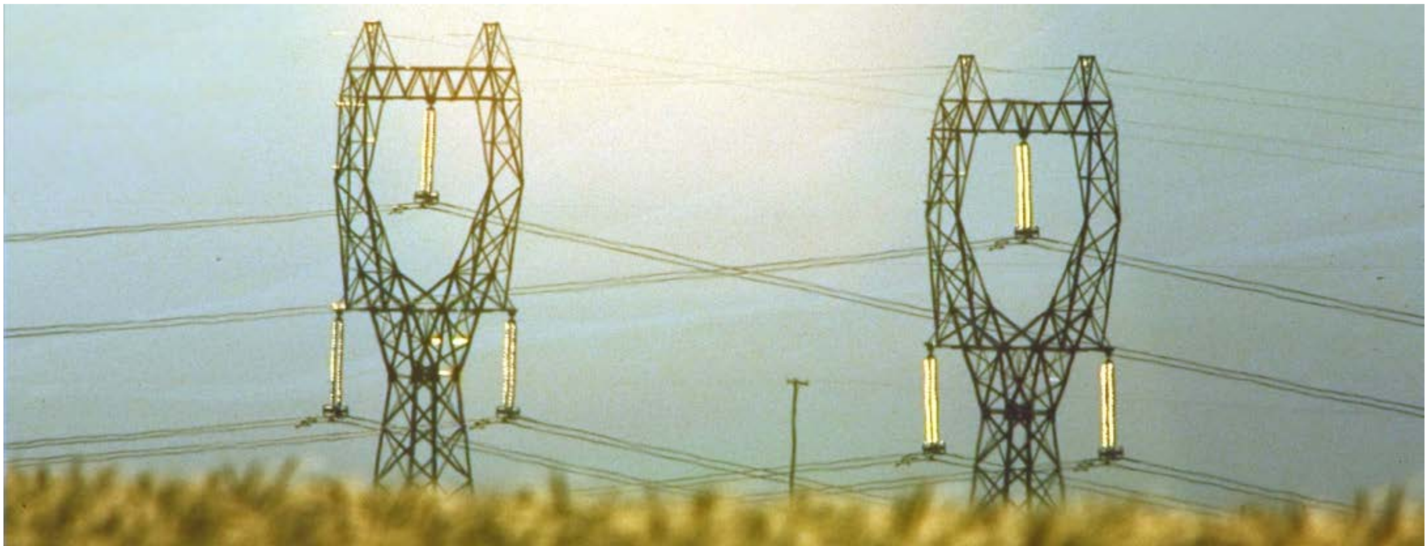

B O N N E V I L L E   P O W E R   A D M I N I S T R A T I O N

2015
TRANSMISSION PLAN

How the transmission system is planned for the future

Prepared by Transmission Planning - TPP
TPP Manager – Melvin Rodrigues

July 2016

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Introduction

This **BPA Transmission Plan (T-Plan)** is intended to document the latest forecast of transmission projects in BPA's service territory for the next ten years. It begins by discussing the three main aspects of the Transmission Planning Process – reliability assessment, transmission service, and interconnections. Even though each of these aspects has a unique process, it all rolls into a comprehensive system assessment. For reliability assessment, each year Transmission Planning conducts its system assessment to identify upgrades needed to serve projected customer demand and projected firm transmission services over the expected range of forecast demand. Within BPA's service territory there are approximately 24 load service areas and seven transfer areas. This T-Plan contains planned and proposed projects within these areas that are expected to meet the forecasted requirements to maintain acceptable technical performance to BPA and other customers over the 10 year horizon. For transmission service, transmission planning conducts a periodic assessment of requests for future long-term firm transmission service and proposed projects to enable transmission service in areas of the system where it is projected there will be insufficient available transmission capability. For interconnections, Transmission Planning conducts feasibility, impact and facilities studies to define the facilities required to interconnect to the BPA transmission system.

This T-Plan also includes the information necessary to satisfy Attachment K of BPA's Open Access Transmission Tariff (OATT). Historically, Transmission Planning has published the BPA Plan in accordance with Attachment K. The information provided in the BPA Plan is included here, primarily in the Transmission Needs section. The T-Plan offers a broader planning perspective that will continue to meet the OATT requirements as well as fulfill objectives laid out in the planning process.

As an agency, BPA coordinates long-term planning activities between Power Services and Transmission Services to ensure BPA can effectively and reliably deliver on its statutory load serving obligations to its regional firm power and transmission customers. The system assessment conducted to support the reliability assessment aspect of the transmission planning process includes coordination of assumptions for federal resources and BPA load serving obligations.

To obtain an electronic or hard-copy of this Transmission Plan, contact Sheryl Geyer, Transmission Planning Administrative Assistant, at sageyer@bpa.gov or 360-619-6775.

Photos on front cover and throughout the document are provided by BPA Photo Archives.
Google Maps were used to depict the load service areas and transmission paths.

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Executive Summary

The BPA Transmission Plan (TPlan) documents the forecast of transmission projects in BPA's service territory for the next ten years. It includes transmission needs identified from the annual reliability system assessment, transmission service requests, generation interconnection requests, and line-load interconnection requests. This T-Plan reflects our commitment to meeting reliability needs and serving customer's needs.

The TPlan is comprised of the following:

- **Transmission Planning's Annual System Assessment:** The System Assessment is a comprehensive assessment of BPA's transmission system to ensure reliable service to customers while meeting compliance with applicable North American Electric Reliability Corporation (NERC) Planning Standards and Western Electricity Coordinating Council (WECC) Regional Criterion. The studies and analysis are performed to determine the transmission expansion plans required to reliably supply projected customer demand and projected transmission services over the Planning Horizon. Based on the studies and analysis for the 2015 System Assessment 19 reliability projects were identified to provide a reliable transmission system and comply with the applicable NERC Standards and WECC Criteria with energization dates of 2017 through 2024. The annual System Assessment Summary Report (a separate document) is evidence of our compliance.

- **Long-Term Firm Transmission Service Requests:** Transmission Planning conducts a Cluster Study for Transmission Services Requests (TSR). This study is performed to assess if transmission system expansion is required to accommodate customers' requests for service. BPA has not conducted a Cluster Study since 2013. This TPlan provides the status of transmission projects that resulted from previous cluster studies. BPA will conduct a cluster study in 2016. As of July, 2016, BPA had received 67 TSRs with an associated Demand of 3,284 megawatts for consideration in the 2016 cluster study.

- **New Generation Interconnection Requests**: Since 2005 BPA has received over 300 requests for generator interconnections (GI) to the BPA transmission system totaling over 45,000 MW. The GI's have been cyclical with a large number of requests received in the 2006-2011 timeframe, then a downturn between 2012 and 2014, and now an upswing since 2015. Between 2005 and 2011 a majority of requests received were for wind generation, from 2012 to 2014 the generator requests received included more natural gas and hydroelectric generation projects, and since 2015 a majority of the requests are solar projects. Historically about 10-15% of requests have moved to construction. This has resulted in upwards of 4,800 MW of wind generation additions and there is construction underway for over 400 MW of natural-gas-fired generation directly interconnected to the BPA transmission system. Presently there are 33 requests in the generation interconnection queue that are in either the feasibility, impact, or facilities study stages of the GI process in Transmission Planning. This includes one hydro generation request for 210 MW, four natural gas generation requests totaling 2,110 MW, 23 solar generation requests totaling 1,610 MW, one battery storage facility for 150 MW, and four wind generation requests totaling 916 MW. For the wind, three of the requests totaling 566 MW are re-studies due to withdrawal of earlier queued requests. For the solar projects 14 of the requests are 20 MW or less. The future planned generation interconnection projects included in this TPlan are those that have a requested generation interconnection greater than 20 MW and have an executed Large Generation Interconnection Agreement (LGIA). These project(s) have a well-defined plan of service and a reasonable estimate of cost and schedule.

Line and Load Interconnection Requests: Since June of 2014 through June 2016, there were 25 line or load interconnection requests with more than 2,614 megawatts of load to be served in the next 10 years, which is about one request every month. These load additions include six large industrial loads. The requests are in various stages of the interconnection study process. Line or load interconnections are typically for new load addition or to allow the customer to shift the delivery of service to different point on their system. Only interconnection requests which have a significant impact to the BPA transmission system and have an executed construction agreement with the customer are included in this TPlan.

The TPlan includes a description, proposed energization date, and estimated costs for a total of 64 projects with energization dates from 2015 through 2024. These projects mainly include reliability, operations and maintenance, line and load interconnections and generation interconnections. There are 27 transmission expansion projects for reliability forecasted to be in-service between 2017 and 2024 at an estimated cost of approximately $935 million. An estimated spend of $722 million is included for the I-5 Corridor Reinforcement project.

Purpose

The purpose of BPA's Transmission Plan (T-Plan) is to document the latest forecast of transmission needs for at least the next ten years. This T-Plan discusses the various drivers and processes that occur during planning as transmission needs are identified and plans of service are developed to meet those needs.

Each year Transmission Planning conducts a comprehensive system assessment to identify upgrades needed to ensure reliable service for projected customer demand and project firm transmission services over the expected range of forecast system demands for at least the next ten years. The system assessment process is described in the Reliability Planning and System Assessment section. The transmission needs identified from the system assessment analysis are provided in the Transmission Needs section. This section provides a description of the areas, description of a project, the preferred alternative, an estimate cost, and estimated schedule for completion of the preferred alternative in each of the load service and transfer areas. There is also a listing of recently completed projects for each load service or transfer area. In some instances it also provides deferred plans of service where applicable.

Another purpose of this T-Plan is that it provides the latest forecast of transmission needs and projects in BPA's service territory for the next ten years in accordance with Attachment K of the BPA Open Access Transmission Tariff (OATT). This includes plans for service needed for reliability purposes from the annual system assessment as well as plans for facilities needed to provide requested interconnection or long-term firm transmission service.

Prior to this new T-Plan, the legacy BPA Plan detailed the proposed projects for the next ten years in accordance with Attachment K of the BPA OATT. For clarification, the BPA Plan is a separate publication. Bringing together the purposes described above, the T-Plan describes the comprehensive planning perspective that will continue to meet the OATT requirements.

Finally, one other purpose of this T-Plan is to support BPA's recent planning process coordination efforts between Transmission and Power Services. As an agency, BPA coordinates long-term planning activities between Power Services and Transmission Services to ensure BPA can effectively and reliability deliver on its statutory load serving obligations to its regional firm power and transmission customers.

Transmission Planning Landscape

Transmission Planning's view of the landscape is broad, and it is looked upon with the goal of providing a reliable, flexible, environmentally responsible, and cost effective transmission system. Transmission Planning conducts the planning process in an open, coordinated and transparent manner through a series of open planning meetings that allow anyone to provide input into and comment on the development of the ten-year plan. Transmission Planning also strives to have a regionally coordinated system. Therefore, Transmission Planning experts engage in regular meetings with interconnected utilities for information exchange and joint studies, conduct stakeholder meetings, and participate in regional planning. Below are changes in the landscape that Transmission Planning participates in or is impacted by.

- **Reliability Standards**

  Ever present in the landscape is the North American Electric Reliability Corporation (NERC) reliability standards and Western Electricity Coordinating Council (WECC) regional criterion. Each year Transmission Planning's annual System Assessment is conducted to meet the NERC Transmission Planning TPL Standards and the WECC System Performance Regional Criterion to ensure than the BPA network is planned such that it can supply projected customer demand and projected firm transmission over the expected range of forecast system demand. Over the past several years, NERC has been revising the standards with the objective of making requirements clear and measurable. These revisions have led to new requirements being identified and some criteria that are more stringent leading to additional investments. In addition, with new TPL standards in effect the 2016 System Assessment will address the new or changed requirements. To this end, Transmission Planning expects for these requirements to continue to evolve in the future.

- **Seventh Northwest Power Plan**

  The Northwest Power and Planning Council (Council) published the Seventh Power Plan where energy efficiency takes the lead role in meeting the region's energy needs, followed by demand response and increased use of existing natural gas-fired plants as regional coals plants are retired. The Council's analysis shows that energy efficiency can meet the region's expected load growth, an average increase of 0.5 to 1.0 percent each year through 2035.

  The Seventh Power Plan recommends continued improvement in system scheduling and operating procedures across the region's balancing authorities. The region also needs to invest in its transmission system to improve market access for utilities, reduce line losses, and help develop cost-effective renewable generation. The Seventh Plan calls for the region to be prepared to develop significant demand responses resources by 2021 to meet additional winter peaking capability. The Northwest's power system has historically relied on the hydro system to provide peaking capacity, but under critical water and weather conditions, additional capacity is needed to meet the region's adequacy standard.

  An important finding in the Seventh Power Plan is that future electricity needs can no longer be adequately addressed by only evaluating average annual energy requirements. Planning for capacity to meet peak load and flexibility to provide within-hour, load-following, and regulation services will also need to be considered.

- ***FERC Order 1000***

  The Federal Energy Regulatory Commission (FERC) Order 1000 ruling aims to increase competition in the electric transmission industry. The three key areas of the ruling include cost allocation, transmission planning and the removal of federal right of first refusal. It also aims to allow large-scale renewable energy projects to connect to the grid. FERC Order 1000 required public transmission utilities to engage in regional and interregional transmission planning.

  FERC Order 1000 requires jurisdictional utilities to form planning regions that would adopt transmission planning processes resulting in regional transmission plans. In 2015 ColumbiaGrid began implementing FERC Order 1000 starting with a new planning process which complies with both the Planning and Expansion Functional Agreement (PEFA) and Order 1000 Functional Agreements. These are two fundamental documents that outline the role and responsibilities of participating parties developed to support and facilitate multi-system transmission planning through an open and transparent process.

  BPA is a member of ColumbiaGrid. However, BPA has not elected whether or not to join the ColumbiaGrid Order 1000 process. BPA is not FERC-jurisdictional; therefore, BPA has a choice whether or not to join the planning process.

- **Energy Imbalance Market**

  Energy imbalance is the difference between the forecast load or generation and the actual load or generation. An Energy Imbalance Market (EIM) is intended to provide better generation-load balancing by adjusting generation in much smaller time increments. The benefits of an EIM include economic efficiency or an automated dispatch, savings due to diversity of loads and variables resources in the expanded footprint, and favorable impacts to reliability or operational risk.

  The EIM was launched in 2014 by the California Independent System Operator (CAISO) and PacifiCorp. NV Energy, Puget Sound Energy and Arizona Public Service are scheduled to join the EIM. Portland General Electric announced it is exploring steps to join the western energy imbalance market. THE EIM does not directly impact the building out of the BPA transmission system in the immediate future; however, Transmission Planning does provide insight to BPA customers who have contractual agreements.

- **Section 111(d) of the Clean Air Act**

  Under the Clean Air Act (CAA) section 111(d), CO_2 emission guidelines for existing fossil fuel-fired electric generating units are established. State compliance plans are due in September 2016. States can request a two-year extension. Every state in the lower 48 is connected electrically to its neighbors and thus every state's 111(d) plan can potentially impact its neighboring states. EPA allows states to join together to submit multi-state compliance plans. Cost effective demand-side resources are expected to be the foundation of many state 111(d) plans. The Clean Power Plan is expected to create opportunities to further modernize the western grid into a flexible, resilient system that will meet or exceed state and federal environmental goals.

Load and Resource Forecast

For the annual system assessment, Transmission Planning engineers run the power flow models using WECC bases cases as a starting point. For BPA loads, considerable effort associated with load forecasting prior to the forecast being submitted to WECC is done outside of Transmission Planning. Transmission Planning coordinates with BPA's Load Forecasting and Analysis and the Transmission Planning and Grid Modeling groups to ensure the forecast is adequate. The WECC cases are modified to correct errors and update system topology.

In addition, Transmission Planning stays abreast on regional load growth and resource forecasts. The Pacific Northwest Utilities Conference Committee (PNUCC) in its *2015 Northwest Regional Forecast* states that this year's forecast is similar to the previous year's forecast in that regional loads are expected to grow, but at a modest pace. The ten-year annual growth rates in the report are well under one percent for regional loads. The reasons for the flat growth is utility conservation efforts are having a dampening effect on load growth.

The BPA White Book, which is snapshot of the federal system and the Pacific Northwest region loads and resources for a ten-year period, also provides useful information for our planning process. The Northwest Power and Conservation Council (NPCC), which provides an electricity demand forecast, adopted its Seventh Power Plan in February 2016. Transmission Planning also keeps an eye on Regional Planning Organizations such as ColumbiaGrid, the Northern Tier Transmission Group, the Northwest Power Pool and Peak Reliability.

Reliability Planning and System Assessment

One of the primary responsibilities of Transmission Planning is the annual system assessment that looks out over a ten-year planning horizon and identifies projected transmission needs. The assessment consists of an evaluation of whether or not the planned transmission grid can meet the forecasted outlook and existing obligations while meeting the established reliability standards. Deficiencies in meeting these standards are noted in the system assessment and then addressed. Transmission Planning uses computer models to test the adequacy of the transmission system under a wide variety of future system conditions. Transmission Planning engineers run the power flow models using WECC bases cases as a starting point.

For BPA loads, considerable effort associated with load forecasting prior to the forecast being submitted to WECC is done outside of Transmission Planning. Transmission Planning coordinates with BPA's Load Forecasting and Analysis and the Transmission Planning and Grid Modeling groups to ensure the forecast is adequate. The WECC cases are modified to correct errors and update system topology. Transmission Planning uses the output of the models to gauge the performance of the transmission system. The results are compared to standards adopted by the NERC and WECC.

During the assessment, Transmission Planning evaluates approximately 24 load service areas and seven transfer areas which consists of 13 flow gates. The facilities in the load service areas are grouped by either electrical or geographical proximities. The major load centers in the Pacific Northwest are located west of the Cascade Mountains including Seattle and Portland. For most of the load service areas in the Pacific Northwest, the load typically peaks in the winter season, although there are a few load areas that also peak in summer. There are interties that connect the BPA transmission system with other regions in the WECC region including British Columbia, Montana, Idaho, and both Northern and Southern California. Each transfer path for the system assessment is composed of several individual paths which are located within a similar geographic area and function similarly to transmit bulk power across the system.

For the 2015 System Assessment, Transmission Planning's comprehensive evaluation results in identifying potential transmission needs. Around September each year, Transmission Planning begins identifying potential projects. Each New Start Project is assigned to a coordinating and planning engineer who will help develop the project scope until funding is approved and the project moves into the design phase.

Non-wires Assessment

Transmission Planning along with the BPA Agency Team explores possible non-wires alternatives to constructing or delaying the construction of transmission projects. Some non-wires alternatives often considered include demand response, energy efficiency, and generation re-dispatch. In the non-wires analysis load forecast are reviewed, appropriate alternatives are selected, and the alternatives are tested and their performance compared to the transmission construction alternative.

Transmission Planning conducts the non-wires assessment as part of its System Assessment. Transmission Planning study engineers include a qualitative analysis of potential non-wires alternatives as part of each area assessment report. All of the area assessment reports include a description of the potential for non-wires measures to slow or flatten the load growth in the area. For areas where corrective action plans are identified to comply with NERC reliability standards within the near or longer-term planning horizon, the assessment report includes a discussion of the potential for non-wires alternatives to mitigate the upcoming problem, or defer the need date for a correction action plan. If non-wires measures will not assist in deferring or mitigating a correction action plan, the report will explain why.

In addition, Transmission Planning prepares a 20-page Non-Wires Assessment report every year that covers all load services areas. A non-wires summary table is provided in the Appendix of this T-Plan. The summary table shows potential projects by area, potential needs, lead time for projects planned, magnitude of load area peak, amount of load reduction needed, number of projects planned for the area, total cost of the projects, joints projects planned, number of customers and more.

Commercial Service

- ***Transmission Service***

  Transmission Service Requests
  BPA customers may make a request for long-term transmission service. Once the customer completes an application BPA makes a determination of available transfer capability (ATC) and whether it will be able to provide service. If ATC is not sufficient on a flowgate, it goes into study status until a request is made for a Cluster Study or the customer makes a request for an individual study.

If ATC is sufficient on all flowgates, the TSR is further assessed for limitations on sub-grid facilities not captured by existing flowgates. If the TSR fails the sub-grid check the TSR goes into study status until further action is initiated for a Cluster Study or the customer makes a request for an individual study. A TSR must pass both an ATC and sub-grid check to be granted.

Transmission Planning's tariff obligations for TSR include Section 19 and 32 of the BPA Open Access Transmission Tariff (OATT). These sections pertain to additional study procedures for firm point-to-point (PTP) and network integration (NT) transmission service requests. Specifically Sections 19.1 through 19.6 of the OATT address the System Impact Study (SIS) and Facilities Study procedures for firm PTP customers. Section 32.1 through 32.5 address the SIS and FAS and Section 32.6 the Cluster Study procedures. Transmission Planning conducts the additional studies as prescribed in the OATT.

- ***Interconnection Service***

<u>Generation Interconnection Requests</u>
BPA customers may request interconnection to BPA's system for interconnecting new generation. BPA receives Generator Interconnection (GI) requests according to Attachment L Large Generator Interconnection Process (LGIP) and Attachment N Small Generator Interconnection Process (SGIP) of the BPA OATT. The GI projects listed in this T-Plan include large generator projects, over 20 megawatts, and have an executed Large Generator Interconnection Agreement (LGIA) or construction agreement. Currently, there are two projects by one customer requesting to interconnect a generation facility to the BPA system.

<u>Line and/or Load Requests</u>
Customers may also request new points of interconnection on BPA's transmission system. These Line or Load Interconnections (LLI) are typically for new load service addition or to allow the customer to shift the delivery of service to different points on their system. The interconnection of lines and of loads is governed by BPA's OATT. Similar to the generator interconnection projects, only larger projects which have an executed interconnection or construction agreement are included in this T-Plan.

Project Development

After the annual system assessment is complete, Transmission Planning begins developing projects that were identified as transmission needs. Transmission Planning fulfills two primary objectives of project development. One is to identify system problems and potential solutions. The second is to begin the preliminary steps to seek capital funding approval of a project. There are several aspects of a new transmission project such as developing detailed technical studies of project alternatives, selecting preferred plans of service, calculating cost and risks, and designing project requirement diagrams. Transmission Planning works closely with other BPA departments in developing projects.

One new aspect in the project development process is BPA's Capital Investment Portfolio (CIP) strategy. The purpose of CIP is to rank the cost and benefits of all projects agency wide, using specific metrics, to optimize the agency investment portfolio. Transmission Planning submits the initial nomination form for a project to be considered in the capital investment portfolio and works with other BPA groups to complete the process. Many, but not all, projects in Transmission Planning are expansion investments and are built for reliability and compliance purposes. Expansion investments are those that grow the asset base meaning it adds capacity or new capabilities, or that it increases operational output or productivity. These projects are typically funded first along with investments that sustain or replace existing assets in order to maintain system performance or capability.

Transmission Planning also works closely with others to develop a business case for a project. Once a project is authorized by the appropriate approval body for capital funding, the project moves into the design phase where Transmission Planning takes on a support role and from there Transmission Planning provides information when called upon. A list of Transmission Planning projects with expected in-service dates and investment category is provided in the Appendix.

Research and Development Efforts

BPA's research agenda is guided by a process that identifies the agency's immediate and future capability gaps and pinpoints technologies with the potential to resolve those business challenges. This process includes the development of technology roadmaps, which provide BPA a framework to help plan, coordinate and forecast technology developments so the agency can focus its R&D investments in areas that deliver the most value to the agency and its stakeholders. Transmission Planning's contribution to Research and Development is in many areas such as power system modeling, power system performance evaluation, validation and use of Synchrophasors.

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Overview

This document lays out BPA's Transmission Plan (T-Plan) for the system over a ten-year planning horizon. Recognizing the many uncertainties that exist in preparing this type of forecast, the T-Plan shows a robust, yet flexible, forecast. The proposed projects shown in the Transmission Needs section are not intended to be a well-defined set of projects to be implemented on a set schedule. Set schedules for projects are developed at a later stage. Decisions on the implementation of specific projects are made based on reliability needs that are affected by many factors such as the customer need, load growth, state and national policy, aging equipment, infrastructure security, impact of intermittent resources, and power planning. As these factors change over time so do the projects and the information contained in the T-Plan. The studies that support the T-Plan reflect current assumptions about these factors. As a result, the T-Plan will be updated as needed to reflect changing circumstances.

How this Transmission Plan is Organized

This T-Plan is divided into three main parts. The first part describes the Transmission Planning Process such as the purpose, key drivers, planning criteria, and more. The following three sections are all under the umbrella of the transmission planning process such as transmission reinforcements, transmission service requests, and interconnection requests. These sections describe the individual planning processes and their respective methodologies.

The middle part presents the Transmission Needs section. This section is organized by load service and transfer areas. Each area includes a geographical description, map, BPA customers, and area peak loads. Plans of service are separated into three categories: proposed, recently completed and deferred. The 2015 System Assessment findings are included. Generation and line and load interconnection projects are included at the end of this section.

In the final part, the project development process is briefly described. The project development process describes detailed technical studies of projects alternatives, recommended plans of service, cost and risk, and project requirement diagrams. FERC Order 1000 and its impacts to the transmission planning process are provided. A brief section on research and development efforts in Transmission Planning is also provided.

Intended Audience

The intended audiences of this T-Plan are executives, organizations with BPA, and BPA customers who need to know BPA's future transmission plans. It is expected that it will also directly inform a variety of stakeholders who participate in the Attachment K transmission planning processes. Because the T-Plan is a public document, it is expected that it will indirectly inform other members such as transmission owners, utilities, consumer groups, environmental advocates, lawmakers, non-governmental organizations, researchers, and engineers. Finally, this T-Plan is aimed at educating readers of varying levels of technical expertise with the information necessary to provide input into the T-Plan.

Transmission Services Roles and Responsibilities

The role of BPA's Transmission Services is to provide open access transmission service for customers, utilities, generators, and power marketers consistent with applicable regulatory requirements. In fulfilling this role, Transmission Planning is responsible for analyzing the changing load and resource trends and patterns and planning a transmission system that will meet the needs of the Pacific Northwest for the future consistent with our mission and vision. From the planning standpoint, the power system can be viewed from a simplistic standpoint of three basic components.

Loads

The loads tend to be clustered into geographical areas. For planning purposes, Transmission Planning has defined over 20 load areas. Examples include the Portland load area, the Seattle load area, the Spokane load area, etc. In the Transmission Needs section of this T-Plan projected loads are shown for each load service area. Summer and winter loads in megawatts are shown five and ten years out for each area. A list of potential projects is identified by load service and transfer areas in the Transmission Needs section.

Transfer areas, Network Paths or Flow Gates

The transfer areas and paths represent the transmission system that moves energy between the loads, generation, and external interconnections described above. There are seven transfer areas and 13 internal flow gates.

External Interconnections

BPA is part of a western interconnection that includes the whole western United States and Canada. There are four interconnected external areas, British Columbia, Montana, Idaho, and California. Bonneville has high capacity interties that interconnect the loads and resources in the Bonneville service area to loads and resources in these adjacent interconnected areas.

BPA's Service Territory

BPA operates and maintains about 75% of the high-voltage transmission network in its service territory. BPA's service territory is approximately 300,000 square miles and includes Idaho, Oregon, Washington, western Montana and small parts of eastern Montana, California, Nevada, Utah, and Wyoming. BPA's transmission system includes more than 15,000 circuit miles of transmission lines and over 260 substations. The transmission system serves many sectors of the Northwest including publicly owned and investor owned utilities, independent power producers and direct service industries.

BPA System Overview

The BPA transmission system is characterized primarily by hydro generation on the main stem Columbia and lower Snake Rivers remote from load centers. Most of the generation is run-of-the-river hydro. In addition, there are several thermal generators located along the I-5 corridor from Seattle to Portland. Over the last 10 plus years, BPA has also interconnected upwards of 4,850 MW of wind generation to the BPA transmission system along the lower Columbia River basin in southern Washington and northern Oregon, as well as along the lower Snake River in southeast Washington.

The major load centers in the Pacific Northwest are located west of the Cascade Mountains including Seattle and Portland. For study purposes, the transmission system is divided into load service areas. The facilities in the load service areas are grouped by either electrical or geographical proximity. For most of the load areas in the Pacific Northwest, the load typically peaks in the winter season (November-February), although there are a few load areas that also peak in the summer season (June-September).

There are also interties that interconnect the BPA main grid in the Pacific Northwest with other sub-regions in the Western Electricity Coordinating Council (WECC) region including British Columbia, Montana, Idaho, and both northern and southern California. The following paragraphs describe the typical seasonal patterns across the main grid transmission system.

In the winter season, hydro and thermal generation is operated to generally serve peak load in the Pacific Northwest. The load in the Pacific Northwest typically peaks in the winter. This results in high flows in the east-to-west direction across the Cascade Mountains, to deliver generation to the load centers in western Washington and western Oregon. With some thermal generation located in western Washington, transfers between Seattle and Portland are generally low in the winter.

The spring and early summer seasons (March-June) are when high hydro run-off occurs due to snow melt across the region (spring run-off scenario). During this time, much of the water in the northern Columbia River basin is stored behind Canadian dams, and the hydro generation along the Snake River is peaking. This results in high flows across the transmission system in an east-to-west direction from northern Idaho and eastern Washington feeding the interties to California. After the spring run-off, generation along the lower Snake River drops off dramatically during the summer.

During the late summer season (July-September), water that was stored in the spring, is released through hydro projects in Canada. This results in high generation levels at hydro plants along the Columbia River. These high generation levels produce high flows across the transmission system in the north-to-south direction from the Upper Columbia and Canada and down through the system to serve load centers in Puget Sound, the Willamette Valley, and California.

To effectively study the different scenarios created by these seasonal patterns, the BPA transmission system is divided into transfer areas for the system assessment. Each of these transfer areas is composed of several individual paths or flowgates which are located within a similar geographic area and function similarly to transmit bulk power across the system. Since the various system patterns occur seasonally and are dependent on weather, stresses on the paths do not all occur simultaneously.

BPA Mission

The Bonneville Power Administration's mission as a public service organization is to create and deliver the best value for our customers and constituents as we act in concert with others to assure the Pacific Northwest:

- An adequate, efficient, economical and reliable power supply;
- A transmission system that is adequate to the task of integrating and transmitting power from federal and non-federal generating units, providing service to BPA's customers, providing interregional interconnections, and maintaining electrical reliability and stability; and
- Mitigation of the Federal Columbia River Power System's impacts on fish and wildlife.

BPA is committed to cost-based rates, and public and regional preference in its marketing of power. BPA will set its rates as low as possible consistent with sound business principles and the full recovery of all of its costs, including timely repayment of the federal investment in the system.

BPA Vision

BPA will be an engine of the Northwest's economic prosperity and environmental sustainability. BPA's actions advance a Northwest power system that is a national leader in providing the following.

- High reliability;
- Low rates consistent with sound business principles;
- Responsible environmental stewardship; and
- Accountability to the region.

BPA delivers on these public responsibilities through a commercially successful business.

Transmission Planning Process

Transmission Planning Process

The main purpose of Transmission Planning is to identify solutions and develop plans of service to meet the future needs of the BPA system. Transmission Planning identifies transmission projects based on three main categories of transmission solutions – reliability, transmission service, and interconnections.

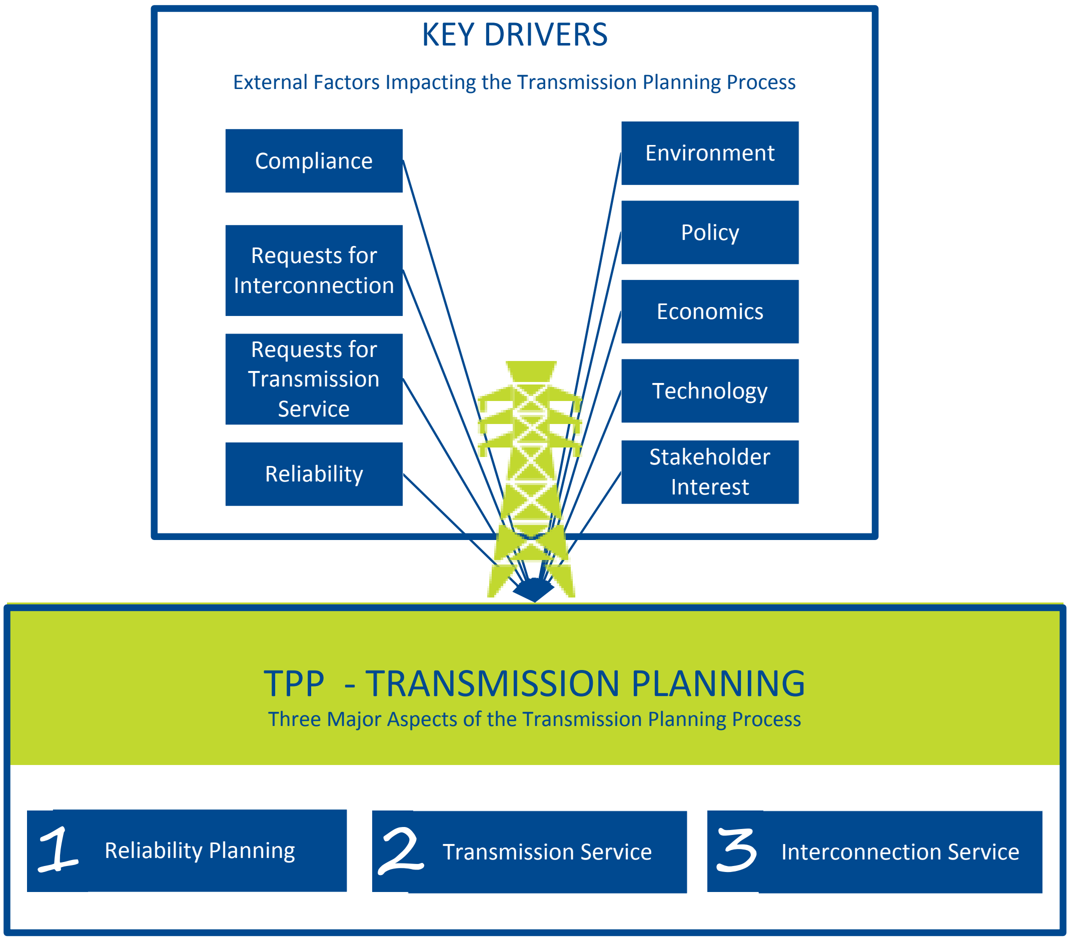
First, fulfilling this purpose from the reliability perspective includes conducting an annual transmission planning process that culminates into a 10-year plan that meets our statutory obligations and is compliant with North America Electric Reliability Corporation (NERC) Standards and Western Electricity Coordinating Council (WECC) Regional Criterion. BPA Transmission Planning applies the NERC Planning Standards and WECC Regional Criterion to ensure reliability of the system. Compliance to these standards and criteria is one of the driving factors behind capital investments on the transmission system. The reliability studies necessary to ensure such compliance comprise a foundational element of the transmission planning process. Transmission Planning performs its annual system assessment to verify compliance with applicable NERC reliability standards. The planning analysis is conducted across a ten-year horizon. The resulting projects from the system assessment are provided in this T-Plan in the Transmission Needs section.

Second, Transmission Planning conducts technical assessments of transmission service requests (TSR) for long-term firm transmission service on its network. Transmission Planning conducts the Cluster Study Analysis of TSRs and determines the reinforcement requirement to accommodate the service.

Third, when a customer makes a request for interconnection – generation or line and load – to the BPA transmission system, Transmission Planning conducts studies and supports development of plans of service for the interconnection.

Key Drivers

There are three broad categories in the transmission planning process, which are reliability planning, customer requests for the transmission service on BPA's system, and generator and line and load interconnection customer requests. Each one of these categories has established processes in place. Transmission Planning monitors the various external factors that have an impact such as compliance, reliability, stakeholder interest, environmental factors, etc. and funnel those customer requests or system needs through the appropriate planning process. The following page provides a brief explanation of the broad planning processes in Transmission Planning.



Planning Processes

Power Services and Transmission Planning

BPA is working to ensure that Power Services and Transmission Planning are coordinated in their long-term planning activities, processes and decision-making in a way that enables BPA to efficiently and reliably meet and deliver on its statutory load-serving obligations to its regional firm power and transmission customers. Developing this plan meets part of the combined planning objective. The decision on future transmission load service policy and products may impact current planning processes and that information will be reflected in future T-Plans.

Reliability and Load Service

BPA plans the transmission system to serve expected loads and load growth for at least the next ten years based on forecasts. The forecasted peak loads, plus existing long-term firm transmission service obligations, are used to determine the system reinforcement requirements for reliability. BPA plans the system in accordance with the NERC Planning Standards and WECC Regional Criterion to maintain system reliability. Within the BPA service area, load growth occurs at different rates depending on the specific geographic area. BPA has divided its service area into load service areas grouped by either electrical or geographical proximity. The load areas in the Transmission Needs section are listed roughly in order from largest to smallest, based on total estimated load served in each area.

Transmission Service Requests

Qualified customers may request long-term firm transmission service on BPA's transmission system. This service is requested through Transmission Service Requests (TSR) according to the terms of the BPA OATT. TSRs are one of the drivers for system expansion projects. BPA manages these customer requests for transmission service through its Network Open Season (NOS) process or its successors. More information about the NOS process and the Cluster Study is provided in a later section and in the Appendix.

Generator Interconnection Service Requests

Qualified customers may request interconnection to BPA's system for interconnecting new generation. BPA receives Generator Interconnection (GI) Requests according to the Attachment L (Large Generator Interconnection Process) and Attachment N (Small Generator Interconnection Process) of the BPA OATT. The Generator Interconnection projects listed in this T-Plan include projects over 20 MW (Large Generator Projects) which have an executed Large Generator Interconnection Agreement (LGIA) or construction agreement.

Line and Load Interconnection Service Requests

Qualified customers may request new points of interconnection on BPA's transmission system. These Line or Load Interconnections (LLI) are typically for new load service or to allow the Customer to build or shift the delivery of service to different points on their system. This service is requested according to BPA's Line and Load Interconnection Procedures Business Practice. Similar to the generator interconnection projects, only larger projects which have an executed interconnection or construction agreement are included in this T-Plan. The LLI interconnection process is very similar to the generation interconnection process. Please refer to the generation interconnection process chart in the Appendix for further information.

Planning Criteria

BPA operates under NERC's mandatory and enforceable reliability standards. BPA must adhere to these mandatory standards when planning, operating, and maintaining its transmission system. Specifically, NERC's Standard TPL-001-4 which is referred to as the Transmission System Planning Performance Requirements is applicable to Transmission Planning. The purpose of the TPL standard is to establish transmission system planning performance requirements within the planning horizon to develop a bulk electric system that will operate reliably over a broad spectrum of system conditions and following a wide range of probable contingencies.

