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May 9, 2023

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 Direct, 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. The 2023 NRF identifies some important new trends, particularly around regional loads and related resource needs in the future. 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/system-planning/northwest-regional-forecast/>



May 4, 2023
Crystal Ball, Executive Director
Contact: Phone: 503-294-1259
crystal@pnucc.org

As electricity demand grows, increased coordination and innovation crucial to keeping the grid reliable

Portland, Ore. – The Pacific Northwest Utilities Conference Committee released its *2023 Northwest Regional Forecast* today, which shows utilities will need even greater coordination to meet rapidly increasing electricity demand while continuing the transition to cleaner energy sources.

The *Forecast* is significant in light of recent extreme weather conditions that have already resulted in higher demand, emphasizing the importance of having enough capacity to meet rising energy needs. The *Forecast* projects a remarkable 20 percent increase in load over the next five years. This equates to roughly 4,000 average megawatts or quadrupling the amount of annual electricity used in the city of Seattle. Growth in industrial loads is the main short-term driver, in addition to the longer-term trend in an increasing reliance on electricity as a primary source of energy.

“Utilities in the region are increasing the pace of their plans for new renewable resources and energy storage, and identifying new transmission needs in their preferred resource portfolios,” said PNUCC Executive Director Crystal Ball. “As demand and resources grow, working together to increase regional coordination and develop innovative solutions will be crucial to maintaining a reliable interconnected grid.”

PNUCC’s updated 10-year *Forecast* serves as an annual barometer for the region’s electric power system and provides a snapshot of electricity demand and the existing and proposed generation resources Northwest utilities are planning on to continue to provide customers with safe, reliable and affordable energy.

“New clean energy legislation and government funding can help advance clean energy technology and modernize the grid,” Ball said. “The *2023 Forecast* doesn’t include emerging technologies, such as advanced nuclear, offshore wind, renewable hydrogen, and long-duration storage, that are considered part of the future grid. However, utilities anticipate technological advancements will be required to further diversify the mix of clean generation, and utilities are expected to update their plans as they gain more information about future loads, resources and transmission opportunities.

For the first time, the *Forecast* projects the region needs higher amounts of summer capacity resources to meet summer peak hour demand (electricity use) compared to the winter capacity needs. Winter peak hour demand remains higher than summer. In addition to summer and

winter peak needs, the *Forecast* monitors annual energy needs (electricity demand across all hours of the year). This year's *Forecast* shows more growth in the annual energy deficit as well. Watching changes in these trends provides the region with greater situational awareness and identifies areas where more coordination can help.

Utilities are predicting greater energy efficiency savings compared to last year's forecast, recognizing energy efficiency as a key resource in the region. The ten-year savings projected in the *2023 Forecast* are slightly higher as utilities seek more savings to meet growing capacity and energy needs during the clean energy transition. Utilities also continue to deploy and find new ways to rely on customers to reduce energy use at peak times, such as incentivizing shifting energy usage to different times of day.

Two elements that will impact future load are electrification and climate change, both of which are expected to unfold and affect loads differently across the region. The potential impact of electric vehicle and heating system adoptions is slight in this year's *Forecast* but is expected to increase over the next several years.

Utilities have a strategic focus on the need for upgraded and new transmission infrastructure to ensure a reliable and resilient grid that can accommodate the forecasted changes. Planning and construction of new transmission infrastructure is underway and more enhancements to the transmission system will be needed as it is a critical component to integrating new resources and delivering generation to load centers.

The Executive Summary of the *Forecast*, as well as the full report, can be found at: 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.

2023 Northwest Regional Forecast

Executive Summary

The *Northwest Regional Forecast (Forecast)* has provided a consistent assessment of the region’s electric power system for over 70 years. By examining utility-reported information, the *Forecast* provides a utility perspective on trends in the evolving power system, such as changes in demand, resources and emerging technologies for meeting future electric power needs.

This year’s snapshot is particularly significant given recent record-breaking winter and summer peaks, which have utilities focused on the need for sufficient capacity to meet a rising demand for electricity on top of the transition to clean energy. The *2023 Forecast* shows Northwest utilities are anticipating a significant increase in loads over the next five years and working to meet a growing demand for electricity with renewable resources, energy storage and dependable capacity.

Loads Show Up with More Certainty

The *2023 Forecast* reflects accelerated and steeper regional load growth compared to previous years. Much of this load growth is attributed to more certainty in prospective new industrial loads over the next five years.

Figure 1: Load Forecasts Comparison 2023 vs. 2022

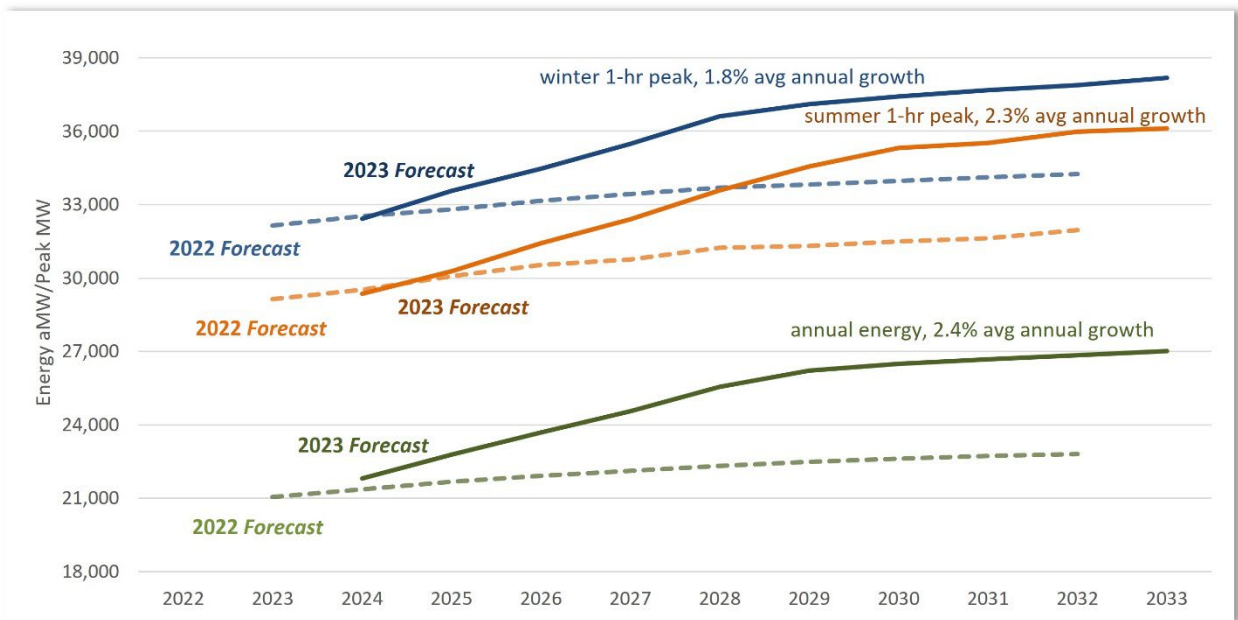
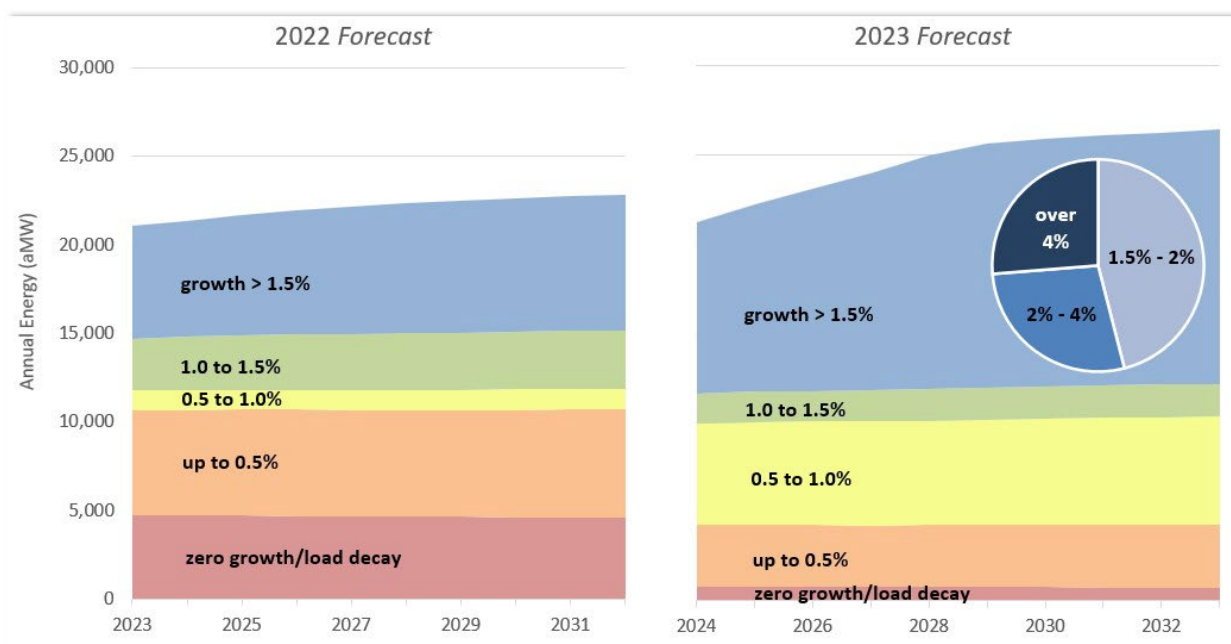


Figure 1 on page 4 shows the 2023 load forecasts in solid lines and last year’s forecasts in the dashed lines. The 2023 loads reflect a markedly different trajectory than past forecasts, with a 20 percent increase in load growth in the first five years. Much of the expected growth can be attributed to new industrial customers’ solidifying plans and schedules for development. The projected loads flatten out over the latter five years of the *2023 Forecast*. Annual energy, winter and summer peak forecasts increase at roughly the same magnitude in the first five years, indicating that prospective new load is flat and not necessarily seasonal.

