those who push electricity-only approaches are taking an oversimplistic view of a complex problem, ignoring potential risks to reliability and affordability in doing so.

As a provider of both electricity and gas in BC, FortisBC recognizes the importance of addressing climate change and is leading the way in shaping our province's clean energy transition. It's working to better understand and prepare both its energy systems to meet demand under various carbon-reduction scenarios so that it can provide safe, reliable and affordable energy.

Gas and electricity systems have different strengths, and we need to leverage those to reduce GHGs. The gas system offers low-cost seasonal storage and high deliverability during periods of peak demand that are key to meeting growing customer needs. Not only that, but existing gas systems can be used to deliver renewable and low-carbon energy[12] like RNG and potentially hydrogen in the future.

Much like the gas system, electrification has a role to play in achieving net zero, but it is not a complete solution. Electricity systems across Canada are going through a massive transition of their own: reducing their own emissions, replacing aging infrastructure and investing in adaptation to ensure reliability in the face of a changing climate. This must all be done while also scaling up to meet growing demand as society uses more electricity for things like electric vehicles. That is why we should take care not to deepen this challenge by seeking to electrify peak winter heating — a challenge that involves building large amounts of infrastructure that would only get used for a few months each year and a task that is more suited to the strengths of the existing gas system. These challenges underscore the benefits of a diversified approach to meeting energy demand, with gas and electricity systems working in tandem.

For example, during a cold snap on January 20, 2024, FortisBC's gas system set a new peak demand record, delivering more than 21,000 MW of energy across the province, about twice the amount of energy delivered by the electricity systems (FortisBC and BC Hydro combined). Much of the additional electricity required to meet peak demand would likely be generated from dispatchable sources such as gas. Because renewable power from wind and solar can only be generated when there is wind and sun present, they may not be available when needed. There is also a limited amount of new hydroelectric power available.

That is why the gas system is so important to our energy future — it is designed to serve this type of load and is increasingly providing low-carbon[13] energy, such as RNG. Derived from organic sources, RNG blends seamlessly into our existing gas system, displacing conventional natural gas. This makes it a "drop-in" energy that allows customers to use their existing gas appliances or equipment, while still achieving emissions reductions.

And the costs of full electrification are significant. FortisBC analyzed the data from both its electricity and gas systems and climate data over the last three years in the City of Kelowna to estimate the impact that various levels of electrification would have on meeting peak winter energy demand and the estimated cost of developing the required electricity infrastructure. It found that replacing all the energy currently provided by the gas system in Kelowna would more than triple the peak demand for electricity by 2040.

The analysis showed a limited ability to lower this peak demand even with the widespread adoption of high-efficiency electric heat pumps, enhancing energy conservation opportunities and shifting electric vehicle charging to overnight hours.

This preliminary study highlighted that the existing gas system is critical for energy security, supply and affordability and that the electricity and gas systems, when used together, provide a viable, cost-effective and sustainable method to meet climate targets. Both gas and electricity services have a role to play in meeting the growing energy needs of consumers. Instead of replacing critical infrastructure, at a considerable cost to customers, we can use low-carbon fuels like RNG and, potentially, hydrogen to reduce the burden that electricity systems are already facing. It remains important to have both energy systems working together because it allows the consumer to make the choice that's right for them while ensuring that not all of our energy needs are reliant on a single system.

[12] FortisBC uses the term renewable and low-carbon gas to refer collectively to the low-carbon gases or fuels the utility can acquire under the Greenhouse Gas Reduction (Clean Energy) Regulation, which are includes RNG (also called biomethane), hydrogen, synthesis gas (from wood waste) and lignin. FortisBC's renewable and low-carbon gas portfolio currently includes only RNG. Other gases and fuels may be added to the program over time. Depending on their source, all of these gases have differing levels of lifecycle carbon intensity. However, all of these gases are low carbon when compared to the lifecycle carbon intensity of conventional natural gas.

[13] When compared to the lifecycle carbon intensity of conventional natural gas. The burner tip emission factor of FortisBC's current RNG portfolio is 0.29 grams of carbon dioxide equivalent per megajoule of energy (gCO_2e/MJ). FortisBC's current RNG portfolio lifecycle emissions are -22 gCO_2e/MJ. This is below BC's low carbon threshold for lifecycle carbon intensity of 36.4 gCO_2e/MJ as set out here: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/electricity/bc-hydro-review/bc_hydrogen_strategy_final.pdf

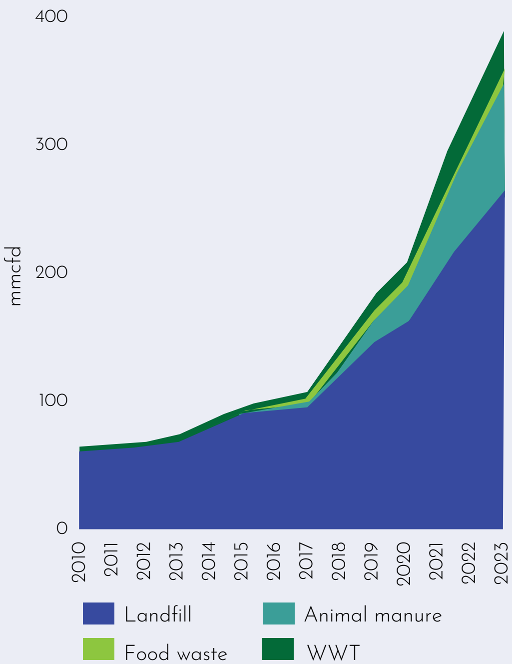
Renewable Natural Gas Production Grows

Just like the electric grid delivers green electrons generated by renewable resources like wind and solar, natural gas infrastructure can deliver green molecules like RNG (discussed in this sidebar) and hydrogen (see following sidebar). Pipes matter. What they deliver will evolve and enable us to meet our decarbonization goals.

RNG, also called biogas or biomethane, is made by capturing and purifying methane released from decomposing organic wastes. RNG has a double emissions-reduction benefit: 1) it prevents methane from escaping into the atmosphere and contributing to climate change (decomposing organic wastes make up 30% of U.S. methane emissions) and, 2) it can seamlessly displace conventional natural gas across a range of applications (space heating, transportation, etc.). As of summer 2023, there are more than 300 RNG facilities in operation in North America, according to the Coalition for Renewable Natural Gas. Some 178 more RNG facilities are under construction across the continent, with another 303 facilities in planning stages.

FIGURE 16. Sources of RNG in North America

Production capacity by feedstock type



Source: *Wood Mackenzie, 2023*

Landfills are the largest source of methane for RNG, but animal waste projects are on the rise, followed by food waste and wastewater treatment projects. (See Figure 16.)

Regionally, gas utilities and pipelines continue to ramp up efforts to work with farmers, developers and local governments to capture and inject RNG into existing natural gas systems. Assisting these efforts are governmental policies and incentives to encourage further development.

In **British Columbia,** the provincial CleanBC RoadMap to 2030 sets a commitment to achieve BC's legislated GHG reduction target of 40% below 2007 levels by 2030. Renewable and low-carbon gases such as RNG and hydrogen are expected to play a significant role in meeting the Province's CleanBC targets. As of today, FortisBC is receiving RNG from 14 suppliers. FortisBC's regulator, the BC Utilities Commission, has approved an additional 17 projects. Changes in May 2021 to the provincial Greenhouse Gas Reduction Regulation allow FortisBC to increase the amount of renewable and low-carbon gases it has in its supply portfolio up to 15% and enable increased investment in renewable and low-carbon gases.

In **Washington,** the state legislature passed a law in 2019 that requires each gas local distribution company (LDC) to offer RNG to its customers and gives those entities the ability to introduce RNG into their standard supply portfolios, provided the cost of RNG does not increase customer costs by more than 5%. Washington gas utilities have worked with Washington Utilities and Transportation Commission (WUTC) staff and other interested parties to develop RNG cost recovery rules, RNG program limitations and RNG gas quality requirements.