BPA established a comprehensive reliability program. The purpose of BPA's Reliability Criteria for System Planning is to provide guidance to supplement the NERC Transmission Planning Performance Requirements. The BPA Reliability Criteria for System Planning also provides a guideline for making assumptions when planning the transmission system and where sensitivity studies are specified within the NERC planning standards. These criteria are intended to provide firm guidance but not absolute standards for transmission planning.

BPA is also required to apply the WECC system performance criteria where applicable to plan the transmission system and meet mandatory compliance. The System Performance Regional Criterion adopted by the WECC establishes criteria for impacts that disturbances in one Transmission Planner's system can have on other systems external to that Transmission Planner's area.

The design of BPA's transmission system is intended to meet the reliability performance requirements of all NERC, WECC and BPA standards and criteria.

Factors Affecting the Long-Term Transmission Plan

Factors that affect long-term transmission planning include:

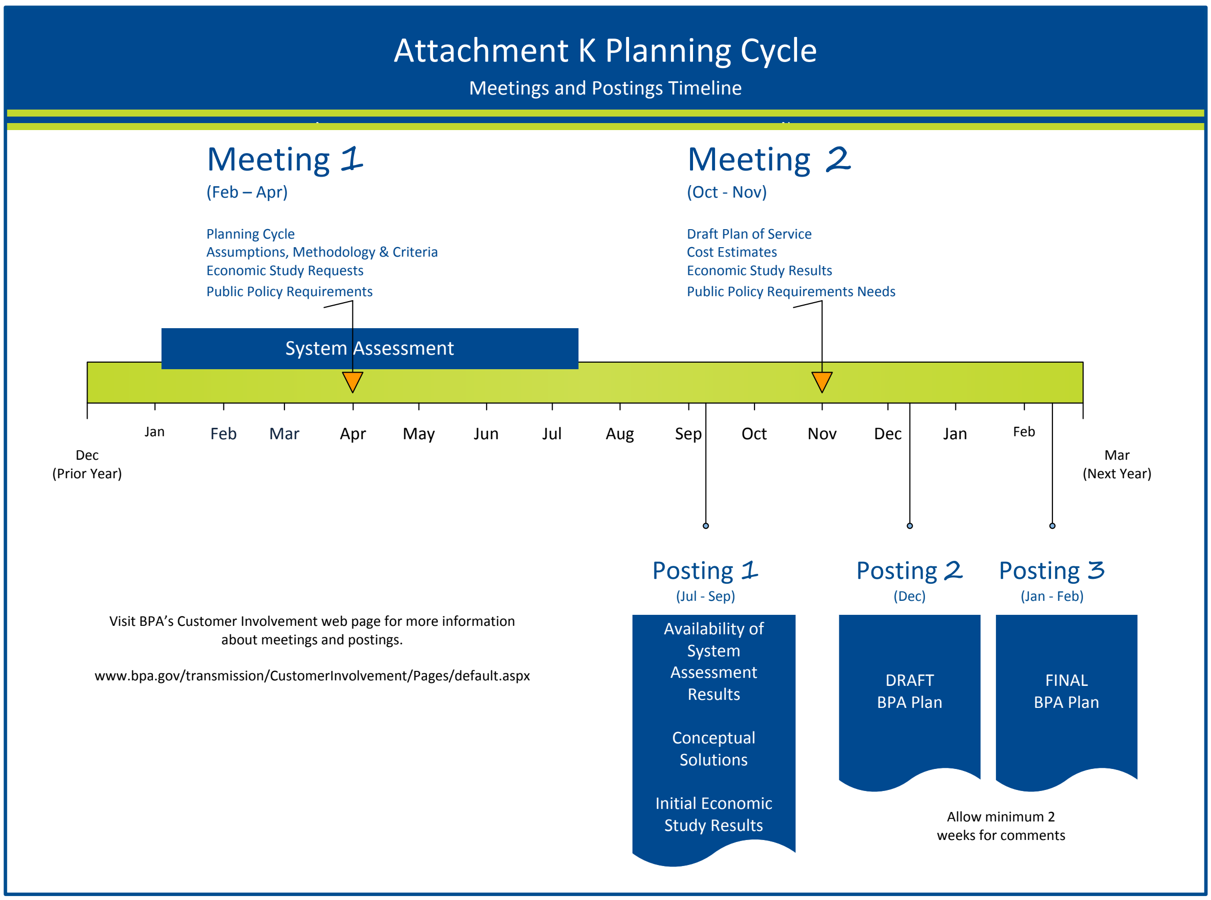
- Changes in reliability requirements
- Changes in load forecast
- Impact of non-wires solutions
- Impacts from energy efficiency and Renewable Portfolio Standards programs
- Other state and national policy programs
- New or retired generation and transmission
- FERC Order 1000

The studies that support this T-Plan reflect current assumptions regarding these factors. Therefore, the plan needs to be updated periodically to capture, among other factors, updated assumptions. BPA's non-wires solutions can result in the deferral of transmission investments.

Attachment K Public Meetings and Postings Timeline

Transmission Services conducts system planning meetings in accordance with Attachment K of the BPA Open Access Transmission Tariff (OATT). These meetings provide customers and interested parties the opportunity to discuss and provide input to the studies and development of the plans of service.

BPA provides information about the Transmission Services Attachment K process including notifications of meetings, results of planning studies, plans of service and other reference information on its web site. To request participation in the Planning Process, complete and email the Participation Request form.



Economic Study Requests

As part of BPA's Attachment K Planning process economic studies may be requested by customers to address congestion issues or the integration of new resources and loads. Each year BPA will complete up to two economic studies per year at its expense. A customer may make a request for an economic study by submitting a request to PlanningEconomicStudyRequest@bpa.gov. A request may be submitted at any time. A request submitted after October 31 will be considered in the next prioritization process. There were no economic study requests received during the study cycle which closed on October 31, 2015.

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Non-Wires Assessment

BPA Requirement to Explore Non-Wires Alternatives

Transmission Planning along with the BPA Agency Team explores possible non-wires alternatives that include demand response, energy efficiency, and generation re-dispatch as possible alternatives to constructing or delaying the construction of transmission projects. Transmission Planning conducts the non-wires assessment as part of its annual System Assessment. In the non-wires analysis load forecast are reviewed, appropriate alternatives are selected, and the alternatives are tested and their performance compared to the transmission construction alternative.

2015 Non-Wires Assessment by Load Service Area

In Transmission Planning, as part of the Load Service Area Assessment, study engineers include a qualitative analysis of potential non-wires alternatives as part of the area assessment report. All of the area assessment reports include a description of the potential for non-wires measures to slow or flatten the load growth in the area. For areas where corrective action plans are identified within the near or longer-term planning horizon, the assessment report includes a discussion of the potential for non-wires alternatives to mitigate the upcoming problem, or defer the need date for a correction action plan to comply with NERC Standards.

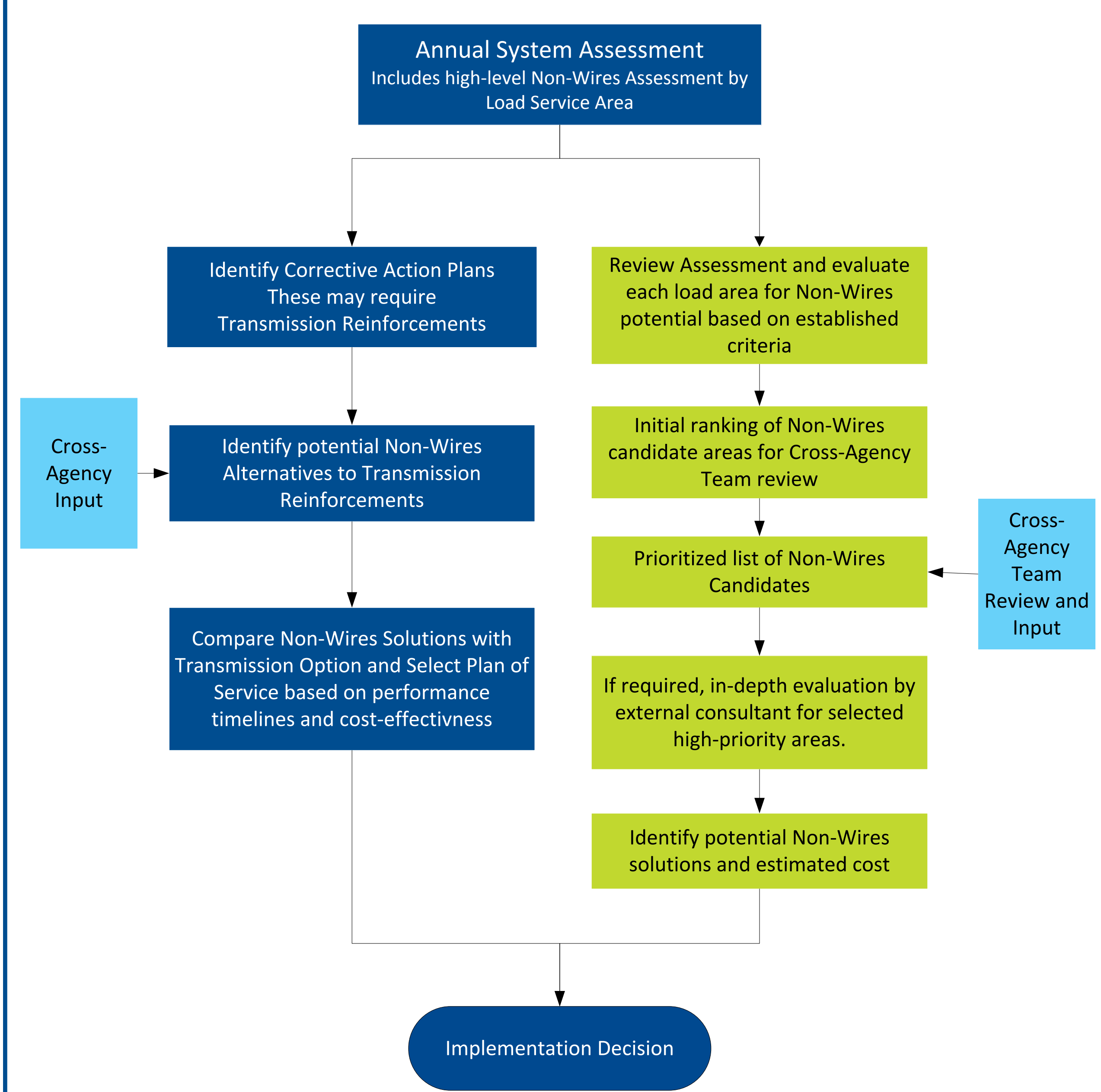
Some of the potential non-wires measures include the following approaches. Consider how much load reduction would be needed per year to keep the rate of growth flat and how many megawatts the peak load would need to be reduced per year in order to defer the need for the reinforcements. Customer Service Engineering and/or an account executive could provide insight into how willing a potential customer may be to participate in energy efficiency or a demand reduction program. Evaluating if there are opportunities of individual large sources of load where energy efficiency or load shifting could make a difference by working with just one or two customers.

If non-wires measures will not assist in deferring or mitigating a correction action plan, the report will explain why. Particular examples include light load is the critical condition, the identified project is already part of the sustain program, the need date does not provide sufficient lead time to implement non-wires because it’s two years or less.

The summary table provided in the Appendix shows potential projects by area, potential needs, lead time for projects, magnitude of load area peak, amount of load reduction needed, number of projects, cost of the projects, joints projects planned, number of customers and more.

Transmission Planning

Non-Wires Planning Process



Reliabilty Planning & System Assessment

The BPA transmission planning process, known as the System Assessment, is a comprehensive assessment of BPA's transmission system to ensure compliance with applicable North America Electric Reliability (NERC) Planning Standards and Western Electricity Coordinating Council (WECC) Regional Criterion. WECC is the Regional Reliability Organization for NERC. The NERC Standards TPL-001-4 require that BPA conduct an annual assessment to ensure that the BPA network is planned such that it can supply projected customer demand and projected firm transmission services over the expected range of forecast system demands. The assessment is conducted over a 10-year planning horizon.

Over the past several years, NERC has been revising the standards with the objective of making requirements clear and measurable. In many cases new requirements have been identified and some criteria are more stringent leading to new investments. In addition, new TPL standards will be in effect next year and the 2016 System Assessment will address and reflect those changes.

How this Section is Organized

This section discusses the following topics associated with Transmission Planning's System Assessment.

1. Provides an overview of Transmission Planning's System Assessment.

2. Provides information about the System Assessment process.

3. Provides information about Technical Studies and Detailed Reports.

4. Provides the System Assessment assumptions and methodology.

5. Provides a brief explanation of the System Assessment Summary Report.

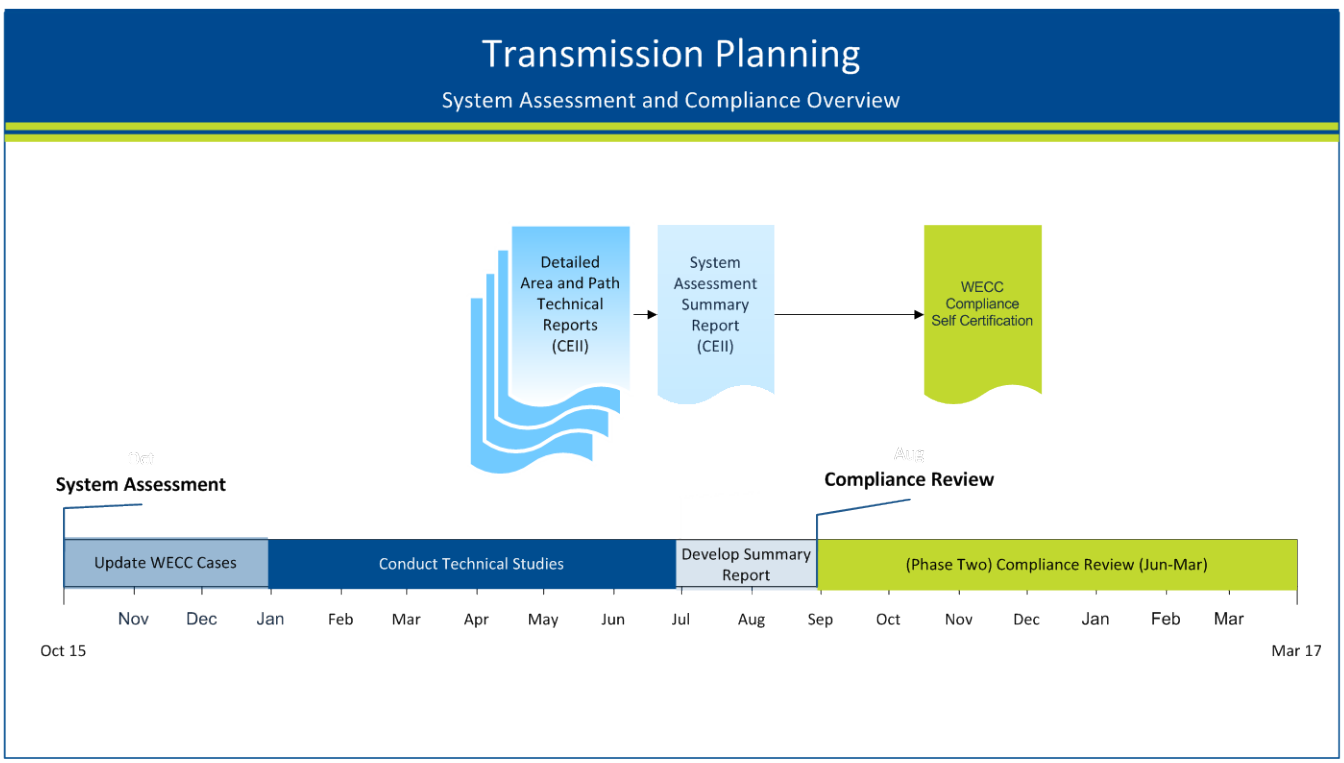
6. Provides brief information about WECC compliance.

System Assessment and Compliance Overview

The diagram below shows a high-level view of the System Assessment and Compliance Overview processes and timelines. The System Assessment can be thought of as in two major parts. The System Assessment where the WECC cases are updated, technical studies are performed and reports are prepared. This occurs in the first half of the year. Then, in the Fall, WECC compliance begins, which includes self-certification and in some years a WECC audit.

The System Assessment begins in mid-October each year and runs through to the end of August. During this time, the WECC cases are updated. From January through June, Transmission Planning prepares the technical studies for the load and transfer areas. These technical studies are documentation and evidence of Transmission Planning completing a system assessment. From July through August the System Assessment Summary Report is compiled using the information contained in the technical studies. This Summary Report is the documentation that Transmission Planning provides to the BPA Compliance Office.

In the fall, WECC compliance review begins, which includes annual self-certification and a WECC audit every three years. The WECC compliance process begins at the end of August when Transmission Planning submits compliance documentation.



System Assessment Process

In Transmission Planning's System Assessment process, data collection, modeling, and assessments are performed. Transmission Planning develops comprehensive computer models to test the adequacy of the transmission system under a wide variety of future system conditions. Transmission Planning uses the output of the modeling to gauge the performance of the transmission system. The results are compared to standards adopted by NERC and WECC. It's essentially all the work that occurs in order to develop detailed technical studies that will eventually result in identifying new transmission projects. The effort that Transmission Planning makes in preparing the technical studies is considerable. Once the load and transfer area detailed technical studies are completed, those technical studies are used to develop the Summary Report, and the Summary Report is used as the basis for compliance documentation.

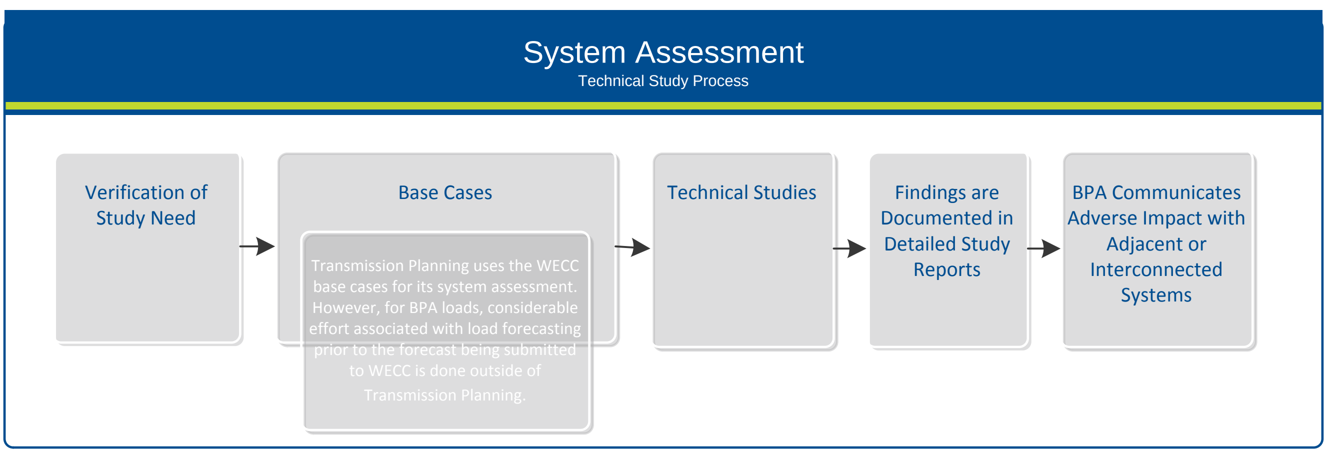
A detailed graphic of the system assessment is provided in the Appendix. What is not shown in this picture above is that once the System Assessment part is completed, Transmission Planning develops a potential project list. Typically in about October, the newly identified transmission needs are incorporated into the Transmission Needs section of this T-Plan.

Technical Studies and Detailed Reports

Below is an explanation as to the work that is performed during the technical studies aspect of the System Assessment.

Verification of Study Need

A determination is made as to whether a current study qualifies or if a new study is needed for a load area or path. If a new study is required, the result of the assessment process will be a new study report dated for the current year's assessment. If it is determined that a previous study is a qualified past study, the process will result in a verification report documenting the verification checks that support the conclusion that a new study is not required, and reference to the previous study report. At a minimum, a good validation of the load forecast used in studies for each load area should be done annually to verify the timing of corrective action plans.



Basecases

Transmission Planning's assessment includes the creation of a new set of study base cases every two years starting with WECC approved base cases from the latest WECC Study Program. Additional base cases are created as necessary to cover conditions that may need to be studied. For the year that new cases are not developed, the previous year's cases are updated for any study needs identified. If there is not an appropriate WECC approved base case in the latest WECC Study Program, the latest WECC approved base case from the previous WECC Study Program or from the previous year's assessment, whichever is later, are modified for the corresponding year and season.

For background, WECC provides its members with approved base cases that are used for system assessments. A WECC base case is a computer model of the transmission network including loads, resources and topology. WECC has a process that calls for the submission of load and topology forecasts from investor-owned utilities for the development of the WECC base cases. All registered members of the interconnected WECC system are required to submit this data.

Transmission Planning uses the WECC base cases for its system assessment. However, for BPA loads, considerable effort associated with load forecasting prior to the forecast being submitted to WECC is done outside of Transmission Planning. Transmission Planning coordinates with BPA's Load Forecasting and Analysis, Power Services, and the Transmission Planning and Grid Modeling groups to ensure the forecast is adequate. Additionally, after WECC releases a base case, there may be a lag in the data. For example, if a new generation plant or a new load comes online that was not captured in the forecasts, Transmission Planning updates the forecast as needed. Transmission Planning works directly with investor-owned utilities and the BPA Load Forecasting and Analysis Group to update the forecast. Any necessary load or resource adjustments are made to the forecast based upon the latest information available at the time studies are done.

The base cases use load forecasts from BPA's Load Forecasting and Analysis group which is the same initial load forecast used by Power Services for the Resource Program. Each cycle, BPA incorporates any long-term firm (LTF) Transmission Service contracts that it has completed since the previous cycle. Load forecasts used in all planning cases comes from the same source and are based on the same assumptions. The loads only change to reflect the timeframe being studied.

Technical Studies

A. Base case Review and Modification

The base cases are reviewed in more detail and then modified based on individual load areas and transfer areas as follows.

- Stressing paths to appropriate limits for the area of study,
- Verifying generation patterns that affect the area of study,
- Verifying load forecast based on expected conditions and historical data for the load area,
- Verify system additions and/or modifications in the area of study,
- Verify generation additions or changes in the area of study.

B. Studies

The study process ensures all load areas and paths are evaluated to meet all applicable NERC Planning Standards and WECC Criterion. The study process also includes establishment and annual maintenance for standardizing tools, parameters, and assumptions, and continuing improvement of the process.

Short circuit analysis is conducted in BPA's High Voltage group on an annual basis. Transmission Planning provides assumptions to the High Voltage group of projects to include in the analysis for the next five years. Results of the short circuit analysis and any corrective action plans that result from that study (such as circuit breaker replacements) are included in the System Assessment

Below is a list of the different types of analysis Transmission Planning performs in the System Assessment:

- Steady State (Power Flow) Contingency Analysis
  (post-transient and post-AGC when appropriate)
- Voltage Stability Analysis (PV and QV studies)
- Transient Stability Analysis
- Short Circuit Analysis

C. Corrective Action Plans

The study process includes the development of corrective action plans as required. These plans consider non-wire solutions, remedial action schemes, or system additions/upgrades. The corrective action plans are studied to ensure they provide adequate system performance. If there are multiple alternatives, the best overall plan is recommended. If a non-wires solution is feasible to either correct a problem or delay a reported corrective action plan, a potential non-wires plan and the impact of the non-wires solution are documented in the detailed area or path report for further evaluation.

Technical Study Findings are Documented in Detailed Study Reports

After the study process is complete the findings are documented in detailed study reports. In the event that a previous year's detailed report is still valid, a validation report will be completed. This type of report includes the verification checks that support the conclusion that a new study is not required, and reference to the previous study report.

BPA Communicates Adverse Impact with Adjacent or Interconnected Systems

After the technical studies are completed and detailed reports are finalized, each area and path planner identifies the Transmission Planners (TPs) and Planning Coordinators (PCs) to communicate the assessment results with. These are generally the TPs and PCs which are adjacent to or interconnected with the particular study area or path. If those TPs and PCs have systems adjacent to several BPA areas or paths, the respective planners for those areas and paths coordinate with regards to communicating the assessment results (e.g. sharing a single report or multiple reports, having a joint meeting with affected utilities, or several individual meetings, etc.).

For those adjacent TPs where BPA's assessment results show there is no adverse impact to the adjacent system, it is sufficient to share that information with the adjacent TP and request their confirmation that they share the same conclusion and document this correspondence.

For those TPs and PCs where the assessment results show BPA has an impact on the adjacent system or the adjacent utility has an adverse impact on BPA's system, each area/path planner needs to resolve the issues with the adjacent TP and/or PC and document all communication and resolution. This can include face-to-face meetings and providing more detailed supporting documentation to the other utility in addition to the initial assessment results.

System Assessment Assumptions

The major assumptions that form the basis of the system assessment studies are load, generation, internal and external path flows, and transmission system topology. These assumptions are represented by the WECC approved base cases which are used as the starting point for the assessment studies.

In addition, as part of base case development of the system assessment, base case assumptions for loads and resources are verified based on historical data and against the BPA White Book to ensure federal and regional load and resource obligations are captured. Each year, BPA Power Services publishes the *Pacific Northwest Loads and Resources Study* (White Book) which covers both federal and regional load and resource obligations. In addition, base case assumptions are coordinated with BPA Power Services to identify whether any other generation patterns need to be captured in the studies, and to capture any significant long-term resource outages from the Outage Resource Forecast.

To cover the planning horizon and the critical system conditions as required by the NERC Reliability Standards, BPA developed base cases for the Near-Term Planning Horizon which represents:

a) Winter and summer peak load conditions for year two of the planning horizon
b) Winter and summer peak load conditions for year five of the planning horizon
who Spring off-peak load conditions for year two of the planning horizon

BPA also developed base cases for the long-term planning horizon which represents: winter and summer peak load conditions for year nine of the planning horizon. This particular year was selected because it was the most current WECC approved base case representing the long-term planning horizon and therefore had the most updated loads, resource, and topology information with which to begin the assessment.

Base Cases

Base case assumptions for loads and resources are verified based on historical data and against the White Book to ensure federal and regional load and resource obligations are captured. Base case assumptions are also coordinated with BPA Power Services to identify whether any other generation patterns need to be captured in the studies, and to capture any significant long-term resource outages from the Outage Resource Forecast. For the 2015 System Assessment, BPA used the following WECC approved base cases as shown below.

Year	Season	Load Level	Notes
2017	Spring	Off-Peak	Approximately 65% of spring peak loads and high hydro generation to reflect spring runoff scenario
2017	Winter	Peak	Near term (2-year) expected winter peak
2017	Summer	Peak	Near term (2-year) expected summer peak
2020	Winter	Peak	Near term (5 year) expected winter peak
2020	Summer	Peak	Near term (5 year) expected summer peak
2024	Winter	Peak	Long-term (6-10 year) expected winter peak
2024	Summer	Peak	Long term (6-10 year) expected summer peak

Loads and Transfers

Transmission Planning coordinates with Power Services with regard to loads and transfers to ensure that what is modeled is adequate to meet Power Service's needs.

As required by the NERC Planning Standards, the transmission system is planned for expected load conditions over the range of forecast system demands. Normal summer and winter peak loads are based on a 50% probability of exceedance. Off-peak spring loads reflect a condition of approximately 65% of spring peak. Historical load levels for peak and off-peak load conditions are also examined to make sure the loads represented in the base cases are reasonable.

Also as required by the NERC Planning Standards, the transmission system is planned to meet projected firm transmission services over the range of forecast system demands. At a minimum, projected firm transmission services are modeled for the load area studies. In addition, the transfer areas are studied up to their transfer limits or at a minimum to the firm transmission obligations.

Resources

Transmission Planning coordinates with Power Services with regard to BPA's Federal Resources to ensure that what is modeled with respect to our generation patterns is adequate to meet Power Service's needs.

At a minimum, the base cases model resources with assumed firm transmission service. Beyond that, other resources are modeled as needed to meet projected customer demands (load) and projected firm transmission service. The amount of northwest internal generating resources are not able to meet the long term winter peak loads. Therefore, northwest utilities rely on seasonal diversity in resource needs with other regions to meet winter peak loads.

There is over 7000 MW of wind generation interconnected throughout the northwest. This is reflected in the WECC base case models. However, peak load reference cases used for the load area assessments typically assume minimal wind generation on-line. This assumption is made because of the intermittent nature of wind resources. This is consistent with historical data which shows that the output of wind generators has no definite correlation with load levels and is often quite low during peak load periods, which creates more limiting conditions for the load areas. For transmission paths which are affected by wind generation, wind sensitivity studies are conducted to assess the impact.

Topology and Future Projects

The transmission system topology is reviewed and updated with the latest information for the near term (one to five years out) and long term (six to ten years out) planning horizons. Since adding conceptual projects to the assessment could mask future system problems, most future proposed projects are not included in the near term base cases. The only future projects that are generally included in the near term cases are those where BPA or the sponsoring companies have made firm commitments to build the project within the next five years. These are typically projects that are currently under construction or, at a minimum, that have budget approval. In the longer term base cases, a limited number of future projects are modeled which may not have budget approval, but are considered likely to proceed. By including projects that utilities are actively pursuing, the next level of reinforcement needs can be identified and prioritized.

Remedial Action Schemes

At the transfer levels modeled in the base cases, remedial action schemes (RAS) may be used to ensure reliable operation of the transmission system. Some of these RAS schemes will trip or ramp generation or load for specific contingencies. For the system assessment, RAS was modeled as appropriate based on the specific contingencies and system transfer levels that were modeled.

Transmission Facility Ratings

All BPA transmission facility ratings included in the system assessment are based on the latest information available in the Transmission System Electrical Data and Transformer Loading Guides. Ratings for non-BPA facilities are determined by the owner of the facility. By the WECC System Performance Regional Criterion (which supplements the NERC Standards), requirement WR2 states:

> *Individual systems or a group of systems may apply requirements that differ from specific requirements in Table W-1 for internal impacts. If the individual requirements are less stringent, other systems are permitted to have the same impact on that part of the individual system for the same category of disturbance. If these requirements are more stringent, these requirements may not be imposed on other systems. This does not relieve the system or group of systems from WECC requirements for impacts on other systems.*

Therefore, if another utility applies ratings other than equipment nameplate ratings for their facilities (such as emergency limits for a transformer), then BPA is permitted to apply the same limits when meeting performance standards.

Reliability Standards and Criteria

The BPA transmission system is planned to meet applicable NERC Transmission Planning System Performance Standards TPL-001-4. System tests and the required performance for those tests are established in the NERC Transmission System Planning Performance (TPL) Standards. To meet the required performance for system normal and contingency events, BPA plans the transmission system consistent with the planning events and required performance established. These include the following planning events based on the TPL standards:

- Category A – No contingencies
- Category B – Event resulting in the loss of a single element
- Category C – Event resulting in the loss of two or more elements
- Category D – Extreme Events

In addition to the NERC Planning Standards, BPA also applies the WECC System Performance Regional Criterion, TPL-001-WECC-CRT-2.1, where applicable.

Note: At the time of writing this T-Plan, the existing NERC TPL standards were consolidated and updated by NERC under TPL-001-4. However the requirements will be phased-in over a period of time. Requirements R1 and R7 became effective January 2015. The remainder of the requirements (R2, R3, R4, R5, R6, and R8) will become effective January 2016. Corrective action plans for select Planning Events can include Non-Consequential Load Loss and curtailment of Firm Transmission Service until January 2021 as documented in the NERC TPL-001-4 standard. Those modified TPL standards were applied during the 2015 System Assessment.

System Assessment Methodology

Once the transmission system is divided into load service areas and transfer areas, each area is then studied under the limiting system conditions for that area. Each area is evaluated in order to identify any potential performance deficiencies and determine possible corrective action plans or confirm existing corrective action plans to meet applicable standards and criteria and ensure system reliability and cost-effectiveness. For each load and transfer area, studies are conducted to ensure that existing and forecast load and projected firm transmission service can be served throughout the planning horizon and that existing corrective action plans, such as system reinforcements, are adequate. The studies conducted for each load and transfer area include steady state, voltage stability, and transient stability studies. And a short circuit analysis is conducted annually as part of BPA's Switchgear Replacement Program. Provided below is a general description of these items.

Steady State

The steady state timeframe is considered to be the period of time, generally greater than 30 minutes after a disturbance occurs, after all transients have settled out. For acceptable steady state system performance, equipment loadings must be within their ratings and voltages must be within applicable limits.

Voltage Stability

Voltage instability is a system state in which an increase in load, a disturbance, or a system change causes voltage to decay quickly or drift downward, and automatic and manual system controls are unable to halt the decay. Voltage stability is assessed in the post-transient timeframe. This is the interval from one to several minutes following a disturbance after the transient response settles down. Voltage decay may take anywhere from a few seconds to tens of minutes. Unabated voltage decay can result in angular instability or voltage collapse depending on where it occurs. For voltage stability analysis, each bus on the transmission system is expected to maintain adequate reactive power margin in accordance with the WECC System Performance Regional Criterion. Voltage stability is required with the area modeled at a minimum of 105% of the reference load or transfer level for system normal conditions (Category A) and for single contingencies (Category B). For multiple contingencies (Category C), voltage stability is required with the area modeled at a minimum of 102.5% of the reference load or transfer level.

Transient Stability

Transient stability is assessed for the timeframe from zero to ten seconds. This timeframe assesses the dynamic performance of the transmission system during and immediately after an event occurs, usually initiated by a fault on the system. System stability is driven by large angle differences between coherent clusters of generation at the sending and receiving ends of a system. For transient stability analysis, the transmission system is expected to remain stable with damped oscillations, and voltage and frequency excursions are expected to remain within applicable limits in accordance with the WECC System Performance Regional Criterion.

Short-Circuit

A short circuit analysis is conducted annually as part of BPA's Switchgear Replacement Program to determine whether circuit breakers have interrupting capability for faults they are expected to interrupt. The short circuit analysis is conducted for a five-year timeframe which covers the near-term planning horizon. In general, short circuit current is higher when more sources of current are modeled. Assumptions in the studies include modeling all grounding sources associated with busses serving load, and assuming all generation sources modeled on line. The worst case fault current through substation breakers is calculated looking at the case with all lines in service and by removing each line into the substation being studied.

System Assessment Summary Report

After the system assessment technical studies are completed, Transmission Planning develops its annual System Assessment Summary report. The report is typically under development mid-year. The purpose of this report is to document BPA's system assessment to meet the NERC Reliability Planning (TPL) Standards. The System Assessment Summary Report provides an overall summary of the system assessment and is used as evidence and supporting documentation for the annual self-certification and a potential WECC audit. WECC audits are on a three-year cycle. The information in the report is considered critical energy infrastructure information and distribution is controlled.

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Long-Term Available Transfer Capability

Overview

In 2002, Transmission Services was experiencing queue congestion on its internal transmission system and identified a need to quantify this congestion. This resulted in the development of a Long-Term Available Transfer Capability (LT ATC) methodology. The goal of the LT ATC methodology was to help BPA identify how much capacity was available for additional transmission sales across the network flowgates. Another goal was to allow Transmission Services (TS) to monitor LT ATC across these congested areas in order to inform system planning and system operations.

Transmission Services uses its LT ATC methodology as a process to identify the capacity to make available to requestors of Long Term Firm (LTF) Transmission Service on the BPA Network. BPA relies on a flow based calculation to model LTF obligations, including commitments of the Federal Columbia River Power System (FCRPS), non-Federal Designated Resources, forecast resources and Point-to-Point reservations, on the BPA Network as well as to account for assumed obligations on adjacent transmission systems in the Northwest.

Transmission Planning performs the flow based assessment of the long-term Existing Transfer Commitments (ETC), and Total Transfer Capability (TTC) values on the Network Flowgates, by season and scenario. The results are then provided to the Transmission Reservation Desk for final calculation of LT ATC and administration of BPA's transmission inventory. The LT ATC also informs the Cluster Study described in the Transmission Service section.

More recently, BPA is engaging in a Transmission Load service (TLS) project to review its Network Integration Transmission Service (NT) product and determine what level of changes, if any, are necessary to ensure the product meets the needs of BPA and its transmission customers. Transmission Planning is participating in the functional on-going cross-agency collaboration and coordination on provision of power and transmission service to NT customers. The results of the TLS project may impact the LT ATC and the Cluster Study.

Base Case Assumptions Posting

Transmission Planning provides LT ATC Base Case Assumptions on the BPA web site. This document provides the list of assumptions used to develop the base case for calculating LT ATC on BPA's internal paths. Assumptions are broken into the following four categories – load, infrastructure projects, interties, and generation. The LT ACT methodology is being reviewed by BPA. More information will be available at a later date.

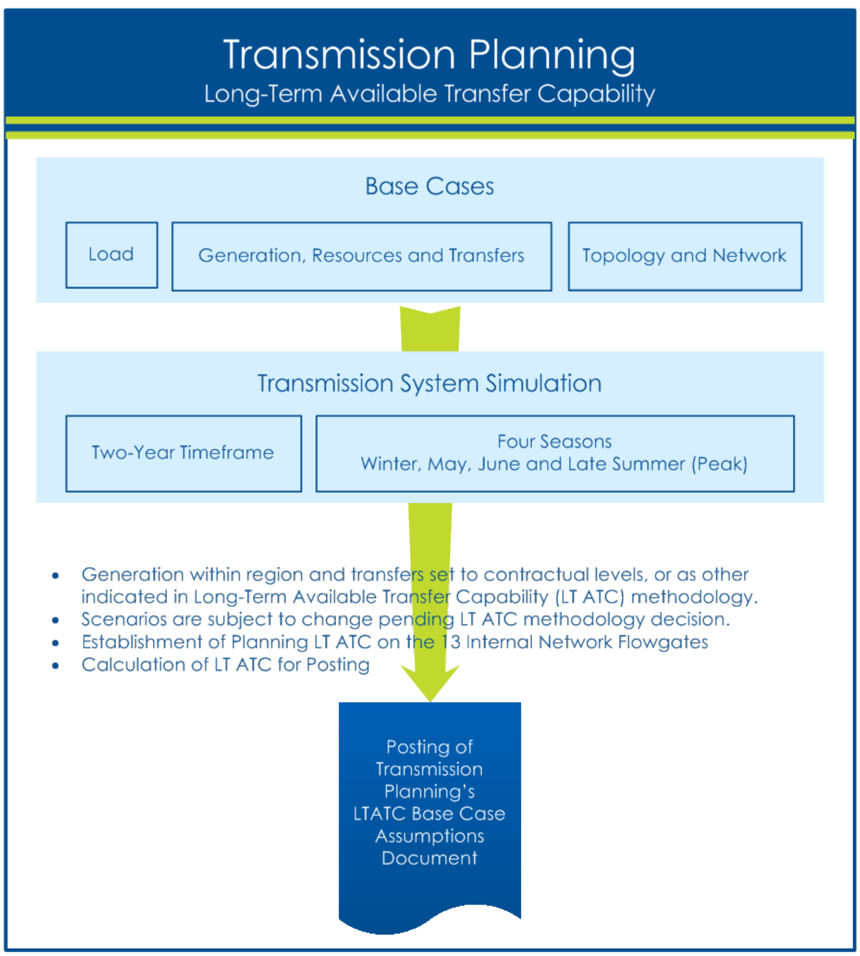
Development

The LT ATC methodology calls for the LT ATC Update to be completed annually. Transmission Planning conducts the LT ATC Update on an annual basis that typically begins in June for release in late summer or fall prior to commencement of the Cluster Study portion of the Network Open Season.

