Northwest **Power** and **Conservation** Council

May 7, 2024

MEMORANDUM

TO: **Council Members**

FROM: **Jennifer Light, Director of Power Planning**

SUBJECT: **PNUCC Northwest Regional Forecast**

BACKGROUND:

Presenter: Crystal Ball, Executive Director, and Aliza Seelig, Analytics and Policy Director, PNUCC; Gillian Charles, Red Kite Consulting

Summary: The Pacific Northwest Utilities Conference Committee (PNUCC) released its annual update to the Northwest Regional Forecast (NRF). This report is a summation of the region's forecasted loads and resources over the next ten years from the utilities' perspectives. Last year, the 2023 NRF identified important new trends, particularly around growth in regional loads. This 2024 NRF builds on those trends, anticipating a surge in electricity demand driven in large part by data centers, high-tech manufacturing, and increasing electrification. The forecast also shows significant plans for new resources. The PNUCC team will walk through this year's findings and themes.

Relevance: The NRF provides a forecast of loads and resource supply to identify potential needs in the near future. This provides one view into the region's load/resource balance that can inform on future resource needs.

More Info: https://www.pnucc.org/wp-content/uploads/2024-PNUCC-Northwest-Regional-Forecast-final.pdf

Bringing the *Power* of good ideas *Together.*

May 1, 2024
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Demand for Electricity in the Pacific Northwest Could Grow by Over 30% in Next Decade

Portland, Ore. – The 2024 update to the Pacific Northwest Utilities Conference Committee's (PNUCC) *Northwest Regional Forecast (Forecast)* reveals more momentum for the surge in demand for electricity in the Pacific Northwest. The increase is attributed to factors such as data center development, high-tech manufacturing growth and the continued trend toward electrification.

The *Forecast* projects electricity consumption could increase from about 23,700 average megawatts (aMW) in 2024 to about 31,100 aMW in 2033 (an increase of 7,400 aMW), which is an increase in demand of over 30% in the next 10 years. Last year's *Forecast* projected demand could rise by 24% in 10 years. This pace of expected growth is remarkable compared to the region's more modest growth over the past 40 years. An increase of 7,400 aMW is equivalent to having to meet the electricity demand of about seven cities the size of Seattle.

The dual challenge of extraordinary growth in consumption and the transition to lower carbon-emitting generation resources translates to a tremendous and urgent need to upgrade the region's electricity infrastructure – including expanding transmission capacity and diversifying power supplies as well as accelerating the adoption of advanced grid technologies.

"While individual utilities have unique needs, there is a shared commitment to collaboration in developing an unprecedented amount of new generation in the next 10 years. This will require intense coordinated planning along with strong public support to assure an adequate, reliable power supply during the region's transition to a cleaner energy future," said PNUCC Executive Director Crystal Ball.

Pacific Northwest utilities are investing in cleaner generating resources and accelerating resource acquisitions to keep up with planned retirements and projected demand increases. Over the next decade, utilities have identified an unprecedented amount of about 29,000 megawatts (MW) installed nameplate capacity of new resources to meet customer energy and capacity needs. The current total Northwest utilities generating resources installed nameplate capacity is 55,600 MW.

In addition to the annual assessment, PNUCC, a not-for-profit trade association, brings together Pacific Northwest consumer-owned and investor-owned utilities and other power industry partners to enhance coordination and build understanding in areas such as resource adequacy, electricity markets and transmission planning.

Additional Key Takeaways from PNUCC's 2024 *Forecast*:

Using energy efficiently Energy efficiency and demand response programs continue to be a critical component of an adequate power supply by helping lower energy use and reduce peak demand. The *Forecast* projects summer demand response to double, reducing the region's one hour peak by about 500 MW in 2024 to over 1,000 MW in 2033. Winter demand response is stepping up quickly as well. The *Forecast* projects a winter demand response increase from over 200 MW in 2024 to close to 600 MW in 2033.

The resource mix matters Hydroelectric dams play an important role in the regional electricity system providing over 33,000 MW of installed nameplate capacity. They generate clean power and store water in large reservoirs behind the dams that can be used to dependably meet seasonal and peak demands. With the growth of wind and solar power, utilities are starting to add in energy storage technologies, such as lithium-ion batteries, to increase the ability to store surplus energy and supply it to the grid during periods of high demand, or periods when wind and solar generation decreases. The ability to provide power during a peak load event depends on the time of year, type of generating resource, its geographic location, access to fuel, access to transmission, and other factors that impact the capability to generate and deliver power at any given time. To maintain reliability today, Pacific Northwest utilities rely on the capacity of hydro, nuclear, coal and natural gas. The path to reducing carbon emissions will need to include clean energy solutions beyond traditional resources and short duration batteries.

Transmission expansion is essential The ability to build enough generation and acquire enough capacity is one thing; the ability to deliver it is another. Expanding the capacity of the transmission system will be critical for reliably serving the growing load and delivering more power from where it is produced to where it is needed. A more connected grid across the West will enhance access to diverse energy resources, help balance the variability of demand and supply and bolster grid resiliency.

Utilities are prioritizing resource adequacy and reliability Utilities are focused on ensuring there is sufficient and reliable supply to meet demand, particularly during extreme weather events that are increasing in frequency due to climate change. The multi-day cold snap in January 2024 is an example of the region coming dangerously close to having inadequate supply. Solutions for ensuring resource adequacy include extending the usefulness of existing infrastructure, like converting coal plants to natural gas plants, and exploring and investing in emerging technologies. Long duration energy storage, clean hydrogen, advanced nuclear and other emerging technologies do not yet show up in the *Forecast*, but they could profoundly reshape the future regional energy landscape.

PNUCC annually provides an assessment of the Pacific Northwest electric utility industry from a regional perspective. This effort is captured in the updated *Forecast,* a longstanding resource that tracks power system trends, including shifts in demand, resource changes and emerging technologies. The Executive Summary of the *Forecast*, as well as the full report, can be found at: https://www.pnucc.org/system-planning/northwest-regional-forecast/

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Pacific Northwest Utilities Conference Committee (PNUCC) is a not-for-profit trade association of consumer-owned and investor-owned utilities and other power industry partners that share a common interest in the efficacy and reliability of the Northwest Power system.