Currently there are seven projects producing or soon-to-begin producing RNG in Washington state – two landfills and one multi-farm dairy-waste digester connected to Williams Northwest Pipeline; two wastewater treatment facilities connected to Puget Sound Energy's (PSE) distribution system; and one landfill and a food-waste digester attached to Cascade Natural Gas's distribution system. (One very large landfill project is off-line due to contractual disputes with the landfill.) Currently, the output of some facilities is committed to serving the vehicle fuel market, primarily in California. However, as the vehicle fuel market matures and reaches saturation, it is expected that landfill- and wastewater-sourced RNG will be redeployed to serve local utility demand.

In **Oregon**, similar to Washington, a law passed in 2019 (SB 98) that required the Public Utility Commission to adopt RNG programs for both large and small gas utilities, enabling them to fully recover costs of integrating RNG into their systems. Up to 5% of a utility's revenue requirement may be used to cover the incremental costs of RNG. The law also outlines goals for adding as much as 30% RNG into the state's pipeline system by 2050. A 2017 study by Oregon's Department of Energy showed a technical potential of recovering some 48 billion cubic feet (Bcf) of RNG within the state annually, an amount that could supply every home using natural gas in Oregon today with a local, renewable energy source.[15]

RNG development could reduce U.S. GHG emissions between 101-235 million metric tons (MMT) by 2040 – the equivalent of reducing GHG emissions from average annual residential natural gas use by 95% from levels observed over the last 10 years.[14]

To date, there are six RNG facilities operating or soon to begin operating in Oregon. These include two at dairy farms (Boardman, Tillamook), a third facility in Junction City that uses methane from both locally sourced cow manure and agricultural residues, two wastewater treatment plants (Eugene, Portland), and a planned facility in Lakeview that will process wood waste. Like RNG producers in Washington state, most of these projects are earmarked

[14] https://www.gasfoundation.org/2019/12/18/renewable-sources-of-natural-gas/

[15] Biogas and Renewable Natural Gas Inventory SB 337 (2017), 2018. www.oregon.gov/energy

to supply the California vehicle market (via sale of RTCs), although some Portland RNG will power city trucks at a natural gas fueling station now in operation. However, these projects provide additional local benefits, including emissions reductions, air quality improvements and additional revenue streams. In addition, projects often sell the commodity or "brown" gas separately from the environmental attributes. For NW Natural, which has purchase agreements in place with Shell New Energies (Junction City facility), this provides an additional on-system resource of natural gas supplies.

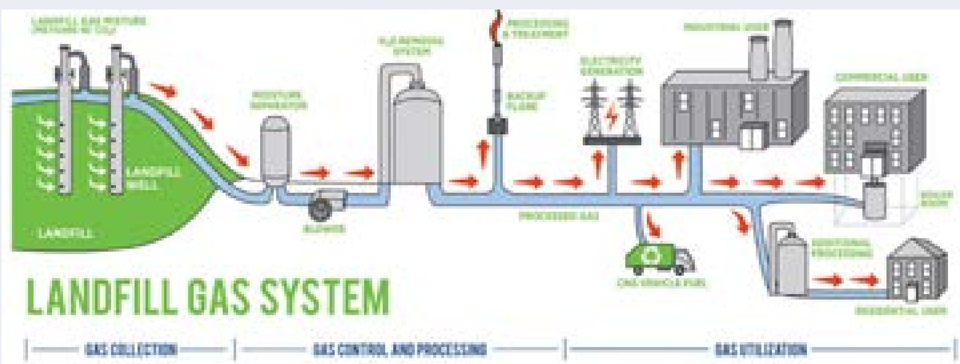
In **Idaho**, which currently has no policies encouraging direct utility RNG investment or procurement of RNG into utility supply portfolios, there are nonetheless three RNG facilities providing approximately 525,000 Dth/year to Intermountain Gas Company and Williams Northwest Pipeline.

Here is a look at RNG developments for each of our NWGA member companies:

FortisBC (BC)
FortisBC has increased its supply of RNG and is exploring the supply potential of other low-carbon gases (such as hydrogen). Once all of FortisBC's current RNG projects are active and producing RNG to their maximum contracted capacity, the company anticipates delivering more than 23 million gigajoules (GJ) (about 22 MMDth) of RNG annually to its customers, equivalent to the gas needs of more than 256,000 homes in BC, based on average annual usage of 90 GJ per home. FortisBC's goal is to replace 75% of the natural gas running through its system with renewable and low-carbon gases by 2050.

On the customer side, FortisBC received approval from the BC Utilities Commission to provide a mandatory and increasing blend of RNG to all customers. FortisBC was the first utility in North America to introduce a voluntary RNG program where customers can designate between 5-100% of their natural gas use as RNG. If changes to the customer program are approved, the existing voluntary RNG program will continue.

FIGURE 17. Example of RNG Production from a Landfill Source



Enbridge (throughout Canada and the U.S.)
Enbridge's gas utility, Enbridge Gas, is actively involved in seven Canadian RNG projects operating or under construction, with an additional 50+ projects in various stages of development. Recently, Enbridge partnered with Divert to invest nearly $100 million to build a first-of-its-kind Longview Integrated Diversion & Energy Facility (IDEF) at the Mint Farm Industrial park, which will process up to 100,000 tonnes/year (tpy) of food waste from retailers and other companies in Washington and Oregon and transform it into approximately 240,000 Dth of RNG annually. Importantly, the operation will offset up to 23,000 metric tons of CO_2 a year at full processing capacity. The Longview facility broke ground on Sept. 7, 2023, and is expected to be in-service by the end of 2024.

TC Energy (throughout Canada, the U.S. and Mexico)
TC Energy began transporting RNG on its system in Canada in 2002 and in the U.S. in 2005. The company's portfolio includes 16 RNG connected facilities across the U.S. Regionally, TC Energy is a partner in the Threemile Canyon Farms project in Boardman (OR), which produces around 1,200 -1,400 MMbtu/day (1.2 - 1.4 MDth)or enough RNG from livestock to reduce GHG emissions equivalent to removing 28,875 passenger vehicles from the road or the energy consumed by 16,285 homes.

Williams Northwest Pipeline (WA, OR, ID)
Currently there are two landfills and one multi-farm dairy-waste digester directly connected to Williams Northwest Pipeline in Washington state producing more than 4,000 Dth/day. In Oregon, Williams has one RNG trucking interconnect that sources gas from a multi-farm dairy-waste digester and has the ability to inject directly into the pipeline. Williams has three Idaho RNG producers (dairy farms directly connected) to the pipeline, two came online in 2020 and the third in 2023. Additionally, Williams Northwest Pipeline has a trucking interconnect located in Idaho, bringing total RNG producers to four. Williams continues to engage other RNG producers for potential future projects.

Avista (WA, OR, ID)
Avista has connections with five RNG production facilities throughout its service area and beyond. Regionally, Avista has contracted with Pine Creek RNG on projects in Washington state, which includes the Horn Rapids Landfill in Richland. Horn Rapids construction is expected to be completed in January 2024, and will produce 300,000 Dth of RNG annually. Avista, which offers customers a program to subscribe to blocks of RNG like many NWGA members, also obtains RNG from the H.W. Hill Renewable Natural Gas facility in Roosevelt, WA, through an agreement with PSE. The total output of these and other Pine Creek projects contracted with Avista is an expected 970,000 Dth annually, which is equivalent to the natural gas used by some 17,500 homes. These and upcoming RNG projects will help Avista meet its aspirational goals to reduce natural gas emissions and be carbon neutral by 2045.

Puget Sound Energy (WA)
PSE began inclusion of RNG in its standard portfolio in mid-2020 and now expects RNG volumes of approximately 3 MMDth during 2024, with approximately half from regional sources and the remainder from out-of-state sources. While PSE has a goal of supplying RNG equal to 10% of its sales volume by 2030, it is currently limited by the 5% customer bill impact limitation. The utility continues economic analysis and preliminary discussions with numerous developers seeking to complete RNG projects in western and central Washington and with various municipal and regional wastewater treatment plants and landfills that seek to create additional revenue streams and reduce their own carbon footprint. It also began offering a voluntary RNG program to its gas customers in early 2022.

