Planning for the future transmission system

2022 Transmission Plan

Open Access Transmission Tariff
Attachment K Planning Process
December 2022

BONNEVILLE POWER ADMINISTRATION

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1. Transmission Expansion Scenarios

This BPA Transmission Plan (T-Plan) is produced in accordance with the requirements of BPA's Open Access Transmission Tariff Attachment K (Attachment K) Planning Process. The planning process is conducted in an open, coordinated and transparent manner through a series of open planning meetings. The planning process occurs on an annual basis and results in a public posting of this Transmission Plan. The Open Access Transmission Tariff (OATT) Attachment K Planning Process (Section 2) provides a diagram of the planning cycle, public meetings and posting timeline.

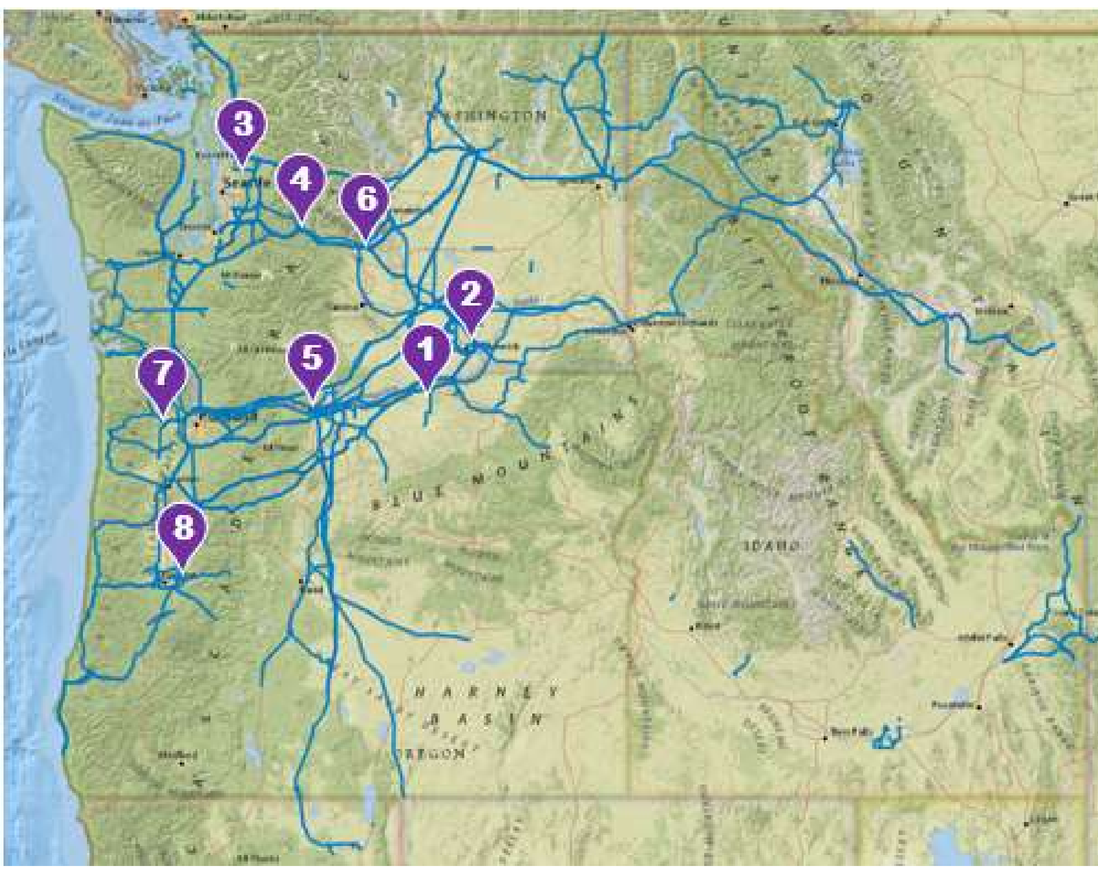
BPA plans the transmission system to serve expected loads and load growth for at least the next ten years based on forecasts. The forecasted peak loads, plus existing long-term firm transmission service obligations, are used to determine the system reinforcement requirements for reliability. BPA plans the system in accordance with the NERC Planning Standards and WECC Regional Criterion to maintain system reliability. Plans of Service are identified based on three broad categories: system assessment, customer requests for transmission service, and generator and line and load interconnection customer requests.

This report is divided into two main sections. The first portion consists of process information. The Transmission Planning Processes (Section 3) provides descriptions, timelines, diagram and maps of these processes. Section 4 provides 2022 System Assessment methodology information. Section 5 discusses the transmission planning landscape. The second portion (Sections 6-9) consists of plans of service and the status of transmission expansions and reinforcements. This transmission expansion scenario discusses transmission expansion needs identified and ongoing transmission expansion projects. It also includes a summary on the interconnection requests queue.