Most utilities projecting load growth

Anticipated load growth is based on utilities’ unique circumstances such as service territory characteristics, local economic factors and energy policies. This results in varying load projections, with some utilities expecting flat or little load growth and other utilities anticipating marginal to substantial increases in load growth.

Figure 2: Load Forecast Growth Rate Comparison 2022 vs. 2023



In general, utility load growth rates are shifting up, as evidenced by the comparison of the 2022 and 2023 *Forecasts* in Figure 2 above. Here individual utility annual energy loads are aggregated into ten-year load growth bins. For example, the yellow bin is the aggregate load of utilities projecting a load growth between 0.5 percent and 1 percent. In the *2022 Forecast*, utilities with the highest projected load growth (over 1.5 percent, blue bin) represented roughly a quarter of the regional load by the last year of the forecast. In this year’s *Forecast*, the share of load from utilities projecting load growth above 1.5 percent has doubled and now represents about half of the Northwest load by 2033. Within the blue bin, about a quarter represents load growth above 4 percent.

As noted earlier, the primary driver for increased growth rates is new industrial loads. While these loads are starting to show up in the utility load projections with more certainty, supply chain issues and changing economic conditions can affect the timing of these new large industrial customer loads.

Electrification and climate change effects still coming

Two elements that will impact future loads are electrification and climate change, both of which are expected to unfold and affect loads differently across the region. Machines that currently run on fossil fuels like cars and heating systems are being replaced with electric versions, but electrification is a formidable task and hard to predict, which is why the potential impact of electrification is slight in this year's *Forecast*.

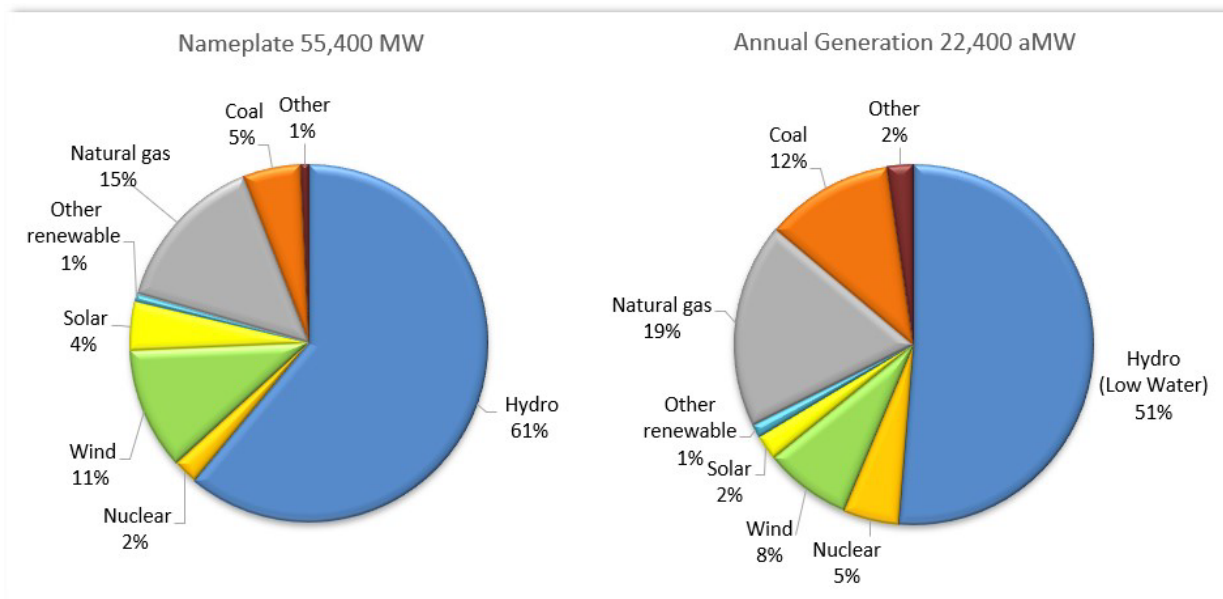
As electric vehicle adoption among consumers increases, some utilities are starting to project increases in demand. Electrification is not expected to impact utilities uniformly and other potential electrification opportunities driven by new building codes, for example, have yet to be completely understood and incorporated. The overall effect of electrification and our understanding of it is expected to increase over the next several years.

Experiences from weather can influence customer choices which impact load such as new or increased use of air conditioning. Many utilities are reporting that effects of climate change have increased their summer peak and/or decreased their winter peak. Utilities are including the effects of climate change into projected loads at different levels of granularity. Some utilities are emphasizing more recent years of weather and temperature, capturing the extreme events we are starting to see more frequently. Other utilities have incorporated global climate models into their forecasting to simulate what future climate effects on load could look like. Utilities representing about one third of the total load have not incorporated climate change into their projected loads.

Hydropower, Energy Efficiency Remain Strong Foundation

The majority of Northwest generation is carbon-free, and hydropower remains the foundation. In Figure 3 on page 7, the left pie shows Northwest utilities' generating resources nameplate capacity (similar to last year at about 55,400 MW), and the right pie is the expected annual energy from these resources. Resource fuel types move around the clock from clean to carbon emitting. Even under low water conditions, hydropower provides over half of total utility generation on an energy basis and clean energy resources make up almost 70 percent of the total annual utility generation. With increasing projected load and the push to decarbonize the power sector, wind and solar along with other clean resources will increase in share. Hydropower will continue to play an important role in reliability because of the Northwest's hydropower's storage and flexibility characteristics.

Figure 3: Northwest Utilities Generating Resources 2023



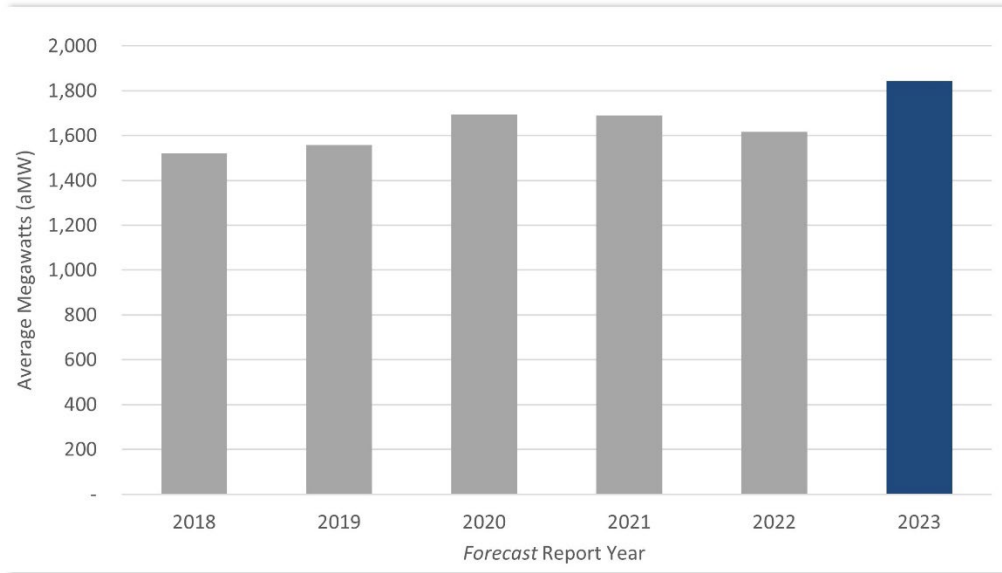
On path for decarbonizing power supply

Several utilities are steadily phasing out coal-fired generation. By 2026, these utilities will have reduced their reliance on coal by over 4,800 megawatts since 2019. As utilities keep some options on the table to meet near-term increases in demand during a period with high resource development risk, plans are shifting. Compared to last year’s *Forecast*, 222 megawatts of planned coal exits were pushed back from no later than the end of 2025 to be no later than the end of 2029. Also, natural gas resources are forecast to have an increased role for reliability until energy storage and other emerging technologies are proven. Plans are progressing to convert Jim Bridger coal units 1 and 2 to natural gas in 2024. These resources provide a bridge to meet peak demand and fill in during potential low water years until sufficient new capacity resource technologies and transmission can be added. Over time as emissions and clean energy targets increase, natural gas use is projected to diminish.