Cascade Natural Gas (WA, OR)
Cascade Natural Gas has RNG projects currently under contract, where Cascade receives most but not all Renewable Thermal Credits (RTCs), that will put more than 1 MMDth/year into the company's system. Washington projects include a food processing wastewater processing facility in Pasco; a landfill facility and agricultural biomass digester, both in Richland; and a grocery waste processing facility in Longview. In Oregon, Cascade is building an RNG production facility at a Bend landfill. Together, these RNG projects will displace the equivalent of 17,120 residential customers' annual natural gas usage based on average customer consumption. Cascade also procures RNG via offtake[16] agreements and plans to continue directly adding RNG to its system as opportunities are identified. As of 2023, then, Cascade had signed agreements with options to purchase or develop RNG that will allow the Company to offset approximately 16% total emissions by 2027.

NW Natural Gas (OR)
Northwest Natural is connected to three RNG producers in Oregon. These include the Shell New Energies Junction City biomethane facility, which began sending RNG through NW Natural pipelines in December 2021 using methane from locally sourced cow manure and agricultural residues to produce 160,139 MMbtu (160 MDth) of RNG annually. The Metropolitan Wastewater Management Commission project in Eugene-Springfield, commissioned in 2021, supplies 32,708 MMBtu (33 MDth) of RNG annually, while the City of Portland's Columbia Boulevard Wastewater Treatment Plant will begin supplying RNG to NW Natural's system in 2024. NW Natural has also announced it will build an RNG facility at the Greater Wenatchee Regional Landfill in Washington. That facility, to go online in 2025, is expected to convert landfill gas into roughly 300,000 MMBtu (300 MDth) per year, enough to heat roughly 4,500 homes.

NW Natural also procures RNG via offtake agreements and two Midwest projects currently operating at Tyson Foods facilities. The Tyson projects are expected to generate more than 281,534 MMBtu (282 MDth) of RNG each year – the equivalent of heating about 4,266 homes in Oregon. In all, through 2023, NW Natural had signed agreements with options to purchase or develop RNG totaling 3% of the company's annual sales volume in Oregon, with plans to increase to 5% within the next two years and 10% by 2029.

Intermountain Gas Company (ID)
Intermountain has worked with the Idaho PUC to implement an RNG Facilitation Plan allowing Intermountain to actively work with RNG producers in Idaho. To date, Intermountain has connected three RNG producers – dairy farms in southern Idaho – that produce approximately 1,440 Dth/day or nearly 525,000 Dth/year. Intermountain planned to bring on its fourth project in January 2024 and expects to add two more – one of which will be its first landfill project – by the end of 2024. Intermountain recently received a blanket certificate to allow for transport of RNG for injection into Williams Northwest Pipeline that will allow it to bring on additional RNG projects. Intermountain continues to receive RNG inquiries across its service territory and anticipates it will continue to add additional facilities past 2024.

Regionally, this means natural gas pipelines located in and/or serving the Pacific Northwest are carrying increasing percentages of RNG. Williams Northwest Pipeline, for example, to date has transported over 19.2 Bcf of RNG on its system; its pipeline moved over 2.6 Bcf of RNG in 2023 alone.

[16] Through "offtake" or "book-and-claim" agreements, gas companies purchase the environmental attributes, or Renewable Thermal Certificates (RTCs), generated by new RNG facilities located anywhere in the U.S. RTCs are similar to Renewable Energy Certificates (RECs) used by electric utilities. The Coalition for Renewable Natural Gas offers a primer on book-and-claim here: https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/648cbcceb61ff77436e8892e/1686944976011/RNG+and+Book+and+Claim+Accounting+2023.pdf

The Role of Hydrogen in a Low-Carbon Future

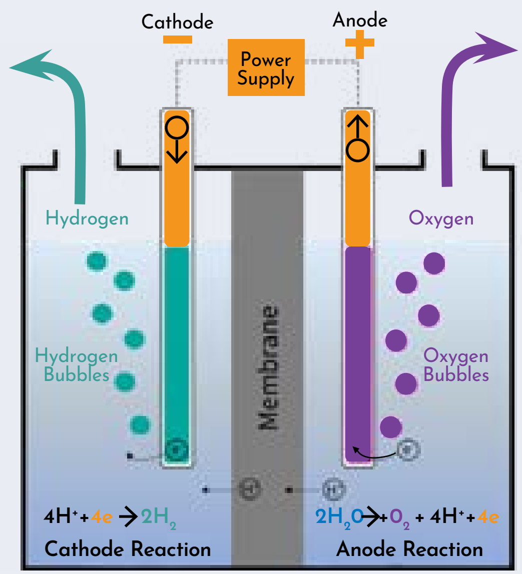
Hydrogen has promise as a fuel because it burns without creating GHGs. While there are multiple ways to produce it, the cleanest and most promising process uses only renewable energy sources. Called "green" hydrogen, renewable hydrogen is created by utilizing excess wind, solar or hydroelectric power to separate water molecules into hydrogen and oxygen. Following this electrolysis process, the hydrogen enters natural gas pipelines and oxygen is released into the air. Renewable Hydrogen acts just like battery storage for excess renewable electricity. It captures the excess power so we can use it when the wind isn't blowing and the sun isn't shining, and it helps balance energy needs with energy supply.

Hydrogen can also be used multiple ways, such as to heat homes, fuel cars, planes and ships, and power factories. In addition, production can rapidly scale to meet potential demand and, as noted above, it can be transported and delivered using the natural gas industry's vast existing pipeline network, minimizing investment in costly new infrastructure. However, producing green hydrogen can be costly; which is why government subsidies are directed at researching innovations to make it commercially viable.

Thanks to government incentives, there were 33 operational green hydrogen facilities across North American as of 2022, with five more expected to be operational in 2023.[17] And projects are starting to be developed right here in our own backyard.

In Washington, Douglas County PUD's new Renewable Hydrogen pilot project near Baker Flats, East Wenatchee, is expected to begin production in June 2024, with a phase two expansion recently approved. This project was made possible through bipartisan legislation approved in 2019 that authorizes public-utility districts to produce and sell green hydrogen. Also in Washington, PSE has run a series of pilot hydrogen projects at its Georgetown Training Facility (2021) and Tacoma Operating base (2022) to test different hydrogen/natural gas blends for system impacts, including potential leaks, air quality changes, gas quality, and impact on appliances. PSE intends to continue researching and sharing what it learns as part of its membership in the Renewable Hydrogen Alliance (RHA[18]).

FIGURE 18. How Electrolysis Works to Create Hydrogen



Source: *U.S. Department of Energy*

In Oregon, after several years of initial testing, NW Natural stepped up its hydrogen blending efforts in 2022 to 15% to heat NW Natural's resource center and training facility in Sherwood, OR, the first facility in the state to receive blended hydrogen. Today, NW Natural is working on blending at 20% levels.[19] On the state level, the Oregon Department of Energy (ODOE) released a report[20] in November, 2022, that recommends next steps to the Legislature for addressing how renewable hydrogen can fit into the state's existing renewable energy and GHG reduction policies and goals.

In October 2023, the U.S. Department of Energy (DOE) selected the Pacific Northwest Hydrogen Association's PNWH2 Hub[21] as one of seven federal Infrastructure Investment & Jobs Act Regional Clean Hydrogen Hubs. PNWH2 includes proposed projects from 17 companies, including local utilities PSE and Portland General Electric. The intent is to produce green hydrogen at scale for use locally in the region in heavy-duty transportation (including maritime), grid reliability, industrial processes, and other "hard-to-abate" sectors.

Similarly, in BC, FortisBC is collaborating with the University of British Columbia's School of Engineering to study how to safely and reliably blend hydrogen with natural gas in FortisBC's existing system. FortisBC has also partnered with Suncor Energy (Suncor) and Hazer Group Limited (Hazer) for a pilot project in Port Moody that explores the use of an innovative methane pyrolysis technology for the first time in North America.[22] On the provincial level, the BC Hydrogen Strategy (Strategy) was released in July 2021, clarifying how the province will promote, incentivize, and support the development of low-carbon hydrogen production, use, and export over the next 10 years and beyond. The Strategy's immediate priorities included scaling up production of renewably sourced hydrogen, establishing regional hydrogen hubs and deploying medium- and heavy-duty fuel-cell vehicles. To expedite these priorities, a BC Hydrogen Office has been established to work with federal and local governments to help attract investments and simplify the multi-jurisdictional review and permitting processes.