2024 Northwest Regional Forecast

Executive Summary

From technological advancements to evolving consumer demands, electric utilities and industry partners are adapting to major shifts that are underway in the energy sector. Through collaboration, the Pacific Northwest Utilities Conference Committee (PNUCC) annually provides an assessment of the electric utility industry from a regional perspective. The effort is captured in the *Northwest Regional Forecast* (*Forecast*), a longstanding resource tracking power system trends, including shifts in demand, resource changes and emerging technologies. It is important to note that a gap between loads and resources in the *Forecast* does not necessarily mean the region will be unable to meet demand. Rather, the *Forecast* serves as a barometer for building increased awareness for how the picture is changing.

The *Forecast* anticipates a surge in demand for electricity in the Pacific Northwest over the next decade that surpasses PNUCC's previous projections. The increase is attributed to factors such as data center expansion, high-tech manufacturing growth and the trend toward electrification. Electric utilities across the nation are projecting increases in demand for similar reasons.

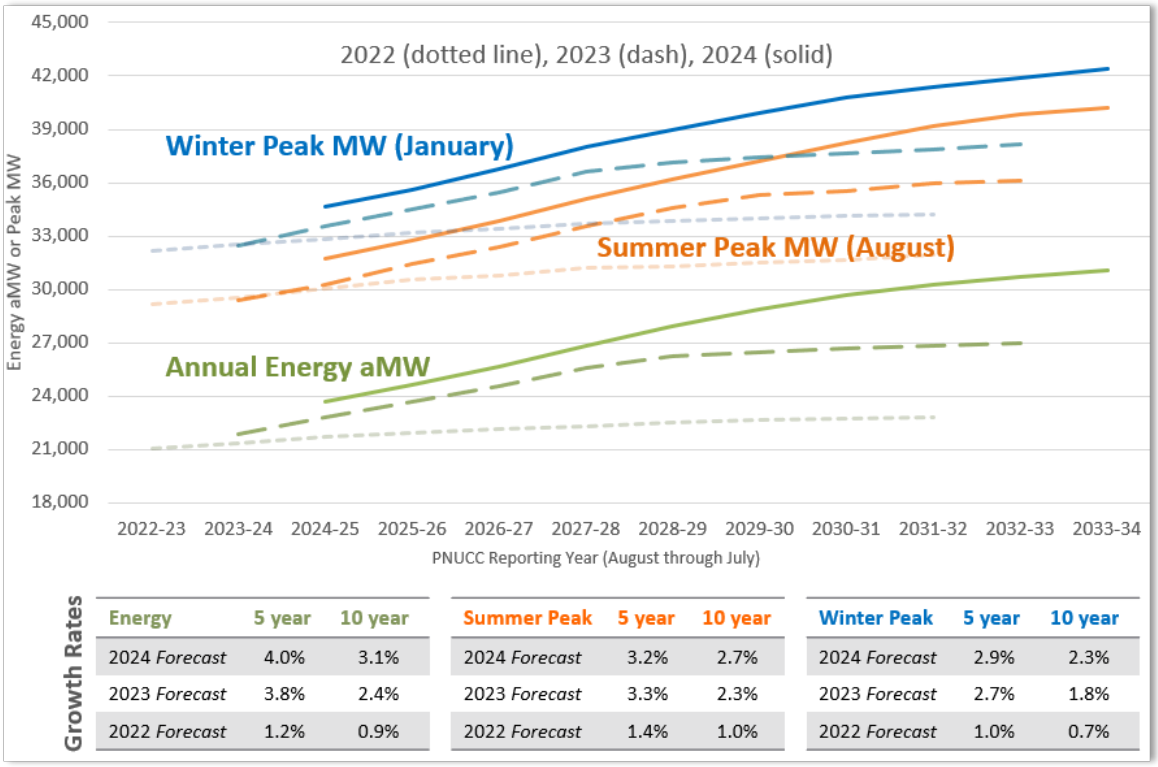
The dual challenge of extraordinary growth in demand and the transition to lower carbon-emitting generation resources translates to a tremendous and urgent need to upgrade the region's electricity infrastructure – including expanding transmission capacity and diversifying power supplies as well as accelerating the adoption of advanced grid technologies.

Surge in Projected Demand Signals End of Stagnant Growth

Demand for electricity is projected to increase from about 23,700 average megawatts (aMW) in 2024 to about 31,100 aMW in 2033 (an increase of 7,400 aMW), which is an increase in demand of over 30% in the next 10 years (as shown Figure 1). For comparison, last year's *Forecast* projected demand could rise by 24% in 10 years.

The rapid expansion of data centers is one of the reasons for the expected increased volume in the Northwest. According to a Cushman & Wakefield report that evaluates data centers by their electricity usage, the Oregon data center market ranks as the fifth largest in the nation. High-tech manufacturing and the trend toward electrification also contribute to the expected increase in demand.

Figure 1: 2024 Load Forecast Compared to 2023 and 2022



Growth Rates

Energy	5 year	10 year
2024 *Forecast*	4.0%	3.1%
2023 *Forecast*	3.8%	2.4%
2022 *Forecast*	1.2%	0.9%

Summer Peak	5 year	10 year
2024 *Forecast*	3.2%	2.7%
2023 *Forecast*	3.3%	2.3%
2022 *Forecast*	1.4%	1.0%