Energy efficiency and demand-side innovations are mainstays

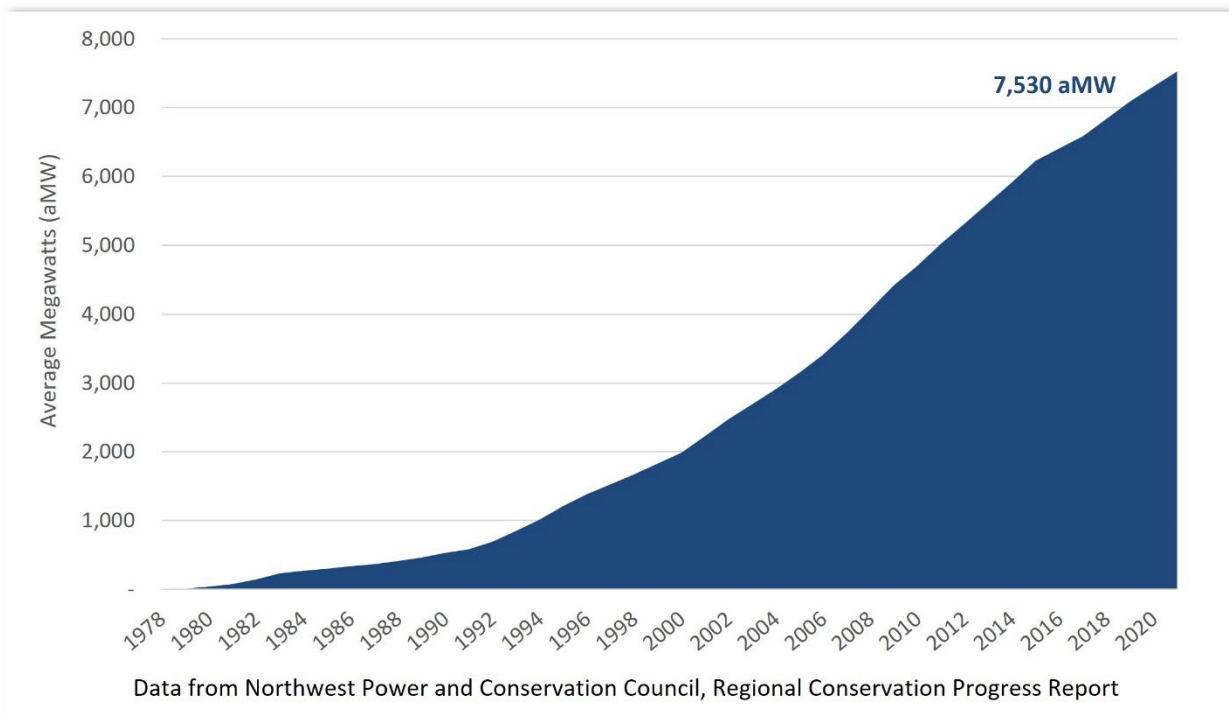
Utilities are projecting greater energy efficiency savings compared to last year’s forecast, recognizing energy efficiency as a key resource in the region. Figure 4 on page 8 is a snapshot of the ten-year projected cumulative savings from the past several *Forecasts*. The ten-year savings projected in the 2023 *Forecast* are slightly higher, as utilities seek more savings to meet growing capacity and energy needs during the clean energy transition.

Figure 4: 10-year Cumulative Energy Efficiency Projections



Over the past 40 years, the region has achieved over 7,500 average megawatts of energy efficiency savings – over 60% of which are from utility programs, per the Northwest Power and Conservation Council (Figure 5). The remaining savings come from the Northwest Energy Efficiency Alliance market transformation efforts, state codes and federal standards, and other savings occurring in the market beyond direct program dollars.

Figure 5: Cumulative Regional Energy Efficiency Savings

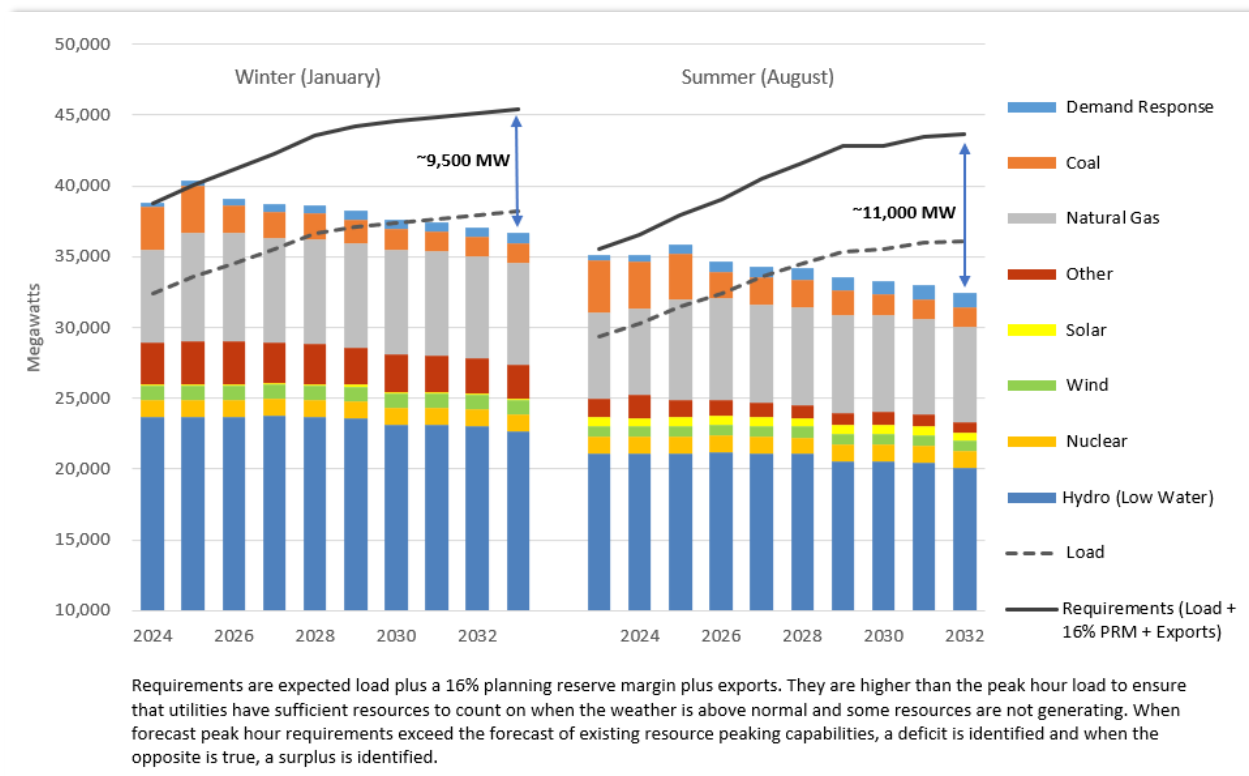


In addition to energy efficiency, utilities continue to deploy and find new ways to rely on customers to reduce energy use at peak times. The *Forecast* projects regional demand response programs will grow. For example, summer demand response is projected to reduce the region’s one hour peak by about 400 megawatts in 2024 and by over 950 megawatts in 2033. On average, summer demand response programs provide about 35 percent more peak hour load reduction compared to winter programs. Regional utilities continue to seek opportunities for demand response programs that can provide mutual benefits to the customer and the grid.

Summer Peak Trend Changes

For the first time, the *Forecast* projects the region needs higher amounts of summer capacity resources to meet summer peak hour demand (electricity use) compared to the winter capacity needs. Figure 6 below shows the winter and summer peak load and resource picture if no planned future resources are procured. By the last year of the *Forecast*, the summer peak deficit grows to over 11,000 megawatts and the winter deficit gets above 9,000 megawatts. Winter peak hour demand remains higher than summer. Observed changes in resources are a bigger factor than changes in loads. Generating resources are forecast to contribute more to meet peak hour demand in winter. Summer generating resource contributions are changing less. On the load side, summer peak hour loads are increasing faster than winter peak hour loads.

Figure 6: Peak Capacity Load/Resource Picture

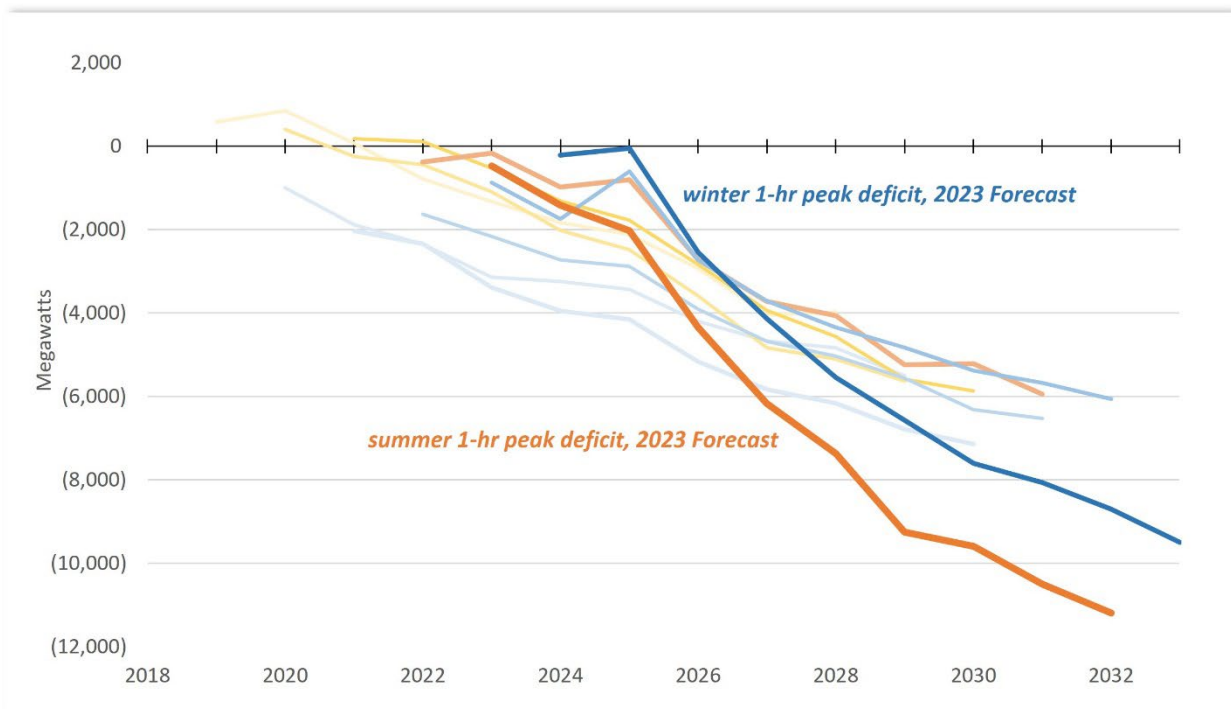


The *Forecast* provides a comparison of Northwest utilities' peak hour requirements to the anticipated resource peaking capabilities. A deficit is not a bright line for how much generation needs to be added to keep the lights on. Rather, the *Forecast's* value is the observation of trends over time and brings another element of situational awareness for the region's utilities to identify areas for additional coordination. The figure also shows the region's move away from coal and expectation that natural gas resources play a steady role in serving peak in the region. Utilities are announcing coal plant retirements and exits as they continue to explore the options for their replacements.

Figure 7 below compares the summer and winter 1-hour peak surplus or deficit across *Forecasts* from 2019 to 2023. The solid bold line is this year's projection. The dashed bold line is the 2022 *Forecast's* projections. In the next five years, the summer peak deficit and need for power is anticipated to grow to about 8,000 megawatts and winter approaches 6,000 megawatts.