[17] https://www.airswift.com/blog/green-hydrogen-projects-usa#:~:text=There%20were%2033%20operational%20Green,tons%20per%20annum%20(MTPA)
[18] https://renewableh2.org/
[19] NW Natural 2022 Community and Sustainability Report. NW Natural Community & Sustainability Report - NW Natural.
[20] https://www.oregon.gov/energy/Data-and-Reports/Documents/2022-ODOE-Renewable-Hydrogen-Report.pdf
[21] https://pnwh2.com/pnwh2-hub
[22] https://www.fortisbc.com/news-events/media-centre-details/2022/07/04/hydrogen-partnership-to-advance-new-pilot-facility-with-cleanbc-support

Appendices

APPENDIX A – Data Tables

APPENDIX B – Planning Assumptions Including Weather Design

APPENDIX C – Resource Deficiencies and Preferred Resources

APPENDIX A1: Maximum Withdrawal Dth/day

SUPPLY	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031	2031/2032	2032/2033
Pipeline Interconnects	**4,144,264**	**4,144,264**	**4,144,264**	**4,144,264**	**4,144,264**	**4,436,063**	**4,436,063**	**4,436,063**	**4,436,063**	**4,436,063**
WCSB via TCPL/GTN	**1,565,059**	**1,565,059**	**1,565,059**	**1,565,059**	**1,565,059**	**1,565,059**	**1,565,059**	**1,565,059**	**1,565,059**	**1,565,059**
Stanfield (NWP from GTN)	692,920	692,920	692,920	692,920	692,920	692,920	692,920	692,920	692,920	692,920
Starr Rd (NWP from GTN)	165,000	165,000	165,000	165,000	165,000	165,000	165,000	165,000	165,000	165,000
Palouse (NWP from GTN)	70,459	70,459	70,459	70,459	70,459	70,459	70,459	70,459	70,459	70,459
GTN Direct Connects	511,568	511,568	511,568	511,568	511,568	511,568	511,568	511,568	511,568	511,568
Kingsgate/Yahk BC Interior from TCPL	125,112	125,112	125,112	125,112	125,112	125,112	125,112	125,112	125,112	125,112
Rockies via NWP	**495,000**	**495,000**	**495,000**	**495,000**	**495,000**	**495,000**	**495,000**	**495,000**	**495,000**	**495,000**
NWP North from NWP south	655,000	655,000	655,000	655,000	655,000	655,000	655,000	655,000	655,000	655,000
Max Demand on Reno Lateral	(160,000)	(160,000)	(160,000)	(160,000)	(160,000)	(160,000)	(160,000)	(160,000)	(160,000)	(160,000)
WCSB via Westcoast Pipeline	**2,084,205**	**2,084,205**	**2,084,205**	**2,084,205**	**2,084,205**	**2,376,004**	**2,376,004**	**2,376,004**	**2,376,004**	**2,376,004**
T-South to Huntingdon	1,854,000	1,854,000	1,854,000	1,854,000	1,854,000	2,163,000	2,163,000	2,163,000	2,163,000	2,163,000
T-South to BC Interior (Including Kingsvale)	230,205	230,205	230,205	230,205	230,205	213,004	213,004	213,004	213,004	213,004
Storage	**2,791,608**	**2,791,608**	**2,791,608**	**2,791,608**	**2,791,608**	**2,821,608**	**2,821,608**	**2,821,608**	**2,821,608**	**2,821,608**
Jackson Prairie (NWP from JP)	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000
Mist Storage (NWN)	639,000	639,000	639,000	639,000	639,000	639,000	639,000	639,000	639,000	639,000
Plymouth (NWP from LNG)	305,300	305,300	305,300	305,300	305,300	305,300	305,300	305,300	305,300	305,300
Newport LNG (NWN)	64,500	64,500	64,500	64,500	64,500	64,500	64,500	64,500	64,500	64,500
Portland LNG (NWN)	130,800	130,800	130,800	130,800	130,800	130,800	130,800	130,800	130,800	130,800
Nampa LNG (IGC)	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Gig Harbor Satellite LNG (PSE)	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Swarr Stn Propane (PSE)	-	-	-	-	-	30,000	30,000	30,000	30,000	30,000
Tilbury LNG (FortisBC)	155,466	155,466	155,466	155,466	155,466	155,466	155,466	155,466	155,466	155,466
Mount Hayes LNG (FortisBC)	153,042	153,042	153,042	153,042	153,042	153,042	153,042	153,042	153,042	153,042
LNG Tacoma (PSE)	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000
Total Available Supply	**6,935,872**	**6,935,872**	**6,935,872**	**6,935,872**	**6,935,872**	**7,257,671**	**7,257,671**	**7,257,671**	**7,257,671**	**7,257,671**

APPENDIX A2: Annual Demand Forecast (Dth) – Expected Case

REGION/SECTOR	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031	2031/2032	2032/2033
BC Lower Mainland & Van. Island	**144,720,761**	**145,275,108**	**145,463,739**	**235,973,361**	**236,761,137**	**236,906,201**	**237,267,934**	**237,618,391**	**238,214,151**	**238,280,304**
Residential	58,977,535	59,407,756	59,831,899	60,241,053	60,627,751	60,987,095	61,336,073	61,674,285	62,001,422	62,317,615
Commercial	44,890,113	44,933,182	44,971,053	45,003,336	45,030,032	45,048,913	45,061,668	45,073,914	45,083,782	45,092,497
Industrial	40,853,112	40,934,169	40,660,787	130,728,972	131,103,354	130,870,192	130,870,192	130,870,192	131,128,947	130,870,192
Power Generation	-	-	-	-	-	-	-	-	-	-
W. Washington	**268,804,639**	**270,403,968**	**278,735,189**	**288,763,546**	**289,778,544**	**289,228,670**	**286,825,784**	**284,687,864**	**284,135,998**	**281,628,785**
Residential	73,740,018	73,737,852	74,283,060	74,540,150	75,014,130	75,198,662	75,832,303	76,530,853	77,324,026	77,200,482
Commercial	44,301,181	44,172,533	44,296,138	44,366,195	44,591,578	44,669,111	44,935,152	45,222,491	45,572,362	45,536,290
Industrial	82,845,798	83,327,196	85,614,654	86,803,774	87,133,645	87,317,358	87,561,728	87,815,209	88,119,156	88,304,355
Power Generation	67,917,641	69,166,386	74,541,338	83,053,428	83,039,191	82,043,538	78,496,602	75,119,311	73,120,453	70,587,658
W. Oregon	**154,303,809**	**153,582,118**	**153,002,185**	**152,341,122**	**151,638,105**	**150,642,188**	**149,740,447**	**148,663,680**	**147,870,459**	**146,768,451**
Residential	41,690,916	41,649,804	41,537,012	41,359,639	41,018,954	40,694,013	40,279,160	39,732,543	39,240,452	38,735,545
Commercial	18,378,512	18,360,707	18,329,182	18,275,977	18,159,549	18,044,213	17,913,202	17,733,664	17,584,880	17,449,795
Industrial	55,110,792	54,448,018	54,012,402	53,581,917	53,336,014	52,780,373	52,424,495	52,073,883	51,921,538	51,459,522
Power Generation	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590
BC Interior	**63,502,353**	**63,773,993**	**63,926,138**	**64,231,369**	**64,444,310**	**64,724,094**	**65,044,394**	**65,359,539**	**65,668,230**	**65,973,427**
Residential	19,751,489	20,046,749	20,340,228	20,627,159	20,902,689	21,157,208	21,408,688	21,657,068	21,902,113	22,143,803
Commercial	12,066,399	12,140,942	12,214,905	12,288,288	12,361,090	12,432,850	12,501,670	12,568,435	12,632,081	12,695,588
Industrial	31,684,465	31,586,302	31,371,004	31,315,923	31,180,531	31,134,036	31,134,036	31,134,036	31,134,036	31,134,036
Power Generation	-	-	-	-	-	-	-	-	-	-
E. Washington & N. Idaho	**76,380,830**	**77,002,797**	**78,352,357**	**78,518,439**	**79,288,438**	**78,953,925**	**79,171,933**	**79,037,360**	**78,459,858**	**78,150,929**
Residential	23,714,743	23,782,636	24,018,882	24,199,785	24,494,058	24,511,031	24,599,055	24,795,501	25,046,044	25,114,295
Commercial	16,148,879	16,146,504	16,222,376	16,270,532	16,382,718	16,355,313	16,363,952	16,419,065	16,501,189	16,495,980
Industrial	18,954,420	19,108,111	19,267,794	19,426,199	19,585,796	19,743,570	19,903,837	20,066,059	20,230,973	20,395,254
Power Generation	17,562,789	17,965,547	18,843,305	18,621,922	18,825,866	18,344,011	18,305,089	17,756,736	16,681,652	16,145,401
E. Oregon & Medford	**146,235,417**	**147,992,038**	**151,313,040**	**148,005,648**	**146,142,069**	**142,356,870**	**141,864,348**	**142,007,938**	**138,915,354**	**135,951,115**
Residential	9,208,379	9,331,971	9,472,329	9,607,161	9,757,371	9,863,632	9,994,763	10,128,438	10,278,259	10,395,575
Commercial	5,714,874	5,785,685	5,866,178	5,944,564	6,033,040	6,098,766	6,177,219	6,257,829	6,348,280	6,420,709
Industrial	9,152,443	9,270,294	9,390,252	9,512,205	9,636,556	9,762,380	9,890,389	10,020,317	10,152,778	10,286,967
Power Generation	122,159,721	123,604,088	126,584,281	122,941,718	120,715,103	116,632,093	115,801,978	115,601,355	112,136,036	108,847,864
S. Idaho	**114,831,624**	**116,626,066**	**118,712,282**	**120,837,478**	**123,291,331**	**125,788,517**	**128,331,661**	**130,924,066**	**133,569,313**	**136,271,284**
Residential	37,069,551	37,904,818	38,921,864	39,938,925	41,158,396	42,377,777	43,597,157	44,816,538	46,035,918	47,255,299
Commercial	17,554,448	17,704,669	17,929,789	18,156,379	18,469,118	18,782,370	19,095,622	19,408,874	19,722,126	20,035,377
Industrial	40,917,612	41,726,566	42,570,615	43,452,161	44,373,804	45,338,357	46,348,869	47,408,642	48,521,256	49,690,595
Power Generation	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013
PNW Annual Demand - Expected	**968,779,433**	**974,656,088**	**989,504,929**	**1,088,670,962**	**1,091,343,934**	**1,088,600,464**	**1,088,246,501**	**1,088,298,838**	**1,086,833,362**	**1,083,024,295**
Residential	264,152,631	265,861,585	268,405,275	270,513,871	272,973,347	274,789,418	277,047,199	279,335,225	281,828,234	283,162,613
Commercial	159,054,406	159,244,222	159,829,620	160,305,270	161,027,125	161,431,535	162,048,485	162,684,271	163,444,699	163,726,236
Industrial	279,518,643	280,400,657	282,887,508	374,821,151	376,349,700	376,946,266	378,133,547	379,388,338	381,208,684	382,140,920
Power Generation	266,053,753	269,149,624	278,382,526	283,030,670	280,993,762	275,433,245	271,017,271	266,891,003	260,351,745	253,994,525