The assessment is performed on a two year look-ahead basis. For example, for its LT ATC Update to be completed in 2016, BPA will consider loads, topology, and resources, including commitments of the FCRPS developed through coordination with Power Services, non-Federal Designated Network Resources, forecast resources, and PTP reservations, expected to be in place for the calendar year of 2018.

The origin of the LT ATC base case comes from the System Reliability Planning and System Assessment base case. The cases are reviewed and modified to reflect planned projects. The LT ATC Update uses load forecasts similar to those used in the Reliability Planning and System Assessment. The base cases use load forecasts from BPA's Load Forecasting and Analysis group which is the same initial load forecast used by Power Services for the Resource Program. The load forecasts are updated with the most up-to-date load forecast data available from utilities. Each cycle, BPA incorporates any LTF Transmission Service contracts that it has completed since the previous cycle.

The diagram below shows a high-level process of Transmission Planning's LT ATC.



Transmission Service Requests

Transmission Planning conducts the Cluster Study analysis of Transmission Service Requests (TSR) and determines the transmission reinforcement requirements to accommodate the transmission service. The purpose of the Cluster Study is to determine how much available transfer capability can be offered and which new facilities, if any, will be required to accommodate customer requests for transmission service.

Transmission Planning conducts the Cluster Study analysis as part of BPA's Network Open Season (NOS) process. NOS exists to manage and respond to requests for long-term firm transmission requests on the BPA network. BPA conducts NOS to contractually and financially secure a long-term firm commitment from customers with eligible transmission service requests to purchase long-term firm transmission service. To initiate the NOS process BPA offers a Precedent Transmission Service Agreement (Agreement) to all customers with a network TSR in the OASIS queue. A brief summary of historical information about the NOS process is provided in the Appendix. More detailed information is available on BPA's web site at www.bpa.gov.

Cluster Study

A Cluster Study simultaneously evaluates, by aggregating multiple TSRs into a cluster, all customer requests for long-term firm transmission service and evaluates total demand across its network paths. The study is performed to assess if transmission system expansion is required to accommodate customers' request for service.

There are four aspects that are addressed:

- Determination of which requests can be accommodated by the existing system; the Cluster Study relies extensively upon the output of the LT ATC Update to complete this determination.
- Determination of which requests the existing transmission system cannot accommodate and require system reinforcement
- Development of plans of service for requests that require system reinforcement
- Demonstration that the transmission system can accommodate the requests for service following completion of the identified reinforcements.

Cluster Study Report

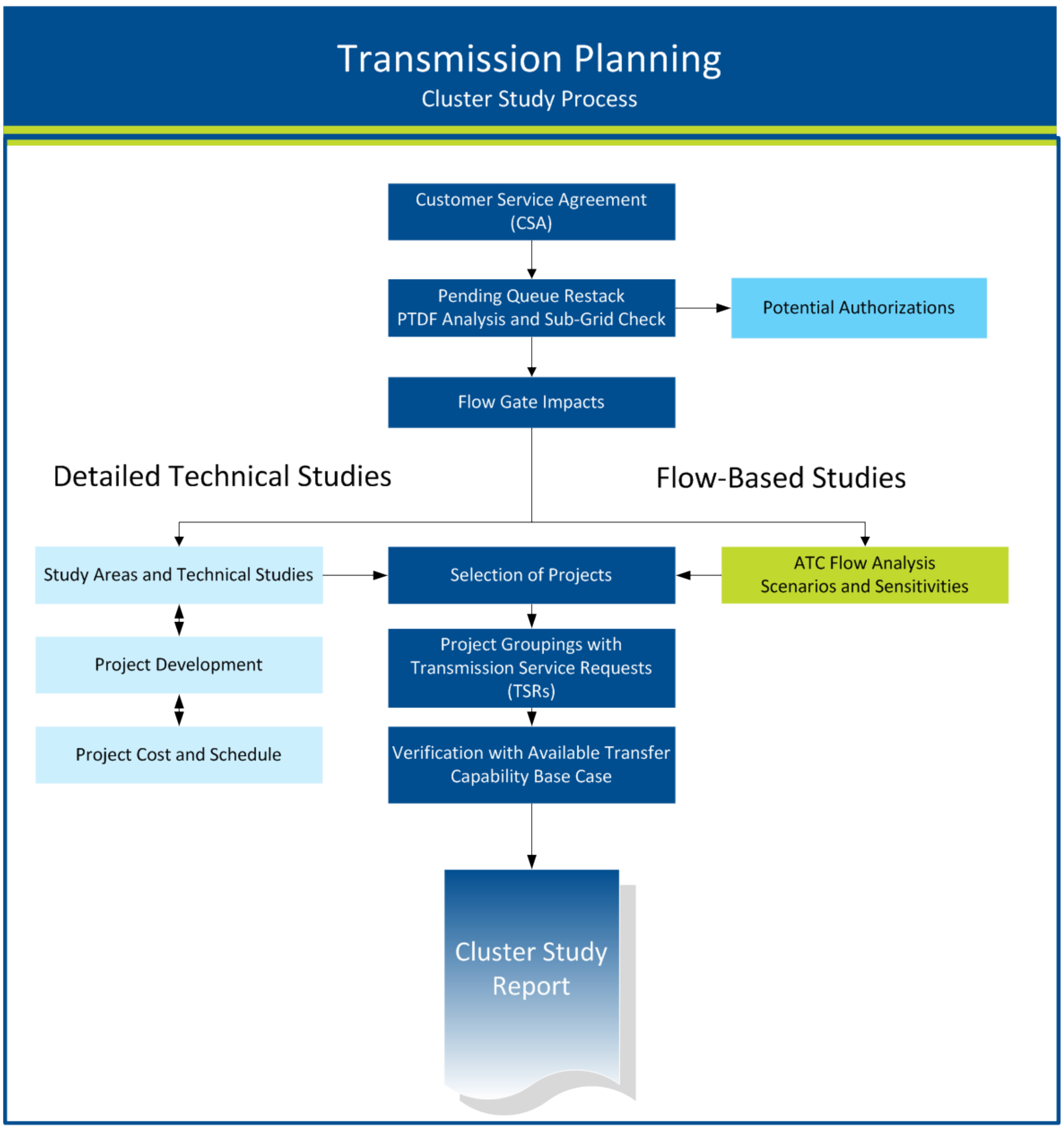
The Cluster Study report summarizes the findings of the analysis and power flow modeling that is conducted and includes a list of projects. It also provides information about the methodology employed for the current Cluster Study, including study areas, generation scenarios, and generation sensitivities. It may also provide background on projects completed outside NOS and projects from the previous NOS, and other reliability or load service projects.

Process

The diagram below depicts the current Cluster Study process from Transmission Planning's perspective. It is provided for informational purposes only. BPA customers who request transmission service may do so during a limited-time submission window (a.k.a. open season). After the request for transmission service window closes, agreements are offered to all eligible customers who made a TSR. This agreement obligates the customer to pay for its pro-rata share of the Cluster Study costs.

The transmission queue is first restacked by removing TSRs for which customers failed to return an executed agreement including sufficient data exhibits. The remaining TSRs are evaluated to see if existing LT ATC (as informed by the LT ATC Update) can accommodate any potential offers of service. TSRs with cumulative material impacts that exceed the LT ATC for any impacted flow gate are included in the Cluster Study. BPA then determines if it is able to make offers of service based on existing LT ATC to any of the TSRs that remain in the queue.

Transmission Planning performs a Cluster Study to determine additional facilities, if any, required to accommodate service to TSRs for which there is insufficient LT ATC. Transmission Planning proceeds with detailed technical studies and flow-based studies. Based on the study's results, potential projects are identified.



Methodology

ATC and Sub-Grid Assessment

Transmission Planning performs two assessments for each TSR, paired with a sub-grid check, to determine which TSRs can be served by the existing system and which requests require system reinforcement.

The first assessment considers the pending queue for long-term firm transmission service after TSRs that elected not to sign a CSA have been removed. The remaining TSRs are evaluated to see if the released ATC, if any, can accommodate any potential offers of service. TSRs with cumulative material impacts that exceed the ATC for any impacted flow gate are identified for inclusion in the Cluster Study.

In order to further evaluate the impact of the request on the network, a second assessment is performed which considers the requested Point of Receipt (POR) and Point of Delivery (POD) on the internal network. Based on the second assessment, TSRs with impacts which can be accommodated by the existing ATC are reconsidered for possible offers of service. Based on the assessment using the requested POR and POD, TSRs with cumulative material impacts that still exceed the ATC for any impacted flow gate are identified for further analysis to determine requirements to accommodate the requested service.

In addition to the assessments described above, a sub-grid check is performed on each TSR to consider impacts on other facilities that are not part of the monitored flow gates. The sub-grid assessments rely, to the maximum extent possible, on operational experience and previous studies (such as Generation Interconnection studies) to identify where reliability concerns exist. TSRs with sub-grid impacts that exceed reliability limits require system reinforcement and are analyzed for further determination of requirements needed to accommodate the requested service.

In order for a particular TSR to qualify for service without requiring system reinforcement, a conclusion must be reached that there is system capability across all monitored network flow gates affected by the request and all sub-grid impacts are within applicable reliability limits. If Transmission Planning is unable to conclude that there is system capability across all monitored flow gates or sub-grid impacts are not within applicable reliability limits for a particular request, further study is needed to identify whether and if so, what system reinforcements may be necessary to increase the Total Transfer Capability (TTC) across all deficient flow gates (with an associated increase in ATC) and address all sub-grid reliability concerns.

Study Areas for TSRs Needing System Reinforcement

For all TSRs that require further evaluation to determine the requirements to accommodate the requested service, TSR's are combined with similar PORs (i.e., those PORs that are close enough to cause similar impacts on the transmission system). These combinations result in forming Cluster Study areas that are studied in more detail to identify whether reinforcement is needed, and if so what plans of service would accommodate the requested service.

A detailed power flow, voltage and transient stability study are performed on each of the study areas to define the actual reinforcements needed. These studies consider a combination of firm and non-firm uses of the system including load growth, interconnection projects, and projects on adjacent systems that are included to stress the system to identify expansion needs. The result is a more robust expansion plan to meet the expected, as well as requested, obligations of the system.

Assumptions

The following assumptions are typically used in the Cluster Studies.

Generation Dispatch

Hydro Generation

The Federal Columbia River Power System (FCRPS) generation is at a dispatch level based upon actual historical generation levels. This pattern is intended to better reflect how FCRPS operation meets non-power constraints and obligations. The pattern provides for the 95th percentile MW dispatch level for each of the FCRPS projects for the appropriate season; that is to say that the dispatch level in the Cluster Study would be at or above the actual dispatch for 95% of the hours for the appropriate season.

Thermal Generation

Thermal resources (gas and coal) are dispatched off according to the Thermal Merit Order Sequence to accommodate new requests for service while balancing generation with load and exports. Thermal resources were chosen because it is likely that with the availability of low cost hydro and wind resources thermal generation would be expected to dispatch off due to economic reasons. If interested in the thermal sequence, see Appendix E in the *2013 Network Open Season Cluster Study Report*. The Cluster Study Report is considered Critical Infrastructure Information and distribution of the report is limited to parties that have a need to know and have fulfilled non-disclosure requirements with BPA.

Wind Generation

BPA models all wind resources – Point to Point (PTP), Network Integration Transmission Service (NITS), and new requests – at 60% of their contracted or designated value, in the Base Scenario. The wind generation level is a variable in the Scenarios developed by BPAT.

Generation Scenarios

BPA develops generation scenarios to inform the requirements for providing firm transmission. The scenarios may change in the future. Three scenarios are analyzed – base, high wind and no wind. The base scenario establishes minimum facilities required to accommodate the requested service. The high wind and no wind scenarios provide information about additional constraints that may arise – not necessarily based upon firm uses – which may require additional reinforcements to be in place.

Generation Sensitivities

BPA develops additional generation sensitivities to help determine the requirements for providing firm transmission and to address market concerns. BPA analyzes sensitivities such as export, load growth, reduced hydro generation, and other factors. The first three sensitivities establish alternatives to the dispatch sequence. All sensitivities start from the base scenario. In the future the sensitivities may change.

Interconnection Service

BPA provides services for interconnection to BPA's transmission system. BPA customers may request interconnection to BPA's system for interconnecting new generation. BPA receives Generator Interconnection (GI) requests according to Attachment L Large Generator Interconnection Process (LGIP) and Attachment N Small Generator Interconnection Process (SGIP) of the BPA OATT. The GI projects listed in this T-Plan include large generator projects, over 20 megawatts, and have an executed Large Generator Interconnection Agreement (LGIA) or construction agreement.

Customers may also request new points of interconnection on BPA's transmission system. These Line or Load Interconnections (LLI) are typically for new load addition or to allow the customer to shift the delivery of service to different points on their system. The interconnection of lines and of loads is governed by BPA's OATT. Similar to the generator interconnection projects, only projects which have an executed interconnection or construction agreement are included in this T-Plan.

Generation Interconnection Process

When a customer makes a request for a generator interconnection, Transmission Planning conducts and supports development of three studies:

- Interconnection Feasibility Study [FES]
- Interconnection System Impact Study [ISIS]
- Interconnection Facilities Study [FAS]

The LGIP provides for these three increasingly-detailed study stages. They explore and refine a design and estimate for a plan of service that will be defined in detail in a LGIA, following NEPA review. Because BPA is a federal agency, it is required to comply with NEPA. For nearly all interconnection projects, an Environmental Review Agreement is required to establish BPA's NEPA compliance.

There are several levels of review, and the costs and implications of each review is discussed in the Scoping meeting, which is held immediately after an interconnection request is received. The customer participates in meetings that review each study report, and each subsequent study requires the customer to confirm the recommended and agreed-upon decisions arising from the previous stage.

Each study report will be followed by a review meeting, which provides opportunities for the customer and BPA representatives to meet and discuss all the aspects of the proposed interconnection and to obtain clarity on any outstanding issues.

Once the customer requests for the interconnection to proceed, a business case is developed, and a Project Requirements Diagram (PRD) and budget costs are finalized. After these steps are completed the interconnection moves into the project development stage.

Scoping Meeting

The purpose of the scoping meeting is to review the proposed project, discuss alternative interconnection options, and to discuss the interconnection process with the customer. Transmission Planning supports BPA Customer Service Engineering in this meeting. Below is a general explanation of the highlights of the process from Transmission Planning's perspective. Diagrams of the generator interconnection study and scoping processes are provided in the Appendix and are for informational purposes only.

Alternative Review Meeting

Transmission Planning conducts an Alternative Review Meeting (ARM) to determine the various feasible interconnection options from BPA's perspective. The ARM will typically identify two, but not more than three interconnection options. The intent of the ARM is to identify the agreed-upon potential Point of Interconnections (POI) for the Scoping meeting. The POIs will be set at this meeting. At the ARM, any issues that may fall outside the normal timelines specified in the OATT (e.g. complete FES in 45 days) will be discussed. The ARM is also an appropriate time to decide which studies will be performed. For example, the large generator interconnection procedure (LGIP) provides for a scenario where the FES may be bypassed and the interconnection process may proceed directly to the SIS.

Feasibility Study and Report

Transmission Planning conducts a feasibility study when a project warrants a need; however, there are work interdepencies among Transmission Planning and Customer Service. Execution of the FES Agreement is optional if BPA and the customer agree. If a FES is needed, Transmission Planning performs power flow steady state analysis, produces a sketch of the project, and determines typical costs and schedule. A feasiblity study report provides preliminary identification of any circuit breaker short circuit capability limits exceeded as a result of the interconnection; of any thermal overload or voltage limit violations resulting from the interconnection; and a non-binding estimated cost of facilities required to interconnect the large generating facility to the transmission system and to address the identified short circuit and power flow issues. The customer pays a study deposit for the FES. The FES is followed up with a FES results meeting conducted by BPA Customer Service.

System Impact Study and Report

Transmission Planning performs voltage stability and transient stability analysis, reviews fault duty studies, and produces the ISIS report. A PRD is developed and a typical cost and schedule are determined. The ISIS is based upon the results of the FES and the technical information provided by the interconnection customer in the interconnection request. The customer pays the study deposit for the ISIS. The ISIS report provides the identification of any circuit breaker short circuit capability limits exceeded as result of the interconnection; identification of any thermal overload or voltage limit violations resulting from the interconnection; identification of any instability or inadequately damped response to system disturbances resulting from the interconnection; and a description and non-binding, good-faith estimated cost of facilities required to interconnect the generating facility to the transmission system and to address the identified short circuit, instability, and power flow issues. The ISIS is followed up by a results meeting with the customer.

Facilities Study and Report

A facilities study is optional if BPA and the customer agree. If the parties agree that a FAS is needed, the customer pays the study deposit. Transmission Planning develops the PRD and develops preliminary costs and schedule. The FAS report provides a description, estimated cost, and schedule for required facilities to interconnect the generating facility to the transmission system, and addresses the short circuit, instability, and power flow issues identified in the ISIS. The FAS report is followed up with a FAS results meeting with the customer.

Project Development and Capital Investment Prioritization Process

Once NEPA clearance has been granted and the customer makes the request to proceed with the generator interconnection, Transmission Planning begins the project development and capital investment prioritization processes. Transmission Planning creates and finalizes a PRD, conducts a Project Strategy Meeting (PSM), and develops a business case. A diagram depicting the generator internconnection project development process is provided in the Appendix.

Line and Load Interconnection Process

Customers may request new points of interconnection on BPA's transmission system. Line or Load Interconnections (LLI) are typically for a new load addition or to allow the customer to shift the delivery of service to different points on their system. The interconnection of lines and of loads is governed by BPA's OATT. Similar to the generator interconnection projects, only line and load projects which have an executed interconnection or construction agreement are included in this T-Plan.

When a customer makes a request for a new line or load addition, Transmission Planning conducts and supports development of two studies:

- Interconnection System Impact Study [LLISIS]
- Interconnection Facilities Study [LLIFAS]

The LLI process provides for these two studies. They explore and refine a design and estimate for a plan of service that will be defined in detail in a LLI agreement, following NEPA review. Because BPA is a federal agency, it is required to comply with NEPA. For nearly all interconnection projects, an Environmental Review Agreement is required to establish BPA's NEPA compliance.

There are several levels of review, and the costs and implications of each review is discussed in the Scoping meeting, which is held immediately after an interconnection request is received. The customer participates in meetings that review each study report, and each subsequent study requires the customer to confirm the recommended and agreed-upon decisions arising from the previous stage.

Each study report will be followed by a review meeting, which provides opportunities for the customer and BPA representatives to meet and discuss all the aspects of the proposed interconnection and to obtain clarity on any outstanding issues.

Once the customer requests for the interconnection to proceed, a business case is developed, and a Project Requirements Diagram (PRD) and budget costs are finalized. After these steps are completed the interconnection moves into the project development stage.

Additional Information about interconnections is available on the BPA web site at

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Transmission Needs

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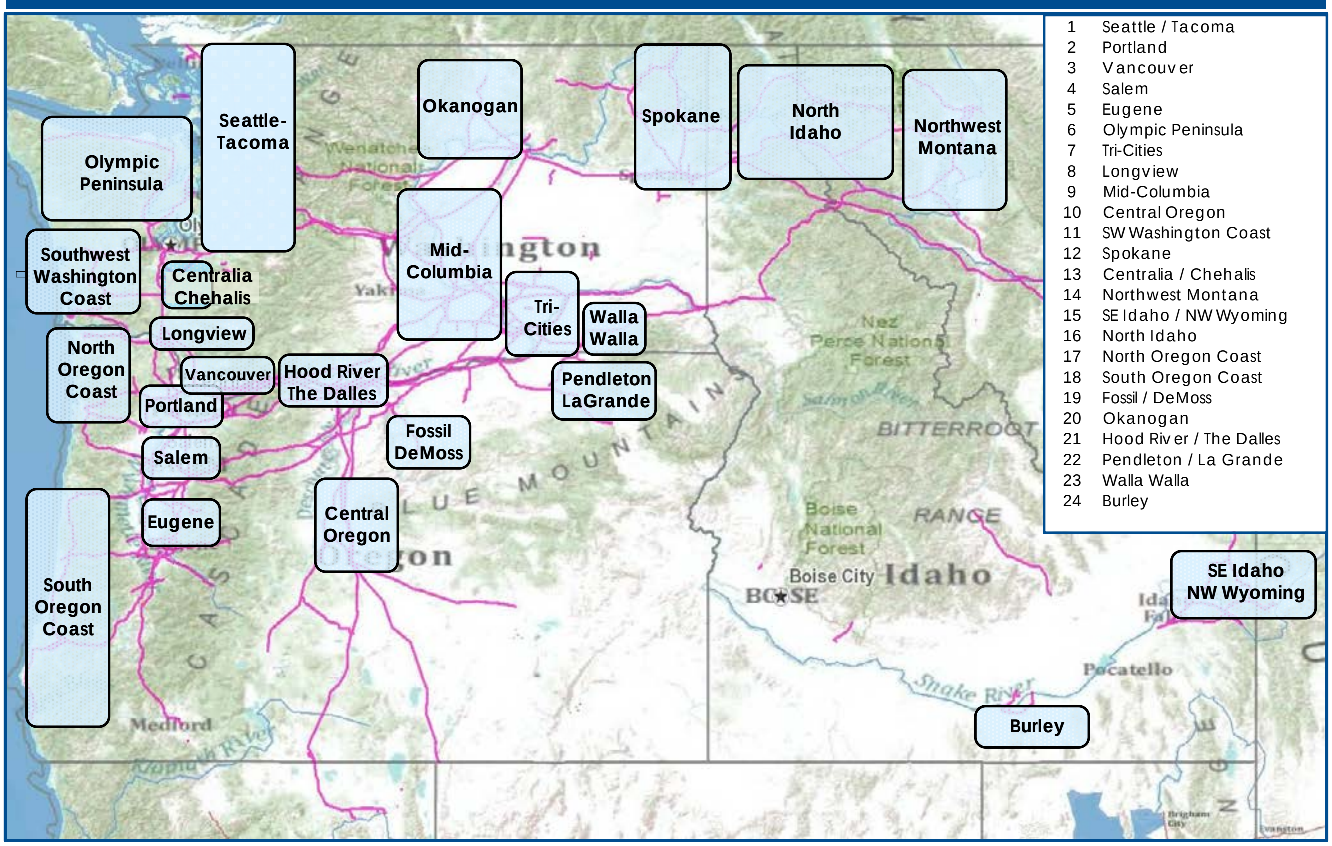
Transmission Needs

On an annual basis, Transmission Planning provides a ten-year plan for reinforcements to BPA's transmission system and is provided in accordance with Attachment K of the BPA Open Access Transmission Tariff. This section provides a narrative description of the transmission needs identified through the transmission planning process, the preferred alternative, an estimated cost, and estimated schedule for completion of the preferred alternative. It also reflects any plans for facilities needed to provide requested interconnection or long-term firm transmission service on BPA's system. The objective of this section is to identify and describe reinforcement projects for the transmission system. It contains proposed projects identified to meet the forecast requirements of BPA and other customers over the 10-year planning horizon.

BPA's service territory is divided into 24 load service areas based on electrical or geographical proximity. The load areas range from major load centers such as Seattle-Tacoma and Portland, to smaller load areas like the DeMoss/Fossil load area. The load areas are listed roughly in order from the largest to the smallest load.

Transmission Planning

Load Service Areas



How this section is organized

This section provides the proposed new facilities organized by type of project. The types of projects include the following.

1. Projects required to provide load service and meet Planning Reliability Standards,

2. Projects required to meet requests for transmission service,

3. Projects required to meet requests for Generator Interconnection service, and

4. Projects required meeting requests for Line and Load Interconnection service.

Some projects may satisfy multiple criteria; however they will only be described once.

In addition to proposed projects, this section includes a listing of Recently Completed Projects for each load area or path. This category includes projects which have been completed since the previous update to the BPA Plan and includes 2015 assessment findings.

Where applicable, there is also a category called Deferred Plans of Service. This consists of plans of service which have been mentioned in previous BPA Plans; however the present year's system assessment shows the need date has moved beyond the planning horizon. This is typically a result of reduced load growth resulting in changes to the load forecast for the particular area.

NOTES:

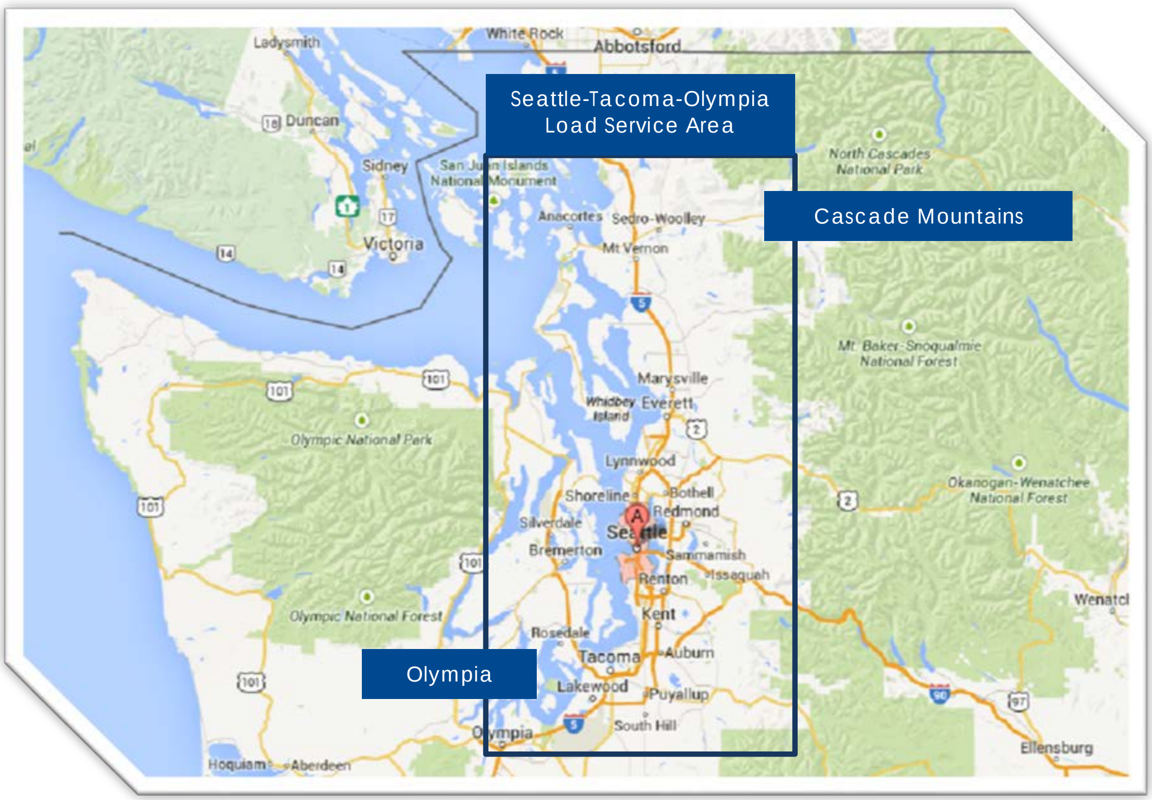
1. Estimated Project Costs are direct costs (overheads are not included).

2. Where official cost estimates have not been developed, the indicated project cost reflects the best information available, based on typical costs of similar projects.

Transmission Needs by Load Service Area

1 Seattle/Tacoma/Olympia Area

The Seattle/Tacoma/Olympia area includes a large portion of northwestern Washington. It is bordered on the north by Canada and on the south by Olympia. It is bordered on the east by the Cascade Mountains and on the west by the Puget Sound. It includes Whatcom, Skagit, Snohomish, King, Pierce, Thurston, and north Lewis counties. It includes the greater Seattle area including Bellevue and Everett. To the north, the Seattle metropolitan area includes Blaine, Bellingham, Sedro Woolley and Mount Vernon and to the south the Seattle metropolitan area includes Puyallup and Olympia.



The customers in this area include:

- Whatcom County Public Utility District (WPUD)
- Puget Sound Energy (PSE)
- Seattle City Light (SCL)
- Snohomish County Public Utility District (SPUD)
- Tacoma Power Utilities (TPU)
- Alder Mutual Light Co. (Alder)
- City of Eatonville (COE)
- City of Milton (Milton)
- City of Steilacoom (COS)
- Elmhurst Light and Power (EL&P)
- Lakeview Light and Power (LL&P)

- Ohop Mutual Light (OML)
- Parkland Light and Power (PL&P)
- Peninsula Light (PI)

The load area is served by the following major transmission paths or lines:

- From the north by the Northwest-British Columbia path (or Northern Intertie)
- From the east by the West of Cascades North path
- From the south by the Raver-Paul path
- From the west by the Satsop-Olympia 230 kV and Satsop-Paul 500 kV lines

Local Generation and Load

The Seattle/Bellingham area has over 2500 MW of local generation which consists primarily of hydro and thermal (coal and gas-fired) generators. The Tacoma/Olympia are has approximately 750 MW of local generation. The local generation includes:

Seattle/Bellingham Sub-Area	Maximum MW	Owner
PSA Generators		
Enserch	185	PSE
Fredonia	320	PSE
Sawmill (Fredonia)	33	PSE
Komo (Baker)	13	PSE
Lower Baker	85	PSE
Upper Baker	105	PSE
March Point (Texaco)	150	PSE
Ferndale	280	PSE
Sumas	140	PSE
Whitehorn	180	PSE
Diablo	170	SCL
Gorge	180	SCL
Ross	450	SCL
Jackson	120	SPUD
Other Generators		
Cedar Falls	30	SCL
Tolt River	17	PSE
Twin Falls	25	PSE
Snoqualmie Falls	54	PSE
TOTAL	2,537	

Tacoma/Olympia Sub-Area	Maximum MW	Owner
Alder	50	TPU
Frederickson, LLP (230 kV)	270	BPA/PSE
Frederickson, PSE (115 kV)	160	PSE
Cushman	145	TPU
LaGrande	69	TPU
Simpson	64	TPU
TOTAL	758	

Seattle and Tacoma Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Seattle/Tacoma/Olympia	7285	10080	7057	9768	7328	9945

Proposed Plans of Service

Tacoma 230 kV Series Bus Sectionalizing Breaker

- Description: This project adds a 230 kV series bus sectionalizing breaker at Tacoma Substation.
- Purpose: This project mitigates issues caused by a 230 kV bus sectionalizing breaker failure at Tacoma Substation.
- Estimated Cost: $800,000
- Energization: 2017

Tacoma 230 kV Bus Tie Breaker

- Description: This project adds a 230 kV bus tie breaker, and a 230 kV auxiliary bus sectionalizing disconnect switch at Tacoma Substation.
- Purpose: This project improves the operations and maintenance flexibility at Tacoma Substation.
- Estimated Cost: $1,500,000
- Energization: 2017

Silver Creek Substation Reinforcements

- Description: This project adds a 230 kV breaker to separate the east and west 230 kV busses and adds a 69 kV circuit breaker on the low side of the 230/69 kV transformer.
- Purpose: This project increases the reliability and facilitates maintenance of the station since a fault on the 230 kV bus (with the existing configuration) currently drops both 230/69 kV transformer banks.
- Estimated Cost: $4,100,000
- Energization: 2019

Paul 500 kV Shunt Reactor Addition

- Description: This project adds a shunt reactor (180 MVAR at 550 kV) at Paul Substation.
- Purpose: This project is required to maintain voltage schedules in the Puget Sound area during light load conditions.
- Estimated Cost: $9,500,000
- Energization: 2016

Raver 500/230 kV Transformer

- Description: This project adds a 1300 MVA, 500/230 kV transformer at Raver Substation. This project is part of the overall Puget Sound Area/Northern Intertie (PSANI) Regional Reinforcement Plan. This is a joint project between participating utilities in the Puget Sound area.
- Purpose: This project is required to support load growth in the Puget Sound area.
- Estimated Cost: $41,500,000
- Energization: 2016

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

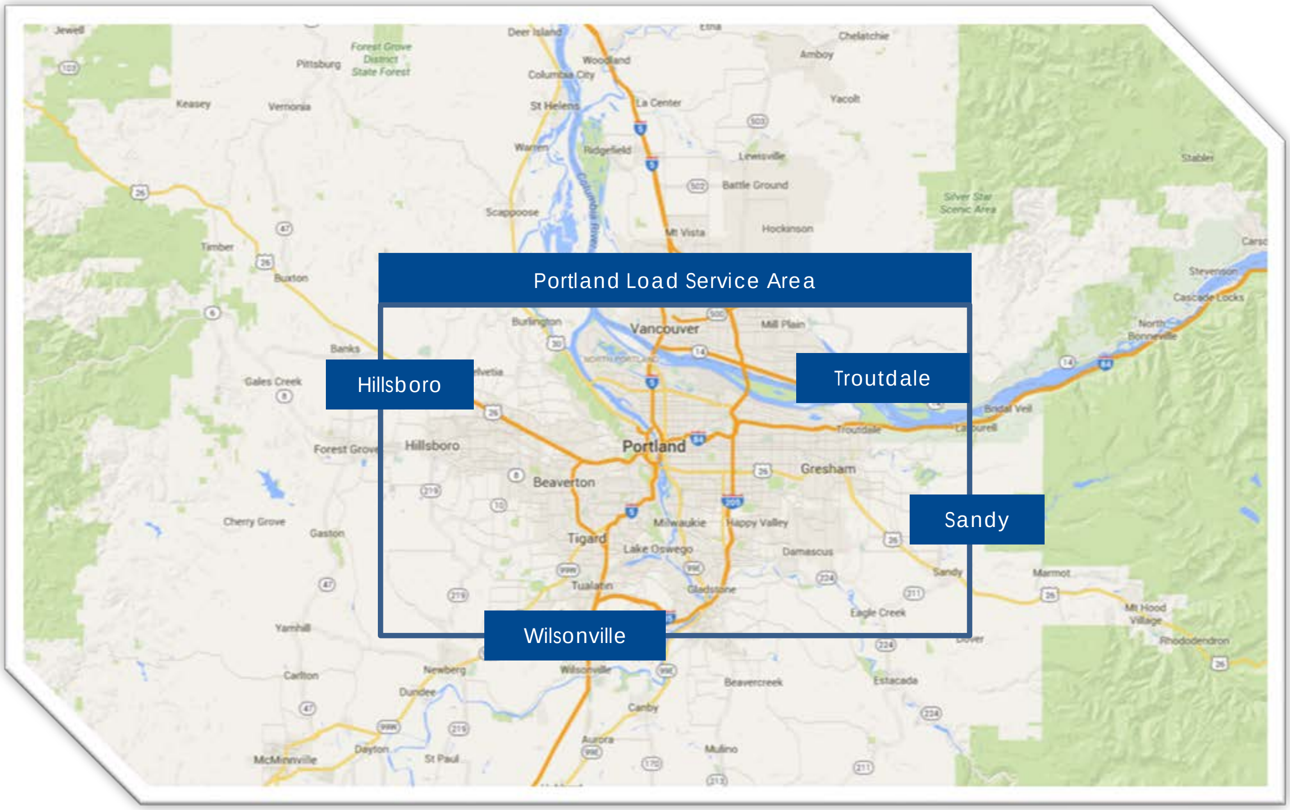
Deferred Plans of Service

Maple Valley 230 kV Series Bus Sectionalizing Breaker

- Description: This project adds a 230 kV series bus sectionalizing breaker at Maple Valley Substation.
- Purpose: This project mitigates a potential failure of the existing 230 kV bus sectionalizing breaker at Maple Valley Substation.
- Estimated Cost: $2,000,000
- Energization: Beyond the Planning Horizon

2 Portland Area

The Portland load service area includes the greater Portland metropolitan area in Oregon and the surrounding communities of Troutdale, Gresham, Sandy, Beaverton, Hillsboro, Tigard, Tualatin and Wilsonville, Oregon. This area includes Multnomah, Washington, northeast Clackamas, and south Columbia counties.



The customers in this area include:

- Portland General Electric (PGE)
- PacifiCorp (PAC)
- City of Forest Grove
- Western Oregon Electric Coop.
- Columbia River Public Utility District
- McMinnville Water and Light

The load area is served by the following major transmission paths or lines:

- From the north by the Paul-Allston path
- From the south by the Pearl-Ostrander and Pearl-Marion 500 kV lines
- From the east by the West of Cascades South path

Local Generation and Load

The Portland area has approximately 700 MW of local generation, including:

- PGE Beaver Combined Cycle (495 MW)
- PGE Bull Run Hydro #1 (21 MW)
- City of Portland Bull Run Hydro #2 (33 MW)
- PGE Faraday Hydro (33 MW)
- PGE North Folk Hydro (38 MW)
- PGE Oak Grove Hydro (50 MW)
- PGE River Mill Hydro (19 MW)
- PGE Sullivan Hydro (15 MW)

The Portland load service area is both summer and winter peaking with high levels of residential, commercial, and industrial loads. The peak summer loads are due to high levels of air conditioning load. The peak winter loads are due to high levels of base board electric heating load. The Portland area load forecast is:

Portland Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Portland	4012	4136	3883	4238	4058	4377

Proposed Plans of Service

Pearl 500 kV Upgrades

- Description: This project adds a 500 kV circuit breaker at Pearl Substation and re-terminates the Pearl 500/230 kV transformer No. 2 into the new bay position.
- Purpose: This project improves system reliability for the South of Allston path.
- Estimated Cost: $2,100,000
- Energization: 2016

Keeler 500 kV 500/230 kV Transformer Re-termination

- Description: This re-terminates the Keeler 500/230 kV transformer from the west bus to the east bus.
- Purpose: This project improves balancing the loads on the Keeler 230 kV bus.
- Estimated Cost: $2,000,000
- Energization: 2017/18

Troutdale 230 kV Bus Sectionalizing Breaker Addition

- Description: This project adds a series 230 kV bus sectionalizing breaker at Troutdale Substation.
- Purpose: This project is required to maintain reliable load service to the Portland area.
- Estimated Cost: $2,000,000
- Energization: 2018

I-5 Corridor Reinforcement Project

- Description: This proposed project includes a new 500 kV transmission line (approximately 70 miles) between a new substation in the vicinity of Castle Rock, Washington and a new substation in Troutdale, Oregon.
- Purpose: This project addresses the issue of providing reliable service to loads in southwest Washington and northwest Oregon. This project also meets the FERC Open Access requirements by building the necessary transmission facilities to accommodate requests for firm transmission service across BPA's network.
- This project was identified in the 2008 Network Open Season.
- Estimated Cost: $722,000,000
- Energization: 2021

Carlton Upgrades

- Description: This project adds four additional circuit breakers at Carlton substation: two each at the 115 and 230 kV buses. Additionally, the Forest Grove–McMinnville 115kV line will be looped into the Carlton 115 kV bus, creating the Forest Grove–Carlton and Carlton–McMinnville 115kV lines.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $3,800,000
- Energization: 2018

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

Split Pearl-Sherwood 230 kV Lines and Re-terminate

- Description: This project splits the double circuit Pearl-Sherwood 230 kV #1 and #2 lines into separate circuits and develops the necessary 230 kV bay positions at Pearl and Sherwood.
- Purpose: This project is required to maintain reliable load service to the Portland area.
- Estimated Cost: $1,500,000
- Energization: Beyond the planning horizon.

