

2023 Pacific Northwest Loads and Resources Study

April 2023







Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

April 20, 2023

In reply refer to: PGPR-5

Dear Interested Parties:

The Pacific Northwest Loads and Resources Study, commonly called “The White Book”, is the Bonneville Power Administration’s (BPA) annual publication of the Federal system and the Pacific Northwest (PNW) region’s loads and resources for the upcoming ten year period.

The White Book is used by BPA as a planning tool, as an information source for customers, as a published source of loads and resources information for regional interests, and as a data source for the Columbia River Treaty studies. The White Book is not used to guide day-to-day operations of the Federal Columbia River Power System or to determine BPA revenues or rates.

New for this white book, firm energy planning is based off the tenth percentile of the Tier One System Firm Critical Output (T1SFCO), previously water year 1937. Moving to percentile approach helps avoid any anomaly observed in a single water year. As a prime example, January 1937 being the worst monthly streamflow on record, comparison between this white book and the 2022 White Book, particularly in January 120-Hr (MW) metric, displays the results of this change.

This 2023 White Book presents Federal system and the region’s load obligations, contracts, and resources as of December 2022 for operating years (OY) 2024 through 2033. The 2023 White Book includes the following studies:

- **Federal System Analysis**—forecast of Federal system firm loads and resources based on expected load obligations and different levels of generating resources that vary by different energy planning. The results are summarized below:
 - **Annual Energy Surplus/Deficits:** Under firm; the Federal system is projected to have annual energy deficits across the study period, ranging from deficits of 18 aMW to 424 aMW. Except for the first year of the study period, these annual energy deficit projections are greater than those projected in the 2022 White Book. Under median water conditions; the Federal system is projected to have annual energy surpluses through the study period.
 - **January 120-Hour Capacity Surplus/Deficits:** Under firm water conditions; the Federal system is projected to have January 120-Hour capacity surpluses through most of the study period with the only deficit in OY2033. Surpluses starting at 414 MW for the first year gradually decline to a deficit in the last year of 123 MW. These 120-Hour capacity results are different than those projected in the 2022 White Book largely due to the change in firm water conditions planning. . Under median water conditions; the Federal system is projected to have January 120-Hour capacity surpluses over the study period.

- **PNW Regional Analysis**—forecast of regional firm loads and resources, based on expected retail loads and different levels of generating resources that vary by water conditions. The decommissioning of existing resources, the availability of uncommitted PNW Independent Power Producer (IPP) generation, and new resource additions are key variables in the results of this analysis. The results are summarized below:
 - Annual Energy Surplus/Deficits: Under firm water conditions; the PNW region is projected to have an annual energy surplus as large as 2,316 aMW in OY 2024, slowly decreasing to a deficit of 61 aMW by OY 2033. These annual energy projections are more surplus throughout the study period than was forecasted in the 2022 White Book. Under median water conditions; the PNW region would see even larger energy surpluses over the study horizon.
 - January 120-Hour Capacity Surplus/Deficits: Under firm water conditions; the PNW region is projected to have January 120-Hour capacity deficits over most of the study period ranging from 774 MW to 3,506 MW, except for the first two years (OY 2024 and OY 2025) which are slightly surplus. These deficit projections are much less than those shown in the 2022 White Book. Under median water conditions; the PNW region has January 120-Hour capacity surpluses through the final year of this study.

BPA is currently starting the development of its 2024 Resource Program designed to evaluate long-term power resources acquisition strategies. Many factors contribute to the uncertainty of the longer term resources outlook for the region; such as resource retirements and development, resource adequacy and the efforts surrounding it, carbon free resource requirements, and the most recent Climate Resiliency efforts. As with resources, there is also much uncertainty with loads including the potential for electrification. The 2023 White Book is available on BPA's website: <https://www.bpa.gov/energy-and-services/power/resource-planning> or from BPA's Visitor Center, which you can reach toll-free at 800-622-4520 (or 503-230-4636). Details regarding regional loads, contracts, and generating resources are available upon request. Available report list can be found in Appendix A.

Please send questions and/or comments to Steve Bellcoff (503) 230-3319.

Sincerely,

Robert Petty
Manager, Power and Operations Planning

Enclosure

2023 PACIFIC NORTHWEST LOADS AND RESOURCES STUDY

The White Book

BONNEVILLE POWER ADMINISTRATION
April 2023



Cover Picture:

Source: BPA Photo Archive <https://river.bpa.gov>

The Dalles Dam is located roughly 190 miles upstream from the mouth of the Columbia River and a couple of miles east of the City of The Dalles. It was constructed between 1952 and 1957 by the United States Army Corps of Engineers, and was the federal government's effort to develop hydropower and navigation potential of the Columbia River after World War II.

The Dalles Dam was constructed after the Bonneville Dam in 1937 and McNary Dam in 1945. In addition to meeting the electrical power demand, a newer navigation lock would replace Corps' original and smaller Dalles-Celilo Canal.

For more history on The Dalles Dam, please visit [The Dalles Dam \(oregonencyclopedia.org\)](#).



ACKNOWLEDGMENTS

Preparation of the annual Pacific Northwest loads and resources study is a complex, multidisciplinary effort. BPA wishes to acknowledge the team—BPA staff and others—whose diligence and dedication result in a reliable, high quality document.

Bonneville Power Administration

Generation Asset Management:

Long Term Power Planning Group
Regional Coordination Group
Operational Planning Group

Customer Support Services:

Load Forecasting and Analysis Group

Bulk Marketing and Transmission Services:

Long Term Sales and Purchasing Group

NW Requirements Marketing:

Office of General Counsel

Pacific Northwest Utilities Conference Committee

Northwest Power & Conservation Council



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Section 1: Summary

Planning Context

The Pacific Northwest Loads and Resources Study (commonly referred to as the “White Book”) is a planning document produced by the Bonneville Power Administration (Bonneville) that presents its projection of load and resource conditions for the upcoming 10-year period (operating year 2024 through 2033). The White Book includes analysis of Bonneville’s forecasts of expected power obligations and resource generation for both the Federal system and the Pacific Northwest (PNW) region as a whole. The information contained in the White Book is used for: 1) long-term planning studies for Bonneville; 2) planning studies for the Columbia River Treaty (Treaty); and 3) as a published record of information and data for customers and other regional planning entities. The White Book is not used to guide day-to-day operations of the Federal Columbia River Power System (FCRPS).

Bonneville’s White Book traditionally focuses on long-term deterministic power planning for the Federal system and the PNW region. Bonneville’s Federal System Analysis calculates the Federal system load and resource balance by comparing expected Federal system loads and contract obligations to forecasted Federal system resource generation and contract purchases. In the same manner, Bonneville’s PNW regional analysis calculates the PNW regional load and resource balance by comparing expected regional retail loads and contract obligations to forecasted regional resource generation and contract purchases. Hydropower resources for the Federal system and PNW region include variability by incorporating a variety of generation forecasts, associated with streamflows from the most recent 30-historical water conditions¹ of the 2020 Modified Flows. These deterministic analyses are modeled by operating year (OY²), defined as August-July, to be consistent with regional coordination of the Treaty and PNCA. Results are presented in: 1) annual and monthly energy, expressed in average megawatts (aMW); and 2) monthly peak capacity, presented in 120-Hour peak megawatts (MW). The Federal System Analysis is presented in [Section 2](#), and the Pacific Northwest Regional Analysis is presented in [Section 3](#).

Bonneville, like the rest of the electric power industry, continues to explore ways to more comprehensively assess the ability of the power system to meet long-term load obligations. Bonneville periodically incorporates additional studies and data into its planning that look at different analytical methods and analyze different scenarios. This year’s White Book does not incorporate any other studies.

The 2023 White Book is published as a single summary document. Beginning with the 2022 White Book the Technical Appendices are no longer published along with the summary document, rather, [Appendix A](#) at the end of this summary document contains the list of reports previously included in the Technical Appendices, and those reports are available upon request. Please contact [Steve Bellcoff](#), srbellcoff@bpa.gov, (503) 230-3319 with requests.

The total retail load, contract, and generation forecasts used in this study were updated as of December 31, 2022. The 2023 White Book supersedes the 2022 White Book.

Load Obligations

The load obligations for the Federal system and PNW region contain multiple components in this study, and load obligation forecasts are categorized as follows: 1) Total Retail Loads (TRL), defined as each individual

¹ Additional details please refer to [Climate Change and the FCRPS \(including the Climate Change Resiliency effort\)](#)

² Operating Year (OY) is the time frame August 1 through July 31. For example, OY 2024 is August 1, 2023 through July 31, 2024.

utility's retail electric power consumption on its system, including electrical system losses; and 2) contract obligations, which include reported PNW utility long-term contract sales within the PNW region (Intra-Regional Transfers (*Out*)) and outside the PNW region (Exports). Contract obligations also include Federal system power sales delivered to Federal agencies, public bodies, cooperative, and tribal utility preference customers as stated under section 5 of the Northwest Electric Power Planning and Conservation Act (NW Power Act), 16 U.S.C. 839 et seq., (December 5, 1980).

Forecasts of the regional TRL and Federal system load obligations are produced by Bonneville's Agency Load Forecasting (ALF) system. ALF forecasts are completed for individual PNW entities under one of two approaches; 1) using statistical approaches that are based on time-series-based regressions that follow the fundamental assumption that historical retail electricity consumption patterns will continue into the future, 2) statistically adjusted end-use models. The statistically adjusted end-use models include calculated indexes for heating equipment, cooling equipment, and other equipment. ALF forecasts also assume normal weather conditions and do not include any explicit adjustments for the impacts of climate change, however they do use temperature normals based on recent history in order to be consistent with recent climate trends. Contract obligations not associated with Bonneville's Regional Dialogue contracts follow individual contract terms through the life of the contract and are not assumed to be renewed. All Federal system load and contract obligations are assumed to be firm and served by Bonneville regardless of weather, water, or economic conditions.

Resource Types

Regional resources consist of "on the ground" generating facilities and contract purchases that are used to serve retail loads. PNW resources (including the Federal system) are predominantly hydro based, therefore, generation levels can vary greatly both from month-to-month and from year-to-year. This analysis classifies resources as; 1) Hydro resources, which include regulated, independent, and small hydro projects; 2) Non-hydro renewable resources, which include wind, solar, and other projects; 3) Thermal resources, which include nuclear, coal, natural gas, petroleum, biofuel and cogeneration projects; and 4) Contract purchases, which include reported PNW utility long-term contract purchases from within the PNW region (Intra-Regional Transfers (*In*)) and from outside the PNW region (Imports). The generation forecasts for these resources are provided by Bonneville models or from the project owners, and those are described below.

Hydro resources

- Regulated Hydro: Regulated hydro projects mainly consist of PNW Columbia River Basin hydro power projects for which the operation and generating capability is hydraulically coordinated to meet power and non-power requirements. Bonneville forecasts the coordinated energy and capacity production from these hydro power projects using its Hydrosystem Simulator (HYDSIM) model. The HYDSIM model takes into account individual project operating characteristics and conditions, to determine energy production expected on a project-by-project basis. Generation forecasts for these projects incorporate the month-to-month power and non-power requirements under each of the 30-historical streamflow conditions of record, 1989 through 2018. The HYDSIM model is described further in the [Hydro Resource Modeling](#) section.
- Independent Hydro: Independent hydro projects include those hydro projects whose generation output typically varies by water condition but are not operated as part of the coordinated Columbia River Basin system. Independent hydro generation forecasts can vary month-to-month for energy and capacity, and are developed and provided by individual project owners/operators for the same 30-historical water conditions as the Regulated Hydro projects.

- Small Hydro: Small hydro project generation forecasts are either provided by individual project owners or are based on historical actual generation. These generation forecasts can vary month-to-month but are not assumed to vary by water condition.

Non-hydro renewable resources

- Wind: Firm wind generation incorporates the statistical modeling of wind generation based on historical weather data and actual generation from currently operating PNW wind projects. The single operating year with the lowest total PNW wind generation is selected as the firm wind year. The firm wind year generation performance determines each project's energy forecast. The Federal system and PNW regional capacity analyses assume zero capacity contribution from wind resources.
- Solar: Solar projects are utility scale solar facilities that are metered and the generation is being sent to the grid, and does not include any behind the meter resources. The Federal system and PNW regional capacity analyses assume zero capacity contribution from solar resources.
- Other: Other renewables include any other project identified as renewable, including geothermal and biomass/biogas waste projects. Generation forecasts for these resources are based on energy and capacity forecasts submitted by individual project owners.

Thermal resources

- Thermal resources include nuclear, coal, natural gas, petroleum, biofuel, and cogeneration. Generation forecasts for these projects are based on energy and capacity capabilities submitted by project owners. These forecasts typically vary month-to-month, and total plant generation is reduced in order to account for scheduled maintenance. Forecasts are adjusted to show actual operational capabilities and expectations, and not to reflect economic dispatch.

Contract purchases

- Contract Purchases/Imports: Contract purchases include signed Federal system purchases and regional contract purchases with power delivered to PNW entities reported by utilities publically and in data submittals. These purchases are treated as resources in both the Federal system and regional analyses. Purchases between entities within the PNW are called Intra-regional Transfers (*In*) and purchases from entities outside the PNW are called Imports. With the exception of contracts associated with the Treaty, all existing Federal system and regional contract purchases follow individual contract terms through the life of the contract and are not assumed to be renewed. Treaty power deliveries are assumed to be in place through the study period.

Adjustments to Resources

This White Book assumes that resource generation and contract purchases must be reliably delivered to load centers. To take this into account, this study makes adjustments to generation forecasts for: 1) Operating and Balancing Reserves, held to meet reliability standards; and 2) Transmission Losses, associated with power deliveries. These resource adjustments are reductions to both energy and capacity and are described below:

- Operating and Balancing Reserves: Operating reserves consist of both spinning and non-spinning contingency reserves that respond to the unforeseen loss of a resource, which are calculated by summing 3 percent of forecast load and 3 percent of forecast generation. Balancing reserves consist of regulating, load following, and imbalance reserves that are dedicated to maintaining within-hour load and resource balance. The modeling of reserves, including those for wind integration, is described in the Hydro Resources Modeling section below. The reserve forecasts included in this 2023 White Book are modeled consistent with those used in Bonneville's BP-24 Initial Rates Proposal.

- Transmission Losses: During the transmission of power to load centers some of the electrical energy is lost, usually in the form of heat, which is known as transmission losses. Transmission losses are calculated on a monthly basis and vary by generation, based on the sum of all generation and contract purchase forecasts. The transmission loss factor has several components that combine to give the estimate of losses typically associated with Federal system generation: (1) step-up transformers from generation to the high-voltage transmission network, (2) high-voltage network transmission, (3) transfers to Federal loads over non-Federal transmission systems, and (4) step-down transformers from high-voltage transmission to low-voltage delivery. The Federal system transmission loss factors used in this Study are:
 - Energy is 3.11 percent, September through May and 3.16 percent, June through August.
 - Capacity is 3.16 percent, September through May and 3.21 percent, June through August.

Hydro Resources Modeling

The HYDSIM hydro regulation model forecasts the energy production from the regulated hydroelectric power projects in the PNW. This includes the 14 largest federal hydroelectric projects in the mid-Columbia Federal system, and other major hydro projects in the PNW. Project level generation forecasts are produced in a continuous study for each month within of the 30 year-historical streamflow³ record (October 1989 through September 2018). Energy production is maximized by coordinating hydro operations while meeting power and non-power requirements. HYDSIM produces results for 14 periods; ten complete months, plus two periods each for April and August. April and August are divided because natural streamflows and operations often change significantly during these months. Consequently, generation can differ significantly between the beginning and end of these months. For simplicity, the 14-period results are referred to as “monthly” values in this report.

The HYDSIM studies encompass both power and non-power operating requirements. Each hydro study specifies particular non-power hydroelectric project operations for fish, such as seasonal flow objectives, minimum flow levels for fish, spill for juvenile fish passage, reservoir target elevations and drawdown limitations, and turbine operation requirements. The operations modeled include the following as outlined in the US Army Corps of Engineers PNCA data submittals:

- National Marine Fisheries Service 2008 Willamette BiOp (July 11, 2008)
- 2020 Columbia River System Operations Environmental Impact Statement (CRSO EIS), (Sept. 28, 2020)
- 2020 NOAA Fisheries Federal Columbia River Power System Biological Opinion (2020 NMFS BiOp) (July 24, 2020)
- 2020 US Fish and Wildlife Service Biological Opinion (November 12, 2019)

The Pacific Northwest Coordination Agreement (PNCA) coordinates the planning and operation of the members’ hydroelectric power projects in the PNW. PNCA project owners provide physical plant data as well as power and non-power constraints in an annual data submittal to the Western Power Pool. Bonneville incorporates this data into HYDSIM to simulate the coordinated operation of the PNW hydro system. This coordination agreement expires on September 15, 2024. PNCA project owners are currently engaging in discussions regarding PNCA expiration and future coordination.

The construction of three large storage projects in Canada under the Treaty between the United States and Canada enhanced the volume of storage in the Columbia River Basin. These projects provide downstream power benefits by increasing the firm power generating capability of U.S. hydro projects. The Treaty calls for

³ [2020 Modified Flows](#)

an Assured Operating Plan (AOP) to be completed six years prior to each operating year, and allows a Detailed Operating Plan (DOP) to be completed, if agreed upon, in the year prior to the operating year. The Canadian project operations simulated in HYDSIM are based on the best available information from the Treaty planning and coordination process. Canadian operations included in this 2023 White Book are based on the official 2022 AOP studies, with additional modifications that reflect updates expected in the official DOP studies.

Both the United States and Canada have the ability to terminate most of the provisions of the Treaty any time after September 16, 2024, with a minimum of 10 years advance notice. Neither Canada nor the United States have provided notice of termination; therefore, this study assumes the Treaty continues throughout the study period including current flood risk management provisions.

Bonneville has other operational agreements with Canada that are not part of the Treaty. One operational agreement is the Non-Treaty Storage Agreement (NTSA) that allows additional shaping of Columbia River flows for power and fish operations by utilizing storage not specified by the Treaty from Canadian reservoirs. The NTSA allows water to be released from Canadian project storage during the spring of dry years. The NTSA also allows water to be stored in the spring during years when the spring flow targets from the 2008 NOAA BiOp would be met with a subsequent release of water in the summer. These operations have been included in this study based on the NTSA signed with British Columbia Hydro in April 2012, which expires on September 15, 2024⁴.

Balancing reserves, both incremental and decremental, reduce the ability to shape Federal system generation. Incremental reserves are modeled by reducing the generation capability of projects. In this study, the impacts of incremental reserves are shown as a reduction in the capacity analyses and are categorized as operating and balancing reserves. Decremental reserves are not specifically reported in this study as they do not cause a limitation in generation capability.

Firm Water Planning: To ensure sufficient generation to meet load, Bonneville bases its resource planning on firm water conditions or firm expected generation. Firm water conditions are defined as when the PNW hydro system would produce the least amount of power while taking into account the historical streamflow record, power and non-power operating constraints, the planned operation of non-hydro resources, and system load requirements. For operational purposes, Bonneville considers firm water conditions to be the tenth percentile of the monthly Tier One System Firm Critical Output (T1SFCO) system results. The percentile approach eliminates the anomalies observed in any single water year, e.g. 1937; it also aligns with metrics used in Bonneville's Resource Program. For additional details, please refer to Bonneville's [Climate Change Resiliency Letter](#) to the region (June 6, 2022).