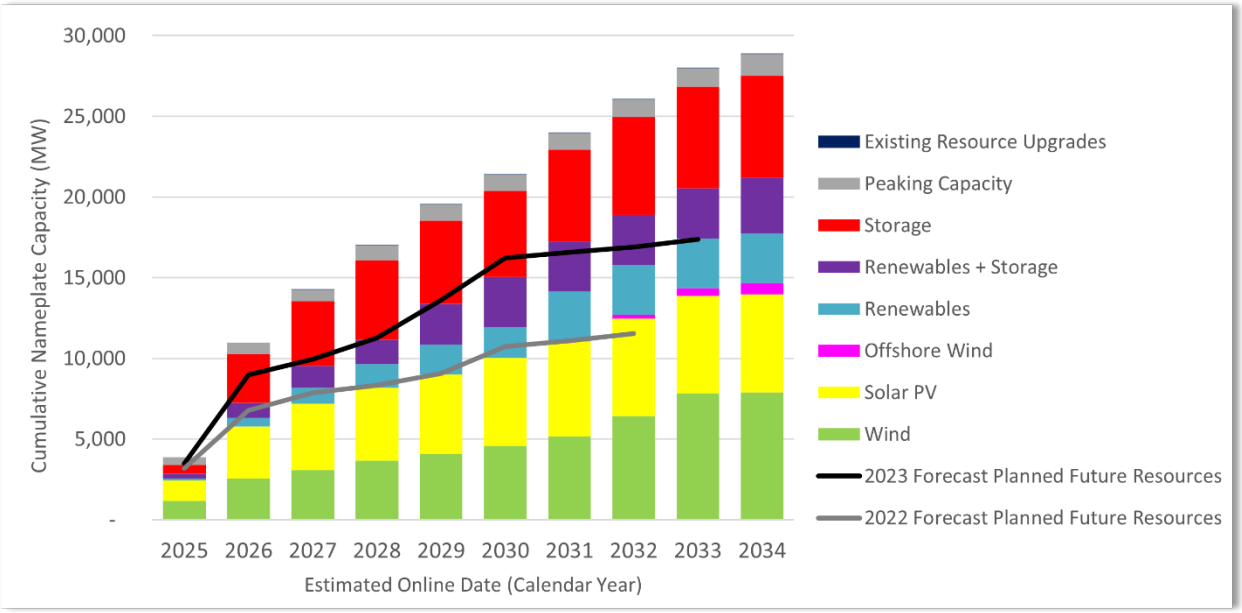
Winter Peak	5 year	10 year
2024 *Forecast*	2.9%	2.3%
2023 *Forecast*	2.7%	1.8%
2022 *Forecast*	1.0%	0.7%

Another way to measure demand is by the annual energy load growth rate. The 10-year annual energy load growth rate for the *2024 Forecast* is 3.1% (annually compounded). Utilities in aggregate have not forecast a rate of growth for annual energy load this high since the early 1980s (which is shown in Figure 9). Three years ago, the regional annual load growth rate was forecast to be 0.9%, which was more in line with the decades long trend of about 1-2% per year. Utilities are experiencing load growth due to different factors and at varying rates. For example, some utilities are experiencing increased demand from a boom in residential growth due to population shifts, while other utilities have flat or decreasing demand forecasts because of energy efficiency investments or more stringent state and local building codes and standards.

Utility Plans Include More Resources

Over the next decade, utilities have identified plans for about 29,000 megawatts (MW) nameplate capacity of new resources to meet customer energy and capacity needs. Figure 2 shows an unprecedented development of resources on a short timeline for the industry. Past *Forecasts* showed more than 17,000 MW nameplate (solid black line) were planned by 2033 and more than 11,000 MW nameplate (solid gray line) by 2032. PNUCC aggregates utility-reported planned future resources from resource planning assessments to provide a regional picture. Utility plans are reviewed and updated frequently and are developed through comprehensive analysis with input from a stakeholder process. Consequently, these plans, particularly the longer-range elements, change over time.

Figure 2: Planned Future Resources



In Figure 2 the stacked bars amount to the cumulative nameplate for planned future resources by resource type for each year of the *Forecast*. Wind, solar and battery resources make up most of the planned generation as utilities look to decarbonize their resource portfolios. For utilities that have not been specific about the kind of renewable resources included in their plans, the resources are identified as renewables.

The data in the graph does not include committed resources for 2024 and 2025 and coal to natural gas conversions. Committed resources and coal to gas conversions get combined with existing resources in the load and resource balance picture. Further, this graph does not reflect any uncommitted independent power producer resources with which utilities or customers may acquire or enter into contracts.

Storage is a big part of the solution

Hydroelectric dams are the cornerstone of the Pacific Northwest electricity system, providing over 33,000 MW of installed capacity. They generate clean power and store water in large reservoirs behind the dams that can be used to dependably meet seasonal and peak demands. Because hydroelectric dams are flexible resources that can store fuel, they have helped integrate new variable renewable resources in the region. With the growth of wind and solar power, utilities are also starting to add battery storage resources to store surplus energy and supply it to the grid during periods of high demand, or periods when wind and solar generation decreases.

Batteries co-located with renewable generation, standalone batteries and pumped hydro increase through the *Forecast*. The most commercially available battery storage technology — utility scale lithium-ion — is designed to discharge their capacity over a four-hour period before needing to recharge. In the Northwest, which is prone to prolonged peak demand and fuel limitations over multiple cold days, long duration energy storage could be a complimentary solution. Developers are making progress on longer

duration battery and compressed air energy storage technologies, but they are not yet showing up in utility planned future resources.

Energy efficiency and demand response

Energy efficiency and demand response programs have reduced the need for new resource development in the past and continue to be a critical component of an adequate power supply by helping lower energy use and peak demand.