1.1 Ongoing Transmission Expansion

1.1.1 Ongoing Major Transmission Expansion Projects

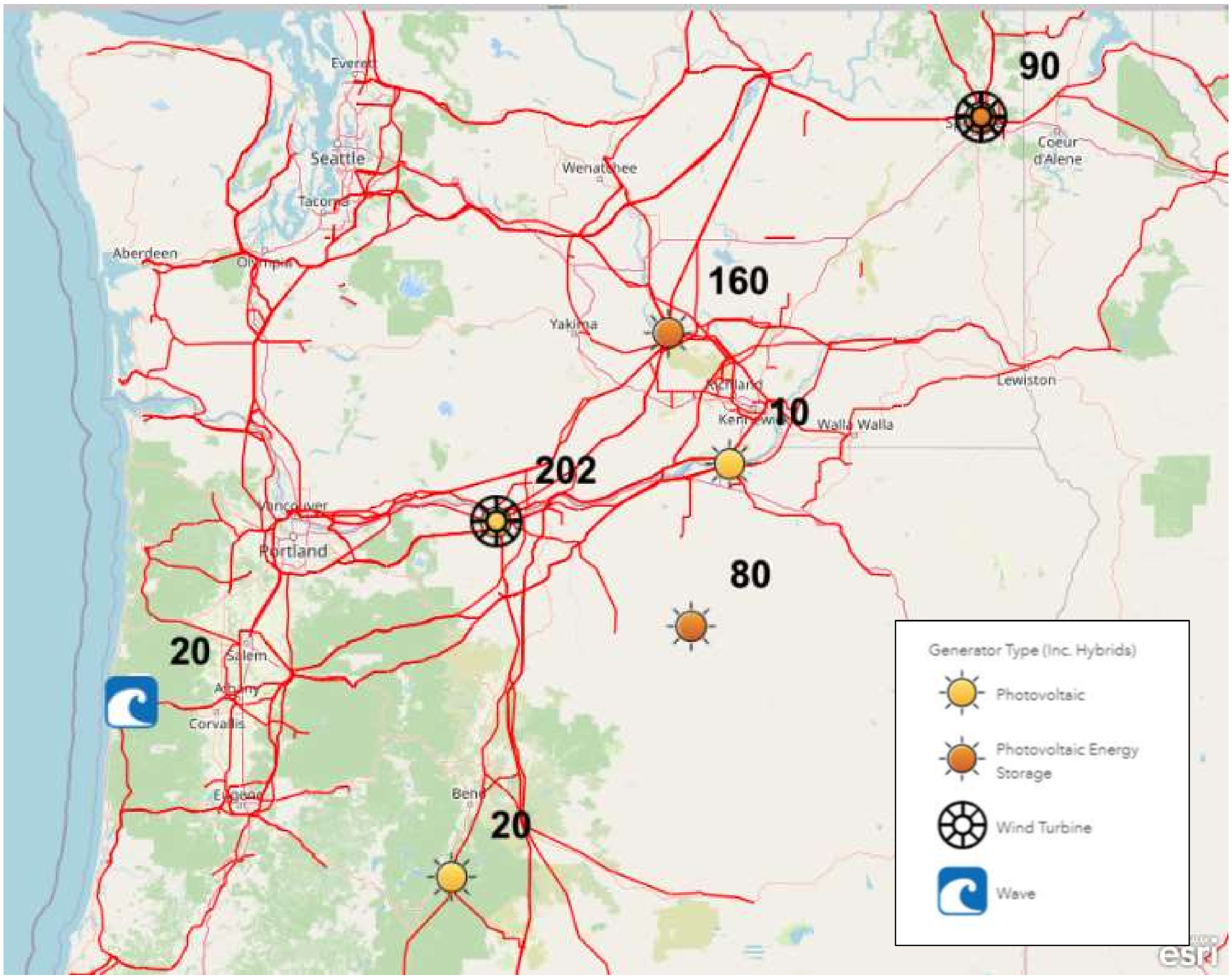
The map below shows the general locations of the top eight active transmission expansion projects over the ten-year planning horizon with expected energization dates. The expansion projects are ranked by estimated costs.