Variability of Hydro Generation: The generating capability of Federal system and regional hydro projects depends on the amount of water flowing through the facilities, the physical capacity of the facilities, any flow or operating requirements pursuant to biological opinions, and other operating limitations. Water conditions cause hydro generation to vary greatly year to year depending on factors such as precipitation, snowpack, and temperature. Project-level generation forecasts for regulated hydro resources are produced using HYDSIM for each of the 30 historical streamflow conditions of record, which are based on the period from 1989 through 2018. In addition, Federal independent hydro project generation was updated by the Army Corps of Engineers, The Bureau of Reclamation, and other project owners incorporating the 2020 modified flows and up to date project operations.

This White Book study uses three generation scenarios to demonstrate the magnitude of hydro generation variability:

⁴ Bonneville acknowledges that there are ongoing discussions regarding the continuation of both the NTSA and the PNCA.

- Firm water: tenth percentile (P10) of system generation by month with the most recent historical 30-year streamflow conditions, it represents the firm water condition for energy and capacity of the hydro system.
- Median water: 50th percentile (P50) of system generation by month of the most recent historical 30-year streamflow conditions, it represents the exact middle value of generation for energy and capacity.
- High water: 90th percentile (P90) of system generation by month of the most recent historical 30-year streamflow conditions, this represents the high generation scenario of the energy and capacity of the hydro system.

Generation percentile by month for each OY in the study is included in [Exhibit 4-6](#).

Hydro Capacity Modeling: Bonneville uses the RiverWare model to forecast usable hydro capacity for long-term planning purposes. RiverWare is used to simulate the relationship of hydro energy to hydro peaking capability for Federal system regulated hydro resources. RiverWare incorporates the monthly historical 30 water year reservoir storage and flows from HYDSIM. For each month, RiverWare forecasts hourly Federal system hydro generation by maximizing generation while meeting non-power requirements. The forecasts take into account scheduled hydro maintenance and reserves.

For hydro resources, the 120-Hour capacity forecasts are created by evaluating hourly generation from RiverWare over a specific period of time. This capacity metric is defined as the average generation forecasts from the 6 highest heavy load hours per day, 5 days per week, for 4 weeks per month (6 x 5 x 4 = 120 hours). While available, the White Book does not include 1-Hour hydro capacity forecasts because it does not represent a sustainable generation but rather a single hour peak, meaning it does not consider the ability of the hydro system to sustain generation levels over a multiple hour period. January 120-hr capacity has been the most constrained metric historically, a prime example for avoiding anomalies in a single water year, January 1937 was the extreme month resulted in one percentile of the 80-water year generation distribution from the 2022 White Book. Comparisons between the 2022 White Book, which uses 1937 as firm critical condition, and this White Book, P10, will display the large difference mostly due to the anomaly of 1937 in both Federal and Regional systems.

The 120-Hour capacity analysis presented in this study better reflects the ability of the hydro system to sustain a generating peak energy level to meet load obligations throughout each month. The 120-Hour capacity presented in this analysis can be expressed as either capacity in megawatts (MW) or energy over super peak load hours in average megawatts.

Notable Updates

The 2023 White Book includes updated forecasts of Federal system power sales contract (PSC) obligations, PNW regional Total Retail Loads, contract purchases, and generation as of December 1, 2022, including:

- Updates associated with BPA's [Climate Change Resiliency](#) effort, including using the recent 30 year historical record and monthly P10 as Firm conditions.
- Three customers elected to change product elections from BPA's Slice Product to Load Following Product, and the new product election is reflected from October 1, 2024 across the study period.
- Updated retirement dates associated with planned thermal (coal) generation retirements.

Sources of Uncertainty

The forecasts presented in this document represent the best information currently available under the defined metrics for loads and resources. However, all forecasts are affected by uncertainty in economic conditions, weather, environmental and governmental policies, and other factors that could significantly affect the magnitude, duration and timing of projected surpluses and/or deficits. Some of these uncertainties include:

- Changes to hydro system operations in response to Endangered Species Act requirements or other environmental considerations;
- Changes to hydro system operations in response to court actions and/or operational agreements;
- Natural variations in weather affecting electrical power demand and streamflow runoff that affect hydroelectric power generation;
- Potential increases or decreases in retail and industrial loads due to changes in local, regional, and/or national economic conditions;
- Potential new large individual retail loads and/or other changes to major industrial operations;
- Potential service to new loads such as new customers or the Department of Energy's Richland vitrification plant operations;
- Potential future policy requirements at local, state, and federal levels regarding the amount and type of renewable resources, conservation standards, electric vehicle saturation, and/or carbon emissions;
- Fuel cost and availability, which may be affected by environmental factors or competing uses for industry, transportation, and import/export markets;
- Changes to operating limits on existing and future thermal resources;
- Changes to retirement dates associated with resources;
- Failures of resources to operate at anticipated times and/or output levels;
- Changes to Treaty obligations and/or operations;
- PNW entities' ability to purchase power from new and existing uncommitted regional resources to serve retail load;
- PNW entities' ability to purchase and transmit power from extra-regional import/export markets;
- Future climate change impacts to retail loads, streamflows, and resources.

The potential impacts of these and other sources of uncertainty are not quantified in this report.

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Section 2: Federal System Analysis

The Federal System Analysis provides a deterministic forecast of Federal system loads and resources over a 10-year period from OY 2024 through 2033. This analysis incorporates forecasts of the Federal system's firm requirements power sales contract (PSC) obligations, contract sales and purchases, and resource generation. This section presents firm Federal system load and resource forecasts for energy and 120-Hour capacity. The detailed components of the Federal system study are available upon request.

Load Obligations

Bonneville's ALF system is used to forecast Federal system load obligations, as described previously in [Section 1: Summary - Load Obligations](#). The types of Federal system load obligation forecasts include: 1) Federal reserve power obligations to the U.S. Bureau of Reclamation (USBR); 2) Bonneville's Regional Dialogue PSC obligations to public, cooperative, and tribal utilities, and Federal agency customers; 3) contract obligations to investor-owned utilities (IOUs); 4) contract obligations to Direct Service Industry (DSI) customers; and 5) other Bonneville contract obligations, which include contract sales to entities within the PNW region (Intra-Regional Transfers (*Out*) and to those outside the PNW region (Exports). These load obligations are all considered firm power deliveries and are assumed to be served by the Federal system regardless of weather, water, or economic conditions. Bonneville's forecasts of these obligations are as follows:

USBR obligations: USBR must meet statutory directives to provide reserve power to irrigation district facilities associated with USBR projects. Individual USBR project authorizations provide for irrigation districts to receive reserve power from specific FCRPS projects. Bonneville markets the remaining power from USBR projects in the PNW.

Regional Dialogue CHWM PSC obligations to Public & Federal agency customers: In December 2008, Bonneville executed Regional Dialogue PSCs with public, cooperative, and tribal utilities, and federal agency customers. Bonneville is obligated to provide firm power deliveries from October 1, 2011, through September 30, 2028. Three types of products were offered to customers: Load Following, Slice/Block, and Block. Of the 134 customers who have signed Regional Dialogue Contracts; 121 are currently Load Following customers, 10 are Slice/Block customers, and three are Block customers. Three customers: Benton PUD, Grays Harbor PUD, and Pacific PUD recently switched from Slice/Block customers to Load Following starting in the BP24 Rate Period and are now included in this study as Load Following customers.

Under the Regional Dialogue PSCs, customers must make periodic elections of how to serve their Above Rate Period High Water Mark (A-RHWM)⁵ load by: 1) adding new non-Federal resources; 2) acquiring power from non-Federal resources; and/or 3) requesting Bonneville to supply additional power. The current customer elections have been set through fiscal year (FY) 2025, and this study assumes that the current elections continue through the study period. Based on this assumption, Federal system Regional Dialogue PSC obligation forecasts include elected and forecasted A-RHWM load for the study period. [Table 2-1](#) presents the A-RHWM load included in Bonneville's obligations by FY, which are consistent with the BP-24 Initial Rate Proposal.

⁵ "A Rate High Water Mark (RHWM) defines a public customer's maximum eligibility to purchase an amount of power service at Tier 1 Rate for a Rate Period, subject to limitation by the customer's New Requirement." (P.2 [Regional Dialogue](#) June 4, 2010)

Table 2-1

**Federal System
Annual Above-Rate High Water Mark (A-RHWM) Obligations
FY 2025 through 2033**

Energy (aMW)	2025	2026	2027	2028	2029	2030	2031	2032	2033
A-RHWM Obligations	382	408	434	460	495	516	536	549	575

IOU Load Service under Regional Dialogue PSCs: The six IOUs in the PNW region are Avista Corporation, Idaho Power Company, NorthWestern Energy Division of NorthWestern Corporation, PacifiCorp, Portland General Electric Company, and Puget Sound Energy, Inc. The PNW IOUs all signed Bonneville RD PSCs for FY 2011 through 2028; however, no IOUs have elected to take power service under these contracts and no net requirements power sales are assumed for the IOUs through the study period.

Direct Service Industrial (DSI) contracts: Bonneville has one DSI customer, Port Townsend Paper Corporation. Port Townsend Paper Corporation’s contract with Bonneville expires on September 30, 2028. Federal system DSI deliveries are forecasted at 11 aMW and expected to remain at that level throughout the study period.

Other Contract Obligations: Bonneville provides federal power under a variety of additional contract arrangements. These contract obligations are categorized as 1) power sales; 2) power or energy exchanges; 3) capacity sales or capacity-for-energy exchanges; 4) power payments for services; and 5) power commitments under the Treaty. These arrangements, collectively called “Other Contract Obligations,” are determined by individual contract provisions and have various delivery arrangements and rate structures. These contracts include power deliveries to entities within the PNW region (Intra-Regional Transfers (*Out*)) and to those outside the PNW region (Exports).

Treaty, Regional Dialogue PSC, and DSI power deliveries are assumed to remain in place through the study horizon. Bonneville’s Other Contract Obligations follow individual contract terms and are not assumed to be renewed after expiration.

Firm Loads: The Federal system total firm load forecast shows a 2.50 percent average annual load growth over the study period. While Bonneville’s forecast of PSC requirements load increases about 11 percent over the study period, Bonneville’s Exports and Intra-Regional Transfers decrease due to the expiration of contracts throughout the study period. Other Contract Obligations that expire during the study period include Federal system power sales, and Federal system capacity sales. Overall, the total Federal system load obligations remain relatively flat on an annual basis over the study period. Relatively flat load growth is an expectation for the Federal system do to the nature of BPA’s Regional Dialogue PSCs. While the study horizon continues past the end of Regional Dialogue contracts, and obligations are placed on BPA under the future Provider of Choice contracts is unknown at this time, the study assumes a continuation of Regional Dialogue PSC load levels for planning purposes.

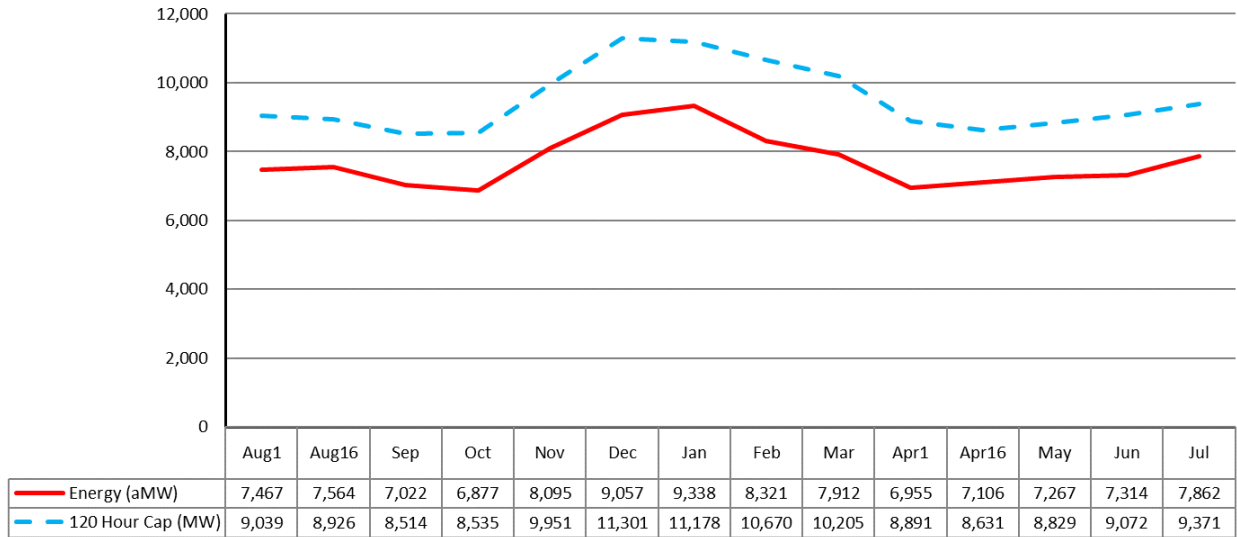
Conservation: The PSC obligation forecasts developed by ALF are expected load forecasts, which include conservation identified by individual Bonneville customers.

Bonneville loads can vary greatly throughout the year. At a high level, Bonneville forecasts represent higher loads in the winter (November through February) due to lower temperatures that increase heating loads, and lower loads during the spring, early summer and early fall when temperatures are mild. July and August loads

tend to be slightly higher than the rest of the summer due to increasing PNW air conditioning loads. [Table 2-2](#), here, illustrates the monthly shape of the forecasted Federal system firm load obligations for OY 2024. Monthly energy and 120-Hour capacity are projected to maintain a similar shape over the study period.

Table 2-2

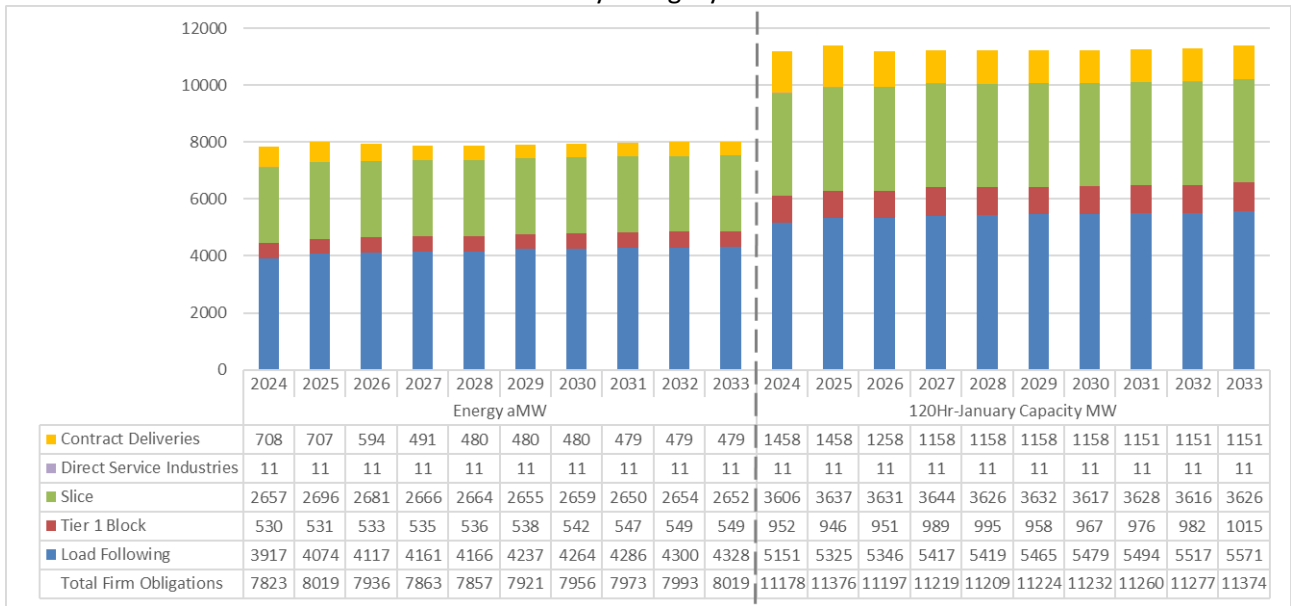
**Federal System
Monthly Energy and 120-Hour Capacity Load Obligations
OY 2024 Firm Water Condition**



On an annual basis Bonneville loads vary across the study period. [Table 2-3](#), next, illustrates the annual Federal system firm load obligations for OY2024 through 2033.

Table 2-3

**Federal System
Annual Energy and 120-Hour Capacity Load Obligations
OY 2024 through 2033 Firm Water Condition
By Category**

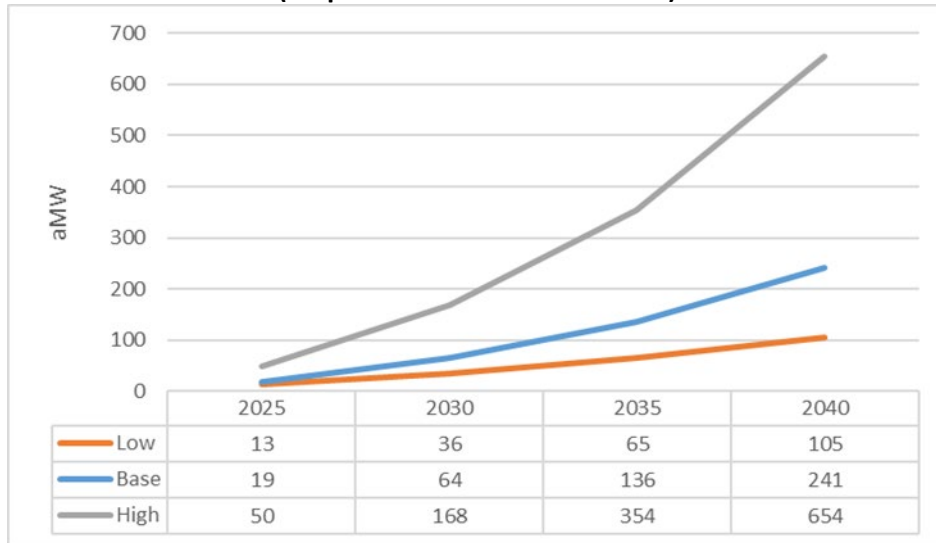


Electrification in Load Obligations

While Bonneville’s contractual load forecast includes a small increase in load resulting from electrification, the growing interest in electrification suggests a potential for significant load growth in the future and an area Bonneville will continue to monitor. [Table 2-4](#), a re-print from 2022 White Book, presents Bonneville’s view of the possible range of load growth resulting from electrification in customers’ load. While this study includes the base forecasted load increases from the table, a range of possible customer load increase is presented. It is important to note that due to the tiered structure of Bonneville’s Regional Dialogue PSCs, only a share of increased load may become a Bonneville obligation. These possible electrification increases are expected to result from electrical vehicle use and the increasing conversion to electric applications to reduce greenhouse gases.

Table 2-4

Federal System
Annual Energy – Electrification Load Obligation Increases
(Re-print from 2022 White Book)



Resources

In the PNW, Bonneville is directed to market power from Federal hydroelectric projects and other resources acquired to meet firm power contractual obligations. Bonneville does not own generating resources, rather, Bonneville markets power from Federal resources and certain non-Federal generating resources whose output Bonneville has acquired under contracts. These resources and contract purchases are collectively called “Federal system resources” in this study. Federal system resources are currently comprised of: 1) Hydro resources, which include regulated, independent, and small hydro projects; 2) Non-hydro renewable resources, which include wind, solar, and other projects; 3) Thermal resources, which includes nuclear (Columbia Generating Station); and 4) Contract purchases, which include contract purchases from entities within the PNW region (Intra-Regional Transfers (*In*)) and from those outside the PNW region (Imports), including Non-Federal Canadian Entitlement Return power and transmission loss returns under Slice/Block contracts.

Federal System Resource Types: [Table 2-5](#), summarizes Bonneville’s resources and contract purchases available to meet the Federal system load obligations. For OY 2024, Federal system resources are forecast to produce 7,785 annual aMW of generation under Firm water conditions, with reserves and losses included.

