BONNEVILLE POWER ADMINISTRATION

2012 Pacific Northwest Loads and Resources Study

October 2012

THIS PAGE INTENTIONALLY LEFT BLANK

Department of Energy

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

POWER SERVICES

February 8, 2013

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 snapshot of both the Federal system and the Pacific Northwest (PNW) region loads and resources for the upcoming ten year period. As such, the 2012 White Book provides a picture of both the Federal system and Pacific Northwest (PNW) region loads and resources for Operating Years (OY) 2014 through 2023 as of October 29, 2012.

The White Book serves several purposes: it analyzes BPA's load and resource conditions for sales and purchases; it develops information used by BPA in its Columbia River Treaty (Treaty) studies; and it provides regional information for customers, regional interests, and other planning entities. The White Book is not a guide for day-to-day operations of the Federal Columbia River Power System (FCRPS) nor is it used for determining BPA revenues or rates..

Starting with this 2012 White Book, BPA will only publish the document every other year (even years). This document includes four distinct studies:

- Federal System Analysis – a Federal forecast of firm loads and resources based on expected loads and critical water.

  For the 2012 White Book, the annual energy surplus/deficit forecasts under 1937-critical water conditions are relatively unchanged from the 2011 White Book. However, the January 120-hour capacity forecast under 1937-critical water conditions shows larger deficits over the entire study period for the Federal system compared to the 2011 White Book.

  Deficits identified in this analysis could be mitigated through actions discussed in the 2013 Resource Program to address the needs identified in the Needs Assessment study.

- Federal System Needs Assessment – a Federal forecast of energy, capacity, and ancillary services under multiple load scenarios (expected, high growth, and low growth, extreme weather event) and varying resource performance.

  This assessment is the foundation for defining the power supply obligation needs for the Resource Program which has been published simultaneously with the White Book.

  The analysis shows that under a variety of conditions and timeframes, BPA may need to supplement the existing Federal system to meet existing and projected firm power obligations.

  BPA's 2013 Resource Program analyzed the results of the Federal System Needs Assessment and describes options of how BPA plans to address these deficits. The Resource Program concluded that the majority of these deficits could be mitigated through the achievement of the Council's Sixth Power Plan conservation targets and market purchases.

- Federal System Resource Adequacy – provides multiple stochastic measures of the Federal system's ability to meet its aggregate energy and capacity demands at any time under many different combinations of conditions. This analysis is used by BPA as it continues to explore and advance its understanding of resource adequacy as it relates to the Federal system.

  BPA continues to investigate its draft resource adequacy metrics, as well as alternative metrics appropriate for large hydro-based systems. Additional analyses are required before establishing a metric and standard for the Federal system.

  PNW Regional Analysis – a regional forecast of firm loads and resources based on expected loads and critical water. The Regional annual energy surpluses forecasted under 1937-critical water conditions are slightly higher than the 2011 White Book. However, the January 120-hour capacity forecast under 1937-critical water conditions show smaller surpluses through OY 2019 and larger deficits from OY 2020 through the end of the study period, when compared to the 2011 White Book. The White Book assumes all PNW uncommitted IPPs are dedicated to serve PNW regional firm load.

  BPA is reviewing this forecast with other regional forecasts produced, particularly PNUCC's Northwest Regional Forecast and the Northwest Power & Planning Council's 6th Power Plan forecast. Deficits identified in this analysis could be mitigated through options discussed in the Council's Sixth Power Plan. Additional mitigation options have been discussed by the Council's Northwest Resource Adequacy Forum.

In addition, BPA is examining the concept of "system flexibility" in this 2012 White Book. BPA is interested in how the concept of flexibility can be further defined and measured and ultimately addressed and will continue to work in various regional forums to advance this topic.

BPA will publish a biennial summary update during the off years that contains only major changes in the Federal System Analysis and PNW Regional Analysis studies from the last White Book publication. All information currently contained in the Technical Appendices will continue to be available electronically.

Additional copies of the 2012 White Book can be obtained from BPA's Public Information Center, 1-800-622-4520. The Technical Appendices present regional loads, grouped by major PNW utility categories and detailed contract and resource information. The Technical Appendices are available only in electronic form. Both the White Book and the Technical Appendices are available on BPA's website at: *www.bpa.gov/power/whitebook*

Please send questions or additional comments to Tim Misley (503) 230-3942.

Sincerely,

/s/ Stephen R. Oliver

Stephen R. Oliver
Vice President, Generation Asset Management

Enclosure

2012 PACIFIC NORTHWEST LOADS AND RESOURCES STUDY
The White Book

BONNEVILLE POWER ADMINISTRATION
October 2012

Cover Picture:

Source: BPA Photo archive

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

Power Services Business Operations

Pacific Northwest Utilities Conference Committee

Northwest Power & Conservation Council

THIS PAGE INTENTIONALLY LEFT BLANK

Table of Contents

SECTION 1: EXECUTIVE SUMMARY 3

Planning Context 3
Sources of Uncertainty 4
Change in White Book Publication 4
Summary of Analyses and Results 5
Federal System Analysis 5
Federal System Needs Assessment 6
Federal System Resource Adequacy 7
Pacific Northwest Regional Analysis 8

SECTION 2: METHODOLOGY 11

Federal System Analysis (Section 3) 11
Federal System Needs Assessment (Section 4) 11
Federal System Resource Adequacy (Section 5) 11
Pacific Northwest Regional Analysis (Section 6) 12
Load Obligations 12
Hydro Resources Modeling 15
Hydro Capacity Modeling 17
Pacific Northwest Hydro Resources 18
Non-Hydro Resources 19
Reserves and Losses 19
Independent Power Producers 20

SECTION 3: FEDERAL SYSTEM ANALYSIS 21

Federal System Analysis Assumptions 21
Federal System Analysis Firm Load Obligations 21
Federal System Analysis Resources 24
Federal System Analysis Surplus/Deficit Projections 30
Variability of Federal System Analysis Surplus/Deficit Projections 32
Federal System Analysis Conclusion 33
Comparison to Previous White Books 33

SECTION 4: FEDERAL SYSTEM NEEDS ASSESSMENT 39

Federal System Needs Assessment Assumptions 39
Federal System Needs Assessment Load Scenarios 40
Major Changes from the 2010 Needs Assessment 42
Federal System Needs Assessment Metrics 42
Federal System Needs Assessment Results 43
Federal System Needs Assessment Conclusions & Next Steps 50

SECTION 5: FEDERAL SYSTEM RESOURCE ADEQUACY 53

Federal System Resource Adequacy Assumptions 53
Federal System Resource Adequacy Metrics 55
Federal System Resource Adequacy Results 57
Sensitivity of Results to Key Assumptions 63
Federal System Resource Adequacy Conclusions & Next Steps 64

SECTION 6: PACIFIC NORTHWEST REGIONAL ANALYSIS 65

PNW Regional Analysis Assumptions 65
PNW Regional Analysis Firm Energy Load Projections 65
PNW Regional Analysis Firm Resources 67
Potential Variability of PNW Regional Resources 70
PNW Regional Analysis Firm Energy Surplus/Deficit Projections 74
Potential Variability of PNW Regional Energy Surplus/Deficit Projections 76
PNW Regional Analysis Conclusion 78
Comparison to Previous White Books 79
Comparison to Council's Sixth Power Plan 82

SECTION 7: FEDERAL SYSTEM EXHIBITS 85

Exhibit 7-1: Annual Energy 87
Exhibit 7-2: Monthly Energy 91
Exhibit 7-3: Annual 120-Hour Capacity 95
Exhibit 7-4: Monthly 120-Hour Capacity 99
Exhibit 7-5: 80 Water Year Monthly Energy 103

SECTION 8: PACIFIC NORTHWEST REGIONAL EXHIBITS 107

Exhibit 8-1: Annual Energy 109
Exhibit 8-2: Monthly Energy 113
Exhibit 8-3: Annual 120-Hour Capacity 117
Exhibit 8-4: Monthly 120-Hour Capacity 121
Exhibit 8-5: 80 Water Year Monthly Energy 125

Section 1: Executive Summary

Planning Context

The White Book is a planning analysis produced by BPA that informs BPA of its load and resource conditions for sales and purchases. The White Book provides a 10-year look at the expected obligations and resources in the Federal system and PNW region. The White Book is used as a planning tool for the Columbia River Treaty (Treaty) studies, as an information tool for customers and regional interests, and as a publication of information utilized by other planning entities for their analyses. The White Book is not used to guide day-to-day operations of the Federal Columbia River Power System (FCRPS) or determine BPA revenues or rates.

This 2012 White Book includes forecasted retail loads, power supply obligations, and generating and contract resources for the Federal system and PNW region as of October 19, 2012. The PNW region is represented by BPA's marketing area as defined by section 3(14) of the 1980 Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act), P.L. 96-501, and includes Oregon, Washington, Idaho, Montana west of the Continental Divide, and portions of Nevada, Utah, and Wyoming that lie within the U.S. Columbia River drainage basin. The hydro generation estimates incorporate plant characteristics, streamflows, and non-power requirements from the Pacific Northwest Coordination Agreement (PNCA). Non-hydro resource capability estimates were provided by BPA, PNW Federal Agencies, public body, cooperative, and investor-owned utility (IOU) customers through direct submittals to BPA and/or annual Pacific Northwest Utilities Conference Committee (PNUCC) data submittals. This study does not reflect potential future climate change impacts on total retail loads (TRL) and resources.

Traditionally, this long-term power planning document focused on deterministic analysis for the Federal system and PNW region and showed annual and monthly energy and 1-hour and 120-hour capacity results. BPA, like the rest of the electric power industry, is looking at more comprehensive metrics and assessment of the power system. As such, the 2012 White Book has been expanded to incorporate both Federal System Needs Assessment and Federal System Resource Adequacy analyses to investigate these metrics. The Federal System Needs Assessment evaluates the ability of the existing FCRPS resources to meet projected firm load obligations under a specific set of conditions and timeframes (such as extreme weather, and varying economic conditions). The Federal System Resource Adequacy assessment provides a stochastic analysis of the Federal system's probability of meeting firm load under a variety of conditions. Further, in the absence of an industry standard definition and metric, BPA is developing the definitions and metrics needed to plan for the necessary level of system flexibility required to meet the emerging more dynamic load, operational reserve, and real time market needs on a long-term planning basis. As the flexibility provided by existing resources is exhausted and the challenges associated with integrating variable energy resources increase, these metrics will be essential in assuring an adequate and reliable power supply. In this 2012 White Book, BPA proposes the following definition as a standard for system flexibility:

The capability of a power system to deploy its resources to meet aggregate planned and unplanned variability in load and generation occurring at intra-minute, intra-hour, and intra-day time intervals.

BPA continues to improve its understanding of power system flexibility as it relates to the Federal system and PNW region through research and collaboration with other PNW utilities and organizations.

Sources of Uncertainty

The forecasts and studies presented in this document represent the best information currently available under each of the defined metrics. However, major changes in regional resources and power sales products could affect the magnitude, duration and timing of projected surpluses and/or deficits. Some of these uncertainties include:

- Federal system and PNW regional water availability that affects hydroelectric generation;
- Potential increases or decreases in loads due to economic conditions;
- Potential service to new public utilities, Department of Energy (DOE)-Richland vitrification plant operations, and Direct Service Industries (DSI);
- Changes in local, regional, and national economic conditions;
- Failure of existing or contracted generating resources to operate at anticipated times and output levels;
- Changes to Columbia River Treaty (Treaty) obligations;
- Availability of new and existing regional resources that can be purchased to serve firm load;
- Changes to hydro system operations in response to Endangered Species Act or other environmental considerations; and
- Future climate change impacts to loads and resources.

Change in White Book Publication

Beginning this year, BPA plans to produce and publish a complete White Book only every other year beginning in 2012. In addition, starting with this 2012 White Book (and every even year thereafter), BPA will include a Federal System Needs Assessment study and a Federal System Resource Adequacy. During the off years (odd years) BPA will publish a biennial summary update that contains only major changes to Federal system and PNW regional TRLs, power supply obligations, and generating and contract resources from the last White Book publication. All information currently contained in the Technical Appendices will continue to be available electronically on an annual basis, for all publications.

Summary of Analyses and Results

Following is a summary of the studies in this 2012 White Book. The overall methodology is described in Section 2. Please see the specific section for additional details on each study.

Federal System Analysis

The Federal System Analysis is an operating year (OY) analysis that provides a deterministic projection of BPA's firm loads and resources over a 10-year period. Firm load and resource forecasts are made for both energy and 120-hour capacity based on Federal system power sales contract (PSC) obligations, Federal system resources, and Federal system contracts (including power purchased from non-Federal resources). The study period for this analysis is OY 2014 through 2023.

Key Results

Energy: The annual energy surplus/deficit forecasts under 1937-critical water conditions are relatively unchanged from the 2011 White Book. Figure 1-1, below, shows a slight surplus in OY 2014 and deficits beginning in OY 2015 for the Federal system that continues through the end of the study period.

Figure 1-1

Federal System Surplus/Deficit Projections
For OY 2014 through 2023
Using 1937-Critical Water Conditions
Annual Energy in Average Megawatts

Energy (aMW)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
2012 White Book	11.5	-284	-169	-340	-280	-388	-367	-507	-434	-561

120-hour Capacity: The January 120-hour capacity forecast under 1937-critical water conditions, presented in Figure 1-2, page 6, shows larger deficits over the entire study period for the Federal system compared to the 2011 White Book. The primary reason for these larger 120-hour capacity deficits is due to the reshaped Grand Coulee operations in the hydro regulation. Grand Coulee's January through March operation has been reshaped to prevent the project from drafting too deeply for winter fish flow requirements based on input from USBR and the National Oceanic and Atmospheric Administration (NOAA). These are not new operating restrictions but estimates for simulating likely in-season management decisions. By reducing regulated flow in January under 1937-critical water conditions, these revised operations reduced the January 120-hour capacity of the Federal system by approximately 2,000 MW reshaping this flow into other months.

Figure 1-2

Federal System Surplus/Deficit Projections
For OY 2014 through 2023
Using 1937-Critical Water Conditions
January 120-hour Capacity in Megawatts

January 120-Hour Capacity (MW)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
2012 White Book	-788	-707	-675	-803	-904	-775	-953	-1,011	-1,161	-1,059

Conclusion

This Federal System Analysis illustrates the potential bounds (high and low) of the Federal System. Deficits identified in this analysis could be mitigated through actions discussed in the 2013 Resource Program to address the needs identified in the Needs Assessment study.

Federal System Needs Assessment

While the Federal System Analysis identifies the surplus/deficit under critical water for informational and planning purposes, this Needs Assessment examines five metrics for input into BPA's 2013 Resource Program. The Needs Assessment measures the expected generation capability of the existing Federal system resources to meet projected load obligations under a range of conditions and timeframes. The Needs Assessment does not discuss potential actions that BPA could take to meet any identified needs. Those are evaluated and discussed in BPA's Resource Program. For this 2012 White Book, BPA's Needs Assessment examines the potential needs associated with FY 2016 and 2021.

Key Results

The analysis shows that under a variety of conditions and timeframes, BPA may need to supplement the existing Federal system to meet existing and projected firm power obligations. These conclusions reflect additional limitations on the projected capability of the FCRPS to meet BPA's load obligations since the 2010 Needs Assessment analysis was performed. Specifically, updates to the hydro modeling assumptions have, in general, decreased the expected annual and winter FCRPS forecast generation. The 2012 Needs Assessment projects more significant deficits in the January-February timeframe, some improvement to the second half of August, and increased deficits in September relative to the 2010 Resource Program.

Under the ***expected*** case, modest annual energy deficits under 1937-critical water conditions are projected. In addition, there are significant deficits (both heavy load hour (HLH) and all hours) in several months at the 10th lowest percentile, notably January and February (winter) and Aug 16 and September (summer). Under the ***extreme*** weather scenario, BPA is minimal to no longer capacity surplus in winter or summer. Additionally, the Federal system is insufficient to meet the forecasted

99.5 percent level of service for balancing reserve requirements for FY 2016 and 2019. Since forecasts were not available for FY 2021, FY 2019 was used as a proxy in this analysis.

These results are subject to a wide range of uncertainty. Many variables that make up the uncertainties to meet Federal system firm power loads are noted above. Any combination of these factors may contribute to eliminating, reducing, or even increasing deficit projections in this analysis. BPA will continue to evaluate and update this analysis.

Conclusion

BPA's 2013 Resource Program analyzed the results of the Federal System Needs Assessment and describes options of how BPA plans to address these deficits. The Resource Program concluded that the majority of these deficits could be mitigated through the achievement of the Council's Sixth Power Plan conservation targets and market purchases. The Resource Program also discusses other actions BPA plans to take to address these deficits.

Federal System Resource Adequacy

The Federal System Resource Adequacy analysis is a fiscal year (FY) analysis that provides a stochastic simulation to assess the Federal system's probability of meeting firm load obligations under many different combinations of supply and demand. This analysis simulates many combinations of resource generation, due to variable water supply, wind generation, and forced outages against a varying firm load obligation, based on temperature. Given variations in these uncertainties, the analysis examines the planned adequacy of the Federal system in meeting BPA firm load obligations under many possible futures of supply and demand. For this 2012 White Book, BPA examines the Federal system's capability of meeting firm load obligations in FY 2016 and 2017.

Key Results

As shown by Figure 1-3, page 8, the annual loss-of-load probability (LOLP) is 2.4 percent in FY 2016 and 2.7 percent in FY 2017. Both results are within the acceptable range for the standards currently being considered for the Federal system. Droughts, particularly those lasting more than a year, are the primary driver of the worst games with January and February being the months of most concern. However, if long-term purchases to meet Above High Water Mark (AHWM) obligations are not finalized, or accessing the full amount of assumed market depth becomes more difficult, the annual LOLP increases significantly.

Figure 1-3

Federal System Resource Adequacy Projections
For FY 2016 and 2017
Annual Loss-of-Load Probability in Percent

Fiscal Year	2016	2017
2012 White Book	2.4%	2.7%

Conclusion

BPA continues to improve its understanding of resource adequacy as it relates to the Federal system. This analysis suggests that water supply, load obligations, and market depth are primary drivers of Federal Loss of Load Probability results. BPA continues to investigate its draft resource adequacy metrics, as well as alternative metrics appropriate for large hydro-based systems. Additional analyses are required before establishing a metric and standard for the Federal system.

Pacific Northwest Regional Analysis

The PNW Regional Analysis is an operating year analysis that provides a deterministic projection of the PNW region's firm loads and resources over a 10-year period. Firm load and resource forecasts are made for both energy and 120-hour capacity based on regional TRLs, contract obligations, and resources. This White Book analysis assumes that all regional Independent Power Producer (IPP) generation (energy and capacity) is available to meet regional firm load.

Key Results

Energy: Figure 1-4, below, shows the PNW regional annual energy surplus/deficit projections which portray slightly higher surpluses under 1937-critical water conditions than the 2011 White Book. This assumes all PNW uncommitted IPPs are dedicated to serve regional firm loads. The PNW uncommitted IPP energy forecast for OY 2014 is 3,285 aMW.

Figure 1-4

PNW Regional Surplus/Deficit Projections
For OY 2014 through 2023
Using 1937-Critical Water Conditions
Annual Energy in Average Megawatts

Energy (aMW)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
2012 White Book	3,704	3,275	2,973	2,642	2,557	2,136	1,888	1,036	417	90

Figure 1-5, below, shows the significant variability of PNW regional surplus/deficit projections depending on the level of IPP generation available to the region.

Figure 1-5

PNW Regional Surplus/Deficit Projections
Utilizing Different Levels of Uncommitted IPP Generation Available to the Region
Using 1937-Critical Water Conditions
Annual Energy in Average Megawatts

Energy (aMW)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
100% IPP (3,285 aMW)	3,704	3,275	2,973	2,642	2,557	2,136	1,888	1,036	417	90
50% IPP (1,643 aMW)	2,062	1,633	1,330	999	915	493	245	-606	-1,226	-1,553
0% IPP (0 aMW)	419	-10	-312	-643	-728	-1,149	-1,397	-2,249	-2,868	-3,195

120-hour Capacity: The January 120-hour capacity forecast under 1937-critical water conditions, shown in Figure 1-6, below, shows smaller surpluses through OY 2019 and larger deficits in OY 2020 through the end of the study period than the 2011 White Book. This assumes all PNW uncommitted IPPs are dedicated to serve PNW regional firm load. The PNW uncommitted IPP 120-hour capacity forecast for OY 2014 is 3,600 MW.

Figure 1-6

PNW Regional Surplus/Deficit Projections
For OY 2014 through 2023
Using 1937-Critical Water Conditions
January 120-hour Capacity in Megawatts

January 120-Hour Capacity (MW)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
2012 White Book	1,474	1,783	1,087	797	310	27	-465	-1,871	-2,607	-2,521

Conclusion

While not a Regional planning entity, this analysis presents BPA's view of the region. Projected regional deficits identified could be mitigated through options discussed in the Council's Sixth Power Plan. Additional views of mitigation options have been discussed by the Council's Northwest Resource Adequacy Forum.

Section 2: Methodology

Federal System Analysis *(Section 3)*

Energy: Annual and monthly firm energy surpluses and deficits are reported for the Federal system on an operating year basis (August through July) for OY 2014 through 2023 using a deterministic approach. These metrics reflect forecasted firm power load obligations, generating resources, transmission losses, and power contract sales and purchases. Surpluses and deficits are calculated for 1937-critical water conditions as well as all 80 historical water years of record to show the impacts of variability in hydro generation.

120-hour Capacity: Monthly 120-hour capacity surpluses and deficits are reported for the Federal system on an operating year basis for OY 2014 through 2023 using a deterministic approach. The 120-hour capacity metric reflects the average surpluses and deficits over the 6 highest heavy load hours per day, 5 days a week, for 4 weeks a month (6 x 5 x 4 = 120 hours). These metrics reflect forecasted firm load obligations, generating resources, transmission losses, operating and balancing reserves, and power contract sales and purchases. Surpluses and deficits are calculated for 1937-critical water conditions as well as all 80 historical water years of record to show the impacts of variability in hydro generation.

Federal System Needs Assessment *(Section 4)*

The Federal System Needs Assessment analysis provides multiple energy and capacity metrics for the Federal system on a fiscal year basis for FY 2016 and 2021. These metrics include annual energy deficits under 1937-critical water conditions, seasonal/monthly heavy load hour (10th percentile by month), 120-hour capacity (10th percentile by month), 18-hour capacity under extreme weather conditions, and reserves for ancillary services. The seasonal/monthly heavy load hour and 120-hour capacity metrics reflect the 10th lowest percentile of surplus/deficit projections by month.

Federal System Resource Adequacy *(Section 5)*

The Federal System Resource Adequacy analysis includes three draft metrics for the Federal system on a fiscal year basis (October through September) for FY 2016 and 2017. These stochastic metrics include the annual LOLP, monthly LOLP, and Conditional Value at Risk (CVaR). For this 2012 White Book, BPA has added the monthly LOLP metric to identify conditions that may produce significant monthly problems missed by the annual LOLP metric.

Pacific Northwest Regional Analysis *(Section 6)*

Energy: Annual and monthly firm energy surpluses and deficits are reported for the PNW region on an operating year basis for OY 2014 through 2023 using the same deterministic approach used in the Federal System Analysis. These metrics reflect forecasted TRLs, generating resources, transmission losses, and contract sales and purchases that leave or enter the PNW region. Surpluses and deficits are calculated for 1937-critical water conditions as well as all 80 historical water years of record to show the impacts of variability in hydro generation.

120-hour Capacity: Monthly 120-hour capacity surpluses and deficits are reported for the PNW region on an operating year basis for OY 2014 through 2023 using the same deterministic approach used in the Federal System Analysis. The 120-hour capacity metric reflects the average surpluses and deficits as previously discussed. These deterministic metrics reflect forecasted TRLs, generating resources, transmission losses, operating and balancing reserves, and contract sales and purchases that leave or enter the PNW region. Surpluses and deficits are calculated for 1937-critical water conditions as well as all 80 historical water years of record to show the impacts of variability in hydro generation.

Load Obligations

Federal system firm load obligations are based on BPA's 2008 Regional Dialogue (RD) Power Sales Contracts (PSCs) with Public Agency and Federal Agency customers. Under the PSCs BPA is obligated to provide power sold from October 1, 2011, through September 30, 2028. Three types of products were offered to customers: Load Following, Slice/Block, and Block. One hundred eighteen customers signed the Load Following service contract, 17 signed the Slice/Block service contract, and no customers signed the Block only service contract. Under these power contracts, customers must make periodic elections pertaining to serving future load growth by customers either 1) adding new non-Federal resources, or 2) buying power from sources other than BPA, and/or 3) requesting BPA to supply power for load. These elections are reflected in the customer load forecasts for the Federal system. BPA includes these customer elections in calculating its firm load forecast produced by the Agency Load Forecasting (ALF) system. This ALF system is based on a combination of historical electricity consumption, data from the expired Subscription PSCs, and new data submittals. ALF uses a statistical approach that is based on time-series-based regressions that reflect a fundamental assumption that historical retail electricity consumption patterns will continue into the future.

The PNW Regional Analysis incorporates TRL forecasts for PNW Public Agencies, USBR, IOUs, and DSIs. The TRL forecasts for some Public Agency customers incorporate data submitted to BPA through their PNUCC submittals or TRL forecasts furnished directly to BPA. TRL forecasts reflect normal weather conditions, unless noted, and do not reflect assumptions on future climate change impacts.

ALF forecasting methods allow load forecasts to be influenced by heating and cooling weather conditions and explicitly model new industrial production sites in a customer's service territory.

Load Following Regional Dialogue Power Sales Contracts: The Load Following product provides firm power to meet the customer's TRL, less the firm power from the customer's non-Federal resource generation and purchases from other suppliers used to serve its TRL, if any. The total RD PSC load obligation for the Load Following product is forecast by totaling the PSC's firm requirement load obligations for all BPA Load Following customers.

Slice/Block Regional Dialogue Power Sales Contracts: The Slice/Block product provides firm power to serve the customer's TRL up to its planned net requirement. The Block portion provides a planned amount of firm requirements power in a fixed monthly shape, while the Slice portion provides planned amounts of firm power in the shape of BPA's generation from the Tier 1 System. The total RD PSC service obligation for the Block portion is forecast by totaling the Block obligations for all customers. The total RD PSC service obligation for the Slice portion is forecast by multiplying the forecast monthly Tier 1 System output by the sum of the individual customers' Slice Percentages as stated in their Slice/Block power contracts.

United States Bureau of Reclamation: BPA is obligated by statute to provide power from the Federal system to several irrigation facilities and districts associated with USBR projects in the PNW. These irrigation districts have been congressionally authorized to receive power from specified FCRPS projects as part of the USBR project authorization. BPA does not contract directly with these irrigation districts; instead, there are several agreements between BPA and USBR that provide details on these power deliveries.

Investor-Owned Utilities: BPA's power supply obligations to the IOUs are based upon the IOUs' "Bridge" New Resource Firm Power Block PSCs (Bridge NR Block contracts) and their Residential Exchange Program Settlement Implementation Agreements (REPSIA). Under the IOUs' Bridge NR Block contracts, the IOUs have a contractual right, but no obligation, to place a requirements load obligation on BPA under section 5b(1) of the Northwest Power Act. To date, no IOU has requested to buy power from BPA to serve its load. As such this study assumes that no Federal system power deliveries will occur through the study horizon. The IOUs also are currently engaging in exchanges with BPA pursuant to section 5(c) of the Northwest Power Act under their REPSIAs. Although the exchange is described as a simultaneous exchange of power, BPA has traditionally implemented it as a financial transaction. This study assumes that the Residential Exchange Program will continue to be implemented as a financial transaction for the period covered by this study.

Direct Service Industries: The TRL forecasts for DSIs within the PNW incorporate current and future estimates of industrial and economic conditions for specific DSIs. BPA is currently making power sales deliveries to Alcoa, Inc. (Alcoa) and Port Townsend Paper Corporation (Port Townsend). Port Townsend's current contract with BPA runs through September 30, 2022, and the 2012 White Book shows service to Port Townsend through that timeframe. Additionally, the White Book also incorporates a new contract with Alcoa for 300 aMW that continues through September 30, 2022. As a result, the White Book shows 312 aMW of Federal system power sales to DSIs through September 30, 2022.

Other Contracts: BPA and other PNW regional generators provide power to customers under a variety of contract arrangements not included in the Public Agencies, USBR, IOU, or DSI forecasts. These contracts include obligations outside the PNW region (exports) and obligations within the PNW region. These contract sales were updated as of October 19, 2012. All existing contract sales not included under BPA's regional net requirements service PSCs follow individual contract terms through expiration and are not assumed to be renewed.

Canadian Entitlement Return: Under the terms of the Treaty, the downstream power benefits provided by the construction of three large storage projects in Canada are shared equally between the United States and Canada. The Canadians' share of benefits is called "Canadian Entitlement". The Determination of Downstream Power Benefits analysis is performed annually and establishes the amount of downstream power benefits for each succeeding sixth year. Under the Treaty, BPA and each of the non-Federal mid-Columbia project owners are obligated to return their share of the downstream power benefits owed to Canada in proportion to the benefit they receive. The non-Federal Canadian Entitlement obligations are delivered to BPA, which, in turn, delivers the Federal and non-Federal participants' obligations to Canada. BPA's delivery of the Canadian Entitlement Return obligation to Canada is a U.S. treaty obligation and is considered a Federal system obligation that is shown as a BPA and PNW regional export.

Conservation: The Federal system firm load obligations forecast includes an embedded projection of programmatic conservation savings established under BPA conservation programs. For the 2012 White Book studies a historic embedded annual conservation savings of approximately 56 aMW is assumed throughout the study period. Additionally, 4 aMW of annual incremental conservation is also embedded in the forecast, as new planned conservation.