Top 8 Transmission Expansion Projects by Costs		$ in Millions	Expected Energization
1	**L0482: Longhorn 500/230 KV Substation** (Umatilla, Boardman) Design Phase	$143	2024
2	**G0558: South Tri-Cities Reinforcement Webber Canyon** (Tri-Cities) Design Phase	$97	2025
3	**PSANI (Puget Sound Area Northern Intertie)** (Seattle, Tacoma, and Olympia) In Construction	$90	2021/2024
4	**Schultz-Raver: Series Caps TSEP 2020** (West of Cascades North) Queue Phase	$50	2025
5	**L0380 Quenett Creek Substation** (Hood River, The Dalles) Design Phase	$40	2023
6	**Schultz-Wautoma: 500 KV Series Capacitors** (South of Allston) In Construction	$30	2024
7	**Keeler 2: 500/230 KV Transformer Bank** (South of Allston) Draft Phase	$25	2028
8	**Alvey 115 KV Bus Sectionalizing Breaker Addition and Transformer Bank 3 Replacement** (Eugene) In Construction	$19	2022
—	BPA Transmission Lines		

1.1.2 Renewable Generation Interconnection Requests in Construction Phase

As of September 2022, there are approximately 11 generation interconnection requests in the construction and completion phase totaling approximately 1,485 megawatts. The generation types include wind turbine, photovoltaic, photovoltaic + energy storage and wave. The customer or project name is deemed protected information. Therefore the map below shows the general locations of each requests the associated megawatt and generation type.



Queue No.	Queue No. Status	Megawatt Total	Generator Type (Including Hybrids)
G0099	Construction	600	Wind Turbine
G0238	Completion in Progress	202	Wind Turbine
G0242-G0420	Construction	90	Photovoltaic
G0367	Construction	202	Photovoltaic
G0368	Construction	101	Photovoltaic
G0505	Construction	20	Wave
G0514	Construction	10	Photovoltaic
G0521	Completion in Progress	20	Photovoltaic
G0578	Construction	160	Photovoltaic + Energy Storage
G0605	Construction	80	Photovoltaic + Energy Storage

1.2 New Corrective Actions Plans and Reinforcements Identified

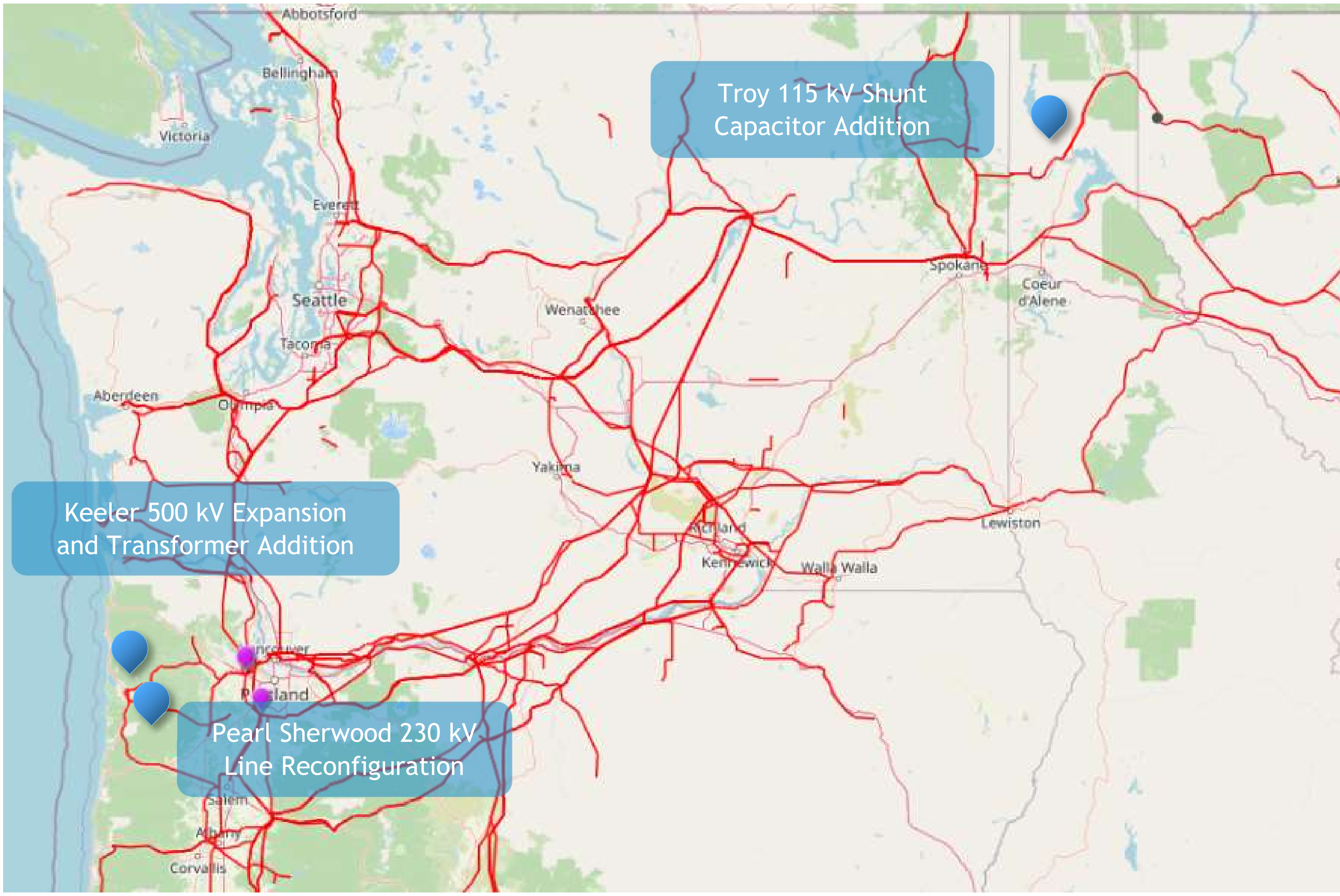
1.2.1 System Assessment Corrective Action Plans