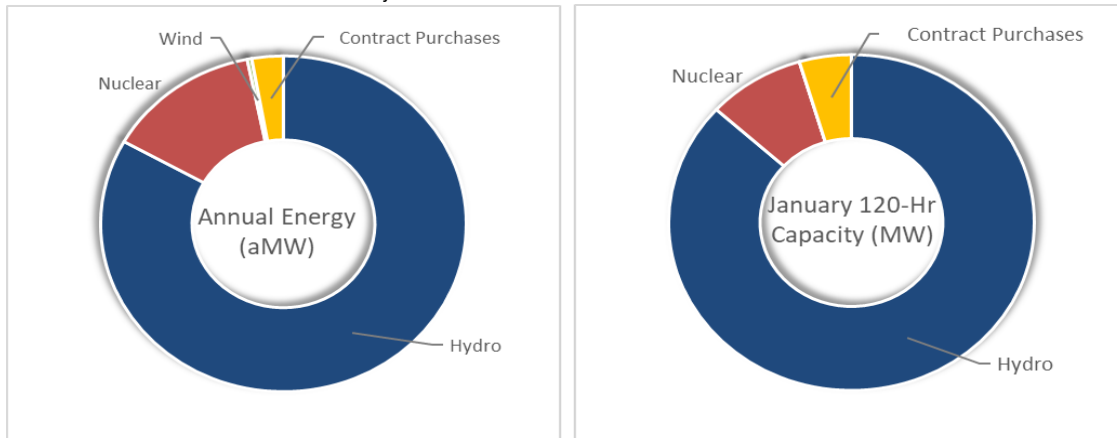
Table 2-5^{a/}

**Federal System
Generation Forecast by Resource Type
OY 2024 Firm Water Conditions**

Resource Type	Annual Energy (aMW)	Percent of Firm Energy	January 120-Hour Capacity (MW) ^{b/}	Percent of Capacity
Hydro	6,662	83%	11,828	88%
Nuclear	1,116	14%	1,178	9%
Wind	33	0.4%	0	0%
Other Renewables	0	0%	0	0%
Contract Purchases	227	3%	627	3%
Total Federal Resources	8,038	100%	13,633	100%

^{a/} Any discrepancies in totals for figures portrayed in this table are due to rounding.

^{b/} Federal resource estimates are before adjustments for reserves and transmission losses



Federal system resources are comprised of:

- **Federal system hydro resources:** [Table 2-6](#) shows the Federal system hydro resources from which Bonneville markets firm and non-firm power. Additionally it shows the variability of individual Federal system hydro project generation for the three water conditions that represent firm, median and high water conditions.
- **Federal system non-hydro resources:** Federal system non-hydro resources are generating resources whose output have been purchased by Bonneville. [Table 2-7](#) shows these generating resources, which include: 1) Columbia Generating Station; and 2) wind projects (non-hydro renewable resources). Forecasts for these resources are generally consistent from year to year, but may change annually based on scheduling for annual maintenance, refueling, and capital improvements.

Federal system contract purchases: Bonneville purchases or receives power under a variety of contract arrangements from entities within the PNW region (Intra-Regional Transfers (*In*)) and from outside the PNW region (Imports), to meet Federal system load obligations. These contract purchases, presented in [Table 2-7](#) are made up of: 1) power purchases, 2) power or energy exchange purchases, 3) power assigned to Bonneville under Treaty-related agreements, and 4) transmission loss returns under Slice/Block contracts. Bonneville’s contract purchases are considered firm resources that are delivered to the Federal system regardless of weather, water, or economic conditions. Transmission loss returns capture the return of Slice/Block transmission losses to the Federal system as specified in the Slice/Block contracts, and these returns are also treated as Federal system resources. With the exception of deliveries from Treaty-related and Slice/Block contracts, each contract purchase follows specific delivery terms and expiration dates and is not assumed to be renewed. Treaty-related and Slice/Block contracts are assumed to remain in place through the study horizon.

Table 2-6

**Federal System
Hydro Project Generation by Various Streamflow Conditions⁶
OY 2024**

Project	Initial Service Date	Operator	Number of Units	Maximum Capacity (MW) ^{d/}	High Energy (aMW) ^{c/}	Median Energy (aMW) ^{c/}	Firm Energy (aMW) ^{a/c/}
Regulated Hydro							
1. Albeni Falls	1955	USACE	3	50	22.4	24.0	22.5
2. Bonneville ^{b/}	1938	USACE	18	1,221	674	535	397
3. Chief Joseph	1955	USACE	27	2,614	1,733	1,374	1,123
4. Dworshak	1974	USACE	3	465	277	203	170
5. Grand Coulee / GCL Pumping	1941	USBR	27	6,684	3,049	2,330	1,924
	1973		6	314			
6. Hungry Horse	1952	USBR	4	310	146	94	84
7. Ice Harbor	1961	USACE	6	693	266	198	151
8. John Day	1968	USACE	16	2,480	1,328	977	762
9. Libby	1975	USACE	5	605	259	247	168
10. Little Goose	1970	USACE	6	930	278	188	151
11. Lower Granite	1975	USACE	6	930	279	186	134
12. Lower Monumental	1969	USACE	6	930	313	212	147
13. McNary	1953	USACE	14	1,120	665	556	456
14. The Dalles	1957	USACE	22	2,080	1,030	808	631
15. Total Regulated Hydro Projects <i>(sum lines 1 through 14)</i>			169	21,426	10,319	7,934	6,320
Independent Hydro Projects							
16. Anderson Ranch	1950	USBR	2	40	19.3	11.7	10.4
17. Big Cliff	1954	USACE	1	21	13.4	13.2	11.0
18. Black Canyon	1925	USBR	2	8.5	7.5	6.8	5.5
19. Boise Diversion	1908	USBR	3	2.5	1.5	1.2	1.0
20. Chandler	1956	USBR	2	12.2	8.4	6.8	5.3
21. Cougar	1964	USACE	2	28	16.2	16.7	15.6
22. Cowlitz Falls	1994	LCPD#1	2	70	27.8	30.4	24.2
23. Detroit	1953	USACE	2	115	43.0	47.6	33.5
24. Dexter	1955	USACE	1	17	11.4	10.1	9.5
25. Foster	1968	USACE	2	23	11.1	12.1	10.1
26. Green Peter	1967	USACE	2	92	30.7	37.6	24.7
27. Green Springs	1960	USBR	1	18	6.7	6.7	6.7
28. Hills Creek	1962	USACE	2	34	20.6	17.0	15.9
29. Lookout Point	1954	USACE	3	138	45.9	40.4	32.0
30. Lost Creek	1975	USACE	2	56	43.5	38.8	27.7
31. Minidoka	1909	USBR	4	28	38.7	29.2	24.7
32. Palisades	1957	USBR	4	177	96.9	87.4	73.1
33. Roza	1958	USBR	1	14	13.9	9.3	7.9
34. Total Independent Hydro Projects <i>(sum lines 16 through 33)</i>			38	894	457	423	339
Small Non-Federally Owned Hydro Projects							
35. Dworshak/Clearwater Small Hydro	2000	ID DWR	1	5.4	2.6	2.6	2.6
36. Rocky Brook	1985	MCPD#1	1	1.6	0.3	0.3	0.3
37. Total Non-Federally Owned Hydro Projects <i>(line 35 + line 36)</i>			2	7	2.9	2.9	2.9
38. Total Hydro Generation <i>(line 15 + line 34 + line 37)</i>			209	22,327	10,778	8,360	6,662

a/ Firm energy is the 12-month annual average for OY 2024 assuming 10th percentile (P10) water conditions
b/ Bonneville Dam generation totals include Bonneville Fishway
c/ High Energy = 90th percentile, Median Energy = 50th percentile, Firm Energy = 10th percentile
d/ Maximum Capacity represent full capacity of resource including overload.

⁶ Streamflow conditions do not always have a linear correlation with generation. Projects with smaller head (head equals forebay level minus tailwater level) are susceptible to having the inverse effect between flow and generation, e.g. Albeni Falls. Higher flow passes through the project increasing the tailwater level which results in less head (due to the increased tail water condition), this results in lower generation than in some other lower flow conditions.

Table 2-7

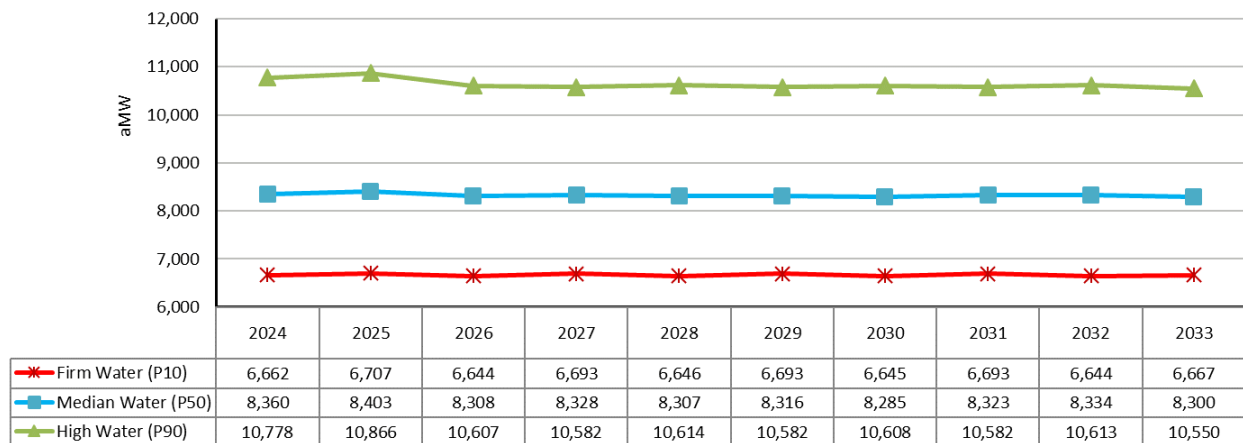
**Federal System
Non-Hydro Project Generation and Contract Purchases
OY 2024**

Project	Initial Service Date	Resource Type	Operator	Maximum Capacity ^{a/} (Peak MW)	Firm Energy (aMW)
Non-Hydro Resources					
1. Columbia Generating Station	1984	Nuclear	ENW	1,178	1,116
2. Condon Wind Project ^{b/}	2002	Wind	Condon Wind Project, LLC	0	0.0
3. Stateline Wind Project ^{c/}	2001	Wind	PPM, FLP	0	21.2
4. Klondike Phase III ^{d/}	2007	Wind	NW Wind Power	0	11.8
5. Fourmile Hill Geothermal ^{e/}	Not in Service	Geo.	Calpine	0	0
6. Total Federal System Non-Hydro Resources <i>(sum lines 1 through 5)</i>				1,178	1,149
Contract Purchases					
7. Canadian Entitlement for Canada (non-Federal)				235	134
8. Canadian Imports				1	1
9. Pacific Southwest Imports				0	0
10. Intra-Regional Transfers In (Pacific Northwest Purchases)				350	63
11. Slice Transmission Loss Return				41	29
12. Total Federal System Contract Purchases <i>(sum lines 7 through 11)</i>				627	227
13. Total Federal System Non-Hydro Resources and Contract Purchases <i>(line 6 + line 12)</i>				1,805	1,376

Federal System Hydro Generation Variability: The generating capability of Federal system hydroelectric projects depends on the amount of water flowing through the facilities, the physical capacity of the facilities, flow requirements pursuant to biological opinions, and other operating limitations. [Table 2-8](#), next, shows the annual variability of hydro generation under three streamflow conditions.

Table 2-8

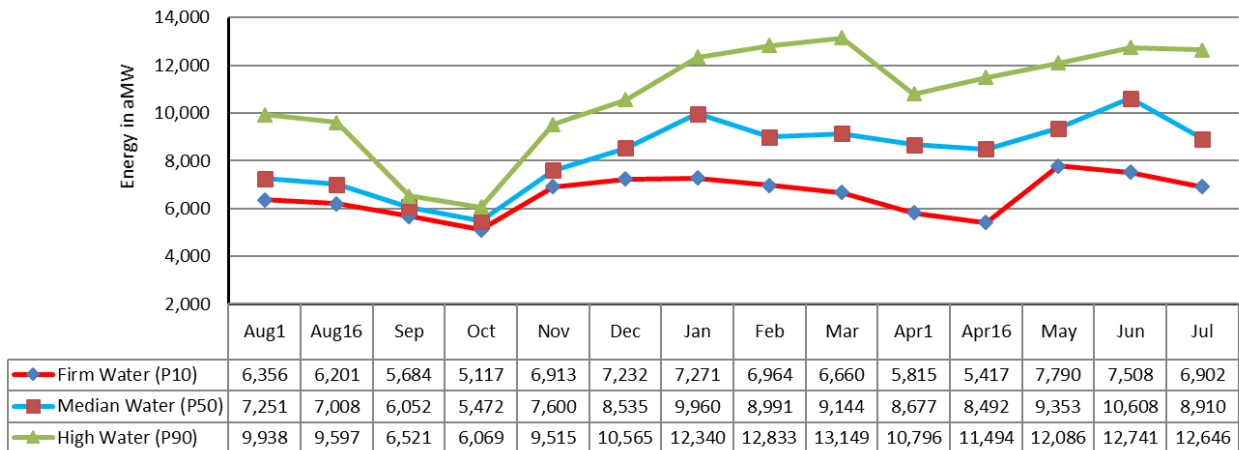
**Federal System
Variability of Annual Hydro Generation
OY 2024 through 2033
Under Different Water Conditions**



In OY 2024, annual Federal system hydro energy generation is forecasted to be 6,662 aMW under Firm water conditions. However, under the high streamflow conditions these same Federal system hydro resources could generate 10,778 aMW. [Table 2-8](#), above, shows the annual variability of Federal system hydro generation, and [Table 2-9](#) shows the monthly variability of the Federal system hydro generation for OY 2024, under the same water conditions. Higher generation levels in the January through mid-April period are largely due to drafting reservoirs for power production and flood control, which can vary widely due to rainfall and snowpack levels in the Columbia River Basin. Power production from late-April through July is variable due to the timing and amount of the Columbia River Basin snowmelt runoff. Power production decreases through the end of the summer and early fall as streamflows are reduced due to depleted snowpack and lower precipitation levels. Annual water volume variability does not have a substantial impact on generation from the Federal system hydro resources in September and October. Hydro generation can vary by more than 6,000 aMW in a single month depending on project operations and the availability of water.

Table 2-9

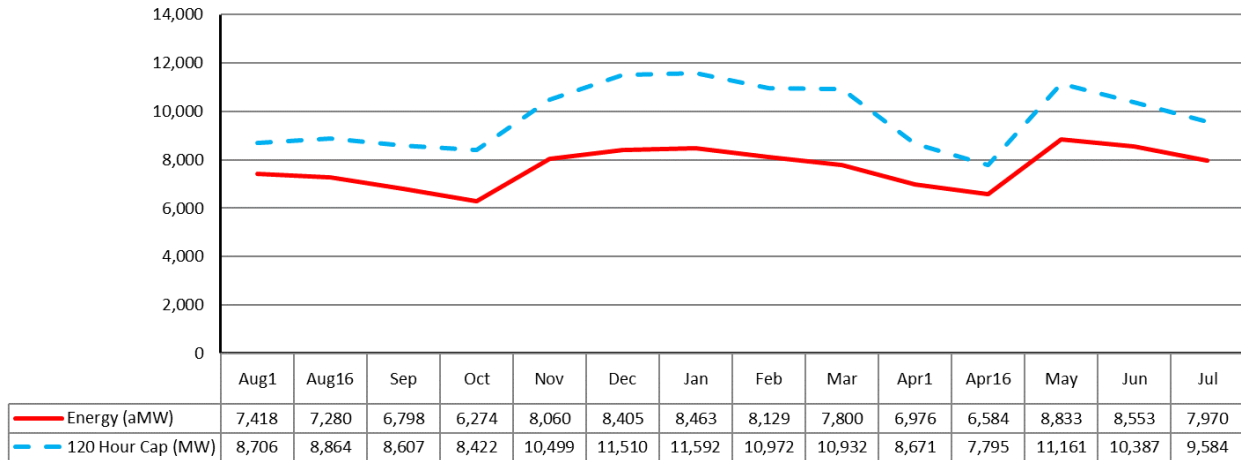
**Federal System
Variability of Monthly Hydro Generation
OY 2024 - Under Different Water Conditions**



Total Federal System Resources: [Table 2-10](#), illustrates the monthly shape of the forecasted total Federal system generation for energy and 120-Hour capacity for OY 2024, under Firm water conditions. This includes generation from all Federal system hydro and non-hydro resources and Federal system contract purchases. The Federal system maintains similar monthly shapes over the study period, with the highest generation forecasted in mid-summer, early winter, and late spring periods.

Table 2-10

**Federal System
OY2024 Monthly Generation
Energy and 120-Hour Capacity
Firm Water Conditions**



Key Results

Annual Energy: [Table 2-11](#), shows that the Federal system is forecasted to have annual energy deficits throughout the study period. The individual components of the Federal system annual energy loads and resources are shown in [Exhibit 4-1](#) for OY 2024 through 2033. The Federal system monthly energy loads and resources are shown in [Exhibit 4-2](#) for OY 2024.

Table 2-11

**Federal System
Annual Energy Surplus/Deficit
OY 2024 through 2033
Firm Water Conditions**

Energy (aMW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Surplus/Deficit	-18	-289	-147	-223	-159	-303	-263	-357	-303	-424

[Table 2-12](#) compares the 2023 White Book Federal system annual firm energy surplus/deficit results to those from the 2022 White Book. Comparing with the previous White Book, the 2023 White Book shows an increased deficit throughout the studying period except for the first year, with larger deficits in the end of the study period. These results reflect changes in both load obligations and Federal system generation.

Table 2-12

**Federal System
Annual Energy Surplus/Deficit Comparison
OY 2024 through 2033
Firm Water Conditions**

Energy (aMW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
2023 White Book P10 generation	-18	-289	-147	-223	-159	-303	-263	-357	-303	-424
2022 White Book 1937 Critical Water Conditions	-103	-245	-39	-118	-25	-164	-68	-204	-105	n/a
Difference <i>(2023 WBK – 2022 WBK)</i>	86	-44	-107	-105	-134	-139	-195	-153	-198	n/a

120-Hour Capacity: [Table 2-13](#) shows that the Federal system January 120-Hour capacity is mostly surplus under the firm water condition, except for the last operating year of the study period. The detailed components of the Federal system January 120-Hour capacity loads and resources for OY 2024 through 2033 are shown in [Exhibit 4-3](#). The Federal system monthly 120-Hour capacity loads and resources are shown in [Exhibit 4-4](#) for OY 2024.

Table 2-13

**Federal System
January 120-Hour Capacity Surplus/Deficit
OY 2024 through 2033
Firm Water Conditions**

January 120-Hour Capacity (MW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Surplus/Deficit	414	199	467	69	98	53	66	10	15	-123

[Table 2-14](#) compares the 2023 White Book January firm 120-Hour capacity surplus/deficit results to those from the 2022 White Book. This study shows a large difference in January 120-Hour capacity when compared with 2022 White Book in each of the forecast OY, majority due to change from critical 1937 to P10 firm water condition analysis which affecting hydro capacity. Details previously stated in the [Hydro Resources Modeling](#) section.