Figure 3: Ten-year Cumulative Energy Efficiency Projections

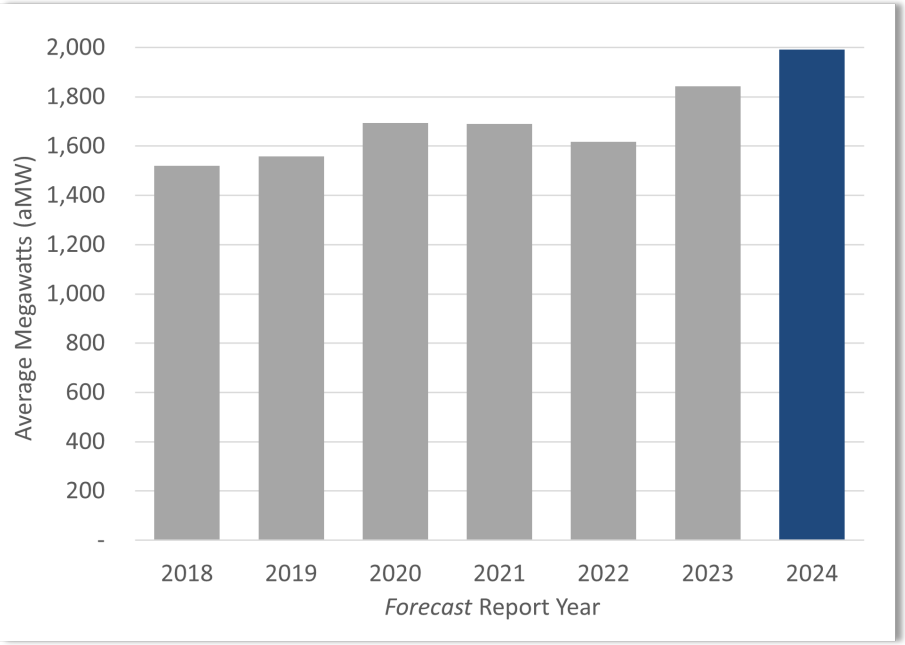
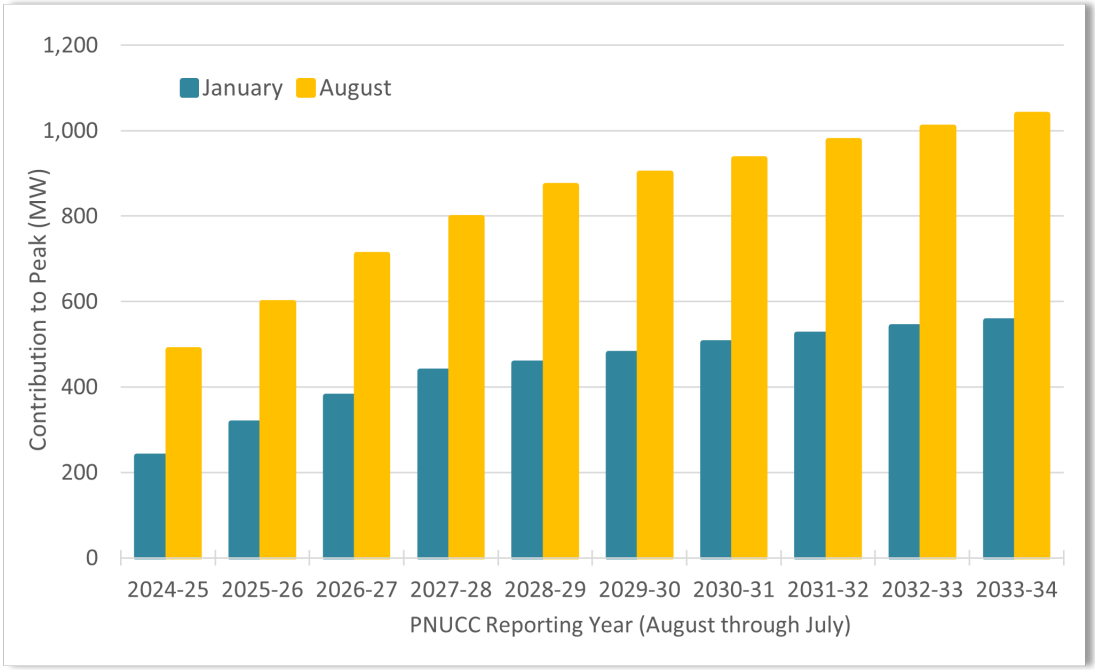


Figure 3 shows projected cumulative energy efficiency savings of around 2,000 aMW over the next 10 years – approximately 150 aMW higher this year than last year. This builds on the nearly 7,700 aMW of energy efficiency that has been acquired in the region over the past 45 years.

Energy efficiency is an important resource to meet demand now and in the future, as well as a strategy to mitigate risk from uncertainty. The Northwest Power and Conservation Council's (Council) *2021 Power Plan* recognized that some jurisdictions would need to invest in energy efficiency beyond the Council's target as part of a cost-effective strategy for reducing carbon emissions.

Figure 4: Demand Response Contribution to Peak



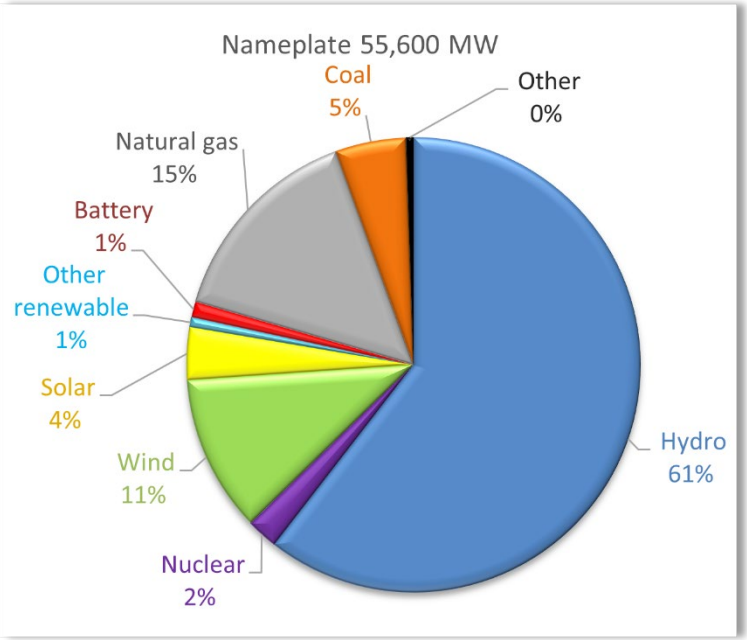
Demand response programs are an effective tool during summer and winter extreme weather events to shift consumption of electricity away from peak periods. As the grid becomes more strained, utilities are incorporating more customer demand response.

Figure 4 shows the utilities' active and projected summer and winter demand response programs. The *Forecast* projects summer demand response to double, reducing the region's one hour peak by about 500 MW in 2024 to over 1,000 MW in 2033. While summer demand response programs continue to provide almost twice the peak load reduction in comparison to winter demand response programs, the *Forecast* projects a winter demand response increase from over 200 MW in 2024 to close to 600 MW in 2033. Further, several utilities have expressed their intent to explore pilot projects and deploy new demand response programs within their service territories that are not yet showing up in the *Forecast*.