Hydro Resources Modeling

The Hydrosystem Simulator (HYDSIM) model estimates the energy production that can be expected from regulated hydroelectric power projects in the PNW Columbia River Basin. For the 80 historical water years of record (1929 through 2008) that are modeled, hydro energy production is maximized by coordinating hydro operations while continuing to meet power and non-power requirements. HYDSIM produces results for 14 periods, which are composed of 10 complete months plus April and August split into two half-months. April and August are each divided in half because natural streamflows often change significantly during these months. Key changes in operating constraints, such as flood control elevations and fish migration streamflows, also occur during the middle of April. Consequently, hydro system capability sometimes differs significantly between the beginning and end of these months. For simplicity, these 14-period results are referred to as "monthly" values in this report.

The HYDSIM studies incorporate the power and non-power operating requirements expected to be in effect, including those described in the National Oceanographic and Atmospheric Administration (NOAA) Fisheries FCRPS Biological Opinion (BiOp) regarding salmon and steelhead, published May 5, 2008; the NOAA Fisheries FCRPS BiOp Amendment, published May 20, 2010; the U.S. Fish and Wildlife Service (USFWS) FCRPS BiOp regarding bull trout and sturgeon, published December 20, 2000; the USFWS Libby BiOp regarding bull trout and sturgeon, published February 18, 2006; relevant operations described in the Northwest Power and Conservation Council's (NPCC) Fish and Wildlife Program; and other fish mitigation measures. Each hydro regulation study specifies particular 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 efficiency requirements.

2010 Level Modified Streamflows: The HYDSIM model uses streamflows from historical years as the basis for estimating power production from the hydroelectric system. This study uses the 2010 level of modified historical streamflows which was published in August 2011. These data reflect historical estimates of 1929 through 2008 unregulated streamflows assuming estimated irrigation depletions from 2010. This study also expands the number of hydro conditions modeled in the study. Hydro generation estimates depicted in the 2011 White Book were from a 70 historical water year data set. This update was not just 10 years of new streamflow data added to the previous 70 historical water year data set; rather, it is an entirely new data set that revised the previous 70 water years of streamflows to the same 2010 level of irrigation depletions and added 10 more years of streamflow data. All 80 historical water years of streamflows are modeled to forecast the expected operations of the hydroelectric system under varying hydro conditions.

Pacific Northwest Coordination Agreement Hydro Operating Characteristics: The PNCA coordinates the planning and operation of member power systems in the PNW Columbia River Basin. All PNCA project owners provide physical plant data and all power and non-power constraints in an annual data submittal. BPA

incorporates this project data into HYDSIM to simulate the operation of the PNW hydro system.

Columbia River Treaty Operations: The Treaty between the United States and Canada enhanced the volume of storage in the Columbia River Basin with the construction of three large storage projects in Canada. These projects provide downstream power benefits by increasing the firm power generating capability of U.S. hydro projects. The Treaty calls for 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, 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. As the DOP is usually completed a few months prior to the operating year, Canadian operations included in this 2012 White Book are based on the official 2014 AOP and 2015 AOP studies with a few modifications to reflect updates expected in the official DOP studies.

Non-Treaty Storage Agreement Operations: The Non-Treaty Storage Agreement (NTSA) allows additional shaping of Columbia River flows for power and fish operations by utilizing non-Treaty storage in Canadian reservoirs. The NTSA allows water to be released from Canadian non-Treaty 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 are being met with a subsequent release of water in the summer. These operations have been included in this study based on the long-term agreement signed with B.C. Hydro in April 2012.

Balancing Reserves: To ensure sufficient intra-hour balancing reserves, ***Incremental*** balancing reserves were modeled by reducing the maximum amount of generation at several projects, reserving some of the generation in case generation needs to increase when incremental reserves are called upon. ***Decremental*** balancing reserves require that the system be able to decrease generation on command, and thus the system must generate above its normal minimum generation level. Therefore, decremental reserves were modeled as an increase to the minimum generation level at the Federal system hydro projects that might carry these reserves. Incremental and decremental balancing reserve amounts of 900 MW and 1,100 MW, respectively, were used to represent the balancing reserves supplied by the Federal system. These amounts are based on the Federal system balancing reserve limits presented in the BP-14 Rate Case Generation Inputs workshop on August 8, 2012.

Other Significant Hydro Modeling Changes: Hydro regulation studies are updated on a regular basis to reflect the best information available. This 2012 White Book includes a significant modeling update to Grand Coulee operations to better reflect expected actual operations. Grand Coulee's January through March operation has been reshaped to prevent the project from drafting too deeply for winter fish flow requirements based on input from USBR and NOAA. These are not new operating restrictions but estimates for simulating likely in-season management decisions. Although not described here, numerous other standard hydro modeling updates are included in the 2012 White Book studies. These minor

updates are consistent with the BP-14 Initial Rate Proposal which describes these modeling updates in detail.

Use of Critical Water for Firm Planning: To ensure sufficient generation to meet load, BPA bases its resource planning on critical water conditions. Critical water conditions are 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, BPA considers critical water conditions to be the eight month critical period of September 1936 through April 1937. However, for planning purposes in the White Book the "critical period" is represented by the historical streamflows from August 1936 through July 1937. The hydro generation estimates under 1937-critical water conditions determine the critical period firm energy for the regulated and independent hydro projects.

Hydro Capacity Modeling

BPA uses its Hourly Operating and Scheduling Simulator (HOSS) model to simulate the relationship of hydro energy to hydro peaking capability for Federal resources. The hydro peaking capability assumes monthly heavy load hour hydro generation is maximized and is not an indication of the Federal hydro system's ability to react to system distress. This relationship was simulated for a variety of hours per month over the sequence of the 80 historical water years. Two separate capacity methodologies are discussed in this 2012 White Book, with the 18-hour capacity included in the Needs Assessment and the 120-hour capacity included in the Federal System Analysis, Federal System Needs Assessment, and PNW Regional Analysis. The 1-hour capacity forecasts are included in the Technical Appendix for informational purposes only.

1-Hour (Instantaneous) Hydro Capacity: Monthly 1-hour capacity forecasts for Columbia River Basin regulated and independent hydro projects are based on individual project full-gate-flow maximum generation at mid-month reservoir elevations over the sequence of 80 historical water years. The 1-hour hydro capacity estimates, however, do not consider the ability of the hydro system to sustain generation levels needed to meet day-to-day and month-to-month hydro operations. This inability to sustain full hydro capacity is because there are more hydro generating units than fuel (water) available to operate all units on a continuous basis. For this reason, other methodologies are used to produce hydro capacity estimates that better reflect the actual ability to generate the hydropower needed to meet expected peak firm load obligations throughout each month given quantities of water available.

18-Hour Capacity: The 18-hour capacity forecasts reflect the Federal system's hydro generating capability over the 6 highest load hours per day during a three-day weather event. Extreme weather events are modeled in February (cold snap) and the second half of August (heat wave) as these periods tend to be the most limited.

120-Hour Capacity: The 120-hour capacity forecast for the hydro system uses the monthly distribution of reservoir storage and streamflow runoff to maximize energy and capacity production while meeting non-power requirements and firm load obligations throughout the month. The 120-hour capacity forecasts take into account forecasted scheduled hydro maintenance and operating and balancing reserves, which are netted out for reporting purposes. The 120-hour capacity represents the average over the 6 highest heavy load hours per day, 5 days a week, for 4 weeks a month (6 x 5 x 4 = 120 hours).

Capacity or Energy: Capacity methods shown in these analyses are calculated over specific timeframes (i.e. 120-hour, 18-hour, or 1-hour). These capacity metrics are created by evaluating energy components over a specific period of time. In the case of instantaneous, it is simply a maximum at a moment, while the 120-hour is energy averaged over 120 peak hours (6 hours per day, 5 days per week, for 4 weeks). Similarly, the 18-hour is energy averaged over 18 hours (6 hours per day for 3 consecutive days). Therefore capacity can be can be expressed as either capacity in megawatts (MW) or as an energy over peak load hours in average megawatts (aMW).

Pacific Northwest Hydro Resources

Hydro resource forecasts in the White Book are produced using three different methods. 1) Regulated hydro generation estimates are provided by the HYDSIM model. 2) Independent hydro forecasts are usually provided by individual project owners for the same 80 historical water conditions. 3) Small hydro projects are provided by individual project owners but do not vary by water condition.

Regulated Hydro Generation: The HYDSIM model is used to estimate the energy production that can be expected from specific hydroelectric power projects in the PNW Columbia River Basin when operating in a coordinated fashion and meeting power and non-power requirements over the sequence of 80 water years. The hydro projects modeled in HYDSIM are called regulated hydro projects. These projects include the 14 largest projects in the Federal system, the mid-Columbia projects, and other major projects in the PNW. The hydro regulation study uses individual project operating characteristics and conditions to determine energy production expected from each specific project. The HYDSIM model provides project-by-project monthly energy generation estimates for the regulated hydro projects that vary by water year.

Independent Hydro: Independent hydro includes smaller hydro projects whose generation output typically varies by water condition. These projects are not modeled or regulated in the HYDSIM model. Independent hydro generation estimates are provided by individual project owners for the sequence of 80 water years. The independent hydro generation forecast can vary by water year and study year.

Small Hydro: Generation estimates for the small hydro projects are provided by individual project owners and are assumed to not vary by water year.

Non-Hydro Resources

Thermal, Cogeneration, and Non-Wind Renewable Resources: These projects include nuclear, coal, gas-fired, cogeneration, and renewable resources such as geothermal, solar, and biomass projects. Generation forecasts are based on the energy and capacity capability information submitted to BPA by individual project owners. Total plant output is reduced to account for scheduled maintenance and operating reserves held for spinning and non-spinning. Columbia Generating Station (CGS), large thermal (nuclear), has a biennial scheduled refueling outage in odd years throughout the study period.

Wind Resources: The annual firm wind methodology uses historical wind generation and a statistical model of PNW wind generation based on historical weather data to estimate historical generation for all PNW wind projects currently operational. The operating year with the lowest total PNW wind generation is selected as the firm wind year. Each project's monthly generation (actual or estimated) during the firm wind year becomes its wind energy forecast. This new methodology only provides the wind generation forecasts included in the Federal system and PNW regional energy analyses. Consistent with previous White Books, the Federal system and PNW regional capacity analyses still assume no capacity contribution from wind generation.

Other Resource Contracts: Federal system or regional contract purchases and imports into the PNW region are treated as resources. These contract purchases were updated as of October 19, 2012. All existing Federal system and regional contract purchases follow individual contract terms through expiration and are not assumed to be renewed.

Reserves and Losses

Operating Reserves: The White Book includes hydro capacity reductions for operating reserves that contain contingency reserves and balancing reserves. 1) Contingency reserves (spinning and non-spinning) represent the reserves that respond to the unforeseen loss of a resource. The contingency reserve obligation is calculated by summing 3 percent of forecast load and 3 percent of forecast generation. 2) Balancing reserves (regulating, load following, and generation/energy imbalance) represent the reserves dedicated to maintain within-hour load-resource balance, including reserves for wind integration. Modeling of incremental and decremental balancing reserves, including those for wind integration, is described in Section 2: Methodology, Hydro Resources Modeling, Balancing Reserves on page 15. The reserve forecasts included in this 2012 White Book are consistent, in calculation and assumption with the BP-14 Initial Rate Proposal.

Transmission Losses: Transmission losses involve several components that combine to give the estimate of losses typically associated with system generation. In the White Book, transmission loss estimates are calculated on a monthly basis and vary by water condition. The loss factors for the transmission system are applied to generation, 2.82 percent for energy and 3.35 percent for peak deliveries when averaged over the year. Transmission losses are treated as a resource reduction.

Independent Power Producers

Generation forecasts are based on the energy and capacity capability information submitted to BPA by the project owners or, for wind resources, the annual firm wind methodology. Uncommitted PNW IPP projects that have been built or that are under construction are assumed to be dedicated to meet PNW regional firm loads unless otherwise specified.

Section 3: Federal System Analysis

Federal System Analysis Assumptions

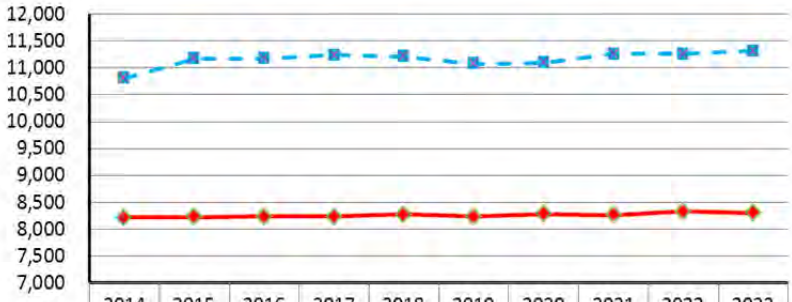
The Federal System Analysis is based on Federal system resources, Federal contracts, including power purchased from non-Federal resources, and Federal PSC's as of October 19, 2012. This analysis is based on the assumptions and methodologies discussed in Section 2: Methodology, starting on page 11. Additionally the Federal System Analysis includes an additional 29.7 aMW of BPA-funded conservation identified in the BP-14 Initial Rate Proposal, over the FY 2014-2015 rate period.

Federal System Analysis Firm Load Obligations

Federal system firm loads continue to change over the study period; these changes are in both annual energy and monthly shape of the firm requirements loads over the year. BPA's RD PSC forecasts project load growth for both Load Following and Slice/Block customers. Federal system firm load obligation forecasts assume that BPA will be serving the same percentage of load growth reflecting customer elections made under their PSCs. This is forecasted at an average annual growth rate of approximately 0.8 percent over the study period. While the PSC firm requirements load continues to increase over the study period, exports and intra-regional transfers show reductions as current contracts and settlement agreements expire in OY 2015 through 2018. These include surplus Federal PSCs with the Cities of Pasadena and Riverside, a wind energy shaping contract with Pacific Gas and Electric(PG&E), and the WNP-3 settlements with Avista Corporation (Avista) and Puget Sound Energy (Puget). When all of these factors are considered, the total Federal system firm load obligations remain relatively flat over the study period. Figure 3-1, page 22, shows the firm annual energy obligation forecast between 8,216 aMW and 8,323 aMW over the study period. The Federal system firm 120-hour capacity load obligation for is between 10,809 MW and 11,323 MW over the same period.

Figure 3-1

Federal System Firm Load Obligations
For OY 2014 through 2023
Annual Energy and January 120-Hour Capacity



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Energy (aMW)	8,216	8,222	8,230	8,227	8,273	8,232	8,274	8,259	8,323	8,300
January 120 Hour Cap (MW)	10,809	11,174	11,172	11,241	11,214	11,079	11,099	11,263	11,262	11,323

While looking at the Federal system firm obligations on an annual basis gives a picture of what is happening annually over the study period, it does not provide a picture into how the total firm load obligation is shaped monthly during the year. Figures 3-2 and 3-3, page 23, illustrate the monthly shape of the forecasted Federal system firm load obligation. Monthly average energy and 120-hour capacity are projected to maintain a similar monthly shape over the study period, with the highest loads being forecasted during the normal winter cold temperatures (November through February) and the lowest loads being forecasted in September, October, April and June with milder temperatures.

Figure 3-2

Federal System Firm Load Obligations
For OY 2014 through 2023
Monthly Energy in Average Megawatts

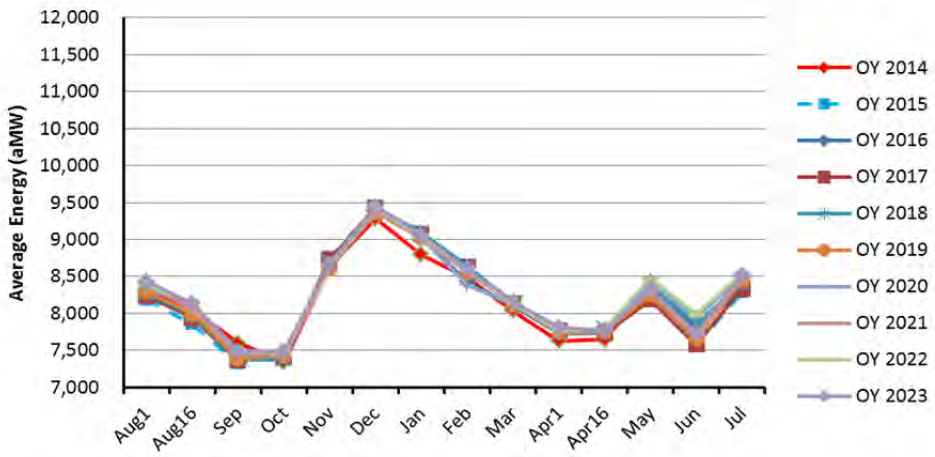
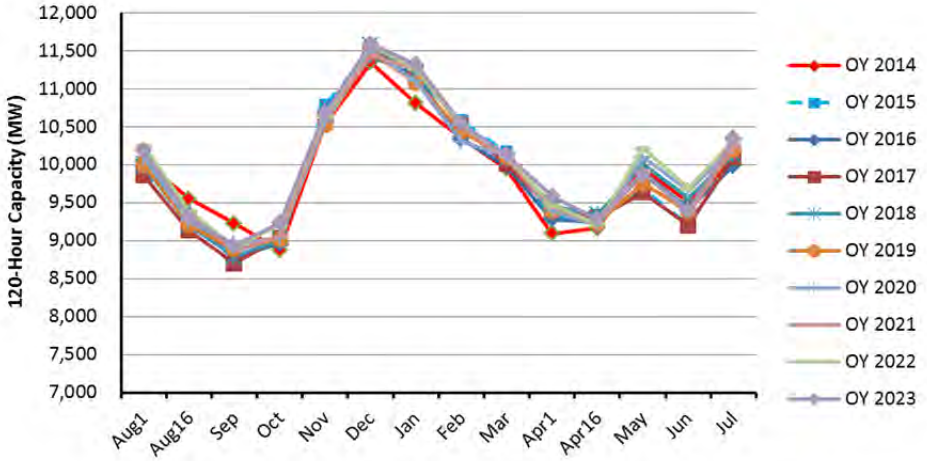


Figure 3-3

Federal System Firm Load Obligations
For OY 2014 through 2023
Monthly 120-Hour Capacity in Megawatts



Federal System Analysis Resources

The Federal system includes resources with a range of different fuel and generation types. Figure 3-4, below, summarizes the resources and contract purchases available to BPA to meet the Federal system firm load obligations for OY 2014. Federal system firm energy resources are comprised of approximately 82 percent hydro, 12 percent nuclear, 5 percent contract purchases and 1 percent renewables (which is supplied by wind and a small amount of solar).

Figure 3-4

Federal System Resources†
For OY 2014
Under 1937-Critical Water Conditions
Annual Energy and January 120-Hour Capacity

Project Type	Annual Energy (aMW)	Percent of Firm Energy	January 120-Hour Capacity (MW)	Percent of Capacity
Hydro	6,917	81.7%	11,283	87.1%
Nuclear	1,030	12.2%	1,130	8.7%
Cogen	19	0.2%	12	0.1%
Small Hydro	3	0.0%	3	0.0%
Renewables	60	0.7%	0	0.0%
Contract Purchases	437	5.2%	529	4.1%
Total Federal Resources	**8,466**	**100.0%**	**12,958**	**100.0%**

† Federal resource estimates are before adjustments for reserves and transmission losses.

The resources summarized above are shown in detail on the following pages. The Federally owned hydro resources from which BPA markets firm and non-firm power are detailed in Figure 3-5 on page 25. BPA also markets firm power purchased from non-Federally owned resources and firm power purchase contracts. These non-Federally owned resources are detailed in Figure 3-6 on page 26.

Figure 3-5

Federally Owned Hydro Resources
Energy and Capacity for OY 2014

Project	Initial Year of Service	Number of Units	Nameplate Rating (MW)	Firm Energy† (aMW)	120-Hour January Capacity†† (MW)
Regulated Hydro					
Albeni Falls	1955	3	49	24	25
Bonneville **	1938	20	1,195	404	921
Chief Joseph	1955	27	2,614	1,142	2,408
Dworshak	1974	3	465	143	434
Grand Coulee	1941	27	6,735	1,988	5,340
• GCL Pump Generation	1973	6	314		
Hungry Horse	1952	4	428	76	319
Ice Harbor	1961	6	693	157	586
John Day	1968	16	2,480	817	2,295
Libby	1975	5	605	181	483
Little Goose	1970	6	930	178	859
Lower Granite	1975	6	930	174	737
Lower Monumental	1969	6	930	182	810
McNary	1953	14	1,120	486	1,036
The Dalles	1957	24	2,052	486	1,036
Idle Capacity Reduction					-8,376
Total Regulate Hydro Resources		**173**	**21,540**	**6,439**	**8,913**
Independent Hydro					
Anderson Ranch	1950	2	40	13	4
Big Cliff	1954	1	21	10	3
Black Canyon	1925	2	10	6	3
Boise Diversion	1908	3	3	1	0
Chandler	1956	2	12	6	4
Cougar	1964	2	28	19	6
Detroit	1953	2	115	33	103
Dexter	1955	1	17	9	3
Foster	1968	2	23	12	3
Green Peter	1967	2	92	27	8
Green Springs	1960	1	18	7	7
Hills Creek	1962	2	34	18	4
Lookout Point	1954	3	138	35	8
Lost Creek	1975	2	56	30	44
Minidoka	1909	4	28	11	2
Palisades	1957	4	176	69	9
Roza	1958	1	13	7	2
Total Independent Hydro Resources		**36**	**824**	**314**	**213**
Total Federally Owned Hydro Resources		**209**	**22,364**	**6,753**	**9,126**

† Firm energy is a 12-month annual average for OY 2014 assuming 1937-critical water conditions.

†† This is the 120-hour hydro generation for January 2014 assuming 1937-critical water conditions.

Figure 3-6

Non-Federally Owned BPA Resources and Contracts
Energy and Capacity for OY 2014

Project	Type	Operator	Initial Year of Service	Firm Energy† (aMW)	120-Hour January Capacity†† (MW)
Hydro					
Cowlitz Falls	Hydro	Lewis County PUD	1994	26.2	10.0
Idaho Falls Bulb Turbines	Hydro	Idaho Falls Power	1982	14.0	22.3
1. Total Non-Federally Owned BPA Hydro Resources				**40.2**	**32.3**
Nuclear					
Columbia Generating Station	Nuclear	ENW	1984	1030.0	1130.0
2. Total Non-Federally Owned BPA Nuclear Resources				**1030.0**	**1130.0**
Cogen					
Georgia Pacific Paper Wauna	Cogen.	Georgia Pacific	1996	19.2	24.0
3. Total Non-Federally Owned BPA Cogen Resources				**19.2**	**24.0**
Small Hydro					
Dworshak/Clearwater Small Hydro	Hydro	State of Idaho DWR	2000	2.6	3.0
Rocky Brook	Hydro	Mason PUD No 1	1999	0.3	1.6
4. Total Non-Federally Owned BPA Small Hydro Resources				**2.9**	**4.6**
Renewables - Wind					
Condon Wind Project	Wind	Condon Wind Project, LLC	2002	9.6	0.0
Foote Creek 1	Wind	Foote Creek 1, LLC	1999	4.0	0.0
Foote Creek 2	Wind	Foote Creek 2, LLC	1999	0.5	0.0
Foote Creek 4	Wind	Foote Creek 4, LLC	2000	4.4	0.0
Klondike Phase I	Wind	NW Wind Power	2001	6.8	0.0
Klondike Phase III	Wind	NW Wind Power	2007	14.2	0.0
Stateline Wind Project	Wind	PPM, FLP	2001	20.7	0.0
Renewables - Other					
Fourmile Hill Geothermal †††	Geo.	Calpine	Unknown	0.0	0.0
Ashland Solar Project	Solar	City of Ashland, OR	2000	0.0	0.0
White Bluffs Solar	Solar	Energy Northwest	2002	0.0	0.0
5. Total Non-Federally Owned BPA Renewable Resources				**60.3**	**0.0**
Firm Contracts					
Canadian Entitlement for Canada (non-Federal)				136.4	239.0
Canadian Imports				30.6	1.0
Pacific Southwest Imports				22.1	72.2
Inland Southwest Imports				0.0	0.0
Eastern Imports				0.0	0.0
Intra-Regional Transfers In (Pacific Northwest Purchases)				210.9	512.0
Slice Transmission Loss Returns				36.6	50.7
6. Total BPA Firm Contracted Resources				**436.6**	**874.9**
7. Transmission Loss Returns				**-238.7**	**-347.3**
Total Non-Federally Owned BPA Resources and Contracts (1+2+3+4+5+6+7)				**1350.5**	**1718.4**

† Firm energy is a 12-month annual average for OY 2014, hydro resources assume 1937-critical water.

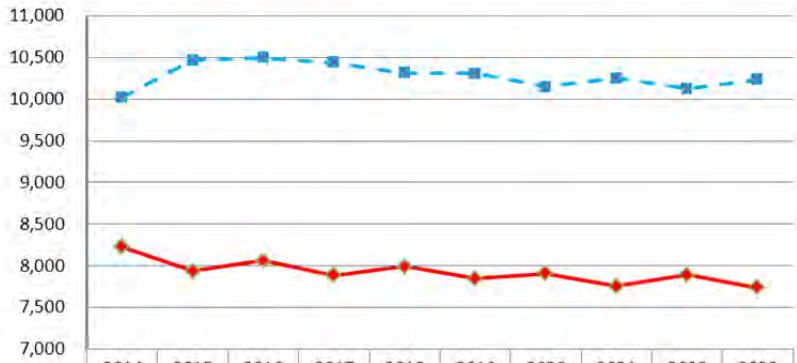
†† This is the 120-hour hydro generation for January 2014, hydro resources assume 1937-critical water.

††† Fourmile Hill is assumed to be not in operation within the study period.

There are modest changes in the Federal system resource stack and generation forecasts over the study period, shown below in Figure 3-7. In general, the Federal system firm energy and 120-hour capacity resource forecasts decline through the study period, based on contract and settlement agreements expiring in the OY 2015 through 2018 timeframe. These include surplus power contracts with the Cities of Pasadena and Riverside, Georgia-Pacific Paper (Wauna), a wind energy shaping contract with PG&E, the WNP-3 settlements with Avista and Puget, and the purchased output from the Idaho Bulb Turbine hydro projects. Along with the expiration of long-term contracts, resource forecasts change on an annual basis driven by issues such as maintenance, refueling, and capital improvements.

Figure 3-7

Federal System Resources
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Annual Energy and January 120-Hour Capacity

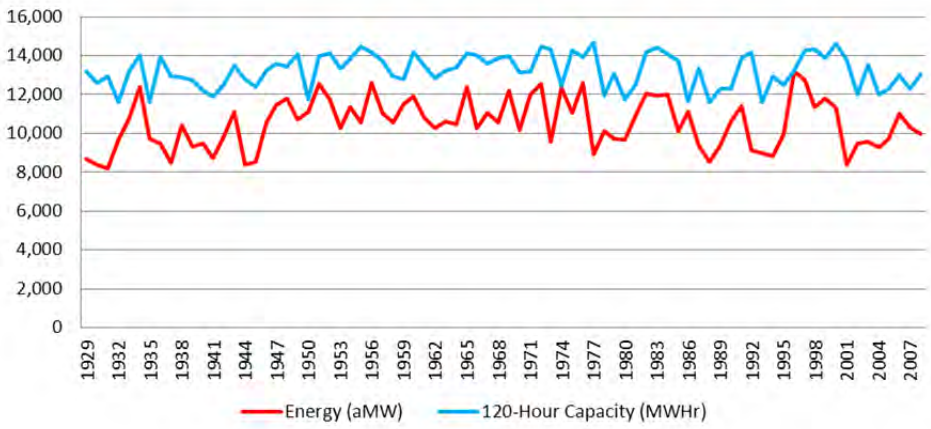


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Energy (aMW)	8,227	7,937	8,061	7,887	7,994	7,844	7,907	7,752	7,889	7,739
January 120 Hour Cap (MW)	10,021	10,467	10,497	10,438	10,310	10,304	10,146	10,251	10,124	10,230

The Federal system resource forecast shown above reflects 1937-critical water conditions. Since the Federal hydro system makes up about 82 percent of BPA's resources, the availability of water is the single largest driver of forecasted Federal system resource generation. Figure 3-8, page 28, shows the variability in Federal hydro resources over the 80 historical water conditions.

Figure 3-8

Federal System Hydro Resources
For OY 2014
Under 80 Historical Water Conditions
Annual Energy and January 120-Hour Capacity

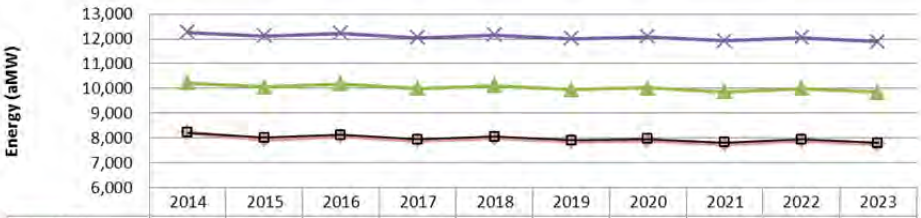


Energy max 13,203 and min 8,206 aMW, 120-Hour Capacity max 12,986 and min of 9,914 MW

The hydro variability described above translates directly into the variability of the Federal system resources. Figure 3-9, below, illustrates the annual average energy variability of Federal system resources for OY 2014 through 2023 under four scenarios: 1) 1937-critical water conditions (the base case of this study); 2) the average of the bottom 10 percent; 3) the average of the middle 80 percent; and 4) the average of the top 10 percent of the 80 historical water conditions (1929 through 2008).

Figure 3-9

Federal System Resources
For OY 2014 through 2023
Under Different Levels of Water Conditions
Annual Energy in Average Megawatts



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1937	8,227	7,937	8,061	7,887	7,994	7,844	7,907	7,752	7,889	7,739
Bottom 10%	8,205	8,013	8,118	7,942	8,049	7,899	7,963	7,807	7,943	7,793
Middle 80%	10,209	10,055	10,175	9,996	10,104	9,954	10,020	9,862	9,996	9,846
Top 10%	12,267	12,110	12,232	12,047	12,154	12,003	12,076	11,911	12,043	11,892

While looking at Federal system resources on an annual basis provides a picture of trends over the study period, it does not show how Federal resources are shaped monthly over the year. Figures 3-10 and 3-11, below, illustrate the monthly shape of the Federal resource forecast under 1937-critical water conditions. Monthly Federal resource forecasts for average energy and 120-hour capacity maintain similar shapes over the study period, with the highest generation forecasts being in late spring/early summer and early winter periods. The lowest generation forecasts occur in the early fall and February timeframes.

