



B

2017 PSE Integrated Resource Plan

Legal Requirements and Other Reports

This appendix identifies where each of the regulatory requirements for electric and gas integrated resource plans is addressed within the IRP and reports on the progress of the 2015 IRP electric and gas utility action plans. It also delivers two additional reports.

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1. REGULATORY REQUIREMENTS

Figures B-1 and B-2 delineate the regulatory requirements for electric and natural gas integrated resource plans and identify the chapters of this plan that address each requirement.

Figure B-1: Electric Utility Integrated Resource Plan Regulatory Requirements

Statutory or Regulatory Requirement	Chapter and/or Appendix
<p>WAC 480-100-238 (3) (a) A range of forecasts of future demand using methods that examine the effect of economic forces on the consumption of electricity and that address changes in the number, type and efficiency of electrical end-uses.</p>	<p>Chapter 4, Key Analytical Assumptions Chapter 5, Demand Forecasts Appendix E, Demand Forecasting Models</p>
<p>WAC 480-100-238 (3) (b) An assessment of commercially available conservation, including load management, as well as an assessment of currently employed and new policies and programs needed to obtain the conservation improvements.</p>	<p>Chapter 6, Electric Analysis Appendix J, Conservation Potential Assessment</p>
<p>WAC 480-100-238 (3) (c) An assessment of a wide range of conventional and commercially available nonconventional generating technologies.</p>	<p>Chapter 6, Electric Analysis Appendix D, Electric Resources and Alternatives Appendix K, Colstrip Appendix L, Electric Energy Storage Appendix M, Washington Wind and Solar Costs</p>
<p>WAC 480-100-238 (3) (d) An assessment of transmission system capability and reliability, to the extent such information can be provided consistent with applicable laws.</p>	<p>Chapter 8, Delivery Infrastructure Planning Appendix I, Regional Transmission Resources</p>
<p>WAC 480-100-238 (3) (e) A comparative evaluation of energy supply resources (including transmission and distribution) and improvements in conservation using the criteria specified in WAC 480-100-238 (2) (b), Lowest reasonable cost.</p>	<p>Chapter 2, Resource Plan Decisions Chapter 6, Electric Analysis Chapter 8, Delivery System Planning Appendix I, Regional Transmission Resources Appendix N, Electric Analysis Appendix J, Conservation Potential Assessment</p>



Statutory or Regulatory Requirement	Chapter and/or Appendix
<p>WAC 480-100-238 (3) (f) Integration of the demand forecasts and resource evaluations into a long-range (e.g., at least ten years; longer if appropriate to the life of the resources considered) integrated resource plan describing the mix of resources that is designated to meet current and projected future needs at the lowest reasonable cost to the utility and its ratepayers.</p>	<p>Chapter 2, Resource Plan Decisions</p>
<p>WAC 480-100-238 (3) (g) A short-term plan outlining the specific actions to be taken by the utility in implementing the long-range integrated resource plan during the two years following submission.</p>	<p>Chapter 1, Executive Summary</p>
<p>WAC 480-100-238 (3) (h) A report on the utility's progress towards implementing the recommendations contained in its previously filed plan.</p>	<p>Appendix B, Legal Requirements and Other Reports</p>
<p>WAC 480-100-238 (4) Timing. Unless otherwise ordered by the commission, each electric utility must submit a plan within two years after the date on which the previous plan was filed with the commission. Not later than twelve months prior to the due date of a plan, the utility must provide a work plan for informal commission review. The work plan must outline the content of the integrated resource plan to be developed by the utility and the method for assessing potential resources.</p>	<p>2017 Integrated Resource Plan Work Plan filed with the WUTC July 14, 2016, and Updated Work Plan filed April 7, 2017</p>
<p>WAC 480-100-238 (5) Public participation. Consultations with commission staff and public participation are essential to the development of an effective plan. The work plan must outline the timing and extent of public participation. In addition, the commission will hear comment on the plan at a public hearing scheduled after the utility submits its plan for commission review.</p>	<p>Appendix A, Public Participation</p>
<p>RCW 19.280.030 (e) An assessment of methods, commercially available technologies, or facilities for integrating renewable resources, and addressing overgeneration events, if applicable to the utility's resource portfolio.</p>	<p>Appendix H, Operational Flexibility Overgeneration events are not applicable to PSE.</p>