Northwest Generating Resources

The pie chart in Figure 5 shows the Northwest Utility Generating Resources for 2025. Total installed capacity for 2025 is about 55,600 MW. This year the *Forecast* includes a new category for battery storage, which has grown to 1% and is expected to quickly become an even larger share. Utilities also rely on imports from outside the region, energy efficiency and demand response to meet load.

Figure 5: Northwest Utilities Generating Resources



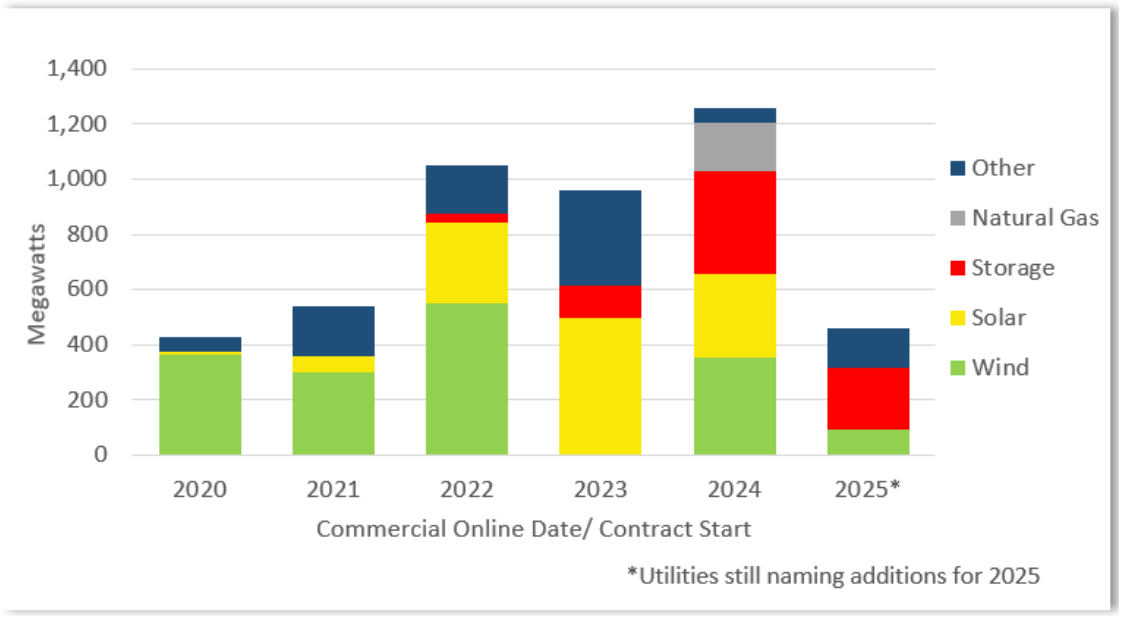
The Bar for New Resources Keeps Moving Higher

Northwest utilities have been steadily adding new resources to the regional generating mix to replace carbon-emitting resources. While the total installed capacity has increased slightly, these new resources have not significantly expanded to meet the anticipated rise in electricity demand.

Reported long-term acquisitions

Over the past five years, the majority of new generating resources have been solar and wind, with some additions of battery storage. The incremental additions reported from 2020 through 2025 are shown in Figure 6. Past *Forecasts* have not summarized this information, but the landscape is changing, and it is important to show how the picture is evolving. The data include committed resources that are named and under construction with a high degree of certainty to be added.

Figure 6: Incremental Nameplate Capacity 2020-2025 Acquisitions

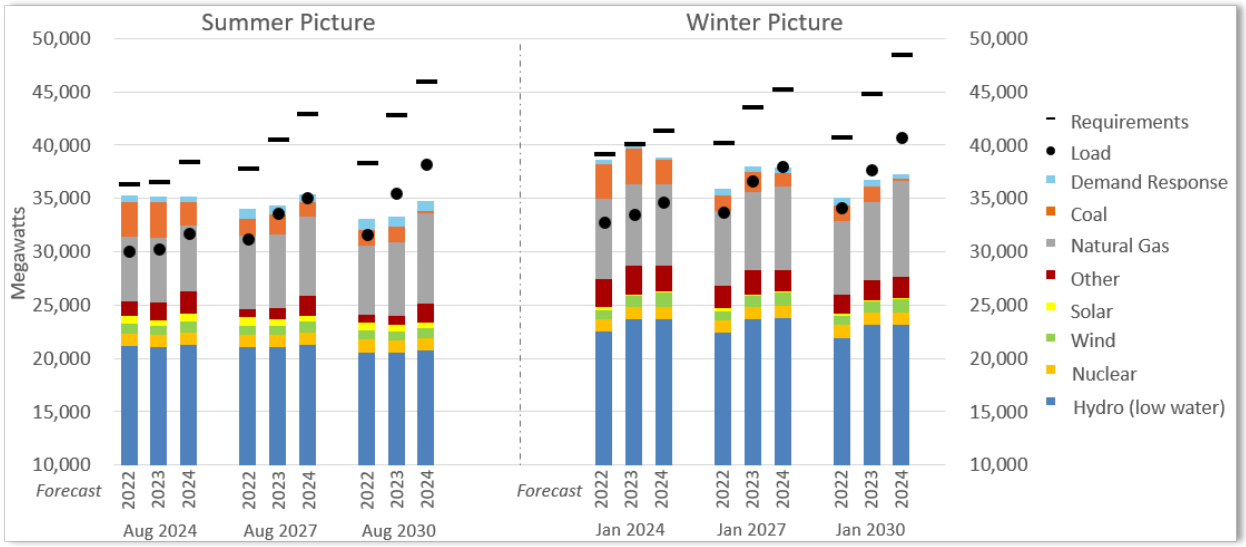


In total, utility reported resource acquisitions have increased the regional utility resource stack by approximately 4,700 MW (nameplate capacity) from 2020 through 2025. Wind additions are 1,657 MW, solar additions are 1,166 MW, storage additions are 748 MW and natural gas additions are 175 MW. The other category in Figure 6 includes imports of 335 MW, new contracts for existing regional resources of 598 MW and 12 MW of hydro upgrades. Because utilities are still naming additions for 2025, the 2025 planned future resources data in this graph appears relatively low at approximately 450 MW.