APPENDIX A3: Annual Demand Forecast (Dth) – High Case

REGION/SECTOR	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031	2031/2032	2032/2033
BC Lower Mainland & Van. Island	**147,290,312**	**149,340,522**	**151,039,305**	**243,097,675**	**245,461,766**	**247,200,910**	**249,179,308**	**251,171,083**	**253,432,861**	**255,189,229**
Residential	59,513,006	60,262,920	61,014,232	61,757,708	62,485,312	63,191,414	63,893,552	64,591,173	65,283,812	65,971,460
Commercial	46,096,605	46,846,270	47,602,593	48,365,117	49,133,774	49,906,034	50,683,669	51,472,906	52,271,755	53,081,739
Industrial	41,680,702	42,231,332	42,422,480	132,974,850	133,842,680	134,103,463	134,602,088	135,107,004	135,877,294	136,136,031
Power Generation	-	-	-	-	-	-	-	-	-	-
W. Washington	**273,768,809**	**275,491,373**	**283,922,067**	**294,051,445**	**295,194,662**	**294,771,005**	**292,490,429**	**290,444,974**	**290,029,910**	**287,688,099**
Residential	74,608,455	74,686,564	75,254,136	75,571,354	76,099,925	76,357,739	77,033,148	77,765,171	78,658,042	78,617,425
Commercial	44,721,235	44,607,100	44,779,186	44,862,512	45,133,936	45,236,677	45,554,479	45,873,571	46,233,025	46,252,335
Industrial	86,521,477	87,031,324	89,347,408	90,564,150	90,921,609	91,133,051	91,406,200	91,686,920	92,018,389	92,230,681
Power Generation	67,917,641	69,166,386	74,541,338	83,053,428	83,039,191	82,043,538	78,496,602	75,119,311	73,120,453	70,587,658
W. Oregon	**159,356,993**	**159,473,279**	**159,522,189**	**159,982,850**	**160,064,236**	**160,448,770**	**160,259,581**	**159,910,322**	**160,024,526**	**161,026,525**
Residential	44,814,318	45,100,959	44,899,493	45,293,684	45,001,080	45,351,063	44,928,872	44,782,086	44,782,553	45,348,294
Commercial	19,722,723	19,902,804	20,273,508	20,477,984	20,799,890	21,134,973	21,478,992	21,387,270	21,407,842	22,065,507
Industrial	55,696,362	55,345,926	55,225,599	55,087,592	55,139,677	54,839,144	54,728,127	54,617,376	54,710,542	54,489,134
Power Generation	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590
BC Interior	**64,769,509**	**65,779,860**	**66,677,495**	**67,746,094**	**68,730,275**	**69,800,910**	**70,930,165**	**72,069,586**	**73,217,732**	**74,378,114**
Residential	19,972,438	20,402,763	20,836,011	21,267,275	21,691,429	22,098,260	22,506,269	22,915,369	23,325,284	23,735,965
Commercial	12,414,719	12,698,775	12,988,223	13,283,154	13,583,660	13,889,316	14,198,038	14,510,804	14,826,385	15,148,281
Industrial	32,382,352	32,678,322	32,853,261	33,195,665	33,455,186	33,813,335	34,225,857	34,643,413	35,066,062	35,493,868
Power Generation	-	-	-	-	-	-	-	-	-	-
E. Washington & N. Idaho	**80,036,865**	**83,823,676**	**86,137,299**	**87,222,768**	**88,758,360**	**88,816,349**	**89,126,940**	**89,173,418**	**89,002,842**	**89,173,657**
Residential	24,073,326	24,191,155	24,479,291	24,713,094	25,064,997	25,134,677	25,275,218	25,529,944	25,843,125	25,966,656
Commercial	16,475,284	16,500,464	16,604,115	16,680,450	16,822,668	16,822,468	16,857,770	16,941,844	17,054,895	17,076,530
Industrial	19,858,562	20,028,160	20,203,874	20,378,332	20,554,203	20,727,860	20,904,167	21,082,542	21,263,814	21,444,065
Power Generation	19,629,693	23,103,897	24,850,018	25,450,891	26,316,493	26,131,344	26,089,786	25,619,088	24,841,008	24,686,406
E. Oregon & Medford	**160,861,769**	**178,019,494**	**186,584,153**	**186,060,656**	**186,879,180**	**184,122,011**	**183,198,312**	**186,958,861**	**187,007,429**	**186,631,501**
Residential	9,491,102	9,626,587	9,779,174	9,926,426	10,089,453	10,208,152	10,352,252	10,499,057	10,662,504	10,793,032
Commercial	5,895,440	5,973,433	6,061,266	6,146,898	6,242,967	6,316,071	6,402,294	6,490,802	6,589,239	6,669,461
Industrial	9,537,505	9,669,608	9,811,720	9,948,321	10,095,678	10,236,109	10,387,636	10,532,683	10,689,292	10,838,921
Power Generation	135,937,721	152,749,866	160,931,993	160,039,011	160,451,083	157,361,679	156,056,130	159,436,320	159,066,394	158,330,086
S. Idaho	**131,524,676**	**132,374,078**	**133,260,329**	**134,185,953**	**135,153,678**	**136,166,459**	**137,227,496**	**138,340,258**	**139,508,503**	**140,736,308**
Residential	47,231,617	47,231,617	47,231,617	47,231,617	47,231,617	47,231,617	47,231,617	47,231,617	47,231,617	47,231,617
Commercial	22,039,553	22,039,553	22,039,553	22,039,553	22,039,553	22,039,553	22,039,553	22,039,553	22,039,553	22,039,553
Industrial	42,963,493	43,812,895	44,699,146	45,624,769	46,592,494	47,605,275	48,666,313	49,779,074	50,947,319	52,175,125
Power Generation	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013
PNW Annual Demand - High	**1,017,608,932**	**1,044,302,283**	**1,067,142,838**	**1,172,347,441**	**1,180,242,156**	**1,181,326,414**	**1,182,412,232**	**1,188,068,501**	**1,192,223,803**	**1,194,823,432**
Residential	279,704,263	281,502,565	283,493,954	285,761,159	287,663,812	289,572,921	291,220,929	293,314,417	295,786,937	297,664,448
Commercial	167,365,560	168,568,400	170,348,444	171,855,670	173,756,448	175,345,092	177,214,796	178,716,751	180,422,695	182,333,406
Industrial	288,640,452	290,797,566	294,563,489	387,773,679	390,601,526	392,458,236	394,920,388	397,449,012	400,572,713	402,807,825
Power Generation	281,898,658	303,433,752	318,736,951	326,956,932	328,220,369	323,950,164	319,056,120	318,588,321	315,441,458	312,017,753