Table 2-14

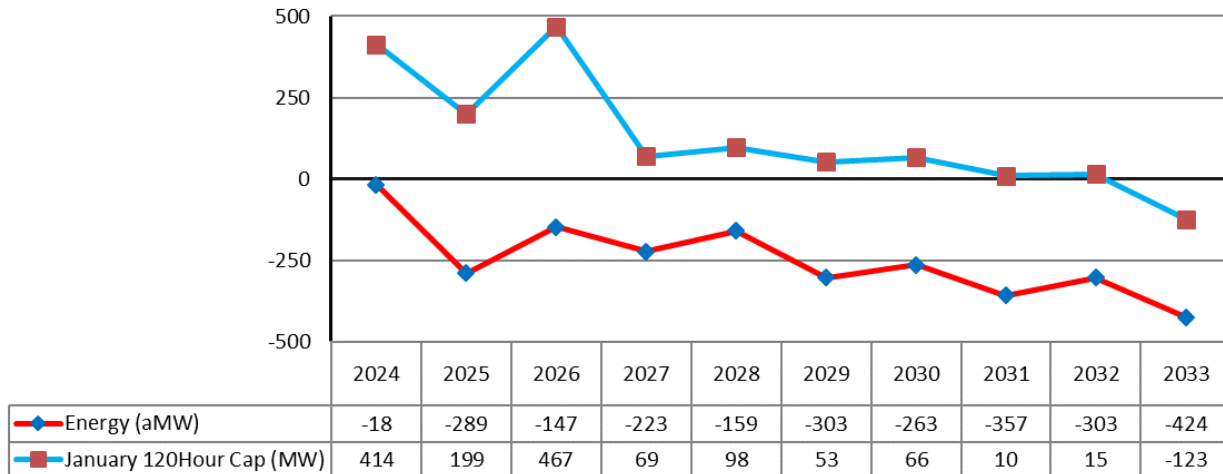
**Federal System
January 120-Hour Capacity Surplus/Deficit Comparison
OY 2024 through 2033
Firm Water Conditions**

January 120-Hour Capacity (MW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
2023 White Book P10 generation	414	199	467	69	98	53	66	10	15	-123
2022 White Book 1937 Critical Water Conditions	-1,215	-1,312	-1,086	-1,263	-1,254	-1,099	-1,208	-1,163	-1,267	n/a
Difference (2023 WBK – 2022 WBK)	1629	1511	1554	1332	1351	1151	1274	1174	1282	n/a

Federal System Annual Surplus/Deficits: [Table 2-15](#) graphically presents the annual firm energy and January 120-Hour capacity surplus/deficits. Over the study period, the Federal system is forecasted to have annual firm energy deficits as high as 424 aMW at the end of the study period. The January firm 120-Hour capacity forecasts show the Federal system surplus trend decreasing over the period, and eventually deficit at the last year of the study period at 123 MW. Variations in the annual energy deficits between the odd and even OYs are due to the biennial Columbia Generation Station (CGS) maintenance schedule.⁷

Table 2-15

**Federal System
Annual Energy and January 120-Hour Capacity Surplus/Deficit
OY 2024 through 2033
Firm Water Conditions**



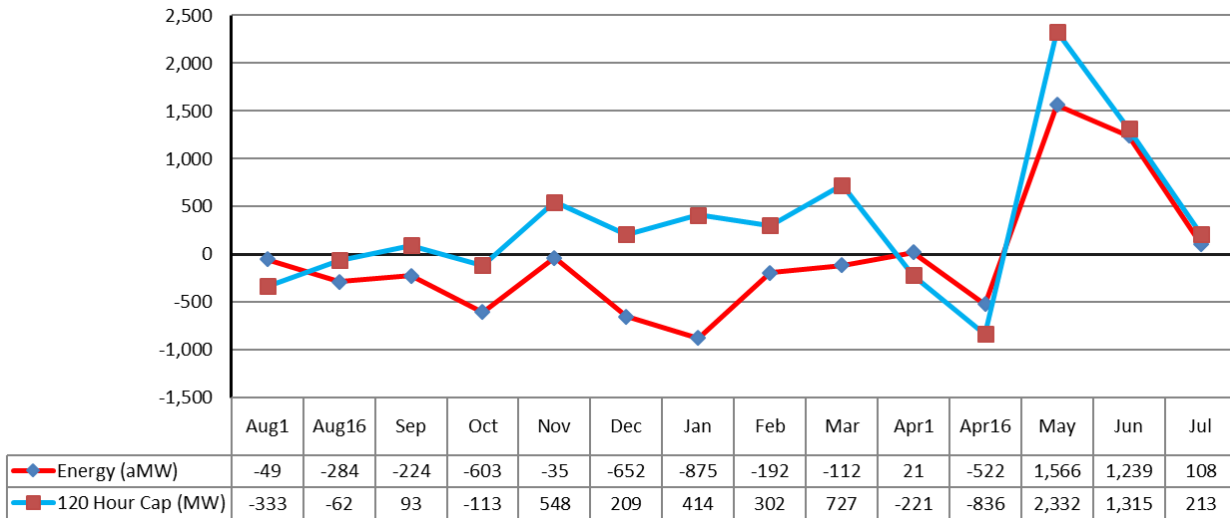
Federal System Monthly Surplus/Deficit: [Table 2-16](#) graphically presents the Federal system monthly firm energy and 120-Hour capacity surpluses and deficits for OY 2024. Forecasts for energy and 120-Hour

⁷ During even calendar years, CGS does not have scheduled maintenance and is forecast to produce 1,116 aMW annually. In odd calendar years, CGS has scheduled maintenance in May and June, and is forecasted to produce 994 aMW annually.

capacity maintain similar monthly shapes over the study period. This shows that for each month the Federal system energy and 120-Hour capacity surplus or deficit position changes during the year, with December, January, and the second half of April showing the largest monthly deficits in energy. May and June showing the largest surpluses.

Table 2-16

**Federal System
Monthly Energy and 120-Hour Capacity Surplus/Deficit
OY 2024 Firm Water Conditions**



Conclusion

Under Firm water conditions the Federal system shows annual firm energy deficits throughout the 2024-2033 study period. These annual energy deficits range from 18 aMW in OY 2024 to as high as 424 aMW in OY 2033. Under firm water conditions, the Federal system generally shows larger monthly energy deficits across the winter and early spring until spring runoff start, with surpluses through the spring runoff in May and across the early summer months.

The Federal system capacity analysis shows January 120-Hour capacity, under firm water condition, surplus until the last year of the study horizon on an annual basis. On a monthly basis, the study shows 120-Hour capacity largest deficits in April, caused by low water conditions in years where run-off hasn't began in until later, and surpluses though most of the year.

As water conditions improve, the Federal system surplus/deficit forecasts can vary greatly. For example, the annual energy surpluses can increase by more than 3,000 aMW under better water conditions, while the monthly surplus or deficit position can vary by more than 5,000 aMW (March). Similarly, Federal system 120-Hour capacity surpluses and deficits for OY 2024 can vary by more than 4,500 MW in the second part of April depending on water conditions.

Federal system monthly energy deficits are generally greater than the 120-Hour capacity deficits under firm water conditions. This result indicates that the Federal system is continues to be more energy constrained than capacity across the study period. The range of Federal system monthly surpluses and deficits forecasts under all 30-historical water conditions is presented in [Exhibit 4-5](#). Additional monthly and annual details for OY 2024 through 2033 are available upon request, and a detailed list of available data is included in [Appendix A](#).

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Section 3: Pacific Northwest Regional Analysis

The PNW Regional Analysis is an OY analysis that provides Bonneville’s deterministic forecast of the PNW region’s loads and resources over a 10-year period from OY 2024 through 2033. Firm load and resource forecasts are made for both energy and 120-Hour capacity based on regional retail loads, contract obligations, and resources. This White Book analysis assumes that generation from all regional uncommitted Independent Power Producer (IPP) projects is available to meet regional load. Regional retail loads, contract sales and purchases, and generating resource forecasts incorporate annual regional utility data submittals received by Bonneville.

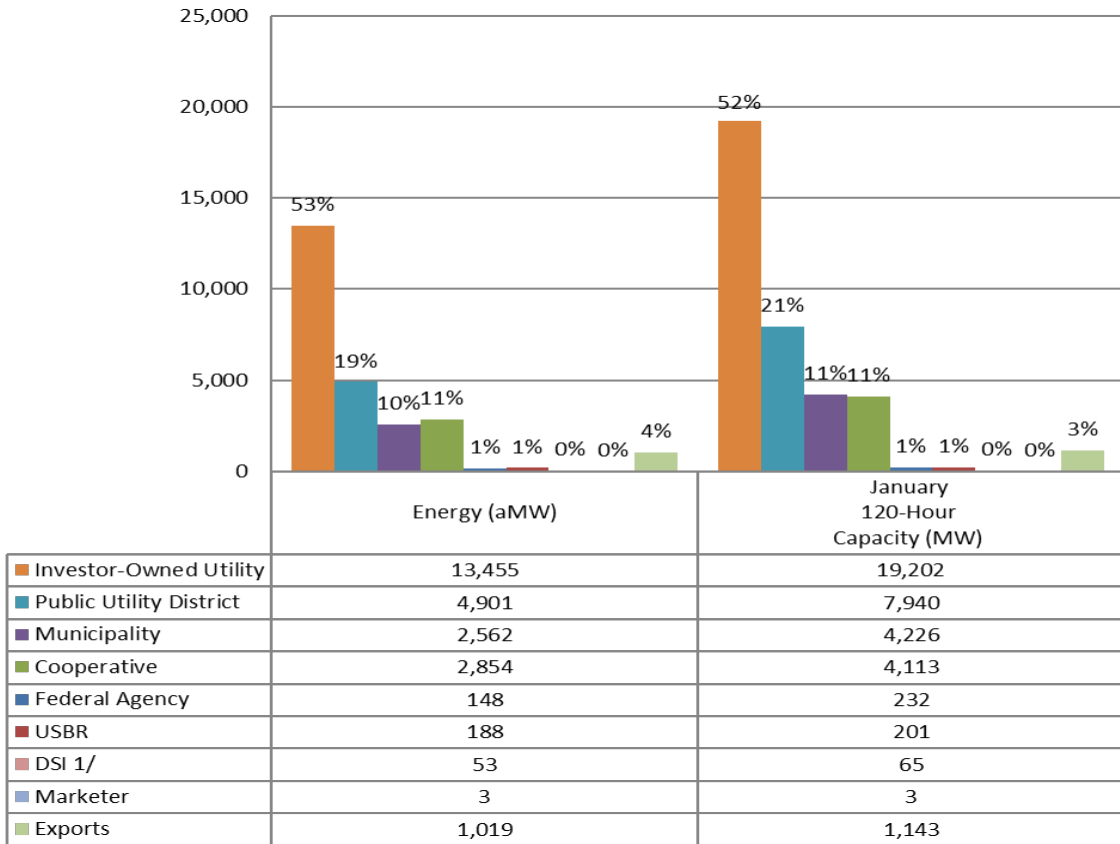
Regional Loads

The regional analysis incorporates regional load projections, which consist of two separate components: 1) Total Retail Loads (TRL), which is the sum of individual utilities’ retail power consumption within the PNW region; and 2) Regional contract sales (Exports), which are the sum of all reported long-term regional contract deliveries to entities outside the PNW region. The TRL forecasts for the regional analysis are developed by Bonneville’s ALF system. TRL forecasts reflect normal weather conditions, include historic conservation savings, and do not include specific adjustments for future climate change impacts. With the exception of power commitments under the Treaty, all Export contract deliveries follow individual contract terms and are not assumed to be renewed after their expiration. Treaty power deliveries are assumed to be in place through the study period. The sum of the forecasted TRL and Export contracts represent the regional loads for the PNW. Regional loads are comprised of about 96 percent retail loads and 4 percent exports.

[Table 3-1](#) shows the forecasted composition of PNW regional load for OY 2024. For the PNW region.

Table 3-1

**PNW Region
Firm Regional Loads by Customer Class
OY 2024**



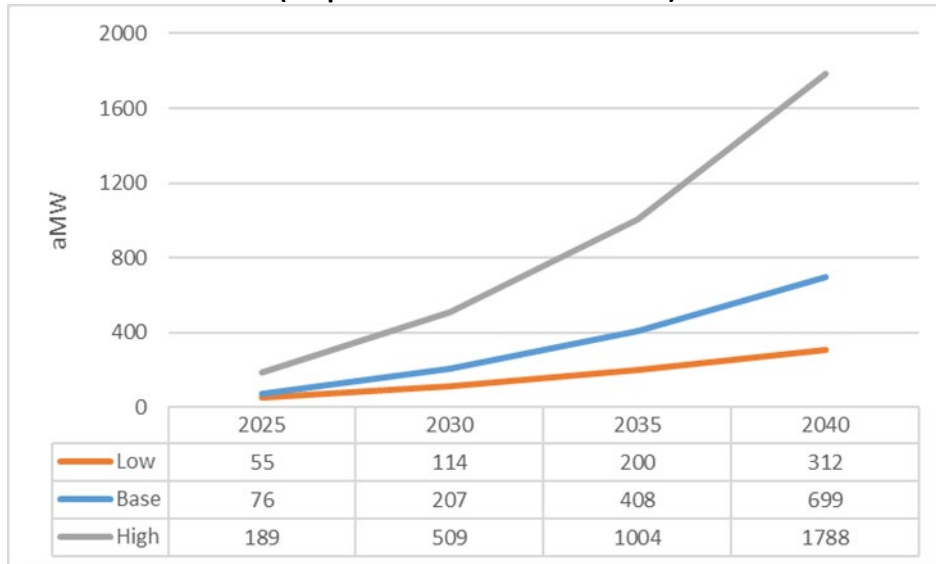
¹ Direct-Service Industry (DSI) loads include regional loads currently served by Bonneville through DSI service contracts and former DSIs served by other energy suppliers.

Electrification in Regional Loads

The regional load forecast includes some electrification, however the growing interest in electrification signals a potential for significant load growth in the future. [Table 3-2](#), a re-print from the 2022 White Book, presents Bonneville’s view of the wide possible range of electrification load increases to regional loads. While this study includes the base forecasted load increases from the table related to electrification, the table shows the range of possible load increase from electrification, with possible electrification load increases on a scale of 2.5 times the base forecast in 2030. Load increases due to electrification are expected to result from electrical vehicle use and the increasing conversion to electric applications to reduce greenhouse gases.

Table 3-2

**PNW Region
Annual Energy – Electrification Load Obligation Increases
(Re-print from 2022 White Book)**



Regional Resources

PNW resources and contract purchases are collectively called “regional resources” in this study. Like the Federal system resources, regional resources vary monthly by water conditions, resource type, and seasonality of generating resource potential. This analysis classifies resources as: 1) Hydro resources, which include regulated, independent, and small hydro projects; 2) Non-hydro renewable resources, which include wind, solar, and other projects; 3) Thermal resources, which include nuclear, coal, natural gas, petroleum, biofuel and cogeneration projects; and 4) Contract purchases, which are identified as Imports.

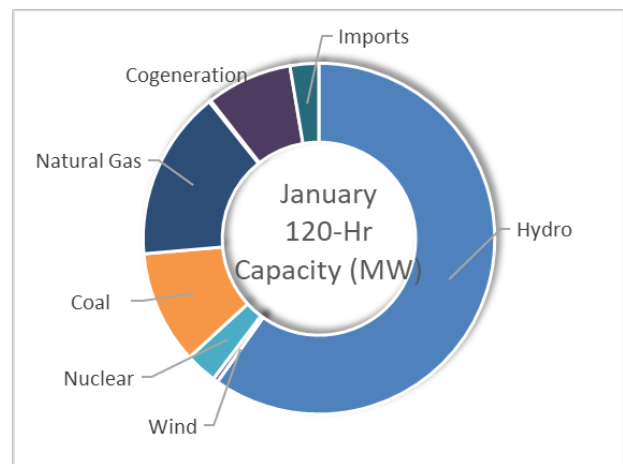
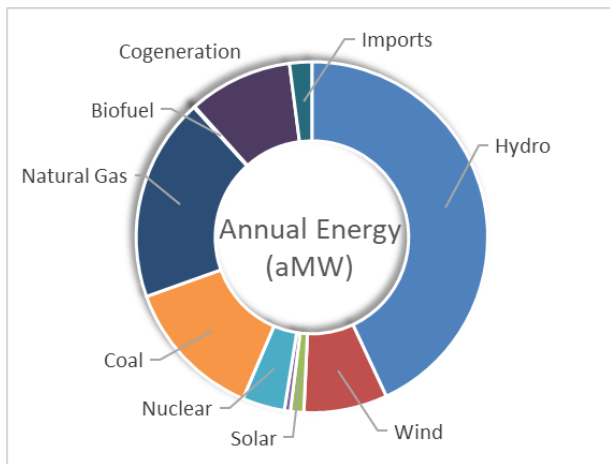
[Table 3-3](#), next, summarizes the resource generation available to meet PNW regional loads. The generation forecasts for these resources are provided by Bonneville models or the project owners. New regional generating projects are included when those resources begin operating or are under construction and have a scheduled on-line date; similarly, retiring resources are removed from the forecasts based on the date of the announced retirement. Regional resource forecasts assume the retirement of the following coal projects over the study period: Centralia 2 (December 1, 2025) and Valmy 2 (January 1, 2026). Contract purchases are provided by the individual utility, follow specific contract provisions, and can have various delivery arrangements.

Table 3-3^{a/}

**PNW Region
Generation by Resource Type
OY 2024 Firm Water Conditions**

Project Type	Annual Energy (aMW)	Percent of Energy	January 120-Hour Capacity (MW)	Percent of Capacity
Hydro	12,081	43%	24,046	60%
Wind	2,200	8%	0	0%
Solar	352	1.2%	0	0%
Other Renewable	159	0.6%	182	0.5%
Nuclear	1,116	4%	1,178	3%
Coal	3,751	13%	4,195	10%
Natural Gas	5,373	19%	6,288	16%
Petroleum	0	0%	39	0.1%
Biofuel	26	0.1%	31	0.1%
Cogeneration	2,737	10%	3,179	8%
Imports	588	2%	1,065	3%
Total Regional Resources	28,382	100%	40,202	100%

^{a/} Any discrepancies in totals for figures portrayed in this table are due to rounding.



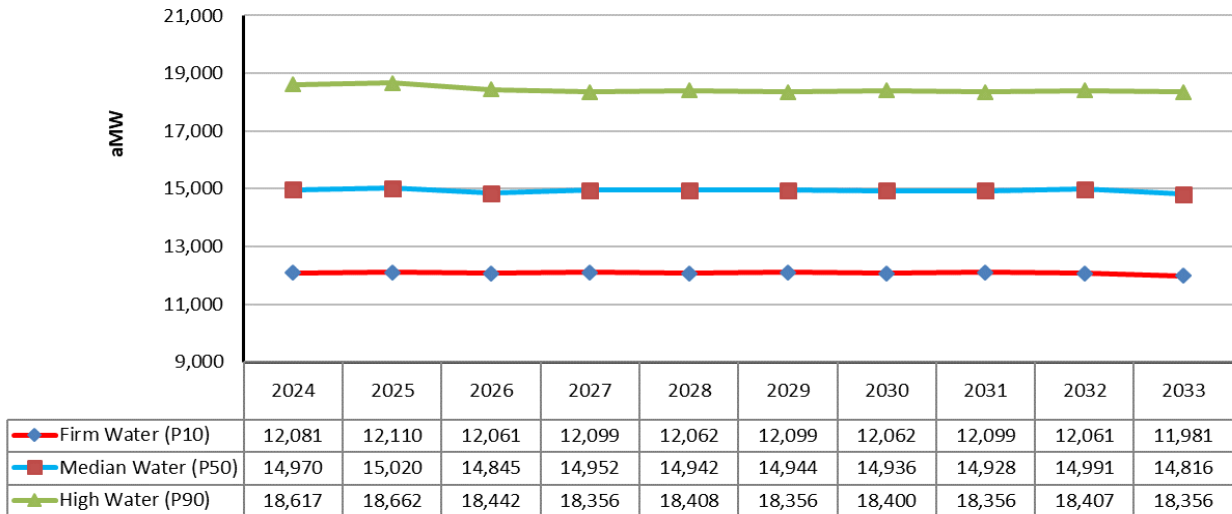
Regional Hydro Generation Variability: The generating capability of regional hydroelectric projects depends upon the amount of water flowing through the facilities, the physical capacity of the facilities, flow requirements pursuant to non-power requirements, and other operating limitations. Similarly to the federal hydro resources, Bonneville utilizes the 30-year streamflow record and percentile of T1SFCO results for planning purposes. To simplify the presentation of hydro generation variability, this study uses three water conditions to represent the magnitude of hydro generation variability.