Figure 7 illustrates how the bar for future resources keeps moving higher. This graph compares the *2022 Forecast*, *2023 Forecast* and *2024 Forecast* of loads and resources for three future years in summer and winter. The colored stack bars are the utility's view of how existing and committed resources contribute to peak requirements. The stack does not include planned future resources. The black dot shows expected peak load, not extreme weather conditions. The black dash above the stack is the requirements – the sum of peak load, a 16% planning margin and export obligations. The resource contributions to peak requirements are shown based on expected operations and low water conditions. Firm imports are included in the other category, along with batteries and miscellaneous other resources that do not fit the main categories.

Tables 3 and 4 in the report provide the complete picture of 10 years of growing deficits. By the end of the forecast the projected summer and winter peak deficits are more than 13,700 MW in both seasons and utilities are forecasting that it will take about 29,000 MW of installed nameplate capacity (Table 9) to fill these gaps.

Figure 7: 2024 Load and Resource Forecast Compared to 2023 and 2022



This load and resource balance is not a resource adequacy assessment for the region. Rather, it is tracking the trend of the forecat load and resource balance to help understand how the picture is changing and to build awareness. To fill the gap, the region will need an unprecedented amount of new generation in the next 10 years that will significantly change the Pacific Northwest resource mix. Utilities are evaluating how existing and new generating resources can be counted on. The Western Resource Adequacy Program (WRAP) is helping utilities understand how much power the region will need to have an adequate system.

Projected demand driven by data center expansion

Compared to this time last year, there is a noticeable nationwide increase in awareness about the rapid expansion of data centers that are essential for advancing Artificial Intelligence (AI) and its incredible appetite for electricity. The use of AI is becoming increasingly important to the nation's economy. During a keynote address at a recent energy industry conference, Microsoft co-founder Bill Gates emphasized electricity is the critical factor determining the profitability of data centers and he expressed astonishment over the staggering amount of power AI will consume. It is challenging to forecast the extent of the potential increase and when it might show up in the region. Some companies developing new data centers are making plans that are not included in the *Forecast*.

Meeting this demand will be quite an undertaking, especially considering the evolving electricity supply. Many companies developing data centers are committed to minimizing their carbon footprints and prefer to power their facilities with carbon-free resources. Clean hydropower, affordable electricity and business incentives have attracted investment in this region, but finding enough power in the future will be a significant challenge. These companies are willing to pay to procure carbon-free, reliable power products to meet their corporate goals and are also exploring solutions that could help reduce power consumption.

Finding even more generating resources for meeting the demand from increased electrification will only increase the bar.

Electrification still to come

Utilities are trying to better understand how much energy and capacity could be needed for the electrification of buildings, transportation, and commercial and industrial applications. The overall effect of electrification is expected to increase over the next several years. Utilities are examining the implications of increased electrification in their load forecasts and updating their plans, a trend that cannot yet be fully captured in PNUCC's annual forecast.

Electric vehicle (EV) adoption among consumers has been increasing. Based on information PNUCC received from utilities, increased demand from charging EVs is projected to approach 4% of total load at the end of the 10-year period. Some utilities are expecting a higher percentage. Seattle City Light for example forecasts EV load could be 10% of their total load at the end of the 10-year period.

Electrification of buildings and industry is expected to lead to a significant increase in electricity consumption, but it will not impact utilities uniformly. Washington, for example, is incorporating building electrification mandates into statewide energy codes. Recent updates to Washington energy codes require builders to install electric heat pumps for space and water heating in most new commercial buildings and multi-family residences. Energy efficiency efforts may offset some of these increases and new load management technologies entering the market that are more controllable could help reduce peak demand when grid capacity is constrained.

Capacity concerns and transmission challenges create risk

Utilities need capacity, not just energy. The capacity contribution of wind and solar resources are dependent on several factors and actual generation can be less than installed nameplate capacity. The ability for a resource to provide power during a peak load event depends on the time of year, type of generating resource, its geographic location, access to fuel, access to transmission, and other factors that impact the capability to generate and deliver power at any given time. To maintain sufficient system resource adequacy, Pacific Northwest utilities rely heavily on the dependable capacity of hydro, nuclear, coal and natural gas. Battery storage increases dependability by storing surplus energy and supplying it later in the day when the energy is needed more, however, current commercial utility scale batteries have limits for meeting demand during multi-day events, like a cold snap in the Pacific Northwest.

While recent federal incentives have supercharged the market for clean energy and storage development and improved economic certainty for projects, other uncertainties – like grid interconnection, supply chain delays and project approvals – remain challenging. Project developers say grid interconnection is the leading cause of project delays and cancellations. Submitting an interconnection request and completing grid studies is only one of many steps in the development process; developers are also running into delays in getting agreements with landowners and experiencing increased equipment costs and delivery delays.

A good representation of how big the utility resource acquisition challenge could be is that the *2024 Forecast* shows utilities could add about 1,250 MW nameplate capacity by the end of 2024. Compared to the *2023 Forecast,* that number is about 50% less than projected last year.

The ability to build enough generation and acquire enough capacity is one thing; the ability to deliver it is another. Expanding the capacity of the transmission system will be critical for reliably serving the growing load and delivering more power from where it is produced to where it is needed. PNUCC members strongly believe the region should work across the Western Interconnection to develop a coordinated approach to grid planning that will identify transmission upgrades and expansion to address transmission constraints and reliably and affordably meet the needs of the future electric grid. Utilities, industry partners, states and others are actively engaged in building a coalition across the Western region to improve coordination in transmission planning through the Western Transmission Expansion Coalition (WestTEC). This initiative aims to identify and build support for transmission solutions that reduce reliability risks and facilitate the interconnection of new electricity generation to meet future load requirements.