Split McLoughlin-Pearl-Sherwood 230 kV Lines and Re-terminate

- Description: This project splits the double circuit portion of the McLoughlin-Pearl-Sherwood 230 kV line into separate circuits and develops the necessary 230 kV bay positions at Pearl and Sherwood.
- Purpose: This project is required to maintain reliable load service to the Portland area.
- Estimated Cost: $1,500,000
- Energization: Beyond the planning horizon.

Pearl 230 kV Bus Sectionalizing Breaker Addition

- Description: This project adds a 230 kV bus sectionalizing breaker at Pearl Substation.
- Purpose: This project is required to provide reliable load service to the Portland area.
- Estimated Cost: $2,000,000
- Energization: Beyond the planning horizon.

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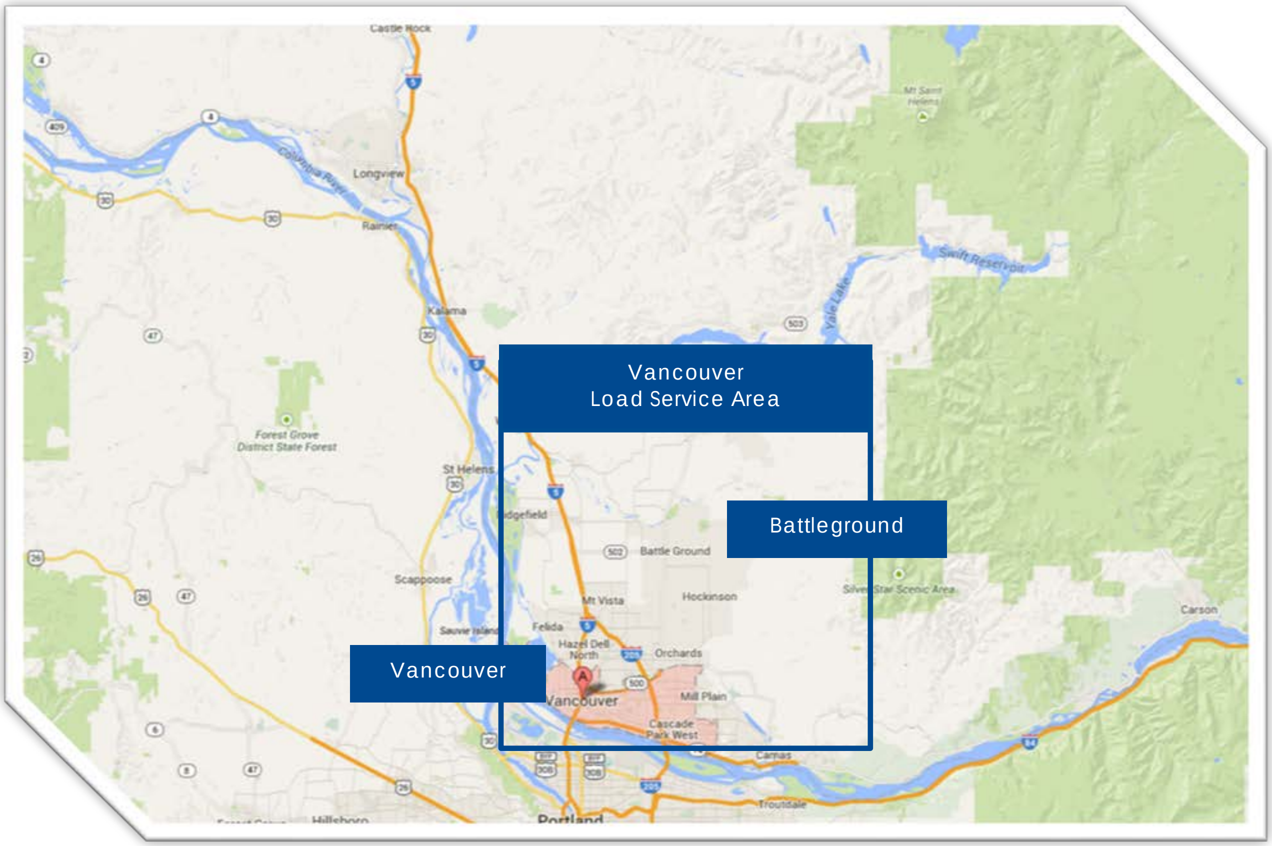
3 Vancouver Area

The Vancouver area is located in southwestern Washington State and encompasses Clark County. This area extends north to the border of the Longview load service area and east to the Cascade Mountain Range. It is bordered on the south and west by the Columbia River. This includes the greater Vancouver, Washington area and the communities of Washougal, Camas, Ridgefield, and Battleground.



The customers in this area include:

- Clark Public Utilities (Clark)
- PacifiCorp (PAC)
- Cowlitz Public Utility District (Cowlitz)

The lines serving the area include:

- North Bonneville Ross 230 kV lines 1 and 2
- McNary-Ross 345 kV line
- Longview-Lexington-Ross 230 kV line
- Bonneville-Alcoa 115 kV line
- Bonneville-Sifton-Ross 115 kV line
- PAC Merwin-Cherry Grove-Hazel Dell-St Johns 115 kV line
- PAC/Clark Troutdale-Runyan-Sifton 115 kV line

Local Generation and Load

The local generation that supports the area load includes:

- Clark River Road (250 MW)
- PAC and Cowlitz Swift Hydro (280 MW)
- PAC Merwin and Yale Hydro (235 MW)
- U.S. Army Corps of Engineers (USACE) Bonneville Powerhouse 1 and 2 (1225 MW)

Vancouver Area Peak Load Forecast (MW)							
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Vancouver	858	1143	752	972	781	1021

Proposed Plans of Service

North Bonneville-Troutdale 230 kV No. 2 Line Re-termination

- Description: This project re-terminates the North Bonneville-Troutdale 230 kV line 2 to the east bus section at North Bonneville Substation.
- Purpose: This project is required to support load service to the Vancouver area.
- Estimated Cost: $2,400,000
- Energization: 2016

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

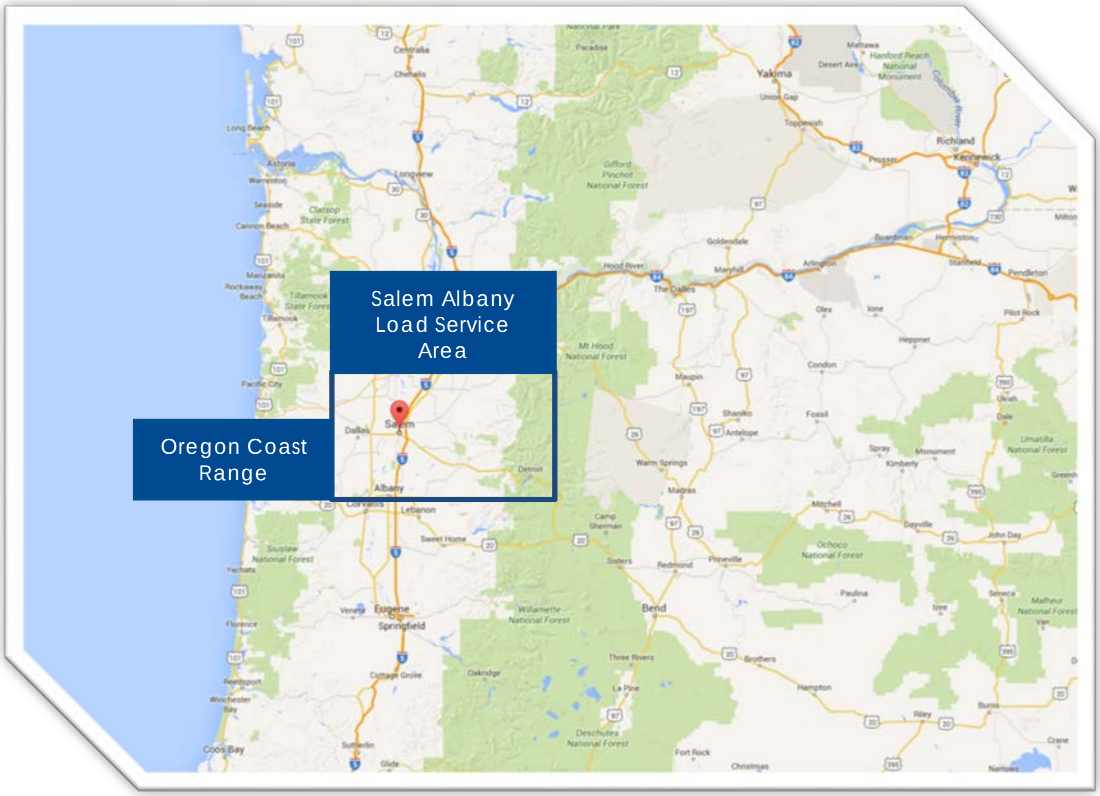
Deferred Plans of Service

Sifton Substation Upgrade

- Description: This project adds three 230 kV breakers and associated disconnect switches at Sifton Substation.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $3,000,000
- Energization: On-Hold/Deferred

4 Salem/Albany Area

The Salem/Albany area is located in northwestern Oregon in the northern Willamette Valley. It is bordered on the north by the Portland load area and on the south by the Eugene load area. It is bordered by the Willamette National Forest to the east and by the central Oregon Coast Range to the west. It includes Polk, Benton, Marion and Linn counties.



The major population areas include Salem, Albany, and Corvallis. Smaller communities include Dallas, Monmouth, Independence, Silverton, Stayton, and Lebanon.

The customers in this area include:

- Portland General Electric in the Salem Area
- PacifiCorp in the Albany, Corvallis, Lebanon Areas
- City of Monmouth
- U.S. Bureau of Mines located in Albany, Oregon
- Several Electric Cooperatives: Western Oregon, Salem Electric, and Consumers Power serving the rural areas

The load area is served by the following major transmission paths or lines:

- From the east by the West of Cascades South (WOCS) path, the Big Eddy-Chemawa 230 kV line, and the Marion-Alvey 500 kV line
- From the north by the (PGE) McLoughlin-Bethel 230 kV line, and the Pearl-Marion 500 kV line 1
- From the south by the Alvey-Marion and Lane-Marion 500 kV lines

Local Generation and Load

The local generation is mostly hydroelectric generation on the north and south forks of the Santiam River.

- USACE Foster Dam (22 MW)
- USACE Green Peter Dam (92 MW)
- USACE Detroit Dam (120 MW)
- Big Cliff Dam (22 MW)
- Consumer's Power, Inc. Adair Generation (5.6 MW)

Salem/Albany Area Peak Load Forecast (MW)						
Area (MW)	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Salem/Albany	907	1046	990	1122	1052	1184

Proposed Plans of Service

Salem-Albany No. 1 and No. 2 115 kV Line Upgrade

- Description: These 115 kV lines will be rebuilt with larger conductors as part of BPA's wood pole replacement program.
- Purpose: The system assessment did not show a need for the line upgrades within the 10-year planning horizon, but it will eventually be needed to maintain load service to the area. It is more efficient to complete the line upgrades at the same time as the wood pole replacement project.
- Estimated Cost: $32,000,000
  Included as part of the wood pole replacement program.
- Energization: 2016 (No. 2 line) 2017 (No. 1 line)

Santiam-Chemawa 230 kV Line Upgrade

- Description: This project upgrades the Santiam-Chemawa 230 kV line to a maximum operating temperature of 100 degrees C.
- Purpose: The system assessment showed a need for the line upgrade potentially beyond the 10-year planning horizon, but it will eventually be needed to maintain load service to the area. It is more efficient to complete the line upgrade at the same time as the steel pole replacement project for this line.
- Estimated Cost: Included as part of the steel pole replacement program. Estimated costs to be determined at a later date.
- Energization: 2017/2018

Recently Completed Plans of Service

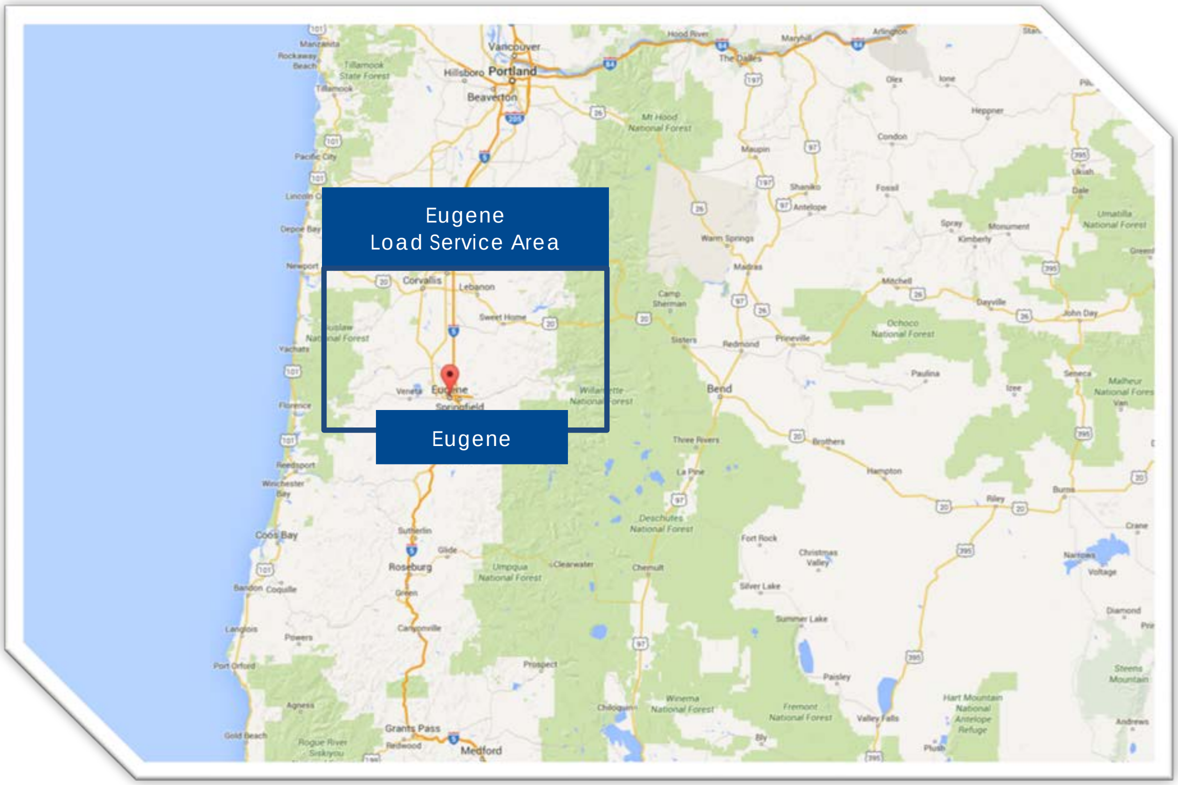
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

5 Eugene Area

This load area includes the western Central Willamette Valley in Oregon. It includes Polk, Benton, and Linn counties. It is bounded by Willamette National Forest on the east and the coast range on the west. It is bounded by the Salem/Albany load area to the north and PacifiCorp's load area south of Eugene. The major population areas include Eugene, Springfield, and Corvallis, and the communities of Harrisburg, Cottage Grove, and Drain.



The customers in this area include:

- PacifiCorp (PAC)
- Eugene Water and Electric Board (EWEB)
- Emerald Public Utility District (Emerald)
- Several Electric Cooperatives: Blachley-Lane, Lane Electric, Douglas Electric, Coos-Curry, and Consumers Power serving the rural areas

The load area is served by the following major transmission paths or lines:

- From the east by the West of Cascades South (WOCS) path, the Big Eddy-Chemawa 230 kV line, and the Marion-Alvey 500 kV line
- From the south by the PAC Alvey-Dixonville 500 kV line

Local Generation and Load

The local generation in this area includes hydroelectric generation on the McKenzie River and other generation as follows:

- EWEB Carmen (94.5 MW)
- USACE Cougar (28 MW)

- EWEB Weyco (47 MW)
- EWEB Leaburgs (13.8 MW)
- EWEB Stone Creek (12.5 MW)
- EWEB Waltville (9.7 MW)
- USACE Hills Creek Green (34 MW)

Loads in this area are primarily residential and commercial, with a smaller industrial component. The Eugene area load forecast is:

Eugene Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Eugene	605	895	650	880	672	911

Proposed Plans of Service

Alvey 500 kV Shunt Reactor Addition

- Description: This project adds a new 500 kV Shunt Reactor (180 MVAR) at Alvey Substation.
- Purpose: This project is required to maintain voltage schedules during light load conditions in the Eugene area.
- Estimated Cost: $10,300,000
- Energization: 2016

Alvey 115 kV Bus Sectionalizing Breaker Addition

- Description: This project adds a 115 kV bus sectionalizing breaker at Alvey Substation.
- Purpose: This project improves operations and maintenance flexibility
- Estimated Cost: $3,600,000
- Energization: 2020

Alvey 230 kV Bus Sectionalizing Breaker Addition

- Description: This project installs a new 230 kV bus sectionalizing breaker.
- Purpose: This project improves reliability for the Eugene area.
- Estimated Cost: $1,600,000
- Energization: 2017/18

Lane 230 kV Bus Sectionalizing Breaker Addition

- Description: This project adds a 230 kV bus sectionalizing breaker at Lane Substation.
- Purpose: This project is required to maintain reliable load service for the Eugene area.
- Estimated Cost: $1,600,000
- Energization: 2016

Lane 230 kV Reactor Addition

- Description: This project adds a 230 kV reactor at Lane Substation.
- Purpose: This project is required to maintain voltage (180 MVARs) schedules during light load conditions in the Eugene area.
- Estimated Cost: $2,800,000
- Energization: 2019

Recently Completed Plans of Service

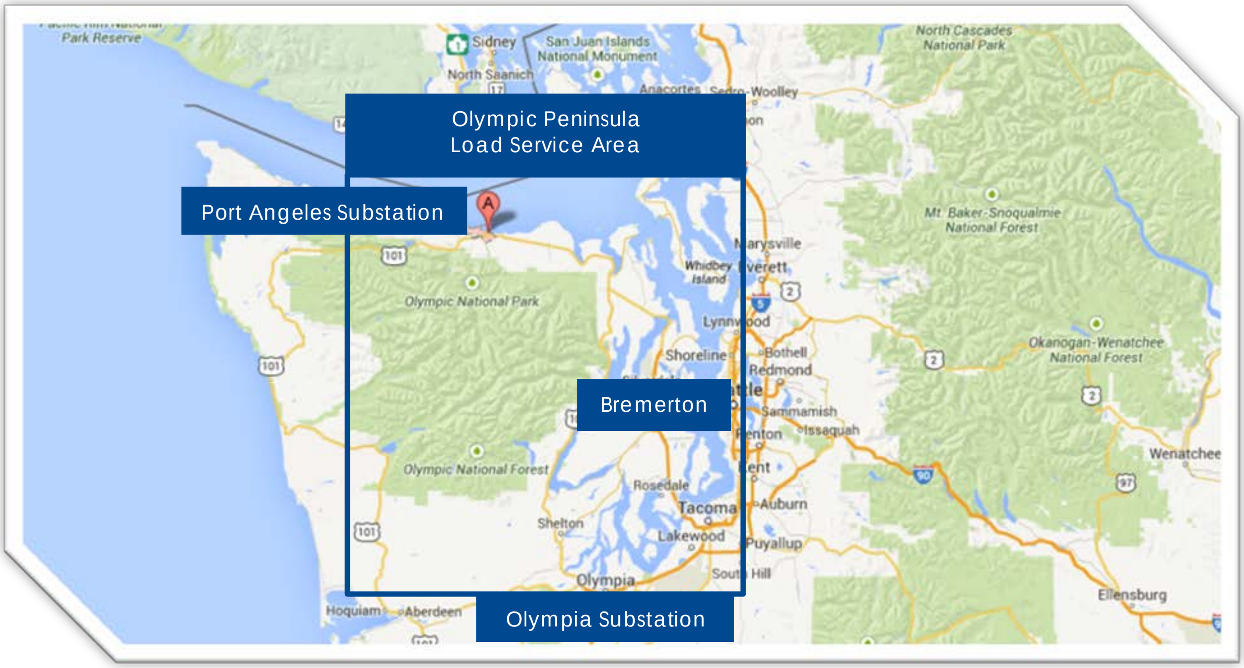
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

6 Olympic Peninsula Area

The Olympic Peninsula in Washington State is a long radial system extending about 110 miles from BPA's Olympia Substation northwest to BPA's Port Angeles substation. This area includes the Olympic Peninsula north and west of Olympia. Included within this area are Clallam, Mason, Kitsap and the western portion of Jefferson counties. The primary communities served include Shelton, Bremerton, and Port Angeles, as well as the US Navy in the Bremerton area. The smaller communities include Potlatch, Hoodsport, Quilcene, Fairmount, Duckabush, and Sequim.



The customers in this area include:

- Puget Sound Energy
- City of Port Angeles
- Clallam County Public Utility District
- Mason Public Utility District 1 and 3
- US Navy

The load area is served by the following major transmission paths or lines:

- Satsop-Shelton 230 kV line
- Three Olympia-Shelton 230 kV lines
- Two Olympia-Shelton 115 kV lines

Local Generation and Load

There is no generation connected directly to the load area, although there is some generation at Mason that serves the Tacoma area and the Grays Harbor plant located south of the load area.

The Olympic Peninsula area load forecast is:

Olympic Peninsula Area Peak Load Forecast (MW)							
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Olympic Peninsula	637	1245	787	1304	835	1326

Proposed Plans of Service

Sappho 69 kV Shunt Capacitor Addition

- Description: This project adds 69 kV shunt capacitors (9.6 MVAR) at Sappho Substation.
- Purpose: This project is required to maintain reliable load service to the Port Angeles area.
- Estimated Cost: $1,900,000
- Energization: 2017

Kitsap 115 kV Shunt Capacitor Modification

- Description: This project moves one group of 115 kV shunt capacitors from the south bus to the north bus at Kitsap substation.
- Purpose: This project is required to maintain voltage schedules on the Kitsap Peninsula transmission system.
- Estimated Cost: $1,400,000
- Energization: 2018

Fairmount 230 kV Reactor

- Description: This project adds a new 230 kV Shunt Reactor (40 MVAR) at the Fairmount Substation.
- Purpose: This project is required to maintain voltage schedules during light load conditions in the Northwest Washington, Olympic Peninsula Load area.
- Estimated Cost: $3,000,000
- Energization: 2017

Recently Completed Plans of Service

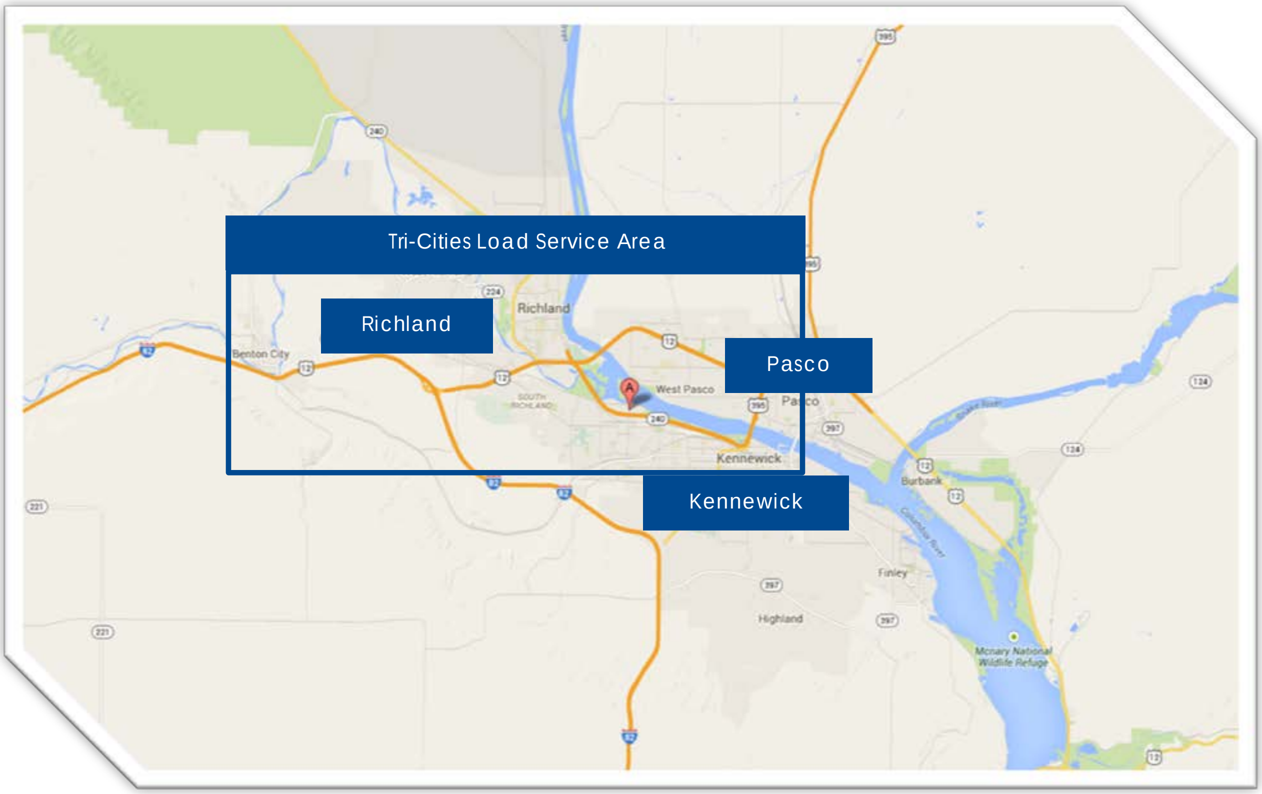
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

7 Tri-Cities Area

The Tri-Cities area is in South Central Washington and includes the three major communities of Pasco, Kennewick and Richland. This load area includes the irrigation loads of Big Bend Electric, Benton PUD, and Benton REA and many other communities near the Tri-Cities area such as West Richland and Benton City.



The customers in this area include:

- Franklin County Public Utility District
- City of Richland
- Benton County Public Utility District
- Benton Rural Electric Association
- Big Bend Electric Coop
- Columbia Rural Electric Association
- South Columbia Basin Irrigation District
- U.S. Bureau of Reclamation
-

The load area is served by the following major transmission paths or lines:

- From the east by the Lower Monumental-McNary 500 kV line which is tapped at Sacajawea with a 500/115 kV transformer
- From the north by the Midway-Benton 230 kV line and the Midway-White Bluffs 230 kV line
- From the south by the McNary-Franklin 230 kV line

Local Generation and Load

The local generation is mostly hydroelectric generation. The Columbia Generating Station (1100 MW) is physically located in the Tri-Cities area, but not electrically. Therefore it was not considered part of the local generation.

- USACE Ice Harbor Hydro (700 MW)
- USBR Chandler Hydro (12 MW)
- USACE McNary Hydro (1200 MW)
- South Columbia Basin Irrigation District Hydro (Scooteney, Glade & Ringold) (6 MW)
- Florida Power Nine Mile Wind (100 MW)
- NWE Nine Canyon Wind (90 MW)

Tri-Cities Area Peak Load Forecast (MW)							
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Tri-Cities	1050	943	1406	1135	1472	1166

Proposed Plans of Service

Badger Canyon 115 kV Bus Tie Addition

- Description: This project adds a 115 kV bus tie breaker at Badger Canyon Substation.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $1,100,000
- Energization: 2016

Grandview 115 kV Bus Tie Addition

- Description: This project adds a 115 kV bus tie breaker at Grandview Substation.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $1,800,000
- Energization: 2017

Midway-Grandview 115 kV Line Upgrade

- Description: Rebuild the 9 mile Midway – Blackrock 115 kV line section by summer 2016, and rebuild the 16 mile Blackrock – Grandview 115 kV line section by summer 2017.
- Purpose: This project is needed to provide adequate load service to the Tri-Cities area.
- Estimated Cost: $15,300,000
- Energization: 2018

McNary 500/230 kV Transformer No. 2

- Description: This project has two parts. The first part adds a 500/230 kV transformer (1428 MVA) at McNary Substation. The second part adds current limiting reactors (5 ohms) in series with the 230 kV bus sectionalizing breaker between bus sections one and two at McNary.
- Purpose: This project is required to reliably integrate generation in the McNary area.
- Estimated Cost: $22,200,000
- Energization: 2017

Jones Canyon 230 kV Shunt Reactor Addition

- Description: This project adds a 230 kV shunt reactor (40 MVAR) at Jones Canyon Substation.
- Purpose: This project is required to maintain voltage schedules in the area during light load conditions.
- Estimated Cost: $2,000,000
- Energization: 2017

Richland 115 kV Reconfiguration

- Description: This project adds a 115 kV load break disconnect switch at First Street Substation.
- Purpose: This project allows load to be shifted in order to maintain reliable service and keep equipment loadings within rated limits.
- Estimated Cost: $50,000
- Energization: 2016

White Bluffs 230/115 kV Low Side Disconnect Switches

- Description: This project increases the rating of the low side transformer disconnect switches at White Bluffs Substation.
- Purpose: This upgrade is needed to prevent equipment from exceeding rating limits.
- Estimated Cost: $80,000
- Energization: 2017

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

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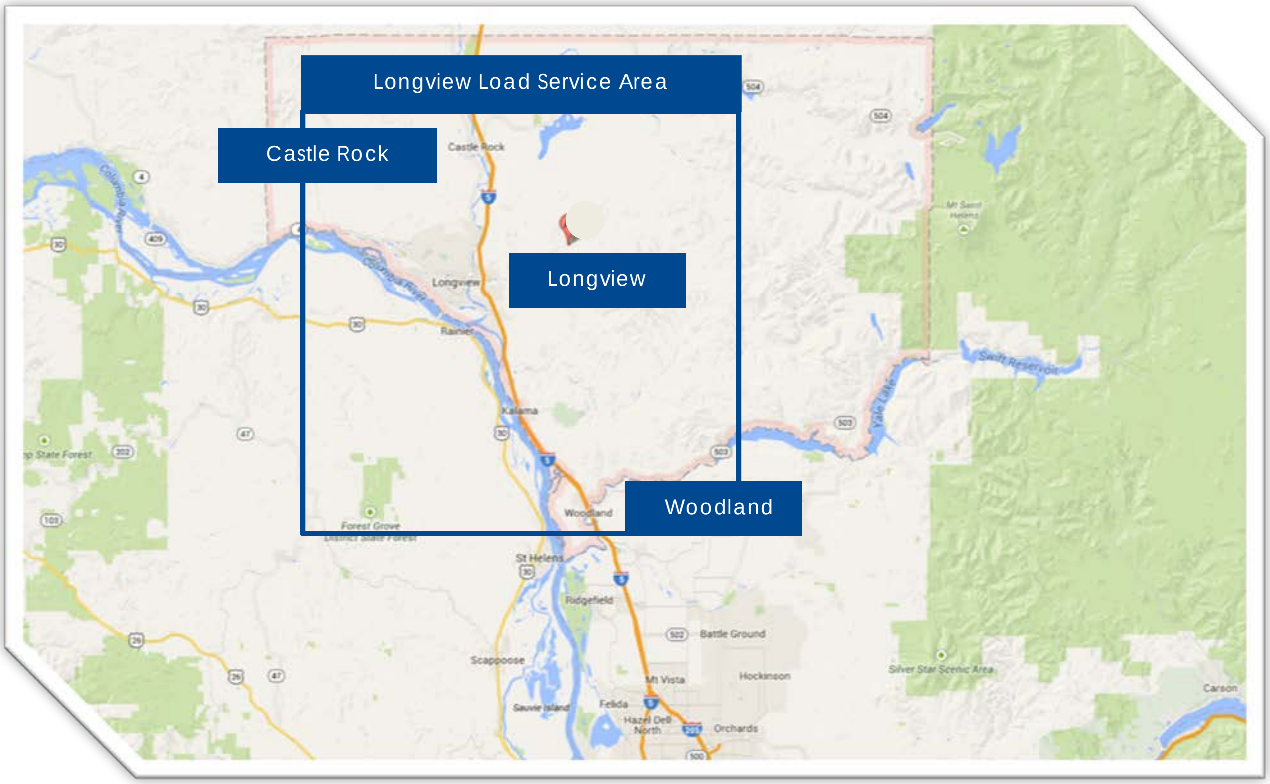
8 Longview Area

This area includes Cowlitz County in Washington State. The major population areas include Longview, Washington as well as the communities of Kelso, Kalama, Castle Rock, and Woodland, Washington.



The customers in this area include:

- Cowlitz Public Utility District
- PacifiCorp (PAC)

The load area is served by the following major transmission paths or lines.

- Longview-Allston 230 kV lines 1, 2 and 3
- Longview-Allston 115 kV line 4
- The Chehalis-Longview 230 kV lines 1 and 2
- Ross-Lexington 230 kV line
- PAC Merwin-Cardwell 115 kV line

Local Generation and Load

The local generation that supports the area load includes:

- Mint Farm (270 MW)
- PAC and Cowlitz Swift Hydro (280 MW)
- PAC Merwin and Yale Hydro (235 MW)
- Weyerhauser Company (80MW)
- Longview Fiber (55MW)

Longview Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Longview Area (Cowlitz PUD)	640	830	695	883	758	923

Proposed Plans of Service

Lexington 230 kV Bus Tie Breaker

- Description: This project adds a 230 kV bus tie breaker at Lexington Substation.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $800,000
- Energization: 2015

Longview Area 230/115 kV Transformer Addition

- Description: This project adds a 230/115 kV transformer in the Longview area. It may be possible to accomplish this by re-strapping an existing 230/69 kV transformer bank to 230/115 kV operation.
- Purpose: This project is required to maintain reliable load service to the Longview area.
- Estimated Cost: $8,000,000
- Energization: 2021

Recently Completed Plans of Service

Longview-Lexington 230 kV Line Re-termination

- Description: This project re-terminates the Longview-Lexington 230 kV line into the Longview 230 kV Annex Substation.
- Purpose: This project is required to maintain reliable load service to the Longview area.
- Estimated Cost: $900,000
- Energization: 2015

Deferred Plans of Service

There are no deferred plans of service for this area.

9 Mid-Columbia Area

The Mid-Columbia (Mid-C) area includes the Columbia Basin area of central Washington, excluding the Tri-cities area (Kennewick, Pasco, and Richland), which is considered a separate load area. The Mid-C area extends from Moses Lake in Grant county, east to Leavenworth in Chelan county, Ellensburg in Kittitas county and Yakima in Yakima county to the west. It extends from Chelan and Douglas Counties to the north to Sunnyside in the south.

The customers in this area include:

- Chelan County PUD (Chelan)
- Douglas County PUD (Douglas)
- Kittitas County PUD (Kittitas)
- City of Ellensburg
- Benton REA (BREA)
- PacifiCorp (PAC)
- Benton County PUD (BPUD)
- Grant County PUD (Grant)

The load area is served by the following major BPA transmission branches:

- From the northeast by two Grand Coulee-Columbia 230 kV lines, a Grand Coulee-Rocky
- Ford-Midway 230 kV line and a Grand Coulee-Midway 230 kV line
- From the south by the Midway-Big Eddy and the Midway-North Bonneville 230 kV lines

Local Generation and Load

The local generation that supports the area load includes three classes:

Hydroelectric generation – There are 5 major hydroelectric plants on the Columbia River, including:

- Douglas Wells Dam (840 MW)
- Chelan Rocky Reach Dam (1287 MW)
- Chelan Rock Island Dam (660 MW)
- Chelan Wanapum Dam (1038 MW)
- Grant Priest Rapids Dam (955 MW)

Wind generation – There are 2 wind farms; these include:

- Puget Sound Energy Wild Horse (273 MW)
- Horizon Kittitas Valley Wind (101 MW)

Other Generation – The other local generation includes:

- USBR Roza Power Plant Yakima Project (13 MW)
- Grant Quincy Chute Hydroelectric (9.4 MW)
- Grant Potholes East Canal (6.5 MW)
- Chelan Falls Hydroelectric Project (59 MW)
- Summer Falls Power Plant (92 MW)

Mid-Columbia Area Peak Load Forecast (MW)							
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Mid-Columbia Load Area Total	2074	2321	2460	2741	2468	2785

Proposed Plans of Service

Columbia 230 kV Bus Tie and Bus Sectionalizing Breaker Addition

- Description: This project adds a new 230 kV bus tie breaker and 230 kV bus sectionalizing breaker at Columbia Substation.
- Purpose: This project improves operational and maintenance flexibility at Columbia Substation.
- Estimated Cost: $2,100,000
- Energization: 2016
  (This project will be completed with the Northern Mid-Columbia Area Project below).

Moxee 115 kV Bus Tie Breaker Addition

- Description: This project adds a 115 kV bus tie breaker at Moxee Substation.
- Purpose: This project will improve operational and maintenance flexibility.
- Estimated Cost: $1,200,000
- Energization: 2017

Northern Mid-Columbia Area Project

- Description: This is a joint project between BPA, Grant PUD, Douglas PUD, and Chelan PUD. This project will result in a new Columbia-Rapids 230 kV line.
- Purpose: This project is required to maintain reliable load service to the Northern Mid-Columbia area.
- Estimated Cost: $5,900,000 (the estimated cost is BPA's share of the total project cost).
- Energization: 2016

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

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10 Central Oregon/Alturas Area

Central Oregon:
The Central Oregon area includes the communities of Madras to the north, the cities of Redmond and Bend to the west, the city of Prineville to the east and the city of La Pine and community of Sun River to the south. It includes Jefferson and Deschutes counties in Oregon.