Figure 3-10

Federal System Resources
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Monthly Energy in Average Megawatts

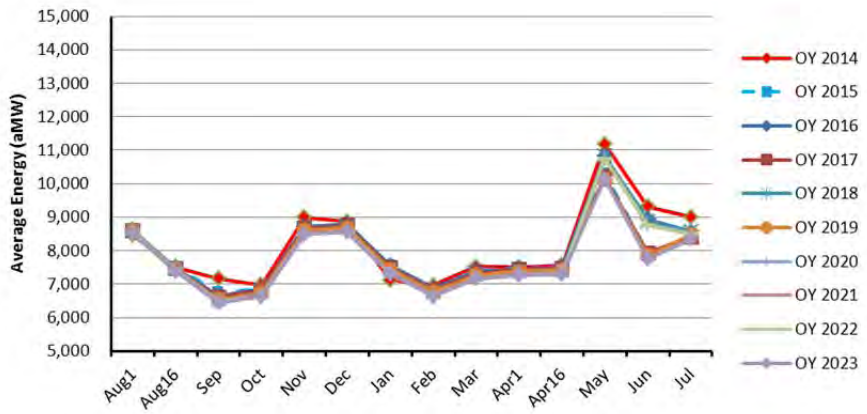
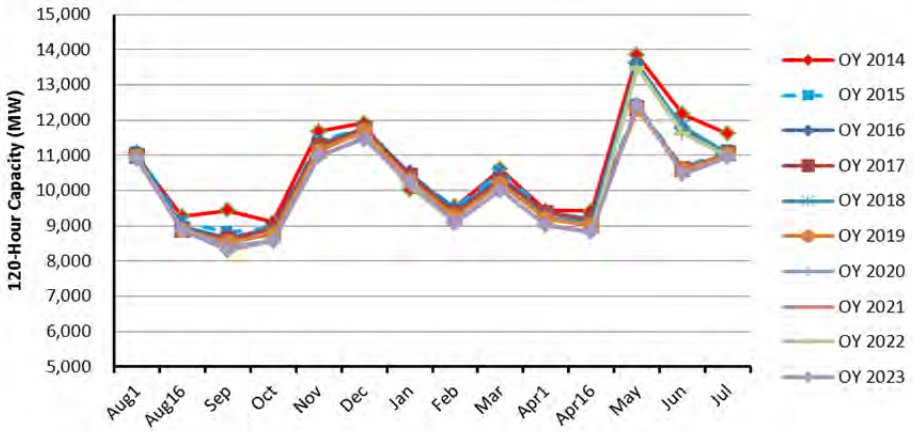


Figure 3-11

Federal System Resources
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Monthly 120-Hour Capacity in Megawatts



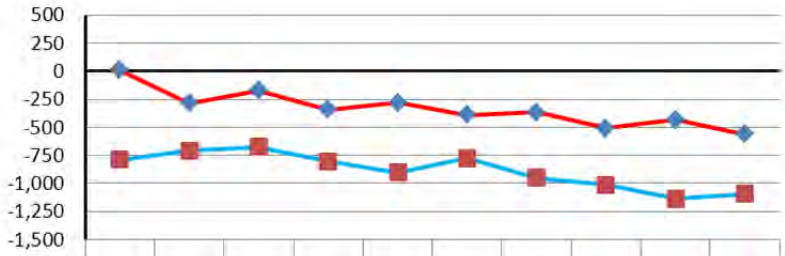
The high generation levels in early winter are largely due to drafting reservoirs for power production. Federal hydro resources are generally operated at lower power production levels during January through March and reservoir draft is minimized to assist fish passage as identified in current BiOp flow requirements based on the planning model operation (real-time operation may look different). Power production reaches its highest levels during the Columbia River Basin's peak snowmelt runoff period that occurs from May through July. Finally, power production decreases through the end of the summer and early fall as streamflows recede.

Federal System Analysis Surplus/Deficit Projections

The difference between the firm load obligations and firm resource forecasts described above provides the following firm power surplus/deficit projections for the Federal system. The annual Federal system firm power surplus/deficit projections under 1937-critical water conditions are presented in Figure 3-12, below, for OY 2014 through 2023. Under 1937-critical water conditions, the Federal system is projected to have an annual firm energy surplus of 11 aMW in OY 2014 followed by deficits throughout the rest of the study period, ending with a deficit of -561 aMW in OY 2023. The 120-hour capacity projections show the Federal system is deficit throughout the study period, ranging from -675 MW to -1,138 MW.

Figure 3-12

Federal System Surplus/Deficit Projections
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Annual Energy and January 120-Hour Capacity



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Energy (aMW)	11	-284	-169	-340	-280	-388	-367	-507	-434	-561
January 120 Hour Cap (MW)	-788	-707	-675	-803	-904	-775	-953	-1,012	-1,138	-1,093

Figures 3-13 and 3-14, below, illustrate the monthly shaped firm surplus/deficit projections for the study period. On a monthly basis, the Federal system is projected to be surplus during the spring and deficit during the late summer, early fall, and winter.

Figure 3-13

Federal System Surplus/Deficit Projections
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Monthly Energy in Average Megawatts

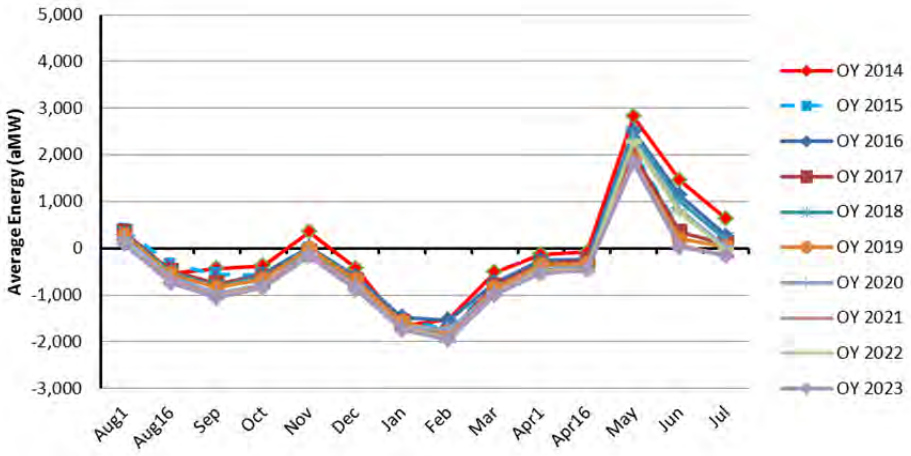
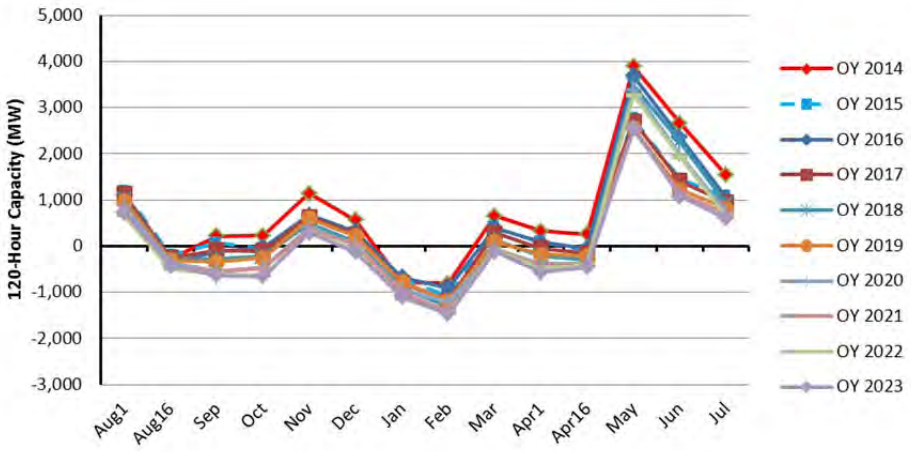


Figure 3-14

Federal System Surplus/Deficit Projections
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Monthly 120-Hour Capacity in Megawatts

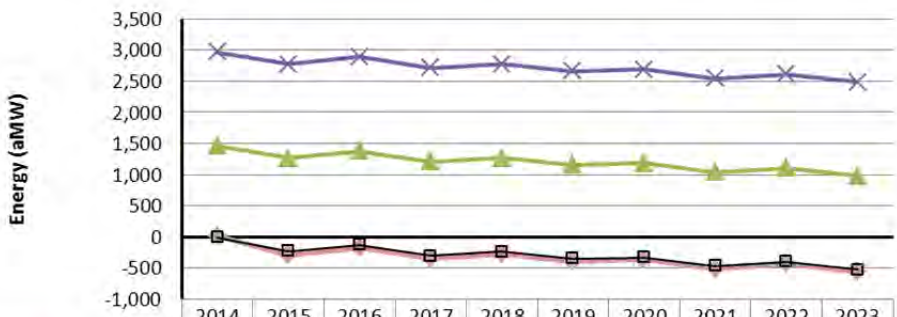


Variability of Federal System Analysis Surplus/Deficit Projections

As discussed previously, the variability of the Federal hydro resources based on the 80 historical water conditions has a direct and significant effect on Federal system surplus/deficit projections. Figure 3-15, below, illustrates the potential variability in annual average energy surplus by comparing the Federal system surplus/deficit forecasts for OY 2014 through 2023 under the same four resource scenarios: 1) 1937-critical water conditions (the base case of this study); 2) the average of the bottom 10 percent; 3) the average of the middle 80 percent; and 4) the average of the top 10 percent of the 80 historical water conditions (1929 through 2008). This comparison shows that, under these four scenarios, the Federal system surplus/deficit projections vary by approximately 3,000 aMW throughout the study horizon.

Figure 3-15

Federal System Surplus/Deficit Projections
For OY 2014 through 2023
Under Different Levels of Water Conditions
Annual Energy in Average Megawatts

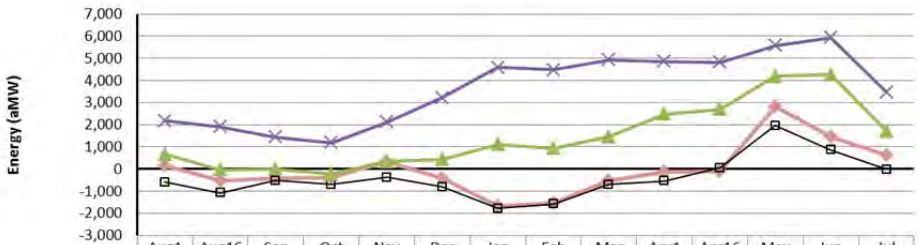


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1937	11.5	-284.4	-169.2	-340.3	-279.6	-387.5	-367.1	-507.2	-434.5	-561.1
Bottom 10%	-5.6	-230.0	-128.7	-301.1	-240.3	-348.2	-326.6	-467.8	-395.8	-522.5
Middle 80%	1,462	1,266	1,380	1,206	1,268	1,160	1,183	1,040	1,111	984
Top 10%	2,969	2,770	2,888	2,709	2,772	2,663	2,691	2,543	2,613	2,484

Figure 3-16, below, illustrates the monthly variability under the same four water condition scenarios.

Figure 3-16

Federal System Surplus/Deficit Projections
For OY 2014
Under Different Levels of Water Conditions
Monthly Energy in Average Megawatts



	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul
1937	165	-532	-432	-372	348	-417	-1,668	-1,521	-515	-125	-82	2,816	1,455	632
Bottom 10%	-590	-1,083	-520	-705	-385	-803	-1,783	-1,581	-701	-545	59	1,957	870	-16
Middle 80%	657	-43	7	-235	345	433	1,113	937	1,463	2,482	2,701	4,190	4,263	1,710
Top 10%	2,173	1,910	1,445	1,190	2,124	3,214	4,577	4,476	4,927	4,856	4,828	5,573	5,934	3,474

Federal System Analysis Conclusion

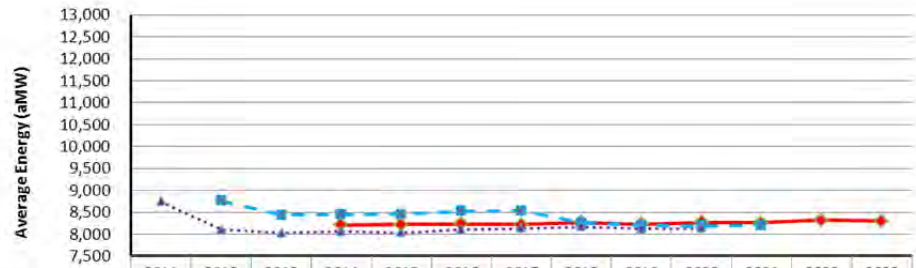
In conclusion, this Federal System Analysis illustrates the potential bounds (high and low) of the Federal System. Other analyses have been developed to provide key inputs for strategic planning activities. Deficits identified in this analysis could be mitigated through actions discussed in the 2013 Resource Program to address the needs identified in the Needs Assessment study. The 2013 White Book supplement will include updated firm loads, power sales and power purchase contracts, and generating resource forecasts. BPA will provide the next complete analysis of loads and resources for long-term planning in the 2014 White Book.

Comparison to Previous White Books

Figures 3-17 and 3-18, page 34, illustrate how the 2012 White Book firm requirement load obligations compare to those published in the 2010 and 2011 White Books. These load forecasts reflect the implementation of the RD contracts. The 2012 White Book load forecast shows a slight change in the annual firm energy load obligation from the previous White Books. However, the 2012 White Book January 120-hour capacity Federal system firm load obligations are substantially lower than the 2011 White Book forecast due to updates in the ALF forecasting methodology and process.

Figure 3-17

Federal System Firm Load Obligations
Comparison to Previous White Book Studies
Annual Energy in Average Megawatts



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				8,216	8,222	8,230	8,227	8,273	8,232	8,274	8,259	8,323	8,300
WBK2011		8,767	8,436	8,452	8,462	8,527	8,532	8,260	8,202	8,190	8,207		
WBK2010	8,740	8,107	8,029	8,064	8,036	8,106	8,136	8,172	8,128	8,134			

Figure 3-18

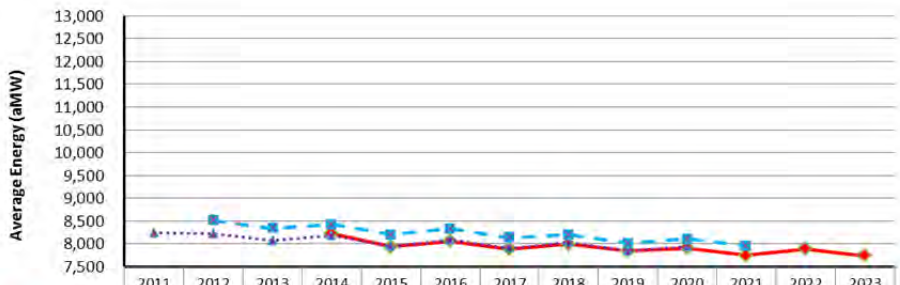
Federal System Firm Load Obligations
Comparison to Previous White Book Studies
January 120-Hour Capacity in Megawatts

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				10,809	11,174	11,172	11,241	11,214	11,079	11,099	11,263	11,262	11,323
WBK2011		12,001	11,706	11,793	11,904	11,917	11,986	11,606	11,667	11,599	11,681		
WBK2010	12,699	10,945	11,019	11,017	11,110	11,110	11,252	11,195	11,251	11,182			

Figures 3-19 and 3-20, below, illustrate how the 2012 White Book Federal resources compare to those published in the 2010 and 2011 White Books. The current resource forecast shows a slight reduction in annual energy and larger reductions in the January 120-hour capacity. Again, the reduction in January 120-hour capacity is based on the HYDSIM modeling changes described in Section 2: Methodology, Hydro Resources Modeling, on page 15.

Figure 3-19

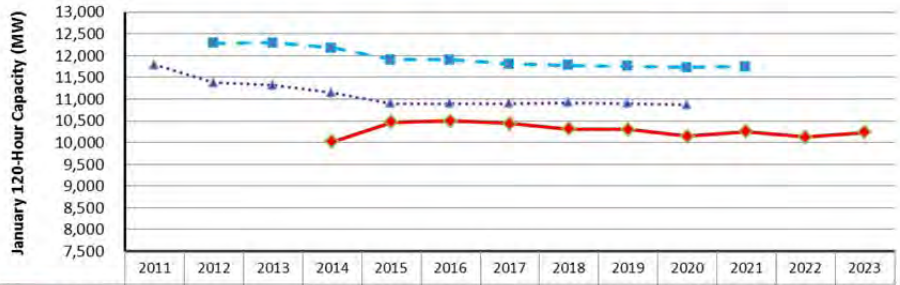
Federal System Resources
Comparison to Previous White Book Studies
Under 1937-Critical Water Conditions
Annual Energy in Average Megawatts



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				8,227	7,937	8,061	7,887	7,994	7,844	7,907	7,752	7,889	7,739
WBK2011		8,510	8,344	8,423	8,197	8,334	8,131	8,204	8,010	8,105	7,956		
WBK2010	8,239	8,219	8,071	8,179	7,951	8,089	7,912	8,030	7,844	7,938			

Figure 3-20

Federal System Resources
Comparison to Previous White Book Studies
Under 1937-Critical Water Conditions
January 120-Hour Capacity in Megawatts

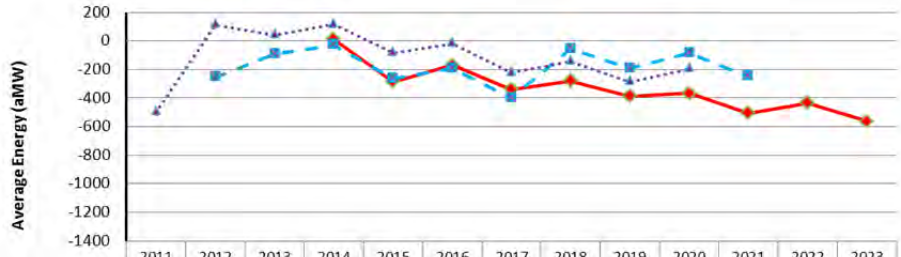


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				10,021	10,467	10,497	10,438	10,310	10,304	10,146	10,251	10,124	10,230
WBK2011		12,288	12,295	12,175	11,903	11,901	11,801	11,778	11,754	11,730	11,750		
WBK2010	11,788	11,380	11,318	11,145	10,894	10,897	10,895	10,919	10,899	10,870			

Figures 3-21 and 3-22, below, compare these 2012 White Book firm surplus/deficit projections, described above, to previous White Book study results. The 2012 White Book Federal system firm surplus/deficit projections continue to follow similar patterns as those in the last two publications. However, the 2012 White Book forecast shows additional changes in the 120-hour capacity projections largely due to the HYDSIM modeling changes, update to Grand Coulee operations to better reflect expected actual operations. Grand Coulee's January through March operation has been reshaped to prevent the project from drafting too deeply for winter fish flow requirements, which is further described in Section 2: Methodology, Hydro Resources Modeling, on page 15.

Figure 3-21

Federal System Surplus/Deficit Projections
Comparison to Previous White Book Studies
Under 1937-Critical Water Conditions
Annual Energy in Megawatts



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				11	-284	-169	-340	-280	-388	-367	-507	-434	-561
WBK2011		-257	-92	-29	-266	-194	-401	-56	-192	-85	-250		
WBK2010	-501	113	42	115	-85	-17	-224	-142	-285	-196			

Figure 3-22

Federal System Surplus/Deficit Projections
Comparison to Previous White Book Studies
Under 1937-Critical Water Conditions
January 120-Hour Capacity in Megawatts

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				-788	-707	-675	-803	-904	-775	-953	-1012	-1138	-1093
WBK2011		-92	-29	-266	-194	-401	-56	-192	-85	-250	0		
WBK2010	-501	113	42	115	-85	-17	-224	-142	-285	-196			

The differences seen reflect new methods and models used to produce Federal system reports in this 2012 White Book. Over time the White Book's presentation has evolved to better depict the current state of the Federal system. These changes include updates to forecasting tools, hydro models, and incorporating new reporting capabilities which improve the White Book process and corresponding results for long-term planning. Although the processes and specific values change over time, the latest information is the most accurate. As illustrated, the general trend of load growth and generating resource production continues to remain consistent with each White Book study.

Section 4: Federal System Needs Assessment

While the Federal System Analysis identifies the surplus/deficit under critical water for informational and planning purposes, this Needs Assessment examines five metrics for input into BPA's 2013 Resource Program. The Needs Assessment measures the expected generation capability of the existing Federal system resources to meet projected load obligations under a range of conditions and timeframes. The Needs Assessment does not discuss potential actions that BPA could take to meet any identified needs; those are evaluated and discussed in BPA's Resource Program. For the 2012 White Book, BPA examines the potential needs associated with FY 2016 and 2021.

Federal System Needs Assessment Assumptions

BPA's existing resource capability is forecasted using two BPA models: HYDSIM for monthly, seasonal, and annual energy; and HOSS for hourly energy and capacity. The models assess the resource capability to meet loads under expected conditions and extreme temperature events, over a range of possible water conditions.

The HYDSIM study used for this Needs Assessment is the same study used for the rest of the 2012 White Book and the BP-14 Initial Rate Proposal. As part of this assessment (Needs Assessment), BPA has made specific changes to forecasts and certain model assumptions which are detailed below, including using stochastic load variability to simulate load uncertainty, and stochastic unit performance for CGS to simulate unplanned outages. This assessment does not model any internal or regional transmission constraints that may limit the ability to match system generation to load.

Three load obligation scenarios were developed and analyzed for the study years FY 2016 and 2021[1]. These scenarios were produced by BPA's ALF system. The underlying load forecast for the expected scenario is also used in the Federal System Analysis. The low and high scenarios were constructed by applying a growth percentage to the aggregate load obligation forecast in the expected case. This is to simulate the potential range of uncertainty of the overall load obligation forecast, but not identify changes to specific categories of load (i.e. DSIs, Tier 2, NLSLs, etc.).

ALF's load obligation forecast methodology automatically includes projections of programmatic conservation savings that continue at the level established under current BPA conservation programs. For the 2012 Needs Assessment scenarios, the historic estimate of embedded conservation savings is approximately 56 aMW throughout the study period. An additional, 4 aMW of annual incremental

[1] 2016 is a non-refueling year for CGS; 2021 is a refueling year for CGS.

conservation is also included in the forecast, as new planned conservation. It does not include the incremental amount of conservation needed to meet the Council's Sixth Power Plan targets[1].

The load forecast methodology projects load growth for both Load Following and Slice/Block customers. In September 2011, customers provided elections on how they would serve load growth for the FY 2015 -2019 period. The resulting percentages from those elections were then used to estimate the potential load obligations in the expected scenario that BPA would be serving in the out years. There is additional uncertainty across all three scenarios to the load obligations from the impact of the different BPA Tier 2 products as well as how customers may change their elections during the FY 2020-2024 timeframe.

Federal System Needs Assessment Load Scenarios

Expected Case: The expected load case, is consistent with the 2012 White Book forecast, with an average annual growth rate of approximately 0.8 percent over the next 25 years.

This scenario includes a data warehouse load forecast based on plants that are highly likely to start production in the next 10 years. The expected Tier 2 load is approximately 128 aMW in FY 2016 and approximately 255 aMW in FY 2021. For the 18-hour capacity study only, the expected case is adjusted to include a three-day extreme weather event in each of February and August.

High Economy Scenario: The high economy case forecasts a robust increase in the economy due to increased spending (Federal and consumer). The expected average annual growth rate for 25 years from 2012 is approximately 2.4 percent.

This scenario anticipates higher load growth that could be caused by a number of factors such as additional population in-migration to the region to meet employment needs; additional Federal spending on military facilities and growth at local Naval facilities; clean-up activity at DOE-Richland; and increased aluminum production in the region. The forecast of data warehouses is aggressive, but still possible to occur in the next 10 years. The Tier 2 load obligation could be as high as 550 aMW in FY 2021.[2]

Low Economy Scenario: The low economy forecasts includes a double-dip recession due to current regional, national and international economic conditions including the potential impacts due to Federal government funding sequestration. This economic condition would be followed by slow employment growth in the region.

---

[1] How additional incremental conservation needed to meet the Council's Sixth Power Plan targets is used to mitigate or eliminate the deficits identified in this Needs Assessment will be discussed in the Resource Program.

[2] This maximum amount assumes that all Regional Dialogue customers elect to have BPA serve their Above High Water Mark (AHWM) load in FY 2021.

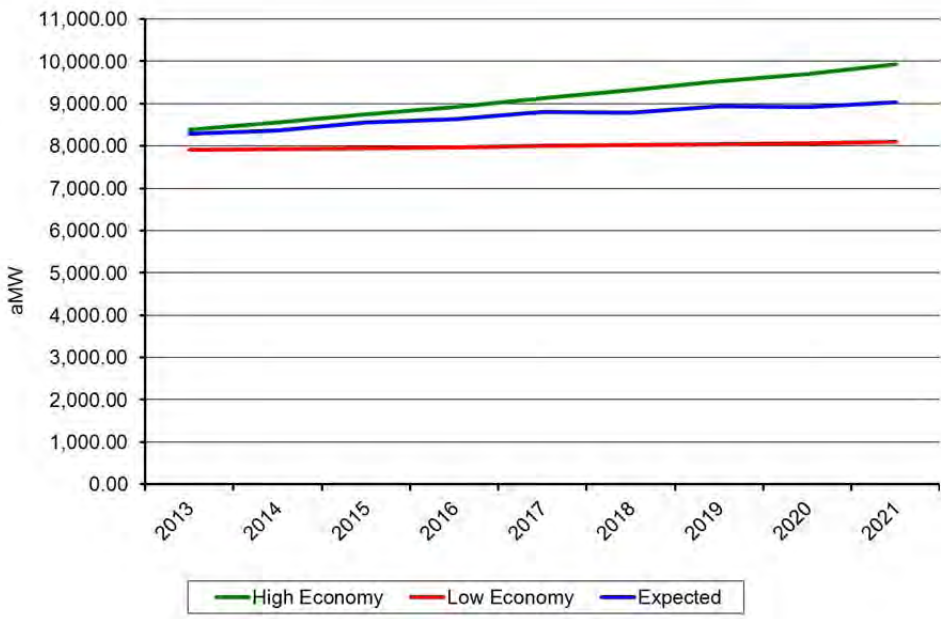
The expected average annual growth rate for 25 years from 2012 is approximately 0.1 percent.

This scenario anticipates lower load growth that could be caused by a number of factors such as reduced growth at local Naval facilities because of reduced Federal spending on military facilities or postponed funding of clean-up activity at DOE-Richland. It does not anticipate closures of specific industries or out-migration of the region. The data warehouse forecast only includes plants that are in service this year.

Figure 4-1, below, illustrates the expected case, high economy and low economy load scenarios.

Figure 4-1

Federal System Needs Assessment
Load Scenarios



Average Annual Growth Rates 2013-21: Low Economy 0.1%, Expected 0.8%, High Economy 2.4%

Major Changes from the 2010 Needs Assessment

Several updates to the key study assumptions were made in preparing the 2012 Needs Assessment. These include the following:

Change in study years: Study years 2016 and 2021 are examined for the 2012 Needs Assessment; study years 2013 and 2019 were examined in the 2010 Needs Assessment.

Hydro modeling updates: The 2012 Needs Assessment models 80 water years (update to 2010 level Modified Streamflows); seventy water years were modeled in the 2010 Needs Assessment;

The 2012 Needs Assessment uses the 2015 AOP while the 2010 Needs Assessment used the 2010 AOP. This plan updates the forecasted amount of monthly discharges from the Canadian reservoirs which results in higher August flows but lower September flows.

Balancing Reserves: For this 2012 Needs Assessment, BPA modeled a FCRPS reserve limit of 900 MW Incremental and 1,100 MW Decremental and used the delta between those and the forecasted requirement to calculate the need. In the 2010 Needs Assessment, BPA modeled reserves based on the forecasted requirement at the 30 minute wind persistence and the 99.5% level of service.

Federal System Needs Assessment Metrics

Similar to the 2010 Needs Assessment, BPA analyzed the following metrics for this 2012 Needs Assessment to assess the possible needs of the Federal system for meeting its obligations:

Annual energy deficit under critical water: Annual average energy under 1937-critical water conditions, analyzed under the expected, high and low load scenarios.

Seasonal/monthly heavy load hour (10th percentile by month): 10th lowest percentile (P10) of surplus/deficit by month (which is roughly comparable to the 5th lowest surplus/deficit percentile (P5) by season) under the expected load scenario. Months are analyzed independently.

120-hour capacity (also known as superpeak): Capacity inventory to meet load peaks day after day throughout the month (6 hours per day times 5 days per week times 4 weeks per month = 120 hours) under the expected load scenario.

18-hour capacity: Capacity inventory to meet the 6 peak load hours for 3 consecutive days under the "expected" load case with three-day extreme weather events assuming median water supply and hydro generation. Loads for the three-day event are increased to reflect additional heating or cooling load and wind generation is assumed to be zero. The maximum take of Canadian Entitlement is also assumed. Cold snap analysis includes 10 percent reduction in streamflow to account for icing effects. Heat wave analysis includes 10 percent reduction in CGS generating capability to account for heat impacts on generation.

Reserves for Ancillary Services: The difference between what the FCRPS can supply and the forecasted need.

Federal System Needs Assessment Results

As shown in Figure 4-2, below, the 2012 Needs Assessment shows a wide range of potential annual needs, under critical water conditions, depending on which load scenario is studied as well as needs on a monthly and hourly basis at the 10th percentile conditions. Energy and capacity results are rounded to the nearest 50 aMW. In general, the trends are similar to those discussed in the 2010 Needs Assessment; with modest deficits in annual energy and medium to significant energy deficits in certain winter and summer months. One notable change in this analysis is the reduction of the winter 18-hour capacity for both FY 2016 and 2021.