Figure B-2: Natural Gas Utility Integrated Resource Plan Regulatory Requirements

Statutory or Regulatory Requirement	Chapter and/or Appendix
WAC 480-90-238 (3) (a) A range of forecasts of future natural gas demand in firm and interruptible markets for each customer class that examine the effect of economic forces on the consumption of natural gas and that address changes in the number, type and efficiency of natural gas end-uses.	Chapter 4, Key Analytical Assumptions Chapter 5, Demand Forecasts Appendix E, Demand Forecasting Models
WAC 480-90-238 (3) (b) An assessment of commercially available conservation, including load management, as well as an assessment of currently employed and new policies and programs needed to obtain the conservation improvements.	Chapter 7, Gas Analysis Appendix O, Gas Analysis Appendix J, Conservation Potential Assessment
WAC 480-90-238 (3) (c) An assessment of conventional and commercially available nonconventional gas supplies.	Chapter 7, Gas Analysis Appendix O, Gas Analysis
WAC 480-90-238 (3) (d) An assessment of opportunities for using company-owned or contracted storage.	Chapter 7, Gas Analysis Appendix O, Gas Analysis
WAC 480-90-238 (3) (e) An assessment of pipeline transmission capability and reliability and opportunities for additional pipeline transmission resources.	Chapter 7, Gas Analysis Appendix O, Gas Analysis
WAC 480-90-238 (3) (f) A comparative evaluation of the cost of natural gas purchasing strategies, storage options, delivery resources, and improvements in conservation using a consistent method to calculate cost-effectiveness.	Chapter 7, Gas Analysis Appendix O, Gas Analysis Appendix J, Conservation Potential Assessment
WAC 480-90-238 (3) (g) The integration of the demand forecasts and resource evaluations into a long-range (e.g., at least ten years; longer if appropriate to the life of the resources considered) integrated resource plan describing the mix of resources that is designated to meet current and future needs at the lowest reasonable cost to the utility and its ratepayers.	Chapter 2, Resource Plan Decisions
WAC 480-90-238 (3) (h) A short-term plan outlining the specific actions to be taken by the utility in implementing the long-range integrated resource plan during the two years following submission.	Chapter 1, Executive Summary
WAC 480-90-238 (3) (i) A report on the utility's progress towards implementing the recommendations contained in its previously filed plan.	Appendix B, Legal Requirements and Other Reports



Statutory or Regulatory Requirement	Chapter and/or Appendix
<p>WAC 480-90-238 (4) Timing. Unless otherwise ordered by the commission, each natural gas utility must submit a plan within two years after the date on which the previous plan was filed with the commission. Not later than twelve months prior to the due date of a plan, the utility must provide a work plan for informal commission review. The work plan must outline the content of the integrated resource plan to be developed by the utility and the method for assessing potential resources.</p>	<p>2017 Integrated Resource Plan Work Plan filed with the WUTC July 14, 2016, and Updated Work Plan filed April 7, 2017</p>
<p>WAC 480-90-238 (5) Public participation. Consultations with commission staff and public participation are essential to the development of an effective plan. The work plan must outline the timing and extent of public participation. In addition, the commission will hear comment on the plan at a public hearing scheduled after the utility submits its plan for commission review.</p>	<p>Appendix A, Public Participation</p>



Figures B-1 and B-2 delineate the regulatory requirements for electric and natural gas integrated resource plans and identify the chapters of this plan that address each requirement. B-3 details additional conditions pursuant to WUTC Order 01, dated April 13, 2017, which approved the November 15, 2017 final deadline for this IRP.