The 2022 System Assessment (Section 4) identified two new corrective action plans (CAP) in the Willamette Valley Southwest Washington Planning Area - Portland Load area and one modified CAP in the Eastern Planning Area- North Idaho Load Area. Refer to the **Transmission Needs (Section 7)** for more project information. The CAPs are as follows:

- The **Keeler 500 kV Expansion and Transformer Addition** will add 500 kV breakers at the Keeler substation in order to reconfigure the Keeler 500 kV bus layout into a double-breaker-double-bus arrangement and adds a second 500/230 kV transformer bank at the Keeler substation. The expected in-service date is 2027-2028.

- The **Pearl-Sherwood 230 kV Line Reconfiguration and Pearl 230 kV Bus Series Breaker**. This will be a joint project with PGE. It includes splitting the existing BPA/PGE Pearl-Sherwood No.1 and 2 230 kV jumpered circuits and terminates them into separate bays at Pearl and Sherwood. It also splits the existing BPA/PGE Pearl-McLoughlin-Sherwood 230 kV 3-terminal line into a new Pearl-Sherwood No. 3 230 kV line and a new Pearl-McLoughlin-Sherwood 230 kV three terminal line. The expected in-service date is 2027.

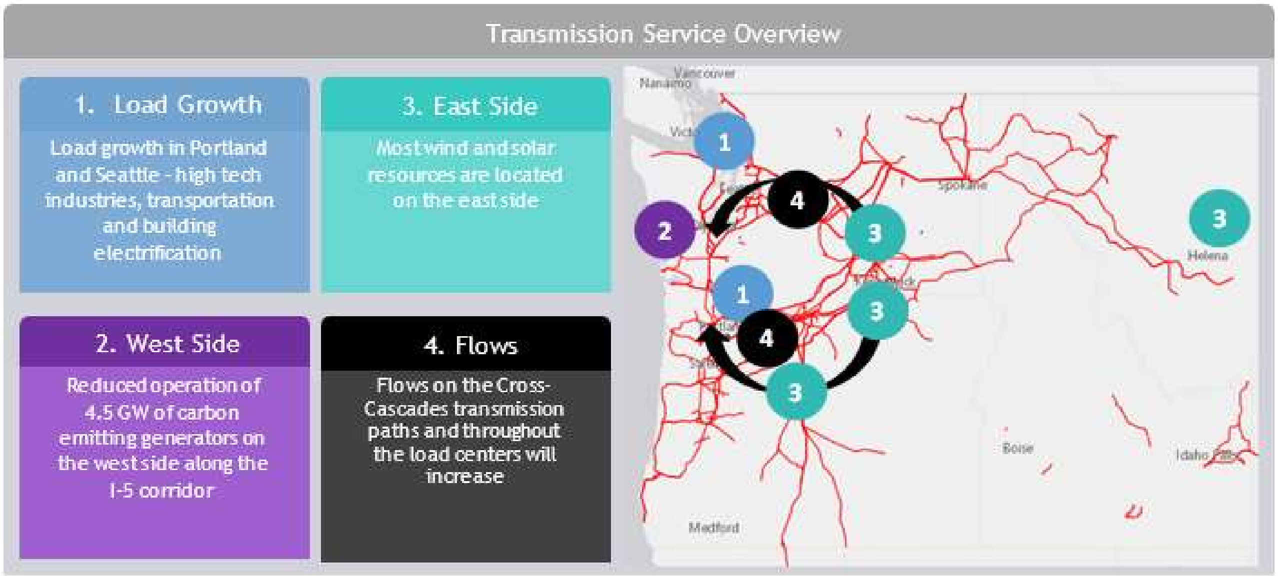
- The **Troy 115 kV Shunt Capacitor Addition** in the North Idaho Load Area installs a shunt capacitor at the Troy Substation. The capacitor size will be 12.6 MVAR. The modification is a change in location from the Libby (FEC) 115 kV Substation to the Troy 115 kV Substation. The expected in-service date is 2025.