This view does not include planned future resources. It is also based on a fixed set of assumptions including normal weather loads, a 16 percent planning reserve margin, low hydro generation, the expected 1-hour peaking capability for generating resources and zero short-term market purchases. The region is monitoring the higher summer peak deficit and the growing magnitude of the deficit. The observed summer deficit can reverse back to higher winter deficits if insufficient winter supply is added and if electrification increases winter peak loads.

Figure 7: Peak Capacity Surplus/Deficit 2019 - 2023 Forecasts

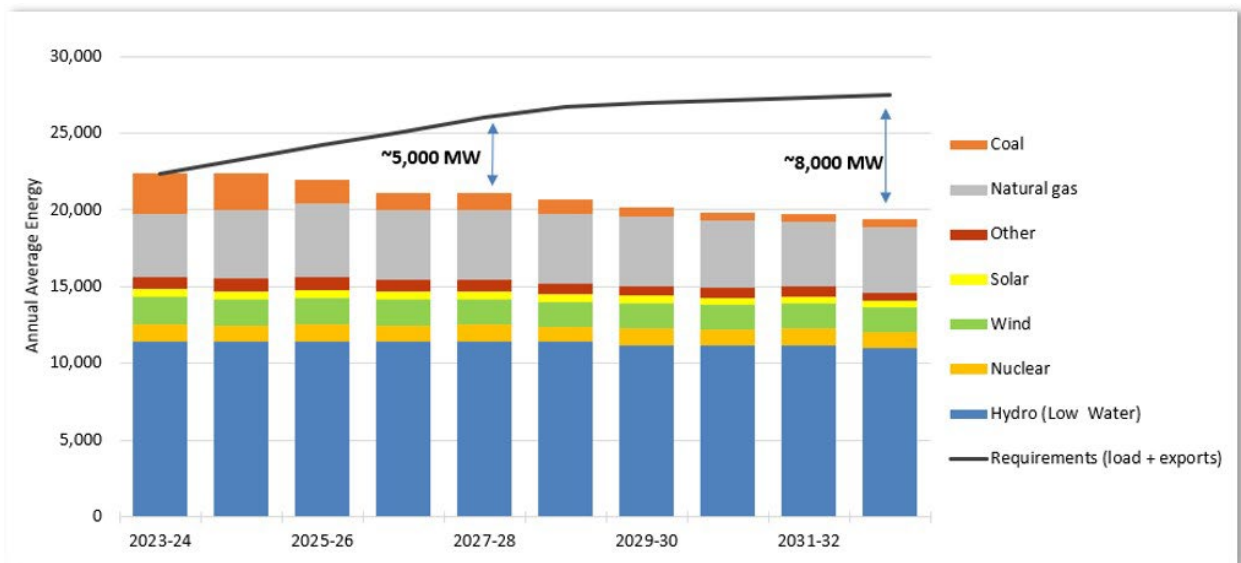


Energy picture helps gage reliability

Monitoring energy deficits can help determine the balance between energy and capacity resources needed in the region. Non-utility owned generation in the region, available power surpluses in interconnected regions, better than low hydro generation and transmission upgrades and expansion can help fill the gaps. Utilities are attentive to these factors as they determine what new resources can best complement their existing power supply.

In addition to summer and winter peak needs, the *Forecast* monitors annual energy needs (electricity demand across all hours of the year). This year's *Forecast*, like last year, shows a growing annual energy deficit (Figure 8) if planned future resources are not acquired. Compared to last year's *Forecast*, where an almost 4,000 average megawatts need was predicted by year ten, this *Forecast's* energy deficit reaches over 8,000 average megawatts in ten years. Watching changes in these trends provides the region with greater situational awareness and identifies areas where more coordination can help.

Figure 8. Annual Energy Picture



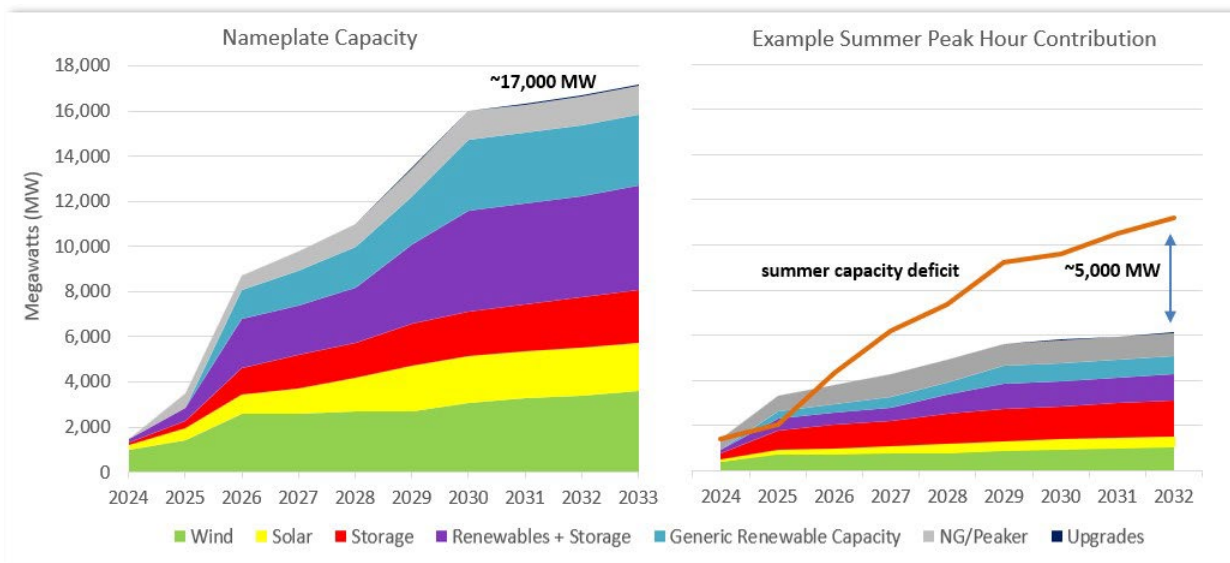
Renewables Combined with Energy Storage Dominate Utility Plans

Utilities are planning for new wind, solar and battery projects to provide much of the new generation to meet rising electric demand and emission reduction goals at a pace that exceeds previous levels. For meeting needs in the next five years, utilities increased the nameplate capacity additions in their preferred portfolios compared to last year's *Forecast*. This translates to over 11,000 megawatts of additions in the next five years, which is up by almost 3,000 megawatts compared to last year's *Forecast*. This *Forecast* anticipates new resource build commitments to start to line up and announcements to roll out before the next *Forecast*. In addition, some utility customers may be procuring their own resources and this *Forecast* may not reflect those additions.

Figure 9 below shows what resources Northwest utilities plan to add to meet their needs. In addition to the increasing amount of renewable energy co-located with storage resources and standalone storage, utilities are looking at capacity resources that include natural gas, peaker and “generic” capacity resources. Some utilities have identified an intention to run the peakers using alternative fuels such as biodiesel or hydrogen.

Figure 9 also shows how these resources might contribute on a regional planning basis to the summer picture highlighted in Figures 6 and 7. The Nameplate capacity (in megawatts), is a measure of the maximum output of a given electric generation plant under optimal conditions, like strong winds or full sun. Generation, measured in megawatt hours, is how much electricity is actually produced. Given the generic nature of the utilities’ preferred resource portfolios, this illustration can vary considerably based on assumptions made about the resources’ geographic location, type, storage capacity amongst other factors. Using the assumptions made in preparing Figure 9 (Example Summer Peak Hour Contribution), the summer capacity deficit shrinks with planned future resources. However, it also shows the region may require additional resources to fill the gap. Peak contributions will also vary depending on the time of year.

Figure 9: Planned Future Resources Picture



Landmark clean energy legislation and unprecedented federal government funding can help advance clean energy technology and modernize the grid. Emerging technologies including advanced nuclear, offshore wind, renewable hydrogen and long-duration storage are being championed as part of the grid of the future. While these technologies are being explored, they do not show up in the information reported in this year’s *Forecast*. In the coming decade, technological advancements will continue to help utilities diversify the mix of clean generation, and utilities will continue to adapt their plans as more information about future loads and resources and transmission opportunities are known.

Transmission solutions and regional coordination crucial to keeping a reliable grid

Several utilities also identify new transmission projects in their preferred resource portfolios and are working to enhance the transmission system. This has been outside the scope of the *Forecast* data tracking. However, transmission is a critical component to delivering generation, much of it from renewable resources, to load centers. New transmission can also make more efficient use of existing resources, possibly reducing the new resource additions required.

Utilities are also enhancing regional coordination by working together to address adequacy concerns and develop enhanced market solutions. The Western Resource Adequacy Program approved by the Federal Energy Regulatory Commission in February 2023 has been recognized as a first-of-a-kind program for resource adequacy that will operate with participants across a wide geographic footprint. Tools like the Western Energy Imbalance Market give system operators real-time visibility across the interconnected grid, which helps share load and resource diversity more efficiently. Expanding coordinated wholesale energy markets can help make more efficient use of existing and newly added resources.

2023

Northwest Regional Forecast



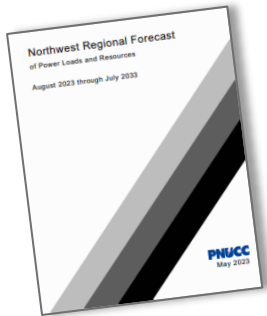
NORTHWEST POWER AND CONSERVATION COUNCIL

WENATCHEE, WA | MAY 17, 2023

Today's Objectives



What is PNUCC?



What is the *Northwest Regional Forecast*?



What are the key takeaways from the *2023 Forecast*?