Figure 4-2

Federal System Needs Assessment
Summary of Results
(positive numbers indicate surplus)

Metric	2016	2021
Annual energy deficit (critical water)	Expected Case: -200 aMW	Expected Case: -500 aMW
	High Economy: -550 aMW	High Economy: -1,450 aMW
	Low Economy: 250 aMW	Low Economy: 50 aMW
Seasonal/monthly (10th percentile by month)	Significant HLH deficits in January, February and September.	Significant HLH deficits in October, January – February, Aug 16 and September.
Superpeak or 120-hour capacity (10th percentile by month)	HLH deficits greater than superpeak deficits except for Aug 16.	HLH deficits greater than superpeak deficits except for Aug 16.
18-hour capacity, positive indicates surplus (extreme weather scenarios)	Winter: 100 MW	Winter: 0 MW
	Summer: 250 MW	Summer: 0 MW
Reserves for Ancillary Services	Inc: -390 MW	Inc: -642 MW
	Dec: -484 MW	Dec: -817 MW

Detailed Fiscal Year 2016 & 2021 Study Results: Looking at the results by month and by season shows a more serious deficit picture compared to the annual view. While the monthly metric is for heavy load hour and superpeak, we also display the average and light load hour deficits for additional information.

The assessment shows BPA typically experiences substantial energy surpluses in May and energy deficits in other months, in years with poor water conditions or other reductions in generation. Water in reservoirs is BPA's form of energy storage, and FCRPS hydro system storage is limited to approximately 35 percent of an average year's runoff. Use of this storage is further constrained by operating requirements, such as flood control and BiOp requirements. As a result, the system has limited ability to store water from season to season, month to month, and even hour to hour.

Accordingly, as shown in Figure 4-3, below and Figure 4-4, page 45, BPA faces deficits for heavy load hour energy in FY 2016 during the winter months, Aug 16 and September under the 10th percentile of surplus/deficit scenarios. This trend is seen again in the FY 2021 analysis. This implies that there is a 1 in 10 chance that BPA will need to acquire additional energy during the 16 highest load hours each day (except Sundays) during the winter, and additional energy over the remaining hours. During the summer, demand is not quite as high as in the winter but the water supply is considerably more limited. Furthermore, the light load hour deficits for both FY 2016 and 2021 are significant in the winter and summer months. This suggests that there is not enough water in the system to generate sufficient energy to meet load obligations for the majority of the year.

Figure 4-3

Federal System Needs Assessment
For FY 2016
10th Percentile Monthly Energy Deficits

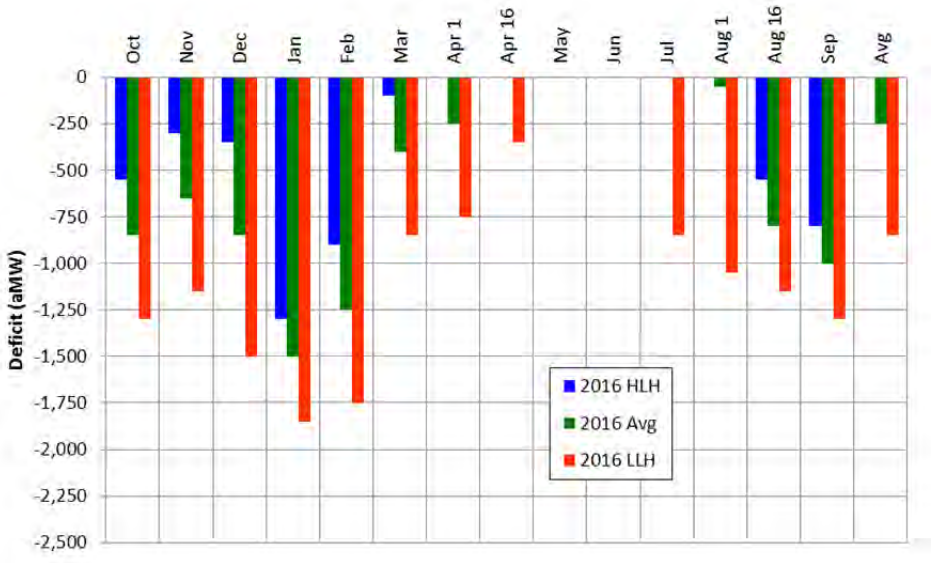
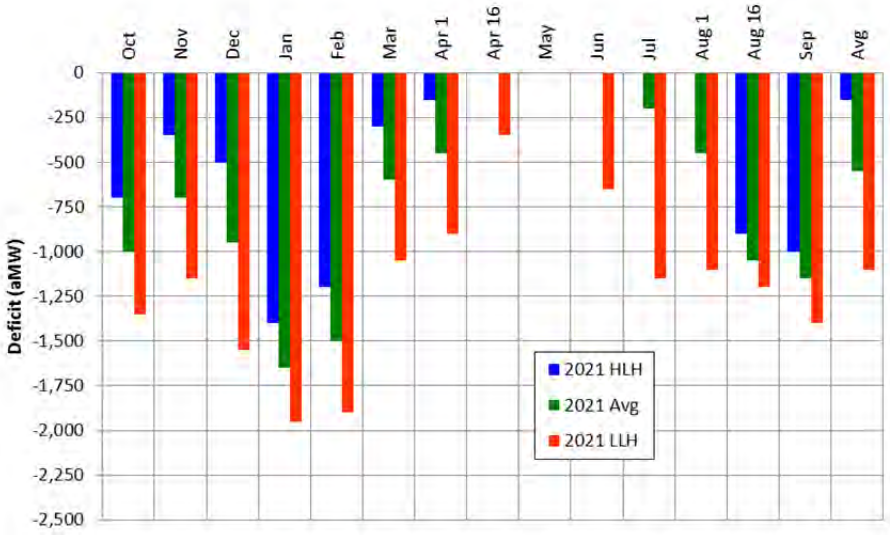


Figure 4-4

Federal System Needs Assessment
For FY 2021
10th Percentile Monthly Energy Deficits



Figures 4-5 and 4-6, below, illustrate the 120-hour superpeak analysis which shows that the deficit for superpeak hours is less than the deficit for heavy load hours for both FY 2016 and 2021 except for Aug 16. This result indicates that there is enough flexibility for the model to shape generation into the superpeak hours, except in the second half of August (Aug 16).

Figure 4-5

Federal System Needs Assessment
For FY 2016
10th Percentile Monthly Surplus/Deficits

	Spk	HLH	Avg	LLH
Oct	-400	-550	-850	-1,300
Nov	50	-300	-650	-1,150
Dec	-50	-350	-850	-1,500
Jan	-800	-1,300	-1,500	-1,850
Feb	-700	-900	-1,250	-1,750
Mar	700	-100	-400	-850
Apr 1	250	100	-250	-750
Apr 16	750	750	300	-350
May	3,650	3,150	2,400	1,500
Jun	2,550	1,750	1,100	300
Jul	950	750	100	-850
Aug 1	650	650	-50	-1,050
Aug 16	-900	-550	-800	-1,150
Sep	-750	-800	-1,000	-1,300
Avg	**450**	**150**	**-250**	**-850**

Figure 4-6

Federal System Needs Assessment
For FY 2021
10th Percentile Monthly Surplus/Deficits

	Spk	HLH	Avg	LLH
Oct	-600	-700	-1,000	-1,350
Nov	-50	-350	-700	-1,150
Dec	-250	-500	-950	-1,550
Jan	-1,000	-1,400	-1,650	-1,950
Feb	-950	-1,200	-1,500	-1,900
Mar	450	-300	-600	-1,050
Apr 1	0	-150	-450	-900
Apr 16	650	700	250	-350
May	3,000	2,500	1,850	950
Jun	1,300	700	150	-650
Jul	550	500	-200	-1,150
Aug 1	0	50	-450	-1,100
Aug 16	-1,250	-900	-1,050	-1,200
Sep	-850	-1,000	-1,150	-1,400
Avg	**100**	**-150**	**-550**	**-1,100**

The energy metrics described previously measure the capability of the Federal system during expected conditions. Under an extreme weather event, the hydro system could flex as much as possible to handle the additional loads from a cold snap or heat wave event but only for a limited amount of time. The water used to meet load demands during the extreme event may be taken out of the rest of the month (or perhaps subsequent months). For example, meeting peak loads in a February cold snap would reduce energy for the rest of February by an estimated 425 aMW (sliced). For an August heat wave, the water needed to meet peak loads for a three-day event reduces the energy available for the rest of the month by an estimated 300 aMW (sliced).

The 18-hour capacity metric shows BPA just adequate to meet daily peak power needs during a three-day extreme cold snap in February or extreme heat wave in August. As seen in the Figures 4-7, 4-8, 4-9 and 4-10, pages 48 and 49, the system has minimal to zero surplus 18-hour capacity during a cold snap or heat wave in either FY 2016 or 2021. The reduction in the winter capacity from the 2010 Needs Assessment is significant[1], and largely results from the differences in the extreme weather load forecast, expiration of winter purchases and changes in winter FCRPS generation forecasts from HYDSIM. A major input into the 2010 Needs Assessment load forecast was calculated incorrectly and its correction is the largest driver of the three drivers mentioned. Due to changes in our load forecasting, database systems, and procedures, we are unable to determine the exact causes for the error in the 2010 Needs Assessment load forecast. From the data available from our last analysis, we can determine it appears that the 2010 Needs Assessment included an incorrect (low) Slice Right to Power forecast which resulted in a higher 18-hour capacity surplus. This 2012 Needs Assessment corrects that error, and combined with the other updates, shows a corrected, more realistic picture of the winter capacity amounts. However, changes to load from either marketing or load uncertainty could result in either higher or lower 18-hour capacity amounts.

[1] In the 2010 Needs Assessment, the winter 18 hour capacity amounts for fiscal years 2013 and 2019 were 1,600 MW and 1,050 MW, respectively.

Figure 4-7

Federal System Needs Assessment
For February 2016
Under Extreme Weather
18-Hour Capacity Surplus/Deficits
(1 in 10 load scenario; 50% hydro scenario)

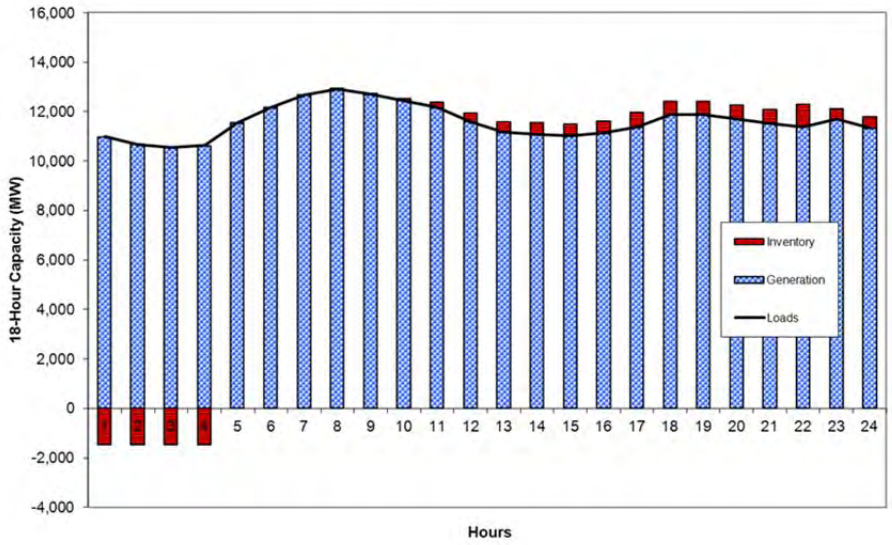


Figure 4-8

Federal System Needs Assessment
For 2nd Half of August 2016
Under Extreme Weather
18-Hour Capacity Surplus/Deficits
(1 in 10 load scenario; 50% hydro scenario)

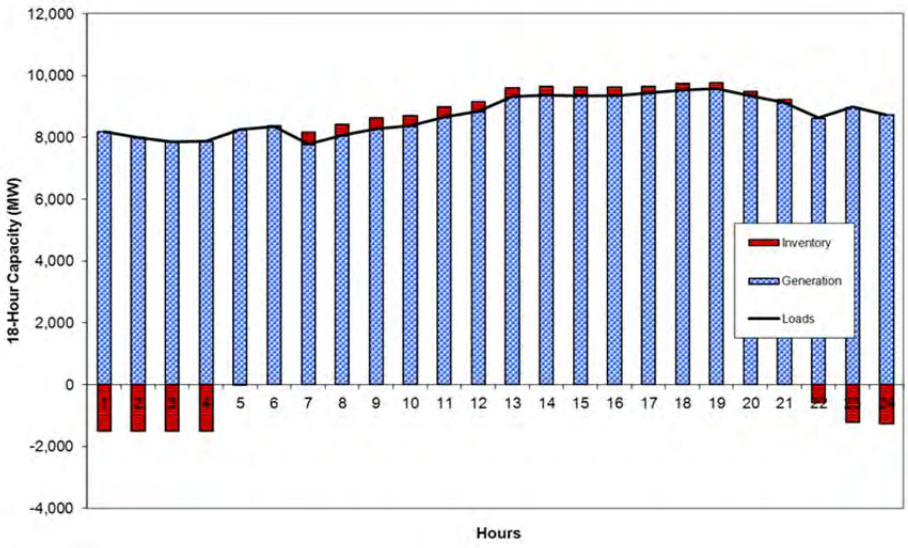


Figure 4-9

Federal System Needs Assessment
For February 2021
Under Extreme Weather
18-Hour Capacity Surplus/Deficits
(1 in 10 load scenario; 50% hydro scenario)

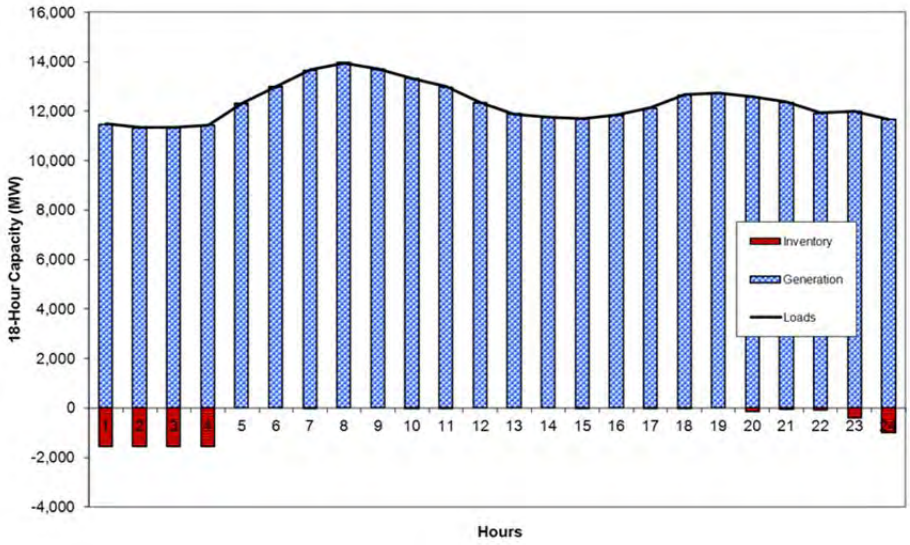
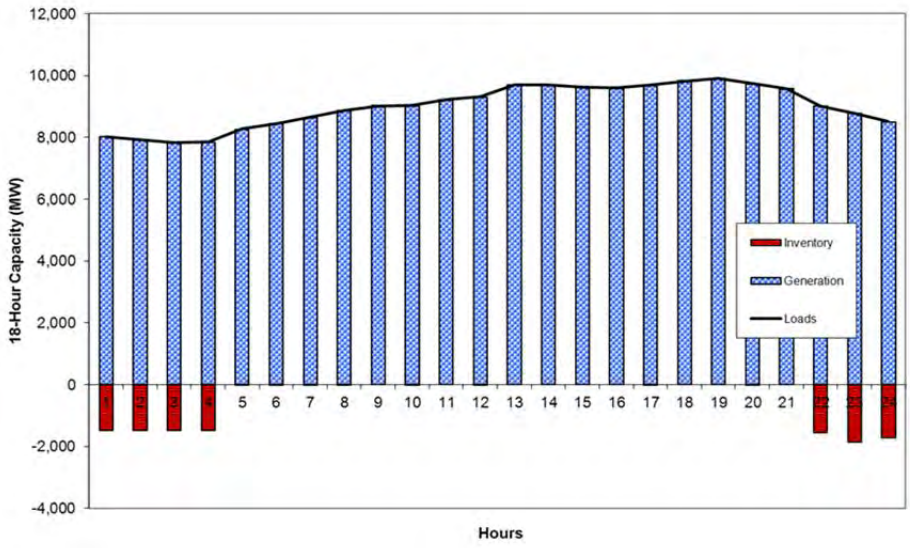


Figure 4-10

Federal System Needs Assessment
For 2nd Half of August 2021
Under Extreme Weather
18-Hour Capacity Surplus/Deficits
(1 in 10 load scenario; 50% hydro scenario)



Currently the FCRPS can supply up to 900 MW of incremental and 1,100 MW of decremental balancing reserves. The ancillary reserves analysis compared the forecast of balancing reserves required for the end of FY 2016 and end of FY 2019 (as the proxy for FY 2021), to the FCRPS established limits. The forecast for both study years shows the required balancing reserves exceeding the limit of what the FCRPS can supply.

Federal System Needs Assessment Conclusions & Next Steps

The analysis shows that under a variety of conditions and timeframes, BPA could need to supplement the existing Federal system generation to meet existing and projected obligations in the time period. These conclusions reflect additional limitations on the FCRPS projected capability to meet BPA's load obligations since the 2010 Needs Assessment analysis was performed. Specifically, updates to the hydro modeling assumptions have, in general, decreased the expected annual and winter FCRPS forecasted generation. Hydro modeling updates included incorporating the 2010 Level Modified Streamflows, changing Canadian project operations, and limiting Grand Coulee's draft during winter operations to better reflect likely in-season management decisions. This updated analysis projects more significant deficits in the January-February timeframe, some improvement to Aug 16, and increased deficits in September.

Under the expected case, modest annual energy deficits are projected under critical water. However, in the high economy and low economy load scenarios, there is a wide range of uncertainty in the load obligations forecast, and the deficits could be erased or become significantly higher. There are also significant deficits (both heavy load hour and all hours) in several of the 10th percentile months, notably January and February (winter) and Aug 16 and September (summer). These deficits would be larger if BPA were to lose any current generating capability. For example, the Needs Assessment assumes 2008 BiOp hydro operation requirements, which, based on an average of historical fish migration at the Snake River dams, typically ends juvenile bypass spill by mid-August. If spill were required through the end of August, the additional spill would correspond to a loss of about 400 aMW of generating capability in the second half of August under all water conditions.

Under the extreme weather scenario, BPA is minimal to no longer capacity surplus in either the winter or summer. The winter capacity numbers changed significantly from the 2010 Needs Assessment, largely as a result of the extreme weather load differences, the expiration of winter purchases and changes in FCRPS generation forecasts,. This capacity metric can be similarly impacted by variations in the load and generating capability uncertainties.

The Federal system resources are insufficient to meet the forecasted 99.5 percent level of service for balancing reserve requirements in FY 2016 and 2019 (proxy for FY 2021). These deficits could increase if BPA adopts higher levels of service. There are many efforts underway to address this issue including the recently released BP-14 Initial Rate Proposal.

The 2013 Resource Program describes how BPA plans to address the deficits identified in this analysis and concludes that the majority of these deficits could be mitigated through the achievement of the Council's Sixth Power Plan conservation targets and market purchases. The Resource Program also discusses other actions BPA plans to take to address these deficits. BPA will continue to evaluate and update this analysis as part of the next formal Needs Assessment scheduled to be completed as part of the 2014 White Book process.

Section 5: Federal System Resource Adequacy

Consistent with its statutory purposes under section 2 of the Northwest Power Act[1], BPA continues to explore and advance its understanding of resource adequacy as it relates to the Federal system. The Federal System Resource Adequacy analysis provides a stochastic simulation to assess the Federal system's probability of meeting firm load obligations under many different combinations of supply and demand. Resource adequacy refers to the ability of a power system to meet the aggregate energy and capacity demand at any time.[2] BPA introduced its initial resource adequacy analysis in the 2011 White Book. For this 2012 White Book, BPA examines the Federal system's capability of meeting firm load obligations in FY 2016 and 2017.

Federal System Resource Adequacy Assumptions

The stochastic analysis in this section of the White Book was performed using a Federal version of the Northwest Power and Conservation Council's (Council) Genesys model. The Council created Genesys to develop a consensus-based resource adequacy framework and to make annual assessments for the PNW. The Council's regional Genesys model tests if the PNW regional power system can meet firm load in a future year under many different combinations of uncertain future conditions. The Federal system version of Genesys was developed to complete a similar analysis for the Federal system. The Federal Genesys model incorporates the following future uncertainties in its analysis:

Water Supply: The large variation in volume runoff impacts the amount of hydroelectric power production in the Federal system. The January to July Columbia River runoff measured at The Dalles from 1929 to 2008 has varied from 53.5 million acre-feet (MAF) in 1977 to 158.2 MAF in 1997;

Load Obligations: Nearly half of the firm load that BPA serves under the 2012 RD PSCs fluctuates with temperature. These load fluctuations can result in approximately 400 aMW of monthly load differences in winter;

Wind: BPA has acquired the output of 248 MW of installed wind capacity to help meet its firm power supply obligations. In addition, Load Following customers taking BPA's Resource Support Services (RSS) have dedicated 10 MW of

[1] To assure the Pacific Northwest of an adequate, efficient, economical, and reliable power supply *[Northwest Power Act, §2(2), 94 Stat. 2697.]*

[2] Adequacy is a component of system reliability, the other component being security, defined by the North American Electric Reliability Corporation as the ability of the system to withstand sudden disturbances.

installed wind capacity to serve their load. These variable energy resources can produce significantly different output from hour to hour; and

Forced Outages: CGS is a 1,130 MW nuclear power plant subject to forced outages.

Two studies were developed for this analysis: 1) a FY 2016 Federal system study where CGS is in a non-refueling year; 2) a FY 2017 Federal system study where CGS is in a refueling year. The studies incorporate the large uncertainties inherent in the Federal power system, noted above, and include the following inputs that may differ from other Federal system analyses in the White Book:

Water Supply: Historical 2010 Level Modified Streamflows from the 1929 to 2008 record are selected sequentially for the stochastic analysis. Sequential water conditions are used because the operation of the Canadian Treaty projects is fixed to a sequential set of water years. Using sequential water conditions may provide a limited representation of potential future water supply variability as each year is always preceded by the same water year (e.g. 1929 always precedes 1930);

Load Obligations: To represent firm load uncertainty due to temperature variations, hourly loads for Load Following customers were forecast for 58 historical temperature years. For the stochastic analysis, one temperature year is randomly selected for each game to determine the hourly loads for Load Following customers;

Wind: Wind generation is based on BPA's acquired output from 248 MW of installed wind capacity. An additional 10 MW of installed wind capacity, from Load Following customers who subscribe to BPA's RSS, is also included. To represent uncertainty in wind generation, 40 synthetic wind years were derived from a statistical analysis of historical wind generation. For the stochastic analysis, one wind year is randomly selected for each game to determine the hourly wind generation;

CGS: The 1,130 MW nuclear power plant is assumed to have a forced outage rate of 8.85 percent and a mean repair time of 200 hours to represent the likelihood and duration of unplanned outages. These assumptions are based on the last 10 years of performance data and do not provide any indication of future performance. In 2017, CGS has a planned 54-day refueling outage in the months of May, June, and July. Because of modeling limitations, this is represented in the FY 2017 study as a 61-day outage for the full months of May and June;

AHWM Resources: The expected amount of resources (both Federal and non-Federal) that will serve AHWM load in FY 2016 and 2017 are included.

These resources total approximately 170 aMW in FY 2016 and 235 aMW in FY 2017 and are still considered estimates at this point in time; and

Market Depth: The assumed wholesale power market viability to support market purchases, if necessary, is 1,000 MW in the winter and 500 MW in the summer per the 2010 Resource Program.

Federal System Resource Adequacy Metrics

As discussed in the 2011 White Book, there is no national industry standard on resource adequacy. However, most utilities and regional transmission organizations have adopted a standard of acceptable resource adequacy as measured by having a loss of load event occurring no more than 1 day in 10 years. Although this standard is useful for capacity-limited power systems dominated by thermal generation, it is not appropriate for BPA because its large hydro-based system is both energy and capacity limited. For example, in low runoff volume years there is the potential for prolonged periods of energy under production that can exceed the 1 day in 10 year standard. Since BPA would rely upon power purchases to meet its firm load obligations in such conditions, the study results for low water years informs BPA of possible power purchase needs in such conditions.

The metric adopted by the Council (and recommended by the Northwest Resource Adequacy Forum) is the Loss-of-Load Probability (LOLP).[1] The Council uses LOLP to signal when regional resource development is not keeping pace with regional load growth. LOLP is a more appropriate metric for BPA's energy and capacity limited system than other existing metrics developed for capacity-limited systems.

North American Electric Reliability Corporation (NERC) Draft Pilot Metrics: BPA has a statutory purpose to assure an adequate, efficient, economical, and reliable power supply. BPA has looked at other efforts in the industry to define and assess resource adequacy, including NERC's Pilot Probabilistic Assessment published in draft form in October 2011. The purpose of the assessment was to produce enhanced resource adequacy metrics for NERC's long-term reliability assessments and to move toward a common set of reliability metrics across different assessment areas throughout the nation and parts of Canada. The three metrics chosen by NERC were:

- <u>Loss of Load Hours (LOLH):</u> The average number of hours with unserved energy across all games, expressed in hours per year.

- <u>Expected Unserved Energy (EUE):</u> The average amount of unserved energy across all hours of all games, expressed in megawatt hours per year. EUE is equivalent to expected Energy-Not-Served (ENS).

[1] *A New Resource Adequacy Standard for the Pacific Northwest.* Council Document Number 2011-14.

- Normalized EUE: The EUE divided by the total annual firm load obligation, expressed as a percent.

NERC has not set standards for these metrics. Several regional transmission organizations (e.g. Midwest Independent Transmission System Operator and PJM Interconnection) completed stochastic modeling and reported these metrics in the NERC draft assessment. For the purposes of comparison only, BPA has included these metrics in the resource adequacy studies below.

BPA Draft Metrics: In addition to the three NERC draft pilot metrics included for comparison, BPA also analyzed the annual LOLP and conditional value at risk (CVaR) metrics that were developed for the 2011 White Book. Moreover, BPA has assessed monthly LOLP values to identify games that have significant monthly problems that may be missed by the annual LOLP metric.

The LOLP metrics measure the likelihood that the Federal system is unable to meet firm load with its expected resources:

- Annual LOLP: The number of games with significant ENS divided by the total number of games, expressed as a percent. As in the 2011 White Book, significant ENS is defined as aggregate annual curtailment energy greater than 50 aMW.

- Monthly LOLP: The number of games with significant ENS divided by the total number of games, expressed as a percent. Significant ENS is defined as aggregate monthly curtailment energy greater than 50 aMW. This metric includes all games that have ENS greater than 50 aMW in any month and is more stringent than the annual LOLP metric.

BPA continues to evaluate a possible standard for the annual LOLP metric. Five percent is the standard adopted by the Council (and recommended by the Northwest Resource Adequacy Forum) to signal when regional resource development is not keeping pace with regional load growth. Using 0 percent may be too conservative, as it may not meet the tradeoff between an adequate resource supply and an economic one. No industry standard has been developed for the monthly LOLP metric.

CVaR, the third metric, measures the magnitude by which the Federal system is unable to meet firm load with its expected resources. CVaR evaluates the tail games, which are the games with the greatest amounts of annual ENS. BPA examined the 2.5 percent of games that had the greatest amounts of annual ENS to determine the monthly magnitudes and seasonality of the ENS. For example, with a 1,000 game simulation, the 25 games with the greatest amounts of ENS are examined by month to determine the monthly expected ENS within the 2.5 percent tail.

Federal System Resource Adequacy Results

Fiscal Year 2016 Study Results: Figure 5-1, below, summarizes the FY 2016 results for the draft pilot metrics adopted by NERC. NERC has not established standards for these metrics which are shown for purposes of comparison with BPA's draft metrics. Overall, the FY 2016 LOLH, EUE, and normalized EUE values for the Federal system are considerably higher than those reported in the NERC draft assessment. The higher values are primarily a result of BPA's hydro-based system being both energy and capacity limited.

Figure 5-1

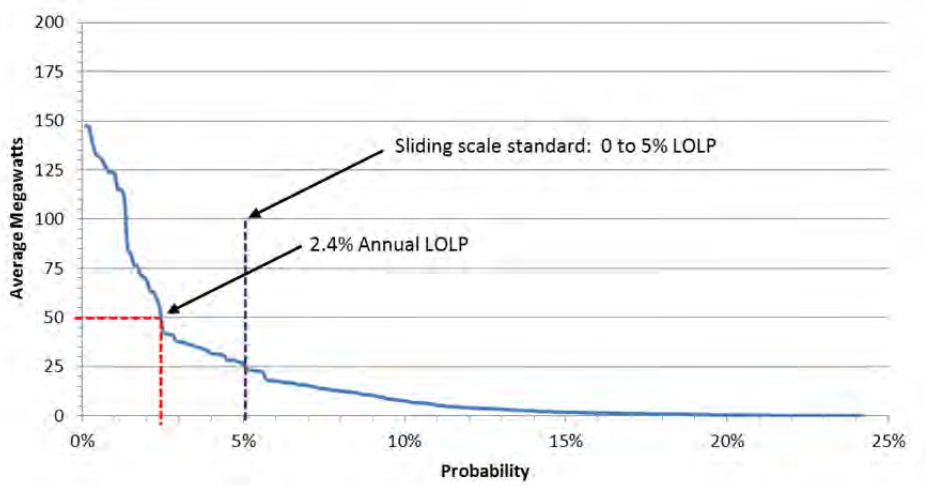
Federal System Resource Adequacy
For FY 2016
NERC Draft Metrics

Metric	Units	FY 2016 Study
LOLH	Hours/Year	61
EUE	MWh/Year	37,655
Normalized EUE	%	0.0504%

Figure 5-2, below, shows the probability of different levels of annual ENS for FY 2016. Of the 1,000 games simulated, 24 had significant ENS of more than 50 aMW on an annual basis. Therefore, the annual LOLP is 2.4 percent. The monthly LOLP is 11.8 percent, or stated another way, in 11.8 percent of the games there was at least one month where the ENS exceeded 50 aMW.