Figure B-3: Additional Conditions Pursuant to WUTC Order 01

Order 01 request	Chapter and/or Appendix or Explanation
Order 5-1(4) Model the availability of transmission to import Montana wind energy resources.	Chapter 6, Electric Analysis
Order 5-2 (4) Perform area-specific analyses of wind resources in eastern Montana, off-shore from the Washington coast, at the Columbia River Gorge, and at the Skookumchuck wind site.	Chapter 4, Key Analytical Assumptions Chapter 6, Electric Analysis Appendix M, Washington Wind and Solar Costs
Order 5-1 (5) PSE will calculate the Effective Load Carrying Capacity of the area-specific wind resources from the data developed by a consulting firm.	Appendix M, Washington Wind and Solar Costs
Order 5-2 (5) PSE will adjust the cost of wind and solar resources based on data produced by a consulting firm.	Chapter 6, Electric Analysis Appendix M, Washington Wind and Solar Costs
Order 5-3 (5) The 2017 IRP will examine a number of actions to reduce carbon emissions and estimate the cost/ton of carbon abatement. This will include additional wind, solar, and conservation resources, in addition to reducing dispatch of gas plants and Colstrip as alternatives.	Chapter 6, Electric Analysis
Order 5-4 (5) PSE will formally request assistance from the Bonneville Power Administration to help clarify what information and studies are required to determine whether Montana wind qualifies as a renewable resource under RCW 19.285, the Energy Independence Act (EIA), and include a summary of those requirements.	Letter was provided to BPA dated April 28. PSE requested feedback by or before July 7, 2016 concerning: 1) what information and studies are required to determine whether Montana wind qualifies as a renewable resource under RCW 19.285, and 2) any summary information concerning the information and studies, and/or whether tariffs or regulations are needed to be addressed before (1) can be fully realized.
Order 5-5 (5) The 2017 IRP will include an analysis examining whether repowering Hopkins Ridge would be cost effective, assuming production tax credits would be available for such repowering.	Chapter 4, Key Analytical Assumptions Chapter 6, Electric Analysis



Order 01 request	Chapter and/or Appendix or Explanation
<p>Order 5-6 (5) PSE will include a sensitivity that examines whether changing the discount rate for conservation impacts cost effectiveness of conservation.</p>	<p>Chapter 4, Key Analytical Assumptions Chapter 6, Electric Analysis</p>
<p>Order 5-7 (5) For the 2019 IRP, PSE will hire a firm to do a survey of resource costs and recommend assumptions for use in the IRP. If reasonable, PSE will have the same consultants provide information for both fossil fuel plants and renewables. That study will include a detailed discussion of potential wind resources off the Washington coast, including areas that may be geographically limited for different reasons.</p>	<p>Appendix M, Washington Wind and Solar Costs Appendix P, Gas-fired Resource Costs</p>
<p>Order 5-8 (6) PSE will perform portfolio sensitivity analysis to examine whether different resource costs would impact the least-cost mix of resources. PSE will also perform tipping point analyses to examine how close different resources are to each other, in terms of value to the portfolio. Furthermore, if Montana wind does not appear to be least-cost, a tipping point analysis will be used to estimate how close it is from other resources to being cost effective.</p>	<p>Chapter 4, Key Analytical Assumptions Chapter 6, Electric Analysis</p>
<p>Order 5-9 PSE's Chapter on System Planning, which includes a transmission and distribution planning discussion, will include an overview and explanation of the system planning process, including transmission that is not related to resources. This chapter will also identify geographic areas that may become capacity constrained in the future to guide future planning analyses. Additionally, for transmission projects that may affect the topology of PSE's transmission system, the System Planning Chapter will include the following information:</p> <ul style="list-style-type: none"> • List of transmission projects completed since the 2015 IRP; • Future planned transmission projects, brief description of the project, and references where interested parties can find additional information that may include needs, alternatives, etc., depending on the magnitude of the project. 	<p>Chapter 8, Delivery Infrastructure Planning</p>



2. REPORT ON PREVIOUS ACTION PLANS

2015 Electric Resources Action Plan

Per WAC 480-100-238 (3) (h), each item from the 2015 IRP electric resources action plan is listed below, along with the progress that has been made in implementing those recommendations.