Table 3-4 shows the annual variability of the region’s hydro generation under the three generation scenarios, details please refer to [Hydro Resources Modeling](#) section.

In OY 2024, annual Firm energy generation from regional hydro projects is forecasted to be 12,081 aMW under the firm water condition. This represents about 43 percent of region’s resources. However, the generating potential from regional hydro projects can vary annually by over 6,000 aMW depending on water conditions.

Table 3-4

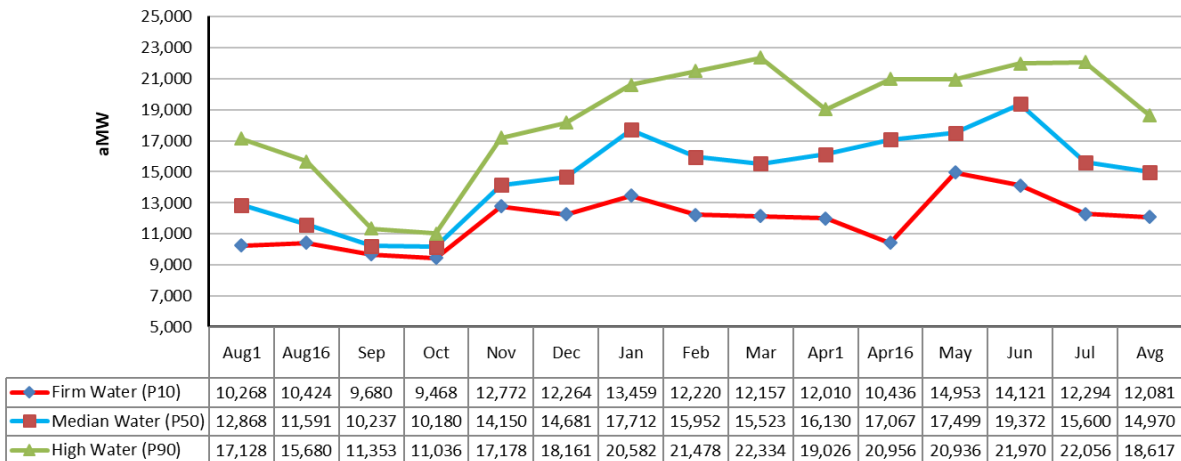
**PNW Region
Variability of Annual Hydro Generation
OY 2024 through 2033
Under Different Water Conditions**



[Table 3-5](#) shows the monthly variability of regional hydro generation under the same three water conditions for OY2024. High generation levels in the January through March period is largely due to drafting reservoirs for power production and flood control, which can vary widely due to rainfall and snowpack levels in the Columbia River Basin. Power production in late-April through July is variable due to the timing and amount of Columbia River Basin snowmelt runoff. Power production decreases through the end of the summer and early fall as streamflows are reduced due to depleted snowpack and lower precipitation levels. Water variability does not have a substantial impact on regional hydro generation from August through November. Regional hydro generation capability can vary by as much as 10,000 aMW in a month, depending on the availability of water.

Table 3-5

**PNW Region
Variability of Monthly Hydro Generation
OY 2024 under Different Water Conditions**



Variability Due to IPP Generation Delivered to the PNW Region: The PNW regional study includes uncommitted PNW IPP generation as regional resources. These resources, or the share of these resources, that are not committed to serving specific loads represent approximately 2,790 aMW of energy with an associated 3,172 MW of January 120-Hour capacity in OY 2024. The inclusion of this uncommitted IPP generation is reasonable from a long-term planning perspective because the PNW Regional Analysis does not include any reliance on market purchases. However, PNW utilities may have to compete with other western markets to secure this generation to meet electricity demand. [Table 3-6](#), below, details the region’s total uncommitted IPP annual energy and January 120-Hour capacity generation forecasts over the OY 2024 through 2033 study period. [Table 3-7](#) details the region’s uncommitted IPP projects and the associated fuel types. If uncommitted IPP generation is secured for long-term periods by load serving entities within the region or outside the region, the IPP forecasts will be updated in future studies to reflect these changes.

Table 3-6

**PNW Region
Uncommitted Independent Power Producer Generation
Annual Energy and January 120-Hour Capacity
OY 2024 through 2033**

Regional Uncommitted IPP	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Annual Energy (aMW)	2,790	2,796	2,622	2,552	2,581	2,592	2,587	2,591	2,586	2,596
January 120-Hour Capacity (MW)	3,172	3,172	2,881	2,881	2,881	2,881	2,881	2,881	2,881	2,881

Table 3-7

PNW Region
Uncommitted Independent Power Producer Projects
OY 2024 Firm Water Condition

Project	Fuel Type	Energy (aMW)	Peak (MW)
Airport Solar	Solar	13	0
Centralia Complex ^{a/b/}	Coal	260	290
Condon Wind	Wind	12	0
Cosmopolis Specialty Fibres	Wood Waste	14	14
Hermiston Power Project	Wood Waste	567	630
International Paper Energy Center	Wood Waste	17	22
Juniper Canyon Wind	Wind	36	0
Kittitas Valley Wind	Wind	24	0
Klamath Generation Facility	Natural Gas	436	484
Klamath Generation Peakings (CT)	Natural Gas	90	100
Klondike Wind 1	Wind	6	0
Klondike Wind 3	Wind	23	0
Klondike Wind 3a	Wind	18	0
Leaning Juniper Wind	Wind	47	0
Longview Fibre Paper & Packaging	Wood Waste	35	35
Nippon Paper Cogen (Port Angeles)	Wood Waste	0	0
Pelton	Hydro	14	41
Priest Rapids	Hydro	85	154
Rock Island	Hydro	169	154
Rocky Reach	Hydro	157	339
Round Butte	Hydro	30	99
Satsop Combustion Turbine Project	Natural Gas	584	650
SDS Lumber	Wood Waste	1	1
Smith Creek (Idaho)	Hydro	7	0
Stateline Wind	Wind	8	0
Tacoma Biomass (WestRock)	Wood Waste	44	55
Tieton Dam (Yakima)	Hydro	0	0
Vansycle Wind	Wind	23	0
Wanapum	Hydro	25	60
Weyerhaeuser Longview	Wood Waste	35	44
Willow Creek Wind	Wind	16	0
Total Uncommitted IPP Generation		2,796	3,172

^{a/} Centralia #1 (670 MW) retired Dec 1, 2020

^{b/} Centralia #2 (670 MW) is scheduled for retirement on Dec 1, 2025

Key Results

Annual Energy: [Table 3-8](#) shows annual energy surpluses for the PNW region throughout the study period under Firm water conditions. This study assumes that 100 percent of the PNW region's uncommitted IPP generation (2,316 aMW in OY 2024) is available to serve regional loads. The individual components of the PNW regional annual energy loads and resources for OY 2024 through 2033 are shown in [Exhibit 5-1](#). OY2024 Monthly PNW regional energy loads and details are shown in [Exhibit 5-2](#). Further details of each component for OY 2024 through 2033 are available upon request.

Table 3-8

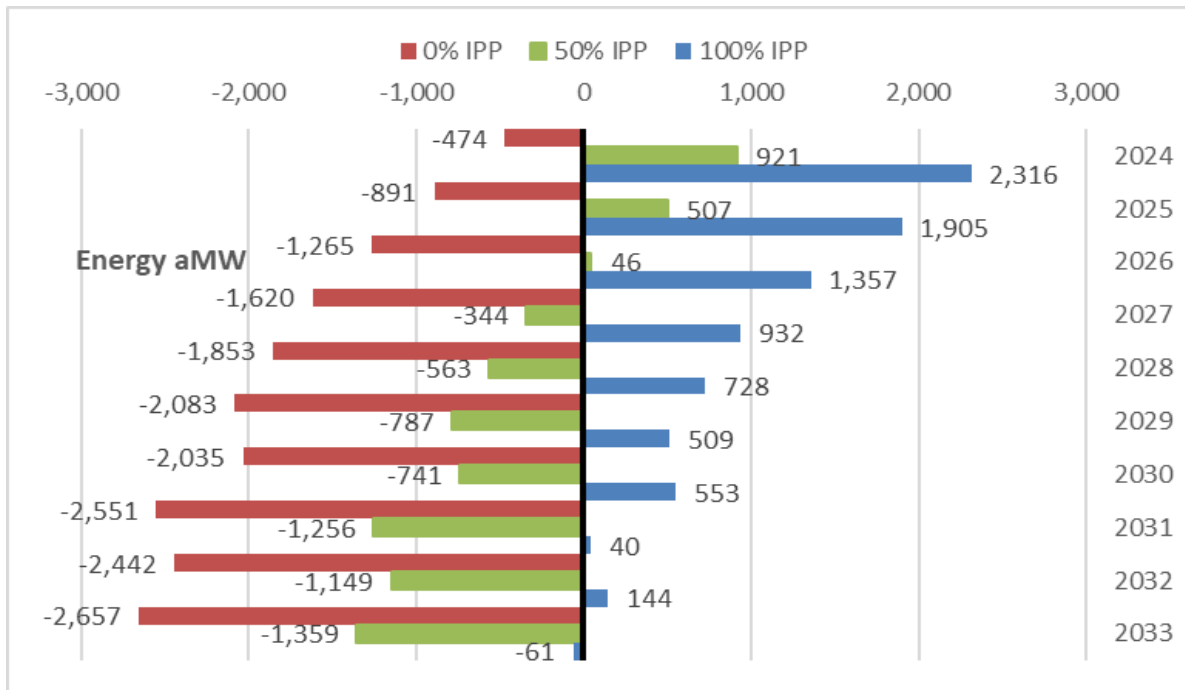
**PNW Region
Annual Energy Surplus/Deficit
Assuming 100% of Uncommitted IPP Generation is Available to the Region
OY 2024 through 2033
Firm Water Conditions**

Energy (aMW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Surplus/Deficit	2,316	1,905	1,357	932	728	509	553	40	144	-61

[Table 3-9](#) shows the significant variability in PNW regional annual firm energy surplus/deficit forecasts depending on the level of uncommitted IPP generation available to the region. IPP generation is detailed in [Tables 3-6](#) and [3-7](#).

Table 3-9

**PNW Region
Variability of Annual Energy Surplus/Deficit
Assuming Different Levels of Uncommitted IPP Generation
OY 2024 through 2033
Firm Water Conditions**



[Table 3-10](#) compares the 2023 White Book PNW regional annual firm energy surplus or deficit forecasts to the 2022 White Book results. The PNW region continues to have annual energy surpluses throughout most of the study period. Comparing to the 2022 White Book, the difference is mainly driven by increased regional resources such as several wind projects coming on-line and hydro generations increase due to change of Firm water conditions.

Table 3-10

PNW Region
Annual Energy Surplus/Deficit Comparison
Assuming 100% of Uncommitted IPP Generation is Available to the Region
OY 2024 through 2033
Firm Water Conditions

Energy (aMW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
2023 White Book P10 generation	2,316	1,905	1,357	932	728	509	553	40	144	-61
2022 White Book 1937 Critical Water Conditions	2277	1810	1180	646	394	43	47	-543	-440	n/a
Difference <i>(2023 WBK – 2022 WBK)</i>	38	96	176	286	334	466	506	583	584	n/a

January 120-Hour Capacity: [Table 3-11](#) shows the January firm 120-Hour capacity surpluses and deficits for the PNW region. The region is forecasted to have January 120-Hour capacity deficits over most of the study period. This assumes that 100 percent of PNW uncommitted IPP generation is available to serve regional loads. The individual components of the PNW regional January 120-Hour capacity loads and resources for OY 2024 through 2033 are shown in [Exhibit 5-3](#), and OY2024 monthly PNW regional 120-Hour capacity loads and resources are in [Exhibit 5-4](#).

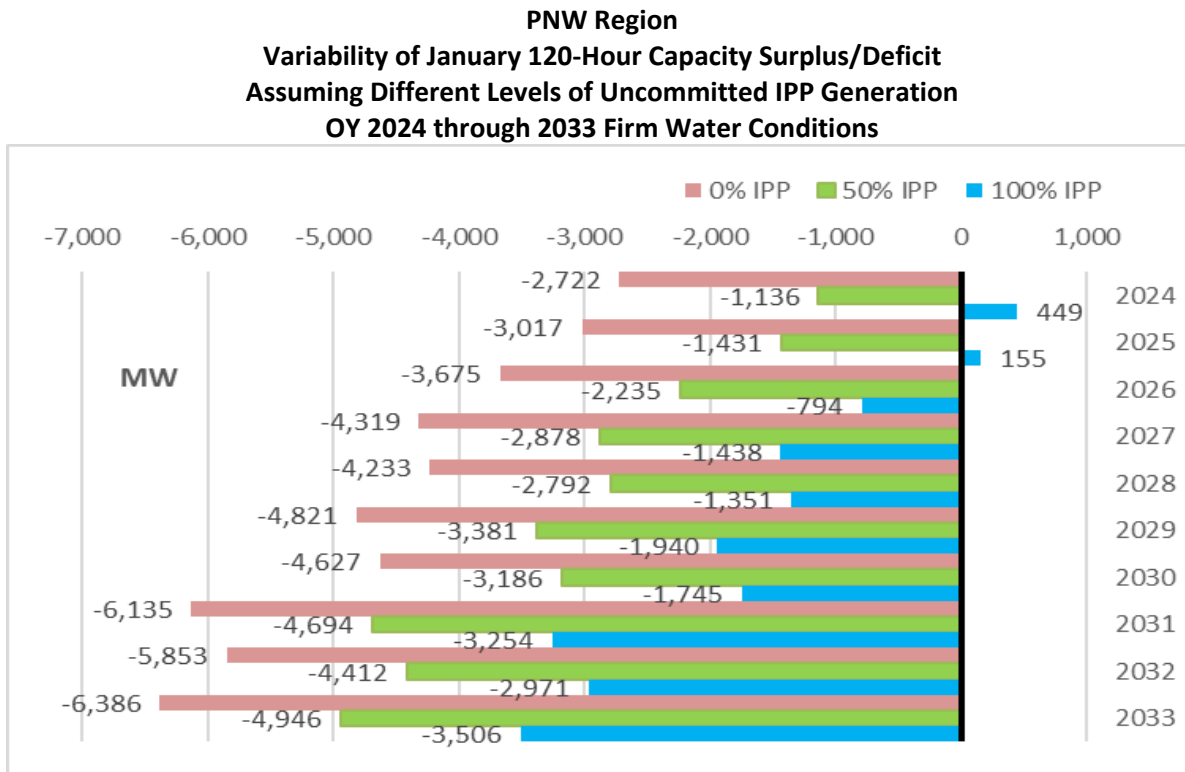
Table 3-11

PNW Region
January 120-Hour Capacity Surplus/Deficit
Assuming 100% of Uncommitted IPP Generation is Available to the Region
OY 2024 through 2033
Firm Water Conditions

January 120-Hour Capacity (MW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Surplus/Deficit	449	155	-794	-1,438	-1,351	-1,940	-1,745	-3,254	-2,971	-3,506

[Table 3-12](#) shows the significant variability in PNW regional January firm 120-Hour capacity surplus/deficit forecasts depending on the level of uncommitted IPP generation available to the region. IPP generation is detailed in [Tables 3-6](#) and [3-7](#).

Table 3-12



[Table 3-13](#) compares the 2023 White Book January firm 120-Hour capacity forecast to the 2022 White Book results. Regional January 120-Hour capacity surplus/deficits show smaller deficits over the study period. The difference in January 120-Hour capacity deficits, compared to the 2022 White Book, are mainly driven by change from critical 1937 to P10 firm water condition analysis which resulted in increased hydro capacity output. Details stated in [Hydro Resources Modeling](#) section.

Table 3-13

PNW Region
January 120-Hour Capacity Surplus/Deficit Comparison
Assuming 100% of Uncommitted IPP Generation is Available to the Region
OY 2024 through 2033
Firm Water Conditions

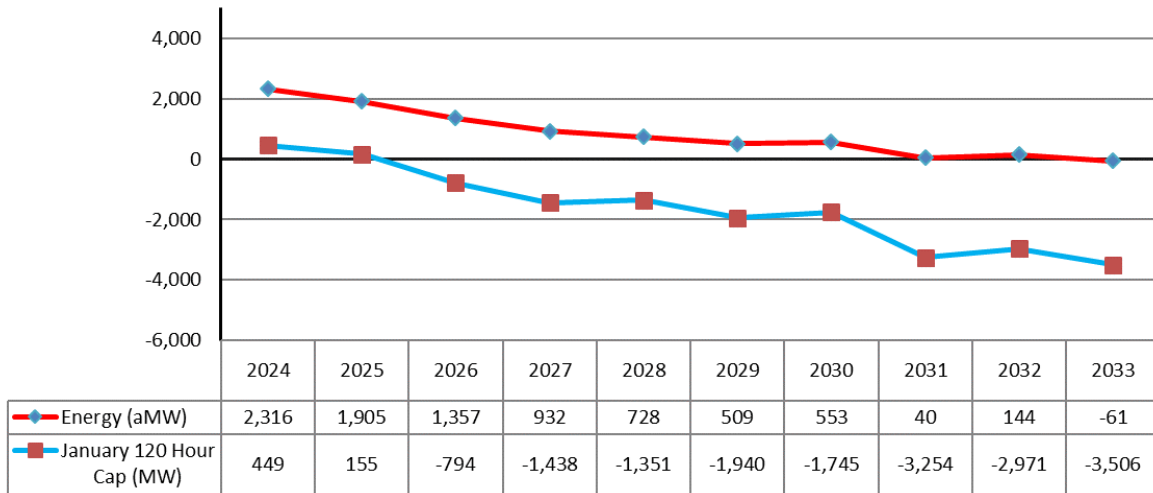
January 120-Hour Capacity (MW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
2023 White Book P10 generation	449	155	-794	-1438	-1351	-1940	-1745	-3254	-2971	-3506
2022 White Book 1937 Critical Water Conditions	-767	-1,069	-2,173	-2,524	-2,846	-2,936	-3,298	-4,300	-4,506	n/a
Difference (2023 WBK – 2022 WBK)	1217	1224	1379	1086	1495	996	1553	1046	1535	n/a

Regional Annual Surplus/Deficit: [Table 3-14](#) graphically presents the annual firm energy and January 120-Hour capacity surplus and deficit forecasts for the PNW Region. These forecasts assume 100 percent availability of the PNW’s uncommitted IPP generation to serve regional loads. The regional annual energy and January 120-Hour capacity surplus and deficit declines over the 10-year study period. By the end of the period, the study

shows an annual energy deficit of 61 aMW, while January 120-Hour capacity is deficit over most of the study period ending with a deficit of 3,506 MW. Continuing declines in the surplus and deficit position over the study period, for both annual energy and January 120-Hour capacity, are driven by a combination of annual load growth, and the reduction of resources across the region.