APPENDIX A4: Firm + Potential Annual Demand Forecast (Dth) – Low Case

REGION/SECTOR	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031	2031/2032	2032/2033
BC Lower Mainland & Van. Island	**140,098,592**	**138,107,215**	**135,826,435**	**223,881,258**	**222,254,780**	**220,050,511**	**218,111,997**	**216,207,608**	**214,590,728**	**212,492,736**
Residential	57,974,044	57,819,944	57,657,153	57,477,423	57,274,242	57,043,753	56,802,468	56,550,359	56,287,491	56,014,325
Commercial	43,621,590	42,952,952	42,290,551	41,633,989	40,983,249	40,336,163	39,694,030	39,062,144	38,438,692	37,824,576
Industrial	38,502,958	37,334,319	35,878,731	124,769,846	123,997,289	122,670,594	121,615,498	120,595,105	119,864,544	118,653,835
Power Generation	-	-	-	-	-	-	-	-	-	-
W. Washington	**264,276,880**	**265,793,606**	**274,042,169**	**282,795,809**	**282,596,209**	**281,104,362**	**277,575,440**	**274,486,299**	**272,865,231**	**269,203,066**
Residential	72,857,625	72,814,739	73,324,718	73,418,155	73,117,980	72,651,810	72,503,289	72,539,622	72,554,713	71,624,750
Commercial	43,875,393	43,732,310	43,836,459	43,634,421	43,551,623	43,364,908	43,313,680	43,339,927	43,427,390	43,071,517
Industrial	79,626,221	80,080,171	82,339,655	82,689,806	82,887,414	83,044,106	83,261,870	83,487,440	83,762,675	83,919,141
Power Generation	67,917,641	69,166,386	74,541,338	83,053,428	83,039,191	82,043,538	78,496,602	75,119,311	73,120,453	70,587,658
W. Oregon	**149,202,863**	**147,416,005**	**146,400,631**	**144,686,402**	**143,031,824**	**140,781,060**	**138,776,790**	**137,379,803**	**134,999,300**	**132,502,779**
Residential	38,594,121	37,962,689	37,936,783	37,385,587	36,793,076	35,845,245	34,849,009	34,416,760	32,914,177	31,615,938
Commercial	16,960,180	16,768,587	16,520,913	16,086,188	15,579,878	15,076,397	14,661,582	14,311,258	13,808,431	13,293,543
Industrial	54,524,973	53,561,140	52,819,345	52,091,037	51,535,280	50,735,828	50,142,609	49,528,195	49,153,103	48,469,708
Power Generation	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590	39,123,590
BC Interior	**60,833,509**	**59,642,505**	**58,383,523**	**57,299,122**	**56,168,400**	**55,120,905**	**54,133,498**	**53,167,038**	**52,219,778**	**51,293,708**
Residential	19,246,169	19,240,866	19,229,717	19,208,476	19,173,101	19,115,470	19,052,544	18,984,489	18,911,309	18,833,200
Commercial	11,764,040	11,663,896	11,563,621	11,463,245	11,362,803	11,261,907	11,158,911	11,054,718	10,948,482	10,842,873
Industrial	29,823,300	28,737,742	27,590,186	26,627,400	25,632,496	24,743,528	23,922,043	23,127,831	22,359,987	21,617,636
Power Generation	-	-	-	-	-	-	-	-	-	-
E. Washington & N. Idaho	**72,395,144**	**69,969,692**	**68,943,883**	**67,847,004**	**67,503,922**	**66,842,180**	**66,929,731**	**66,119,368**	**64,912,235**	**64,240,763**
Residential	23,590,294	23,432,984	23,333,164	23,187,291	23,147,030	22,862,953	22,666,092	22,561,663	22,501,699	22,308,832
Commercial	15,883,248	15,758,340	15,675,155	15,567,832	15,522,768	15,351,968	15,221,216	15,134,259	15,073,104	14,941,532
Industrial	18,071,040	18,213,156	18,360,105	18,506,309	18,653,396	18,798,375	18,947,652	19,097,473	19,249,303	19,402,485
Power Generation	14,850,561	12,565,212	11,575,458	10,585,571	10,180,729	9,828,884	10,094,770	9,325,973	8,088,129	7,587,914
E. Oregon & Medford	**133,489,065**	**114,977,296**	**106,314,186**	**96,792,585**	**91,269,981**	**87,873,016**	**89,635,322**	**84,551,883**	**77,587,805**	**74,004,122**
Residential	8,945,655	8,976,303	8,986,878	8,995,779	9,020,850	9,009,213	9,021,749	9,038,360	9,069,810	9,077,928
Commercial	5,545,820	5,565,290	5,576,419	5,587,053	5,607,876	5,609,627	5,623,814	5,640,771	5,666,812	5,679,465
Industrial	8,797,420	8,909,412	9,020,553	9,134,754	9,251,591	9,366,512	9,483,746	9,602,469	9,724,784	9,850,571
Power Generation	110,200,171	91,526,291	82,730,335	73,074,999	67,389,665	63,887,664	65,506,013	60,270,282	53,126,399	49,396,158
S. Idaho	**110,054,543**	**111,759,263**	**113,741,168**	**115,760,105**	**118,091,265**	**120,463,592**	**122,879,579**	**125,342,364**	**127,855,348**	**130,422,220**
Residential	35,216,073	36,009,577	36,975,771	37,941,979	39,100,476	40,258,888	41,417,299	42,575,711	43,734,122	44,892,534
Commercial	16,676,725	16,819,435	17,033,300	17,248,560	17,545,662	17,843,252	18,140,841	18,438,430	18,736,019	19,033,608
Industrial	38,871,731	39,640,238	40,442,084	41,279,553	42,155,114	43,071,439	44,031,426	45,038,210	46,095,193	47,206,065
Power Generation	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013	19,290,013
PNW Annual Demand - Low	**930,350,597**	**907,665,582**	**903,651,996**	**989,062,285**	**980,916,381**	**972,235,626**	**968,042,356**	**957,254,363**	**945,030,425**	**934,159,395**
Residential	256,423,981	256,257,101	257,444,184	257,614,690	257,626,755	256,787,332	256,312,451	256,666,964	255,973,322	254,367,506
Commercial	154,326,997	153,260,810	152,496,417	151,221,289	150,153,858	148,844,222	147,814,073	146,981,508	146,098,930	144,687,113
Industrial	268,217,644	266,476,180	266,450,661	355,098,706	354,112,580	352,430,383	351,404,844	350,476,723	350,209,590	349,119,442
Power Generation	251,381,976	231,671,492	227,260,734	225,127,600	219,023,187	214,173,688	212,510,987	203,129,168	192,748,584	185,985,333