DEMAND-SIDE RESOURCES

Acquire Energy Efficiency

Develop 2-year targets and implement programs that will put us on a path to achieve an additional 411 MW of energy efficiency by 2021.

PROGRESS. PSE reviewed the 2015 IRP guidance with its Conservation Resource Advisory Group (CRAG) beginning in May 2015. Over the following four months, PSE collaborated with the CRAG to develop its 2016-2017 electric conservation resource target, which was approved by the Commission on December 17, 2015. PSE issued an “all-comers” Request for Proposals (RFP) for possible new energy efficiency programs on May 15, 2015. An additional RFP for existing programs was issued on July 17, 2015.

To ensure that the CRAG is engaged in energy efficiency program development, PSE conducts regular CRAG meetings and provides a variety of communications about the program. These include the CRAG newsletter; routine updates of PSE’s Exhibit 3: Program Details and Exhibit 4: Measures, Incentives and Eligibility; and Annual Reports.



Acquire Demand Response

Develop and implement a demand response acquisition process and issue a Request for Proposal (RFP). The analysis supports addition of demand-response by 2021, but these programs don't fit existing energy efficiency or supply-side resource models.

PROGRESS. PSE developed two RFPs for demand response in 2016. The first focused commercial and industrial customers, and the second focused on residential and small-medium business customers, since these two groups require different technology and implementation strategies. Draft RFPs were filed with WUTC in June 2016 and approved at a WUTC open meeting in September 2016. The RFPs were subsequently released to bidders and posted on PSE's website. PSE received 10 proposals for residential and small-medium business customers and 8 proposals for commercial and industrial customers. All proposals were evaluated by the PSE demand response team, Navigant Consulting, and a group of PSE stakeholders from all departments that would be impacted by the implementation of demand response. Apparent winners were selected through a qualitative scoring process. None of the highest scoring proposals from either RFP were determined to be cost-effective under current methodology, and full-scale programs will not be implemented in 2017.

SUPPLY-SIDE RESOURCES

Clarify before Issuing an All-source RFP

Energy efficiency and demand-response additions appear sufficient to meet incremental capacity need until 2021, and additional renewables are not needed until 2023. PSE intends to issue an all-source RFP¹ in 2016, subject to an update to resource needs, most likely in early summer of 2016. This postponement will provide time to incorporate an updated regional adequacy assessment into our resource need, which is scheduled to be completed by the NPCC in the second quarter of 2016.

PROGRESS. This item was driven by a resource need identified using an updated planning standard. In the 2015 IRP, PSE used a standard driven by the value of reliability to customers instead of a 5 percent Loss of Load Probability standard (LOLP). The Commission expressed concern about adopting the new approach as the basis for resource acquisitions its 2015 IRP acceptance letter. This was extremely helpful feedback. As a result of the Commission's feedback, PSE chose not to adopt the new planning standard, and returned to the 5 percent LOLP standard in the 2017 IRP. This

¹ / Chapter 3, Planning Environment, describes the resource acquisition process.



pushed PSE's resource need out further into the future, as shown in Figure 6-5, of Chapter 6, at page 6-11 of the 2015 IRP. Therefore, PSE determined that issuing an all-source RFP would not be warranted.

Improve Analytical Capabilities

Analysis in the 2015 IRP demonstrated that initial estimates of intra-hour flexibility values could significantly affect the least cost mix of resources and possibly add reciprocating engines to the portfolio. Specifically, in the 2017 IRP planning cycle, we will:

- Define specific elements of intra-hour flexibility that need to be valued and prioritize them according to their potential to impact future resource decisions.
- Refine existing or develop new analytical frameworks to estimate, from a portfolio perspective, the value that different types of resources can provide for each element of flexibility.
- Ensure that frameworks reasonably address energy storage technologies, including batteries, pumped hydro, kinetic storage and others.

PROGRESS. PSE acquired the PLEXOS model to help analyze sub-hourly dispatch for the 2017 IRP. The company also engaged E3 Consulting to perform the analysis, using PLEXOS in consultation with PSE staff. This modeling addressed both day-ahead scheduling and sub-hourly dispatch at the 5-minute level. The analytical framework was applied to lithium ion batteries, flow batteries, pumped hydro storage, different kinds of gas or dual fuel peakers, and baseload combined-cycle gas plants.