Figure 5-2

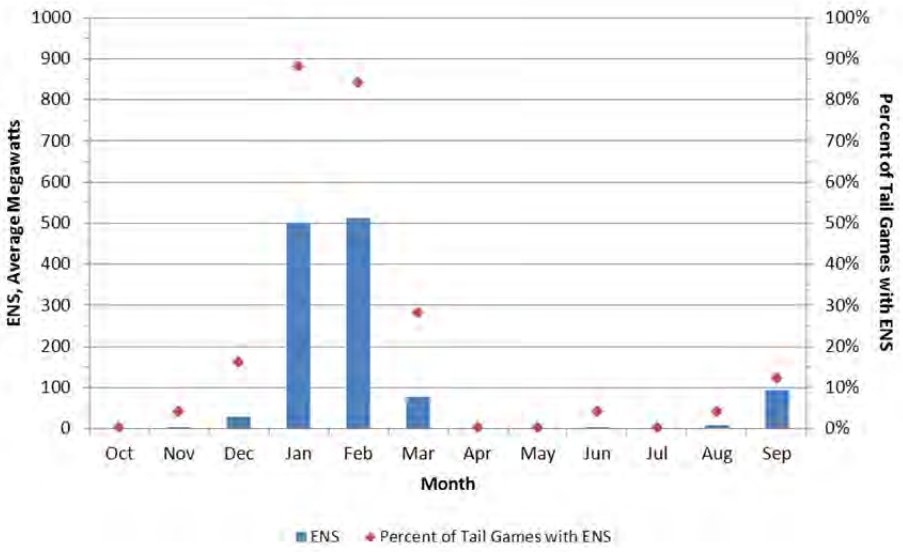
Federal System Resource Adequacy
For FY 2016
Annual ENS and LOLP



The CVaR metric examines the 25 games that have the greatest annual amounts of ENS. Figure 5-3, below, shows the average amount of ENS and percent of games with ENS on a monthly basis for the 25 tail games. January, for example, has 501 aMW of ENS, occurring across 88 percent of the tail games. For this study, the 25 tail games are centered on the months of January and February. Droughts, particularly those lasting more than a year, are the primary driver of the worst games.

Figure 5-3

Federal System Resource Adequacy
For FY 2016
Average ENS and Percentage of Games with ENS in the 25 Tail Games



Fiscal Year 2017 Study Results: Figure 5-4, below, summarizes the FY 2017 results for the draft pilot metrics adopted by NERC. Again, NERC has not established standards for these metrics and they are shown for purposes of comparison only. Consistent with the FY 2016 results, the FY 2017 LOLH, EUE, and normalized EUE values for the Federal system are considerably higher than those reported in the NERC draft assessment. The higher values are primarily a result of BPA's hydro-based system being both energy and capacity limited.

Figure 5-4

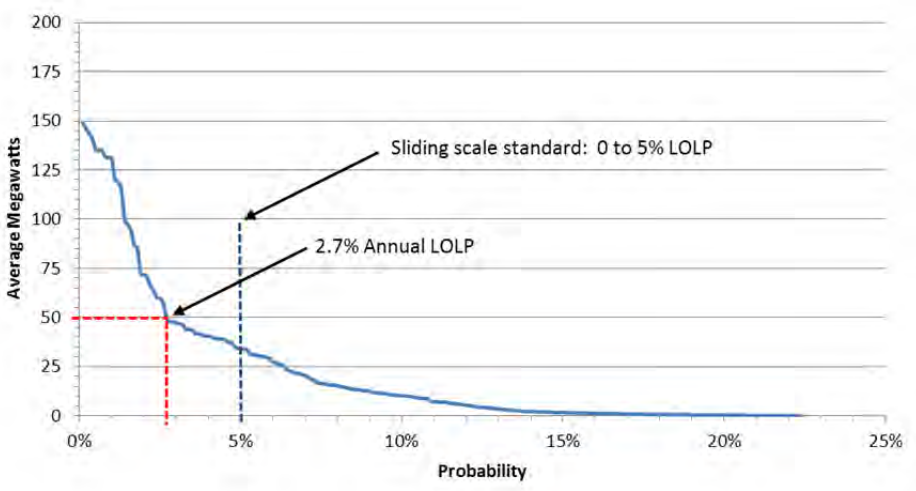
Federal System Resource Adequacy
For FY 2017
NERC Draft Metrics

Metric	Units	FY 2017 Study
LOLH	Hours/Year	71
EUE	MWh/Year	43,513
Normalized EUE	%	0.0582%

Figure 5-5, below, shows the probability of different levels of annual ENS for FY 2017. Of the 1,000 games simulated, 27 had significant ENS of more than 50 aMW on an annual basis. Therefore, the annual LOLP is 2.7 percent. The monthly LOLP is 12.4 percent, or stated another way, in 12.4 percent of the games there was at least one month were the ENS exceeded 50 aMW.

Figure 5-5

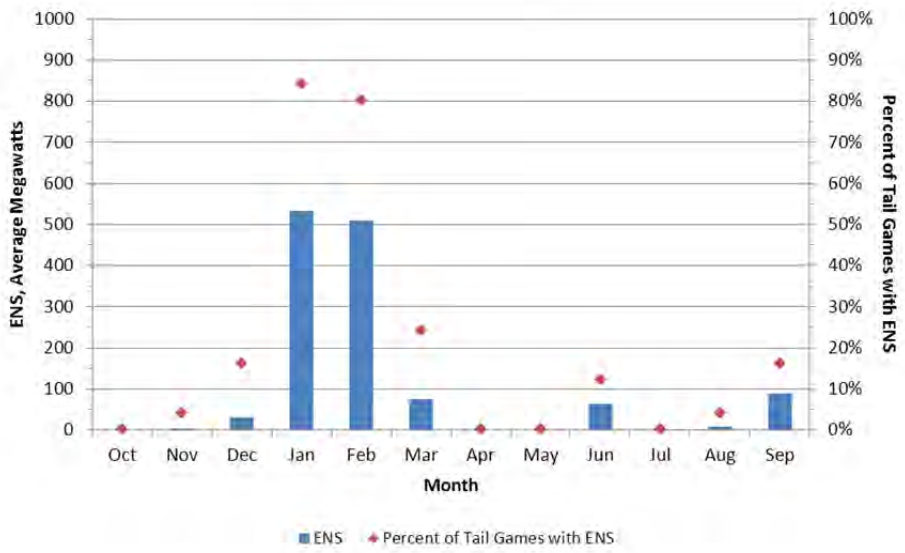
Federal System Resource Adequacy
For FY 2017
Annual ENS and LOLP



The CVaR metric, shown below in Figure 5-6, indicates the 25 tail games are centered on January and February. In both months, the magnitude of ENS exceeds 500 aMW, occurring across at least 80 percent of the tail games. Consistent with the FY 2016 study, droughts, particularly those lasting more than a year, are the primary driver of the worst games.

Figure 5-6

Federal System Resource Adequacy
For FY 2017
Average ENS and Percentage of Games with ENS in the 25 Tail Games



Sensitivity of Results to Key Assumptions

The resource adequacy studies presented above for FY 2016 and 2017 reflect the most appropriate value for each assumption on a long-term planning basis. However, changes in several key assumptions can produce significantly different results. Figure 5-7, below, illustrates the sensitivity of the FY 2016 annual LOLP results to two key assumptions: 1) the significant ENS threshold, and 2) market depth.

The center cell in Figure 5-7 represents the base case annual LOLP for FY 2016 of 2.4 percent, which was illustrated in Figure 5-2, page 58. Moving from left to right across the table reduces the significant ENS threshold while moving down the table increases the market depth. As indicated by the range of annual LOLP values, the study results are very sensitive to these key assumptions. This shows variability in annual LOLP results for FY 2016, an equivalent analysis for FY 2017 would yield similar sensitivities.

Figure 5-7

Federal System Resource Adequacy
For FY 2016
Sensitivity of Annual LOLP Results

		Significant ENS Threshold (aMW)		
		100	50	0
Market Depth (MW)	None†	30.6%	42.7%	81.1%
	Base Case††	1.3%	2.4%	17.9%
	High†††	0.0%	1.3%	3.5%

† Assumes 0 MW for all months
†† Assumes 1,000 MW October-April and 500 MW May-September
††† Assumes 1,300 MW September-February and 1,600 MW March-August

Federal System Resource Adequacy Conclusions & Next Steps

The FY 2016 and 2017 annual LOLP results of 2.4 percent and 2.7 percent are within the "acceptable" range of the annual LOLP standards that BPA is presently considering. However, the monthly LOLP results of 11.8 percent and 12.4 percent show that a considerably higher percentage of games have significant ENS, indicating that some months are significantly worse than the annual average. Together with the CVaR metric, these results suggest that January and February present the highest likelihood of the Federal system being unable to meet firm load without the need to augment the system. Finally, the higher FY 2017 annual and monthly LOLP values are mainly caused by the CGS refueling outage in 2017.

Overall, the conclusions from the 2012 White Book resource adequacy analysis are consistent with the resource adequacy results published in the 2011 White Book. However, the new studies suggest that some months may be of more concern than indicated in the 2011 White Book while others may be of less concern. In particular, the 2012 White Book analysis shows that January has become one of the months of most concern. These changes in monthly results are driven by the hydro modeling updates included in this 2012 White Book, which are described in Section 2: Methodology, Hydro Resources Modeling, page 15.

The study results include the expected amount of resources (both Federal and non-Federal) that will be needed to serve AHWM load in FY 2016 and 2017. If neither BPA nor customers acquire adequate resources to serve the expected AHWM load for FY 2016 and 2017, the annual LOLP increases to 4.4 percent and 6.7 percent, respectively.

The studies presented above also include a market depth of 1,000 MW in the winter and 500 MW in the summer that is available in all hours. Accessing this full amount may become more difficult, which would increase the LOLP.

Over the past year, BPA has improved its understanding of resource adequacy as it relates to the Federal system. BPA analyses suggest that water supply variability, the accuracy of our expected load obligations, and market depth are primary drivers of Federal LOLP results. BPA continues to assess the most appropriate value for each assumption on a long-term planning basis. Further, BPA continues to investigate the draft resource adequacy metrics presented above as well as alternative metrics appropriate for large hydro-based systems. Additional analyses are required before establishing a metric and standard for the Federal system.

In 2012, the Northwest Resource Adequacy Forum produced a regional LOLP assessment for 2017. This assessment, published by the Council, provides a regional perspective on the resource adequacy situation.[1]

[1] For details, see Council document 2012-12 available at: http://www.nwcouncil.org/library

Section 6: Pacific Northwest Regional Analysis

PNW Regional Analysis Assumptions

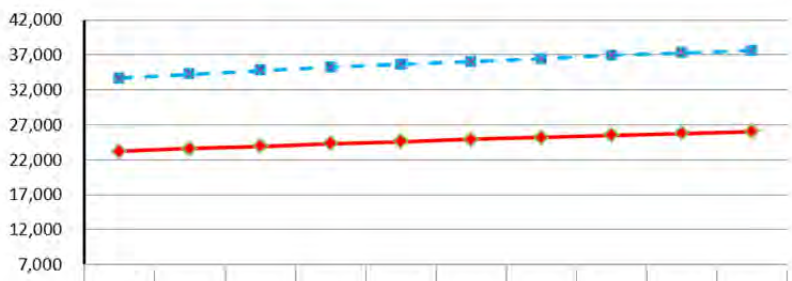
This PNW Regional Analysis is based on regional firm loads, resources, and contracts that were finalized as of October 19, 2012. The regional analysis includes uncommitted PNW IPP generation in the regional resource stack and assumes it is available to meet regional load unless otherwise specified.

PNW Regional Analysis Firm Energy Load Projections

Annual regional firm load projections are comprised of two components: TRL consumption and regional exports. The TRL is based on each individual entity's TRL forecast as discussed in Section 2: Methodology, Load Obligations, page 11, and comprises about 95 percent of regional load projections. Reported long-term and multi-year regional export contracts are contract obligations that regional entities have outside the PNW region. Exports make up the remaining 5 percent of the regional load estimates. Overall, regional total retail firm load obligations for energy and capacity have a forecasted annual growth rate of about 1.1 percent over the study period as illustrated by Figure 6-1, below.

Figure 6-1

PNW Regional Firm Load Obligations
For OY 2014 through 2023
Annual Energy and January 120-Hour Capacity



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Energy (aMW)	23,169	23,586	23,953	24,295	24,588	24,901	25,200	25,517	25,767	26,027
January 120 Hour Cap (MW)	33,672	34,225	34,803	35,263	35,647	36,015	36,418	36,934	37,255	37,638

While looking at regional firm load projections on an annual basis shows the overall trend in loads over the study period, it does not illustrate how those loads are shaped monthly over the year. Figures 6-2 and 6-3, below, illustrate the monthly shape and anticipated load growth of the projected regional firm loads. Monthly average energy and 120-hour capacity maintain very similar shapes over the study period, with the highest loads being forecasted during the winter (December through February), and during the summer (July and August) and the lowest loads being forecasted in the early fall (September and October) and spring (April and May).

Figure 6-2

PNW Regional Firm Load Obligations
For OY 2014 through 2023
Monthly Energy in Average Megawatts

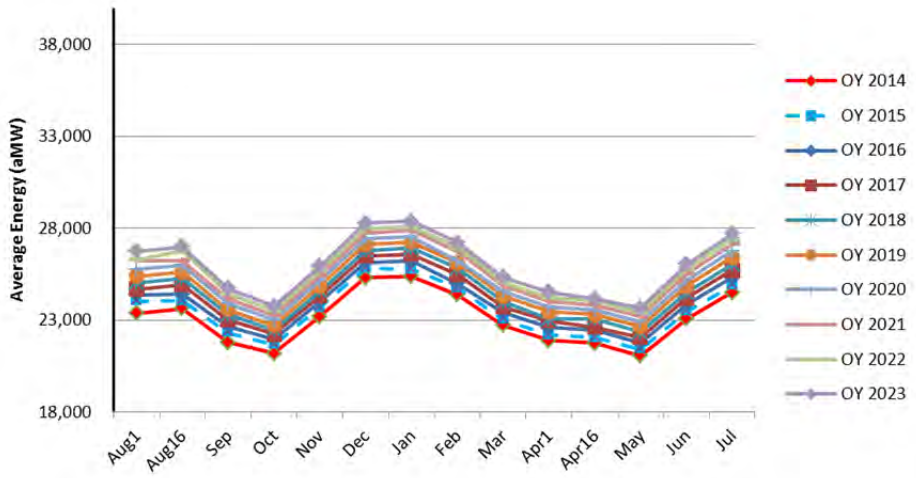


Figure 6-3

PNW Regional Firm Load Obligations
For OY 2014 through 2023
Monthly 120-Hour Capacity in Megawatts

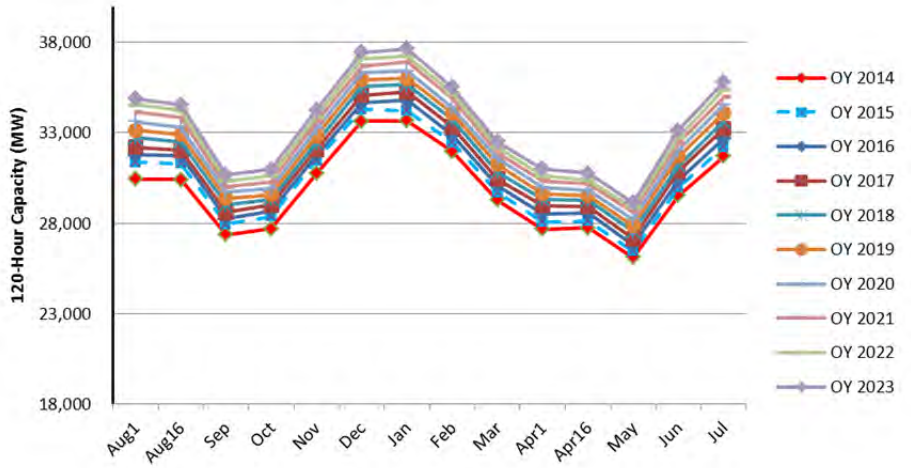


Figure 6-4, below, compares the relative size of regional firm obligations (TRL plus exports) by customer class for OY 2014. IOUs represent over half of the PNW regional firm energy and 120-hour capacity retail load obligations with Public Utility Districts and Municipalities representing most of the remainder.

Figure 6-4

PNW Regional Firm Load
For OY 2014
By Customer Class
Annual Energy and January 120-Hour Capacity

Customer Class	Firm Energy (aMW)	Percent of Firm Energy	January 120-Hour Capacity (MW)	Percent of Capacity
Federal Agency	133	1%	221	1%
USBR	176	1%	15	0%
Cooperative	1,885	9%	3,119	9%
Municipality	2,741	13%	4,591	14%
Public Utility District	4,449	21%	7,336	22%
Investor-Owned Utility	11,401	53%	16,995	51%
Marketer	386	2%	443	1%
Direct-Service Industry	442	2%	463	1%
Total Regional Firm Load	**21,614**	**100%**	**33,182**	**100%**

PNW Regional Analysis Firm Resources

Hydro resources represent a smaller share of the PNW regional resource stack than that of the Federal system because the majority of non-hydro resources in the region are owned by non-Federal entities. These non-hydro resources are primarily comprised of coal, gas, nuclear, oil-fired, and natural gas projects and are included in the large thermal and combustion turbine categories below. Forecasts are included for new generating projects when they have been placed into operation or are in the actual construction process.

Figure 6-5, below, summarizes the regional firm resource's energy and 120-hour capacity by generation type for OY 2014 assuming 1937-critical water conditions. Regional firm energy resources are comprised of approximately 43 percent hydro, 23 percent large thermal (including nuclear), 10 percent cogeneration, 12 percent combustion turbines, 1 percent small hydro, 7 percent renewables (of which 1,840 aMW of the 1,954 aMW is from wind), and 4 percent imports.

Figure 6-5

PNW Regional Resources†
For OY 2014
Under 1937-Critical Water Conditions
Annual Energy and January 120-Hour Capacity

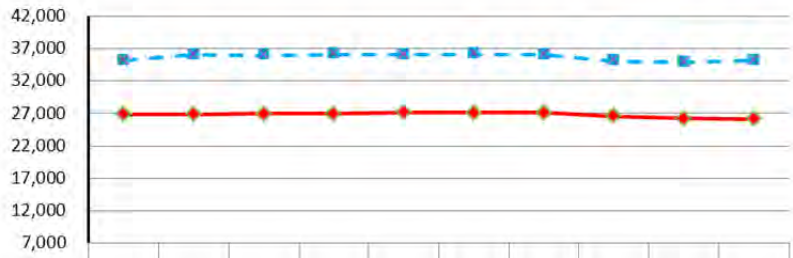
Project Type	Annual Energy (aMW)	Percent of Firm Energy	January 120-Hour Capacity (MW)	Percent of Capacity
Hydro	11,953	43.2%	20,631	52.7%
Large Thermal	6,358	23.0%	7,244	18.5%
Cogen	2,633	9.5%	3,080	7.9%
Combustion Turbines	3,390	12.3%	5,949	15.2%
Small Hydro	253	0.9%	166	0.4%
Renewables	1,954	7.1%	126	0.3%
Small Thermal &Misc	38	0.1%	85	0.2%
Imports	1,085	3.9%	1,866	4.8%
Total Federal Resources	**27,664**	**100.0%**	**39,147**	**100.0%**

† Regional firm resource estimates before adjustments for reserves and transmission losses.

Figure 6-6, below, shows that the aggregated generation estimates incorporated in the regional firm resource forecast do not substantially vary over the study horizon. For OY 2014 through 2020, the forecast shows small annual changes in the resource projections driven by yearly maintenance, refueling, and capital improvements. The regional firm energy and 120-hour capacity forecasts decline slightly over the last three study years, largely driven by the retirement of the Centralia Unit 1 and Boardman coal plants in December 2020.

Figure 6-6

PNW Regional Resources
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Annual Energy and January 120-Hour Capacity



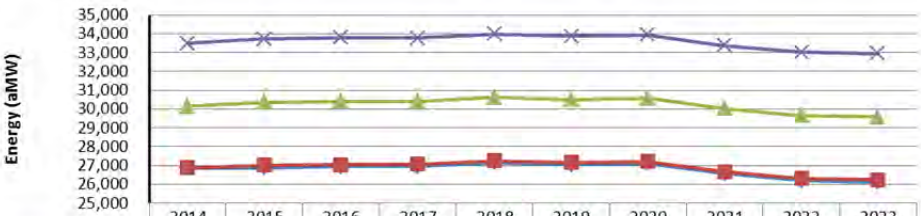
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Energy (aMW)	26,884	26,872	26,936	26,948	27,156	27,047	27,098	26,564	26,194	26,127
January 120 Hour Cap (MW)	35,150	36,013	35,894	36,065	35,962	36,047	35,958	35,068	34,853	35,123

Potential Variability of PNW Regional Resources

Variability Due to Water Conditions: As discussed and illustrated in Section 3: Federal System Analysis, starting on page 21, variability in the 80 water year hydro generation forecast also significantly affects the PNW regional resource forecast, although to a lesser degree, based on hydro resources only making up 43% of the regions resource stack. Figure 6-7, below, illustrates the variability of regional resources for OY 2014 through 2023 using the same four scenarios presented in the Federal System Analysis: 1) 1937-critical water conditions (the base case of this study); 2) the averages of the bottom 10 percent; 3) the averages of the middle 80 percent; and 4) the averages of the top 10 percent of the 80 historical water conditions (1929 through 2008).

Figure 6-7

PNW Regional Resources
For OY 2014 through 2023
Under Different Levels of Water Conditions
Annual Energy in Average Megawatts



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1937	26,884	26,872	26,936	26,948	27,156	27,047	27,098	26,564	26,194	26,127
Bottom 10%	26,884	27,003	27,043	27,052	27,260	27,151	27,205	26,668	26,298	26,231
Middle 80%	30,147	30,352	30,402	30,405	30,614	30,503	30,560	30,020	29,649	29,583
Top 10%	33,481	33,718	33,782	33,771	33,982	33,866	33,932	33,382	33,012	32,945

Variability Due to IPP Generation Amounts Delivered to the PNW Region: The PNW regional study includes uncommitted PNW IPP generation as regional resources. These resources represent approximately 3,600 MW of peak capacity with an associated energy capability of 3,285 aMW. Generation forecasts for these uncommitted regional resources were updated; however, these IPP resources may or may not be available to the PNW when needed to serve regional firm loads. While this assumption is reasonable from a long-term planning standpoint, the resulting regional forecasts may overstate the availability of IPP generation for real-time use within the PNW. The PNW region may have to compete with other western markets to secure uncommitted IPP generation to meet electricity demand. Figure 6-8, below, details the peak capacity and annual energy capabilities of the regional uncommitted IPP projects as well as their fuel type. As uncommitted IPP projects are purchased by load serving entities—whether regional or extra-regional—the generation from projects will be appropriately accounted for in future studies.

Figure 6-8

Expected PNW Regional Uncommitted IPP Projects
For OY 2014
Peak Capacity and Annual Energy

Operating Year 2014	Peak	Energy	Fuel Type
Big Hanaford	248	223	Natural Gas
Centralia #1†	670	577	Coal
Centralia #2††	670	626	Coal
Hermiston Power Project	630	567	Natural Gas
Juniper Canyon Wind	0	40	Wind
Kittitas Valley Wind	0	27	Wind
Klamath Generation Facility	484	435	Natural Gas
Klamath Generation Peaking	100	14	Natural Gas
Leaning Juniper 2a	0	24	Wind
Leaning Juniper 2b	0	27	Wind
Satsop Combustion Turbine Project	650	584	Natural Gas
SP Newsprint Cogen	104	104	Natural Gas
Stateline Wind (4.6% for OY 2014)	0	3	Wind
Weyerhaeuser Longview	44	35	Wood Waste
Total Uncommitted IPP Generation	**3600**	**3285**	

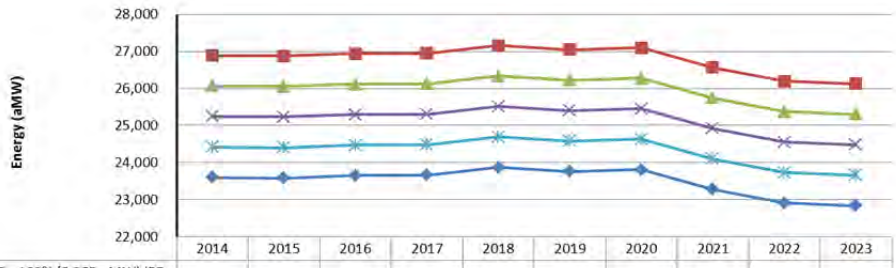
† Centralia #1 (670 MW) is scheduled for retirement on Dec 1, 2020.

†† Centralia #2 (670 MW) is scheduled for retirement on Dec 1, 2025. Puget purchased an increasing amount of this project beginning Dec 1, 2014 and ending Nov 30, 2025.

Figure 6-9, below, illustrates the potential variability of regional resources for OY 2014 depending on the level of uncommitted IPP generation assumed to be delivered in the region: 100 percent (3,285 aMW), 75 percent (2,464 aMW), 50 percent (1,643 aMW), and 25 percent (821 aMW). The level of uncommitted IPP generation assumed to be delivered in the region has a significant impact on PNW regional resource capabilities.

Figure 6-9

PNW Regional Resources
For OY 2014 through 2023
Utilizing Different Levels of Uncommitted IPP Generation Available to the Region
Under 1937-Critical Water Conditions
Annual Energy in Average Megawatts



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
100% (3,285 aMW) IPP Delivered to PNW	26,884	26,872	26,936	26,948	27,156	27,047	27,098	26,564	26,194	26,127
75% (2,464 aMW) IPP Delivered to PNW	26,063	26,051	26,115	26,126	26,334	26,226	26,277	25,743	25,373	25,306
50% (1,643 aMW) IPP Delivered to PNW	25,241	25,230	25,294	25,305	25,513	25,405	25,456	24,921	24,552	24,485
25% (821 aMW) IPP Delivered to PNW	24,420	24,408	24,473	24,484	24,692	24,583	24,634	24,100	23,731	23,664
0% (0 aMW) IPP Delivered to PNW	23,599	23,587	23,651	23,663	23,871	23,762	23,813	23,279	22,909	22,842

While looking at PNW regional resources on an annual basis shows the overall trend in resources over the study period, it does not show how those resources are shaped monthly over the year. Figures 6-10 and 6-11, page 73, illustrate the monthly shape of the regional firm resource forecast under 1937-critical water conditions. The monthly regional resource forecasts for energy and 120-hour capacity maintain similar shapes over the study period, with the highest generation forecasts being in late spring/early summer and early winter periods. The lowest generation forecasts occur in the late summer/early fall and late winter/early spring timeframes.

Figure 6-10

PNW Regional Resources
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Monthly Energy in Average Megawatts

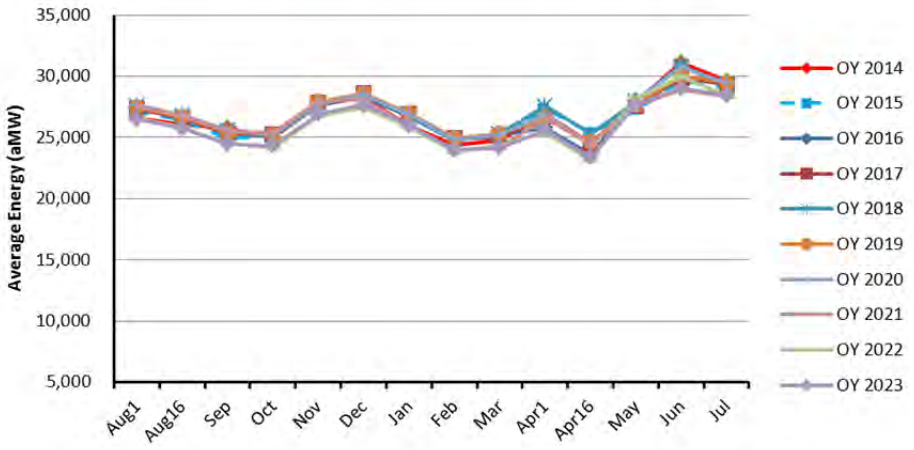
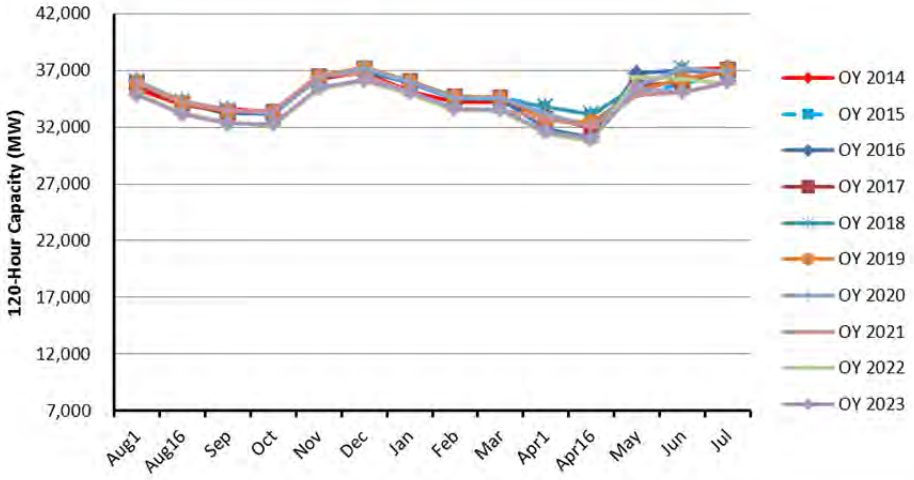


Figure 6-11

PNW Regional Resources
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Monthly 120-Hour Capacity in Megawatts

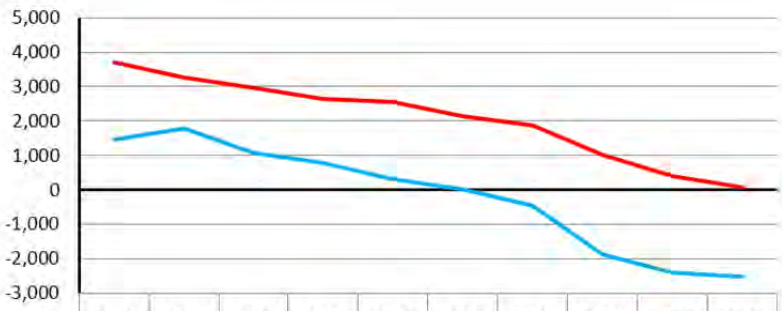


PNW Regional Analysis Firm Energy Surplus/Deficit Projections

The annual PNW regional surplus/deficit projections for OY 2014 through 2023, assuming 1937-critical water conditions and 100 percent of the uncommitted IPP resources are consumed within the PNW region, are presented below in Figure 6-12. The regional firm energy and January 120-hour capacity surplus significantly declines over the 10-year study period. By the end of the period, the energy surplus has been reduced to 90 aMW while the January 120-hour capacity surplus has declined to -2,519 MW. The declines in both energy and 120-hour capacity surplus/deficit projections are primarily driven by steady regional load growth as the regional resource forecast remains fairly constant over the study period.