The customers in the Central Oregon area include:

- PacifiCorp
- Central Electric Cooperative
- Midstate Electric Cooperative

The Central Oregon load area is served by the following major BPA transmission path or lines:

- Big Eddy-Redmond 230 kV line
- Two 500/230 kV transformers at Ponderosa with a Ponderosa-Pilot Butte 230 kV line
- Pilot Butte – La Pine 230 kV line

Alturas:
The Alturas area includes the northeast corner of Modoc County in northern California including the communities of Canby and Alturas.

The customers in the northern California area include:

- Surprise Valley Electrification Corporation
- PacifiCorp

The Alturas load area is served by the following major, BPA transmission path or lines:

- Malin 500/230 kV Transformer and a Malin-Canby-Hilltop 230 kV line with a Canby 230/69 kV transformer
- Hilltop-Warner 230 kV terminated with 230/115 kV Transformer
- La Pine- Chiloquin 230 kV line

Local Generation and Load

The only significant local generation in the area is PGE's Pelton Round Butte Project. This is a hydroelectric project consisting of three hydroelectric plants: Round Butte Dam (338 MW), Pelton Dam (110 MW), and a reregulating dam (20 MW). The generation is interconnected at PGE's Round Butte Substation.

Central Oregon and Alturas Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Central Oregon Area	418	661	446	710	502	736

Proposed Plans of Service

Ponderosa 230 kV Reactor

- Description: This project adds a 225 MVAR 241.5 kV shunt reactor at Ponderosa Substation.
- Purpose: This project is required to provide voltage control in the Central Oregon area.
- Estimated Cost: $5,700,000
- Energization: 2018

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

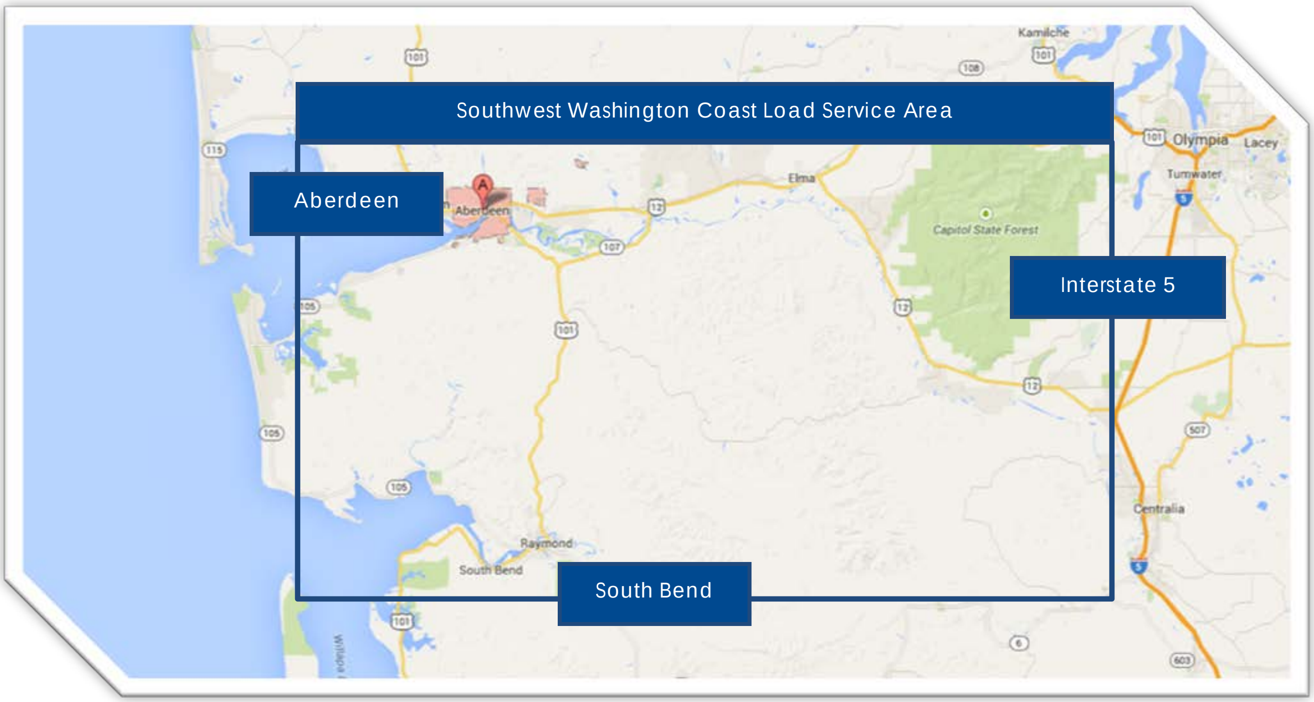
Deferred Plans of Service

LaPine 230 kV and 115 kV Circuit Breaker Additions

- Description: This project adds a 230 kV circuit breaker to the high side of the transformer bank No. 2 at La Pine Substation. This will also add two 115 kV circuit breakers for the low side of the transformer banks 1 and 2 as well as a 115 kV bus tie breaker.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $6,000,000
- Energization: On Hold/Deferred

11 Southwest Washington Coast Area

The Southwest Washington Coast area is comprised of Wahkiakum county, Pacific county, western Lewis county, and southern Grays Harbor county in Washington. It is bordered on the east by Interstate 5 and the west by the Pacific Ocean. It is bordered on the north by the Olympic National Forest and on the south by the Columbia River. The main communities served include Aberdeen, the Raymond/South Bend area, and the communities on the Long Beach Peninsula.



The customers in this area include:

- Grays Harbor Public Utility District (including some industrial load)
- Pacific County Public Utility District No. 2
- Lewis County Public Utility District

Town of McCleary

The load area is served by the following major transmission paths or lines:

- Aberdeen-Satsop 230 kV lines 2 and 3
- Olympia-South Elma 115 kV line
- Chehalis-Raymond 115 kV line 1
- Naselle Tap to the Allston-Astoria 115 kV line 1

Local Generation and Load

Local generation serving the load area includes:

- Wynooche (18.7 MW)
- Weyerhaeuser (15.8 MW)
- Sierra (7.9 MW)

Southwest Washington Coast Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Southwest Washington Coast	183	322	218	355	225	367

Proposed Plans of Service

Holcomb-Naselle 115 kV Line Upgrade

- Description: This line will be rebuilt with larger conductor as part of the wood pole replacement program.
- Purpose: This project is required to maintain reliable load service to the Southwest Washington Coast area.
- Estimated Cost: The cost of this project is included as part of the overall wood pole replacement program. Costs are estimated at $7,200,000.
- Energization: 2018

Recently Completed Plans of Service

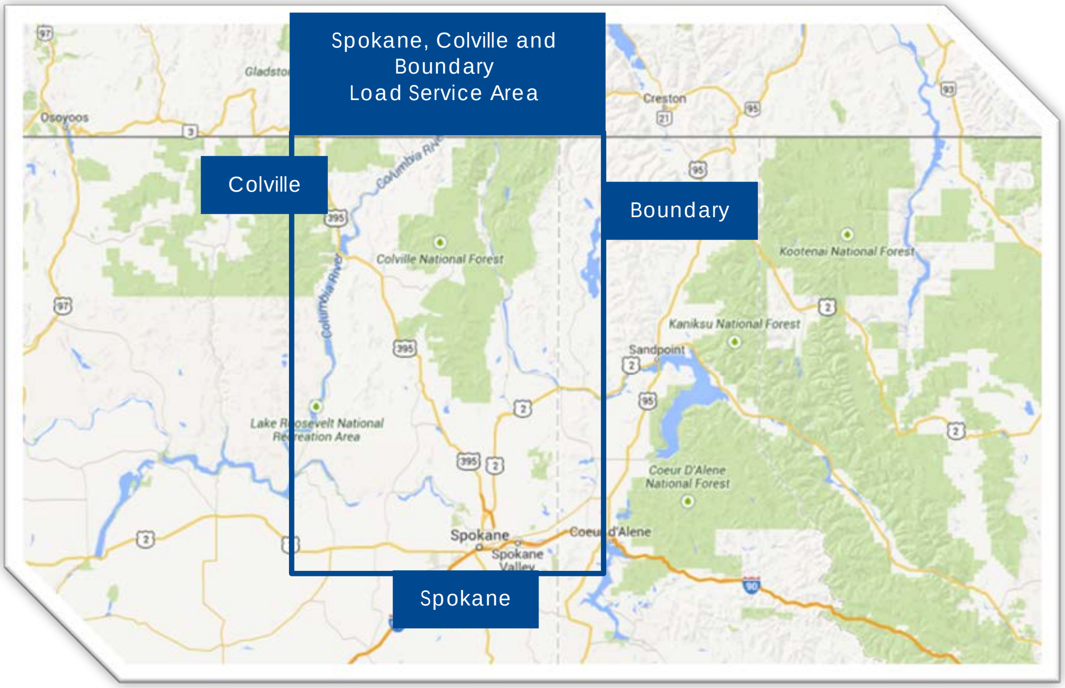
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

12 Spokane/Colville/Boundary Area

This area is located in northeastern Washington State. This load area includes the greater Spokane, Washington area as well as Colville Valley to the north including the communities of Colville and Chewelah. This area also includes Newport, Washington to the east, as well as Pend Oreille, Stevens and Spokane Counties.



The customers in this area include:

- Avista
- Inland Power and Light
- West Kootenai Power and Light
- Pend Oreille PUD
- Ponderay Newsprint Company

The load area is served by the following major transmission paths or lines:

- Bell-Boundary 230 kV lines 1 and 2
- Usk-Boundary 230 kV line
- Taft Bell 500-kV line
- Bell-Lancaster 230 kV line
- Avista Lancaster-Boulder 230 kV line
- Avista Benewah-Boulder 230 kV line
- Avista Rathdrum-Boulder 230 kV line
- Grand Coulee-Bell 500 kV line
- Three Grand Coulee-Bell 230 kV lines
- Grand Coulee-Westside 230 kV line

Local Generation and Load

Local generation serving the load area includes:

- Seattle City Light Boundary (1040 MW)
- Pend Oreille Box Canyon (66 MW)
- USACE Albeni Falls (48 MW)
- Avista Long Lake (88 MW)
- Avista Little Falls (32 MW)
- USACE Dworshak (458 MW)
- Avista Boulder (25 MW)
- Avista Post Street (10 MW)
- Avista Monroe (16 MW)
- City of Spokane – Spokane Waste (22 MW)
- Avista Northeast (68 MW)
- City of Spokane Up River (18 MW)
- Avista Nine Mile (24 MW)
- Avista Post Falls (18 MW)
- Avista Kettle Falls (52 MW)

The Spokane Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Spokane	867	889	763	930	1059	1236

Proposed Plans of Service

Bell 230 kV Bus Sectionalizing Breaker Addition

- Description: This project adds a 230 kV bus sectionalizing breaker at Bell Substation which will split the existing bus section No. 1 into two sections.
- Purpose: This project is required to maintain reliable load service to the Spokane area.
- Estimated Cost: $1,600,000
- Energization: 2016

Recently Completed Plans of Service

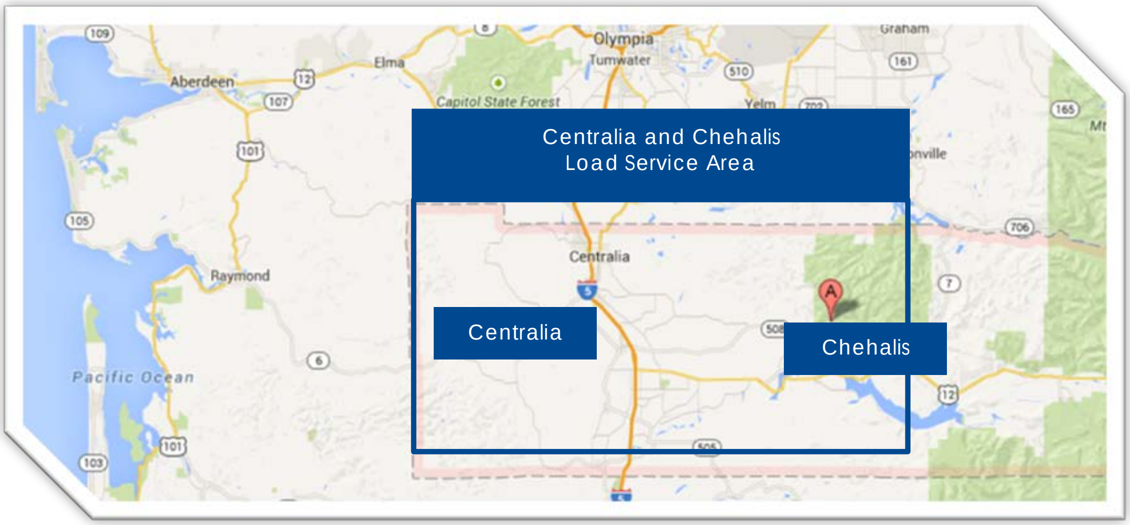
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

13 Centralia/Chehalis Area

The Centralia/Chehalis area includes the cities of Chehalis and Centralia, Washington and the communities within Lewis County in Washington. It consists of a 69 kV transmission loop served out of Chehalis Substation. Chehalis Substation also provides service to Lewis County PUD's Corkins 69 kV Substation and provides support to Raymond and Naselle Substations on the southwest Washington coast.



The customers in this area include:

- Centralia City Light
- City of Centralia
- Lewis County PUD

The load area is served by the following major transmission paths or lines:

- Chehalis- Olympia 230 kV line 1
- Chehalis- Covington 230 kV line 1
- Longview-Chehalis 230 kV line 1
- Longview-Chehalis 230 kV line 2
- Silver Creek-Chehalis 230 kV line 1
- Chehalis-Mayfield 230 kV line 1

Local Generation and Load

Local generation serving the load area includes:

- Tacoma Power Mossy Rock (334 MW)
- Tacoma Power Mayfield (135 MW)
- Lewis County PUD Cowlitz Falls (40 MW)
- Energy Northwest Glenoma (29 MW)
- The City of Centralia Yelm (10 MW)

Centralia / Chehalis Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Centralia/Chehalis	128	227	170	263	177	277

Proposed Plans of Service
There are no proposed projects for this area at this time.

Recently Completed Plans of Service
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service
There are no deferred plans of service for this area.

14 Northwest Montana Area

This includes the Flathead Valley area of northwest Montana including the communities of Kalispell and Columbia Falls.

The customers in this area include:

- Flathead Electric Cooperative
- Northwestern Energy
- Lincoln Electric Cooperative
- U.S. Bureau of Reclamation (USBR)

The Northwest Montana load area is served by the following major transmission paths or lines:

- Taft-Hot Springs 500 kV line
- Noxon-Hot Springs 230 kV line 1
- Flathead-Hot Springs 230 kV line 1
- Libby-Noxon 230 kV line 1
- Libby-Conkelley 230 kV line 1

Local Generation and Load

Local generation serving the load area includes:

- Avista Rathdrum (154 MW)
- Cogentrix Energy Lancaster (270 MW)
- Avista Cabinet Gorge (270 MW)
- USACE Noxon (567 MW)
- USACE Libby (605 MW)
- USBR Hungry Horse (430 MW)
- PPL Global Kerr (194 MW)
- PPL Global Colstrip (2306 MW)

Northwest Montana Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Northwest Montana	234	358	332	432	334	457

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

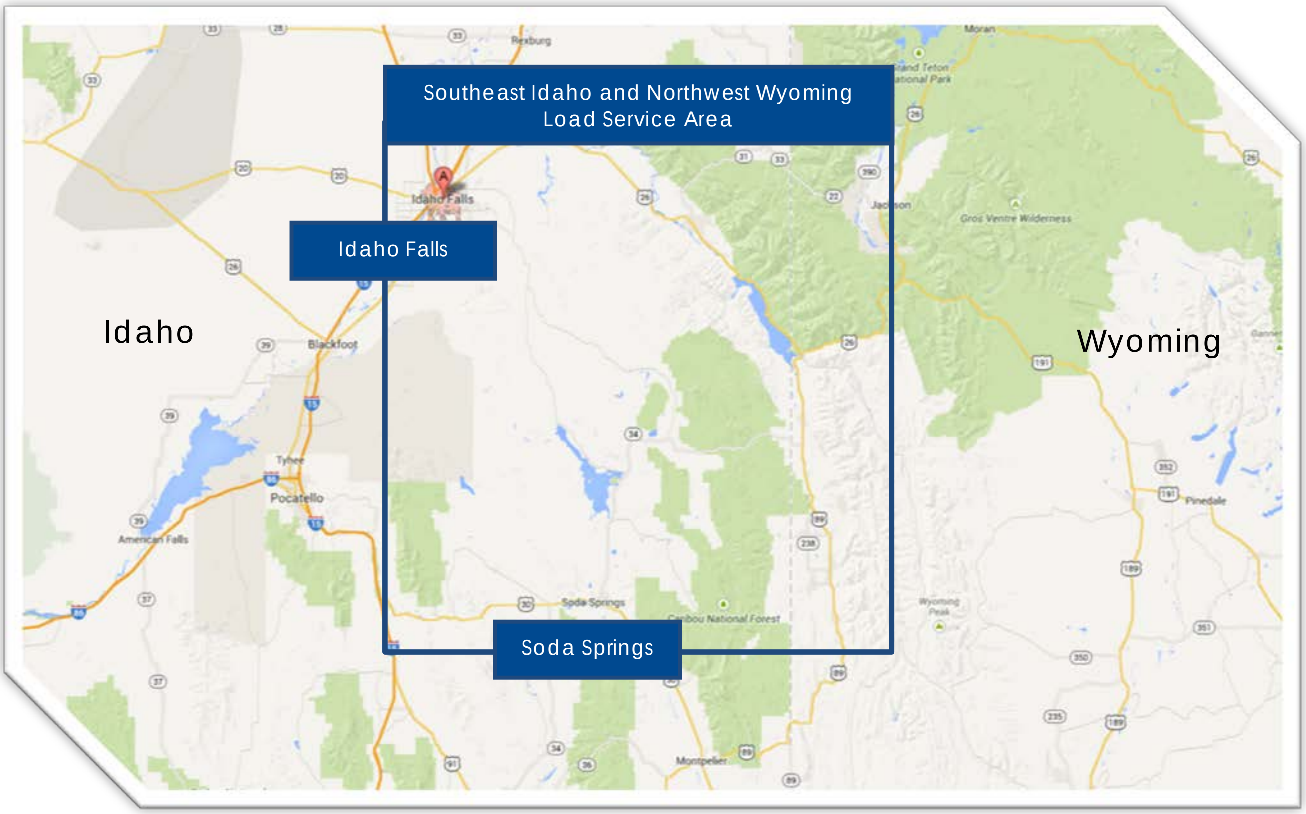
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

15 Southeast Idaho/Northwest Wyoming Area

This load area includes southeast Idaho from Idaho Falls south to Soda Springs and east to Jackson, Wyoming. This area is served by Lower Valley Energy. It also includes the area from West Yellowstone, Montana south to Afton, Wyoming which is served by Fall River Electric Cooperative. This area includes the communities of Jackson, Wyoming and Driggs, Idaho.



The customers in this area include:

- Lower Valley Energy
- Fall River Electric Cooperative (FEC)
- U.S. Bureau of Reclamation (USBR)

The load area is served by the following major transmission paths or lines:

- Goshen-Drummond 161 kV line
- Goshen-Swan Valley 161 kV line
- Goshen-Palisades 115 kV line

Local Generation and Load

Local generation serving the load area includes:

- USBR Palisades Dam (160 MW) (limited to about 8 MW in the winter)
- Horse Butte Wind Project (100 MW)

Southeast Idaho / Northwest Wyoming Area Peak Load Forecast (MW)							
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
SE Idaho / NW Wyoming	141	285	157	301	170	321

Proposed Plans of Service

Lower Valley Area Reinforcement Project

- Description: Construct a new 138/115 kV substation called Hooper Springs Substation and a new double circuit 115 kV line.
- Purpose: This project is required to provide reliable load service to the Southeast Idaho area.
- Estimated Cost: $70,300,000
- Energization: 2018

Drummond Upgrade

- Description: This project adds 115 kV breakers and associated disconnect switches on the high side of the Drummond 115/46 kV No. 1 and No. 3 transformer banks. This project will also upgrade the station service at Drummond.
- Purpose: This project increases operations and maintenance flexibility.
- Estimated Cost: $600,000
- Energization: 2018

Spar Canyon 230 kV Reactor Addition

- Description: This project adds a 230 kV 25 MVAR shunt reactor at Spar Canyon Substation.
- Purpose: This project improves the ability to maintain voltage schedules and increases operations and maintenance flexibility at Spar Canyon.
- Estimated Cost: $3,000,000
- Energization: 2018

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

Teton 115 kV Bus Tie Addition

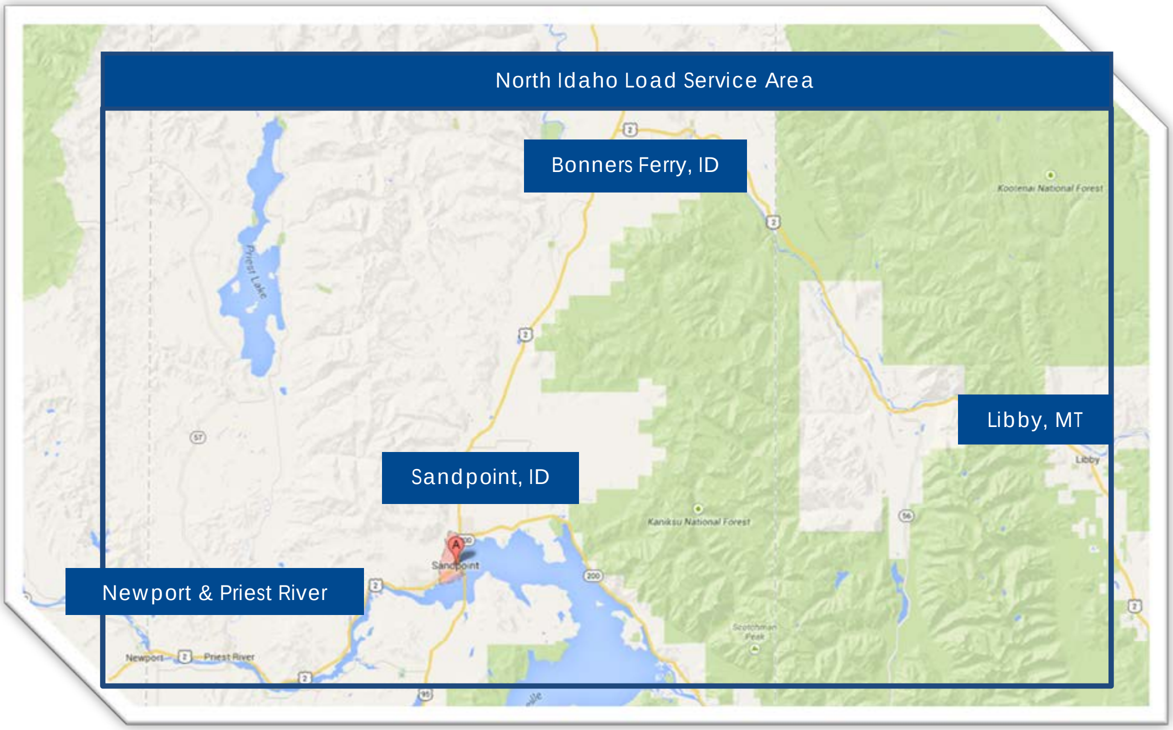
- Description: This project adds a 115 kV bus tie breaker at Teton Substation.
- Purpose: This project increases operations and maintenance flexibility.
- Estimated Cost: $1,100,000
- Energization: On Hold/Deferred

Lost River 230 kV Breaker Addition

- Description: This project replaces a 230 kV Load Breaker Disconnect (LBD) switch with a 230 kV circuit breaker at Lost River Substation.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $1,000,000
- Energization: On Hold/Deferred

16 North Idaho Area

The North Idaho area is composed of northeast Bonner County and Boundary County in Idaho and western Lincoln County in Montana. The main communities are in the Sandpoint, Idaho vicinity. This area includes Newport, Washington and Priest River, Idaho to the west, Bonners Ferry and Moyie Springs to the north, Troy and Libby, Montana to the east, and the communities along the Clark Fork River in Idaho to the south.



The customers in this area include:

- Avista
- Northern Lights Electric Cooperative (NLI)
- City of Bonners Ferry (CBF)
- City of Troy
- Flathead Electric Cooperative (FEC)

The load area is served by the following major transmission paths or lines:

- Libby-Bonners Ferry 115 kV line 1
- Sand Creek-Bonners Ferry 115 kV lines 1 and 2 (currently operated as a single circuit)
- Albeni Falls-Sand Creek 115 kV line 1
- Avista Cabinet Gorge-Bronx-Sand Creek 115 kV line 1

Local Generation and Load

The local generation in the area includes

- USACE Libby (605MW)
- Avista Cabinet Gorge (287 MW)
- Avista Noxon (586 MW)
- USACE Albeni Falls (48 MW)
- EWEB Smith Falls (36 MW)
- NLI Lake Creek (3 MW)
- CBF Moyie (2 MW)
- USBR Hungry Horse (428 MW)

North Idaho Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
North Idaho Area	110	188	119	191	134	200

Proposed Plans of Service

Libby FEC 115 kV Shunt Capacitor Replacement or Restoration

- Description: This project adds a 115 kV shunt capacitor (40 MVAR) at the Libby Substation.
- Purpose: This project is required to maintain adequate voltages in the area following contingencies that involve loss of the connection to the Libby 230 kV system.
- Estimated Cost: $1,500,000
- Energization: 2023

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

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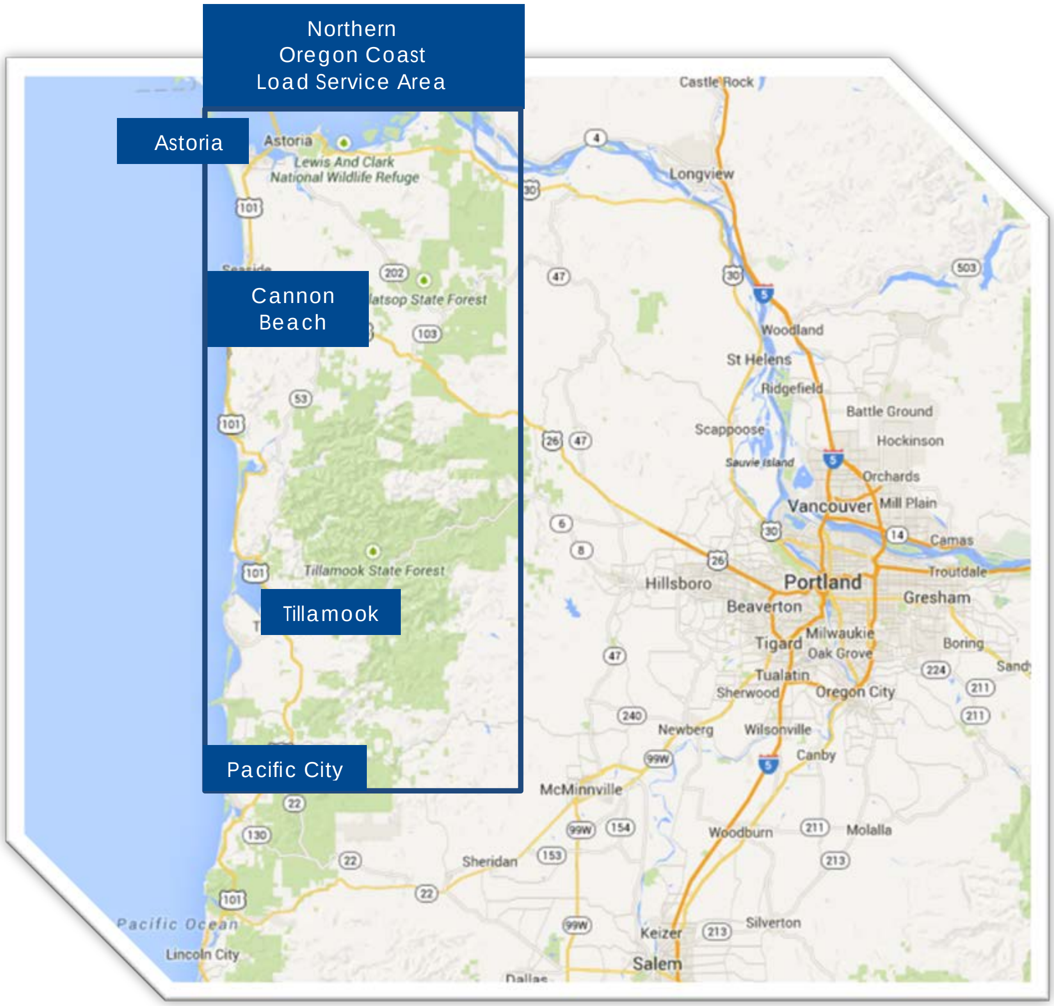
17 North Oregon Coast Area

The North Oregon Coast area includes Tillamook and Clatsop counties along the Oregon Coast. It is bounded by the Clatsop and Tillamook State Forests on the east and the Pacific Ocean on the west. It is bounded by the Columbia River to the north and Pacific City to the south. The population areas include Astoria, Seaside, Cannon Beach, Manzanita, Tillamook, Oceanside, Hebo, and Pacific City.



The customers in this area include:

- Consumer's Power, Inc.
- PacifiCorp
- Portland General Electric
- Tillamook Public Utility District

The load area is served by the following major transmission paths or lines:

- Allston-Clatsop 230 kV line
- Carlton-Tillamook 230 kV line
- Driscoll-Astoria 115 kV line
- Keeler-Tillamook 115 kV line
- Salem-Grand Ronde 115 kV line

Local Generation and Load

Local generation serving the load area includes:

- Clatskanie Public Utility District Wauna Generation at James River Mill (27 MW)
- Loki Generation (gas turbine) (11MW).

North Oregon Coast Area Peak Load Forecast (MW)							
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
North Oregon Coast	137	270	166	291	172	300

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

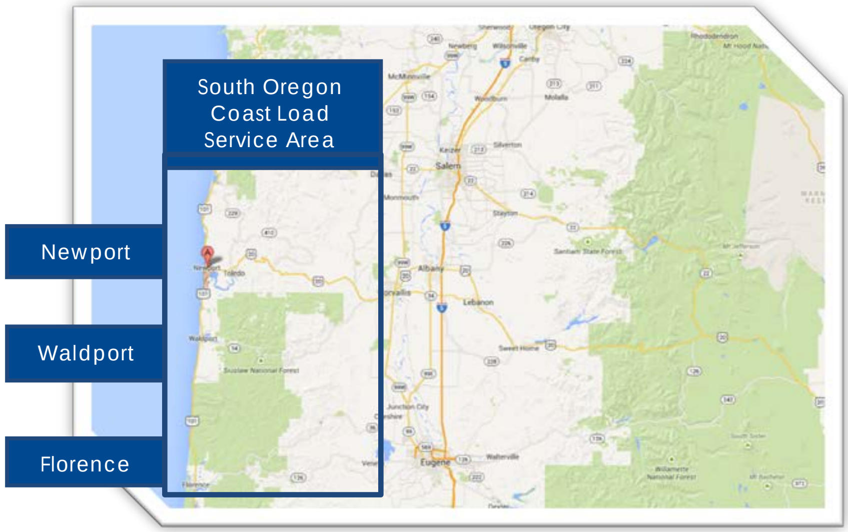
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

18 South Oregon Coast Area

The South Oregon Coast load area includes the communities of Newport, Waldport, Florence, Reedsport, Coos Bay, Coquille, Bandon, Myrtle Point, Gold Beach, Port Orford, and south to Brookings. The load area is bounded by the north Oregon Coast to the north and the Salem-Albany-Eugene area to the east.



The customers in this area include:

- PacifiCorp (PAC)
- Coos Curry Cooperative
- City of Bandon
- Douglas Electric Coop
- Central Lincoln Public Utility District

The load area is served by the following major transmission paths or lines:

- 230 kV Lane-Wendson line 2
- 230kV Alvey-Fairview line 1
- 230kV Reston-Fairview line 2
- 230 kV Fairview-Rogue line 1
- PAC 230 kV Fairview-Isthmus line 2
- Santiam-Toledo 230 kV line 1

Local Generation and Load

There is no local generation in this area.

South Oregon Coast Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
South Oregon Coast	200	440	217	404	226	425

Proposed Plans of Service

Fairview 115 kV Reactor Additions

- Description: This project adds two 115 kV shunt reactors (approximately 25 MVAR each) at Fairview Substation.
- Purpose: This project is required to improve system voltage schedules in the South Oregon Coast area.
- Estimated Cost: $3,950,000
- Energization: 2018

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

Toledo 69 kV and 230 kV Bus Tie Breaker Additions

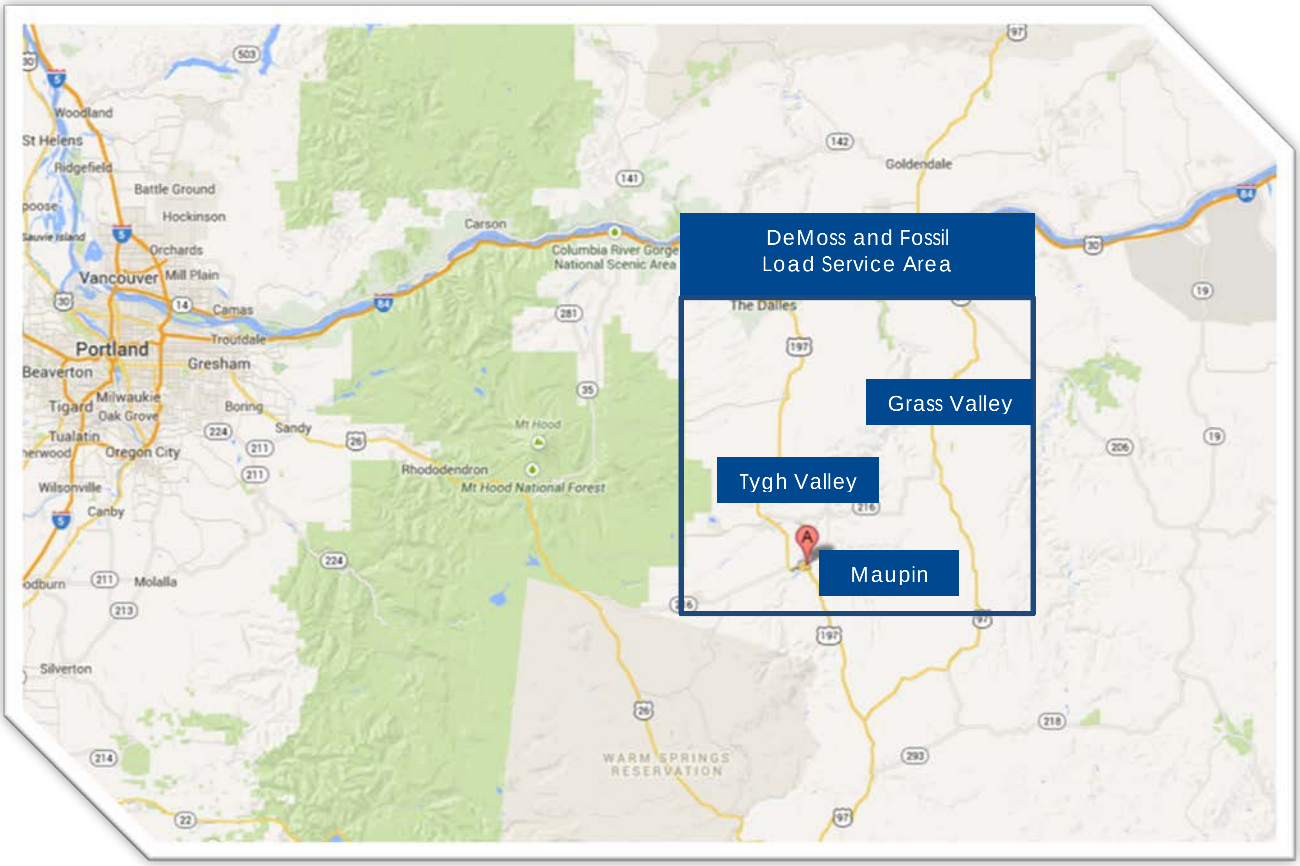
- Description: This project adds a 69 kV bus tie breaker and a 230 kV bus tie breaker at Toledo Substation.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $980,000
- Energization: On Hold/Deferred

Wendson 115 kV Bus Tie Addition

- Description: This project adds a 115 kV bus tie breaker at Wendson Substation.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $650,000
- Energization: On Hold/Deferred

19 DeMoss/Fossil Area

This DeMoss/Fossil load area spans a portion of north central Oregon, including the communities of Maupin, Tygh Valley, and Grass Valley. It encompasses Wasco and Sherman counties in Oregon.



The customers in this area include:

- Wasco Electric Cooperative (WEC)
- Columbia Basin Electric Cooperative
- Columbia Power Cooperative Association
- PacifiCorp

The DeMoss/Fossil load area is served by the following major transmission paths or lines:

- From the north by the Big Eddy-DeMoss 115 kV line
- From the west by the Big Eddy-Redmond 230 kV line (via WEC's Maupin-Fossil 69 kV line)

Local Generation and Load

The local generation includes The Dalles Dam (2084 MW), Seawest's Condon Wind (50 MW) and PaTu Wind (10 MW).