Actively Investigate Emerging Resources

For batteries, continue to explore potential applications and demonstration projects; for solar, update market penetration studies and continue study of system planning implications; for electric powered vehicles, continue load research. Continue to explore the possibilities provided by new emerging resources.

PROGRESS. PSE continues to be a leader in the exploration and adoption of new technologies that meet customer needs and balance environmental impacts.

The 2017 PSE General Rate Case Prefiled Direct Testimony of Michael Mullally provides a summary of PSE's Glacier Battery Storage Project – currently the largest battery storage project in Washington state. PSE continues to evaluate solar technologies. At the May 22, 2017 IRPAG meeting, DNV GL provided analysis that identified solar prices are becoming more cost competitive than wind, largely driven by the current investment tax



credit (ITC) benefits. PSE continues to model battery storage as a potential resource in the IRP analysis, and we are also actively evaluating options for customer electric vehicles and how to meet the needs for the 9,000 electric vehicles residing in PSE territory, including options to encourage charging during off-peak hours.

Participate in the California Energy Imbalance Market (EIM)

PSE has committed to joining the California EIM. This market will allow PSE to purchase sub-hourly flexibility at 15- and 5-minute increments from other EIM participants to meet our flexibility needs when market prices are cheaper than using our own resources. This will also allow PSE the opportunity to sell flexibility to other EIM participants when we have surplus flexibility. The benefits of lower costs on the one hand and net revenue from EIM sales on the other will reduce power costs to our customers.

PROGRESS. PSE entered the CAISO EIM market on October 1, 2017, joining PacifiCorp, NV Energy, and Arizona Public Service as EIM Entities. As estimated by CAISO, participating in the EIM has produced \$5.43 Million in benefits for PSE customers since entering the market.

The success of the CAISO EIM has been well-documented and plans are in place for several entities to join the market. Portland General Electric, Idaho Power, Powerex, Salt River Project and Seattle City Light have all signed contracts to join the market before 2020. By 2020, most of the load in the Western Energy Coordinating Council (WECC) Balancing Authority is expected to be within the EIM footprint. PSE expects additional EIM participants will increase the diversity and liquidity of the market, potentially increasing the benefits associated market participation.



2015 Gas Resources Action Plan

Per WAC 480-90-238 (3) (i), each item from the 2015 IRP gas resources action plan is listed below, along with the progress that has been made in implementing those recommendations.

GAS DEMAND-SIDE RESOURCES

Acquire Energy Efficiency

Develop 2-year targets and implement programs to acquire conservation, using the IRP as a starting point for goal-setting.

PROGRESS. PSE reviewed the 2015 IRP guidance with its Conservation Resource Advisory Group (CRAG) beginning in May 2015. Over the following four months, PSE collaborated with the CRAG to develop its 2016-2017 natural gas conservation resource target, which was approved by the Commission on December 17, 2015. PSE issued an “all-comers” Request for Proposals (RFP) for possible new energy efficiency programs on May 15, 2015. An additional RFP for existing programs was issued on July 17, 2015.

To ensure that the CRAG is engaged in energy efficiency program development, PSE conducts regular CRAG meetings and provides a variety of communications about the program. These include the CRAG newsletter; routine updates of PSE’s Exhibit 3: Program Details and Exhibit 4: Measures, Incentives and Eligibility; and Annual Reports.

GAS SUPPLY-SIDE RESOURCES

Develop the PSE LNG Project

Continue work to develop an LNG facility for serving both the peak needs of gas customers and the transportation markets at the Port of Tacoma.

PROGRESS. PSE is in the execution phase of the PSE LNG project in Tacoma, Wash. A major transportation sector customer has executed long-term agreements. The project is currently under construction and is expected to be in service by late 2019.



Begin Upgrades to Swarr

Implement plans to ensure that the full upgraded capacity of the Swarr propane-air facility is available by the 2016/17 or 2017/18 heating season.