Figure 6-12

PNW Regional Surplus/Deficit Projections
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Annual Energy and January 120-Hour Capacity



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Energy (aMW)	3,704	3,275	2,973	2,642	2,557	2,136	1,888	1,036	417	90
January 120 Hour Cap (MW)	1,475	1,784	1,087	798	310	28	-464	-1,870	-2,406	-2,519

Figures 6-13 and 6-14, below, illustrate the monthly PNW regional firm surplus/deficit projections for the study period. On a monthly basis, the region is projected to have its highest surplus in late spring/early summer while its largest deficits occur in late summer and winter.

Figure 6-13

PNW Regional Surplus/Deficit Projections
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Monthly Energy in Average Megawatts

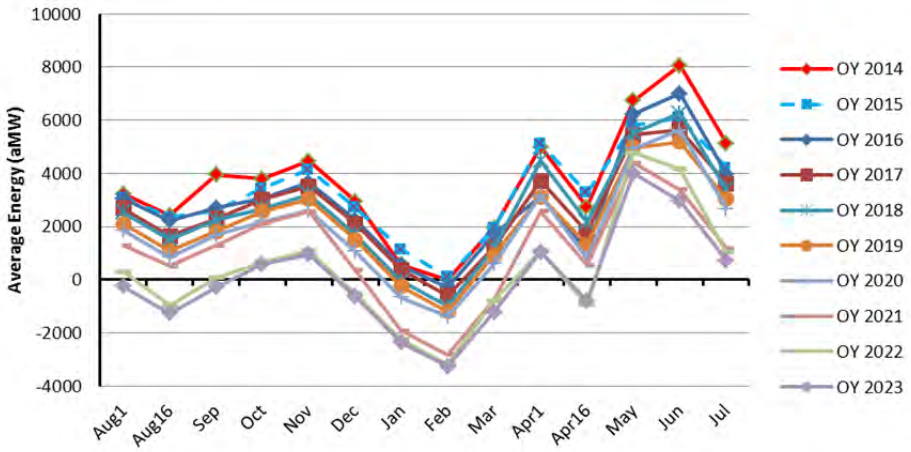
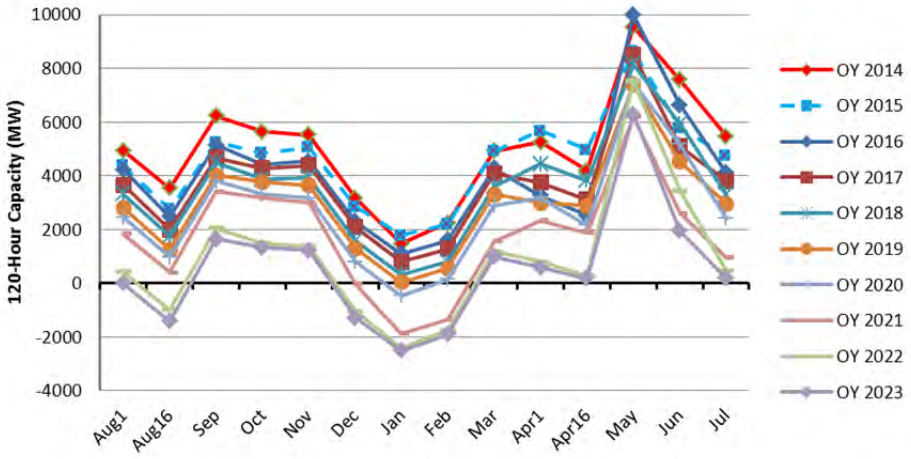


Figure 6-14

PNW Regional Surplus/Deficit Projections
For OY 2014 through 2023
Under 1937-Critical Water Conditions
Monthly 120-Hour Capacity in Megawatts

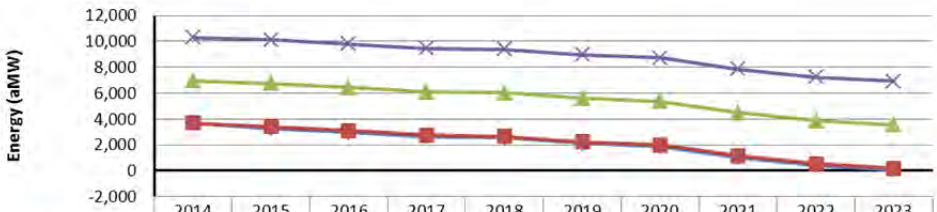


Potential Variability of PNW Regional Energy Surplus/Deficit Projections

Variability Due to Water Conditions: As discussed above, the variability of the PNW region's hydro resources based on the 80 historical water conditions has a direct and significant effect on regional surplus/deficit projections. Figure 6-15, below, illustrates the variability in annual surplus by comparing the regional surplus/deficit forecasts for OY 2014 through 2023 under the same four resource scenarios: 1) 1937-critical water conditions (the base case of this study); 2) the averages of the bottom 10 percent; 3) the averages of the middle 80 percent; and 4) the averages of the top 10 percent of the 80 historical water conditions (1929 through 2008). Since regional surplus/deficit projections for 1937-critical water conditions and the bottom 10 percent are similar, they are essentially the same line. The regional surplus forecast varies significantly depending on the water condition assumed.

Figure 6-15

PNW Regional Surplus/Deficit Projections
For OY 2014 through 2023
Under Different Levels of Water Conditions
Annual Energy in Average Megawatts

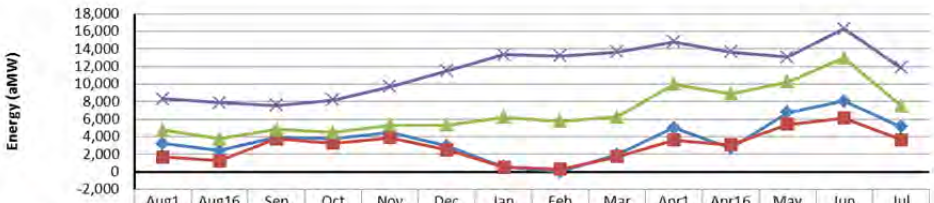


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1937	3,704	3,275	2,973	2,642	2,557	2,136	1,888	1,036	417	90
Bottom 10%	3,704	3,407	3,080	2,746	2,661	2,240	1,995	1,141	521	194
Middle 80%	6,967	6,755	6,438	6,099	6,015	5,592	5,350	4,492	3,872	3,546
Top 10%	10,301	10,121	9,818	9,465	9,383	8,955	8,722	7,854	7,235	6,908

Figure 6-16, below, illustrates the monthly variability under the four water condition scenarios described and shown on an annual basis above. Similar to the annual results, the monthly regional surplus forecast varies significantly depending on the water condition assumed. While better water conditions increase energy surpluses throughout the year, surpluses increase the most during the winter.

Figure 6-16

PNW Regional Surplus/Deficit Projections
For OY 2014
Under Different Levels of Water Conditions
Monthly Energy in Average Megawatts

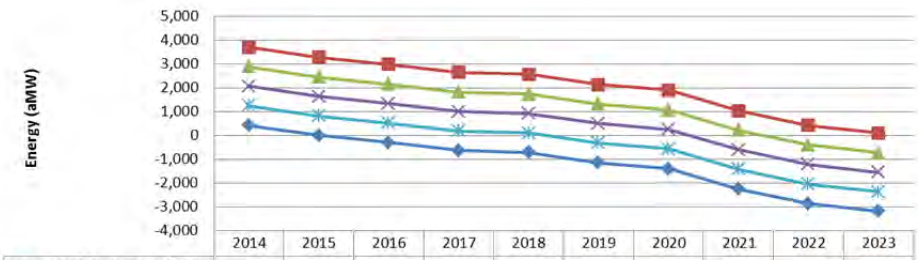


	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul
1937	3,233	2,418	3,952	3,784	4,456	2,947	561	-7	1,965	4,995	2,728	6,744	8,063	5,126
Bottom 10%	1,692	1,251	3,753	3,271	3,896	2,480	544	314	1,728	3,619	3,080	5,392	6,114	3,677
Middle 80%	4,717	3,753	4,824	4,509	5,320	5,315	6,198	5,780	6,259	9,995	8,883	10,239	12,983	7,527
Top 10%	8,321	7,889	7,576	8,166	9,684	11,481	13,333	13,216	13,630	14,801	13,624	13,048	16,272	11,855

Variability Due to IPP Generation Amounts Delivered to the PNW Region: As discussed above, the potential variability of uncommitted IPP generation delivered to the region has a significant effect on regional surplus/deficit projections. Figure 6-17, below, illustrates the potential variability in annual energy surplus/deficit projections for OY 2014 through 2023 under different assumptions for uncommitted IPP generation.

Figure 6-17

PNW Regional Surplus/Deficit Projections
For OY 2014 through 2023
Utilizing Different Levels of Uncommitted IPP Generation Available to the Region
Under 1937-Critical Water Conditions
Annual Energy in Average Megawatts



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
100% (3,285 aMW) IPP Delivered to PNW	3,704	3,275	2,973	2,642	2,557	2,136	1,888	1,036	417	90
75% (2,464 aMW) IPP Delivered to PNW	2,883	2,454	2,151	1,820	1,736	1,314	1,067	215	-404	-731
50% (1,643 aMW) IPP Delivered to PNW	2,062	1,633	1,330	999	915	493	245	-606	-1,226	-1,553
25% (821 aMW) IPP Delivered to PNW	1,240	812	509	178	93	-328	-576	-1,427	-2,047	-2,374
0% (0 aMW) IPP Delivered to PNW	419	-10	-312	-643	-728	-1,149	-1,397	-2,249	-2,868	-3,195

PNW Regional Analysis Conclusion

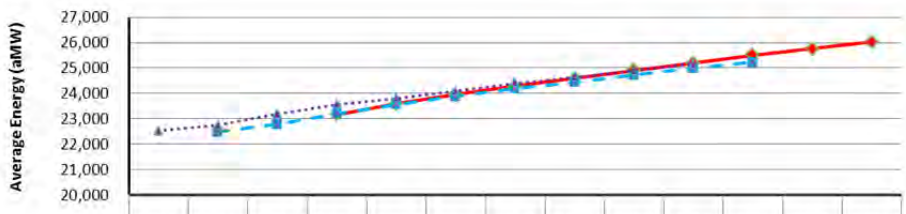
Assuming modest load growth and the availability of energy from all uncommitted IPP resources to serve regional load, the PNW region is projected to be surplus through OY 2023. However, if firm loads grow faster or the IPP resources are unavailable, either from out of region competition or for other reasons, the region could be deficit as soon as OY 2015. While BPA is not responsible for Regional planning, this analysis offers BPA's view of the region. Projected regional deficits identified in this and/or other analysis could be mitigated through options discussed in the Council's Sixth Power Plan. Additional views of mitigation options have been discussed by the Council's Northwest Resource Adequacy Forum. BPA will provide its next complete analysis of regional loads and resources for long-term planning in the 2014 White Book.

Comparison to Previous White Books

Figures 6-18 and 6-19, below, compare the 2012 White Book PNW regional firm load obligation forecast to those published in the 2010 and 2011 White Books. In terms of average energy, the 2012 White Book regional load forecast is virtually the same as the previous White Books.

Figure 6-18

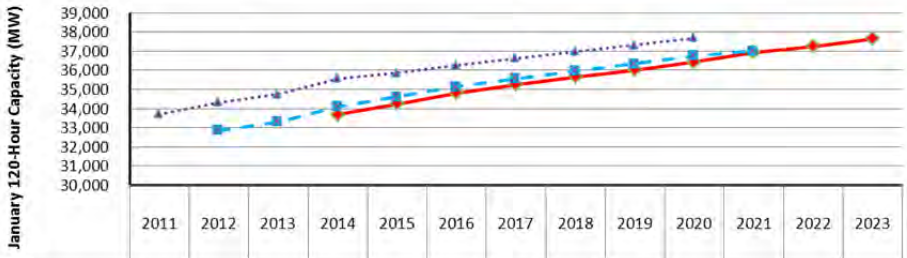
PNW Regional Firm Load Obligations
Comparison to Previous White Book Studies
Annual Energy in Average Megawatts



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				23,16	23,58	23,95	24,29	24,58	24,90	25,20	25,51	25,76	26,02
WBK2011		22,489	22,781	23,205	23,564	23,889	24,194	24,446	24,717	24,994	25,227		
WBK2010	22,512	22,757	23,185	23,576	23,813	24,091	24,409	24,642	24,895	25,161			

Figure 6-19

PNW Regional Firm Load Obligations
Comparison to Previous White Book Studies
January 120-Hour Capacity in Megawatts

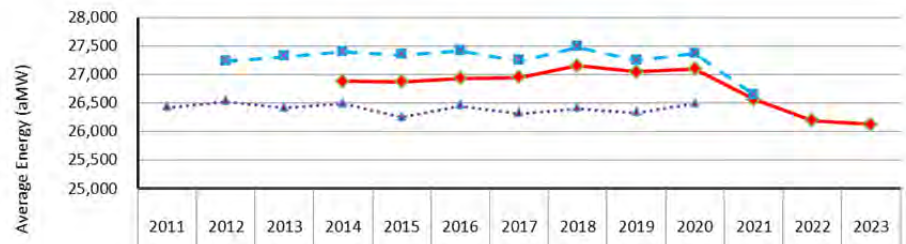


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				33,67	34,22	34,80	35,26	35,64	36,01	36,41	36,93	37,25	37,63
WBK2011		32,85	33,30	34,10	34,62	35,14	35,57	35,97	36,33	36,74	37,01		
WBK2010	33,69	34,31	34,75	35,55	35,84	36,24	36,63	36,98	37,31	37,69			

Figures 6-20 and 6-21, below, compare the 2012 White Book PNW regional resource forecast to those published in the 2010 and 2011 White Books. The current resource forecast shows a slight reduction in annual energy and a substantial reduction in January 120-hour capacity when compared to the 2011 White Book. Again, the reduction in January 120-hour capacity is mostly a result of the HYDSIM modeling changes described in Hydro Resource Modeling in Section 2: Overall Methodology, on page 15.

Figure 6-20

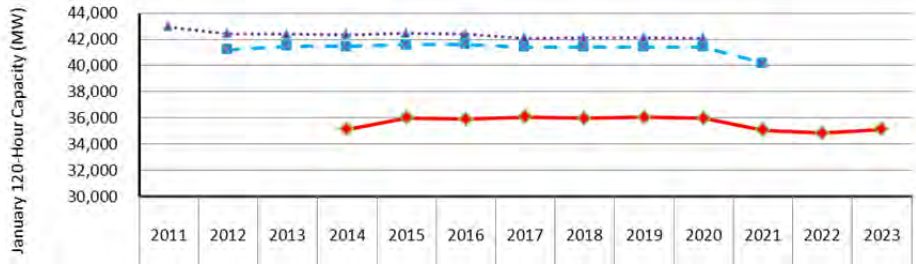
PNW Regional Resources
Comparison to Previous White Book Studies
Under 1937-Critical Water Conditions
Annual Energy in Average Megawatts



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				26,88	26,87	26,93	26,94	27,15	27,04	27,09	26,56	26,19	26,12
WBK2011		27,22	27,31	27,39	27,34	27,41	27,23	27,47	27,24	27,36	26,64		
WBK2010	26,41	26,52	26,41	26,48	26,24	26,44	26,31	26,40	26,32	26,49			

Figure 6-21

PNW Regional Resources
Comparison to Previous White Book Studies
Under 1937-Critical Water Conditions
January 120-Hour Capacity in Megawatts

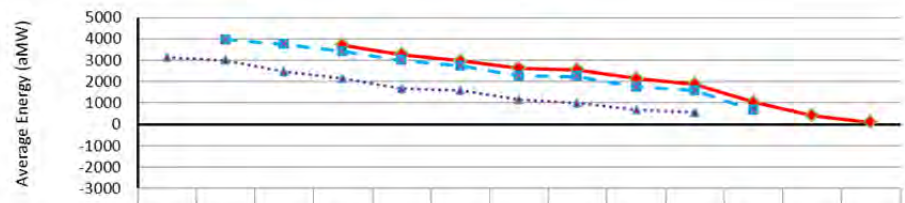


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				35,15	36,01	35,89	36,06	35,96	36,04	35,95	35,06	34,85	35,12
WBK2011		41,22	41,49	41,44	41,57	41,62	41,40	41,42	41,41	41,40	40,18		
WBK2010	42,95	42,42	42,38	42,35	42,43	42,37	42,08	42,11	42,10	42,08			

Figures 6-22 and 6-23, below, compare the 2012 White Book surplus/deficit projections described above to the surplus/deficit forecasts published in the 2010 and 2011 White Books. The 2012 White Book regional surplus/deficit projections continue to follow similar patterns as those in the last two White Book publications. Overall, the 2012 White Book forecasts slightly higher energy surpluses, and slightly lower January 120-hour capacity surpluses than the 2011 White Book.

Figure 6-22

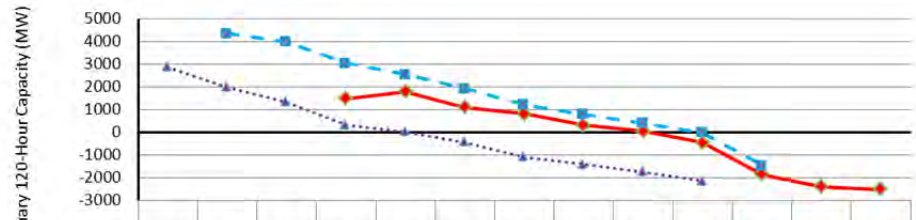
PNW Regional Surplus/Deficit Projections
Comparison to Previous White Book Studies
Under 1937-Critical Water Conditions
Annual Energy in Average Megawatts



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				3704	3275	2973	2642	2557	2136	1888	1036	417	90
WBK2011		3961	3751	3408	2997	2737	2263	2246	1747	1583	652		
WBK2010	3138	3000	2460	2141	1672	1589	1140	994	667	559			

Figure 6-23

PNW Regional Surplus/Deficit Projections
Comparison to Previous White Book Studies
Under 1937-Critical Water Conditions
January 120-Hour Capacity in Megawatts



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
WBK2012				1475	1784	1087	798	310	28	-464	-1870	-2406	-2519
WBK2011		4341	3978	3030	2528	1926	1215	792	401	-33	-1469		
WBK2010	2859	1979	1319	311	18	-446	-1096	-1420	-1762	-2159			

Comparison to Council's Sixth Power Plan

Comparing the PNW regional firm load forecast in the White Book to the Council's Sixth Power Plan (February 2010), requires that only a subset of load obligations are compared to provide consistency. The following discussion compares the non-DSI regional TRL forecast in each publication by removing the regional DSI load component in each forecast. It should be noted that the regional TRL forecasts do not include regional exports, which are a separate component of load obligations to the PNW region.

2012 White Book Non-DSI Total Retail Load Forecast: The 2012 White Book TRL projections were forecasted for each entity and then aggregated into the displayed categories. BPA's TRL forecast is reduced for anticipated BPA-funded conservation through the 2014 Rate Case period. As more utilities report planned or implemented conservation measures, those impacts will be reflected in future BPA TRL forecasts.

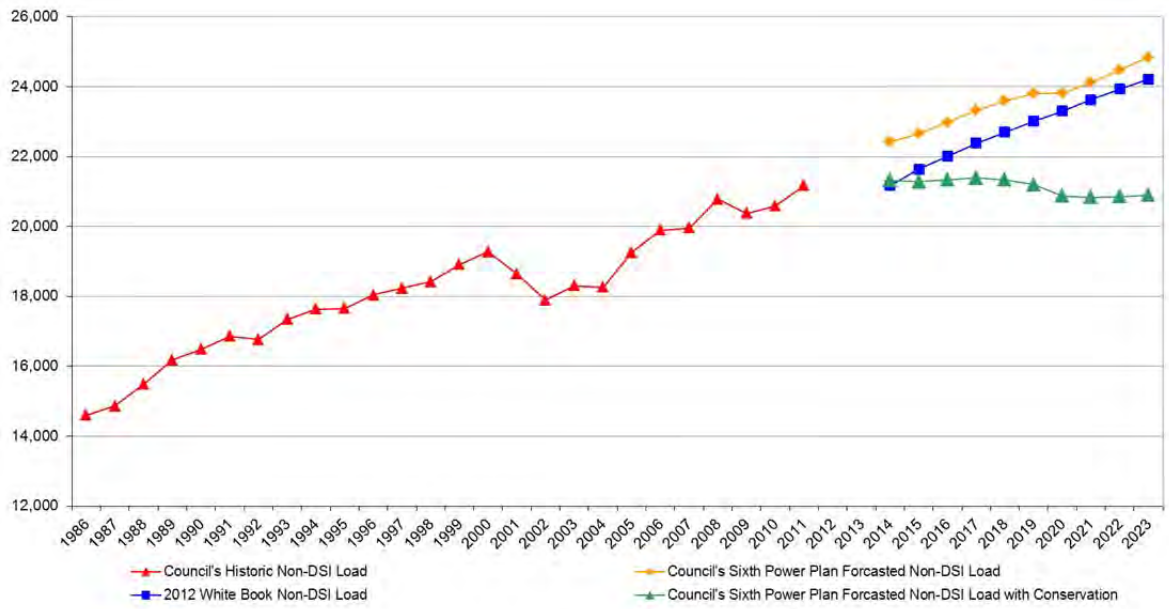
Council Non-DSI Total Retail Load Forecast: The Council's Sixth Power Plan for the near-term reflects lower non-DSI electricity demand due to current economic trends. The expected lower level of demand estimates anticipated levels of permanent load loss not expected to return as part of economic recovery. The Council's Sixth Power Plan is available at: *http://www.nwcouncil.org/energy/powerplan/6*

Comparison of the Non-DSI Total Retail Load Forecasts: The differences between the 2012 White Book and the Council's Sixth Power Plan non-DSI load forecasts, without the Council conservation targets, shows the White Book firm load forecast to be an average of 3.6 percent lower over the 10-year study period. The difference is the extent of the economic downturn reflected in BPA's ALF forecast, when compared to the Council's estimates.

When comparing the 2012 White Book and the Council's Sixth Power Plan non-DSI load forecasts including the Council conservation targets shows the White Book firm load forecast to be an average of 7.1 percent higher over the 10-year study period. The difference is the inclusion of long-term Council conservation targets in the Council's estimates. Figure 6-24, below, compares the historic and forecasted non-DSI regional TRL from the Council's Sixth Power Plan to BPA's regional TRL forecast in the 2012 White Book. The Council's forecast is shown with and without assumed conservation savings that increase from approximately 1,107 aMW in 2014 to approximately 3,945 aMW in 2023.

Figure 6-24

Non-DSI PNW Regional Firm Total Retail Loads Comparison
BPA 2012 White Book Load Projections and the
Council's Sixth Power Plan (February 2010)
Annual Energy in Average Megawatts



THIS PAGE INTENTIONALLY LEFT BLANK

Section 7: Federal System Exhibits

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 7-1: Annual Energy

Federal System Surplus Deficit
Operating Year 2014 to 2023
Using 1937-Water Conditions

Exhibit 7-1: Annual Energy
Federal Report Surplus Deficit
Operating Year 2014 to 2023 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-173308

	Energy-aMW	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	Firm Obligations										
1	**Non-Utility Obligation**	611	613	613	626	641	651	657	662	664	665
2	Federal Agencies	123	125	125	138	153	163	169	174	176	177
3	USBR Obligation	176	176	176	176	176	176	176	176	176	176
4	DSI Obligation	312	312	312	312	312	312	312	312	312	312
5	**Transfers Out**	7604	7609	7617	7601	7632	7581	7617	7597	7659	7635
6	Load Following 2012 PSC	3134	3187	3206	3235	3248	3273	3300	3334	3363	3384
7	Slice Block 2012 PSC	1817	1886	1845	1876	1853	1881	1854	1845	1845	1845
8	Slice Right to Power 2012 PSC	1943	1877	1907	1860	1907	1891	1932	1892	1931	1890
9	Exports	595	565	565	535	531	525	520	515	510	506
10	Intra-Regional Transfers (Out)	115	93.6	93.9	93.6	93.6	10.3	10.3	10.3	10.3	10.3
11	Federal Diversity	0	0	0	0	0	0	0	0	0	0
12	**Total Firm Obligations**	**8216**	**8222**	**8230**	**8227**	**8273**	**8232**	**8274**	**8259**	**8323**	**8300**
	Net Resources										
13	**Net Hydro**	6917	6833	6811	6815	6815	6814	6811	6814	6802	6800
14	Regulated Hydro - Net	6563	6479	6458	6461	6461	6461	6458	6461	6461	6461
15	Independent Hydro - Net	354	354	353	354	354	354	353	354	342	340
16	**Other Resources**	1112	960	1106	941	1093	941	1093	941	1093	941
17	Cogeneration Resources	19.2	19.2	13.1	0	0	0	0	0	0	0
18	Combustion Turbines	0	0	0	0	0	0	0	0	0	0
19	Large Thermal Resources	1030	878	1030	878	1030	878	1030	878	1030	878
20	Renewable Resources	60.3	60.3	60.2	60.3	60.3	60.3	60.2	60.3	60.3	60.3
21	Small Hydro Resources	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88
22	Small Thermal & Misc.	0	0	0	0	0	0	0	0	0	0
23	**Contract Purchases**	437	375	377	360	318	317	232	222	222	222
24	Imports	52.7	52.3	46.1	30.6	30.6	30.6	30.5	30.6	30.6	30.6
25	Intra-Regional Transfers (In)	211	151	160	160	118	118	34.3	25.8	25.8	25.8
26	Non-Federal CER	136	136	135	135	133	132	131	130	130	130
27	Slice Transmission Loss Return	36.6	35.4	35.9	35.0	35.7	35.3	36.1	35.3	36.1	35.3
28	Augmentation Purchases	0	0	0	0	0	0	0	0	0	0

Exhibit 7-1: Annual Energy
Federal Report Surplus Deficit
Operating Year 2014 to 2023 Water Year: 1937
2012 White Book Report Date: **10-19-2012**
S104-WB-20121129-173308

	Energy-aMW	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
29	**Reserves & Losses**	-239	-230	-234	-229	-232	-228	-229	-225	-229	-225
30	Contingency Reserves (Spinning)	0	0	0	0	0	0	0	0	0	0
31	Contingency Reserves (Non-Spinning)	0	0	0	0	0	0	0	0	0	0
32	Load Following Reserves	0	0	0	0	0	0	0	0	0	0
33	Generation Imbalance Reserves	0	0	0	0	0	0	0	0	0	0
34	Transmission Losses	-239	-230	-234	-229	-232	-228	-229	-225	-229	-225
35	**Total Net Resources**	**8227**	**7937**	**8061**	**7887**	**7994**	**7844**	**7907**	**7752**	**7889**	**7739**
36	**Total Surplus/Deficit**	**11.5**	**-284**	**-169**	**-340**	**-280**	**-388**	**-367**	**-507**	**-434**	**-561**

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 7-2: Monthly Energy

Federal System Surplus Deficit
Operating Year 2014
Using 1937-Water Conditions

Exhibit 7-2: Monthly Energy
Federal Report Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-173308