1.2.2 Transmission Service Requests Reinforcements Identified

The Transmission Service Requests Reinforcements (Section 10) lists the recommended reinforcements identified from the 2022 Transmission Service Requests Study and Expansion Process (TSEP). The 2022 TSEP, which includes the Cluster Study, is the process where BPA responds to eligible requests for transmission service on the BPA network and determines where there is insufficient long-term firm (LTF) capacity. Where existing system capability was not adequate to accommodate the requested service, BPA identifies system reinforcements, or projects, that allow BPA to accommodate the incremental requests for service. BPA initiated the 2022 TSEP Cluster Study in June 2021 and received 144 TSRs that met the eligibility requirements with an associated demand of over 11 gigawatts (11,118 MW). Customers also requested a conditional-firm study for 142 TSRs totaling 10 gigawatts (10,553 MW). Renewable mandates such as Oregon House Bill 2021 and Washington's Clean Energy Transformation Act drove the influx of requests from new generation developers. The resource mix in the 2022 study included a dramatic increase in the amount of solar combined with battery storage. This year also saw a prominent arrival of offshore wind requests amounting to 2,200 MW. Customers submit transmission requests in excess of the identified generating resources in order to bid into different competitive solicitations for new capacity and energy to meet utility future load needs. A significant number of requests submitted from a single generating facility to multiple potential delivery points suggests speculation is increasing. The table below shows the reinforcements identified.

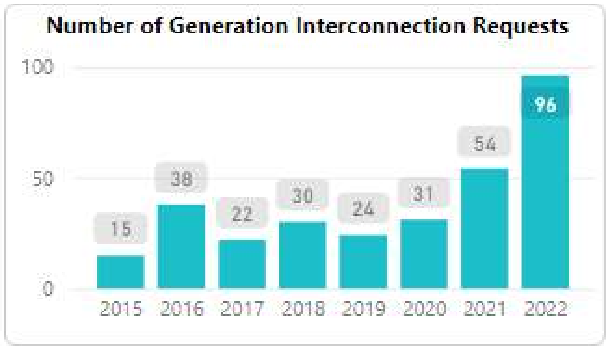
2022 Transmission System Reinforcements Identified			
Area	**Project Description**	**Number of TSRs Affected**	**TSR MWs Enabled (In Megawatt)**
Cross Cascades South	Big Eddy-Chemawa 500 kV Rebuild & Reconfiguration	91	7,462
Raver-Paul	Chehalis to Cowlitz Tap 230 kV Rebuild	22	2,171
Cross Cascades North	Schultz-Raver #3 & #4 500kV Reconductor, Schultz-Raver #4 500 kV Series Cap Upgrade (Phase 2); Olympia 230 kV +350/-300 MVAR SVC; Paul 500 kV 221 MVAR Shunt Cap	83	6,452
South of Allston	Ross-Rivergate 230 kV Rebuild	54	4,955
South of Rock Creek	Rock Creek-John Day 500 kV Rebuild	39	1,910

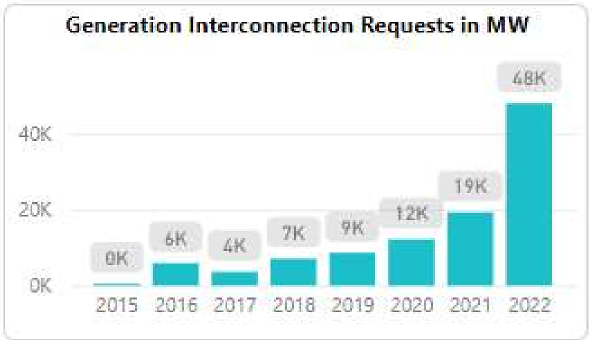


1.3 Potential Transmission Expansion

1.3.1 Number and Status of Generation Interconnection Requests Received

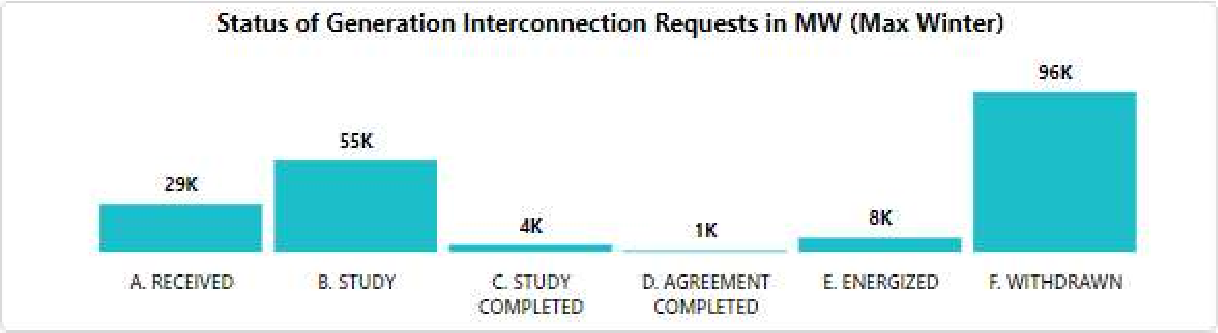
The generation interconnection process is a vital component of open access transmission service and is intended to expedite the development of new generation while ensuring reliability and reasonable rates. New resources seeking to interconnect to the transmission system submit a request and then enter the queue. As of November 2022, 96 generation interconnection requests were received for approximately 48 gigawatts (of maximum winter megawatt). The queue has seen a robust increase in the number of requests in the past two years.