PROGRESS. PSE has developed plans to restore the facility to safe reliable and expanded service; however, with the slower growth and lower peak use per customer in current load forecasts, PSE has only a one- to two-year need for Swarr until the Tacoma LNG facility is online. PSE has determined that it is lower cost to serve the short-term shortfall with short-term pipeline capacity and defer the Swarr upgrade until further need is apparent.

Improve Analysis on Basin Risk

Acquiring long-term pipeline capacity to one supply basin entails risk, as the relationship between gas prices in different supply basins is uncertain and changes over time. Resources that do not rely on making a long-term commitment to one supply basin reduce risk. Such resources may include conservation, on-system storage and market-area storage. These resources avoid placing a bet on which basin-plus-transportation cost will be lowest cost in the long run. PSE will refine its analysis of this risk and work with other gas utilities on ways to improve its ability to analyze this issue in the 2017 IRP.

PROGRESS. With the addition of PSE's LNG peaking plant, the company's gas utility resource need (after cost-effective conservation) was pushed out to the 2024/2025 time frame. Therefore, PSE decided this was not a high priority item.



2015 Gas-Electric Convergence Action Plan

Non-firm Gas Supplies for PSE's Portfolio

Continue monitoring sufficiency of non-firm gas versus backup fuel as PSE begins operating in the California EIM; as regional natural gas demand grows; and as interstate pipelines become more fully utilized.

PROGRESS. In the 2015 IRP, PSE examined the adequacy of backup fuel with non-firm gas supplies for PSE's existing fleet. In the 2017 IRP, we extended that analysis to look out into the future at whether 48 hours of backup fuel would be adequate for additional dual-fuel peakers. These results are presented in Chapter 6, Electric Analysis.

Non-firm Gas Supplies for Regional Adequacy

Work with others in various industry forums on developing resource adequacy criteria for natural gas generating plants that do not have verifiable fuel supply.

PROGRESS. PSE has been an active participant in the Northwest Power and Conservation Council's Resource Adequacy Advisory Committee on this issue. At this time, the approach has been to address this issue as a "what-if" analysis; that is, the Council's study examines the impact on regional resource adequacy if gas units in the region that do not have backup fuel or firm pipeline capacity are not available. This provides reasonable book-ends. On one hand, there may be conditions when those plants are not able to acquire gas supply during extreme weather events. On the other hand, removing them completely from the analysis overstates the impact, because such plants probably can acquire fuel most of the time.



3. OTHER REPORTS

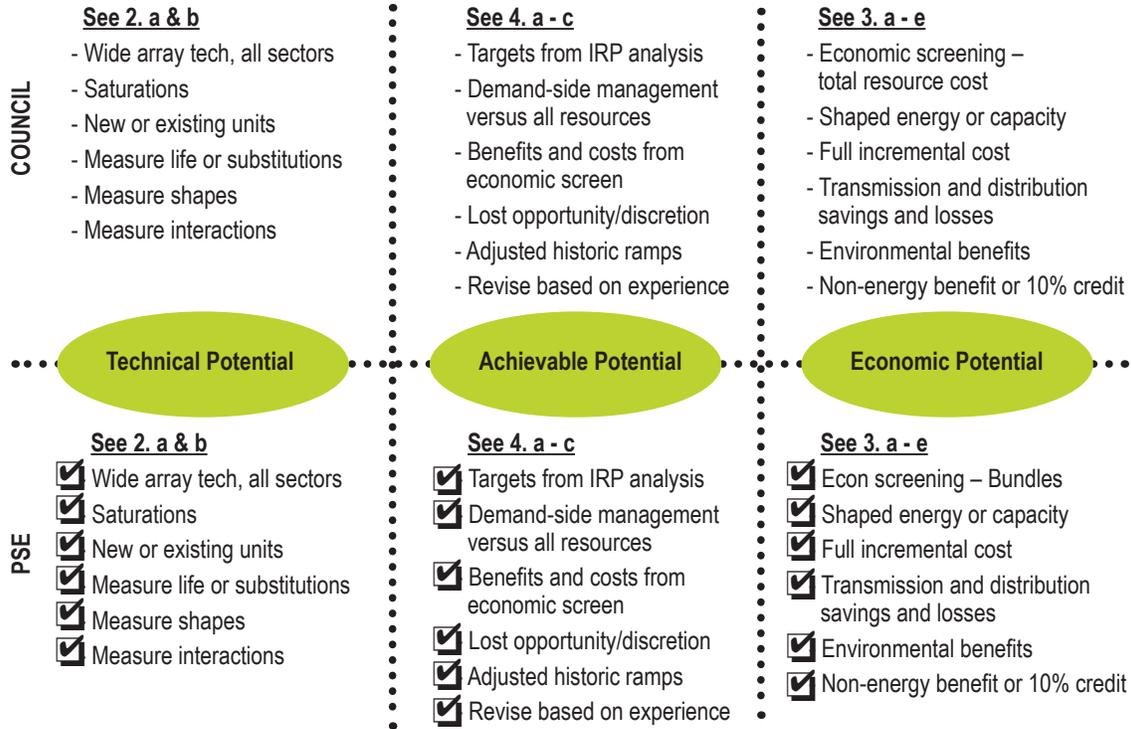
Electric Demand-side Resource Assessment: Consistency with Northwest Power and Conservation Council Methodology