Table 3-14

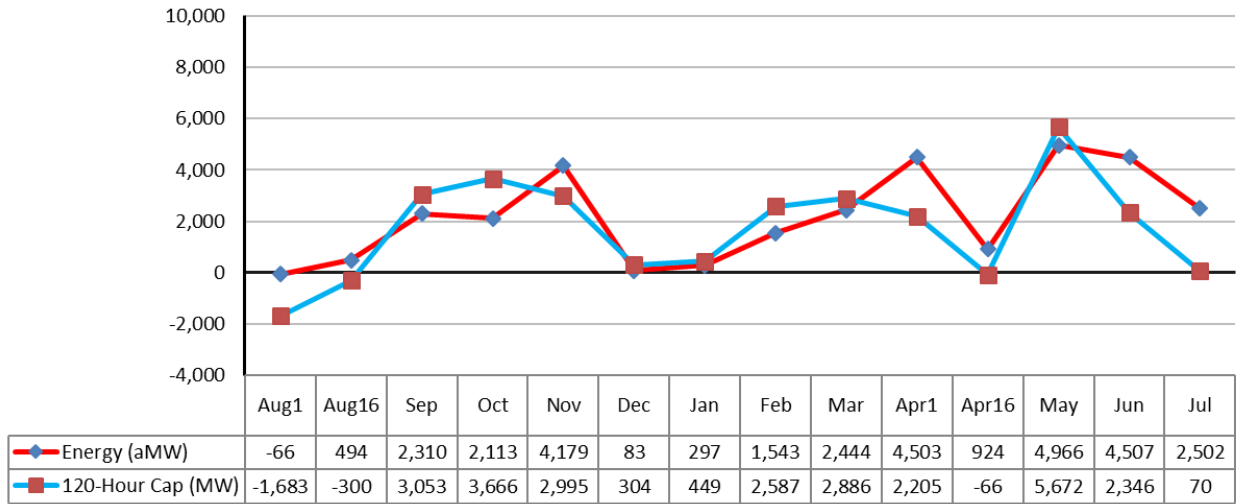
**PNW Region
Annual Energy and January 120-Hour Capacity Surplus/Deficit
OY 2024 through 2033
Firm Water Conditions**



Regional Monthly Surplus/Deficit: [Table 3-15](#) graphically presents the monthly energy and 120-Hour capacity surplus or deficit forecasts for OY 2024. These forecasts assume 100 percent availability of the PNW’s uncommitted IPP generation to serve regional loads. This monthly view shows the variability that the region experiences during the year, with December and January showing a deficit and the late spring showing the largest surpluses. Forecasts for monthly energy and 120-Hour capacity maintain similar shaping over the study period.

Table 3-15

**PNW Region
Monthly Energy and 120-Hour Capacity Surplus/Deficit
OY 2024 Firm Water Conditions**



Conclusion

The PNW region is projected to have annual firm energy surpluses throughout most of the study period and a slight deficit in the last year, assuming modest load growth and 100 percent of the PNW region’s uncommitted IPP generation is available to the region. However, using the same assumptions, the PNW region is forecast to be deficit in January firm 120-Hour capacity through most of the latter study periods, with surplus in the first two years. This study further shows that the PNW region is firm 120-Hour capacity constrained on a monthly basis. Since this analysis assumes that PNW uncommitted IPP generation is used to serve PNW regional load, the supply of power within the region can change dramatically if uncommitted IPP generation is committed to serve loads outside the PNW, or if committed resources retire early or unexpectedly. The surplus and deficit forecasts for all 30-historical water conditions are presented in [Exhibit 5-5](#). Additional monthly and annual details for OY 2024 through 2033 are available upon request, and a detailed list can be found in [Appendix A](#).

The regional energy and capacity deficits identified in this analysis may be mitigated through resource options discussed in the NWPCC’s 2021 Northwest Power Plan. Bonneville provides this PNW regional planning analysis for informational purposes only.

Section 4: Federal System Analysis Exhibits

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Exhibit 4-1: Annual Energy

**Federal System Analysis Surplus Deficit
Operating Year 2024 to 2033
Firm Water Condition**

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Loads and Resources - Federal System
Operating Year: 2024-2033 Water Year: P10
2023 White Book - 30WY Report Date: 12/5/2022
S241-WB-20230315-141333

Energy-aMW	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Firm Obligations										
1 Load Following	3917	4074	4117	4161	4166	4237	4264	4286	4300	4328
2 Preference Customers	3591	3738	3775	3816	3820	3887	3913	3935	3949	3976
3 Federal Agencies	138	148	154	157	159	162	162	163	163	164
4 USBR	188	188	188	188	188	188	188	188	188	188
5 Federal Diversity	0	0	0	0	0	0	0	0	0	0
6 Tier 1 Block	530	531	533	535	536	538	542	547	549	549
7 Tier 1 Block	530	531	533	535	536	538	542	547	549	549
8 Slice	2637	2672	2661	2644	2639	2633	2635	2628	2629	2623
9 Slice Block	1236	1259	1250	1259	1242	1250	1238	1245	1232	1245
10 Slice Output from T1 System	1400	1413	1411	1385	1397	1383	1397	1383	1397	1378
11 Direct Service Industries	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
12 Direct Service Industry	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
13 Contract Deliveries	708	707	594	491	480	480	480	479	479	479
14 Exports	465	468	471	468	469	469	469	469	469	469
15 Intra-Regional Transfers (Out)	243	239	123	22	11	11	11	9	9	9
16 Total Firm Obligations	7803	7996	7915	7841	7833	7899	7931	7952	7969	7990
Net Resources										
17 Hydro	6662	6707	6644	6693	6646	6693	6645	6693	6644	6667
18 Regulated Hydro - Net	6320	6358	6304	6343	6306	6343	6305	6343	6306	6365
19 Independent Hydro - Net	339	345	337	347	337	347	337	347	335	299
20 Small Hydro - Net	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.87	2.88
21 Non-Hydro Renewable	33.0	33.0	33.0	19.8	1.9	0.0	0.0	0.0	0.0	0.0
22 Wind - Net	33.0	33.0	33.0	19.8	1.9	0.0	0.0	0.0	0.0	0.0
23 Solar - Net	0	0	0	0	0	0	0	0	0	0
24 Other - Net	0	0	0	0	0	0	0	0	0	0
25 Thermal	1116	994	1116	994	1116	994	1116	994	1116	994
26 Nuclear - Net	1116	994	1116	994	1116	994	1116	994	1116	994
27 Coal - Net	0	0	0	0	0	0	0	0	0	0
28 Natural Gas - Net	0	0	0	0	0	0	0	0	0	0
29 Petroleum - Net	0	0	0	0	0	0	0	0	0	0
30 Biofuel - Net	0	0	0	0	0	0	0	0	0	0
31 Cogeneration - Net	0	0	0	0	0	0	0	0	0	0
32 Contract Purchases	227	227	228	165	165	165	165	165	165	164
33 Imports	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
34 Intra-Regional Transfers (In)	63.1	63.0	63.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35 Non-Federal CER	134	134	135	135	135	135	135	135	135	135
36 Slice Transmission Loss Return	28.5	28.7	28.7	28.3	28.6	28.3	28.6	28.3	28.6	28.2
37 Reserves & Losses	-253	-253	-253	-253	-255	-256	-257	-257	-259	-258
38 Operating Reserves	0	0	0	0	0	0	0	0	0	0
39 Balancing Reserves	0	0	0	0	0	0	0	0	0	0
40 Transmission Losses	-253	-253	-253	-253	-255	-256	-257	-257	-259	-258
41 Total Net Resources	7785	7707	7769	7619	7674	7596	7669	7594	7666	7566
42 Total Surplus/Deficit	-18	-289	-147	-223	-159	-303	-263	-357	-303	-424

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Exhibit 4-2: Monthly Energy

**Federal System Analysis Surplus Deficit
Operating Year 2024
Firm Water Condition**

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Loads and Resources - Federal System
Operating Year: 2024 Water Year: P10
2023 White Book - 30WY (2001/P10) Report Date: 12/5/2022
S241-WB-20230315-141333

	2024	360	384	720	744	720	744	744	696	744	360	360	744	720	744	8784
Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg	
Firm Obligations																
1 Load Following	3900	3902	3415	3431	3736	4493	4498	4136	3787	3695	3695	3695	3972	4236	3917	
2 Preference Customers	3454	3456	3025	3180	3578	4313	4322	3945	3576	3330	3330	3230	3457	3674	3591	
3 Federal Agencies	116	117	104	129	149	169	167	172	150	131	131	120	120	135	138	
4 USBR	330	329	286	123	9.67	10.8	8.39	18.0	61.0	234	234	345	395	427	188	
5 Federal Diversity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6 Tier 1 Block	342	342	562	488	808	808	891	810	793	386	386	139	21.3	316	530	
7 Tier 1 Block	342	342	562	488	808	808	891	810	793	386	386	139	21.3	316	530	
8 Slice	2439	2448	2317	2256	2844	3050	3243	2668	2629	2170	2321	2730	2619	2579	2637	
9 Slice Block	1133	1133	1116	1136	1322	1510	1494	1331	1276	1178	1178	1133	1084	1120	1236	
10 Slice Output from T1 System	1306	1315	1201	1120	1522	1540	1749	1337	1353	992	1143	1597	1535	1459	1400	
11 Direct Service Industries	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	
12 Direct Service Industry	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	
13 Contract Deliveries	775	861	717	692	695	694	696	697	692	693	693	692	692	720	708	
14 Exports	512	598	454	454	454	454	454	454	454	454	454	454	454	483	465	
15 Intra-Regional Transfers (Out)	263	264	262	237	241	240	241	242	237	238	238	237	237	237	243	
16 Total Firm Obligations	7467	7564	7022	6877	8095	9057	9338	8321	7912	6955	7106	7267	7314	7862	7803	
Net Resources																
17 Hydro	6356	6201	5684	5117	6913	7232	7271	6964	6660	5815	5417	7790	7508	6902	6662	
18 Regulated Hydro - Net	6051	5800	5447	4842	6478	6921	6852	6747	6404	5528	5030	7407	7050	6488	6320	
19 Independent Hydro - Net	303	398	234	273	433	307	416	213	252	283	383	380	455	412	339	
20 Small Hydro - Net	2.63	2.63	2.63	2.67	2.84	3.19	3.21	3.04	3.10	3.09	3.09	2.83	2.72	2.63	2.88	
21 Non-Hydro Renewable	22.6	33.8	31.5	25.3	36.2	27.6	14.8	24.4	28.1	50.2	42.3	45.2	44.7	43.7	33.0	
22 Wind - Net	22.6	33.8	31.5	25.3	36.2	27.6	14.8	24.4	28.1	50.2	42.3	45.2	44.7	43.7	33.0	
23 Solar - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24 Other - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25 Thermal	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	
26 Nuclear - Net	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	
27 Coal - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
28 Natural Gas - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
29 Petroleum - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
30 Biofuel - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
31 Cogeneration - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
32 Contract Purchases	167	168	185	218	255	300	335	287	248	220	223	168	167	170	227	
33 Imports	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
34 Intra-Regional Transfers (In)	0	0	25.0	64.0	88.9	138	164	125	89.0	64.4	64.4	0	0	0	63.1	
35 Non-Federal CER	136	137	136	131	136	131	136	135	132	136	136	136	131	136	134	
36 Slice Transmission Loss Return	30.0	30.2	23.3	21.7	29.6	29.9	33.9	26.0	26.3	19.3	22.2	31.0	35.3	33.5	28.5	
37 Reserves & Losses	-244	-239	-219	-203	-260	-271	-273	-262	-252	-225	-214	-286	-282	-262	-253	
38 Operating Reserves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
39 Balancing Reserves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
40 Transmission Losses	-244	-239	-219	-203	-260	-271	-273	-262	-252	-225	-214	-286	-282	-262	-253	
41 Total Net Resources	7418	7280	6798	6274	8060	8405	8463	8129	7800	6976	6584	8833	8553	7970	7785	
42 Total Surplus/Deficit	-49	-284	-224	-603	-35	-652	-875	-192	-112	21	-522	1,566	1,239	108	-18	

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Exhibit 4-3: Annual 120-Hour January Capacity

**Federal System Analysis Surplus Deficit
Operating Year 2024 to 2033
Firm Water Condition**

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Loads and Resources - Federal System
Operating Year: 2024-2033 Water Year: P10 January
2023 White Book - 30WY Report Date: 12/5/2022

S241-WB-20230315-141333

120Hr-MW	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Firm Obligations	2002	2002	2002	2001	2002	2001	2002	2001	2002	2001
1 Load Following	5151	5325	5346	5417	5419	5465	5479	5494	5517	5571
2 Preference Customers	6182	6354	6372	6443	6442	6525	6534	6542	6572	6602
3 Federal Agencies	224	233	238	240	244	248	248	249	249	250
4 USBR	201	201	201	201	201	201	201	201	201	201
5 Federal Diversity	-1456	-1462	-1465	-1467	-1468	-1509	-1504	-1498	-1505	-1482
6 Tier 1 Block	952	946	951	989	995	958	967	976	982	1015
7 Tier 1 Block	952	946	951	989	995	958	967	976	982	1015
8 Slice	3606	3637	3631	3644	3626	3632	3617	3628	3616	3626
9 Slice Block	1494	1525	1505	1522	1500	1511	1491	1505	1489	1506
10 Slice Output from T1 System	2112	2112	2126	2121	2126	2121	2126	2123	2127	2120
11 Direct Service Industries	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
12 Direct Service Industry	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
13 Contract Deliveries	1458	1458	1258	1158	1158	1158	1158	1151	1151	1151
14 Exports	1142	1142	1142	1142	1142	1142	1142	1142	1142	1142
15 Intra-Regional Transfers (Out)	316	316	116	16.4	16.4	16.4	16.4	9.44	9.44	9.44
16 Total Firm Obligations	11178	11376	11197	11219	11209	11224	11232	11260	11277	11374
Net Resources										
17 Hydro	11828	11828	11899	11876	11899	11876	11899	11876	11899	11861
18 Regulated Hydro - Net	11287	11287	11358	11602	11358	11602	11358	11602	11358	11602
19 Independent Hydro - Net	536	536	536	269	536	269	536	269	536	254
20 Small Hydro - Net	4.59	4.59	4.59	4.59	4.59	4.59	4.59	4.59	4.59	4.59
21 Non-Hydro Renewable	0	0	0	0	0	0	0	0	0	0
22 Wind - Net	0	0	0	0	0	0	0	0	0	0
23 Solar - Net	0	0	0	0	0	0	0	0	0	0
24 Other - Net	0	0	0	0	0	0	0	0	0	0
25 Thermal	1178	1178	1178	1178	1178	1178	1178	1178	1178	1178
26 Nuclear - Net	1178	1178	1178	1178	1178	1178	1178	1178	1178	1178
27 Coal - Net	0	0	0	0	0	0	0	0	0	0
28 Natural Gas - Net	0	0	0	0	0	0	0	0	0	0
29 Petroleum - Net	0	0	0	0	0	0	0	0	0	0
30 Biofuel - Net	0	0	0	0	0	0	0	0	0	0
31 Cogeneration - Net	0	0	0	0	0	0	0	0	0	0
32 Contract Purchases	627	627	631	281	281	281	281	281	281	281
33 Imports	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
34 Intra-Regional Transfers (In)	350	350	350	0	0	0	0	0	0	0
35 Non-Federal CER	235	235	237	237	237	237	237	237	237	237
36 Slice Transmission Loss Return	41.0	41.0	43.2	43.1	43.2	43.1	43.2	43.1	43.2	43.1
37 Reserves & Losses	-2042	-2057	-2043	-2047	-2052	-2059	-2061	-2065	-2066	-2070
38 Operating Reserves	-790	-795	-780	-785	-790	-793	-797	-798	-801	-802
39 Balancing Reserves	-878	-886	-886	-886	-886	-886	-886	-886	-886	-886
40 Transmission Losses	-374	-376	-377	-376	-375	-379	-378	-381	-379	-382
41 Total Net Resources	11592	11576	11665	11288	11306	11277	11297	11270	11292	11250
42 Total Surplus/Deficit	414	199	467	69	98	53	66	10	15	-123

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Exhibit 4-4: Monthly 120-Hour Capacity

**Federal System Analysis Surplus Deficit
Operating Year 2024
Firm Water Condition**

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Loads and Resources - Federal System
Operating Year: 2024 Water Year: P10
2023 White Book - 30WY (2001/P10) Report Date: 12/5/2022
S241-WB-20230315-141333

120Hr-MW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul
Firm Obligations	2016	2008	2016	2006	2014	2009	2002	2004	1992	1994	2008	2005	1994	1994
1 Load Following	4505	4197	3789	3960	4348	5177	5151	4786	4441	4239	4274	4058	4507	4731
2 Preference Customers	4965	4965	4408	4733	5271	6087	6182	5882	5385	5106	5106	4652	4963	5101
3 Federal Agencies	160	160	148	179	204	225	224	242	209	184	184	163	163	185
4 USBR	620	620	577	407	104	144	201	177	343	425	425	520	600	619
5 Federal Diversity	-1240	-1548	-1344	-1359	-1231	-1280	-1456	-1514	-1497	-1476	-1441	-1276	-1219	-1174
6 Tier 1 Block	353	353	606	522	870	897	952	843	847	401	401	149	23.0	339
7 Tier 1 Block	353	353	606	522	870	897	952	843	847	401	401	149	23.0	339
8 Slice	2634	2748	2632	2591	3264	3759	3606	3571	3456	2790	2494	3160	3080	2811
9 Slice Block	1131	1131	1114	1136	1322	1510	1494	1331	1276	1178	1178	1133	1084	1120
10 Slice Output from T1 System	1503	1617	1518	1455	1942	2249	2112	2240	2180	1612	1316	2026	1997	1691
11 Direct Service Industries	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
12 Direct Service Industry	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
13 Contract Deliveries	1536	1617	1476	1451	1458	1458	1458	1458	1451	1451	1451	1451	1451	1480
14 Exports	1201	1283	1142	1142	1142	1142	1142	1142	1142	1142	1142	1142	1142	1170
15 Intra-Regional Transfers (Out)	334	334	334	309	316	316	316	316	309	309	309	309	309	309
16 Total Firm Obligations	9039	8926	8514	8535	9951	11301	11178	10670	10205	8891	8631	8829	9072	9371
Net Resources														
17 Hydro	9116	9280	8977	8604	10790	11790	11828	11257	11244	8901	7975	11677	10864	10014
18 Regulated Hydro - Net	8658	8675	8591	8095	10341	11443	11287	10893	10924	8418	7343	11137	10320	9422
19 Independent Hydro - Net	455	601	383	505	445	343	536	359	316	479	627	535	540	589
20 Small Hydro - Net	3.49	3.49	3.00	4.11	4.49	4.60	4.59	4.62	4.58	4.58	4.58	4.58	4.09	3.19
21 Non-Hydro Renewable	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22 Wind - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23 Solar - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24 Other - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 Thermal	1163	1163	1179	1181	1179	1180	1178	1175	1177	1166	1166	1151	1154	1168
26 Nuclear - Net	1163	1163	1179	1181	1179	1180	1178	1175	1177	1166	1166	1151	1154	1168
27 Coal - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28 Natural Gas - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29 Petroleum - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30 Biofuel - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31 Cogeneration - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32 Contract Purchases	271	273	315	414	474	580	627	529	478	417	412	275	282	275
33 Imports	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
34 Intra-Regional Transfers (In)	0	0	50.0	150	200	300	350	250	200	150	150	0	0	0
35 Non-Federal CER	235	235	235	235	235	235	235	235	235	235	235	235	235	235
36 Slice Transmission Loss Return	34.5	37.2	29.5	28.2	37.7	43.7	41.0	43.5	42.3	31.3	25.6	39.3	45.9	38.9
37 Reserves & Losses	-1844	-1851	-1864	-1776	-1944	-2039	-2042	-1989	-1967	-1814	-1758	-1942	-1913	-1873
38 Operating Reserves	-660	-662	-619	-626	-725	-789	-790	-756	-734	-654	-625	-697	-687	-676
39 Balancing Reserves	-894	-894	-964	-877	-878	-878	-878	-878	-878	-878	-878	-878	-878	-878
40 Transmission Losses	-290	-296	-281	-274	-341	-372	-374	-355	-355	-282	-255	-367	-348	-319
41 Total Net Resources	8706	8864	8607	8422	10499	11510	11592	10972	10932	8671	7795	11161	10387	9584
42 Total Surplus/Deficit	-333	-62	93	-113	548	209	414	302	727	-221	-836	2,332	1,315	213