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
	Firm Obligations															
1	**Non-Utility Obligation**	718	716	670	519	473	498	476	470	505	671	671	743	751	834	611
2	Federal Agencies	113	113	103	107	132	154	151	140	135	113	113	104	105	119	123
3	USBR Obligation	292	290	254	100	27.6	32.8	13.5	16.9	57.8	246	246	327	335	402	176
4	DSI Obligation	312	312	313	311	313	311	312	313	312	312	312	312	311	312	312
5	**Transfers Out**	7583	7334	6926	6823	8165	8785	8315	8018	7530	6958	6975	7625	7110	7533	7604
6	Load Following 2012 PSC	3086	3089	2841	2781	3236	3658	3616	3446	3054	2940	2940	2828	2946	3191	3134
7	Slice Block 2012 PSC	1636	1636	1716	1655	2046	2274	2310	2137	1989	1663	1663	1454	1351	1592	1817
8	Slice Right to Power 2012 PSC	2006	1749	1673	1617	2151	2118	1655	1579	1742	1715	1732	2764	2227	2154	1943
9	Exports	716	721	567	761	517	520	519	642	635	529	529	570	577	586	595
10	Intra-Regional Transfers (Out)	139	140	129	9.00	215	215	215	215	110	110	110	9.00	9.00	9.00	115
11	Federal Diversity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	**Total Firm Obligations**	**8300**	**8050**	**7596**	**7341**	**8638**	**9283**	**8791**	**8488**	**8035**	**7629**	**7646**	**8368**	**7861**	**8366**	**8216**
	Net Resources															
13	**Net Hydro**	7209	6200	5776	5648	7575	7314	5768	5618	6133	6118	6197	10163	8115	7918	6917
14	Regulated Hydro - Net	6848	5842	5444	5327	7304	7135	5623	5466	5881	5684	5752	9445	7451	7514	6563
15	Independent Hydro - Net	361	358	332	321	271	179	145	152	251	434	445	718	664	403	354
16	**Other Resources**	1097	1134	1118	1113	1099	1107	1091	1086	1125	1129	1112	1120	1138	1112	1112
17	Cogeneration Resources	12.4	12.4	14.4	18.4	19.6	22.6	24.0	23.0	23.0	22.0	22.0	19.1	14.2	18.1	19.2
18	Combustion Turbines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Large Thermal Resources	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030
20	Renewable Resources	51.9	89.1	71.2	62.4	46.3	51.1	34.2	30.0	69.0	74.2	57.0	68.1	91.1	61.6	60.3
21	Small Hydro Resources	2.63	2.63	2.63	2.67	2.84	3.19	3.21	3.05	3.10	3.09	3.09	2.83	2.72	2.63	2.88
22	Small Thermal & Misc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	**Contract Purchases**	406	402	478	410	573	703	471	466	481	474	474	224	333	229	437
24	Imports	133	133	23.6	20.4	37.9	269	36.4	37.2	33.9	16.2	16.2	1.12	1.00	16.1	52.7
25	Intra-Regional Transfers (In)	96.5	96.5	290	220	356	260	264	263	280	288	288	32.9	158	34.4	211
26	Non-Federal CER	138	139	133	139	138	134	139	137	134	138	138	138	132	138	136
27	Slice Transmission Loss Return	37.9	33.0	31.5	30.4	40.6	40.0	31.2	29.7	32.8	32.3	32.6	52.2	42.0	40.6	36.6
28	Augmentation Purchases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Exhibit 7-2: Monthly Energy
Federal Report Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-173308

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
29	**Reserves & Losses**	-246	-218	-208	-202	-261	-257	-207	-202	-218	-218	-220	-325	-270	-261	-239
30	Contingency Reserves (Spinning)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	Contingency Reserves (Non-Spinning)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	Load Following Reserves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	Generation Imbalance Reserves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	Transmission Losses	-246	-218	-208	-202	-261	-257	-207	-202	-218	-218	-220	-325	-270	-261	-239
35	**Total Net Resources**	**8466**	**7518**	**7164**	**6969**	**8986**	**8866**	**7124**	**6968**	**7520**	**7504**	**7564**	**11183**	**9316**	**8998**	**8227**
36	**Total Surplus/Deficit**	**165**	**-532**	**-432**	**-372**	**348**	**-417**	**-1668**	**-1521**	**-515**	**-125**	**-81.6**	**2816**	**1455**	**632**	**11.5**

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 7-3: Annual 120-Hour Capacity

Federal System Surplus Deficit
Operating Year 2014 to 2023
Using 1937-Water Conditions

Exhibit 7-3: Annual 120-Hour Capacity
Federal Report Surplus Deficit
January 2014 to 2023 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-173308

	120Hr-MW	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	Firm Obligations										
1	**Non-Utility Obligation**	544	547	548	563	569	573	577	579	581	582
2	Federal Agencies	213	216	217	232	238	242	246	248	250	252
3	USBR Obligation	14.9	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8
4	DSI Obligation	316	316	316	316	316	316	316	316	316	316
5	**Transfers Out**	10265	10627	10624	10678	10645	10506	10522	10684	10681	10740
6	Load Following 2012 PSC	5431	5490	5528	5574	5627	5680	5733	5791	5842	5885
7	Slice Block 2012 PSC	2310	2424	2350	2403	2359	2409	2368	2355	2356	2356
8	Slice Right to Power 2012 PSC	2125	2286	2303	2288	2294	2362	2369	2396	2362	2389
9	Exports	1341	1373	1336	1321	1338	1338	1338	1338	1338	1338
10	Intra-Regional Transfers (Out)	282	283	282	287	283	16.0	16.0	16.0	16.0	16.0
11	Federal Diversity	-1224	-1229	-1176	-1195	-1256	-1300	-1302	-1212	-1234	-1245
12	**Total Firm Obligations**	**10809**	**11174**	**11172**	**11241**	**11214**	**11079**	**11099**	**11263**	**11262**	**11323**
	Net Resources										
13	**Net Hydro**	9953	10767	10883	11009	11105	11197	11222	11316	11184	11299
14	Regulated Hydro - Net	9707	10522	10638	10764	10860	10951	10977	11070	10961	11076
15	Independent Hydro - Net	245	245	245	245	245	245	245	245	223	223
16	**Other Resources**	1159	1159	1159	1135	1135	1135	1135	1135	1135	1135
17	Cogeneration Resources	24.0	24.0	24.0	0	0	0	0	0	0	0
18	Combustion Turbines	0	0	0	0	0	0	0	0	0	0
19	Large Thermal Resources	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130
20	Renewable Resources	0	0	0	0	0	0	0	0	0	0
21	Small Hydro Resources	4.59	4.59	4.59	4.59	4.59	4.59	4.59	4.59	4.59	4.59
22	Small Thermal & Misc.	0	0	0	0	0	0	0	0	0	0
23	**Contract Purchases**	875	679	662	605	471	471	286	286	285	286
24	Imports	73.2	73.2	57.1	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Intra-Regional Transfers (In)	512	313	313	313	182	182	0	0	0	0
26	Non-Federal CER	239	238	237	236	234	232	229	228	228	228
27	Slice Transmission Loss Return	50.7	54.6	54.9	54.5	54.4	56.0	56.2	56.8	56.0	56.7
28	Augmentation Purchases	0	0	0	0	0	0	0	0	0	0

Exhibit 7-3: Annual 120-Hour Capacity
Federal Report Surplus Deficit
January 2014 to 2023 Water Year: 1937
2012 White Book Report Date: **10-19-2012**
S104-WB-20121129-173308

	120Hr-MW	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
29	**Reserves & Losses**	-1966	-2138	-2207	-2311	-2401	-2498	-2497	-2485	-2480	-2490
30	Contingency Reserves (Spinning)	-378	-389	-391	-393	-395	-397	-399	-391	-391	-394
31	Contingency Reserves (Non-Spinning)	-378	-389	-391	-393	-395	-397	-399	-391	-391	-394
32	Load Following Reserves	-478	-533	-576	-639	-687	-726	-726	-726	-726	-726
33	Generation Imbalance Reserves	-385	-464	-485	-523	-567	-622	-622	-622	-622	-622
34	Transmission Losses	-347	-363	-364	-362	-357	-357	-352	-355	-351	-355
35	**Total Net Resources**	**10021**	**10467**	**10497**	**10438**	**10310**	**10304**	**10146**	**10251**	**10124**	**10230**
36	**Total Surplus/Deficit**	**-788**	**-707**	**-675**	**-803**	**-904**	**-775**	**-953**	**-1012**	**-1138**	**-1093**

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 7-4: Monthly 120-Hour Capacity

Federal System Surplus Deficit
Operating Year 2014
Using 1937-Water Conditions

Exhibit 7-4: Monthly 120-Hour Capacity
Federal Report Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-173308

	120Hr-MW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
	Firm Obligations															
1	**Non-Utility Obligation**	1127	1127	1035	999	663	794	544	813	922	947	947	1052	1098	1168	1127
2	Federal Agencies	141	141	131	154	185	214	213	196	197	169	169	151	155	157	141
3	USBR Obligation	671	671	589	529	162	264	14.9	301	409	462	462	585	627	696	671
4	DSI Obligation	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316
5	**Transfers Out**	8917	8427	8193	7875	9873	10557	10265	9546	9026	8147	8218	8899	8410	8906	8917
6	Load Following 2012 PSC	4199	4199	4033	4286	4812	5473	5431	5127	4666	4511	4511	4153	4138	4360	4199
7	Slice Block 2012 PSC	1636	1636	1716	1655	2046	2274	2310	2137	1989	1663	1663	1454	1351	1592	1636
8	Slice Right to Power 2012 PSC	2349	1891	1928	1808	2528	2566	2125	1887	2181	1882	1883	3192	2662	2555	2349
9	Exports	1604	1604	1450	1615	1339	1340	1341	1469	1455	1338	1338	1398	1400	1436	1604
10	Intra-Regional Transfers (Out)	234	234	234	9.00	287	283	282	283	145	143	143	9.00	9.00	9.00	234
11	Federal Diversity	-1105	-1138	-1168	-1498	-1140	-1379	-1224	-1358	-1410	-1390	-1320	-1307	-1150	-1046	-1105
12	**Total Firm Obligations**	**10044**	**9554**	**9229**	**8875**	**10536**	**11351**	**10809**	**10359**	**9948**	**9094**	**9165**	**9950**	**9509**	**10074**	**10044**
	Net Resources															
13	**Net Hydro**	11283	9477	9387	9078	11558	11730	9953	9441	10511	9274	9277	14449	12495	12143	11283
14	Regulated Hydro - Net	10814	9014	8849	8662	11163	11455	9707	9222	10147	8669	8659	13690	11696	11627	10814
15	Independent Hydro - Net	469	464	539	416	395	276	245	219	363	606	618	759	799	516	469
16	**Other Resources**	1146	1146	1147	1152	1154	1157	1159	1158	1158	1157	1157	1154	1148	1151	1146
17	Cogeneration Resources	12.4	12.4	14.4	18.4	19.6	22.6	24.0	23.0	23.0	22.0	22.0	19.1	14.2	18.1	12.4
18	Combustion Turbines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Large Thermal Resources	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130
20	Renewable Resources	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	Small Hydro Resources	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	3.49
22	Small Thermal & Misc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	**Contract Purchases**	529	518	769	708	1006	1118	875	869	876	852	852	325	565	355	529
24	Imports	176	176	72.3	72.3	103	305	73.2	73.2	73.2	56.9	56.9	11.0	1.00	56.0	176
25	Intra-Regional Transfers (In)	58.0	58.0	412	354	604	512	512	512	512	512	512	0	262	0	58.0
26	Non-Federal CER	239	239	239	239	239	239	239	239	239	238	238	238	238	238	239
27	Slice Transmission Loss Return	56.2	45.2	46.1	43.1	60.4	61.3	50.7	45.0	52.1	44.9	44.9	76.4	63.6	61.1	56.2
28	Augmentation Purchases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Exhibit 7-4: Monthly 120-Hour Capacity
Federal Report Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: **10-19-2012**
S104-WB-20121129-173308

	120Hr-MW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
29	**Reserves & Losses**	-1983	-1871	-1864	-1837	-2044	-2091	-1966	-1919	-1945	-1863	-1863	-2086	-2037	-2037	-1983
30	Contingency Reserves (Spinning)	-352	-326	-319	-329	-388	-407	-378	-362	-357	-337	-337	-372	-362	-371	-352
31	Contingency Reserves (Non-Spinning)	-352	-326	-319	-329	-388	-407	-378	-362	-357	-337	-337	-372	-362	-371	-352
32	Load Following Reserves	-486	-486	-486	-478	-478	-478	-478	-478	-478	-478	-478	-478	-492	-492	-486
33	Generation Imbalance Reserves	-411	-411	-411	-385	-385	-385	-385	-385	-385	-385	-385	-385	-400	-400	-411
34	Transmission Losses	-380	-321	-327	-315	-405	-413	-347	-331	-367	-327	-327	-480	-422	-403	-380
35	**Total Net Resources**	**10975**	**9271**	**9440**	**9102**	**11674**	**11914**	**10021**	**9549**	**10599**	**9420**	**9423**	**13842**	**12171**	**11613**	**10975**
36	**Total Surplus/Deficit**	**931**	**-283**	**212**	**227**	**1138**	**563**	**-788**	**-810**	**651**	**326**	**258**	**3892**	**2663**	**1538**	**931**

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 7-5: 80 Water Year Monthly Energy

Federal System Surplus Deficit
Operating Year 2014

Exhibit 7-5: 80-Water Year Monthly Energy
Federal Report Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: **10-19-2012**

S104-WB-20121129-1733082

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
1	1929 Federal Surplus Deficit	376	184	-205	-172	135	-492	-769	-964	-502	-428	706	2029	2180	139	154
2	1930 Federal Surplus Deficit	-69.3	-671	77.4	-449	10.2	-471	-2024	-847	-639	-190	1333	1873	725	938	-49.0
3	1931 Federal Surplus Deficit	158	-497	21.6	-613	244	-977	-1916	-1732	-788	319	-1038	2431	1000	652	-176
4	1932 Federal Surplus Deficit	-576	-1092	-575	-486	-259	-587	-1982	-1879	1071	4343	4097	5254	5047	1319	867
5	1933 Federal Surplus Deficit	370	-3.68	405	-325	-267	283	1011	1812	1804	2200	1874	3761	5922	3051	1633
6	1934 Federal Surplus Deficit	1698	1729	-20.5	434	2314	4078	4640	4223	3312	4804	4243	4270	3082	1258	2811
7	1935 Federal Surplus Deficit	-589	-762	-235	-552	-492	17.6	1157	994	1121	2051	1356	3092	2518	1971	884
8	1936 Federal Surplus Deficit	1354	-147	-400	-342	87.5	-521	-1601	-1547	-195	497	3573	5318	4173	925	719
9	1937 Federal Surplus Deficit	165	-532	-432	-372	348	-417	-1668	-1521	-515	-125	-81.6	2816	1455	632	11.5
10	1938 Federal Surplus Deficit	226	-753	10.9	-502	-348	77.7	953	1252	1705	3409	4381	4496	3712	1866	1400
11	1939 Federal Surplus Deficit	23.5	-265	61.0	-202	17.5	-520	-538	-101	85.7	1930	2273	3983	1815	723	610
12	1940 Federal Surplus Deficit	-262	-923	-329	-161	543	155	-812	-613	1307	2328	2801	3566	2689	309	722
13	1941 Federal Surplus Deficit	-404	-896	-101	-277	-177	-125	-1026	-1351	-651	19.2	731	2630	2702	844	189
14	1942 Federal Surplus Deficit	-61.2	-689	226	-313	108	848	978	-501	-267	276	2283	3027	4301	2463	987
15	1943 Federal Surplus Deficit	855	256	625	-310	-334	109	1717	1519	2202	4937	5198	4571	5541	1545	1894
16	1944 Federal Surplus Deficit	167	-92.4	-118	-321	207	-516	-679	-812	-725	-389	1021	1562	206	320	-39.7
17	1945 Federal Surplus Deficit	-128	-889	-103	-471	19.1	-1509	-1608	-1100	-808	-716	-1103	3574	3991	118	58.1
18	1946 Federal Surplus Deficit	410	-344	43.4	-441	-36.0	249	746	1025	1390	3551	4621	4619	4314	2103	1507
19	1947 Federal Surplus Deficit	766	161	201	-355	191	2636	3505	2768	2417	2506	2290	4410	4664	2199	2121
20	1948 Federal Surplus Deficit	737	-12.9	26.0	1685	1552	1324	3058	1768	1279	2510	3977	5723	5870	2860	2397
21	1949 Federal Surplus Deficit	1836	1326	333	-110	132	165	1359	-351	2656	3311	4276	5430	4297	59.6	1621
22	1950 Federal Surplus Deficit	-500	-916	-483	-349	40.7	8.33	2939	1926	3561	4239	3459	4529	5035	2284	1882
23	1951 Federal Surplus Deficit	1602	1251	117	526	1861	2770	4140	4036	4494	4230	4042	4580	4231	2664	2909
24	1952 Federal Surplus Deficit	1710	514	57.0	1257	912	1415	2464	1968	2433	4271	4498	5471	4638	2011	2343
25	1953 Federal Surplus Deficit	636	-152	-435	-380	107	-508	172	771	995	1564	1875	4336	5999	2631	1301
26	1954 Federal Surplus Deficit	1193	587	-2.47	-187	420	923	2432	2285	2804	2780	2566	4554	4583	3443	2067
27	1955 Federal Surplus Deficit	2206	2140	2020	-61.0	991	495	-52.5	-991	-757	165	1504	3717	5770	3580	1487
28	1956 Federal Surplus Deficit	1949	719	-215	72.7	1477	2705	4106	3986	3561	4158	4770	5180	5848	2789	2932
29	1957 Federal Surplus Deficit	1242	450	94.2	41.3	85.8	999	1012	278	1636	4289	2743	5978	6008	1784	1862
30	1958 Federal Surplus Deficit	143	-639	-37.1	-254	220	-90.2	1336	779	1798	2650	3097	5308	5090	1424	1516
31	1959 Federal Surplus Deficit	30.4	-405	-144	-271	862	2157	3663	3222	2790	3425	2443	3832	5227	2029	2166
32	1960 Federal Surplus Deficit	1808	908	2072	2350	2397	2020	2168	1150	1572	5275	3851	3847	4275	1781	2463
33	1961 Federal Surplus Deficit	682	-196	-241	-170	220	312	1950	1236	2582	3643	1779	4512	5340	1579	1688
34	1962 Federal Surplus Deficit	96.4	-9.71	-248	-331	205	-186	1148	1035	246	4604	4533	4410	4759	88.0	1303
35	1963 Federal Surplus Deficit	529	-196	-230	111	1053	1828	1120	1326	685	1541	1859	3808	4843	1998	1532
36	1964 Federal Surplus Deficit	708	50.9	234	-352	-68.4	253	365	76.7	347	3261	1654	4252	5884	3323	1432
37	1965 Federal Surplus Deficit	1918	650	603	450	735	2848	4435	5085	3999	2372	4584	4778	4202	1994	2810
38	1966 Federal Surplus Deficit	1751	1255	-292	-3.34	479	539	1037	575	-88.3	4189	2281	3377	3058	2006	1287

Exhibit 7-5: 80-Water Year Monthly Energy
Federal Report Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
39	1967 Federal Surplus Deficit	841	-89.9	-126	-358	-42.5	589	2829	2723	3530	1668	37.3	3816	5356	2573	1838
40	1968 Federal Surplus Deficit	1273	336	-6.69	-133	495	560	1886	2151	2108	1116	990	2277	4674	2283	1505
41	1969 Federal Surplus Deficit	1474	780	1050	552	1551	1436	3693	3899	2524	4208	4228	5339	4437	2213	2657
42	1970 Federal Surplus Deficit	317	-279	35.9	-214	301	-244	1043	846	1151	2069	1152	3936	5326	1037	1233
43	1971 Federal Surplus Deficit	389	-293	-217	-324	111	30.5	4170	4006	4122	4076	3778	5349	5744	3390	2518
44	1972 Federal Surplus Deficit	2162	1373	225	85.7	305	856	4230	3742	5408	4857	3187	5310	5744	3284	2910
45	1973 Federal Surplus Deficit	2134	2041	511	31.9	298	506	1097	95.4	-435	-1190	629	2370	2617	456	785
46	1974 Federal Surplus Deficit	-174	-777	-76.3	-532	-99.4	969	5234	5088	4505	4640	4609	5104	5441	3604	2765
47	1975 Federal Surplus Deficit	2109	1350	335	-386	163	63.1	1008	1544	2188	1514	1775	4347	5740	3837	1851
48	1976 Federal Surplus Deficit	1496	757	434	687	1789	3635	3483	3498	3581	4500	4215	5126	4801	2910	2948
49	1977 Federal Surplus Deficit	2414	2452	2455	86.0	212	-489	-733	-500	-504	-768	796	1161	3.17	18.6	350
50	1978 Federal Surplus Deficit	-366	-1033	-722	-555	-542	1019	1012	895	1181	4187	2498	4199	3014	1953	1175
51	1979 Federal Surplus Deficit	387	-59.0	1150	118	224	-275	421	-898	1193	1211	1934	5000	2060	153	917
52	1980 Federal Surplus Deficit	-506	-814	-325	-359	175	-746	-410	-206	-417	2470	2834	5437	4724	595	870
53	1981 Federal Surplus Deficit	-82.7	-699	-14.3	-235	141	2268	2571	997	728	270	2723	5005	5787	2526	1744
54	1982 Federal Surplus Deficit	1786	1797	30.0	-251	511	1122	2666	3603	4904	3742	3206	5039	5295	2686	2566
55	1983 Federal Surplus Deficit	2098	1466	1123	595	592	1383	3113	2523	3952	3511	2635	4723	4480	2690	2503
56	1984 Federal Surplus Deficit	1806	733	331	-85.1	2042	1331	2229	2317	2584	4803	4533	4603	5957	2956	2509
57	1985 Federal Surplus Deficit	971	216	335	-29.0	587	473	624	487	983	2959	3239	4702	2946	-747	1169
58	1986 Federal Surplus Deficit	-801	-1266	-355	-249	1328	302	1815	2305	5263	3980	3718	3561	4517	1341	1877
59	1987 Federal Surplus Deficit	480	-252	-156	-387	105	554	-130	-1319	746	820	1526	4115	2614	416	666
60	1988 Federal Surplus Deficit	-675	-1259	-256	-528	-27.4	-788	-1621	-1466	-645	-29.3	1617	2460	2493	1021	43.2
61	1989 Federal Surplus Deficit	-243	-706	54.7	-753	-330	-67.7	-677	-892	562	3042	4096	4027	2686	293	669
62	1990 Federal Surplus Deficit	-165	-813	-181	-450	287	395	1441	1710	2447	2406	4739	3784	4396	1643	1539
63	1991 Federal Surplus Deficit	1310	527	-270	-564	1833	1587	2382	2707	2525	3249	2715	4344	4146	2775	2107
64	1992 Federal Surplus Deficit	1774	1523	-191	-427	165	-431	-643	-849	-1.06	306	1036	3374	2162	42.3	468
65	1993 Federal Surplus Deficit	-640	-1051	-196	-639	0.38	-296	-1847	-1637	382	755	1433	3868	3311	1333	386
66	1994 Federal Surplus Deficit	165	-331	127	-544	445	-333	-1518	-1519	-506	-196	1334	3176	2672	860	286
67	1995 Federal Surplus Deficit	-126	-766	-11.7	-734	-347	-689	-216	1023	1630	2986	1800	3316	4804	1753	1031
68	1996 Federal Surplus Deficit	419	-110	563	160	2666	4777	4904	4259	5293	3981	5098	5015	5128	3213	3383
69	1997 Federal Surplus Deficit	1947	731	-236	-226	481	1392	4861	5125	5382	4217	5008	5028	5706	3335	3052
70	1998 Federal Surplus Deficit	2014	1022	1068	1870	1415	1036	728	1066	951	1465	2482	5696	5607	1930	2074
71	1999 Federal Surplus Deficit	1095	-300	11.6	-281	-118	897	3361	3487	4165	3111	3585	4611	5757	3162	2390
72	2000 Federal Surplus Deficit	2252	2134	608	-115	2093	1893	1623	1439	1920	4147	4515	3817	2972	1602	2031
73	2001 Federal Surplus Deficit	958	-628	-206	-274	108	-475	-726	-709	-594	-481	700	1953	-302	349	-46.6
74	2002 Federal Surplus Deficit	-374	-773	-553	-1190	-424	-611	-1139	-598	-250	3183	3738	3045	4826	2708	723
75	2003 Federal Surplus Deficit	616	-134	59.2	-520	347	-373	-1198	-877	1607	2362	2151	3226	4503	352	804
76	2004 Federal Surplus Deficit	-433	-1092	-441	-301	269	310	-550	-631	-107	822	2245	3698	3248	579	573
77	2005 Federal Surplus Deficit	-223	-499	130	-109	202	816	800	146	146	203	1445	3885	3462	799	898

Exhibit 7-5: 80-Water Year Monthly Energy
Federal Report Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
78	2006 Federal Surplus Deficit	157	-617	47.4	-593	198	312	1423	2514	2110	4928	4565	5503	4638	1426	1828
79	2007 Federal Surplus Deficit	-280	-946	-162	-493	361	258	1580	582	2858	3059	2476	3927	2823	1806	1311
80	2008 Federal Surplus Deficit	199	-892	-518	-295	148	-265	-185	-367	374	1401	622	5229	5986	2226	1087
	Ranked Averages															
81	Top 10 pct	**1649**	**888**	**184**	**274**	**1453**	**2883**	**4350**	**4244**	**4379**	**4140**	**4393**	**4911**	**4843**	**2681**	**2969**
82	Middle 80 pct	**634**	**17.9**	**119**	**-158**	**365**	**462**	**1090**	**911**	**1526**	**2536**	**2714**	**4225**	**4325**	**1742**	**1462**
83	Bottom 10 pct	**119**	**-548**	**-153**	**-400**	**130**	**-706**	**-1376**	**-1144**	**-652**	**-255**	**394**	**2337**	**1468**	**521**	**-5.57**

Section 8: Pacific Northwest Regional Exhibits

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 8-1: Annual Energy

Regional Surplus Deficit
Operating Year 2014 to 2023
Using 1937-Water Conditions

Exhibit 8-1: Annual Energy
Regional Surplus Deficit
Operating Year 2014 to 2023 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	Energy-aMW	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	Firm Loads										
1	**Regional Firm Loads**	21614	22116	22533	22910	23230	23541	23837	24158	24457	24745
2	Federal Agency	133	135	135	148	163	173	179	184	186	187
3	USBR	176	176	176	176	176	176	176	176	176	176
4	Cooperative	1885	1932	1972	2024	2054	2099	2140	2193	2235	2263
5	Municipality	2741	2770	2803	2831	2854	2876	2895	2918	2938	2958
6	Public Utility District	4449	4510	4555	4603	4655	4706	4751	4807	4856	4909
7	Investor-Owned Utility	11401	11726	11980	12206	12406	12588	12772	12954	13139	13324
8	Marketer	386	388	390	391	392	393	394	396	397	398
9	Direct-Service Industry	442	479	522	530	530	530	530	530	530	530
10	**Exports**	1555	1471	1420	1386	1358	1360	1363	1359	1310	1282
11	Canada	542	517	526	521	523	518	513	508	503	498
12	East Continental Divide	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
13	Inland Southwest	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8
14	Pacific Southwest	983	924	865	835	806	813	821	822	778	754
15	Other	0	0	0	0	0	0	0	0	0	0
16	**Federal Diversity**	0	0	0	0	0	0	0	0	0	0
17		0	0	0	0	0	0	0	0	0	0
18	**Total Firm Loads**	**23169**	**23586**	**23953**	**24295**	**24588**	**24901**	**25200**	**25517**	**25767**	**26027**
	Non-Firm Loads										
1	**Regional Non-Firm Loads**	10.6	10.6	10.7	10.6	10.6	10.6	10.7	10.7	10.7	10.7
2	Federal Agency	0	0	0	0	0	0	0	0	0	0
3	USBR	0	0	0	0	0	0	0	0	0	0
4	Cooperative	0	0	0	0	0	0	0	0	0	0
5	Municipality	0	0	0	0	0	0	0	0	0	0
6	Public Utility District	10.6	10.6	10.7	10.6	10.6	10.6	10.7	10.7	10.7	10.7
7	Investor-Owned Utility	0	0	0	0	0	0	0	0	0	0
8	Direct-Service Industry	0	0	0	0	0	0	0	0	0	0
9	Marketer	0	0	0	0	0	0	0	0	0	0
10	**Total Non-Firm Loads**	**10.6**	**10.6**	**10.7**	**10.6**	**10.6**	**10.6**	**10.7**	**10.7**	**10.7**	**10.7**

Exhibit 8-1: Annual Energy
Regional Surplus Deficit
Operating Year 2014 to 2023 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	Energy-aMW	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	Resources										
11	**Hydro**	11953	11741	11749	11754	11754	11754	11748	11754	11754	11754
12	Regulated Hydro - Net	10902	10690	10699	10703	10703	10703	10698	10703	10703	10703
13	Independent Hydro - Net	1051	1051	1050	1051	1051	1051	1050	1051	1051	1051
14	**Other Resources**	14626	14529	14621	14466	14724	14519	14640	13926	13598	13397
15	Cogeneration Resources	2633	2636	2632	2635	2639	2623	2637	2642	2622	2636
16	Combustion Turbine Resources	3390	3390	3385	3393	3390	3409	3403	3405	3405	3410
17	Large Thermal Resources	6358	6257	6361	6189	6449	6241	6354	5630	5324	5104
18	Renewable Resources	1954	1956	1953	1958	1956	1957	1956	1958	1957	1957
19	Small Hydro	253	253	253	253	253	252	252	253	253	253
20	Small Thermal & Miscellaneous	37.8	37.8	37.8	37.8	37.5	37.5	37.5	37.5	37.5	37.5
21	**Imports**	1085	1382	1349	1509	1465	1559	1496	1655	1603	1734
22	Canada	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
23	East of Continental Divide	302	304	306	308	310	311	313	315	317	318
24	Inland Southwest	461	468	473	476	480	484	487	491	494	498
25	Pacific Southwest	106	106	75.4	59.6	59.6	47.1	47.2	47.1	47.1	47.1
26	Other	148	435	426	597	547	648	580	733	676	802
27	**Reserves & Losses**	-780	-780	-782	-782	-788	-785	-786	-771	-760	-758
28	Contingency Reserves (Non-Spinning)	0	0	0	0	0	0	0	0	0	0
29	Contingency Reserves (Spinning)	0	0	0	0	0	0	0	0	0	0
30	Generation Imbalance Reserves	0	0	0	0	0	0	0	0	0	0
31	Load Following Reserves	0	0	0	0	0	0	0	0	0	0
32	Transmission Losses	-780	-780	-782	-782	-788	-785	-786	-771	-760	-758
33	**Total Resources**	**26884**	**26872**	**26936**	**26948**	**27156**	**27047**	**27098**	**26564**	**26194**	**26127**
34	**Total Surplus/Deficit**	**3704**	**3275**	**2973**	**2642**	**2557**	**2136**	**1888**	**1036**	**417**	**89.8**