Pacific Northwest Utilities Conference Committee

- Unique, diverse membership – consumer-owned and investor-owned utilities and industry partners
- Forum for collaboration
- Long history beginning in 1947 with the Tacoma Conference
 - Staffed up in 1980 to actively engage in regional planning efforts and in analysis of proposed programs and policies

PNUCC's Mission

Bringing the *Power*
of good ideas
Together

Member driven

- Board of Directors
- System Planning Committee

Key priorities

- Regional Power Supply & Demand
- Clean Energy Transition
- Transmission Infrastructure
- Western Wholesale Market Developments
- Emerging Issues

Northwest Regional Forecast: A regional barometer



- For over 70 years, annual look at Northwest utilities' firm requirements & resources
- Tracks trends using consistent assumptions for annual energy, winter, & summer peak
- Power Act footprint (WA, OR, ID, western MT)
- Tool to understand the evolving state of the Northwest power system

Sum-of-utilities loads and resources



Requirements

1-in-2 loads after energy efficiency
16% planning margin for peak
Long-term export contracts



Demand side management

Utilities' savings forecasts



Generating resources

Utility-owned and long-term contracted only
Utilities' expected operation



Hydropower

Low water conditions

2023 Forecast: Key Takeaways

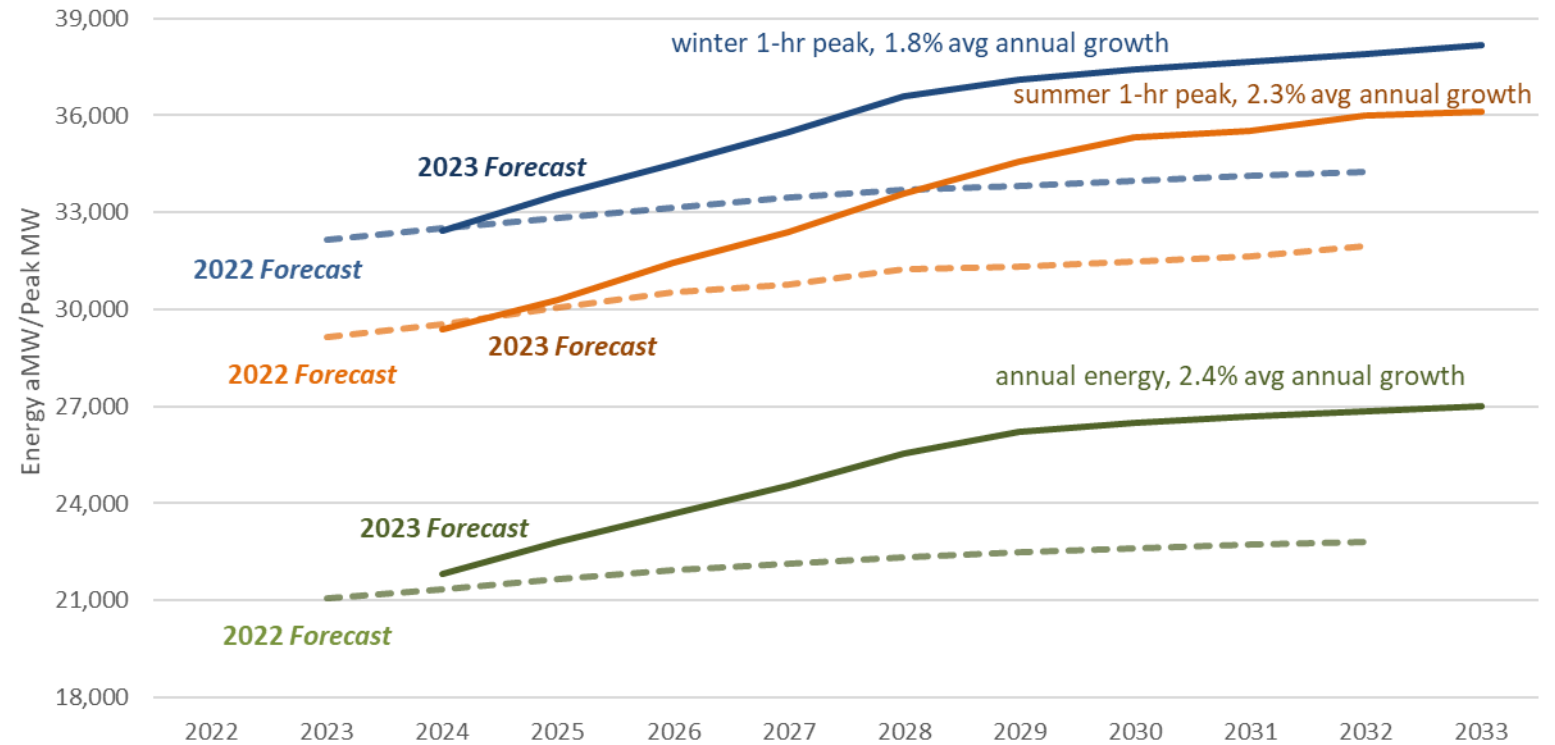
- Rapidly growing load expected over next five years
- Energy efficiency a mainstay and demand response projected to grow
- Monitoring deficits and trends helps gage reliability
- Renewables and energy storage dominate plans
- Transmission enhancements will be needed
- Coordination and innovation crucial to maintaining a reliable interconnected grid

Rapidly growing load

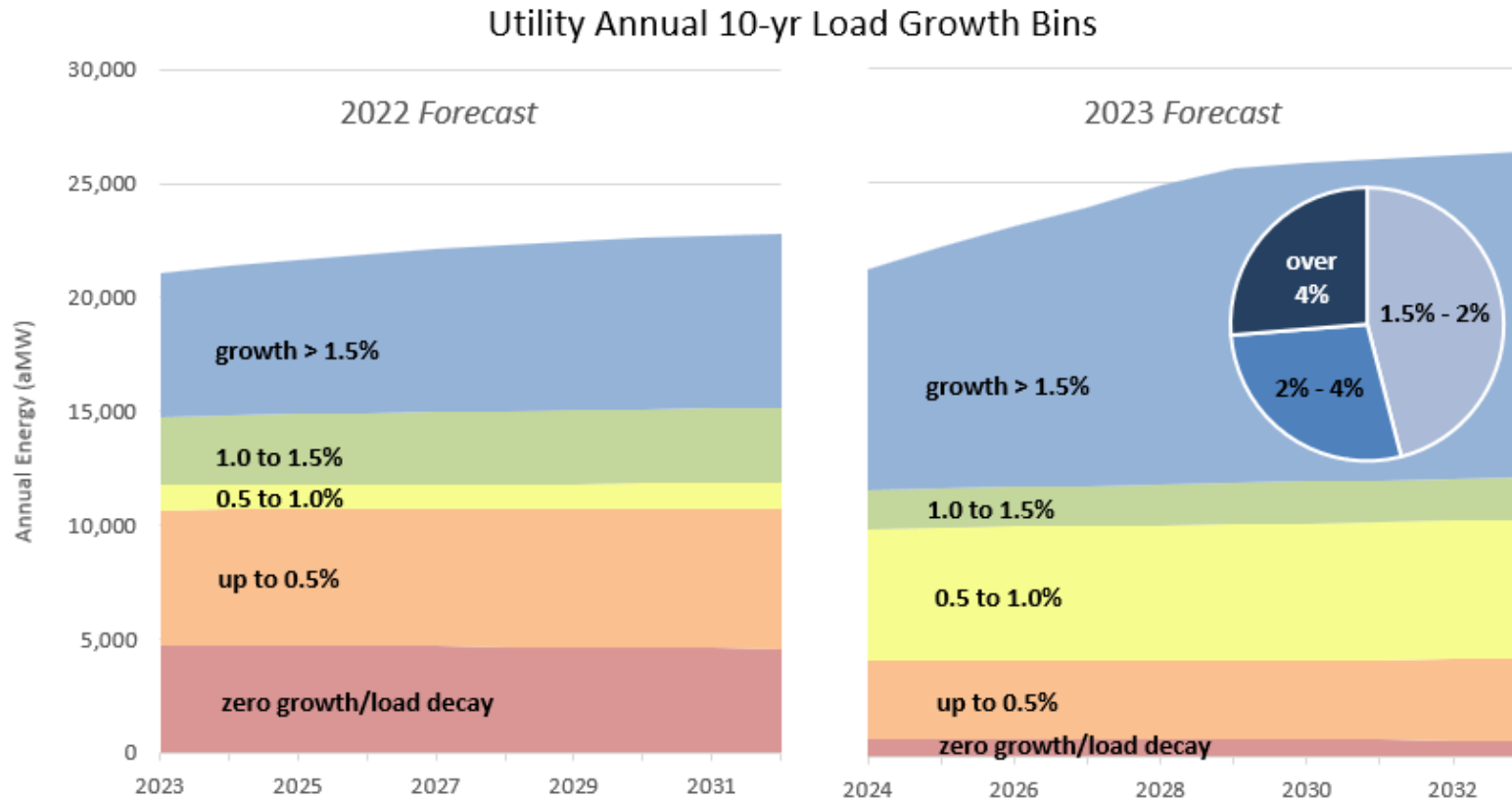
Load forecast comparison – 2023 vs. 2022

2023 growth rates	5 year	10 year
Winter	2.7%	1.8%
Summer	3.3%	2.3%
Annual Energy	3.8%	2.4%