1.3.2 Project Phase of All Generation Interconnection Requests

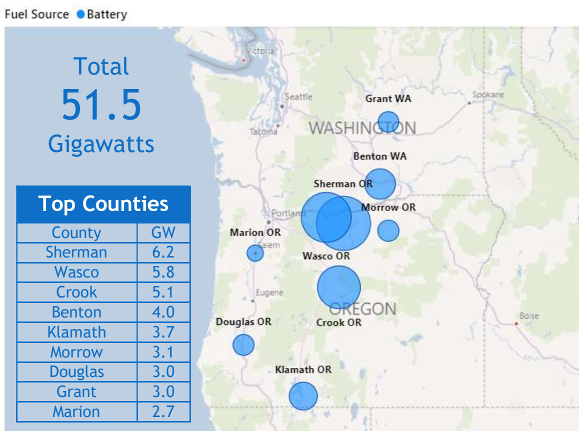
After the request is received, up to three studies are performed. After the study phase if an interconnection agreement is signed then the request enters the construction phase. For all the generator interconnection requests in the queue the majority are in the received or study phase. There is approximately 29 gigawatts (29,000 MW) in the received phase and 55 gigawatts (55,000 MW) of interconnection requests in the study phase. Requests can be in the the received, study, study completed, interconnection agreement executed, or energized phase. Otherwise a request is withdrawn.



1.3.3 Potential Renewable Resources in the Generation Interconnection Queue

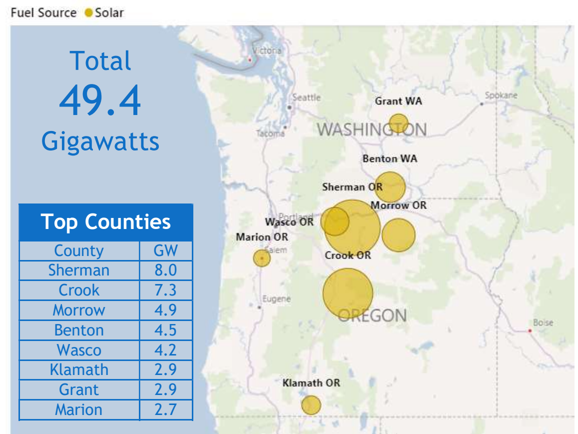
As of November 2022, the generation interconnection queue shows the majority of requests in progress consists of energy storage (51.6 gigawatts), photovoltaic (49.4 gigawatts) and wind turbine (21.4 gigawatts). The maps below shows groupings of requests by county location for the top counties by megawatt. The bigger the dot the greater the megawatt.

Energy Storage



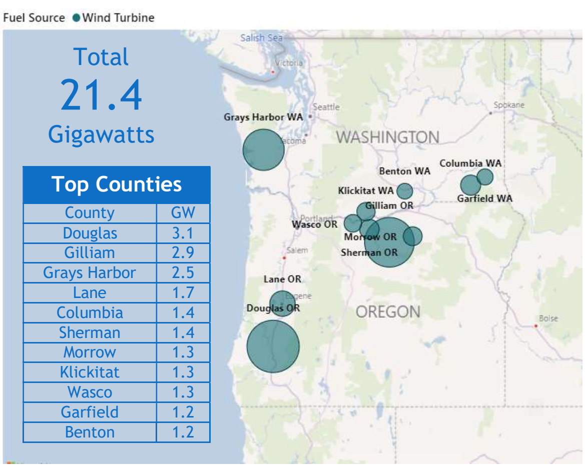
County	GW
Sherman	6.2
Wasco	5.8
Crook	5.1
Benton	4.0
Klamath	3.7
Morrow	3.1
Douglas	3.0
Grant	3.0
Marion	2.7