There are no legal requirements for the IRP to address the Northwest Power and Conservation Council (Council) methodology for assessing demand-side resources. Such comparison, however, may be useful for PSE and stakeholders in implementing sections of WAC 480-109. PSE has worked closely with Council staff on several aspects of our analytical process, including approaches to modeling demand-side resources. We are most grateful for the dialogue, and very much appreciate the opportunity to work with Council staff. WAC 480-109 does not define “methodology.” PSE developed the detailed checklist below to demonstrate that our IRP process is consistent with the Council’s methodology.²

² / References in Figure B-4 refer to the Council’s assessment of its methodology, found at: <https://www.nwcouncil.org/media/112474/Methodology.pdf>



Figure B-4: Comparison of Demand-side Resource Assessment Methodologies, PSE and the Northwest Power and Conservation Council



Department of Commerce

Integrated Resource Plan Cover Sheet

The WUTC is required to provide summary information about the IRPs of investor-owned utilities to the Department of Commerce. Information for the cover sheet is included in Figure B-5, below.



Figure B-5: Load-resource Balance Summary

Resource Plan Year: 2018
 Base Year Start: 01/01/2018
 Base Year End: 12/31/2018
 Five-year Report Year: 2023
 Ten-year Report Year: 2028

Report Years	Base Year = 2018			2023			2028		
	Winter	Summer	Annual	Winter	Summer	Annual	Winter	Summer	Annual
Units	(MW)	(MW)	(aMW)	(MW)	(MW)	(aMW)	(MW)	(MW)	(aMW)
Loads	5,021	3,224	2,681	5,359	3,498	2,864	5,662	3,801	3,036
Exports	14	320	66	11	311	63	0	300	48
Resources									
Conservation/ Efficiency	30	22	22	374	257	239	549	376	355
Demand Response	8			79			107		
Cogeneration									
Hydro	853	762	505	814	768	473	685	743	433
Wind	143	90	242	143	143	275	137	137	261
Other Renewables									
Thermal - Gas	2,061	1,841	1,146	2,061	1,841	1,146	2,061	1,841	1,146
Thermal - Coal	658	658	608	360	360	334	360	360	334
Long Term: BPA Base Year or Tier 1									
Net Long Term Contracts	401	386	410	387	376	394	15	4	5
Net Short Term Contracts	1,722	1,695		1,752	1,670		1,863	1,677	
Other									
Imports	308	8	50	308	8	50	308	8	50
Total Resources, net of Exports	6,170	5,142	2,915	6,267	5,111	2,847	6,085	4,847	2,536
Load Resource Balance (Surplus)/Deficit	(1,149)	(1,918)	(234)	(908)	(1,613)	18	(423)	(1,046)	500