APPENDIX A5: Peak Day Firm Demand/Supply Balance (Dth/day) – Expected Case

PEAK DAY DEMAND (Region/Sector)	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031	2031/2032	2032/2033
BC Lower Main & Van. Island (I-5 Corridor)	**1,133,232**	**1,140,396**	**1,145,644**	**1,396,527**	**1,400,505**	**1,403,925**	**1,407,218**	**1,410,416**	**1,413,536**	**1,416,478**
Residential	517,406	521,133	524,809	528,355	531,706	534,824	537,851	540,784	543,621	546,362
Commercial	416,929	417,444	417,915	418,338	418,714	419,024	419,290	419,555	419,801	420,039
Industrial	198,897	201,818	202,920	449,834	450,084	450,077	450,077	450,077	450,114	450,077
Power Generation	-	-	-	-	-	-	-	-	-	-
W. Washington (I-5 Corridor)	**1,809,718**	**1,816,178**	**1,827,101**	**1,837,253**	**1,841,991**	**1,842,703**	**1,844,578**	**1,846,058**	**1,847,675**	**1,848,339**
Residential	769,489	773,734	781,941	789,630	793,761	793,600	794,162	794,476	794,865	794,593
Commercial	338,488	339,562	341,072	342,335	341,802	341,636	341,834	341,889	341,981	341,823
Industrial	307,985	309,126	310,332	311,530	312,670	313,711	314,825	315,935	317,072	318,165
Power Generation	393,757	393,757	393,757	393,757	393,757	393,757	393,757	393,757	393,757	393,757
W. Oregon (I-5 Corridor)	**1,200,354**	**1,198,562**	**1,196,471**	**1,195,358**	**1,191,150**	**1,187,321**	**1,179,930**	**1,173,770**	**1,167,945**	**1,161,524**
Residential	609,119	608,986	608,729	608,933	606,736	604,894	600,306	596,337	592,244	587,691
Commercial	248,161	247,472	246,887	246,491	245,133	243,960	241,990	240,354	238,907	237,525
Industrial	130,770	129,799	128,549	127,628	126,976	126,162	125,330	124,774	124,489	124,003
Power Generation	212,305	212,305	212,305	212,305	212,305	212,305	212,305	212,305	212,305	212,305
BC Interior	**426,173**	**429,670**	**433,899**	**437,819**	**441,560**	**445,044**	**448,470**	**451,840**	**455,140**	**458,404**
Residential	205,655	208,729	211,785	214,772	217,641	220,291	222,909	225,496	228,047	230,564
Commercial	137,791	138,664	139,531	140,391	141,245	142,087	142,894	143,678	144,427	145,174
Industrial	82,727	82,277	82,583	82,656	82,674	82,666	82,666	82,666	82,666	82,666
Power Generation	-	-	-	-	-	-	-	-	-	-
E. Washington & N. Idaho	**511,413**	**516,807**	**522,274**	**527,289**	**532,291**	**537,138**	**542,074**	**547,083**	**552,212**	**557,308**
Residential	259,992	263,511	267,162	270,484	273,724	276,892	280,146	283,446	286,822	290,178
Commercial	156,069	157,125	158,116	158,978	159,899	160,733	161,559	162,406	163,287	164,149
Industrial	95,352	96,170	96,996	97,827	98,668	99,514	100,369	101,231	102,103	102,981
Power Generation	-	-	-	-	-	-	-	-	-	-
E. Oregon & Medford (Non I-5 Supply)	**679,416**	**681,879**	**689,584**	**692,085**	**694,583**	**697,096**	**699,631**	**702,193**	**704,777**	**707,400**
Residential	91,948	93,252	94,571	95,885	97,186	98,486	99,792	101,110	102,438	103,779
Commercial	50,565	51,217	51,883	52,552	53,221	53,897	54,580	55,269	55,962	56,672
Industrial	35,401	35,907	36,416	36,934	37,462	37,999	38,544	39,099	39,662	40,235
Power Generation	501,502	501,502	506,714	506,714	506,714	506,714	506,714	506,714	506,714	506,714
S. Idaho	**766,089**	**776,654**	**788,249**	**800,139**	**812,119**	**823,529**	**835,232**	**846,934**	**858,644**	**870,349**
Residential	334,220	343,630	353,040	362,447	371,857	381,265	390,675	400,083	409,494	418,905
Commercial	147,315	149,269	151,235	153,128	155,058	156,990	158,911	160,831	162,759	164,680
Industrial	151,054	150,254	150,474	151,064	151,704	151,774	152,147	152,519	152,892	153,264
Power Generation	133,500	133,500	133,500	133,500	133,500	133,500	133,500	133,500	133,500	133,500
Total Design (Peak) Day Demand	**6,526,397**	**6,560,146**	**6,603,223**	**6,886,470**	**6,914,198**	**6,936,757**	**6,957,132**	**6,978,293**	**6,999,928**	**7,019,801**
Total Supply	**6,935,872**	**6,935,872**	**6,935,872**	**6,935,872**	**6,935,872**	**7,257,671**	**7,257,671**	**7,257,671**	**7,257,671**	**7,257,671**
Supply Surplus/(Shortfall)	**409,475**	**375,726**	**332,649**	**49,402**	**21,674**	**320,914**	**300,539**	**279,378**	**257,743**	**237,870**

APPENDIX B: IRP Characteristics

Company	Region/Area	Customer Classes	Forecast Period	Econometrics	Economic Source
Avista	2 divisions (WA/ID, OR); 5 service territories (WA, ID, Roseburg/Medford, Klamath Falls, La Grande); 11 demand areas according to available pipeline capacity.	Residential, commercial, industrial.	20 years	Separate forecast for customers and use per customer. Key drivers: Population growth, service area residential permitting; U.S., California, and service area employment growth; U.S. industrial production; U.S. GDP growth; non-weather seasonal factors; and real natural gas prices.	IHS Global Insight; Bureau of Labor Statistics; Oregon Employment Department; Washington Employment Security Department; Idaho Department of Labor; U.S. Census; Bureau of Economic Analysis; NOAA; Construction Monitor; U.S. Federal Reserve; The Economist; Wall Street Journal; IMF; World Bank; Bloomberg; Blue Chip Consensus; Washington Office of Financial Management.
Cascade	CNGC forecasts at its city gates in the 2023 IRPs. 6 regions; West, Central and East for market share; by county for economic forecasting.	Residential, commercial, industrial, core interruptible. LV customers are included for compliance modeling.	Out to 2050	Customer counts, population growth, employment rates, weather, natural gas price and other regional economic market intelligence.	Woods & Poole, SNL, Federal Reserve, Schneider Electric, Wood Mackenzie and other regional economic market intelligence.
Dominion Energy	Utah, Wyoming and Idaho	Residential by state; small commercial by state; large commercial, industrial, and electric generation gas demand all together; firm customer and transportation. All rate classes are forecasted by state, but non-GS (all but residential and small commercial) is only presented systemwide in the IRP document.	11 years for demand forecast;30 years for SendOut model.	Rate of natural gas service, housing starts, and unemployment rate are used in forecasting by state. Assumptions on changes to appliance efficiency and heating space distributions within the residential sector are built into the demand forecast.	University of Utah's Kem C. Gardner Policy Institute Research, U.S. EIA, U.S. Census Bureau, S&P Global.
FortisBC	Lower Mainland, Vancouver Island, Interior, Whistler, Fort Nelson.	Residential, commercial, industrial, low-carbon transportation (CNG) and global LNG.	20 years	Residential forecast is based on a third-party housing starts growth rates by dwelling type forecast and a use rate forecast. Commercial forecast is based on recent customer additions trends and a use rate forecast, by class. Residential and commercial historic use rate data is normalized for weather by region. Industrial forecast is based on an end-user survey. Efficiency improvements are assumed to follow recent trends. High and low scenarios are based on IRP growth rates.	Conference Board of Canada, user surveys.
Inter-mountain	6 regions (includes an "all other" category); West, Central, and East for Idaho market share rates; by county for economic forecasting	Residential, commercial, and industrial (potato processors, other food processors, chemical and fertilizer, manufacturers, institutions, and all other).	One base year, and 5 forecast years	Customer counts, population growth, employment rates, weather, natural gas price and other regional economic market intelligence.	Woods & Poole; industrial customer survey.
NW Natural	9 regions based on topology of the gas distribution system.	Residential, commercial, and industrial.	Out to 2050	Customer growth drivers: population, housing starts, nonfarm employment. Daily demand drivers: weather variables, time trend, customer count, day of the week, snow depth, water source temperature.	Oregon Office of Economic Analysis; Oregon Employment Department; U.S. Bureau of Economic Analysis; U.S. Bureau of Labor Statistics; U.S. Census Bureau; Northwest Economic Research Center.
Pacific Power	By state (CA, OR, WA, ID, UT, WY).	Residential, commercial, industrial, irrigation, and public street lighting.	20 years	Forecast by state and customer class. Key drivers: New technologies/end use, demographics, employment, income, weather, DSM, and energy efficiency mandates.	IHS, ITRON, AEG
Portland General Electric	Single contiguous service area.	Industrial customers comprise slightly less than 25% of demand with the remainder approximately split between residential, commercial and industrial	20 years	Forecast for residential customers and use per customer. Non-residential modeled by class. Key drivers: Regional population and demographics, building permits, and sector level employment including regional industrial trends and outlook. A trended, gradually warming, normal weather assumption.	Primarily Oregon Office of Economic Analysis economic forecast and S&P Global Market Insights.
Puget Sound Energy	Single contiguous service area.	Firm: residential, commercial, industrial, large volume commercial, large volume industrial. Interruptible: commercial and industrial.	Out to 2050	Regional and national economic growth, demographic changes, weather, climate change, prices, seasonality, DSM for customer growth, and use per customer forecasts.	Moody's Analytics U.S. Macroeconomic Forecast, PSE's regional and economic forecasts, U.S. Bureau of Economic Analysis, U.S. Bureau of Census, Washington State Employment Security Department, Washington Office of Financial Management, NWPCC climate models.