Photovoltaic



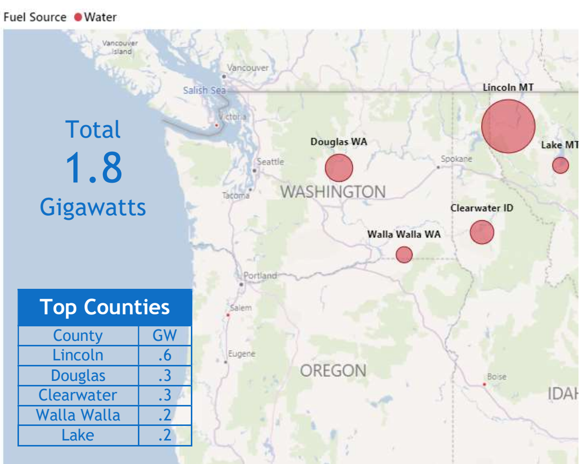
County	GW
Sherman	8.0
Crook	7.3
Morrow	4.9
Benton	4.5
Wasco	4.2
Klamath	2.9
Grant	2.9
Marion	2.7

Wind Turbine



County	GW
Douglas	3.1
Gilliam	2.9
Grays Harbor	2.5
Lane	1.7
Columbia	1.4
Sherman	1.4
Morrow	1.3
Klickitat	1.3
Wasco	1.3
Garfield	1.2
Benton	1.2

Hydro



County	GW
Lincoln	.6
Douglas	.3
Clearwater	.3
Walla Walla	.2
Lake	.2

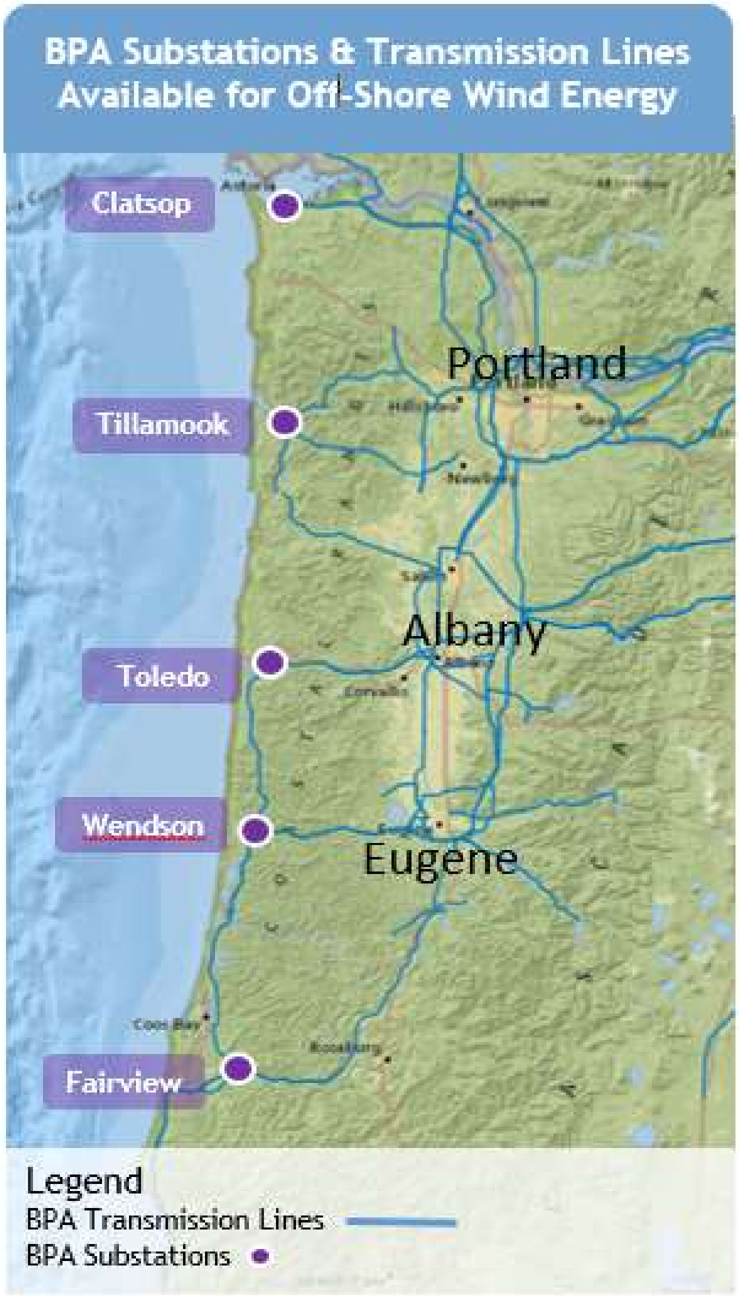
1.2.4 Potential Transmission Expansion for Off-Shore Wind

The U.S. wants to install 30 GW of offshore wind energy by 2030 and has a longer term objective of 110 gigawatts of off-shore wind by 2050. The Department of Interior's Bureau of Ocean Energy Management (BOEM) is the lead agency responsible for leasing off-shore area for commercial development. BOEM is expected to issue leases for Oregon off-shore wind by 2023.