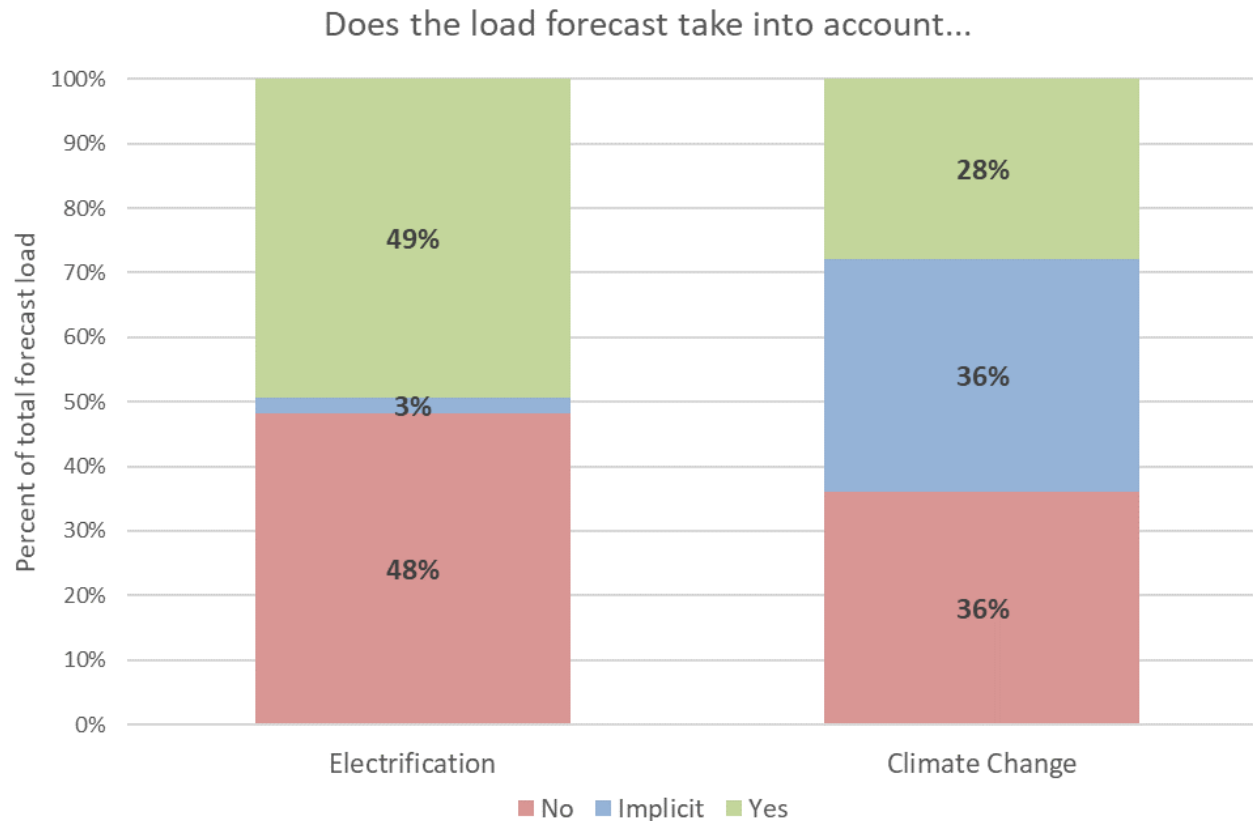
2022 growth rates	5 year	10 year
Winter	1.0%	0.7%
Summer	1.4%	1.0%
Annual Energy	1.2%	0.9%



Most utilities projecting load growth



Electrification and climate change effects still coming

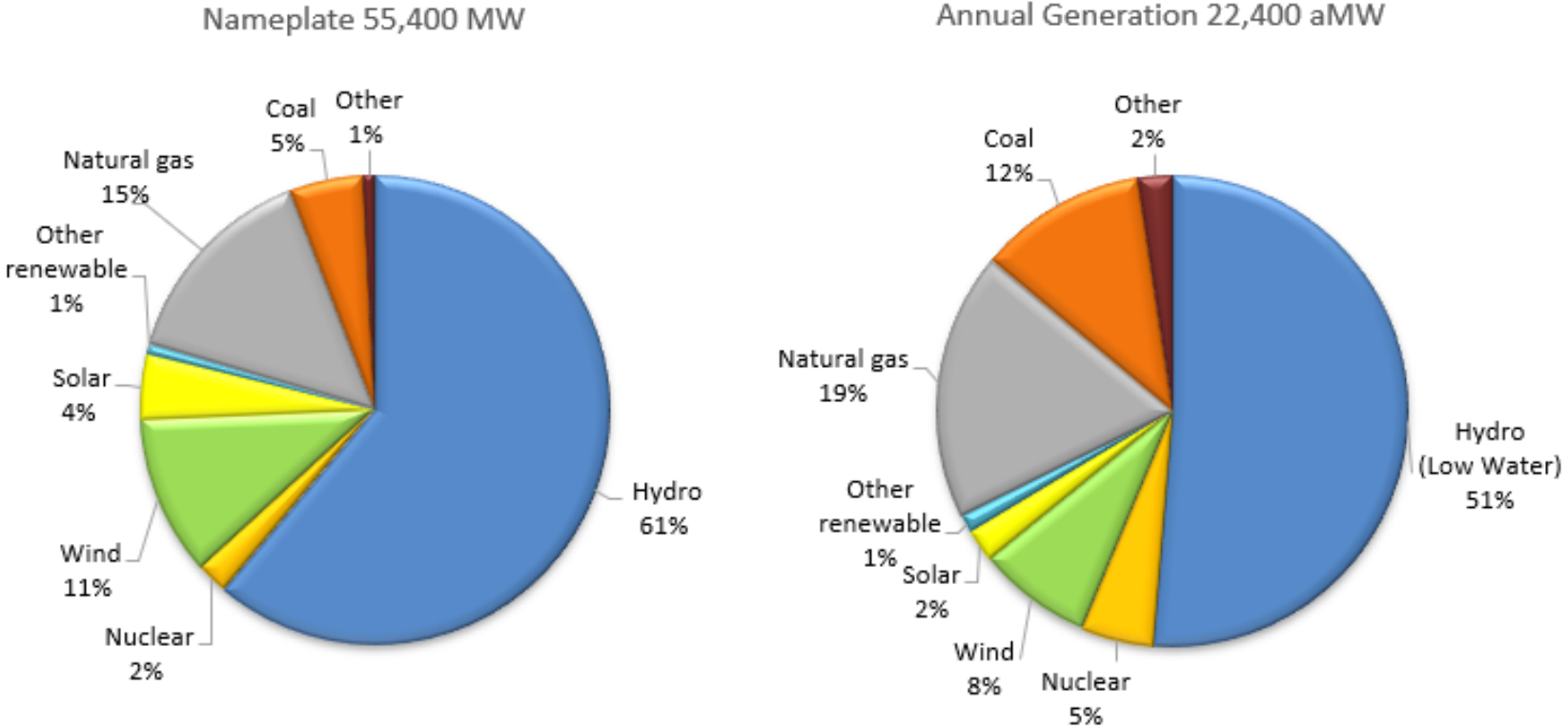


Yes = Explicitly included

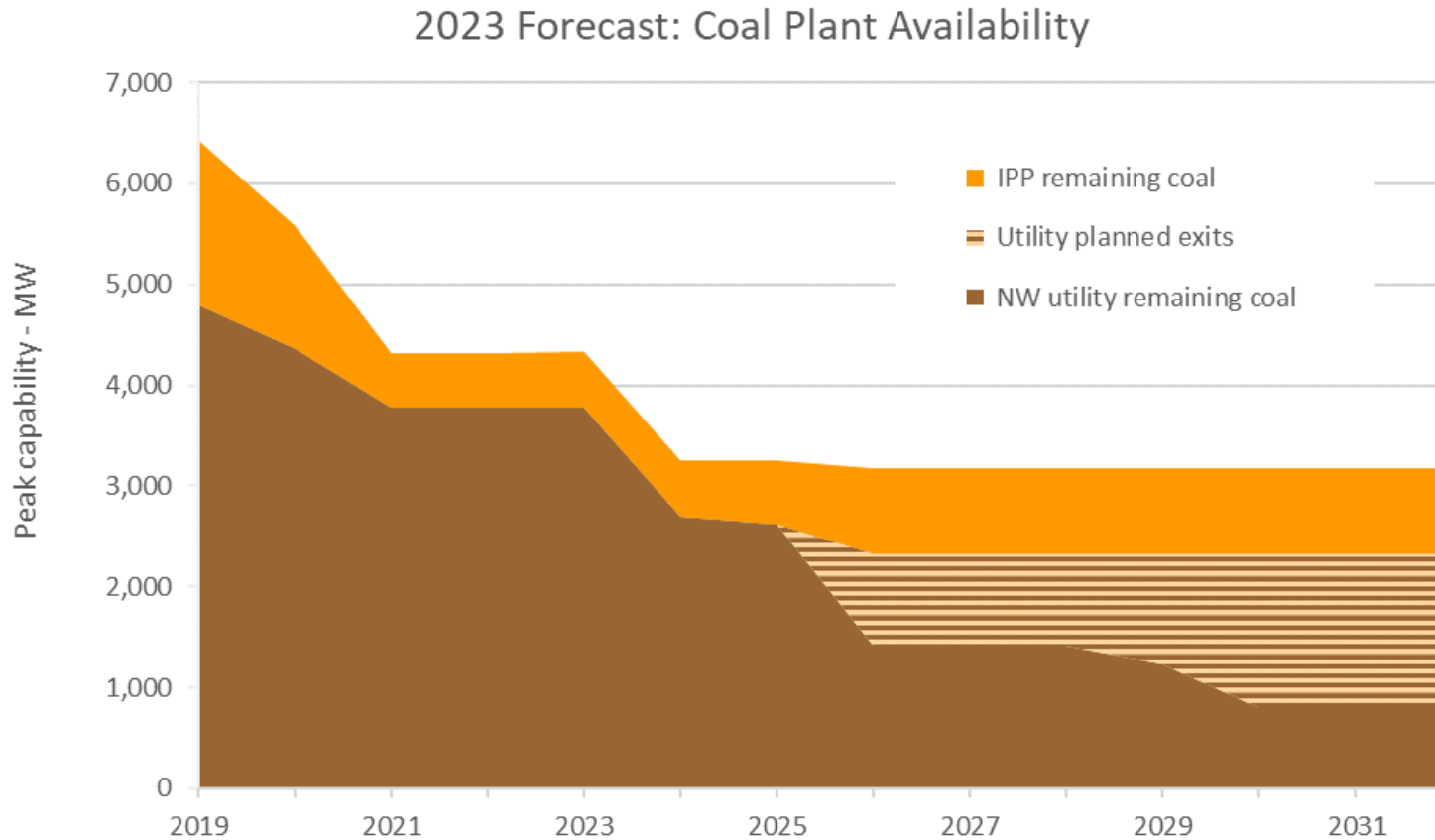
Implicit = Some aspects (e.g. historical trends) may be captured and included