APPENDIX B: Continued

Company	Scenarios Developed	Natural Gas Price Forecast	Design Weather
Avista	PRS, PRS–Low Prices, PRS–High Prices, PRS–Allowance Price Ceiling, Electrification–Expected Conversion Costs, Electrification–High Conversion Costs, Electrification–Low Conversion Costs, High Customer Case, Limited RNG Availability, Interrupted Supply, Carbon Intensity, Social Cost of Carbon, Average Case and Hybrid Case	NYMEX & 2 proprietary 20-year forecasts	The 99th percent probability of a temperature occurring based on the coldest temperature each year by demand area for the past 30 years, trended from the historic peak day and blended with forecasted climate change future weather temperatures.
Cascade	Eight portfolios and six scenarios. Scenarios included Base, Carbon Neutral by 2050, Limited RNG, Increased Electrification, High Customer Growth, and High Price – Interrupted Supply.	A blend of public and private sources (U.S. EIA 20 yr, Wood Mackenzie, NYMEX strips (ICE), NPCC) based on Cascade's general portfolio mix.	System-weighted HDD based on the 99th percentile of Monte Carlo simulated weather.
Dominion Energy	Stochastic modeling yielding mean, median and base cases; normal weather case also reported to inform quarterly variance reporting and pass-through cases	Means and standard deviations associated with historical data from 9 area price indices; average of 2 price forecasts including PIRA (19 months) and IHS CERA (252 months) as basis for stochastic modeling inputs.	1-in-20-year weather occurrence: 70 HDD at SLC coincident across service territory.
FortisBC	Base, high and low scenarios by region based on short-term and long-term growth assumptions. FortisBC's 2022 LTGRP designates its Diversified Energy scenario as its planning scenario, and also has an Upper Bound and Deep Electrification scenario.	GLJ and S&P Global forecasts.	1-in-20-year design day determined through extreme value analysis based on weather data from the last 60 years; result may vary from the actual coldest day in last 20 years.
Inter-mountain	Low, Base and High combined with other variables to yield 6 demand scenarios.	A blend of public and private sources (U.S. EIA 20 yr, Wood Mackenzie, NYMEX strips (ICE), NPCC) based on Cascade's general portfolio mix.	78 HDD for total company, weighted by customers in each district; several distinct laterals and areas of interest are assigned unique HDDs.
NW Natural	Nine scenarios: Balanced Approach, Carbon Neutral by 2025; Dual-Fuel Heating Systems; New Direct-Use Gas Customer Moratorium in 2025, Aggressive Building Electrification; Full Building Electrification; RNG and H2 Production Tax Credit; Limited RNG Availability; and Supply-Focused Decarbonization.	IHS Global Inc. Regional Integrated/North America forecast (formerly known as IHS CERA)	Design peak day: 99th percentile of highest demand day in a given year. Design cold event: 2 cold days prior to the peak day and 2 cold days after the peak day based on regression analysis. Design winter weather: 90th percentile based on cumulative winter HDDs and incorporating climate change trends into the future.
Pacific Power	Base Case (climate change), Low load growth, High load growth, High private generation, Low private generation, 1-in-20 extreme weather, and 20-year normal weather conditions.	PacifiCorp subscribes to expert third-party natural gas forecasting services from Siemens to receive base and scenario forecasts. These forecasts form the basis of PacifiCorp's low, medium, and high natural gas fundamental forecasts for key Western natural gas hubs, provided within Plexos.	Climate change adjusted 20-year normal.
Portland General Electric	PGE evaluated 351 futures to understand the risk profiles. This included varying the portfolio across 3 technology costs futures, 3 capacity need futures, and 39 market price futures.	PGE forward trading curve was used for near-term prices (2023-2026); 2027 prices are a linear interpolation of 2026 and 2028 prices; 2028-2043 prices are based on Wood Mackenzie's 2022 base long-term price forecasts.	For resource adequacy assessment, extensive load and weather data was used to capture variability of weather from 1991-2022.
Puget Sound Energy	Reference and electrification scenarios	Prices for 2024 through 2028 represent 3-month average forward marks. Beyond 2028, natural gas forward prices represent the long-term forecast per Wood Mackenzie. Used the social cost of green house gases as updated by WUTC, and expected price forecast from WA Department of Ecology CCA Allowance prices.	52 HDD daily average for design peak based on and including climate change modeling.

Appendix C: Deficiency and Preferred Supply Resources

Company	IRP File Date	Jurisdiction	Year of Peak Day Deficiency	Preferred Supply Resources Selected
Avista	April 1, 2023	Idaho; Oregon; Washington	No deficiency in planning horizon	N/A
Cascade	February 24, 2023 (WA) June 2, 2023 (OR)	February 24, 2023 (WA) June 2, 2023 (OR)	2038 (WA); 2034 (OR)	Energy efficiency; RNG acquisitions.
FortisBC	May 2022. Next IRP proposed to be filed in 2025 or 2026.	British Columbia	2023 – Interior Transmission System. 2031 – Vancouver Island Transmission System. Possible LNG export expansion would drive project-specific expansion, potentially 2027. Coastal Transmission System – No capacity constraint until NGT and LNG export expansion occurs, potentially 2025-2027.	Pipeline looping, additional compression, Tilbury LNG Storage Expansion (TLSE) Project, Regional Gas Supply Diversity (RGSD) Project.
Intermountain	December 2023	Idaho	No deficiency within 5-year planning horizon.	N/A
NW Natural	September 23, 2022	Oregon; Washington	2023-24 Gas Year	All current resources, plus energy efficiency, citygate delivery agreements, Mist recall, and acquisitions.
Portland General Electric	March 31, 2023	Oregon – PGE has a service area population of approximately 2 million Oregonians in seven counties and 51 cities.	2026	All non-emitting resources: Energy efficiency, demand response, community-based renewable energy systems, wind, solar hybrids, and battery storage.
Puget Sound Energy	April 1, 2021	Washington	2031-32	Energy efficiency.

About the NWGA

The NWGA is a bi-national trade organization of the Pacific Northwest natural gas industry. Its mission is to promote natural gas as a cornerstone of the region's energy, economic and environmental foundation. The NWGA produces timely and regionally relevant information relating to natural gas; shapes and communicates the industry's perspective, and engages in policy analysis and advocacy. NWGA members serve more than three million consumers in communities throughout Idaho, Oregon, Washington and British Columbia.

Avista Utilities
www.avistacorp.com

Cascade Natural Gas Corp.
www.cngc.com

FortisBC Energy
www.fortisbc.com

Intermountain Gas Co.
www.intgas.com

NW Natural
www.nwnatural.com

Puget Sound Energy
www.pse.com

Enbridge Inc.
www.enbridge.com

TC Energy
www.tcenergy.com/

Williams-NW Pipeline
www.northwest.williams.com