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Exhibit 4-5: 30-Water Conditions Monthly Energy

**Federal System Analysis Surplus Deficit
Operating Year 2024**

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Federal Report Surplus Deficit By Water Year
Operating Year 2024
2023 White Book - 30WY Report Date: 12/5/2022
S241-WB-20230315-141333

Energy-aMW - Surplus Deficit	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
1 1989 Federal Report Surplus Deficit	214	991	-258	-603	215	-106	-60.4	-1090	932	1803	2926	2754	1969	285	588
2 1990 Federal Report Surplus Deficit	258	143	-18.0	-230	920	768	1688	3631	1085	1613	2472	2424	4361	2263	1581
3 1991 Federal Report Surplus Deficit	2206	2211	127	-387	2374	1418	3021	3945	2571	2004	1452	2829	3954	3733	2287
4 1992 Federal Report Surplus Deficit	2628	1996	-32.6	-280	383	-1035	-24.2	771	-468	-95.6	-214	2342	1146	-272	388
5 1993 Federal Report Surplus Deficit	115	-32.8	60.5	-623	208	-652	-953	-1595	264	287	-1013	3459	2788	1067	315
6 1994 Federal Report Surplus Deficit	665	516	470	-229	294	-610	-732	-192	-112	-443	783	1761	1239	158	233
7 1995 Federal Report Surplus Deficit	70.9	-240	60.1	-439	116	-329	119	1238	2643	550	155	2274	3978	2143	1003
8 1996 Federal Report Surplus Deficit	717	765	553	761	2871	5040	5419	5794	5744	2630	4122	3617	4732	4688	3607
9 1997 Federal Report Surplus Deficit	2362	2614	351	15.8	796	1561	5600	5496	4913	3189	5466	5756	6411	4996	3555
10 1998 Federal Report Surplus Deficit	2751	3082	1423	2265	1803	451	1412	2787	1376	490	555	5044	4360	2561	2243
11 1999 Federal Report Surplus Deficit	2475	1325	387	-214	-76.9	812	4220	3896	5348	2213	3102	3164	4802	4645	2627
12 2000 Federal Report Surplus Deficit	2972	3361	129	-155	1980	1976	2557	2585	2546	2515	3137	2966	2164	1232	1997
13 2001 Federal Report Surplus Deficit	1450	-29.9	-46.0	-224	46.8	-886	-702	3.36	-373	-939	-1562	619	558	-23.7	-133
14 2002 Federal Report Surplus Deficit	372	-158	-224	-687	-271	-274	-427	-211	409	1166	2787	2553	4514	3287	895
15 2003 Federal Report Surplus Deficit	1332	1164	26.1	-280	394	-767	-555	324	1714	1091	1194	1877	3767	108	745
16 2004 Federal Report Surplus Deficit	-250	-145	-120	-444	912	340	-231	-831	318	587	553	1972	2744	704	479
17 2005 Federal Report Surplus Deficit	-366	413	220	403	832	1174	1063	2526	584	-498	-432	1566	2237	1405	959
18 2006 Federal Report Surplus Deficit	415	53.9	57.4	-634	832	359	2827	4275	1837	3181	2547	4639	3469	2144	1896
19 2007 Federal Report Surplus Deficit	289	-75.8	-85.0	-443	531	467	2408	1206	3971	2162	1527	2568	2590	1325	1376
20 2008 Federal Report Surplus Deficit	16.3	-284	-333	-462	608	-583	665	725	911	230	-522	3400	5463	2893	1082
21 2009 Federal Report Surplus Deficit	1169	1462	271	-274	491	-741	1913	658	-301	2625	2135	2752	2655	686	981
22 2010 Federal Report Surplus Deficit	-109	-626	-60.5	-357	231	-160	-875	-567	-589	21.3	-656	693	4264	2032	324
23 2011 Federal Report Surplus Deficit	329	-83.8	269	-406	-34.9	938	3067	4229	2993	4829	2015	4077	6699	6345	2634
24 2012 Federal Report Surplus Deficit	3565	2328	437	145	646	197	1578	2463	3390	4679	5187	4159	5410	5041	2608
25 2013 Federal Report Surplus Deficit	2822	2643	85.0	-178	1560	2101	1097	996	323	3751	2009	3466	3518	2328	1743
26 2014 Federal Report Surplus Deficit	988	327	353	-101	271	-615	1936	-227	3547	3522	2550	3610	3648	2570	1563
27 2015 Federal Report Surplus Deficit	1888	1303	239	-364	1495	1939	2729	3796	4259	1814	87.1	890	890	-407	1494
28 2016 Federal Report Surplus Deficit	-49.4	-308	-296	-405	53.9	-13.2	502	-163	3754	3062	3423	2933	1892	493	987
29 2017 Federal Report Surplus Deficit	72.4	-127	141	-428	2018	554	2544	2692	6325	5162	4785	5860	5350	1739	2639
30 2018 Federal Report Surplus Deficit	1900	1138	-32.9	-329	-334	565	3286	4230	3423	2966	2307	5347	3770	1170	2098
Ranked Averages															
31 Bottom 10 pct	-4217	-4449	-4052	-3991	-4651	-5562	-5591	-5000	-4695	-4226	-4302	-3853	-3963	-4579	-133
32 Middle 80 pct	-3343	-3438	-3281	-3317	-3616	-4394	-4262	-3815	-3398	-2947	-3001	-2479	-2447	-3351	1032

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Exhibit 4-6: Modeling Details by Metrics

**Water-Year Percentile by Month
Operating Year 2024 - 2033**

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		Hydro Modeling 14 - Period													
Water Year	Aug - I	Aug - II	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr - I	Apr - II	May	Jun	Jul	
Firm Water Condition - P10	Energy aMW														
	OY2024	2016	2008	2002	1989	2011	1993	2010	1994	1994	2010	2008	2005	1994	2003
	OY2025	2016	2008	2002	1989	1989	1993	2010	1994	1994	1992	2008	1994	2005	2001
	OY2026	2016	2008	2002	1989	1989	1993	2010	1994	1994	2010	2008	2005	1994	2003
	OY2027	2016	2008	2002	1989	2011	1993	2010	1994	1994	1992	2008	1994	2005	2001
	OY2028	2016	2008	2002	1989	1989	1993	2010	1994	1994	2010	2008	2005	1994	2003
	OY2029	2016	2008	2002	1989	2011	1993	2010	1994	1994	1992	2008	1994	2005	2001
	OY2030	2016	2008	2002	1989	1989	1993	2010	1994	1994	2010	2008	2005	1994	2003
	OY2031	2016	2008	2002	1989	2011	1993	2010	1994	1994	1992	2008	1994	2005	2001
	OY2032	2016	2008	2002	1989	1989	1993	2010	1994	1994	2010	2008	2005	1994	2003
	OY2033	2016	1995	2002	1989	1989	1993	2001	1994	1994	1992	2008	1994	2005	2001
	120HR-MW														
	OY2024	2016	2008	2016	2006	2014	2009	2002	2004	1992	1994	2008	2005	1994	1994
	OY2025	2016	2008	2016	2006	2010	2009	2002	2016	1992	1994	2008	1994	1992	2001
	OY2026	1993	2017	2016	2006	1999	2003	2002	2016	1992	1994	2010	2005	1994	1994
	OY2027	1993	2008	2016	2006	1999	2003	2001	2016	1992	1994	2010	1994	2005	2001
	OY2028	2010	2017	2016	2006	1999	2003	2002	2016	1992	1994	2010	2005	1994	1994
	OY2029	1993	2008	2016	2006	1999	2003	2001	2016	1992	1994	2010	1994	2005	2001
	OY2030	2010	2017	2016	2006	1999	2003	2002	2016	1992	1994	2010	2005	1994	1994
	OY2031	1993	2008	2016	2006	1999	2003	2001	2016	1992	1994	2010	1994	2005	2001
OY2032	2010	2017	2016	2006	1999	2003	2002	2016	1992	1994	2010	2005	1994	1994	
OY2033	1993	2008	2016	2006	1999	2003	2001	2016	1992	1994	2010	1994	2005	2001	
Median Water Condition - P50	Energy aMW														
	OY2024	1994	2005	2006	2018	2007	2004	1998	1995	2003	1991	2011	1991	2013	2017
	OY2025	2003	2005	2006	2018	2007	2004	1998	2007	2003	1990	2011	1999	2003	2006
	OY2026	1994	2005	2006	2018	2009	2004	2012	1995	2006	2015	2011	2000	2003	2017
	OY2027	1996	1999	2006	2018	2007	2004	1998	1995	2003	2015	2011	2009	2013	2006
	OY2028	1994	2005	2006	2018	2007	2004	1998	1995	2006	2015	2011	1991	2003	2010
	OY2029	2003	1999	2006	2018	2009	2004	1998	1995	2003	2015	2011	2016	2006	1993
	OY2030	1994	2005	2006	2018	2009	2006	1998	1995	2006	1991	2011	1991	2006	2017
	OY2031	2003	2005	2006	2018	2009	2004	1998	2007	2006	2015	2011	2016	2006	1993
	OY2032	1994	2005	2006	2018	2009	2004	2012	2007	2006	1991	2011	2000	2006	2017
	OY2033	2003	2005	1995	2003	2009	2004	1998	1995	2003	2015	2013	2009	2006	2006
	120HR-MW														
	OY2024	2014	2005	1990	1992	2012	2017	2005	2007	2006	2015	2013	2016	2018	2017
	OY2025	2017	1999	1990	2009	2009	2004	2009	1995	2006	1991	2013	1989	1998	1993
	OY2026	1994	2005	2018	2009	2003	2004	2009	1995	2006	1989	2013	2016	2018	2017
	OY2027	2003	1999	1990	2017	2012	2017	2009	1995	2006	1991	2013	1989	2018	2006
	OY2028	1994	2005	2018	2009	2009	2004	2009	1995	2006	1989	2013	2016	2018	2017
	OY2029	2014	1999	1990	2017	2012	2004	2012	1995	2006	1990	2011	1995	2018	2006
	OY2030	1994	2005	2018	2009	2003	2004	2009	1995	2006	1990	2013	2000	2018	2017
	OY2031	2003	1999	1990	2017	2009	2004	2012	1995	2006	1991	2013	1995	2014	2006
OY2032	1994	2005	2018	2009	2009	2017	2009	1995	2003	1989	2013	2000	2018	2017	
OY2033	2014	1999	2015	2017	2009	2017	2012	1995	2006	1990	2011	1989	2018	2006	
High Water Condition - P90	Energy aMW														
	OY2024	1998	1997	2012	2012	2017	2015	2018	2011	1997	2013	1996	1998	2012	1999
	OY2025	1998	1997	2012	2012	2017	2015	2018	2018	1997	1997	2016	1998	2017	1996
	OY2026	1998	2012	2012	2012	2000	2015	2018	2011	1997	2014	1996	1998	2012	1999
	OY2027	1998	1997	2012	2012	2017	2015	2018	2018	1997	2016	1996	2018	2008	1997
	OY2028	2013	1997	2012	2012	2000	2015	2018	2011	1997	2014	1996	1998	2012	1999
	OY2029	1998	1997	2012	2012	2017	2015	2018	2018	1997	2016	1996	2018	2008	1997
	OY2030	2013	1997	2012	2012	2000	2015	2018	2011	1997	2014	1996	1998	2012	1999
	OY2031	1998	1997	2012	2012	2017	2015	2018	2018	1997	2016	1996	2018	2008	1997
	OY2032	2013	1997	2012	2012	2000	2015	2018	2011	1997	2014	1996	1998	2012	1999
	OY2033	1998	1997	2012	2012	2017	2015	2018	2018	1997	2016	1996	2018	2008	1997
	120HR-MW														
	OY2024	1997	1997	1999	2012	1998	2015	1991	2011	2015	2013	2016	1998	2010	1996
	OY2025	2013	1997	1999	2012	1998	2015	1991	2011	2015	2011	1996	1998	2017	2012
	OY2026	2013	2012	1999	2012	2017	2015	1991	2011	2015	2013	2016	1998	2017	1996
	OY2027	1997	2013	1999	2012	1998	2015	1991	2011	2015	2016	1996	2006	2017	1996
	OY2028	1999	1997	1999	2012	2017	2015	1991	2011	2015	2013	2016	1998	2017	1996
	OY2029	1997	2013	1999	2012	1998	2015	1991	2011	2015	2016	1996	2006	2017	1996
	OY2030	1999	1997	1999	2012	2017	2015	1991	2011	2015	2013	2016	1998	2017	1996
	OY2031	1997	2013	1999	2012	1998	2015	1991	2011	2015	2016	1996	2006	2017	1996
OY2032	1999	1997	1999	2012	2017	2015	1991	2011	2015	2013	2016	1998	2017	1996	
OY2033	1997	2013	1999	2012	1998	2015	1991	2011	2015	2016	1996	2006	1997	1996	

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Section 5: Pacific Northwest Regional Analysis Exhibits

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Exhibit 5-1: Annual Energy

**Regional Analysis Surplus Deficit
Operating Year 2024 to 2033
Firm Water Condition**

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Loads and Resources - Pacific Northwest Region
Operating Year: 2024 Water Year: P10
2023 White Book - 30WY (2001/P10) Report Date: 12/5/2022
S241-WB-20230201-101234

Energy-aMW	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Regional Loads										
1 Retail Loads	24164	24439	24600	24808	25001	25170	25266	25339	25378	25470
2 Federal Agency	148	157	163	166	168	169	170	170	170	170
3 USBR	188	188	188	188	188	188	188	188	188	188
4 Cooperative	2854	2995	3078	3200	3322	3380	3419	3440	3453	3474
5 Municipality	2562	2566	2568	2570	2570	2575	2578	2584	2580	2591
6 Public Utility District	4901	4966	5011	5071	5129	5204	5256	5294	5321	5350
7 Investor-Owned Utility	13455	13510	13535	13557	13569	13598	13599	13608	13611	13641
8 Marketer	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
9 Direct-Service Industry	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3
10 Federal Diversity	0	0	0	0	0	0	0	0	0	0
11 Exports	1019	1021	1024	1021	1022	1020	1018	770	675	675
12 Canada	465	468	471	468	469	469	469	469	469	469
13 East Continental Divide	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14 Inland Southwest	0	0	0	0	0	0	0	0	0	0
15 Pacific Southwest	553	552	552	552	552	550	548	300	205	205
16 Other	0	0	0	0	0	0	0	0	0	0
17 Total Regional Loads	25183	25461	25624	25829	26023	26190	26284	26110	26053	26146
Regional Resources										
18 Hydro	12081	12110	12061	12099	12062	12099	12062	12099	12061	11981
19 Regulated Hydro - Net	10868	10868	10834	10872	10836	10872	10835	10872	10836	10764
20 Independent Hydro - Net	969	998	984	983	983	983	984	983	983	974
21 Small Hydro - Net	243	244	244	244	243	244	244	244	243	244
22 Non-Hydro Renewable	2711	2749	2748	2748	2748	2749	2748	2733	2744	2748
23 Wind - Net	2200	2238	2238	2238	2236	2238	2238	2222	2233	2238
24 Solar - Net	352	353	353	353	353	353	353	353	353	353
25 Other - Net	159	159	158	158	159	159	158	158	158	158
26 Thermal	13002	12795	12443	12175	12197	12102	12279	12028	12197	12157
27 Nuclear - Net	1116	994	1116	994	1116	994	1116	994	1116	994
28 Coal - Net	3751	3676	3201	3049	2955	2981	3034	2948	2962	3034
29 Natural Gas - Net	5373	5372	5371	5371	5373	5372	5368	5371	5372	5371
30 Petroleum - Net	0	0	0	0	0	0	0	0	0	0
31 Biofuel - Net	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5
32 Cogeneration - Net	2737	2727	2729	2736	2728	2730	2736	2690	2721	2733
33 Imports	588	591	595	599	603	607	610	130	36	36
34 Canada	38.8	38.8	38.8	38.8	38.8	38.8	38.8	36.7	36.5	36.4
35 East of Continental Divide	0	0	0	0	0	0	0	0	0	0
36 Inland Southwest	502	506	509	513	517	521	525	94		
37 Pacific Southwest	47.1	47.1	47.1	47.1	47.1	47.1	47.1	0.0	0.0	0.0
38 Other	0	0	0	0	0	0	0	0	0	0
39 Reserves & Losses	-883	-880	-867	-860	-860	-858	-862	-841	-842	-838
40 Operating Reserves	0	0	0	0	0	0	0	0	0	0
41 Balancing Reserves	0	0	0	0	0	0	0	0	0	0
42 Transmission Losses	-883	-880	-867	-860	-860	-858	-862	-841	-842	-838
43 Total Regional Resources	27499	27366	26980	26761	26751	26699	26837	26150	26197	26085
44 Total Surplus/Deficit	2316	1905	1357	932	728	509	553	40	144	-61

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Exhibit 5-2: Monthly Energy

**Regional Analysis Surplus Deficit
Operating Year 2024
Firm Water Condition**

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Loads and Resources - Pacific Northwest Region
Operating Year: 2024 Water Year: P10
2023 White Book - 30WY (2001/P10) Report Date: 12/5/2022