No = Not included or no response

Hydropower remains strong foundation



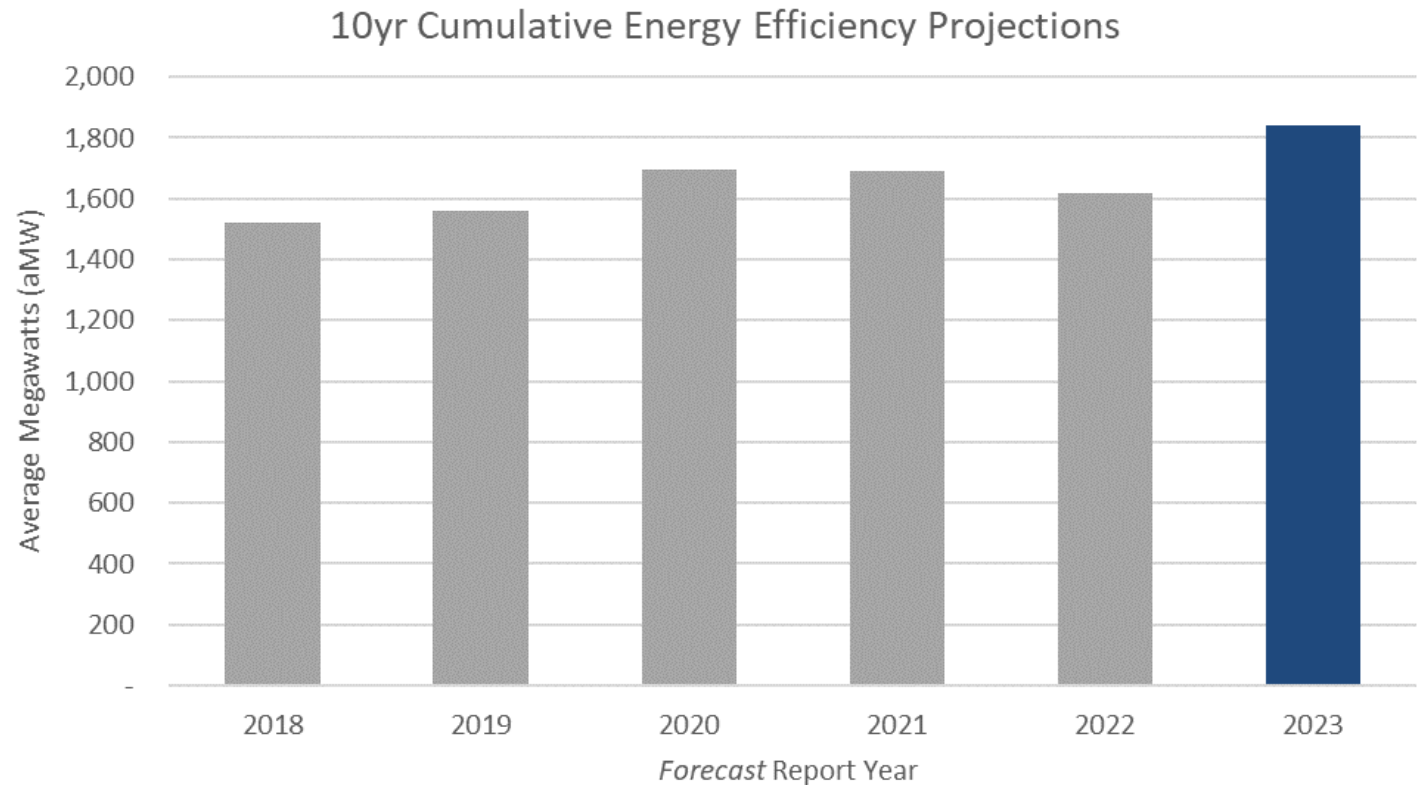
On path for decarbonizing power supply



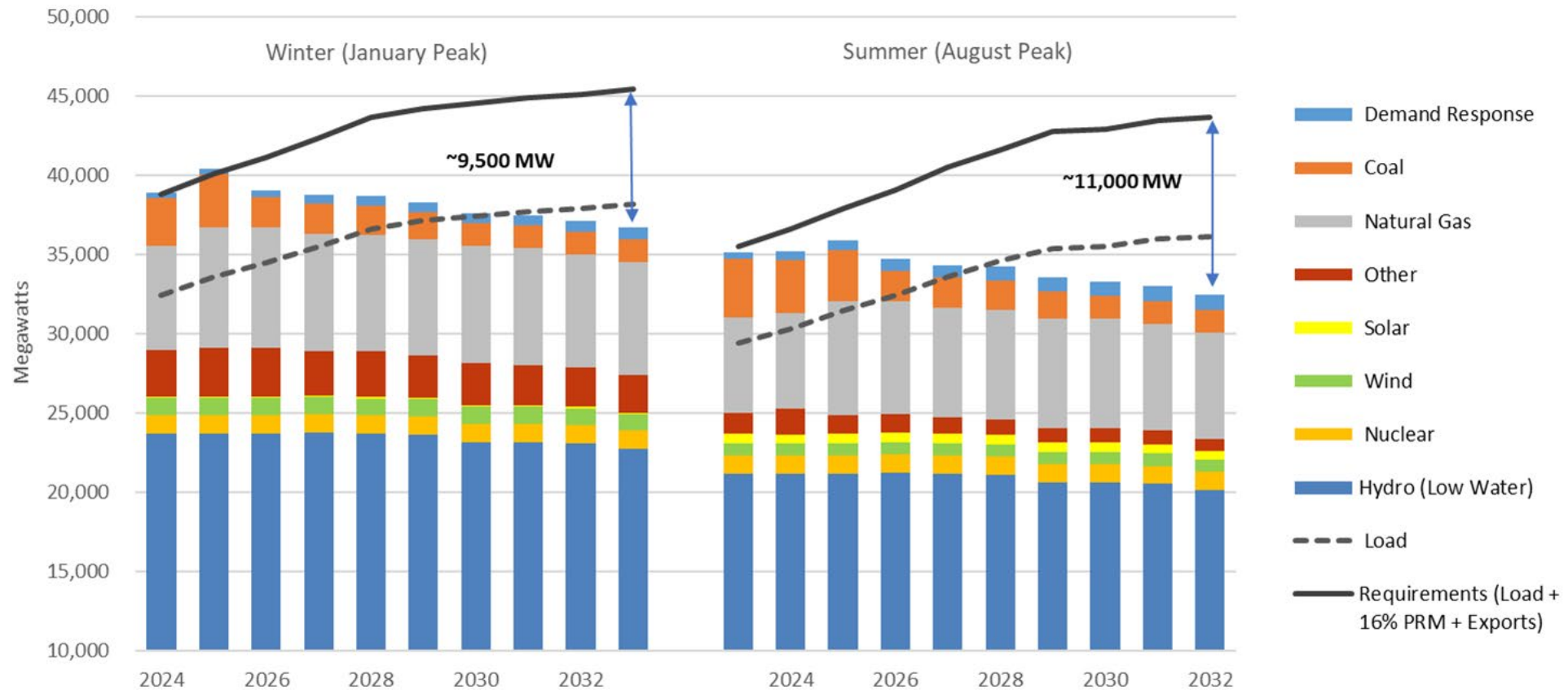
Demand response projected to grow

- Utilities continue to deploy and find new ways to rely on customers to reduce energy use at peak times
- Summer demand response expected to reduce region's one hour peak by over 950 MW in 2033 (35% more than winter program projections)