Based on experience, utilities say planning is essential, but permitting new transmission lines is the biggest hurdle to expanding the electric transmission system, especially in the West. Existing permitting and siting rules and regulations foster perpetual legal challenges that have created decadal delays in the construction of new transmission projects.

Prioritizing Resource Adequacy and Reliability

Utilities are concerned about ensuring sufficient and reliable supply to meet demand, particularly during extreme weather events that are increasing in frequency due to climate change. The region needs a power and transmission system that is bigger than the weather because the region's customers demand a system that is both adequate and reliable.

The Pacific Northwest region will continue to rely on imports and West-wide collaboration is crucial for accessing diverse resources. Utilities are making commitments to broader regional wholesale electricity markets that would help make more efficient use of the existing and newly added resources and optimize transmission across a broader footprint. Organized electricity markets centrally optimize the least-cost dispatch of resources for utilities on the day-ahead through real-time operating timeframe to meet load. This allows for a centrally optimized system of matching buyers and sellers of wholesale electricity. Many Pacific Northwest utilities voluntarily participate in the Western Energy Imbalance Market (WEIM), which has become a valuable tool on a real-time interval that has delivered significant financial benefits to regional participants and improved grid reliability. Utilities are advancing efforts to develop and participate in day-ahead markets.

Extreme weather tests the system

The multi-day cold snap in January 2024 is an example of coming dangerously close to having an inadequate supply. The severe weather from January 12-16, 2024 pummeled the Pacific Northwest. Freezing temperatures were lower on the westside than they were on the eastside at the beginning of the event, which meant balancing authorities experienced system peaks at different times. Demand could have been significantly greater if temperatures across the region had dropped at the same time. The Pacific Northwest relied heavily on imports from the Desert Southwest and Rocky Mountain regions to maintain reliability due to high demand and low water conditions. Natural gas system constraints also reduced fuel supplies to gas-fired power plants, which impacted capacity and forced some utilities to rely more on imports.

The Western Power Pool, the program administrator for WRAP, provided an assessment of the January 2024 cold weather event. WPP found peak load consistently exceeded historical peaks or at or near historical peak load in many areas. "The amount of inter-regional support necessary to manage Balancing Authority (BA) operations through the cold weather event is indicative of the pressing need to address resource adequacy and potential capacity shortfalls as soon as practicable, highlighting the value of a resource adequacy program with a broad geographic footprint and diversity of load and resources," WPP wrote. WPP is calling on utilities to use the January experience to enhance preparedness and help improve the resource adequacy program.

The region's pursuit of solutions for ensuring resource adequacy includes extending the usefulness of existing infrastructure, like converting coal plants to natural gas plants, ensuring a stable natural gas supply to run natural gas plants and exploring emerging technologies.

As coal declines, natural gas is expected to increase and provide reliable supply

The regional coal and natural gas picture is shifting. Utilities continue to exit their positions in coal plants as required by state laws. On the other hand, some utilities have found it is cost-effective to repurpose existing infrastructure to reduce emissions and are planning to convert from coal to natural gas-fired generation. Natural gas can provide a bridge to meet peak demand and fill in during potential low water years until sufficient capacity and transmission infrastructure can be added.

Figure 8: NW Utility Coal and Natural Gas Plant Availability

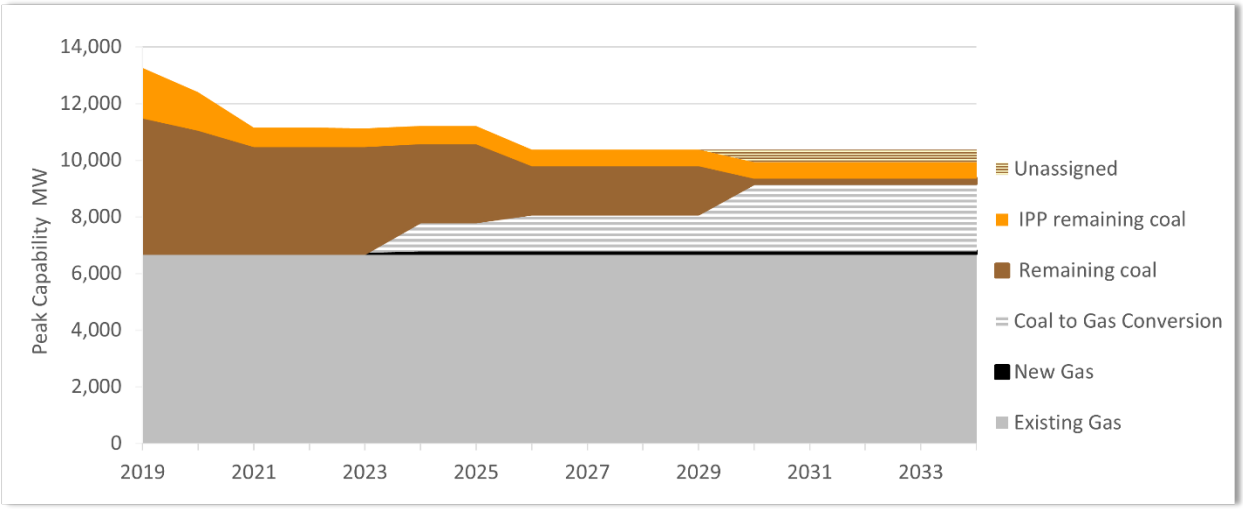


Figure 8 shows expected changes for coal and natural gas resources in the region. It begins with the picture in 2019. Looking ahead, regional coal availability declines gradually. State law requires that coal-fueled resources are eliminated from Oregon's electricity resources by January 1, 2030. Washington's Clean Energy Transformation Act (CETA) requires utilities to eliminate coal-fired resources from Washington rates by December 31, 2025. This decline shows up as retirements and coal-to-natural gas conversions. There is a remaining amount of coal that will be owned by Independent Power Producers and is not assigned to any load. A small amount of regional coal remains unassigned with no future owner identified.

Existing gas plant capability shown in the darker gray shaded area has remained steady. There is a small uptick in natural gas due to the anticipated addition of a new gas plant in 2024. Planned conversions from coal to natural gas are shown in the lighter gray area. (Figure 8 shows Jim Bridger Units 3-4 as coal to gas conversions in 2030. The picture does not reflect PacifiCorp's recently announced plans to retrofit these units with carbon capture technology by 2028 and continue operating them through 2039.)