S241-WB-20230315-141333

Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
Regional Loads															
1 Retail Loads	24532	24549	22061	21872	23791	27239	27403	25401	23803	22650	22650	22270	23640	25230	24164
2 Federal Agency	124	124	115	140	154	185	187	169	157	145	145	131	131	140	148
3 USBR	330	329	286	123	9.67	10.8	8.39	18.0	61.0	234	234	345	395	427	188
4 Cooperative	2956	2958	2682	2408	2633	3030	3109	2924	2778	2706	2706	2802	3007	3209	2854
5 Municipality	2301	2303	2219	2402	2715	3098	3123	2943	2721	2468	2468	2235	2215	2303	2562
6 Public Utility District	4652	4656	4330	4464	5015	5743	5841	5390	4987	4667	4667	4397	4556	4770	4901
7 Investor-Owned Utility	14113	14123	12374	12278	13209	15116	15078	13901	13044	12374	12374	12305	13281	14326	13455
8 Marketer	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
9 Direct-Service Industry	52.2	52.2	52.9	53.8	54.2	53.9	54.3	54.0	53.5	53.9	53.9	52.4	52.1	52.1	53.3
10 Federal Diversity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 Exports	1065	1328	1114	846	1003	873	679	825	880	1215	1102	1147	1192	1313	1019
12 Canada	512	598	454	454	454	454	454	454	454	454	454	454	454	483	465
13 East Continental Divide	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14 Inland Southwest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 Pacific Southwest	552	729	659	390	548	417	223	369	425	760	647	692	737	829	553
16 Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17 Total Regional Loads	25597	25876	23175	22717	24794	28112	28082	26225	24683	23865	23753	23417	24832	26543	25183
Regional Resources															
18 Hydro	10268	10424	9680	9468	12772	12264	13459	12220	12157	12010	10436	14953	14121	12294	12081
19 Regulated Hydro - Net	9116	9103	8687	8438	11669	11209	12324	11211	11018	10883	9046	13383	12510	10901	10868
20 Independent Hydro - Net	827	998	749	867	975	929	1012	877	978	846	1108	1167	1189	988	969
21 Small Hydro - Net	325	323	244	163	128	126	124	132	162	280	282	403	422	405	243
22 Non-Hydro Renewable	2163	2869	2597	2127	2668	2173	1376	2057	2382	3875	3364	3656	3721	3646	2711
23 Wind - Net	1511	2216	2046	1651	2298	1869	1046	1661	1895	3311	2799	3023	3046	2951	2200
24 Solar - Net	492	492	392	315	211	144	181	236	327	406	406	471	535	513	352
25 Other - Net	160	160	158	161	160	160	149	160	159	158	158	162	140	182	159
26 Thermal	13413	13420	13492	13528	13767	13867	13821	13751	12924	12911	11190	10154	11868	13413	13002
27 Nuclear - Net	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116	1116
28 Coal - Net	3821	3822	3825	3826	3824	3828	3828	3827	3799	3654	3457	3216	3842	3824	3751
29 Natural Gas - Net	5585	5592	5654	5719	5851	5921	5914	5853	5804	5484	4427	3403	4232	5587	5373
30 Petroleum - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31 Biofuel - Net	23.6	23.6	25.4	26.7	27.0	24.6	24.3	24.4	27.0	25.4	25.4	27.2	25.0	25.8	25.5
32 Cogeneration - Net	2867	2867	2871	2840	2949	2978	2939	2931	2177	2632	2165	2392	2653	2860	2737
33 Imports	580	580	510	482	669	770	605	605	508	455	455	503	656	708	588
34 Canada	20.8	20.8	15.8	22.0	38.9	49.3	62.3	70.8	62.7	30.2	30.2	28.9	38.6	27.0	38.8
35 East of Continental Divide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36 Inland Southwest	560	559	494	460	449	485	456	471	445	425	425	474	617	681	502
37 Pacific Southwest	0	0	0	0	181	235	87.4	63.3	0	0	0	0	0	0	47.1
38 Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39 Reserves & Losses	-893	-923	-794	-773	-902	-878	-884	-865	-845	-883	-768	-884	-1026	-1016	-883
40 Operating Reserves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41 Balancing Reserves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42 Transmission Losses	-893	-923	-794	-773	-902	-878	-884	-865	-845	-883	-768	-884	-1026	-1016	-883
43 Total Regional Resources	25531	26370	25485	24831	28974	28195	28379	27768	27126	28368	24676	28382	29339	29045	27499
44 Total Surplus/Deficit	-65.7	494	2310	2113	4179	82.8	297	1543	2444	4503	924	4966	4507	2502	2316

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Exhibit 5-3: Annual January 120-Hour Capacity

**Regional Analysis Surplus Deficit
Operating Year 2024 to 2033
Firm Water Condition**

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Loads and Resources - Pacific Northwest Region
Operating Year: 2024-2033 Water Year: P10 - January
2023 White Book - 30WY Report Date: 12/5/2022

S241-WB-20230209-155822

120Hr-MW	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Regional Loads										
1 Retail Loads	34526	34825	35084	35354	35632	35847	36020	36190	36331	36492
2 Federal Agency	232	240	246	248	252	254	255	255	256	256
3 USBR	201	201	201	201	201	201	201	201	201	201
4 Cooperative	4113	4267	4342	4461	4588	4633	4673	4700	4727	4752
5 Municipality	4226	4224	4248	4239	4215	4252	4259	4272	4269	4276
6 Public Utility District	7940	7992	8057	8133	8225	8328	8393	8456	8510	8548
7 Investor-Owned Utility	19202	19296	19386	19471	19552	19619	19676	19737	19805	19871
8 Marketer	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
9 Direct-Service Industry	65.4	65.4	65.4	65.4	65.4	65.4	65.4	65.4	65.4	65.4
10 Federal Diversity	-1456	-1462	-1465	-1467	-1468	-1509	-1504	-1498	-1505	-1482
11 Exports	1143	1143	1143	1143	1143	1143	1143	1143	1143	1143
12 Canada	1142	1142	1142	1142	1142	1142	1142	1142	1142	1142
13 East Continental Divide	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14 Inland Southwest	0	0	0	0	0	0	0	0	0	0
15 Pacific Southwest	0	0	0	0	0	0	0	0	0	0
16 Other	0	0	0	0	0	0	0	0	0	0
17 Total Regional Loads	35668	35968	36227	36496	36774	36989	37163	37333	37474	37634
Regional Resources										
18 Hydro	24046	24050	24120	23728	24120	23728	24120	23728	24120	23728
19 Regulated Hydro - Net	22255	22258	22329	22234	22329	22234	22329	22234	22329	22234
20 Independent Hydro - Net	1640	1640	1640	1342	1640	1342	1640	1342	1640	1342
21 Small Hydro - Net	151	151	151	151	151	151	151	151	151	151
22 Non-Hydro Renewable	182	182	182	182	182	182	182	182	182	182
23 Wind - Net	0	0	0	0	0	0	0	0	0	0
24 Solar - Net	0	0	0	0	0	0	0	0	0	0
25 Other - Net	182	182	182	182	182	182	182	182	182	182
26 Thermal	14910	14910	14106	14106	14106	14106	14106	14046	14106	14106
27 Nuclear - Net	1178	1178	1178	1178	1178	1178	1178	1178	1178	1178
28 Coal - Net	4195	4195	3392	3392	3392	3392	3392	3392	3392	3392
29 Natural Gas - Net	6288	6288	6288	6288	6288	6288	6288	6288	6288	6288
30 Petroleum - Net	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5
31 Biofuel - Net	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6
32 Cogeneration - Net	3179	3179	3179	3179	3179	3179	3179	3119	3179	3179
33 Imports	1065	1068	1071	1075	1078	1081	1085	150	150	150
34 Canada	155	155	155	155	155	155	155	150	150	150
35 East of Continental Divide	0	0	0	0	0	0	0	0	0	0
36 Inland Southwest	610	613	616	620	623	626	630	0	0	0
37 Pacific Southwest	300	300	300	300	300	300	300	0	0	0
38 Other	0	0	0	0	0	0	0	0	0	0
39 Reserves & Losses	-4085	-4086	-4046	-4032	-4062	-4047	-4075	-4027	-4055	-4037
40 Operating Reserves	-2063	-2056	-2038	-2035	-2054	-2051	-2067	-2061	-2076	-2070
41 Balancing Reserves	-878	-886	-886	-886	-886	-886	-886	-886	-886	-886
42 Transmission Losses	-1144	-1144	-1122	-1110	-1122	-1110	-1122	-1079	-1093	-1081
43 Total Regional Resources	36118	36123	35433	35059	35423	35049	35418	34079	34503	34129
44 Total Surplus/Deficit	449	155	-794	-1438	-1351	-1940	-1745	-3254	-2971	-3506

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Exhibit 5-4: Monthly 120-Hour Capacity

**Regional Analysis Surplus Deficit
Operating Year 2024
Firm Water Condition**

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Loads and Resources - Pacific Northwest Region
Operating Year: 2024 Water Year: P10
2023 White Book - 30WY (2001/P10) Report Date: 12/5/2022

S241-WB-20230315-141333

120Hr-MW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul
Regional Loads														
1 Retail Loads	31680	31372	27945	27569	30346	34101	34526	31858	30408	28528	28563	27489	30490	32359
2 Federal Agency	172	172	159	195	207	238	232	235	216	200	200	177	179	193
3 USBR	620	620	577	407	104	144	201	177	343	425	425	520	600	619
4 Cooperative	3670	3670	3309	3290	3559	4002	4113	3897	3698	3601	3601	3529	3715	3895
5 Municipality	3189	3189	2922	3220	3700	4219	4226	4032	3727	3415	3415	3006	3045	3210
6 Public Utility District	6408	6408	5795	6127	6899	7780	7940	7485	6981	6515	6515	5961	6149	6365
7 Investor-Owned Utility	18795	18795	16461	15623	17042	18929	19202	17479	16872	15779	15779	15506	17953	19186
8 Marketer	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
9 Direct-Service Industry	62.8	62.8	63.4	64.6	65.0	65.0	65.4	64.7	65.0	65.4	65.4	64.2	64.3	63.0
10 Federal Diversity	-1240	-1548	-1344	-1359	-1231	-1280	-1456	-1514	-1497	-1476	-1441	-1276	-1219	-1174
11 Exports	1519	1601	1460	1151	1143	1143	1143	1143	1143	1143	1151	1151	1460	1488
12 Canada	1201	1283	1142	1142	1142	1142	1142	1142	1142	1142	1142	1142	1142	1170
13 East Continental Divide	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14 Inland Southwest	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 Pacific Southwest	317	317	317	8.04	0	0	0	0	0	0	8.04	8.04	317	317
16 Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17 Total Regional Loads	33199	32973	29405	28720	31489	35243	35668	33000	31550	29670	29714	28639	31949	33847
Regional Resources														
18 Hydro	19826	21048	20711	20447	22370	23411	24046	23433	23158	20624	19793	23875	23091	22206
19 Regulated Hydro - Net	18066	19006	19162	18716	20983	22010	22255	21854	21561	18657	17693	21711	20918	20092
20 Independent Hydro - Net	1397	1682	1268	1534	1223	1245	1640	1415	1394	1648	1779	1723	1715	1675
21 Small Hydro - Net	363	361	280	197	164	156	151	164	203	319	320	441	459	439
22 Non-Hydro Renewable	193	193	193	194	193	193	182	194	193	193	193	194	192	192
23 Wind - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24 Solar - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 Other - Net	193	193	193	194	193	193	182	194	193	193	193	194	192	192
26 Thermal	14433	14434	14526	14668	14818	14904	14910	14836	14149	14032	12498	13271	13995	14437
27 Nuclear - Net	1163	1163	1179	1181	1179	1180	1178	1175	1177	1166	1166	1151	1154	1168
28 Coal - Net	4194	4194	4193	4194	4194	4195	4195	4195	4194	4194	4194	3861	4193	4193
29 Natural Gas - Net	5929	5929	5989	6084	6213	6282	6288	6224	6176	5772	4717	5615	5496	5932
30 Petroleum - Net	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5
31 Biofuel - Net	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6
32 Cogeneration - Net	3078	3078	3096	3141	3163	3177	3179	3173	2533	2832	2352	2576	3082	3075
33 Imports	942	942	799	739	986	1093	1065	1098	800	705	705	748	1016	1097
34 Canada	146	146	146	147	102	124	155	188	213	147	147	147	146	146
35 East of Continental Divide	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36 Inland Southwest	796	796	653	592	584	669	610	610	587	558	558	601	870	951
37 Pacific Southwest	0	0	0	0	300	300	300	300	0	0	0	0	0	0
38 Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39 Reserves & Losses	-3878	-3945	-3771	-3662	-3884	-4054	-4085	-3973	-3863	-3679	-3541	-3776	-3999	-4015
40 Operating Reserves	-1865	-1890	-1779	-1759	-1914	-2050	-2063	-1968	-1895	-1791	-1724	-1811	-1903	-1933
41 Balancing Reserves	-894	-894	-964	-877	-878	-878	-878	-878	-878	-878	-878	-878	-878	-878
42 Transmission Losses	-1119	-1160	-1028	-1026	-1092	-1126	-1144	-1127	-1091	-1010	-939	-1087	-1218	-1205
43 Total Regional Resources	31516	32672	32458	32386	34484	35547	36118	35587	34436	31875	29647	34311	34296	33917
44 Total Surplus/Deficit	-1683	-300	3053	3666	2995	304	449	2587	2886	2205	-66.5	5672	2346	69.7

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Exhibit 5-5: 30-Water Conditions Monthly Energy

**Regional Analysis Surplus Deficit
Operating Year 2024**

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Regional Report Surplus Deficit By Water Year
Operating Year 2024
2023 White Book - 30WY Report Date: **12/5/2022**
S241-WB-20230209-155822

Energy-aMW - Surplus Deficit	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
1 1989 Regional Report Surplus Deficit	1048	2663	2353	2113	4602	1628	906	281	4111	7914	9128	7491	6530	3491	3657
2 1990 Regional Report Surplus Deficit	1187	1259	2912	2784	6174	4224	5277	8719	5011	7696	7589	6827	10534	7174	5680
3 1991 Regional Report Surplus Deficit	4750	5077	3120	2844	9486	4794	6602	10030	7224	8498	5480	7434	9834	10009	6919
4 1992 Regional Report Surplus Deficit	5705	4767	2996	2601	4565	156	1128	3777	1807	3609	1697	5930	3639	1363	2977
5 1993 Regional Report Surplus Deficit	543	541	2490	1840	4053	82.8	-1051	-360	2981	5165	842	8725	7559	4688	2882
6 1994 Regional Report Surplus Deficit	2446	1917	3716	2740	4087	599	-578	1543	2444	3454	4859	5895	4507	2519	2810
7 1995 Regional Report Surplus Deficit	387	299	2672	2294	3967	1606	1615	5162	7606	5269	2346	6985	10604	6568	4422
8 1996 Regional Report Surplus Deficit	2806	2233	3839	4933	10592	11542	11104	14021	13607	10002	11126	9386	11177	10990	9502
9 1997 Regional Report Surplus Deficit	5359	5572	3754	3570	5725	5230	11547	13276	12313	11313	12464	12666	14208	11924	9279
10 1998 Regional Report Surplus Deficit	6562	6973	6144	8501	7851	3326	4421	7735	5517	5734	3848	10768	11178	7579	7040
11 1999 Regional Report Surplus Deficit	5426	3565	3747	2905	4271	4131	9082	9840	12496	9176	8830	8535	12035	11934	7696
12 2000 Regional Report Surplus Deficit	7331	7646	3484	3336	8798	6268	5968	7343	6922	9707	9295	7909	7295	5151	6612
13 2001 Regional Report Surplus Deficit	3430	1493	2905	2860	3676	-241	-923	1970	1274	3124	-653	2574	3115	1937	1892
14 2002 Regional Report Surplus Deficit	816	404	2310	1996	2857	1383	682	2095	3171	6653	7822	7129	10949	9013	4111
15 2003 Regional Report Surplus Deficit	2942	2864	3151	2481	4226	136	417	2998	5707	5970	4658	5779	9333	2502	3730
16 2004 Regional Report Surplus Deficit	-113	405	2467	2667	5338	2427	862	1285	2956	5113	3439	5868	7478	3597	3275
17 2005 Regional Report Surplus Deficit	-135	1621	3524	4027	5520	4291	3239	6364	3412	3115	1535	4966	6391	4607	4104
18 2006 Regional Report Surplus Deficit	1343	906	2851	2104	5263	2617	6995	9985	5934	10743	7990	10357	10448	6041	6059
19 2007 Regional Report Surplus Deficit	1346	743	3415	2172	5516	3038	5326	4942	10064	8792	5768	7116	7721	4914	5204
20 2008 Regional Report Surplus Deficit	1023	494	2872	2132	4204	909	1905	3383	3828	4292	924	8481	12441	8486	4325
21 2009 Regional Report Surplus Deficit	3407	3564	3306	2565	4967	501	4174	3143	1747	9118	6559	7503	8249	3629	4246
22 2010 Regional Report Surplus Deficit	674	-4.39	2990	2421	4192	1231	297	1538	1339	4503	629	3144	10860	6633	3115
23 2011 Regional Report Surplus Deficit	1953	1078	3236	2482	4179	3867	7423	10522	8708	13224	7355	9799	14280	14397	7536
24 2012 Regional Report Surplus Deficit	8140	5818	3933	3634	5154	2129	4420	6692	8631	12646	11996	9902	12091	12087	7320
25 2013 Regional Report Surplus Deficit	6043	5778	3320	2880	7163	5930	2909	4099	2894	11307	6046	8335	9581	6540	5679
26 2014 Regional Report Surplus Deficit	2345	1566	3658	3263	4336	459	4401	1801	9357	10528	7553	8550	9600	7971	5370
27 2015 Regional Report Surplus Deficit	4230	3368	3206	2745	7043	5802	6382	10091	10039	7906	2578	3127	3639	1150	5165
28 2016 Regional Report Surplus Deficit	-65.7	-10.7	2790	1981	3588	2212	2444	2606	9359	10517	9398	7663	5928	2830	4271
29 2017 Regional Report Surplus Deficit	485	503	2827	3293	8452	3048	5434	7827	14454	14576	11750	11956	12517	5696	7408
30 2018 Regional Report Surplus Deficit	4428	2864	2875	2804	4026	3090	7205	10317	8687	10241	8275	11303	10132	4949	6500
Ranked Averages															
31 Bottom 10 pct	-9987	-9578	-7078	-7069	-8207	-11811	-12756	-10308	-9347	-7144	-9197	-9536	-9137	-9376	
32 Middle 80 pct	-6477	-6264	-4141	-4264	-4433	-7781	-8291	-6111	-5180	-3046	-5140	-4758	-4121	-5244	4261

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Appendix A - Reports Available Upon Request oY2024 - 2033

1. Annual Energy

- 1.1. Federal Report Surplus/ Deficit – Annual
- 1.2. Regional Report Surplus/ Deficit – Annual
- 1.3. Regional Total Retail Load – Annual
- 1.4. Regional Exports – Annual
- 1.5. Regional Imports – Annual
- 1.6. Regional Intra-Regional Transfer – Annual
- 1.7. BPA Sales to Preference and Legacy Customers – Annual
- 1.8. Regional Regulated Hydro – Annual
- 1.9. Regional Independent Hydro – Annual
- 1.10. Regional Small Hydro – Annual
- 1.11. Regional Non-Hydro Renewable – Wind – Annual
- 1.12. Regional Non-Hydro Renewable – Solar – Annual
- 1.13. Regional Non-Hydro Renewable – Other – Annual
- 1.14. Regional Thermal – Nuclear – Annual
- 1.15. Regional Thermal – Coal – Annual
- 1.16. Regional Thermal – Natural Gas – Annual
- 1.17. Regional Thermal – Petroleum – Annual
- 1.18. Regional Thermal – Biofuel – Annual
- 1.19. Regional Thermal – Cogeneration – Annual
- 1.20. Non-Federal CER Deliveries to BPA – Annual
- 1.21. Federal Report Surplus/ Deficit by 80 Water Year – Annual
- 1.22. Regional Report Surplus/ Deficit by 80 Water Year – Annual

2. Monthly Energy

- 1.1. Federal Report Surplus/ Deficit – Monthly
- 1.2. Regional Report Surplus/ Deficit – Monthly
- 1.3. Regional Total Retail Load – Monthly
- 1.4. Regional Exports – Monthly
- 1.5. Regional Imports – Monthly
- 1.6. Regional Intra-Regional Transfer – Monthly
- 1.7. BPA Sales to Preference and Legacy Customers – Monthly
- 1.8. Regional Regulated Hydro – Monthly
- 1.9. Regional Independent Hydro – Monthly
- 1.10. Regional Small Hydro – Monthly
- 1.11. Regional Non-Hydro Renewable – Wind – Monthly
- 1.12. Regional Non-Hydro Renewable – Solar – Monthly
- 1.13. Regional Non-Hydro Renewable – Other – Monthly
- 1.14. Regional Thermal – Nuclear – Monthly
- 1.15. Regional Thermal – Coal – Monthly
- 1.16. Regional Thermal – Natural Gas – Monthly
- 1.17. Regional Thermal – Petroleum – Monthly
- 1.18. Regional Thermal – Biofuel – Monthly
- 1.19. Regional Thermal – Cogeneration – Monthly
- 1.20. Non-Federal CER Deliveries to BPA – Monthly
- 1.21. Federal Report Surplus/ Deficit by 80 Water Year – Monthly
- 1.22. Regional Report Surplus/ Deficit by 80 Water Year – Monthly