DeMoss and Fossil Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
DeMoss / Fossil	26	37	29	37	31	39

Proposed Plans of Service

DeMoss-Fossil Shunt Reactive Additions

- Description: This project adds a 69 kV shunt reactor (4 MVAR) at Fossil substation and a 69 kV shunt capacitor (3.5 MVAR) at DeMoss substation.
- Purpose: This project is required to maintain voltage schedules in the local area.
- Estimated Cost: $2,500,000
- Energization: 2018

Recently Completed Plans of Service

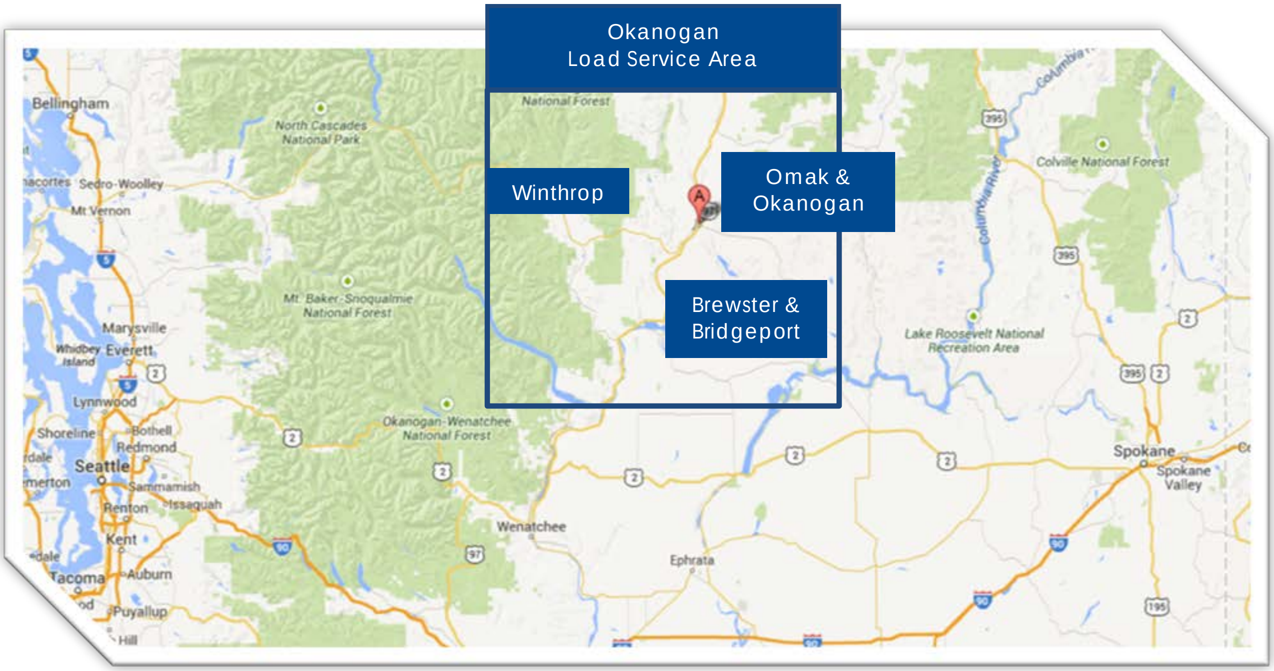
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

20 Okanogan Area

This area includes the Okanogan Valley area of north central Washington including the communities of Omak, Brewster, Bridgeport, Winthrop, Twisp, Pateros, Tonasket, and Okanogan.



The customers in this area include:

- Okanogan Public Utility District
- Okanogan Cooperative
- Douglas Public Utility District (Douglas)

The load area is served by the following major transmission paths or lines:

- Chief Joseph-East Omak 230 kV line
- Grand Coulee-Okanogan 115 kV line 1
- East Omak Tap to the Grand Coulee-Foster Creek 115 kV line
- Douglas Wells–Foster Creek 115 kV line

Local Generation and Load

Generation serving this load area includes:

- Chief Joseph Dam (2,614 MW)
- Grand Coulee Dam (7,079 MW)
- Wells Dam (851 MW)

Okanogan Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Okanogan	144	219	170	232	185	248

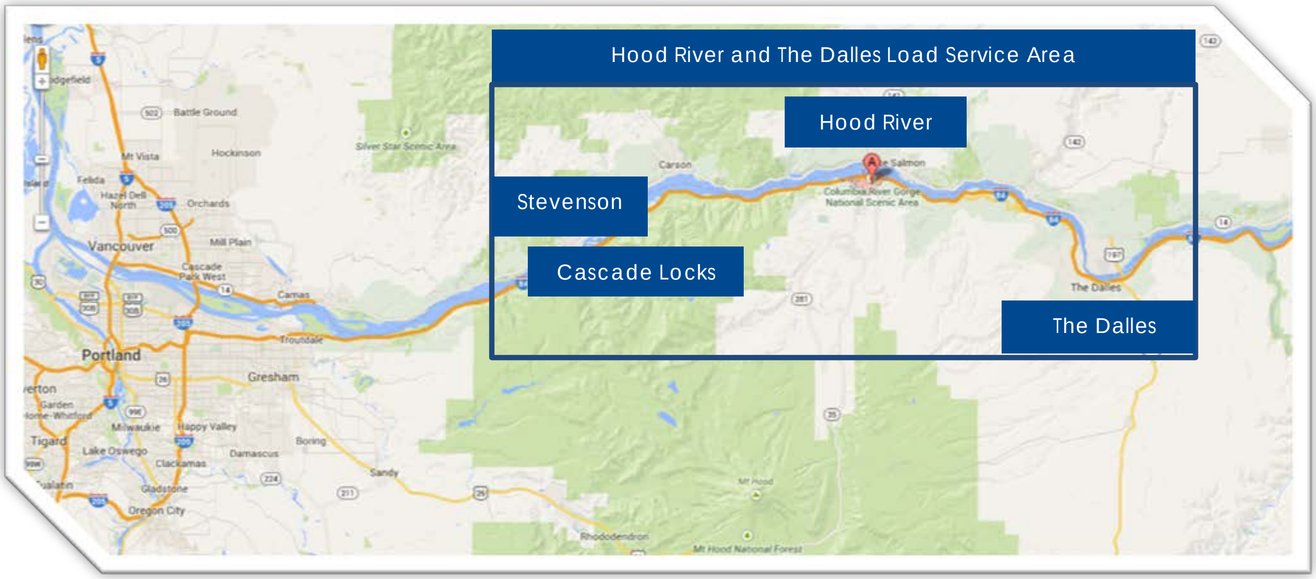
Proposed Plans of Service
There are no proposed projects for this area at this time.

Recently Completed Plans of Service
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service
There are no deferred plans of service for this area.

21 Hood River/The Dalles Area

The Hood River/The Dalles area includes portions of northern Oregon and southern Washington along the Columbia River Gorge. The area spans from Bonneville Dam to the west, to The Dalles Dam to the east. It includes the communities of Cascade Locks, Hood River and The Dalles in Oregon and Stevenson, Carson, White Salmon and Bingen in Washington.



The customers in this area (and the communities they serve) include:

- Klickitat County Public Utility District in White Salmon and Bingen
- Skamania County Public Utility District in Stevenson and Carson
- City of Cascade Locks in Cascade Locks
- PacifiCorp in Hood River
- Hood River Electric Coop in Hood River
- Northern Wasco Public Utility District in The Dalles
- USBR in The Dalles

The load area is served by the following major transmission paths or lines:

- Bonneville Powerhouse 1 – Alcoa 115 kV line
- Bonneville Powerhouse 1 – North Camas 115 kV line
- Bonneville Powerhouse 1 – Hood River 115 kV line
- Chenoweth 230/115 kV transformer
- Big Eddy-Chenoweth 115 kV line
- Big Eddy-The Dalles 115 kV line

Local Generation and Load

Generation (nameplate) serving this area includes:

- USACE Bonneville Powerhouse 1 and 2 (1225 MW)
- USACE The Dalles Powerhouse (2080 MW)
- SDS Lumber Generation (10 MW)
- Farmers Irrigation District Plant 2 (1.8 MW)

Hood River / The Dalles Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Hood River / The Dalles	211	274	227	286	232	295

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

22 Pendleton/LaGrande Area

This area includes the eastern Oregon communities of Pendleton and LaGrande.

The customers in this area include:

- Oregon Trail Electric Cooperative
- PacifiCorp
- Umatilla Electric Cooperative
- Columbia Basin Electric Cooperative

The load area is served by the following major transmission paths or lines:

- From the east by the LaGrande-(IPC) North Powder 230 kV line
- From the west by the McNary-Roundup 230 kV line

Local Generation and Load

The local generation in the area includes

- Horizon's Elkhorn Valley Wind Project (101 MW)

Pendleton / La Grande Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Pendleton /La Grande	123	122	137	138	139	141

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

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23 Walla Walla Area

This area includes the southeastern Washington city of Walla Walla and the southeastern Oregon community of Milton-Freewater to the south.

The customers in this area include:

- Columbia Rural Electric Association
- City of Milton-Freewater
- Umatilla Electric Cooperative
- Clearwater Power Co.
- Inland Power and Light
- PacifiCorp (PAC)

The load area is served by the following major transmission paths or lines:

- PAC Wanapum-Walla Walla 230 kV line
- PAC Wallula-Walla Walla 230 kV line
- IPC Walla Walla- Hurricane 230 kV line
- PAC Talbot-Walla Walla 230 kV line
- Franklin-Walla Walla 115 kV line
- Walla Walla-Tucannon River 115 kV line

Local Generation and Load

The local generation in this area includes:

- NextEra Energy Resources Stateline Wind (92 MW)
- Puget Sound Energy Hopkins Ridge Wind (157 MW)
- Infigen Combine Hills II Wind (63 MW)
- NextEra Energy Resources Vansycle Ridge Wind (25 MW)

Walla Walla load Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Walla Walla (BPA only)	70	63	91	66	95	68

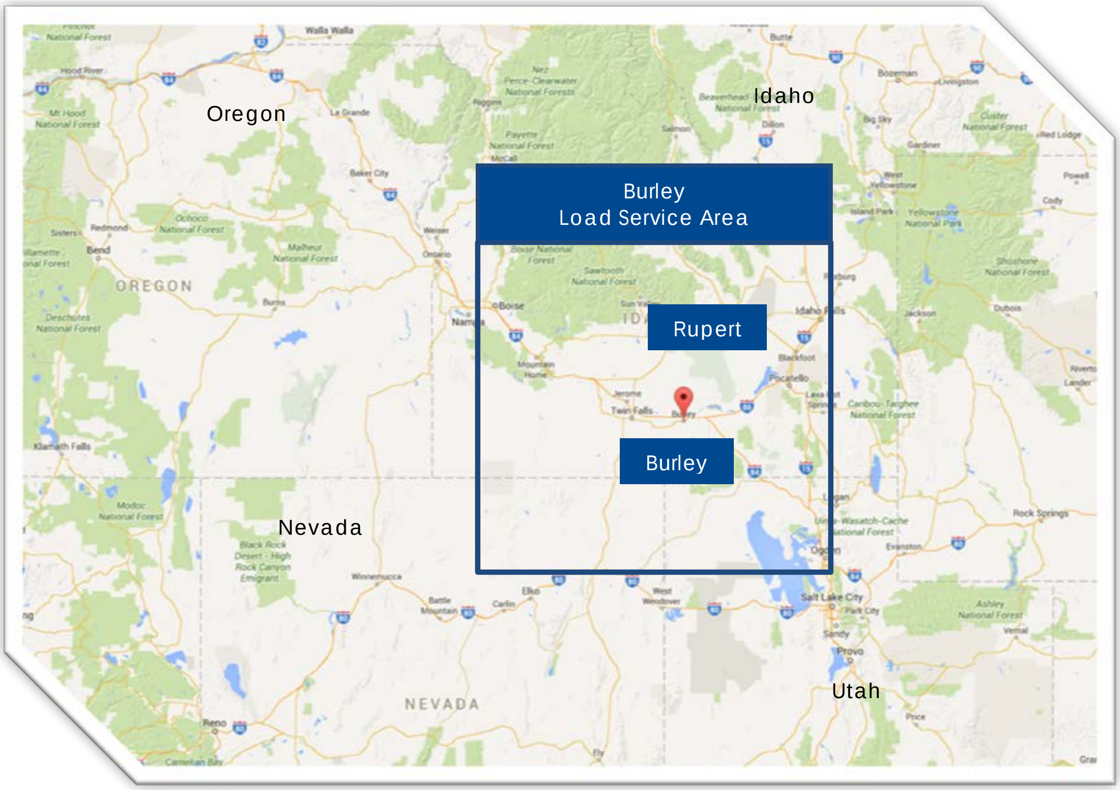
Proposed Plans of Service
There are no proposed projects for this area at this time.

Recently Completed Plans of Service
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service
There are no deferred plans of service for this area.

24 Burley Area (Southern Idaho)

The Burley area is located in Minidoka and Cassia counties in south central Idaho. This area includes the communities of Burley, West Burley, Riverton, Minidoka, Rupert, and Heyburn. The area load is mostly residential and irrigation. Loads peak during the summer due to the irrigation load component.



The customers in this area include:

- Idaho Power
- Raft River Electric Coop
- Riverside Electric
- South Side Electric
- United Electric Coop
- Wells Rural Electric
- U.S. Bureau of Reclamation
- Burley Irrigation District
- East End Mutual
- Farmers Electric
- The Cities of Albion, Burley, Declo, Heyburn, Rupert, and Minidoka

This load area is served primarily by Idaho Power transmission facilities.

Local Generation and Load

Local generation in this load service area includes, Minidoka Power House (28 MW), Milner Power Plant (58 MW), and Bridge Geothermal (13 MW).

The load area load forecast is:

Burley Area Peak Load Forecast (MW)						
Area	Historical Peak Load Summer – Winter		2020 Summer	2020 Winter	2024 Summer	2024 Winter
Burley	465	224	479	259	490	262

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

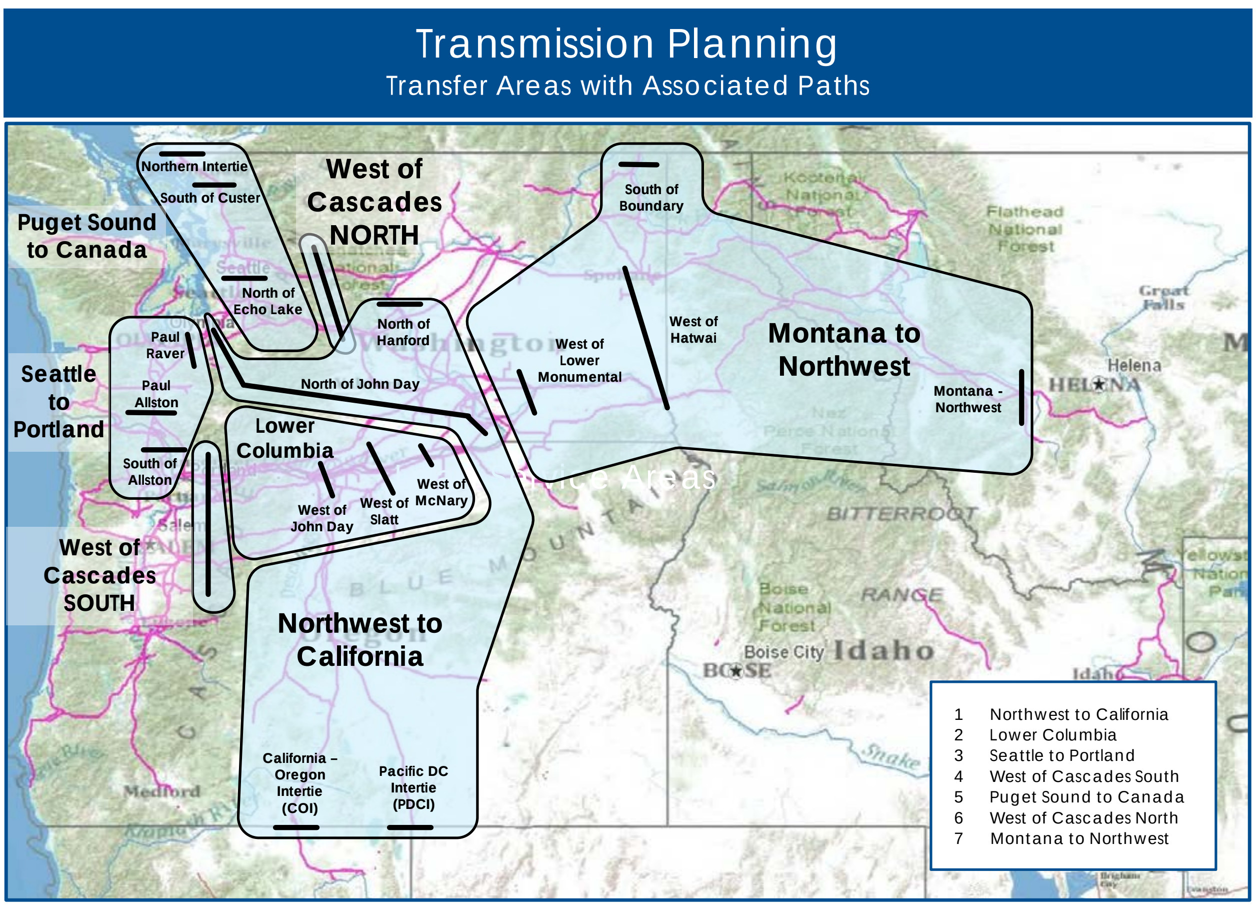
Unity138 kV Breaker Addition

- Description: This project replaces a 138 kV Motor Operated Disconnect (MOD) switch with a 138 kV circuit breaker at Unity Substation.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $1,000,000
- Energization: On Hold/Deferred

Transmission Needs by Transfer Areas and Paths

BPA's service territory includes 5 inter-regional transmission paths (interties) and 14 monitored paths or flowgates within the region (intra-regional). These 19 paths are grouped into 7 Transfer Areas. The paths and transfer areas are listed in the table below.

Transfer Areas	Paths/Flowgates
Northwest to California	California to Oregon Intertie
	Pacific DC Intertie
	North-of-John Day
	North-of-Hanford
Lower Columbia	West-of-McNary
	West-of-Slatt
	West-of-John Day
Seattle to Portland	Raver-Paul
	Paul-Allston
	South-of-Allston
West of Cascades South	West-of-Cascades South
Puget Sound to Canada	North-of-Echo Lake
	South-of-Custer
	Northwest-Canada
West of Cascades North	West-of-Cascades North
Montana to Northwest	West-of-Hatwai
	West-of-Lower Monumental
	Montana-to-Northwest
	South of Boundary



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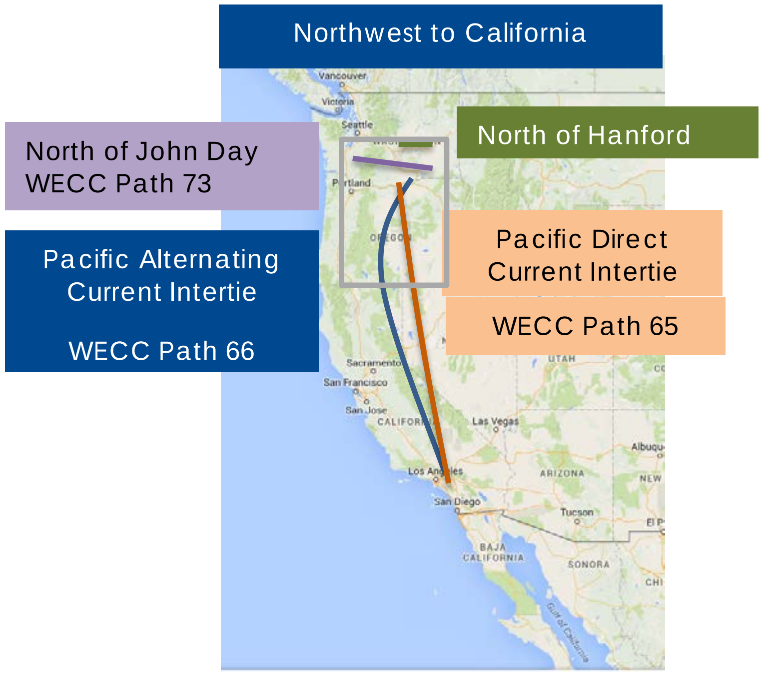
1 Northwest to California Transfer Area

The Northwest to California (NW-CA) paths are the core main grid facilities that support the transfer of power between the Pacific Northwest and California. These paths are bi-directional and have multiple uses. However, the most prevalent use is to transfer power in the north to south direction.



➢ California-Oregon AC Intertie WECC Path 66

Description

This path is the alternating current (AC) Intertie between Oregon and California. The path is monitored at the Oregon-California border south of Malin and Captain Jack Substations.

The path includes the following lines:

- Malin-Round Mountain 500 kV lines 1 and 2
- Captain Jack-Olinda 500 kV

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

➢ Pacific DC Intertie WECC Path 65

Description

This path is the direct current Intertie between Oregon and California and consists of a 500 kV high voltage direct current (HVDC) connection from BPA's Celilo Substation in Oregon to the Los Angeles Department of Water and Power's (LADWP) Sylmar Substation in California.

The path includes the following lines:

- 500 kV multi-terminal D.C. system between Celilo and Sylmar

Proposed Plans of Service

PDCI Uprate

- Description: This project replaces the converters at the Celilo HVDC terminal and re-conductors a section of the DC transmission line.
- Purpose: This project will increase the capacity of the Pacific DC Intertie.
- Estimated Cost: $362,000,000
- Energization: 2016 (Celilo DC upgrade only)

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

➢ North of John Day WECC Path 73

Description

This path is located north of John Day Substation in Oregon. The path includes the following lines:

- Raver-Paul 500 kV
- Wautoma-Ostrander 500 kV
- Wautoma-Rock Creek 500 kV
- Ashe-Marion 500 kV line 2
- Ashe-Slatt 500 kV line 2
- Lower Monumental-McNary 500 kV

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

West of McNary Reinforcement – Refer to project description under Recently Completed Plans of Service for the West of McNary Path under the Lower Columbia transfer area section. This project was completed in 2015.

Deferred Plans of Service

There are no deferred plans of service for this area.

North of Hanford

Description

This path is located north of Hanford substation between Hanford and Grand Coulee. This path includes the following lines:

- Grand Coulee-Hanford 500 kV line 1
- Schultz-Wautoma 500 kV line 1
- Vantage-Hanford 500 kV line 1

Proposed Plans of Service

No projects are proposed for this path at this time.

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

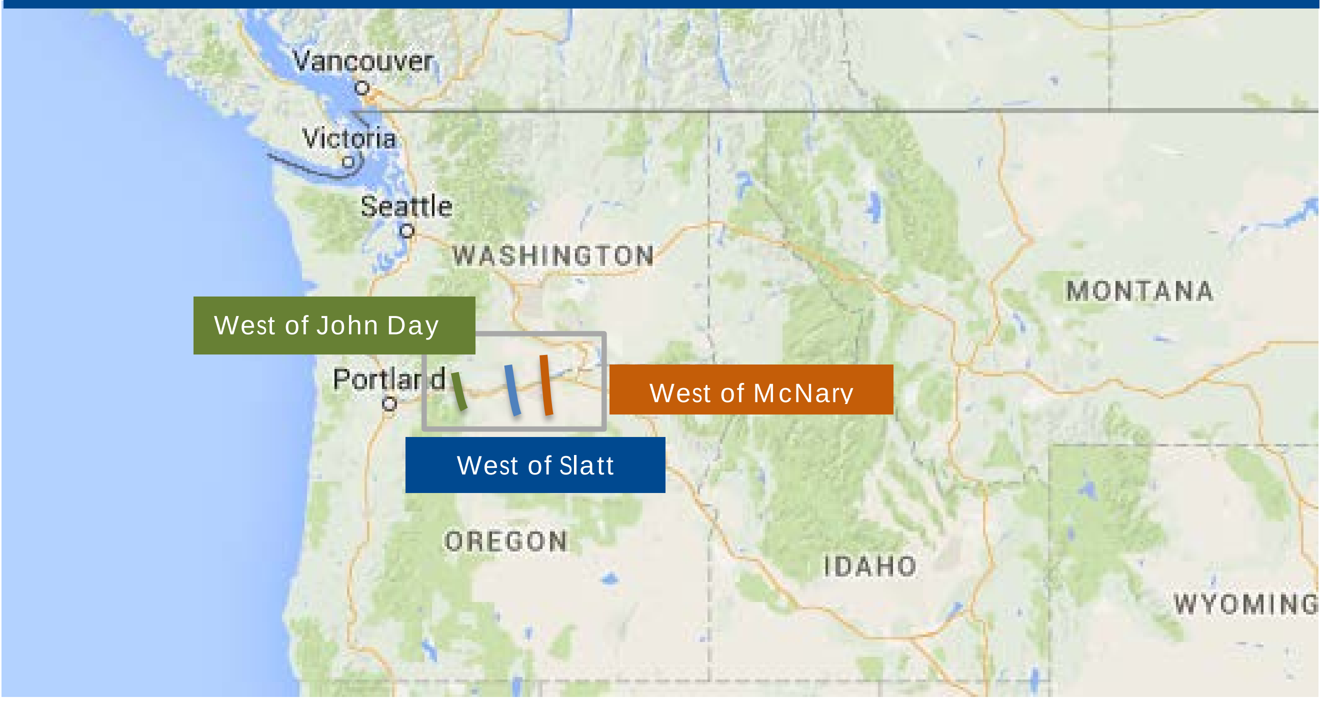
Deferred Plans of Service

There are no deferred plans of service for this area.

2 Lower Columbia Transfer Area

The Lower Columbia Transfer Area includes the area along the lower Columbia River east of Umatilla, Oregon and west to The Dalles, Oregon. It includes the West of McNary (WOM), West of Slatt (WOS) and West of John Day (WOJ) paths. All three paths peak during the spring and summer months with power flowing in the east to west direction. All three paths are in series, but do not necessarily peak simultaneously due to a unique geographic interconnection of generation in the Lower Columbia area. There are large generation hubs of hydro, wind and thermal plants between each path that can operate independently and create non-simultaneous peak flow conditions on each path.

Lower Columbia



➢ West of McNary

Description

This path is located between McNary and Slatt substations in Oregon.

This path includes the following lines:

- McNary-John Day 500 kV line 2
- McNary-Ross 345 kV line 1
- Harvalum-Big Eddy 230 kV line 1
- Jones Canyon-Santiam 230 kV line 1
- Coyote Springs-Slatt 500 kV line 1

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service
West of McNary Reinforcement

- Description: This proposed project includes a new 500 kV transmission line (approximately 28 miles) between Big Eddy substation and a new 500 kV substation (Knight). Knight Substation is a new 500 kV substation near Goldendale, Washington, along the Wautoma-Ostrander 500 kV transmission line.
- Purpose: This proposed project addresses the issue of meeting the FERC Open Access requirements by building the necessary transmission facilities to accommodate requests for firm transmission service across BPA's network. The project also addresses the issue of increased reliability to loads in the southwest Washington and Willamette Valley vicinity.
- This project was identified in the 2008 Network Open Season.
- Estimated Cost: $201,000,000
- Energization: 2015

Deferred Plans of Service

There are no deferred plans of service for this area.

➢ West of Slatt

Description
This path is located between Slatt and John Day Substations in Oregon.

This path includes the following lines:

- Slatt-John Day 500 kV line 1
- Slatt-Buckley 500 kV line 1

Proposed Plans of Service
There are no proposed projects for this area at this time.

Recently Completed Plans of Service
<u>West of McNary Reinforcement</u> – Refer to project description under Recently Completed Plans of Service for the West of McNary Path. This project was completed in 2015.

Deferred Plans of Service
There are no deferred plans of service for this area.

➢ West of John Day

Description
This path is located between John Day Substation and The Dalles Substation in Oregon.

This path includes the following lines:

- John Day-Big Eddy 500 kV line 1
- John Day-Big Eddy 500 kV line 2
- John Day-Marion 500 kV line 1

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

West of McNary Reinforcement – Refer to project description under Recently Completed Plans of Service for the West of McNary Path. This project was completed in 2015.

Deferred Plans of Service

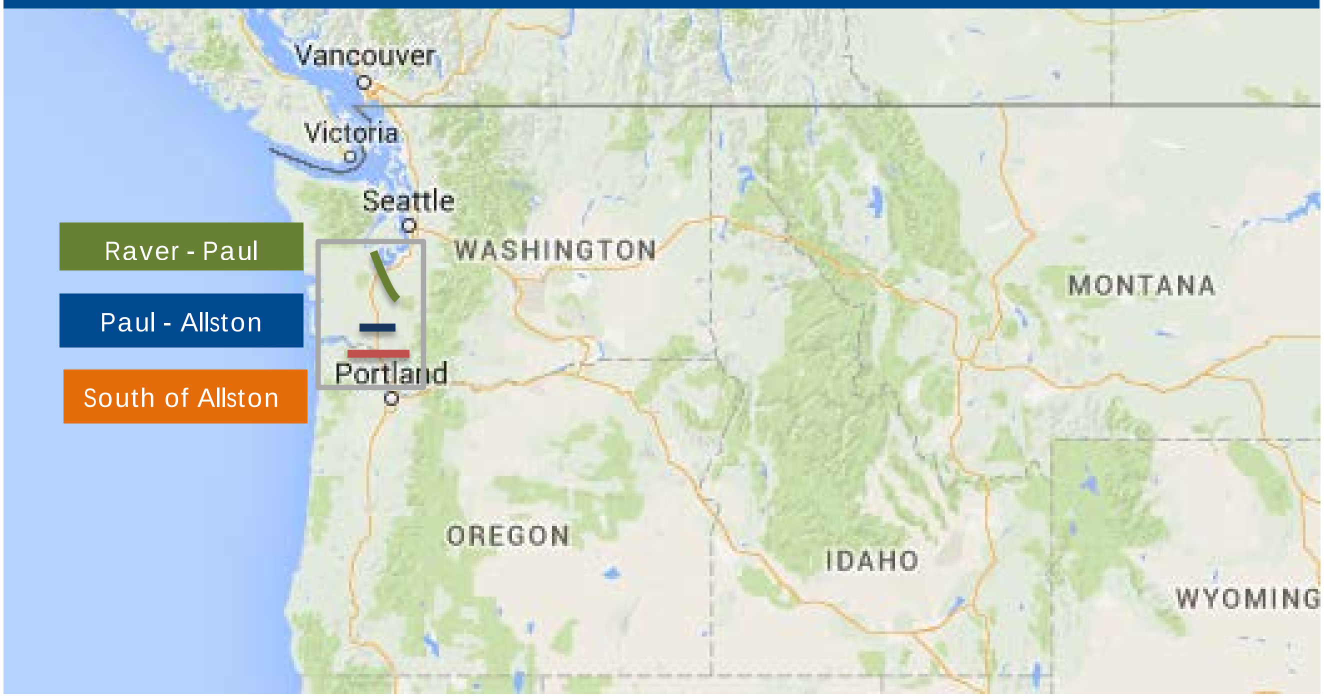
There are no deferred plans of service for this area.

3 Seattle to Portland Transfer Area

The Seattle to Portland Transfer Area is located west of the Cascade Mountains and roughly follows the I-5 Corridor. This Transfer Area includes the following paths: Raver-Paul (RP), Paul-Allston (PA), and South of Allston (SOA).

The Seattle to Portland Transfer Area is the primary transmission corridor between the two largest northwest load centers. Flows between Seattle and Portland are impacted not only by load service, but also by the schedules on the series paths just to the north (Northern Intertie) and south (COI and PDCI). An adjacent path which also impacts this Transfer Area is West of Cascades South (WOCS).

Seattle to Portland



➢ Raver-Paul

Description
This path is located between Raver and Paul Substations in western Washington.

This path includes the following line:

- Raver-Paul 500 kV Line 1

Proposed Plans of Service
There are no proposed projects for this area at this time.

Recently Completed Plans of Service
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service
There are no deferred plans of service for this area.

➢ Paul-Allston

Description
The I-5 Corridor transmission system extends from the Canadian border to the California border west of the Cascades Mountain Range. This portion of the path extends roughly from Chehalis, Washington to Rainier, Oregon. This path provides load service to the Willamette Valley. There are long-standing congestion issues with this path. The path includes the following lines:

- Paul-Allston 500 kV line 2
- Napavine-Allston 500 kV line 1

Proposed Plans of Service
I-5 Corridor Reinforcement Project – Refer to project description under Proposed Plans of Service for the South of Allston Path below.

➢ South of Allston WECC Path 71

Description
The I-5 Corridor transmission system extends from the Canadian border to the California border west of the Cascades Mountain Range. This portion of the path is located south of Allston Substation in Northwest Oregon. This path provides both load service to the Willamette Valley as well as accommodating transmission service requests.

There are long-standing congestion issues with this path. The path includes the following facilities:

- Allston-Keeler 500 kV
- Portland General Electric Trojan-Rivergate 230 kV
- Portland General Electric Trojan-St. Marys 230 kV
- Ross-Lexington 230 kV
- St.Helens-Allston 115 kV
- PacifiCorp Merwin-St. Johns 115 kV
- PacifiCorp Astoria-Seaside 115 kV
- Clatsop 230/115 kV

Proposed Plans of Service

Pearl 500 kV Upgrades

- Description: This project adds a 500 kV circuit breaker at Pearl Substation and re-terminates the Pearl 500/230 kV transformer No. 2 into the new bay position.
- Purpose: This project will improve system reliability for the South of Allston path.
- Estimated Cost: $2,100,000
- Energization: 2016

I-5 Corridor Reinforcement Project

- Description: This proposed project includes a new 500 kV transmission line (approximately 70 miles) between a new substation in the vicinity of Castle Rock, Washington and a new substation in Troutdale, Oregon.

- Purpose: This project addresses the issue of providing reliable service to loads in southwest Washington and northwest Oregon. This project also meets the FERC Open Access requirements by building the necessary transmission facilities to accommodate requests for firm transmission service across BPA's network.
- This project was identified in the 2008 Network Open Season.
- Estimated Cost: $722,000,000
- Energization: 2021

Recently Completed Plans of Service

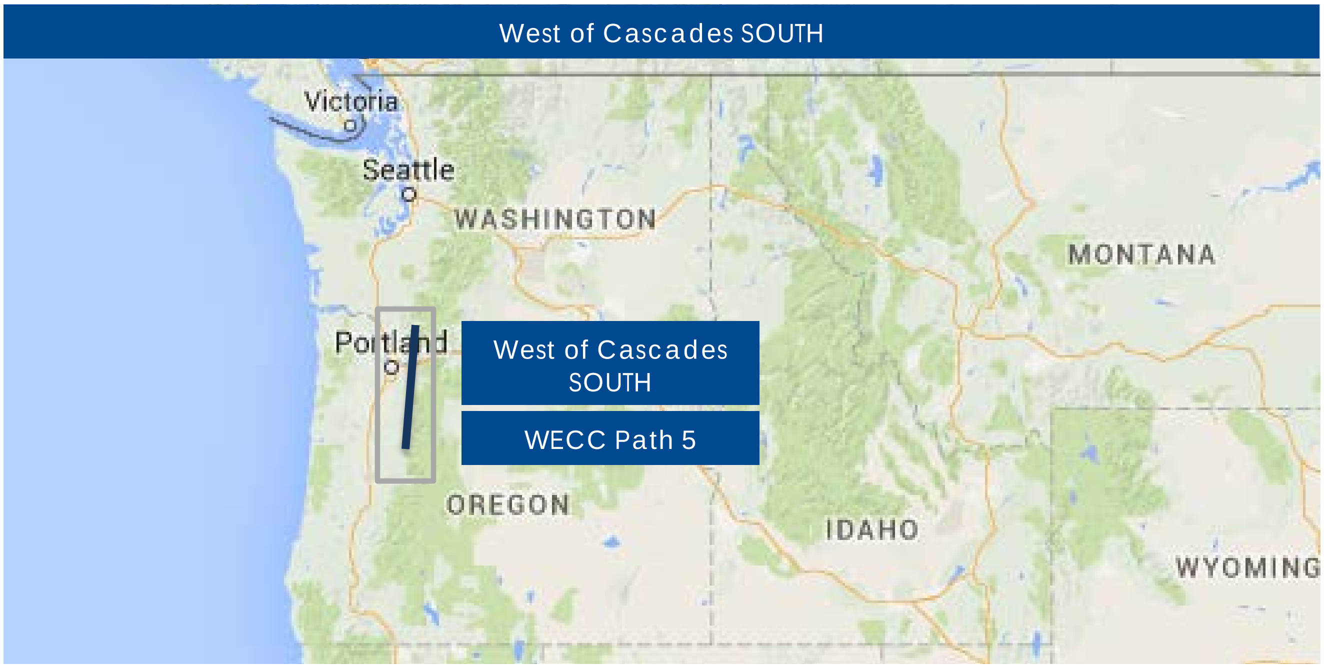
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

4 West of Cascades South Transfer Area

The West of Cascades South Transfer Area includes only the West of Cascades south (WOCS) path. This is a load serving east to west path that transfers power across the Cascades Mountains from Central Washington and northern Oregon to southwest Washington, the Willamette Valley and the Oregon Coast load centers. The WOCS path flow is always in the east to west direction and primarily winter peaking. For spring and early summer operation, high flows on the WOCS path typically occur when there is surplus hydro and wind generation east of the Cascades and thermal generation in the Southwest Washington/Northwest Oregon area is off-line for maintenance or other reasons.



➢ West-of-Cascades South WECC Path 5

Description

This path spans the southern portion of the Cascade Mountains between eastern and western Oregon. The path includes the following lines:

- Big Eddy-Ostrander 500 kV line
- Ashe-Marion 500 kV line 2
- Buckley-Marion 500 kV line 1
- Wautoma-Ostrander 500 kV
- John Day-Marion 500 kV
- McNary-Ross 345 kV
- Big Eddy-McLoughlin 230 kV
- Big Eddy-Chemawa 230 kV
- Midway-North Bonneville 230 kV
- Jones Canyon-Santiam 230 kV
- Big Eddy-Troutdale 230 kV
- Portland General Electric Round Butte-Bethel 230 kV

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

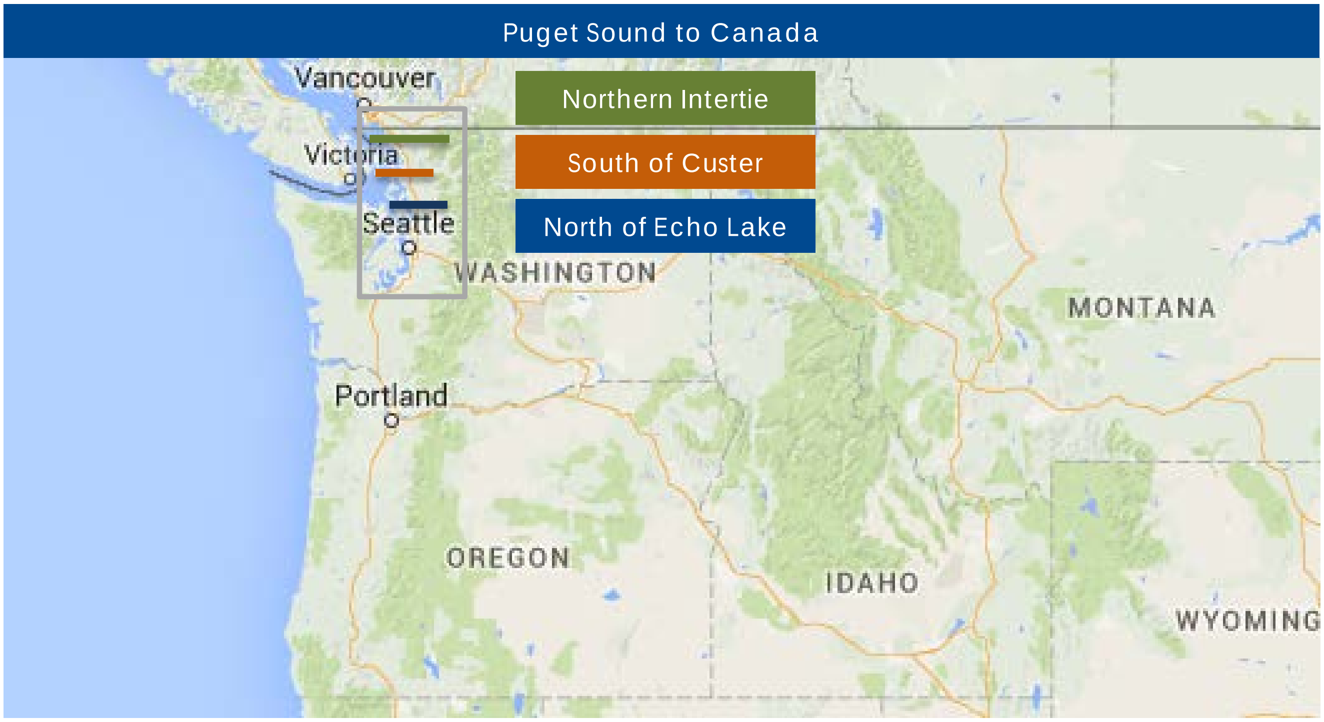
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

5 Puget Sound to Canada Transfer Area

This transfer area includes paths between the Puget Sound area and Canada. Flows from the US to Canada are primarily captured by monitoring the main grid circuits from Northwestern Washington to the US-Canada border. These transfers are critical because they flow though and parallel to the local network of the largest load center in the Pacific Northwest, the Puget Sound. Adjacent paths not included in this transfer area that have direct or indirect impacts include West of Cascades North (WOCN) and Raver-Paul. WOCN can sometimes impose flow limitations. The Puget Sound to Canada Transfer Area includes the North of Echo Lake (NOEL) South of Custer (SOC) and Northern Intertie West (NI-W) paths.