Gas-electric coordination

Electric and natural gas system infrastructure is vital to the reliable operation of the power system. Electric energy and natural gas systems provide reliable energy to millions of people in the Pacific Northwest. The region depends on natural gas supply, storage and pipelines to fuel electric generating plants and heat homes. The interdependence of the two energy sources continues to grow as the region experiences extreme weather events more frequently and relies more on natural gas resources to meet peak demand. Building understanding and awareness of these systems and improving coordination between the electric and natural gas sectors is critical to ensure the necessary investments are made to keep the systems reliable as both sectors decarbonize.

Emerging technologies on the horizon

Regional utilities are actively exploring emerging technologies to meet future demands. Of particular interest to utilities are long duration energy storage, clean hydrogen, advanced nuclear and offshore wind. Puget Sound Energy (PSE) has announced it is partnering with Form Energy to evaluate multi-day energy storage solutions. The partnership allows both companies to collaborate on the development of a 10 MW, 100-hour iron-air battery pilot in PSE's service area. Long duration energy storage can provide power over several days as compared to most commercially available batteries that supply about four hours of energy storage. The pilot project will help PSE determine if a future utility-scale project could be deployed as early as the end of 2026.

Investor-owned and public power utilities are actively involved in the Pacific Northwest Hydrogen Hub (PNWH2), one of seven Regional Clean Hydrogen Hubs across the nation selected to receive federal funding to kick start clean hydrogen production. The PNWH2 Hub spans Washington, Oregon and Montana, and anticipates leveraging renewable resources to produce clean hydrogen exclusively via electrolysis. The economics and reach of this nascent technology will be impacted by the outcome of federal tax credit rulemaking.

There is a resurgence of interest and growing support for advanced nuclear reactors because of the role the non-emitting resource can play in supporting the transition to clean energy in a reliable way. Energy Northwest and X-Energy are jointly developing a next-generation nuclear plant in Washington. Energy Northwest has partnered with public power and investor-owned utilities to study the feasibility of building small modular nuclear reactors near the Columbia Generating Station, the state's only commercial nuclear energy facility. This year, Washington state legislators and Governor Jay Inslee supported allocating $25 million from state funds to study the pros and cons. Energy Northwest anticipates the first reactor could come online by 2031. Furthermore, PacifiCorp's 2023 IRP Update continues to show the value associated with TerraPower's nuclear demonstration project in Kemmerer, Wyoming. The nuclear power company, which is backed by Bill Gates, plans to break ground on the project this year.

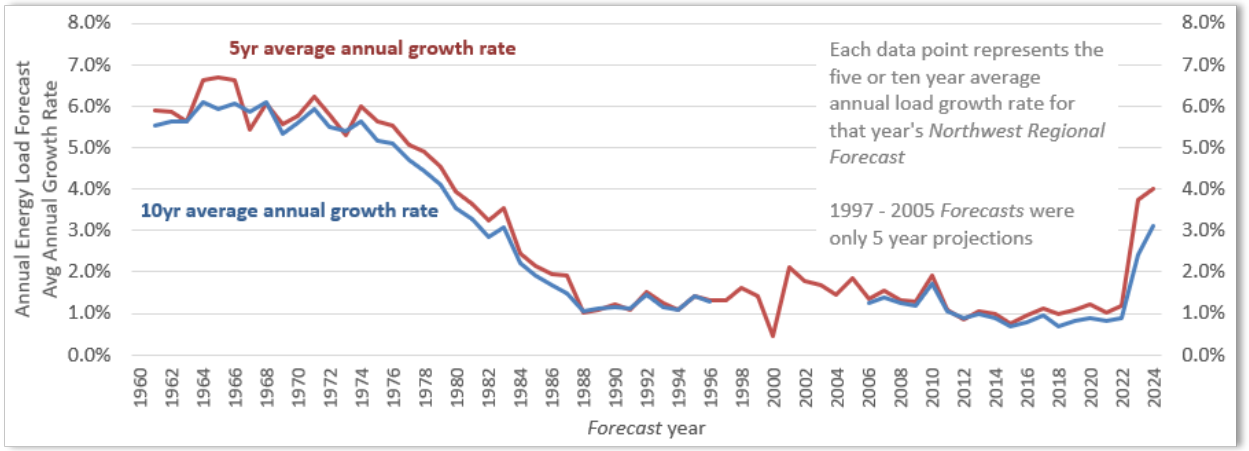
Except for offshore wind, emerging technologies such as long duration energy storage, clean hydrogen, advanced nuclear and others do not show up in the *Forecast*, but they could profoundly reshape the future regional energy landscape.

Utilities are also deploying and finding new ways to partner with customers to reduce energy use at peak times. Some utilities are exploring Virtual Power Plants (VPPs) as a way of managing customer-side resources. In general, a VPP is a portfolio of actively controlled distributed energy resources (DER). Operation of DERs is optimized to provide benefits to the power system and consumers. To a degree, VPPs have existed for decades as demand response programs. But VPPs are rapidly evolving to leverage the expanding mix of DER technologies. A VPP that reliably leverages residential load flexibility could contribute to resource adequacy.

Conclusion

Utilities in aggregate have not forecast a rate of growth for annual energy load this high since the early 1980s. This represents quite a change from the past 40 years of relatively modest growth rates of about 1-2%.

Figure 9: Historical Load Forecast Growth Rates



To accommodate the forecasted surge in demand, the region is planning to add an unprecedented 29,000 MW of new resources in 10 years while decarbonizing the electricity supply. This is an extraordinary number of new resources to develop in 10 years. A more connected grid would provide access to a wider range of resources and allow for the sharing of energy over larger distances. This would help balance the fluctuations in demand and supply, while also enhancing the resilience of the grid. Collectively, Pacific Northwest utilities are building deeper awareness of the crucial need to optimize the system, expand transmission capacity and rapidly integrate additional generating resources. By working together, the region can unlock the solutions that will keep the grid reliable and affordable.