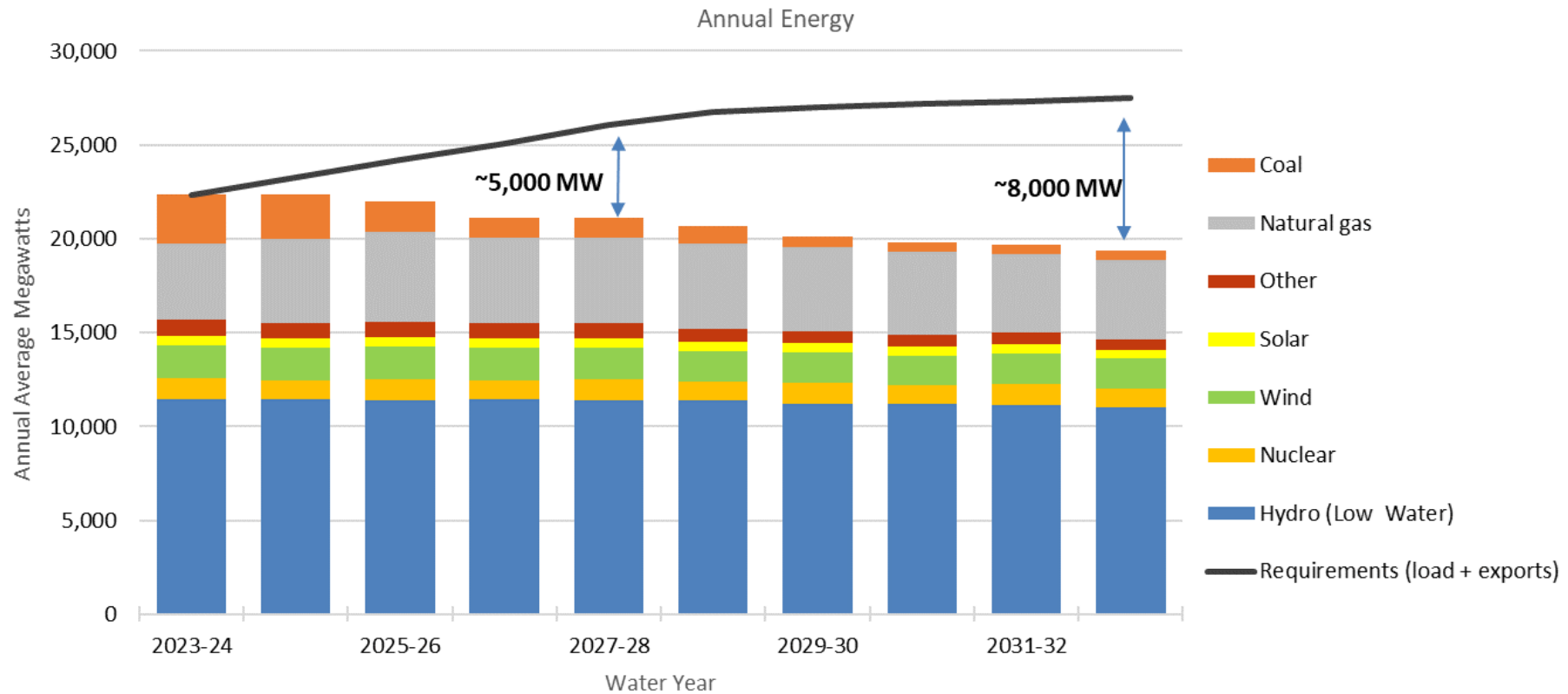
Energy efficiency a mainstay



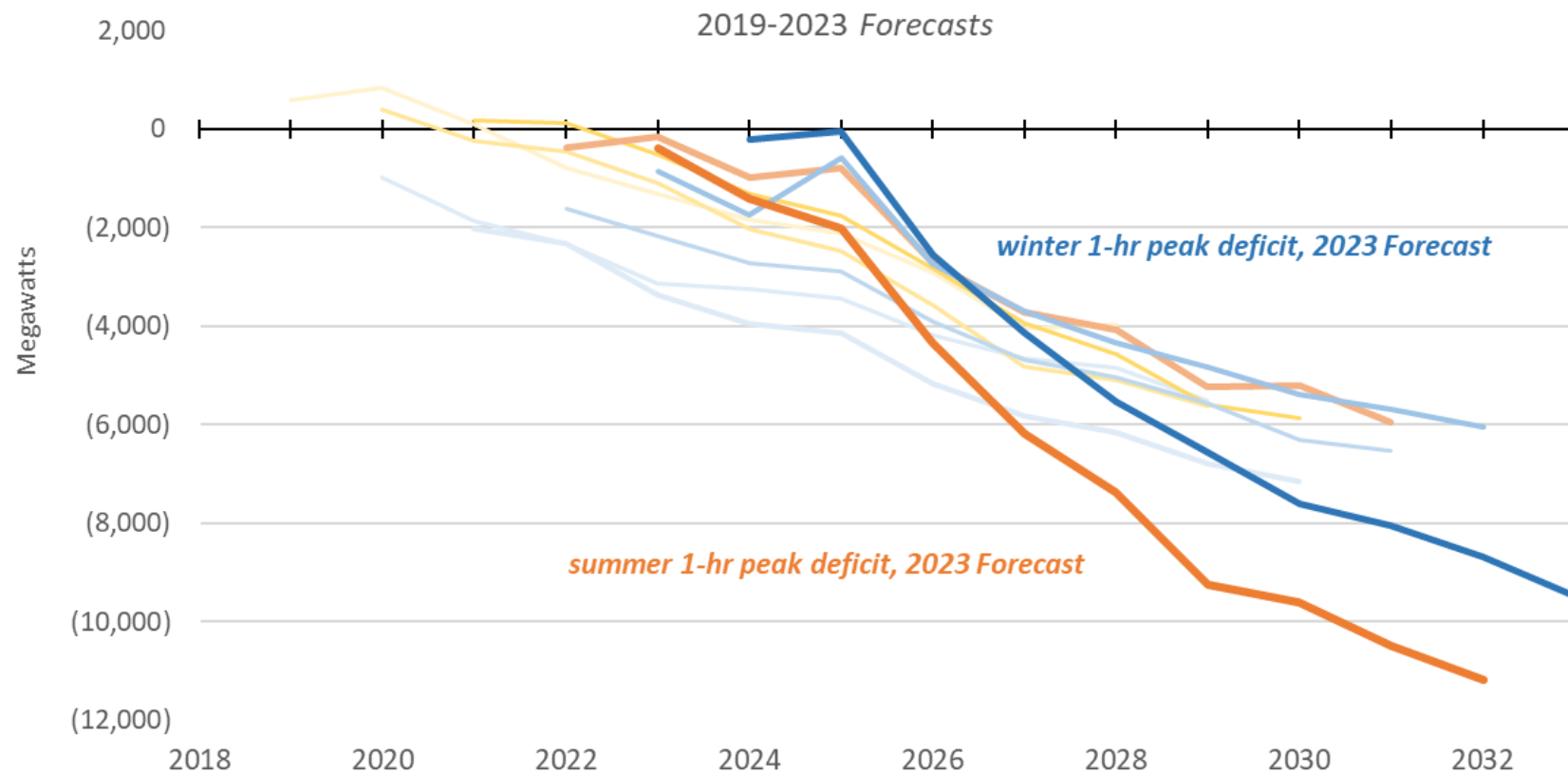
Summer peak resource gap outpacing winter



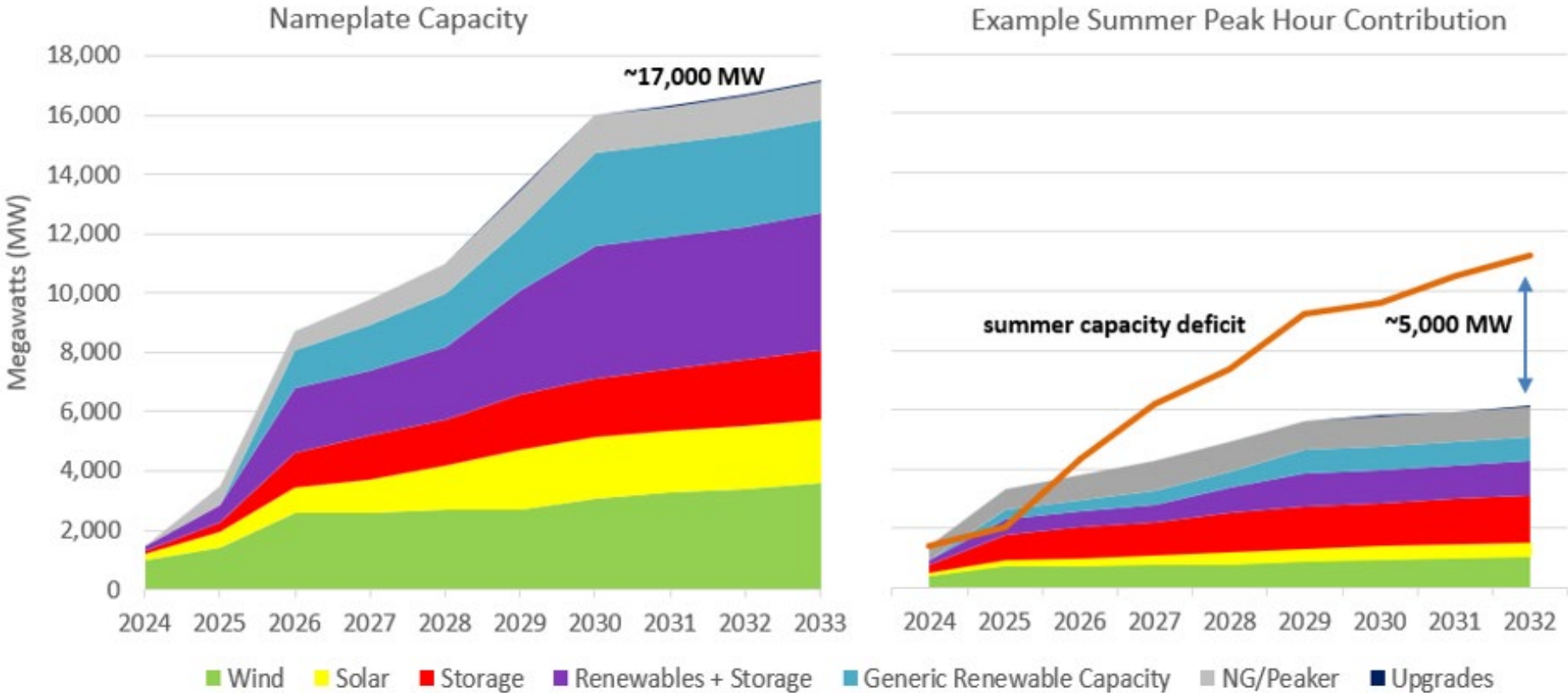
Energy picture provides added situational awareness



Monitoring deficits and trends helps gage reliability



Renewables and storage dominate utility plans



Transmission solutions and regional coordination crucial

- Federal funding can help advance emerging technology and modernize the grid
- Utilities focused on enhancing transmission system
- Addressing resource adequacy across a wide footprint increases situational awareness and reliability
- Expanding coordinated wholesale energy markets can help make more efficient use of existing and newly added resources

2023 Forecast: Key Takeaways

- Rapidly growing load expected over next five years
- Energy efficiency a mainstay and demand response projected to grow
- Monitoring deficits and trends helps gauge reliability
- Renewables and energy storage dominate plans
- Transmission enhancements will be needed
- Coordination and innovation crucial to maintaining a reliable interconnected grid



Questions?

The *2023 Northwest Regional Forecast* can be found at pnucc.org

Thank you!

Crystal Ball
Executive Director

Aliza Seelig
Analytics and Policy Director

Gillian Charles
Red Kite Consulting, LLC