➢ North of Echo Lake

Description

This path is located north of Echo Lake Substation in the Puget Sound area of Washington. This path includes the following lines:

- Echo Lake-Maple Valley 500 kV lines 1 and 2
- Echo Lake-Snoking-Monroe 500 kV line
- Covington-Maple Valley 230 kV line 2

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

➢ South of Custer

Description

This path is located south of Custer Substation in the Bellingham area of Washington State.

This path includes the following lines:

- Monroe-Custer 500 kV lines 1 and 2
- Custer-Bellingham 230 kV line 1
- Custer-Murray 230 kV line 1

Proposed Plans of Service

There are no proposed projects for this area at this time.

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

➢ Northwest to British Columbia (Northern Intertie) WECC Path 3

Description

This path is the intertie between the United States and Canada. It has a western and an eastern component.

This path includes the following lines:

Western component:

- Custer (BPA)-Ingledow (BCTC) 500 kV No. 1
- Custer (BPA)-Ingledow (BCTC) 500 kV No. 2

Eastern Component:

- Boundary (BPA)-Waneta (TECK) 230 kV
- Boundary (BPA)-Nelway (BCTC) 230 kV

Proposed Plans of Service

<u>Monroe 500 kV Line Re-terminations</u>

- Description: This project reconfigures Monroe Substation by developing a new 500 kV bay and re-terminating the Custer and Chief Joseph 500 kV lines.
- Purpose: This project will increase reliability and capacity on the Northern Intertie.
- Estimated Cost: $5,700,000
- Energization: 2018

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

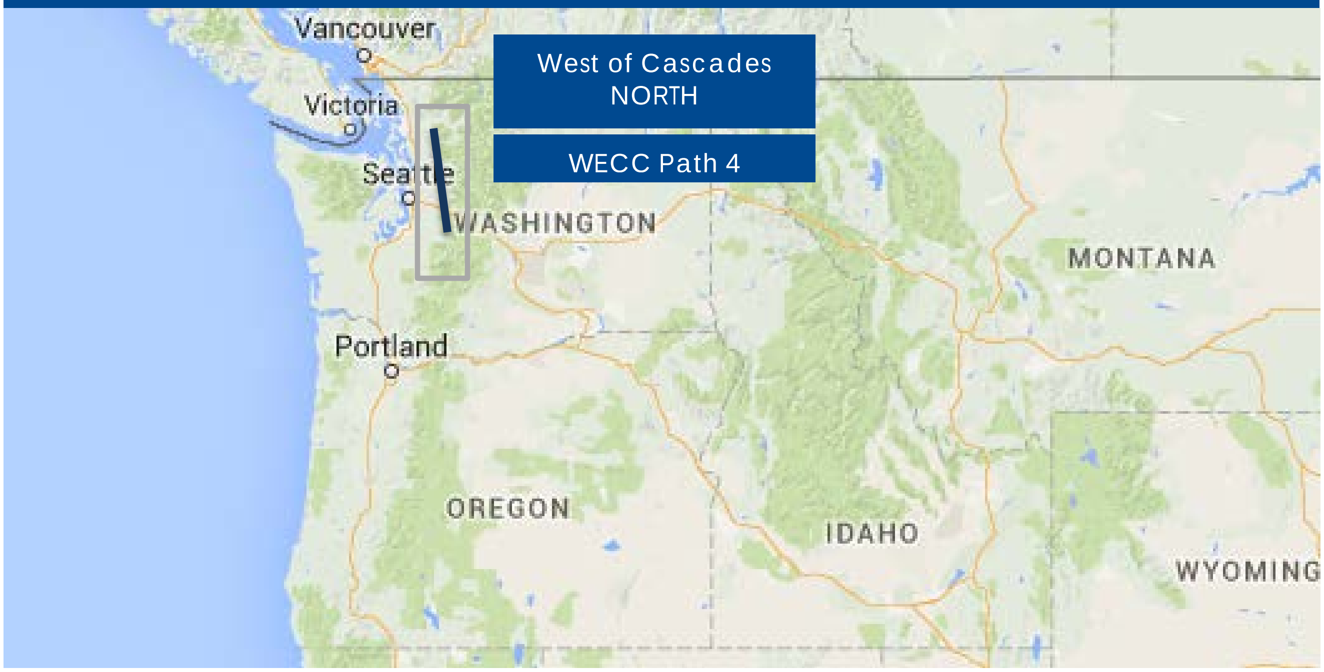
Deferred Plans of Service

There are no deferred plans of service for this area.

6 West of Cascades North Transfer Area

The West of Cascades North Transfer Area includes the single West of Cascades North (WOCN) path. The path monitors east-to-west transfers that primarily serve load in Northwest Washington. These transfers are critical to reliable load service because the load centers in NW Washington and the Puget Sound are the largest in the entire Pacific Northwest. The path typically peaks during winter conditions when the load centers in NW Washington peak. High flows can also occur in the spring and summer months with surplus generation conditions east of the Cascades or with large amounts of generation offline in western Washington; however the flows are significantly less than the winter conditions. The large generation hubs in the east include Upper Columbia hydro generation, Mid-Columbia hydro, and eastern wind plants.

West of Cascades NORTH



➢ West of Cascades North WECC Path 4

Description

This path spans the northern portion of the Cascade Mountains between eastern and western Washington. The path includes the following lines:

- Chief Joseph-Monroe 500 kV line
- Schultz-Raver 500 kV line 1
- Schultz-Raver 500 kV line 3
- Schultz-Raver 500 kV line 4
- Schultz-Echo Lake 500 line
- Chief Joe-Snohomish 345 kV line 3
- Chief Joe-Snohomish 345 kV line 4
- Rocky Reach-Maple Valley 345 kV line
- Coulee-Olympia 300 kV line
- Puget Sound Energy Rocky Reach-Cascade 230 kV
- Bettas Road-Columbia 230 kV line 1

Proposed Plans of Service

Schultz-Raver 500 kV No.3 & No.4 Series Capacitors

- Description: This project adds 500 kV series capacitors at Schultz substation on the Schultz-Raver 500 kV No.3 and No.4 lines.
- Purpose: This project is required to increase capacity on the West of Cascades North path.
- Estimated Cost: $35,000,000
- Energization: beyond 2021

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

7 Montana to Northwest Transfer Area

Flows across the Montana to Northwest transfer area are captured by monitoring three paths, the Montana-Northwest path (MT-NW), West-of-Hatwai path (WOH), and the West-of-Lower Monumental path (WOLM). In addition, flows from Boundary to Bell substation that also flow across the WOH path are captured by monitoring the South-of-Boundary path (SOB). The MT-NW path is a multiple owner path and includes facilities owned by BPA, NorthWestern Energy (WOH), and Avista (AVA). NorthWestern Energy is the path operator for the MT-NW and therefore conducts assessments of the transfer capability limits for the path. The SOB path transfers local generation at Boundary Dam to and from Canada at Nelway.

Montana to Northwest

➢ Montana-Northwest (MT-NW) WECC Path 8

Description

This path is the intertie between Montana and the Northwest. It includes Northwest Energy (NWE), Avista and Bonneville (BPA) lines.

This path includes the following lines:

- Broadview – BPA Garrison 500 kV line 1
- Broadview – BPA Garrison 500 kV line 2
- Mill Creek – BPA Garrison 230 kV line
- Mill Creek – BPA Anaconda 230 kV line
- Ovando – BPA Garrison 230 kV line
- Placid Lake – BPA Hot Springs 230 kV line
- Rattlesnake 230/161 kV transformer

- Kerr – BPA Kalispell 115 kV line
- Thompson Falls – Avista Burke 115 kV line
- Crow Creek –Avista Burke 115 kV line

Proposed Plans of Service
There are no proposed projects for this area at this time.

Recently Completed Plans of Service
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service
There are no deferred plans of service for this area.

Montana to Washington
The 2010 Network Open Season identified some reinforcements to the transmission system between Montana and Washington (M2W) primarily series and shunt compensation that would be needed to accommodate the transmission service requests. The M2W project was proposed to increase available transmission capacity from BPA's Garrison Substation in western Montana to power markets west of the Cascades.

In September 2014, BPA was informed that most of the transmission service requested by customers was no longer needed. This change in circumstances eliminated almost all of the demand to increase available transmission capacity on this part of the system and the need for the M2W Project. Accordingly, after a thorough examination of its obligations and fiscal responsibilities, BPA has decided to no longer pursue the proposed M2W Project. If in the future sufficient demand for transmission service between western Montana and power markets west of the Cascades emerges, BPA would reconsider system expansion at that time.

➢ West of Hatwai (WOH) WECC Path 6

Description
This path is located between northern Idaho (Lewiston area) and eastern Washington.

The path includes the following lines:

- Hatwai – Lower Granite 500 kV line
- Bell – Grand Coulee 230 kV lines 3 and 5
- Westside – Grand Coulee 230 kV line
- PAC Dry Creek – Talbot 230 kV line
- Bell – Creston 115 kV line
- North Lewiston – Tucannon River 115 kV line
- Avista Harrington – Odessa 115 kV line
- Avista Lind – Avista Roxboro 115 kV line
- Avista Dry Gulch 115/69 kV line
- Bell – Grand Coulee 500kV

Proposed Plans of Service
Refer to the project description under Proposed Plans of Service for the Montana to Northwest Path above.

Recently Completed Plans of Service

There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service

There are no deferred plans of service for this area.

➢ West of Lower Monumental (WOLM)

Description
This path is between Lower Monumental and McNary Substations.

This path includes the following lines:

- Lower Monumental-Ashe 500 kV line
- Lower Monumental-Hanford 500 kV line
- Lower Monumental-McNary 500 kV line

Proposed Plans of Service
There are no proposed projects for this area at this time.

Recently Completed Plans of Service
Central Ferry-Lower Monumental 500 kV Line

- Description: This proposed project includes a new 500 kV transmission line (approximately 40 miles) between a new Central Ferry Substation located southeast of Little Goose Dam and the existing Lower Monumental Substation.
- Purpose: This project is required to increase capacity from Central Ferry to Lower Monumental in order to accommodate transmission service requests associated with new wind generation.
- **This project was identified in the 2008 Network Open Season.**
- Estimated Cost: $92,000,000
- Energization: 2015

Deferred Plans of Service
There are no deferred plans of service for this area.

➢ South of Boundary (SOB)

Description
This path is south of Boundary Substation in northeastern Washington.

This path includes the following lines:

- Bell-Boundary 230 kV lines 1 and 3
- Usk-Boundary 230 kV line
- Usk-Bell 230 kV line

Proposed Plans of Service
There are no proposed projects for this area at this time.

Recently Completed Plans of Service
There are no projects that have been completed in this area since the previous planning cycle.

Deferred Plans of Service
There are no deferred plans of service for this area.

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Generator Interconnections

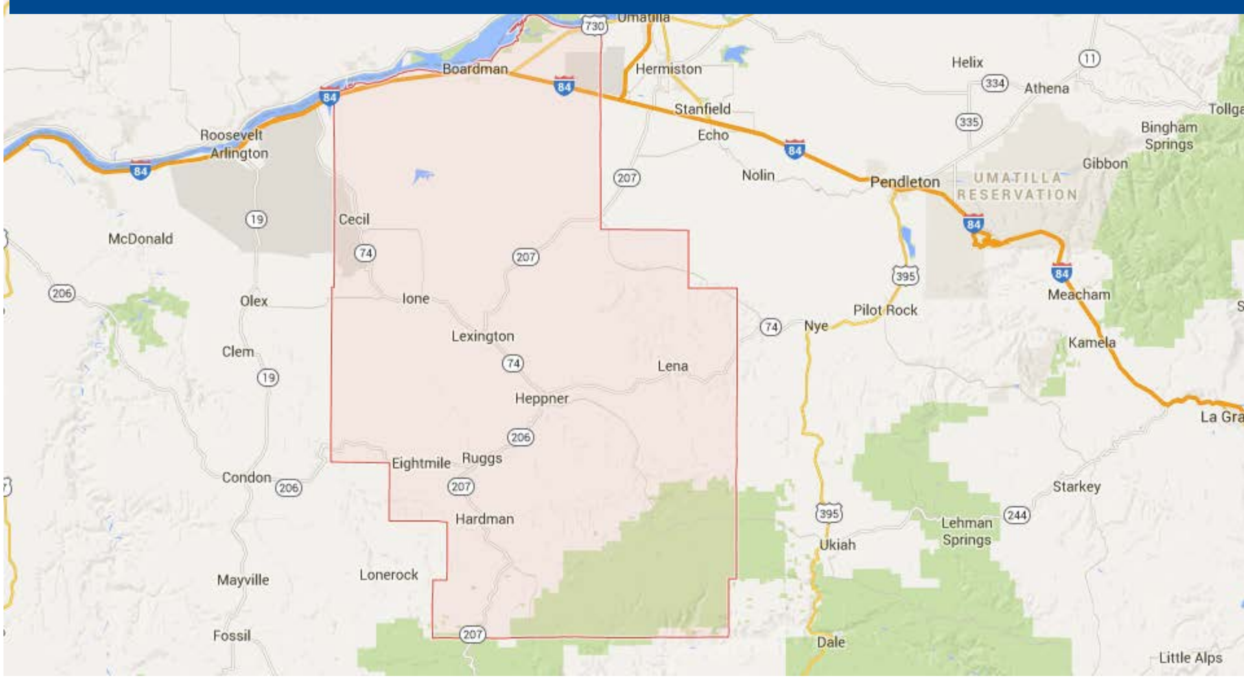
The project(s) provided in this section include those that have a requested generator interconnection greater than 20 MW and have an executed Large Generator Interconnection Agreement (LGIA). These projects have a well-defined plan of service, a reasonable estimate of cost and schedule.

Portland Area Generator Interconnections

Portland General Electric (PGE) Carty Combined-Cycle Combustion Turbine (CCCT) and Carty Increment

- Description: PGE submitted two requests to interconnect its proposed CCCT generating plant project to the BPA transmission system. The first request is for a maximum of 464 MW was submitted and entered into BPA request queue at G0380. The second request is for 36 MW and is G0457. The point of interconnection is at BPA’s Slatt Substation. The project is located in Morrow County, Oregon about 13 miles southwest of Boardman, Oregon and about one miles west of PGE’s Boardman plant. These interconnection requests have signed service agreements with BPA.
- Purpose: The new 500 MW request will accommodate the construction of a new 500 kV substation named Grasslands and a new generating project referred to as Carty. PGE will interconnect to BPA’s Slatt 500 kV substation via PGE’s existing Boardman-Slatt 500 kV transmission line.
- Estimated Cost: $1,024,000
- Energization: 2016

Generation Interconnections



Line & Load Interconnections

The projects in this section include projects that have a requested a line and load interconnection. Similar to the generator interconnections above, BPA has only included those line and load interconnections which have a significant impact to the BPA transmission system and for which there are executed construction agreements with the customer.

Proposed

PacifiCorp Canby Interconnection (L0349)

- Description: This project will add a new 69 kV bay at the Canby substation. This will accommodate two new 69 kV line positions.
- Purpose: Provide requested interconnection to the transmission customer.
- Estimated Cost and energization: Contingent on customer agreements. The interconnection requests (L0349) was withdrawn because BPA and PacifiCorp agreed to proceed with the interconnection as a joint project.

Recently Completed

La Pine-Benham Falls 115 kV Line Interconnection (L0296)

- Description: This project will add a new 115 kV bay at BPA's La Pine Substation to interconnect Mid-State Electric's new 115 kV line to Benham Falls. Reference L0296.
- Purpose: Provide requested interconnection to the transmission customer.
- Estimated Cost: $1,341,886
- Energization: 2015 – BPA completed the substation.

Umatilla Electric Coop Line and Load Phase 1 (L0337, L0340, L0342, L0351, L0352)

- Description: This project constructs a new 230/115 kV substation called Morrow Flats about 1.3 miles east of BPA's existing Boardman Substation. This project loops in two 230 kV lines and adds one 230/115 kV transformer. This also includes a new 230/115 kV transformer at McNary and 230 kV line upgrades.
- Purpose: The project is necessary to accommodate load additions in the Boardman/Hermiston area.
- Estimated Cost: $44,100,000
- Energization: 2015

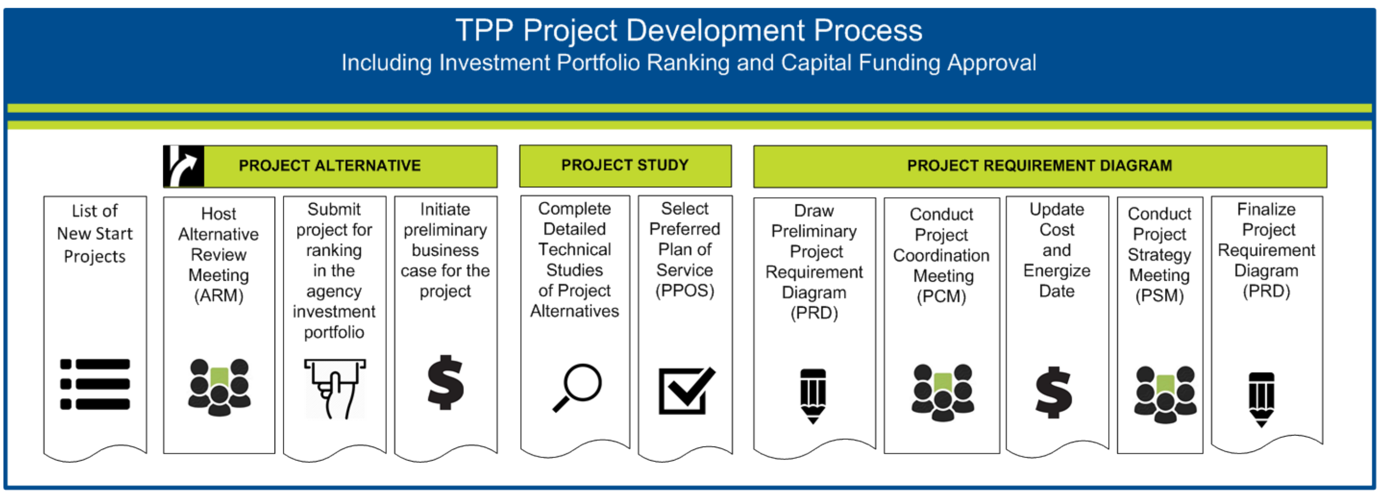
Project Development

Objective

There are two primary objectives of project development. One is to identify system problems and potential solutions and the second is to begin the preliminary steps to seek capital funding approval of a project.

Process

Transmission Planning's project development process begins after the annual system assessment is complete. In the fall each year, transmission projects are identified, detailed technical studies of project alternatives follow, preferred plans of service are selected, cost and risks are calculated, and project requirement diagrams (PRDs) are completed by year end.



The diagram above shows highlights of the current project development process. For each potential project, Transmission Planning conducts a series of meetings with team members from other internal departments. Transmission Planning's first meeting is the alternative review meeting (ARM). The purpose is to develop a list of alternatives that Transmission Planning will study in more detail. Also, the potential risks associated with the project alternatives are discussed. Later in project development process Transmission Planning initiates a project coordination meeting (PCM), which is an intermediate step to developing a plan of service. In this meeting Transmission Planning seeks information about space in the substation, control house space, relay protection packages, communications pathways as well as cost and schedule. The last meeting is the project strategy meeting (PSM). Transmission Planning convenes a PSM for all projects that are complex or will take multiple years to complete. The purpose of the PSM is to provide others the opportunity to provide input on the proposed plan of service (PPOS).

Transmission Planning conducts detailed technical studies of a project's alternatives. The detailed technical study evaluates the technical performance of each alternative and how well each alternative fits into the long-range plan for the area. Sensitivity studies are done as well to determine the worst season and pattern for generation and transfers. The study identifies the project need date.

After the project alternatives are studied, a PPOS is selected. Selecting a PPOS is a compromise among electrical or technical performance, risk assessment, and financial analysis. The electrical or technical performance considers reliability and robustness; operability, maintainability, and constructability; and flexibility to meet changing conditions. The risk assessment considers probabilities and consequences, environmental impacts, and public and legal considerations. The financial analysis considers the initial investment, net present value and cash flow considerations.

After a project's PPOS is selected, a preliminary PRD is drafted, which is a diagram of the PPOS. A PRD is intended to show the overall plan of service and is not to reflect "as built" conditions. The PRD is circulated for comments

During the project development process, Transmission Planning, in collaboration with others, develops cost, benefits and risk associated with a project. Transmission Planning takes the first step to submit a potential project so that it can be ranked in the agency Capital Investment Portfolio (CIP) (a.k.a. prioritization) against other agency projects. The purpose of CIP is to rank the cost and benefits of all projects, using specific metrics, to optimize the agency investment portfolio. Many projects in Transmission Planning are considered expansion investments and are built for compliance purposes. Expansion investments are those that grow the asset base meaning it adds capacity or new capabilities, or that it increases operational output or productivity. These projects are typically funded first along with investments that sustain or replace existing assets in order to maintain system performance or capability.

Also, Transmission Planning, in collaboration with other internal works groups, develops a business case for a proposed project. A project must be authorized by the appropriate approval body. Transmission Planning eventually seeks capital funding approval of a project. Once the project is approved it moves into the design phase. From this point forward, Transmission Planning moves into a support role providing information about the project when called upon.

A list of Transmission Planning projects with expected in-service dates and investment category is provided in the Appendix.

BPA Project Delivery Information

BPA is actively working toward improving the capital project delivery process. Before Project Delivery Information (PDI), Lean and Stream began as separate efforts to improve the capital project delivery processes. Lean was a project delivery system designed to provide a standard, thorough approach to early scope definition and subsequent stages of aligned execution and funding. Stream was about creating a project information system that would be accessible, relevant, reliable and easily managed. Putting these strategies in action came to be known as Project Delivery Implementation (PDI). Findings from BPA's Lean 2 and 3 lessons learned exercise resulted in the Project Delivery implementation. Transmission Planning is a member of the Project Definition Team (PDT). The PDT will screen proposed projects to determine appropriate scoping levels and stage gates. The PDT will also set scoping expectations, including deliverables and due dates for individual scoping efforts.

Research and Development

BPA's research agenda is guided by a process that identifies the agency's immediate and future capability gaps and pinpoints technologies with the potential to resolve those business challenges. This process includes the development of technology roadmaps, which provide BPA a framework to help plan, coordinate and forecast technology developments so the agency can focus its R&D investments in areas that deliver the most value to the agency and its stakeholders. Transmission Planning's contribution to Research and Development is in many areas such as power system modeling, power system performance evaluation, validation and use of synchrophasors.

Synchrophasors

On August 14, 2003, a power failure in Ohio triggered a chain reaction in the United States and Canada. The cascading outage left millions of people in eight Midwest and Northeast states in the dark. The cascading effect ultimately shut down more than 100 power plants. Due to a computer failure, which stalled the alarm system, grid operators did not realize what was happening until it was too late. In the aftermath, this raised serious concerns about the state of the nation's electric grid. It also reinforced the value of time-synchronized measurements for enhanced situational awareness.

A decade later, smart grid devices known as phasor measurement units (PMUs), or synchrophasors, became paramount to grid operators. Synchrophasors are shoe-box sized devices that transmit precise current, frequency and voltage readings that are time-stamped using GPS. With these devices, BPA receives power system readings from key substations and large wind-generation sites, which give operators a more dynamic view of the Northwest power system.

Today, BPA is at the forefront of synchrophasors and has a sophisticated network. It is designed to take split-second automated control actions when it detects a problem on the grid. The result is a feed of power system data that provides grid operators real-time intelligence so they can react more quickly to system disturbances and take actions to avoid a blackout or prevent a disturbance from cascading. BPA championed the use of the technology for greater security and economy on the power system.

BPA Synchrophasor Project

The synchrophasor project provides new capability to monitor and control transmission system operations for the purposes of improving system reliability, increasing transfer capacity, and facilitating the integration of renewable resources within BPA's balancing authority. The project was slated as a 5-year effort to acquire, install, test, and implement synchronized Wide Area Measurement (WAM) and control technology at BPA. BPA's project is conducted to two Phases: Phase 1 spans three years and Phase 2 spans the remaining two years. The project is expected to be completed in 2015.

BPA's project is part of a larger program, called the Western Interconnection Synchrophasor Project (WISP) led by the Western Electricity Coordinating Council (WECC). The WISP program will build a synchrophasor network that serves as a foundation for applications to improve system reliability, enable wind integration and unlock stability-limited capacity in the West.

BPA, WECC and WISP Partners

BPA and others in the West are making wide-area situational awareness a reality. As part of WISP led by the Western Electricity Coordinating Council, BPA, along with 18 utility and technology partners, is building a network of more than 600 PMUs across the western grid. This combined effort and level of commitment has effectively created a paradigm shift that has facilitated a whole new level of cooperation among the energy entities in the West, and it results in a more reliable and secure Western Interconnection.

WISP was partially funded by the American Recovery and Reinvestment Act of 2009 stimulus funds and is part of the Department of Energy's Smart Grid Investment Grant program. The program blends the latest synchrophasor technology with a more robust telecommunications system to give the many transmission operators from Canada to Mexico a much clearer view of the entire transmission system in the West. With all the measurements synchronized to GPS, BPA can see more precisely how all the interconnected power systems in the West are responding to changes or disturbances.

In addition to early detection of equipment failures, the system monitoring and operations improves the integration of renewable energy, such as wind, and unlocks stability-limited capacity, which translates to more efficient power flow on the grid.

Over the past 30 years many engineers and BPA employees have paved the way for the advancement of synchrophasor technologies. At BPA it has been an extraordinary team accomplishment. The Appendix provides a list of BPA accomplishments with regard to synchrophasors.

Technology Innovation Projects

The following technology innovation projects (TIP) were in effect in 2015.

TIP 50 Oscillation Damping Control

- The purpose of this project is to develop a means of analyzing, monitoring and controlling electro-mechanical power oscillations that limit transfer capabilities for normal and contingency conditions covered under the WECC/NERC Reliability Standards or pose a reliability risk under operating conditions that may occur outside planned-for disturbances or operating conditions.
- A final report was issued in 2015.

TIP 51 Voltage Stability Control

- This project looks at a portfolio of operational and control solutions to maintain and increase voltage stability limits. The project's objective is to develop a comprehensive defense in depth control strategy to increase voltage stability across BPA's transmission system.
- Time sequence power flows were completed in 2015.

TIP 274 FCRPS Model Validation and Monitoring

- This project is to develop software applications for the following scenarios. A baseline model to be used by the US Army Corps of Engineers for compliance with NERC MOD Reliability Standards, a PMU-based model validation and performance monitoring of FCRPS generating fleet to be used by BPA Transmission Planning and Grid Modeling, and a wind power plant model to be used by BPA Transmission Planning and Grid Modeling.
- Tools for model validations are expected in 2016.

TIP 313 Power Frequency Control

- The project develops transient stability models of hydraulic turbine-governors. Once the models are developed, validated and confirmed, the next step is to proceed with the WECC Modeling and Validation Work Group on implementing the models in production-grade grid simulators like General Electric PSLF, Siemens PSS®E, and PowerWorld. Deployment of the application will result in more accurate power system stability models, the models are used in transmission planning and operating studies to set operating limits.
- A paper on power frequency controls was completed in 2015.

The following TIPS are in effect in 2015-2016.

- TIP 274 FCRPS
- TIP 313 Power-Frequency Control
- TIP 314 Load Research: End-Use Model Development
- TIP 349 Demonstration of Applications for Baselining Power Oscillations
- TIP 350 Power Plant Dynamic Performance Monitoring Center
- TIP 355 Evaluation of Technical Approaches to Increase Dynamic Transfers
- TIP 348 Measurement-Based Voltage Stability Assessment

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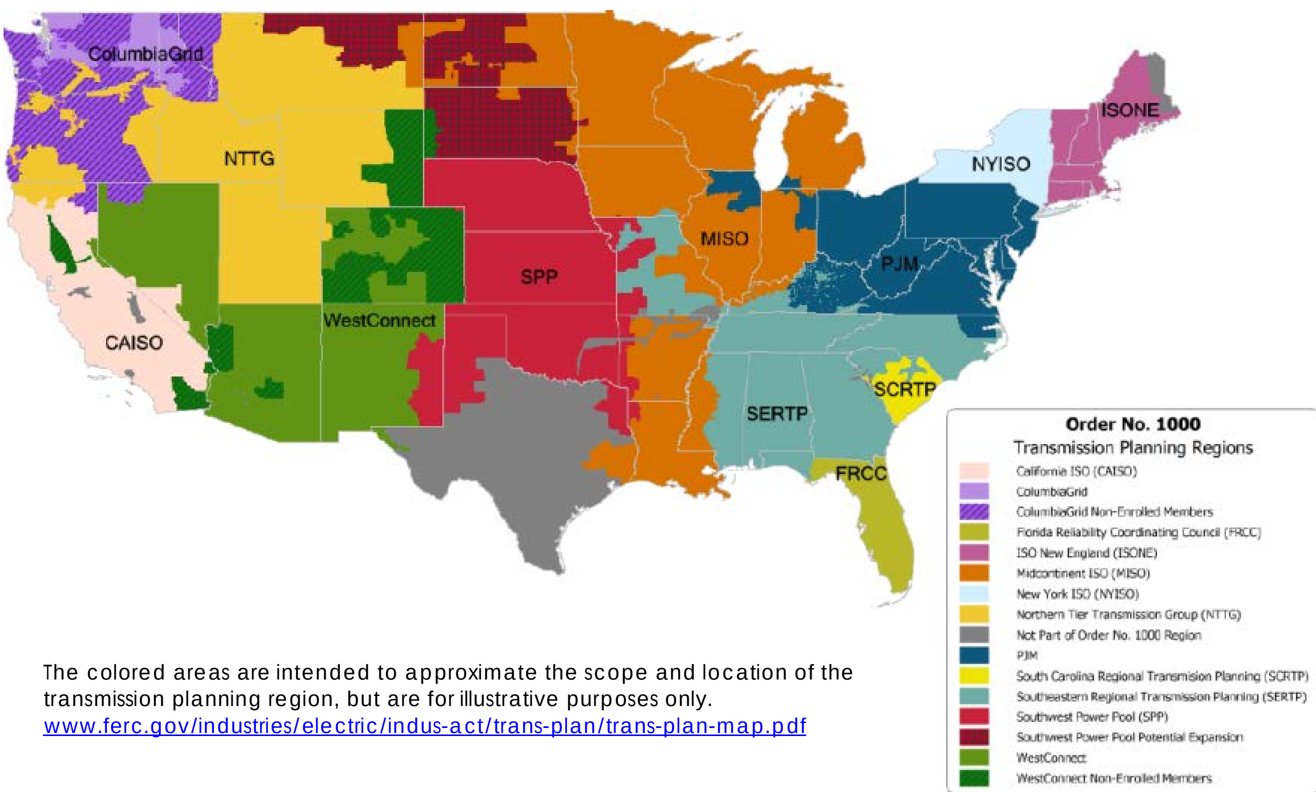
FERC Order No. 1000

In August 2014, the D.C. Circuit Court of Appeals affirmed Federal Energy Regulatory Commission's (FERC) Order 1000 giving the agency the promise of a cleaner, smarter, and more efficient power grid. Order 1000 is a landmark ruling that aims to increase competition in the electric transmission industry. Three key areas include cost allocation, transmission planning and the removal of the federal right of first refusal. It also aims to allow large-scale renewable energy projects to connect to the grid. Order 1000 requires public transmission utilities to engage in regional and interregional transmission planning, while accounting for public policy consideration and develop cost allocation methods to allocate the costs of new transmission projects among beneficiaries of the transmission line.

In December 2014 FERC released the order on the Order 1000 Interregional Compliance filing. FERC Order 1000 required jurisdictional utilities to form planning regions that would adopt transmission planning processes resulting in regional transmission plans. The planning processes have to include processes for transmission developers to propose for cost allocation projects that are within the region. Order 1000 also required each pair of adjoining transmission planning regions to develop common procedures and tariff language to identify and evaluate interregional projects for selection for cost allocation by each region in which a proposed interregional project would be located. In the Western Interconnection, all the planning regions – ColumbiaGrid, CAISO, Northern Tier, and WestConnect – negotiated common interregional coordination provisions for use by all regions in the Interconnection. This recent FERC order addresses those provisions in response to FERC filings by all jurisdictional transmission providers in the Western Interconnection and BPA.



The colored areas are intended to approximate the scope and location of the transmission planning region, but are for illustrative purposes only.
www.ferc.gov/industries/electric/indus-act/trans-plan/trans-plan-map.pdf

Each of these planning entities has their own planning processes. Each Planning Region's regional Order No. 1000 methodologies are the principal vehicles through which Order No. 1000 interregional compliance will be achieved for interregional evaluation and cost allocation.

The FERC-jurisdictional members of ColumbiaGrid (Avista, Puget Sound Energy, and MATL) re-filed compliance with FERC Order 1000 in mid-June 2015 to address deficiencies FERC indicated in their ruling on a previous filing. If the June re-filing is accepted by FERC, ColumbiaGrid members will be compliant with Order 1000.

The map above shows BPA is located in the ColumbiaGrid transmission planning region. BPA is a member of ColumbiaGrid. However, BPA has not elected whether or not to join the ColumbiaGrid Order 1000 process. BPA is not FERC-jurisdictional; therefore, BPA has a choice whether or not to join the planning process.