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 8-2: Monthly Energy

Regional Surplus Deficit
Operating Year 2014
Using 1937-Water Conditions

Exhibit 8-2: Monthly Energy Regional Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
	Firm Loads															
1	**Regional Firm Loads**	21591	21611	20039	19492	21872	24006	24203	23078	21203	20293	20293	19687	21268	22674	21614
2	Federal Agency	125	125	114	119	140	162	159	148	143	125	125	116	116	131	133
3	USBR	292	290	254	100	27.6	32.8	13.5	16.9	57.8	246	246	327	335	402	176
4	Cooperative	1951	1953	1726	1642	1861	2136	2091	1992	1770	1734	1734	1753	1885	2082	1885
5	Municipality	2474	2476	2412	2580	3027	3176	3234	3126	2794	2669	2669	2478	2447	2499	2741
6	Public Utility District	4138	4141	3888	4086	4791	5258	5223	4977	4417	4245	4245	4005	4102	4281	4449
7	Investor-Owned Utility	11788	11803	10871	10179	11203	12394	12630	11971	11184	10443	10443	10178	11544	12428	11401
8	Marketer	380	380	328	345	378	406	411	404	396	389	389	389	398	409	386
9	Direct-Service Industry	443	443	444	441	445	440	442	444	442	443	443	442	440	443	442
10	**Exports**	1803	2022	1774	1704	1343	1310	1188	1311	1522	1620	1452	1394	1811	1833	1555
11	Canada	622	627	488	720	488	488	488	617	604	488	488	488	488	522	542
12	East Continental Divide	15.0	15.0	13.1	13.2	14.3	16.0	15.8	15.5	14.0	13.3	13.3	12.9	13.4	15.7	14.4
13	Inland Southwest	22.6	18.6	11.6	18.8	11.6	15.8	13.7	11.9	8.09	8.80	14.1	20.7	15.4	17.2	14.8
14	Pacific Southwest	1143	1362	1261	952	828	790	671	666	896	1110	937	872	1294	1278	983
15	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	**Federal Diversity**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	**Total Firm Loads**	**23393**	**23633**	**21812**	**21196**	**23215**	**25316**	**25392**	**24389**	**22725**	**21913**	**21746**	**21081**	**23079**	**24507**	**23169**
	Non-Firm Loads															
19	**Regional Non-Firm Loads**	0	0	14.3	0	0	0	3.50	23.0	54.4	33.8	33.8	0	0	0	10.6
20	Federal Agency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	USBR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Cooperative	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Municipality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Public Utility District	0	0	14.3	0	0	0	3.50	23.0	54.4	33.8	33.8	0	0	0	10.6
25	Investor-Owned Utility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	Direct-Service Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Marketer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	**Total Non-Firm Loads**	**0**	**0**	**14.3**	**0**	**0**	**0**	**3.50**	**23.0**	**54.4**	**33.8**	**33.8**	**0**	**0**	**0**	**10.6**

Exhibit 8-2: Monthly Energy
Regional Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
	Resources															
29	**Hydro**	11509	10039	10341	9693	12386	12411	10895	9531	10459	11746	10887	16579	15291	13589	11953
30	Regulated Hydro - Net	10518	9051	9385	8787	11573	11559	10173	8752	9493	10438	9561	14981	13718	12462	10902
31	Independent Hydro - Net	991	988	957	906	813	851	722	779	966	1307	1327	1598	1574	1127	1051
32	**Other Resources**	14946	15824	15423	15107	14853	15054	14537	14326	13976	15084	13438	11141	15698	15765	14626
33	Cogeneration Resources	2772	2771	2781	2745	2789	2870	2826	2834	2047	2789	2129	2244	2512	2735	2633
34	Combustion Turbine Resources	3611	3611	3413	3472	3513	3811	3790	3519	3489	3375	3324	1743	3399	3586	3390
35	Large Thermal Resources	6644	6644	6644	6644	6644	6644	6644	6644	6377	6018	5686	4495	6449	6644	6358
36	Renewable Resources	1548	2428	2291	2029	1733	1561	1118	1169	1867	2579	1967	2201	2848	2327	1954
37	Small Hydro	337	336	256	179	137	129	118	124	157	285	294	417	453	435	253
38	Small Thermal & Miscellaneous	33.9	34.0	37.7	37.9	36.6	39.7	41.0	35.7	38.7	38.1	37.9	41.1	36.4	36.8	37.8
39	**Imports**	944	944	762	905	1235	1618	1277	1256	1028	894	894	912	1056	1139	1085
40	Canada	142	142	16.0	17.3	37.5	285	66.4	72.6	64.8	30.6	30.6	27.5	36.5	21.5	68.5
41	East of Continental Divide	293	293	270	267	303	350	345	342	308	268	268	266	291	316	302
42	Inland Southwest	493	492	453	425	423	455	428	442	414	395	395	441	552	609	461
43	Pacific Southwest	15.8	15.7	22.6	19.4	294	351	260	222	62.9	22.1	22.1	0.12	0	15.1	106
44	Other	0	0	0	177	177	177	177	177	177	177	177	177	177	177	148
45	**Reserves & Losses**	-773	-756	-748	-725	-803	-820	-753	-708	-718	-782	-711	-807	-904	-860	-780
46	Contingency Reserves (Non-Spinning)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	Contingency Reserves (Spinning)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	Generation Imbalance Reserves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Load Following Reserves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	Transmission Losses	-773	-756	-748	-725	-803	-820	-753	-708	-718	-782	-711	-807	-904	-860	-780
51	**Total Resources**	**26626**	**26051**	**25778**	**24980**	**27671**	**28263**	**25956**	**24405**	**24745**	**26942**	**24508**	**27825**	**31142**	**29633**	**26884**
52	**Total Surplus/Deficit**	**3233**	**2418**	**3952**	**3784**	**4456**	**2947**	**561**	**-6.51**	**1965**	**4995**	**2728**	**6744**	**8063**	**5126**	**3704**

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 8-3: Annual 120-Hour Capacity

Regional Surplus Deficit
Operating Year 2014 to 2023
Using 1937-Water Conditions

Exhibit 8-3: Annual 120-Hour Capacity
Regional Surplus Deficit
Operating Year 2014 to 2023 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	120Hr-MW	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	Firm Loads										
1	**Regional Firm Loads**	33182	33859	34419	34914	35359	35770	36176	36602	37000	37394
2	Federal Agency	221	224	225	240	246	251	254	256	258	260
3	USBR	14.9	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8
4	Cooperative	3119	3165	3224	3283	3345	3410	3469	3538	3590	3631
5	Municipality	4591	4622	4649	4680	4707	4734	4759	4788	4815	4841
6	Public Utility District	7336	7396	7465	7520	7586	7649	7712	7775	7835	7899
7	Investor-Owned Utility	16995	17484	17842	18176	18457	18708	18962	19223	19479	19738
8	Marketer	443	445	446	448	450	451	453	454	456	458
9	Direct-Service Industry	463	508	553	553	553	553	553	553	553	553
10	**Exports**	1713	1595	1559	1544	1544	1544	1544	1544	1489	1489
11	Canada	1311	1343	1307	1307	1324	1324	1324	1324	1324	1324
12	East Continental Divide	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9
13	Inland Southwest	0	0	0	0	0	0	0	0	0	0
14	Pacific Southwest	381	231	231	216	199	199	199	199	144	144
15	Other	0	0	0	0	0	0	0	0	0	0
16	**Federal Diversity**	-1224	-1229	-1176	-1195	-1256	-1300	-1302	-1212	-1234	-1245
17		-1224	-1229	-1176	-1195	-1256	-1300	-1302	-1212	-1234	-1245
18	**Total Firm Loads**	**33672**	**34225**	**34803**	**35263**	**35647**	**36015**	**36418**	**36934**	**37255**	**37638**
	Non-Firm Loads										
19	**Regional Non-Firm Loads**	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
20	Federal Agency	0	0	0	0	0	0	0	0	0	0
21	USBR	0	0	0	0	0	0	0	0	0	0
22	Cooperative	0	0	0	0	0	0	0	0	0	0
23	Municipality	0	0	0	0	0	0	0	0	0	0
24	Public Utility District	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
25	Investor-Owned Utility	0	0	0	0	0	0	0	0	0	0
26	Direct-Service Industry	0	0	0	0	0	0	0	0	0	0
27	Marketer	0	0	0	0	0	0	0	0	0	0
28	**Total Non-Firm Loads**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**

Exhibit 8-3: Annual 120-Hour Capacity
Regional Surplus Deficit
Operating Year 2014 to 2023 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	120Hr-MW	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	Resources										
29	**Hydro**	20631	21375	21492	21618	21714	21805	21830	21924	21815	21930
30	Regulated Hydro - Net	19295	20040	20156	20282	20378	20469	20495	20589	20479	20594
31	Independent Hydro - Net	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335
32	**Other Resources**	16650	16651	16651	16650	16650	16650	16650	15400	15400	15400
33	Cogeneration Resources	3080	3080	3080	3080	3080	3080	3080	3080	3080	3080
34	Combustion Turbine Resources	5949	5949	5949	5949	5949	5949	5949	5949	5949	5949
35	Large Thermal Resources	7244	7244	7244	7244	7244	7244	7244	5994	5994	5994
36	Renewable Resources	126	127	127	127	127	127	127	127	127	127
37	Small Hydro	166	166	166	166	166	166	166	166	166	166
38	Small Thermal & Miscellaneous	85.4	85.4	85.4	84.3	84.3	84.3	84.3	84.3	84.3	84.3
39	**Imports**	1866	2185	2027	2196	2098	2200	2095	2307	2203	2381
40	Canada	155	155	155	155	155	155	155	155	155	155
41	East of Continental Divide	468	470	473	475	477	479	482	484	486	488
42	Inland Southwest	573	580	584	587	590	594	597	600	604	607
43	Pacific Southwest	493	493	402	346	346	300	300	300	300	300
44	Other	177	487	413	633	530	672	562	768	658	831
45	**Reserves & Losses**	-3997	-4198	-4276	-4398	-4500	-4608	-4618	-4563	-4563	-4588
46	Contingency Reserves (Non-Spinning)	-958	-977	-986	-993	-1000	-1006	-1012	-1000	-1004	-1011
47	Contingency Reserves (Spinning)	-958	-977	-986	-993	-1000	-1006	-1012	-1000	-1004	-1011
48	Generation Imbalance Reserves	-385	-464	-485	-523	-567	-622	-622	-622	-622	-622
49	Load Following Reserves	-478	-533	-576	-639	-687	-726	-726	-726	-726	-726
50	Transmission Losses	-1218	-1248	-1244	-1250	-1246	-1249	-1246	-1215	-1208	-1217
51	**Total Resources**	**35150**	**36013**	**35894**	**36065**	**35962**	**36047**	**35958**	**35068**	**34853**	**35123**
52	**Total Surplus/Deficit**	**1475**	**1784**	**1087**	**798**	**310**	**28.0**	**-464**	**-1870**	**-2406**	**-2519**

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 8-4: Monthly 120-Hour Capacity

Regional Surplus Deficit
Operating Year 2014
Using 1937-Water Conditions

Exhibit 8-4: Monthly 120-Hour Capacity
Regional Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	120Hr-MW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
	Firm Loads															
1	**Regional Firm Loads**	29140	29140	26271	27116	30166	33313	33182	31497	28856	27339	27339	25709	28488	30521	29140
2	Federal Agency	152	152	142	166	193	222	221	204	205	181	181	163	167	169	152
3	USBR	671	671	589	529	162	264	14.9	301	409	462	462	585	627	696	671
4	Cooperative	2595	2595	2428	2486	2720	3156	3119	2923	2667	2640	2640	2570	2619	2763	2595
5	Municipality	3375	3375	3248	3743	4302	4603	4591	4421	3978	3781	3781	3282	3343	3527	3375
6	Public Utility District	5469	5469	5210	5825	6782	7528	7336	6946	6211	5972	5972	5415	5406	5689	5469
7	Investor-Owned Utility	15975	15975	13771	13485	15120	16643	16995	15810	14499	13429	13429	12819	15433	16766	15975
8	Marketer	440	440	420	419	424	435	443	430	424	412	412	413	431	449	440
9	Direct-Service Industry	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463
10	**Exports**	2398	2398	2243	2077	1714	1713	1713	1842	1831	1713	1721	1688	2193	2229	2398
11	Canada	1463	1463	1311	1543	1311	1311	1311	1440	1427	1311	1311	1311	1311	1345	1463
12	East Continental Divide	19.8	19.8	17.3	17.1	19.1	20.1	20.9	20.1	19.5	18.3	18.3	17.0	18.8	20.5	19.8
13	Inland Southwest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Pacific Southwest	915	915	915	517	384	381	381	381	384	384	392	360	864	864	915
15	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	**Federal Diversity**	-1105	-1138	-1168	-1498	-1140	-1379	-1224	-1358	-1410	-1390	-1320	-1307	-1150	-1046	-1105
17		-1105	-1138	-1168	-1498	-1140	-1379	-1224	-1358	-1410	-1390	-1320	-1307	-1150	-1046	-1105
18	**Total Firm Loads**	**30433**	**30400**	**27347**	**27696**	**30740**	**33646**	**33672**	**31981**	**29276**	**27662**	**27740**	**26090**	**29532**	**31704**	**30433**
	Non-Firm Loads															
19	**Regional Non-Firm Loads**	0	0	14.0	0	0	0	4.00	23.0	54.0	34.0	34.0	0	0	0	0
20	Federal Agency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	USBR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Cooperative	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Municipality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Public Utility District	0	0	14.0	0	0	0	4.00	23.0	54.0	34.0	34.0	0	0	0	0
25	Investor-Owned Utility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	Direct-Service Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Marketer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	**Total Non-Firm Loads**	**0**	**0**	**14.0**	**0**	**0**	**0**	**4.00**	**23.0**	**54.0**	**34.0**	**34.0**	**0**	**0**	**0**	**0**

Exhibit 8-4: Monthly 120-Hour Capacity
Regional Surplus Deficit
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	120Hr-MW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
	Resources															
29	**Hydro**	21484	19961	19708	19236	21915	22147	20631	19624	20675	19355	19323	25122	23825	23144	21484
30	Regulated Hydro - Net	19976	18454	18129	17725	20450	20756	19295	18379	19171	17566	17518	23132	21787	21517	19976
31	Independent Hydro - Net	1508	1507	1579	1511	1464	1391	1335	1245	1504	1789	1805	1990	2038	1627	1508
32	**Other Resources**	16397	16396	16409	16490	16578	16646	16650	16610	15924	16015	15014	13069	15786	16468	16397
33	Cogeneration Resources	2941	2941	2964	3045	3063	3077	3080	3074	2406	3046	2566	2711	2932	2944	2941
34	Combustion Turbine Resources	5602	5602	5665	5748	5876	5940	5949	5904	5853	5707	5707	4623	5075	5599	5602
35	Large Thermal Resources	7244	7244	7244	7244	7244	7244	7244	7244	7244	6726	6196	5062	7090	7244	7244
36	Renewable Resources	126	126	126	126	126	127	126	127	125	125	125	125	125	126	126
37	Small Hydro	401	399	327	244	185	174	166	177	213	327	336	462	481	473	401
38	Small Thermal & Miscellaneous	84.1	84.4	83.5	83.6	83.9	85.0	85.4	85.1	83.7	83.8	83.5	85.7	83.5	82.8	84.1
39	**Imports**	1414	1414	1186	1313	1743	2127	1866	1895	1472	1272	1272	1256	1497	1638	1414
40	Canada	266	266	146	147	102	356	155	188	213	147	147	147	146	146	266
41	East of Continental Divide	391	391	371	370	413	474	468	466	417	360	360	363	395	408	391
42	Inland Southwest	701	701	598	547	549	627	573	571	546	519	519	559	778	851	701
43	Pacific Southwest	55.0	55.0	71.3	71.3	502	493	493	493	118	67.9	67.9	10.00	0	55.0	55.0
44	Other	0	0	0	177	177	177	177	177	177	177	177	177	177	177	0
45	**Reserves & Losses**	-3921	-3827	-3721	-3697	-3980	-4101	-3997	-3887	-3822	-3698	-3648	-3827	-4012	-4071	-3921
46	Contingency Reserves (Non-Spinning)	-898	-876	-830	-839	-930	-981	-958	-918	-886	-846	-839	-865	-917	-945	-898
47	Contingency Reserves (Spinning)	-898	-876	-830	-839	-930	-981	-958	-918	-886	-846	-839	-865	-917	-945	-898
48	Generation Imbalance Reserves	-411	-411	-411	-385	-385	-385	-385	-385	-385	-385	-385	-385	-400	-400	-411
49	Load Following Reserves	-486	-486	-486	-478	-478	-478	-478	-478	-478	-478	-478	-478	-492	-492	-486
50	Transmission Losses	-1226	-1177	-1164	-1156	-1257	-1276	-1218	-1187	-1187	-1142	-1108	-1235	-1286	-1289	-1226
51	**Total Resources**	**35374**	**33944**	**33582**	**33343**	**36256**	**36819**	**35150**	**34243**	**34249**	**32943**	**31960**	**35620**	**37095**	**37178**	**35374**
52	**Total Surplus/Deficit**	**4940**	**3544**	**6221**	**5647**	**5515**	**3172**	**1475**	**2239**	**4919**	**5248**	**4186**	**9530**	**7563**	**5474**	**4940**

THIS PAGE INTENTIONALLY LEFT BLANK

Exhibit 8-5: 80 Water Year Monthly Energy

Regional Surplus Deficit
Operating Year 2014

Exhibit 8-5: 80-Water Year Monthly Energy
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
1	1929 Regional Surplus Deficit	4652	4400	4726	5006	4912	3146	1691	1437	2024	3972	4362	6170	9124	4495	4293
2	1930 Regional Surplus Deficit	3036	2285	5063	3810	4063	2811	100	1991	1776	4441	6184	5132	5587	5564	3654
3	1931 Regional Surplus Deficit	3274	2465	4932	3550	4572	1707	364	385	1398	4898	558	6054	6096	4447	3267
4	1932 Regional Surplus Deficit	1461	1059	3593	3504	3851	3257	-253	-67.2	5361	13438	11843	12021	14510	6644	5538
5	1933 Regional Surplus Deficit	4244	3788	5286	4205	4552	5060	6082	7040	6798	9338	6778	9377	16058	11160	7296
6	1934 Regional Surplus Deficit	7146	7321	4533	6612	9938	12691	13340	12211	10139	14033	11476	10517	10367	6151	9690
7	1935 Regional Surplus Deficit	1981	2113	4426	3910	4402	4657	6364	5987	5296	8687	6021	8468	10161	7953	5911
8	1936 Regional Surplus Deficit	5767	3795	4168	3999	4195	2700	1207	675	2506	5780	10050	12156	13158	5802	5284
9	1937 Regional Surplus Deficit	3233	2418	3952	3784	4456	2947	561	-6.51	1965	4995	2728	6744	8063	5126	3704
10	1938 Regional Surplus Deficit	4076	2260	4794	3905	4228	4865	5919	6086	6552	11723	12775	11641	11638	7621	6878
11	1939 Regional Surplus Deficit	3656	3294	4969	4474	4376	3276	3002	3514	3484	8635	8029	9854	8442	5185	5198
12	1940 Regional Surplus Deficit	2436	1605	4268	4251	5045	4539	2006	2723	6031	9476	8837	8409	9118	4106	5139
13	1941 Regional Surplus Deficit	1920	1488	4535	4241	3849	3806	1242	995	1573	4549	4049	6227	9044	4961	3879
14	1942 Regional Surplus Deficit	2557	1817	4194	4387	4586	5945	5250	2655	2410	5144	7932	7507	12876	8783	5618
15	1943 Regional Surplus Deficit	4687	4005	5256	4209	4313	4814	7311	6875	7717	15388	14126	11596	15253	7918	7848
16	1944 Regional Surplus Deficit	4607	3837	4966	4295	4709	3357	2032	2009	2387	3680	4707	4403	4822	4129	3798
17	1945 Regional Surplus Deficit	2439	1780	4355	3584	4216	1468	951	1496	1556	3544	513	8909	12603	4103	3947
18	1946 Regional Surplus Deficit	4069	2923	5103	4085	4689	5257	6038	5881	6107	12352	12984	11699	13492	8762	7264
19	1947 Regional Surplus Deficit	5435	4258	5453	4304	5316	10168	10529	9822	8500	10376	8593	10409	13602	8419	8390
20	1948 Regional Surplus Deficit	5061	3840	5254	8989	8150	7130	9790	7130	5622	9931	11276	12941	16243	10013	8859
21	1949 Regional Surplus Deficit	7415	6760	5134	5009	5123	4554	6223	3156	8474	11819	12375	12768	13438	4653	7324
22	1950 Regional Surplus Deficit	2732	2080	4237	4279	5079	4591	9972	8155	10983	13701	11142	11141	15117	9867	8175
23	1951 Regional Surplus Deficit	7252	6910	4828	6822	9344	11167	12311	12758	12388	14056	12347	11408	13438	9917	10370
24	1952 Regional Surplus Deficit	6958	4928	4926	8420	6946	7493	8601	7883	8222	13472	12909	13244	14041	8055	8910
25	1953 Regional Surplus Deficit	5023	3620	4333	3991	4449	2976	5145	5758	5286	8243	7068	11048	16146	9716	6726
26	1954 Regional Surplus Deficit	5710	5045	4523	4768	5696	6785	9192	8876	9155	11209	9030	11056	13983	12054	8460
27	1955 Regional Surplus Deficit	8446	8663	8726	5193	7094	5523	3849	2102	1755	6069	5703	8651	15838	11947	7110
28	1956 Regional Surplus Deficit	7634	5291	4215	5925	8443	10552	12510	11457	10671	13707	13869	12666	16562	10460	10292
29	1957 Regional Surplus Deficit	6732	5176	5467	5527	5093	6959	5976	4940	6905	13646	9117	13820	16139	7303	7961
30	1958 Regional Surplus Deficit	3946	2566	5069	4395	4803	4293	6894	6110	6964	10693	9725	12725	14448	6509	7130
31	1959 Regional Surplus Deficit	3541	3149	4867	4476	6822	9219	11324	10218	9019	12038	8989	10037	14871	8876	8611
32	1960 Regional Surplus Deficit	6981	5594	9081	10786	10188	8631	7897	6489	6550	15686	11408	9780	12947	7658	9149
33	1961 Regional Surplus Deficit	5401	3655	4803	4603	5414	4984	7939	6865	8543	12139	6709	10712	14785	6950	7452
34	1962 Regional Surplus Deficit	3825	3792	4526	4262	4826	3985	6095	5693	3555	14384	13086	10722	13778	4528	6606
35	1963 Regional Surplus Deficit	4717	3550	4660	5208	6991	8366	5951	7240	4646	8097	6956	9403	14136	7868	7163
36	1964 Regional Surplus Deficit	4887	4028	5568	4232	4691	4930	4951	4056	4084	11764	6593	10372	16258	11364	7014
37	1965 Regional Surplus Deficit	7540	5269	5789	6121	6175	10689	12774	13886	11393	9936	13261	11883	12849	8135	9779
38	1966 Regional Surplus Deficit	7025	6490	4223	5225	5618	5390	5822	4798	3459	13705	8191	8802	10873	8083	6668
39	1967 Regional Surplus Deficit	4684	4063	4973	4180	4511	6042	9620	9650	10235	8777	3586	9886	15189	9794	7872

Exhibit 8-5: 80-Water Year Monthly Energy
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
40	1968 Regional Surplus Deficit	5942	4396	4377	5218	5897	5648	8099	8674	8258	7099	5044	6485	14170	8863	7226
41	1969 Regional Surplus Deficit	6252	5647	6872	6835	8277	7627	11231	11240	8098	14063	12742	12494	13603	8604	9493
42	1970 Regional Surplus Deficit	4380	3354	5299	4618	5109	3919	6212	5772	5655	9032	5426	10040	14805	6013	6533
43	1971 Regional Surplus Deficit	4422	3235	4753	4201	4935	4623	12532	12472	11780	13451	11655	12597	15800	11856	9297
44	1972 Regional Surplus Deficit	8280	6715	5045	5599	5644	6234	12490	12138	15026	15668	10783	12465	16135	11545	10238
45	1973 Regional Surplus Deficit	8345	8263	5687	5511	5371	5989	6046	4022	2356	2679	4571	6382	9724	4869	5666
46	1974 Regional Surplus Deficit	2814	2059	5025	3955	4874	6911	14914	14482	12948	14498	13185	12062	15643	12246	9907
47	1975 Regional Surplus Deficit	8214	6861	5192	4382	5107	4980	6543	7133	7605	8247	7046	11054	15906	12142	7934
48	1976 Regional Surplus Deficit	6527	5718	5434	7054	8869	12649	11259	10852	10585	14064	12269	12387	14369	10711	10280
49	1977 Regional Surplus Deficit	9048	9525	9545	5259	4810	3076	1865	2458	1994	2930	4550	3692	4345	3327	4454
50	1978 Regional Surplus Deficit	2027	1517	3262	3621	3890	6533	5949	5334	5696	13314	8842	10799	10349	8077	6362
51	1979 Regional Surplus Deficit	4659	4080	6896	5256	4831	3712	4097	2263	6018	6992	6908	11494	8899	4187	5763
52	1980 Regional Surplus Deficit	1983	2067	4411	4081	4376	3104	2968	3974	2697	9742	9645	12915	13979	5439	5795
53	1981 Regional Surplus Deficit	3035	2325	4905	4400	4867	9729	9057	6419	4690	5388	8363	11316	15239	9169	7447
54	1982 Regional Surplus Deficit	6650	7043	4483	4618	5649	6771	9153	11363	13327	12359	9666	12217	15229	10003	9206
55	1983 Regional Surplus Deficit	7681	6642	6654	6518	5986	7639	10720	9518	11416	12148	9059	11604	13747	10034	9297
56	1984 Regional Surplus Deficit	7102	5436	5062	5128	9386	7394	9188	8693	8343	14160	12091	10744	16119	10102	9111
57	1985 Regional Surplus Deficit	5514	4946	5395	5237	6289	5243	4891	4590	5382	11122	10178	11386	10870	2328	6452
58	1986 Regional Surplus Deficit	1437	1068	4462	4874	7787	4875	7971	8259	14378	13095	11104	9227	13323	6183	7870
59	1987 Regional Surplus Deficit	4236	3264	4966	4235	5115	5526	3556	1541	5432	6564	6401	9883	9199	4457	5363
60	1988 Regional Surplus Deficit	1553	959	4503	3556	4054	2404	1046	315	1941	4872	6557	6459	9260	5696	3857
61	1989 Regional Surplus Deficit	2318	1988	4700	3317	4040	3940	2989	1566	4208	10997	12159	9924	9968	4743	5265
62	1990 Regional Surplus Deficit	2899	2199	4708	3826	5551	5645	7589	7365	8109	9930	12331	9487	13237	7688	7223
63	1991 Regional Surplus Deficit	5828	4735	4176	3711	9214	7575	8473	9600	8355	11540	8728	10376	12778	10230	8305
64	1992 Regional Surplus Deficit	7139	6925	4079	3755	4767	3282	2345	2353	3114	5256	5008	7677	7893	3278	4567
65	1993 Regional Surplus Deficit	1465	1207	4153	3517	4223	3023	380	131	3878	6511	6481	9562	10894	6588	4530
66	1994 Regional Surplus Deficit	4030	3213	4893	3474	4819	3207	1409	81.9	2223	4456	6172	7894	9257	5086	4287
67	1995 Regional Surplus Deficit	2505	1672	4613	3300	3847	3047	3781	5904	6945	10812	6554	8562	14110	7359	5999
68	1996 Regional Surplus Deficit	4338	3681	5321	5419	10966	14206	14166	13499	14404	13454	14285	12114	14552	10657	11077
69	1997 Regional Surplus Deficit	7273	5253	4115	4642	5771	7522	13940	14279	14732	13888	14136	12586	16428	11654	10465
70	1998 Regional Surplus Deficit	7865	6116	7043	9812	7981	6745	5928	6255	5800	8319	8585	13171	15649	7854	8475
71	1999 Regional Surplus Deficit	5165	3484	5350	4240	4634	6798	11079	11002	11839	11626	11326	11498	16227	11393	9134
72	2000 Regional Surplus Deficit	8685	8466	5565	4831	9563	8672	7361	6754	7019	13444	13042	9473	10730	7066	8233
73	2001 Regional Surplus Deficit	5063	3015	4827	4244	4342	2874	1525	1786	1857	3251	4886	5071	3662	3961	3525
74	2002 Regional Surplus Deficit	1814	1664	3293	2164	3577	2926	2307	2412	2637	11101	10716	7763	14025	9913	5300
75	2003 Regional Surplus Deficit	4992	3519	5061	3487	4638	3023	2047	1684	6022	9185	7318	7851	12745	4312	5283
76	2004 Regional Surplus Deficit	1904	1107	3923	4194	4641	4609	2689	2359	2900	6165	7520	8728	10745	5152	4859
77	2005 Regional Surplus Deficit	2655	2910	4603	4707	4852	5849	5385	4032	3206	5041	5603	8877	11069	5370	5507
78	2006 Regional Surplus Deficit	3207	2094	4583	3439	4590	4753	7506	8880	7329	14560	12681	12801	13872	6548	7517

Exhibit 8-5: 80-Water Year Monthly Energy
Operating Year 2014 Water Year: 1937
2012 White Book Report Date: 10-19-2012

S104-WB-20121129-1733082

	Energy-aMW	Aug1	Aug16	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr1	Apr16	May	Jun	Jul	Avg
79	2007 Regional Surplus Deficit	2782	1711	4573	3485	6075	5105	7064	5016	9824	11011	8374	9527	10194	7318	6678
80	2008 Regional Surplus Deficit	3785	1839	3806	3833	4151	3703	3374	2766	3921	7487	4290	11800	16175	8858	5930
	Ranked Averages															
81	Bottom 10 pct	**3141**	**2281**	**4641**	**3883**	**4283**	**2672**	**977**	**1121**	**1807**	**4279**	**3773**	**6125**	**7392**	**4748**	**3704**
82	Middle 80 pct	**4769**	**3971**	**5039**	**4742**	**5543**	**5477**	**6180**	**5716**	**6357**	**10055**	**8873**	**10254**	**12983**	**7541**	**6967**
83	Top 10 pct	**6457**	**5112**	**4971**	**5692**	**7511**	**9991**	**13045**	**12919**	**12769**	**13659**	**13017**	**12197**	**14997**	**10666**	**10301**

THIS PAGE INTENTIONALLY LEFT BLANK

BONNEVILLE POWER ADMINISTRATION
DOE/BP-4476 ▪ October 2012