ColumbiaGrid Regional Planning Process

Below the diagram represents ColumbiaGrid's regional planning process (not BPA's) for the FERC Order 1000 Potential Needs. The diagram is provided by Columbia Grid and shows high-level activities only. It does not represent complete details of Columbia Grid's planning process.

https://www.columbiagrid.org/planning-expansion-overview.cfm

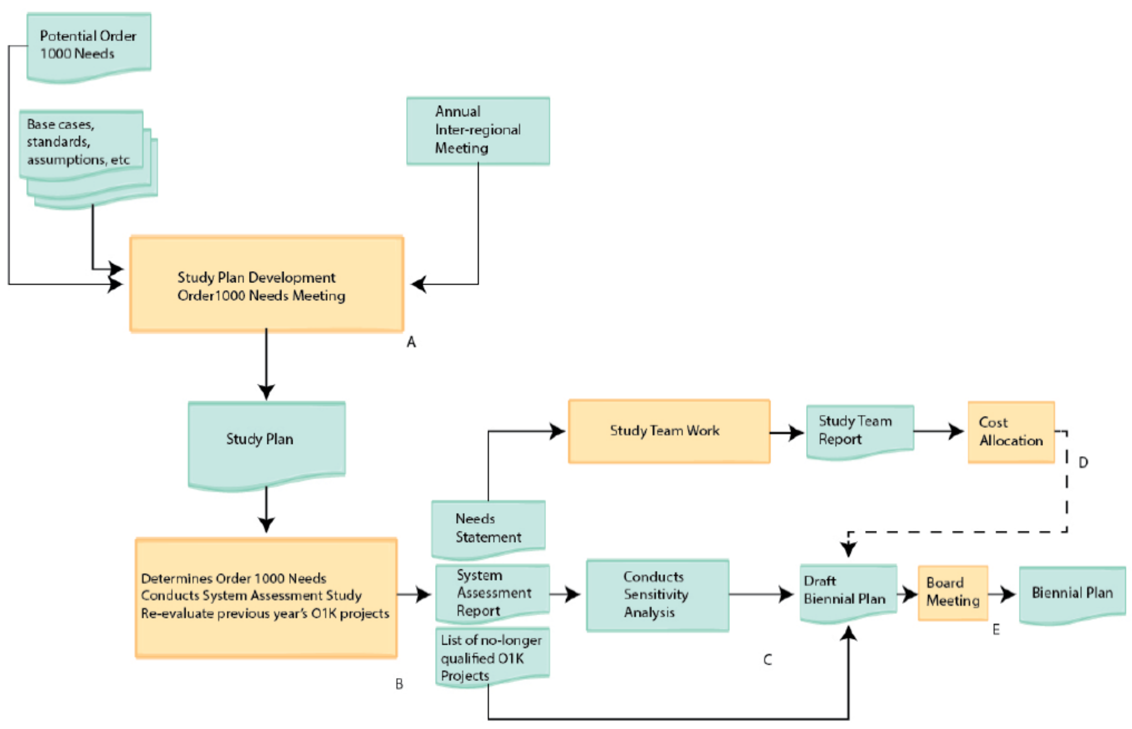


Figure C-1: ColumbiaGrid Planning Process

Appendix

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Appendix

A-1: Projects by Load Service Area

Area		Project Title	Category*	Expected In-Service
1	Seattle - Tacoma - Olympia			
		Tacoma 230 kV Series Bus Sectionalizing Breaker	R	2017
		Tacoma 230 kV Bus Tie Breaker	O&M	2017
		Silver Creek Substation Reinforcements	R	2019
		Paul 500 kV Shunt Reactor Additon	R	2016
		Raver 500/230 kV Transformer (PSANI)	R	2016
		Maple Valley 230 kV Series Bus Sectionalizing Breaker	R	2024
2	Portland			
		Pearl 500/230 kV Upgrades	R	2016
		Keeler 500/230 kV Transformer Re-termination	R	2017/2018
		Troutdale 230 kV Bus Sectionalizing Breaker Addition	R	2018
		I-5 Corridor Reinforcement Project	R-TS	2021
		Carlton Upgrades	O&M	2018
		Split Pearl-Sherwood 230 kV Lines and Re-terminate	R	2024
		Split McLoughlin-Pearl-Sherwood 230 kV Lines and Re-terminate	R	2024
		Pearl 230 kV Bus Sectionalizing Breaker Addition	R	2024
		G0380 and G0457 PGE Carty CCCT and Carty Increment	GI	2016
3	Vancouver			
		North Bonneville-Troutdale 230 kV No. 2 Line Re-termination	R	2016
		Sifton Substation Upgrade	O&M	On Hold-Deferred
4	Salem - Albany			
		Salem-Albany No.1 115 kV Line Upgrade	R	2017
		Salem-Albany No.2 115 kV Line Upgrade	R	2016
		Santiam-Chemawa 230 kV Line upgrade	R	2017/2018
5	Eugene			
		Alvey 500 kV 180 MVAR Shunt Reactor Addition	R	2016
		Alvey 115 kV Bus Sectionalizing Breaker	O&M	2020
		Alvey 230 kV Bus Sectionalizing Breaker	R	2017/2018
		Lane 230 kV Bus Sectionalizing Breaker	R	2016
		Lane 230 kV Reactor (180 Mvars)	R	2019
6	Olympic Peninsula			
		Sappho 69 kV Shunt Capacitor Addition	R	2017
		Kitsap 115 kV Shunt Capacitor Modification	R	2018
		Fairmount 230 kV Reactor	R	2017
7	Tri-Cities			
		Badger Canyon 115 kV Bus Tie Addition	O&M	2016
		Grandview 115 kV Bus Tie Addition	O&M	2017
		Midway-Grandview 115 kV Line Upgrade	R	2018
		McNary 500/230 kV Transformer No. 2	R	2017
		Jones Canyon 230 kV Shunt Reactor Addition	R	2017
		Richland 115 kV Transmission System Reconfiguration	R	2016
		White Bluffs 230/115 kV Low Side Disconnect Switch	R	2017

A-1: Projects by Load Service Area

Area		Project Title	Category*	Expected In-Service
8	Longview			
		Lexington 230 kV Bus Tie Breaker	O&M	2015
		Longview 230/115 kV Transformer Addition	R	2021
		Longview -Lexington 230 kV Line Re-termination	R	2015
9	Mid-Columbia			
		Columbia 230 kV Bus Tie and Sectionalizing Breaker Addition	O&M	2016
		Moxee 115 kV Bus Tie Breaker Addition	O&M	2017
		Northern Mid-Columbia Area Project (New Columbia-Rapids 230 kV line)	R	2016
10	Central Oregon - Northern California			
		Ponderosa 230 kV Reactor	R	2018
		L0296 La Pine - Benham Falls 115 kV Line Terminal	LiLo	2015
		LaPine 230 kV and 115 kV Circuit Breaker Addition for transformers	O&M	On Hold-Deferred
11	Southwest-Washington Coast			
		Holcomb-Naselle 115 kV Line Upgrade	Wood Pole	2018
12	Spokane			
		Bell 230 kV Bus Sectionalizing Breaker Addition	R	2016
13	Centralia - Chehalis			
		None		
14	Northwest Montana			
		None		
15	Southeast Idaho - Northwest Wyoming			
		Lower Valley Area Reinforcement Project (Hooper Springs)	R	2018
		Drummond Upgrade	O&M	2018
		Spar Canyon 230 kV Reactor Addition	O&M	2018
		Teton 115 kV Bus Tie Addition	O&M	On Hold-Deferred
		Lost River 230 kV Breaker Addition	O&M	On Hold-Deferred
16	North Idaho			
		Libby FEC 115 kV Shunt Capacitor Replacement / Restoration	R	2023
17	North Oregon Coast			
		None		
18	South Oregon Coast			
		Fairview 115 kV Reactor Additions	R	2018
		Wendson 115 kV Bus Tie Addition	O&M	On Hold-Deferred
		Toledo 69 kV and 230 kV Bus Tie Breaker Addition	O&M	On Hold-Deferred
		Lane-Wendson 115 kV Line 1 Upgrade	Wood Pole	2016/17
19	Demoss - Fossil			
		DeMoss-Fossil Shunt Reactive Additions	R	2018
20	Okanogan			
		None		
21	Hood River - The Dalles			
		None		
22	Pendelton - La Grande			
		None		

A-1: Projects by Load Service Area

Area		Project Title	Category*	Expected In-Service
23	Walla Walla			
		None		
24	Burley Area (Southern Idaho)			
		Unity 138 kV Breaker Addition	O&M	On Hold-Deferred

*R = Reliability
R - S = Reliability - Sustain
O&M = Operations and Maintenance
GI = Generation Interconnection
R-TS = Reliability - Transmission
TS = Transmission Service
LiLo = Line and Load

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A-2: Projects by Paths

	Area	Project Title	Category*	Expected In-Service
1	Northwest to California			
		PDCI Uprate	R	2016
2	Lower Columbia			
		West of McNary Reinforcement Phase II (NOS 2008)	R-TS	2015
		L0337, L0340, L0342, L0351, L0352 Umatilla UEC New Morrow Flats substation	LiLo	2015
3	Seattle to Portland			
		Pearl 500 kV Upgrades	R	2016
		I-5 Corridor Reinforcement Project	R-TS	2021
4	Puget Sound to Canada			
		Monroe Line Re-terminations	R	2018
5	West of Cascades South			
		None		
6	West of Cascades North			
		Schultz-Raver 500 kV No.3 and No. 4 Series Capacitors	R	2021
7	Montana to Northwest			
		Central Ferry-Lower Monumental 500 kV line (NOS 2008)	TS	2015
		Montana to Washington (CUP West) NOS 2010	TS	Cancelled

*R	=	Reliability
R - S	=	Reliability - Sustain
O&M	=	Operations and Maintenance
GI	=	Generation Interconnection
R-TS	=	Reliability - Transmission
TS	=	Transmission Service
LiLo	=	Line and Load

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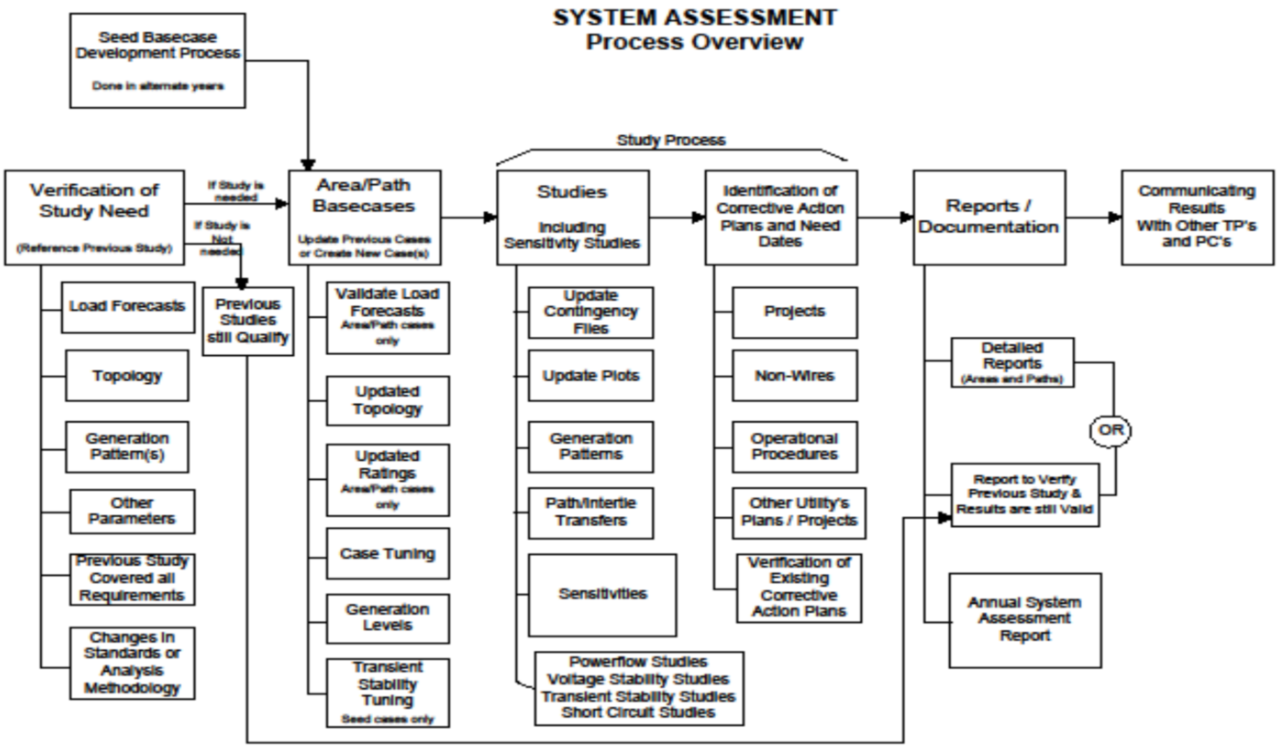
A-3: System Assessment Detailed Process Overview



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A-4: System Assessment
Load Information
Historical and Forecast

The following table lists the load areas in the 2015 System Assessment along with their actual historical peak loads for both the summer and winter seasons. In addition, for each load area, there is a comparison of the load forecasts between the 2014 and 2015 System Assessments. The table shows the forecast summer and winter peak loads for the near term (2019 and 2020) and longer term (2023 and 2024). The 2014 System Assessment used the forecasts shown for the years 2019 (near term) and 2023 (long term). The 2015 System Assessment used the forecasts shown for the years 2020 (near term) and 2024 (long term). This table indicates how the load forecasts changed between the 2014 and 2015 System Assessments and how each of these forecasts compares with historical peak load data. Bold text indicates the **season** with the highest peak load for that area.

	Load Areas	HISTORICAL Historical Peak Load (MW)		2014 ASSESSMENT 2019 Peak Load Forecast (MW)		2015 ASSESSMENT 2020 Peak Load Forecast (MW)		2014 ASSESSMENT 2023 Peak Load Forecast (MW)		2015 ASSESSMENT 2024 Peak Load Forecast (MW)	
		Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
1	Seattle / Tacoma / Olympia	7285	**10080**	7022	10132	7057	9768	7411	10387	7328	9945
2	Portland	4012	**4136**	4282	4673	3883	4238	4404	4165	4058	4377
3	Vancouver	858	**1143**	748	988	752	972	769	1087	781	1021
4	Salem / Albany	907	**1046**	924	1063	990	1122	1030	1305	1052	1184
5	Eugene	605	**895**	645	936	650	880	691	937	672	911
6	Olympic Peninsula	637	**1245**	830	1272	787	1304	972	1276	835	1326
7	Tri-Cities	**1150**	943	1298	1134	1406	1135	1256	1202	1472	1166
8	Longview	640	**830**	643	947	695	883	665	958	758	923
9	Mid-Columbia	2074	**2321**	2236	2629	2460	2741	2326	3103	2468	2785
10	Central Oregon	418	**661**	486	715	446	710	506	791	502	736
11	SW Washington Coast	183	**322**	233	376	218	355	209	350	225	367
12	Spokane	867	**889**	572	614	763	930	703	757	1059	1236
13	Centralia / Chehalis	128	**227**	143	215	170	263	117	233	177	277
14	NW Montana	234	**358**	268	402	332	432	316	444	334	457
15	SE Idaho / NW Wyoming	141	**285**	181	293	157	301	245	292	170	321
16	North Idaho	110	**188**	123	175	119	191	135	223	134	200
17	North Oregon Coast	137	**270**	179	297	166	291	195	307	172	300
18	South Oregon Coast	200	**440**	207	406	217	404	227	390	226	425
19	De Moss / Fossil	26	**37**	30	35	29	37	25	33	31	39
20	Okanogan	144	**219**	163	230	170	232	150	207	185	248
21	Hood River / The Dalles	211	**274**	201	255	227	286	221	262	232	295
23	Pendleton / La Grande	123	122	138	139	137	138	137	142	139	141
22	Walla Walla	70	63	92	63	91	66	95	68	95	68
24	Burley	465	224	428	253	479	259	398	194	490	262

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A-5: Non-Wires Assessment Summary

Non-Wires Assessment Summary

AREA	Potential Project	Potential Needs	Lead Time for Projects Planned (Years)			Number of Proposed Projects	Magnitude of Load Area (Peak In MWs)				Load Reduction Needed			Estimated Project Costs	Joint Projects Planned	Agreements in Place	Industrial Loads	Number of Customers	Known Distributed Generation	Demand Response Pilot
			2-3	4-6	6 +		> 5000	> 1000	> 500	< 500	MW	MW Per	Year	(000,000)						
Seattle	▪		2			2	▪					56		$42.3	•	•	•	4+		
Portland	▪				1	1		▪				43	2025	$1.5	•		•	2	•	•
Vancouver	▪		1			1		▪			49	23			•		•	1		
Salem/Albany	▪				1	1		▪				21	2019					6		
Olympic Peninsula	▪	▪	2			2		▪				10		$3.3			•	6		•
Tri-Cities	▪	▪	1			1		▪				64		$20.5			•	11		
Eugene	▪	▪	1			1			▪		9	9		$1.6			•	6	•	
Longview	▪			3		3			▪			10	2019	$8.0			•	1		
Mid-Columbia	▪		1	2		3			▪			11	2021		•	•		5		
Central Oregon						0			▪		15	3						4		
Spokane						0			▪			24					•	4		
SW Washington Coast						0				▪		3					•	4	•	
Centralia/Chehalis						0				▪		3			•			3		
NW Montana						0				▪								3		
SE Idaho / NW Wyoming		▪				0				▪		4.9						3		
North Idaho	▪				1	1				▪		1	2023	$1.3				5		
North Oregon Coast						0				▪		2.5						3		
South Oregon Coast	▪	▪	1			1				▪	20	1		$20.6				5		
DeMoss / Fossil	▪	▪	1			1				▪		3		$2.0				2		
Okanogan	▪		1			1				▪		2.3						3		
Hood River						0				▪		3					•	4	•	
LaGrande/Pendleton						0				▪		2.6						1		
Walla Walla						0				▪		1						6		
Burley		▪				0				▪		3						16		

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A-6: Transmission Service
Brief History of Network Open Season

Why is NOS needed?

Prior to the first NOS in 2008, transmission requests were taken on a first-come, first-served basis. At one time, the requests amounted to the equivalent of 18,000 megawatts. It was challenging to determine which parties in the queue requesting network transmission were willing to commit immediately to purchase transmission and which were simply seeking transmission capacity for projects that may or may not be built. Speculative requests made it impossible to evaluate the region's priority transmission needs. In turn, it was difficult to determine what, if any new transmission needed to be built and where. BPA initiated the first Network Open Season in March 2008, with the intent of establishing a better way to manage BPA's long-term transmission service request queue and to identify the new infrastructure that would be necessary to support the region's electrical needs.

During the NOS process, participating customers execute or decline a Precedent Transmission Service Agreement. If executed, an agreement contractually obligates the customer to take transmission service on a specific date for a specified period of time. BPA determines the amount of currently available transmission capacity it can use to offer service immediately and proceed with a cluster study to determine whether any system upgrades or new transmission projects are necessary to provide additional service. Once the final security arrangements for the precedent agreements have been made, BPA will "cluster" the requests to determine how much available transfer capability can be offered and which new transmission facilities, if any, will be required to accommodate the requests. The agency will then make a rate determination based on a financial analysis of the cluster study and a regional economic benefit analysis.

Historical Perspective on NOS

BPA has conducted four Network Open Seasons (NOS) (in 2008, 2009, 2010, and 2013), processing requests for long-term transmission service. As a result, BPA has identified several major transmission expansion projects, which are currently in various states of construction or review. The 2008-2010 NOS were conducted on a 12-month timeline, with each subsequent NOS beginning immediately after the closing of the previous NOS. Following the 201 NOS, was the NOS Reform which was an effort to determine a more appropriate timeline for future NOS processes.

BPA did not have a Network Open Season in 2014 or 2015. The drivers behind the Cluster Study extension are a need to better define the transmission upgrades in the ATC methodology, specifically the ATC methodology margin over the North of Hanford flow gate, and due to the complex and interconnected nature of the Mid-C area facilities how to address additional requests for service to and from the Mid-C area. The next NOS cluster study is likely targeted for 2016 or later.

BPA's First NOS (2008)

In 2008, BPA embarked on its landmark NOS process. BPA had 153 requests from 28 customers for 6,410 MW of new long-term firm transmission service. Almost three-quarters of those requests are associated with wind generation, reflecting the region's momentum toward rapid development of renewable resources and the need to comply with state Renewable Portfolio Standards. At the close of the NOS offer period, BPA Transmission Services reevaluated its queue. The transmission service requests of customer's eligible for NOS, but choosing not to participate, were removed. As a result, Transmission Services was able to offer 1,782 MW of new long-term service without constructing new facilities.

For NOS participants who signed their Precedent Transmission Service Agreements (PTSA) and provided Security, BPA Transmission Planning completed the Cluster Study to assess the system impacts of all of the NOS participants' requests and identify the new facilities necessary to provide the requested service. The Cluster Study identified eight key areas of reinforcement on the BPA network that would be needed to serve all of the requests. BPA staff evaluated each of the eight reinforcement projects under BPA's Commercial Infrastructure Financing Proposal (CIFP) to understand the cost and rate pressures associated with those facilities. Each project also was further scrutinized against regional economic benefits and other criteria to understand what projects bring the greatest benefit to the region while minimizing impact to transmission ratepayers.

Five projects were identified that allowed almost 3,700 MW of new transmission service while creating new transmission paths and capacity to deliver power from new renewable resources east of the Cascades to urban loads west of the Cascades and to the head of the California interties.

Second NOS (2009)

BPA's second NOS window for new transmission service requests preliminary results estimated about 98 service requests totaling 5,542 megawatts. Of that, approximately 3,800 megawatts was from wind generation. Customers executed Precedent Transmission Service Agreements for a total of 1,553 MW of service requests. The cluster study identified 293 MW of those requests for which BPA could provide service without constructing new facilities and determined that the remaining requests would require new facilities. The cluster study determined that 1,121 MW of requests can use projects that moved forward in the 2008 Network Open Season.

2010 NOS

BPA announced the 2010 NOS process in a notice to customers in May 2010, and the 2010 NOS commenced in June 2010. BPA offered 121 PTSAs to customers with eligible TSRs representing approximately 7,304 MW of service. Customers signed and met other requirements for 76 of those PTSAs for a total of 3,759 MW. BPA included the TSRs for which customers signed PTSAs in the Cluster Study to determine the system reinforcements, if any, required to provide service.

The Cluster Study included three primary elements.

- First, BPA used its ATC Methodology to identify for each PTSA the impact to each monitored flow gate and other areas of the transmission system to determine if the TSR could be served by the current infrastructure. BPA also performed sub-grid assessments to consider impacts on other facilities on the system that are not included in the monitored flow gates. As a result of these analyses, BPA determined that six TSRs, representing 53 MW, could be authorized with no further system reinforcements beyond any requirements identified in the generator interconnection studies.

- As the second element of the Cluster Study, BPA grouped the requests that were deemed to need additional system reinforcements into study areas based on electrical proximity and the other impacts. For each group of PTSAs for a study area, BPA studied the requests and identified or developed a plan of service for the required system reinforcements.

- For the third step of the Cluster Study, once BPA completed the technical studies, it added the proposed projects to a 2016 ATC base case and confirmed that the projects allowed BPA to provide the requested service.

In the 2010 NOS, BPA determined that none of the identified reinforcements are appropriate for direct assignment to the customer(s) whose TSR(s) require the plan of service. This determination was based on the technical attributes of the plan of service and on BPA's policies, including its Guidelines for Direct Assignment Facilities.

2013 NOS

For the 2013 NOS, at the May 2014 public meeting the cluster study identified a number of issues that require additional time to evaluate and assess. Those include reviewing the NOS and long-term Available Transfer Capability (LT ATC) assumptions; the relationship between identified generation sources and the requested point of receipt; and new long-term reservations at the Mid-Columbia area hubs where there are constraints.

The 2013 Cluster Study concluded in April 2014. BPA identified from the Cluster Study the necessary transmission facilities to accommodate nearly 4,000 MW of requested transmission service. BPA also hosted a public meeting on May 20 to share the results from the 2013 Cluster Study.

Future Open Season Process

Between 2010 and 2013, BPA postponed its NOS process due to concerns with the ability of participants to meet their obligations. In 2013, BPA revised the NOS process, but continued to assess the request for service as a cluster. BPA has not proceeded with development of any projects identified during the 2013 OS. BPA anticipates conducting another cluster study in 2016 after inforporating additional modifications from the Agency's Transmission Load Service initiaitve.

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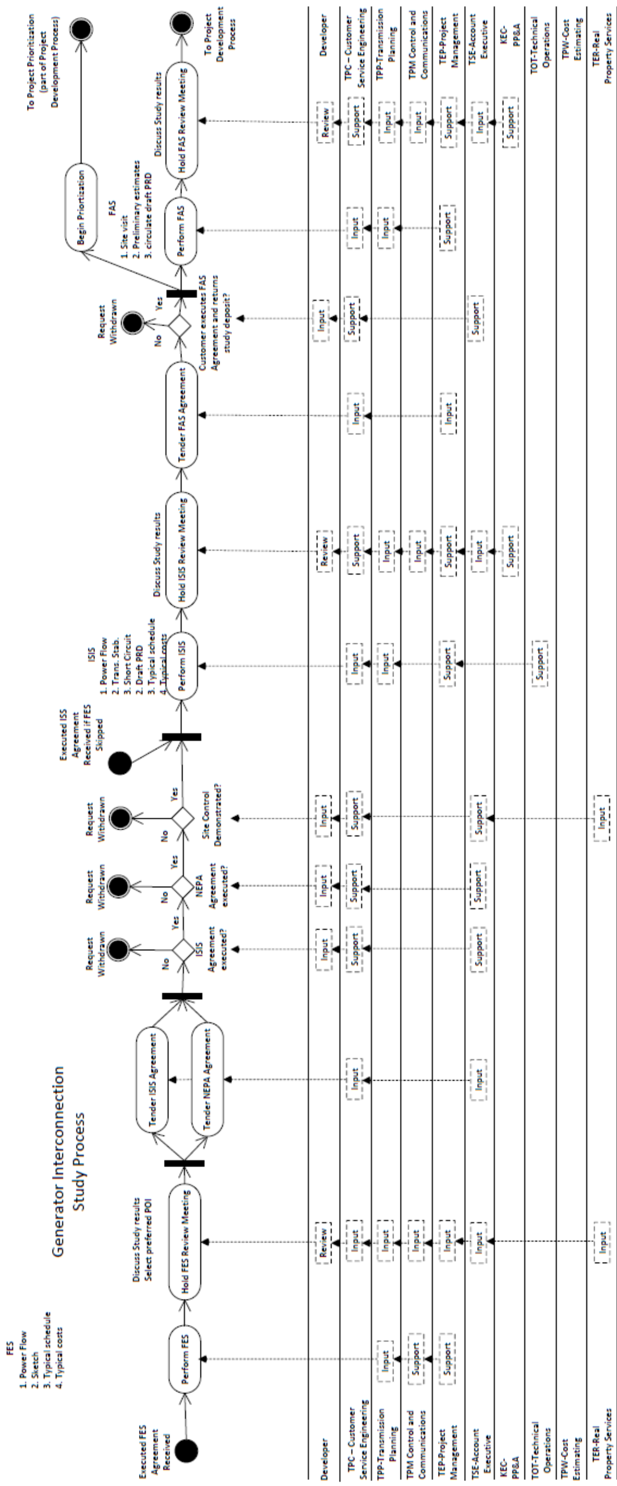
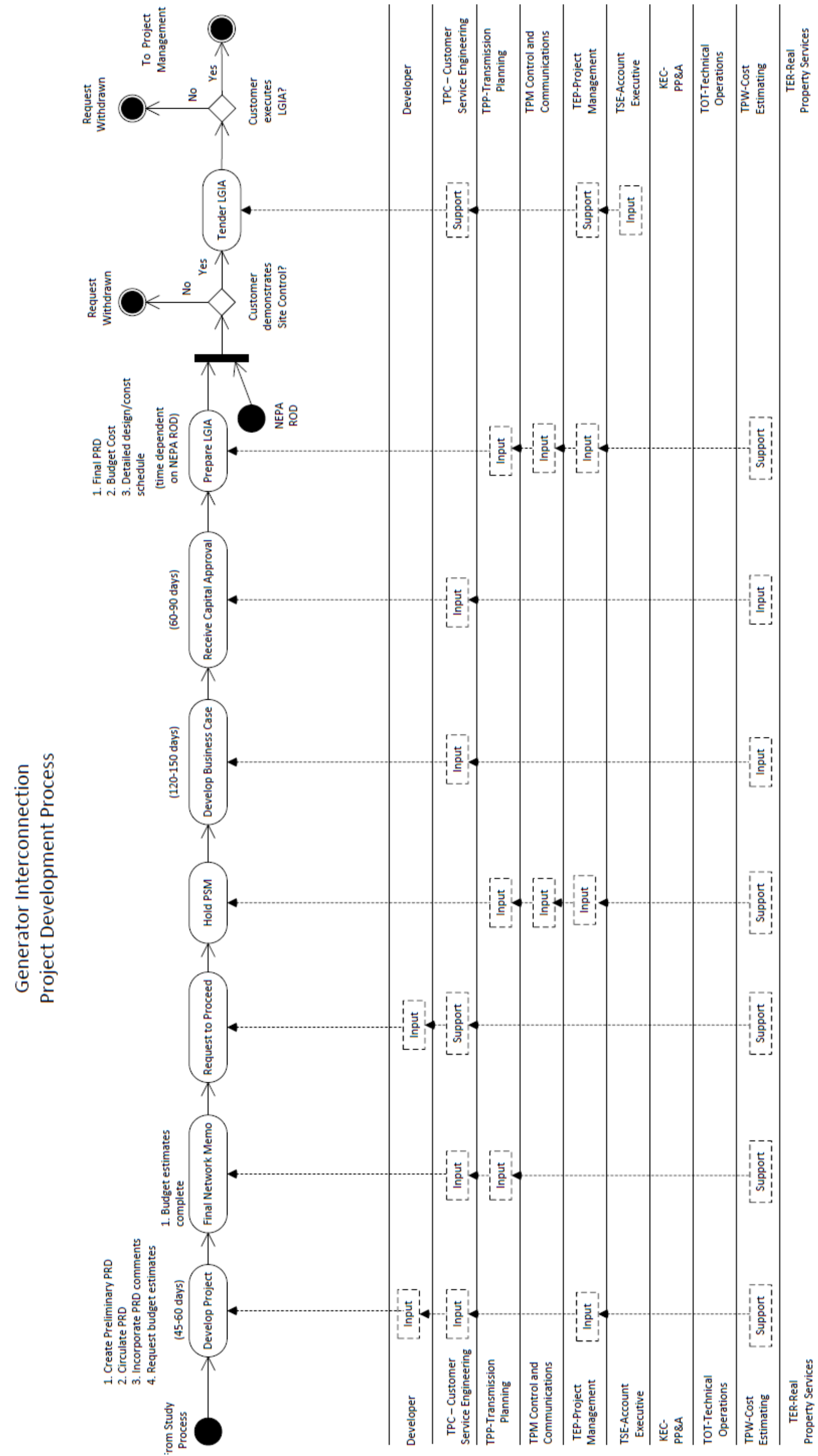
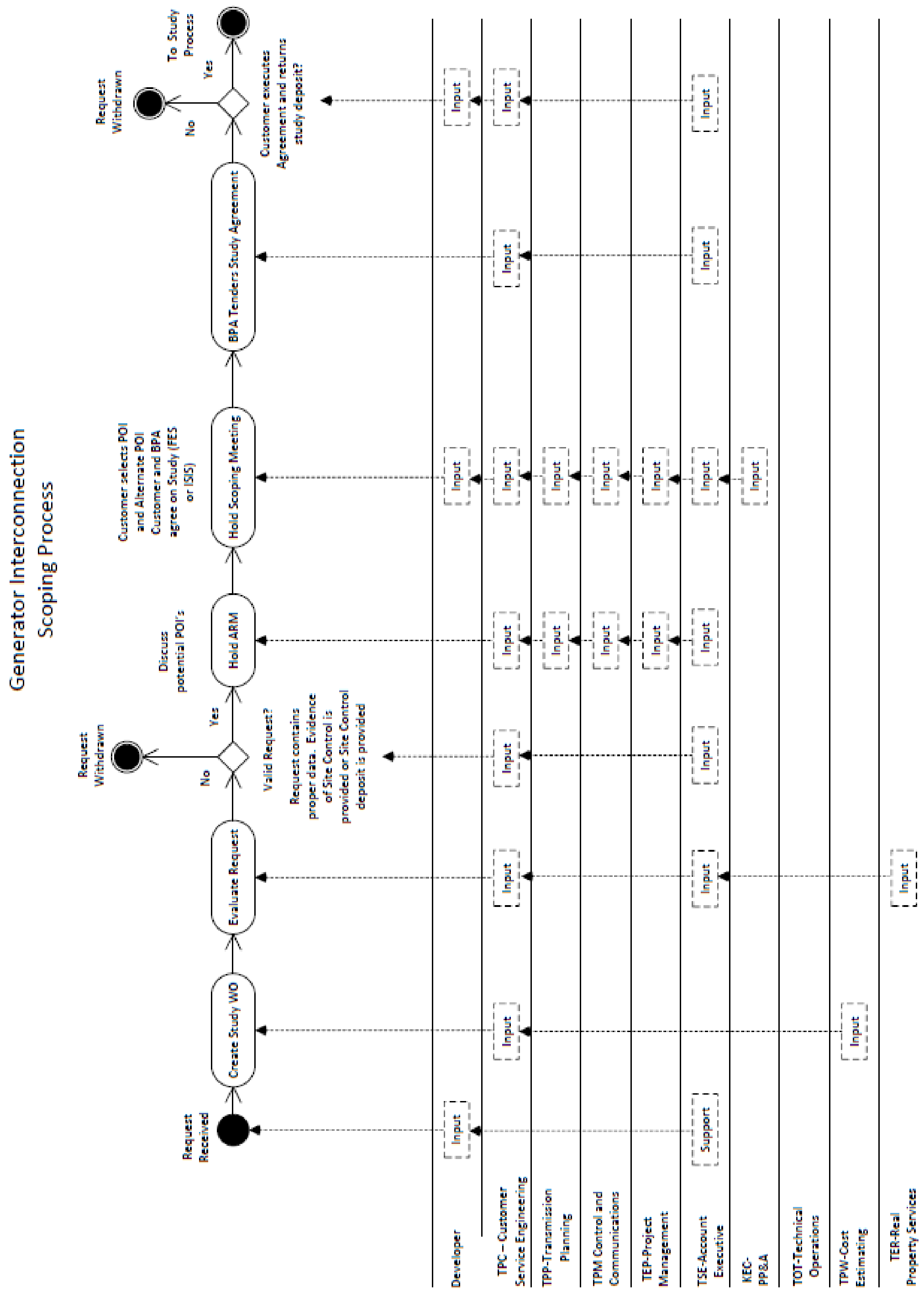
A-7: Generation Interconnection Flow Diagrams
Study Process



A-7: Generation Interconnection Flow Diagrams
Project Development Process



A-7: Generation Interconnection Flow Diagrams
Scoping Process



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A-8: Research and Development Recent Accomplishments

Over the past 30 years many engineers and BPA employees have paved the way for the advancement of synchrophasor technologies. At BPA it has been an extraordinary team accomplishment. Below is a list of BPA accomplishments with regard to synchrophasors. BPA greatly appreciates the support and recognition of our efforts.

- The Western Electricity Coordinating Council, the federal government, and the North American SynchroPhasor Initiative recognized BPA's work with synchrophasors.

- BPA received its first Platts Global Energy Award for deploying the most sophisticated synchrophasor network in North America.

- WECC, a regional entity responsible for coordinating and promoting the reliability of the bulk electric system (infrastructure that connects with neighboring systems) in the Western states, named Kosterev an "Outstanding Contributor of the Year" for his technical role in developing and sharing tools for generator, load and system modeling.

- BPA Transmission Planning employee, Dmitry Kosterev became one of 12 federal employees in the nation to receive the Arthur S. Flemming Award. This award honors outstanding federal employees for their contributions to the government.

- The North American SynchroPhasor Initiative, a work group dedicated to improving power system reliability through wide-area measurement, monitoring and control, named BPA "Outstanding Utility of the Year" for its accomplishments within the synchrophasor community. NASPI called BPA a pioneer in conceptualizing, developing, adopting and championing the use of synchrophasor technology for greater security and economy on the bulk power system. It also recognized BPA's staff as "visionary about synchrophasor technology use, effective in technology deployment, and generous as leaders and teachers to the utility community."

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A-9: Acronyms

Alder	Alder Mutual Light Company
AC	Alternating Current
ARM	Alternative Review Meeting
ATC	Available Transfer Capability
AVA	Avista Corp
BCTC	British Columbia Transmission Corporation
BPA	Bonneville Power Administration
BPUD	Benton Public Utility District
BREA	Benton Rural Electric Association
CAA	Clean Air Act
CAISO	California Independent System Operator
CBF	City of Bonners Ferry
CCCT	Combined-Cycle Combustion Turbine
CEC	Central Electric Coop
Chelan	Chelan County Public Utility District
CIFP	Commercial Infrastructure Financing Proposal
CIP	Capital Investment Portfolio
Clark	Clark Public Utilities
COE	City of Eatonville
COI	California Oregon Intertie
COS	City of Steilacoom
Cowlitz	Cowlitz Public Utility District
Douglas	Douglas County Public Utility District
EIM	Energy Imbalance Market
EL&P	Elmhurst Light and Power
Emerald	Emerald Public Utility District
ETC	Existing Transfer Commitments
EWEB	Eugene Water and Electric Board
FAS	Interconnection Facilities Study
FCRPS	Federal Columbia River Power System
FCRTS	Federal Columbia River Transmission System
FEC	Flathead Electric Cooperative
FERC	Federal Energy Regulatory Commission

FES	Interconnection Feasibility Study
GI	Generator Interconnection
HVDC	High Voltage Direct Current
IPC	Idaho Power Company
ISIS	Interconnection System Impact Study
LADWP	Los Angeles Department of Water and Power
LGI	Large Generator Interconnection
LGIA	Large Generator Interconnection Agreement
LGIP	Large Generator Interconnection Procedure
LL&P	Lakeview Light and Power
LLI	Line and/or Load Interconnection
LT ACT	Long-Term Available Transfer Capability
LTF	Long-term Firm
LVE	Lower Valley Energy
M2W	Montana to Washington
MEC	Midstate Electric Cooperative
Milton	City of Milton
MT-NW	Montana-Northwest
NEPA	National Environmental Policy Act
NERC	North America Electric Reliability Corporation
NWE	Northwestern Energy
NITS or NT	Network Integration Transmission Service
NI-W	Northern Intertie West
NLI	Northern Lights, Inc.
NOEL	North of Echo Lake
NOS	Network Open Season
NPCC	Northwest Power and Conservation Council
NW-CA	Northwest to California
OATT	Open Access Transmission Tariff
OML	Ohop Mutual Light
PA	Paul-Allston
PAC	PacifiCorp
PCM	Project Coordination Meeting
PDI	Project Delivery Information
PDCI	Pacific Direct Current Intertie
PDT	Project Definition Team

PEFA	Planning and Expansion Functional Agreement
PGE	Portland General Electric
PI	Peninsula Light
PL&P	Parkland Light and Power
PMU	Phasor Measurement Unit
PNUCC	Pacific Northwest Utilities Conference Committee
POD	Point of Delivery
POR	Point of Receipt
POS	Plan of Service
PPOS	Proposed Plan of Service
PRD	Project Requirement Diagram
PSE	Puget Sound Energy
PSM	Project Strategy Meeting
PTC	Production Tax Credit
PTP	Point-to-Point
RAS	Remedial Action Scheme
RP	Raver-Paul
RRO	Regional Reliability Organization
SCL	Seattle City Light
7th Plan	Northwest Power and Planning Council's Seventh Power Plan
SMI	Small Generator Interconnection
SOA	South of Allston
SOB	South of Boundary
SPUD	Snohomish County Public Utility District
SVEC	Surprise Valley Electrification Corporation
TIP	Technology Innovation Project
TLS	Transmission Load Service
TPL	Transmission Planning Standard
T-Plan	Transmission Plan
TPU	Tacoma Power Utilities
TS	Transmission Service
TSR	Transmission Service Request
TTC	Total Transfer Capability
UEC	Umatilla Electric Co-op
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation

WEC	Wasco Electric Cooperative
WECC	Western Electricity Coordinating Council
WOCN	West of Cascades North
WOCS	West of Cascades South
WOH	West of Hatwai
WOJ	West of John Day
WOLM	West of Lower Monumental
WOM	West of McNary
WOS	West of Slatt
WPUD	Whatcom Public Utility District

BPA Links For More Information

Our core responsibility is to identify and plan the development of the transmission system to meet the future needs of the grid. This section contains general information about Transmission Planning's processes. Additional information about each of these areas can be found at the web site addresses provided below.

- BPA conducts its annual transmission planning process to satisfy the Attachment K OATT obligation. A core responsibility of Transmission Planning is to plan and approve additions and upgrades to the transmission infrastructure so that as conditions and requirements change over time, it can continue to provide a reliable and efficient system. Transmission Planning fulfills this responsibility through its annual Attachment K planning process. The BPA Plan reflects the outcome of this annual process. The **BPA Plan** is published annually and information about the planning cycle is available at on BPA's Attachment K Planning Process web page. This T-Plan will replace the BPA Plan in the future.

- BPA conducts its Network Open Season process to satisfy the customer requests for access to our transmission system. Network Open Season (NOS) is a BPA initiative to manage and respond to long-term firm transmission requests on the BPA network. Transmission Planning's main contribution to this process is the **Cluster Study** and **Long-Term Available Transfer Capability**. Additional information about NOS is available on BPA's Network Open Season web page.

- BPA conducts its Generation and Line and Load Interconnection processes to satisfy the customer requests to connect to our transmission system. BPA Transmission Services provides services for interconnection to the Federal Columbia River Transmission System. BPA interconnection procedures adhere to the requirements of its Open Access Transmission Tariff. Transmission Planning conducts the Transmission Studies associated with the customer interconnection requests. More information about interconnection procedures is available on BPA's Interconnection web page.

- BPA's pursues Research and Development to deliver the most value to the agency and its stakeholders. BPA's research agenda is guided by a process that identifies the agency's immediate and future capability gaps and pinpoints technologies with the potential to resolve those business challenges. This process includes the development of technology roadmaps, which provide BPA a framework to help plan, coordinate and forecast technology developments so the agency can focus its R&D investments in areas that deliver the most value to the agency and its stakeholders. Transmission Planning's contribution to Research and Development is work on **Synchrophasors**. More information about Technology Roadmaps is available on BPA's Technology Innovation web page.

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