In 2022 the Oregon Public Utility Commission and Oregon Department of Energy requested NorthernGrid to perform reliability and economic studies of gigawatt scale off-shore wind integration in Southern Oregon (Coos Bay and Florence). The Oregon Department of Energy is required to develop a legislative report that identifies the benefits and challenges of integrating up to 3 gigawatts of off-shore wind by 2030.

Southern Oregon has one of the best off-shore wind resources in the world. NREL estimates about 17 gigawatts of off-shore floating wind generation potential on the Southern Coast (Coos Bay, Bandon, and Brookings).

BPA Transmission Planning performed preliminary studies on existing system capabilities to validate how much off-shore wind can be interconnected to the grid on the Southern Oregon Coast. BPA estimates the transmission system along the state's coast can handle up to a certain amount of nameplate capacity. Above that, congestion at the five main points of interconnection along the Oregon coast would force curtailing turbines at times. Transmission congestion is initially confined to the coast and once the energy reaches the Intersate-5 corridor in Oregon's Willamette Valley there are fewer system constraints. For large-scale interconnection major transmission reinforcements will be needed to bring off-shore wind energy into the grid and to deliver power to the Portland metropolitan area.



2. OATT Attachment K Overview

2.1 Responsibilities

The planning processes described in BPA Open Access Transmission Tariff (OATT) Attachment K are intended to result in plans for the Transmission Provider's Transmission System which is updated annually. This planning process supports the responsibilities of BPA under other provisions of its OATT to provide transmission and interconnection service on its transmission system.

Attachment K describes the process by which BPA intends to coordinate with its transmission customers, neighboring transmission providers, affected state authorities, and other stakeholders. Neither Attachment K, nor the BPA Plan, dictates or establishes which investments identified in a BPA Plan should be made, or how costs of such investments should be recovered. BPA decides which of such identified investments it will make taking into consideration information gathered in the planning process described in Attachment K, and any process required by the National Environmental Policy Act, but retains the discretion to make such decisions in accordance with applicable statutes and policies.

Attachment K describes a planning process that contemplates actions by not only the Transmission Provider and its customers under this OATT, but also others that may not be bound to comply with this Attachment K, such as other transmission providers (and their transmission or interconnection customers), States, Tribes, WECC, sub-regional planning groups, and other stakeholders and Interested Persons.

BPA is obligated as specified in Attachment K to participate in planning activities, including providing data and notices of its activities, and soliciting and considering written comments of stakeholders and Interested Persons. However, Attachment K contemplates cooperation and activities by entities that may not be bound by contract or regulation to perform the activities described for them. Failure by any entity or Person other than the Transmission Provider to cooperate or perform as contemplated under this Attachment K, may impede or prevent performance by the Transmission Provider of activities as described in this Attachment K.

BPA uses reasonable efforts to secure the performance of other entities with respect to the planning activities described in Attachment K, but is not obligated for ensuring the cooperation or performance by any other entity described by Attachment K. For example, if and to the extent any Transmission Customer or other entity fails to provide suitable data or other information as required or contemplated by Attachment K, the Transmission Provider cannot effectively include such customer and its needs in the Transmission Provider's planning.

2.2 Planning Cycle

BPA Transmission Services conducts system planning meetings in accordance with its Open Access Transmission Tariff Attachment K. One of the primary objectives of Attachment K, outlined under FERC Order 890, is the development of a transmission expansion plan that covers a ten-year planning horizon. This plan identifies projected transmission reinforcements based on forecasted load growth, projected firm transmission service commitments, interconnection requests, and system reliability assessments. The objective of the assessment is to test the reliability of the transmission system under a variety of system conditions.

Attachment K is an annual cycle that spans the calendar year - January to December. Below is a diagram depicting the overall Attachment K Planning cycle. The process begins with area planning which is conducted by the Planning Engineers. The engineers use the power flow model of the transmission system and conduct technical studies. Once that process is completed, the next stage is developing draft plans of service and producing the System Assessment Summary Report. The purpose of this report is to document BPA's Annual System Assessment and provide evidence of compliance with the NERC Planning Standard TPL-001-4. The NERC Standard TPL-001-4 requires that BPA conduct an annual assessment to ensure that the BPA transmission system is planned to meet the required performance for the system conditions specified in the Standard. Finally, the Transmission Plan is developed and published by year's end. The purpose of the Transmission Plan is to document the projected 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 and new generation and line and load interconnection requests. At least two public meetings and postings occur during the Attachment K Planning cycle to share transmission planning information with customers and stakeholders.

Attachment K Planning Cycle
Customer Meetings and Postings Timeline
Visit BPA's Attachment K Planning Process web page for more information.

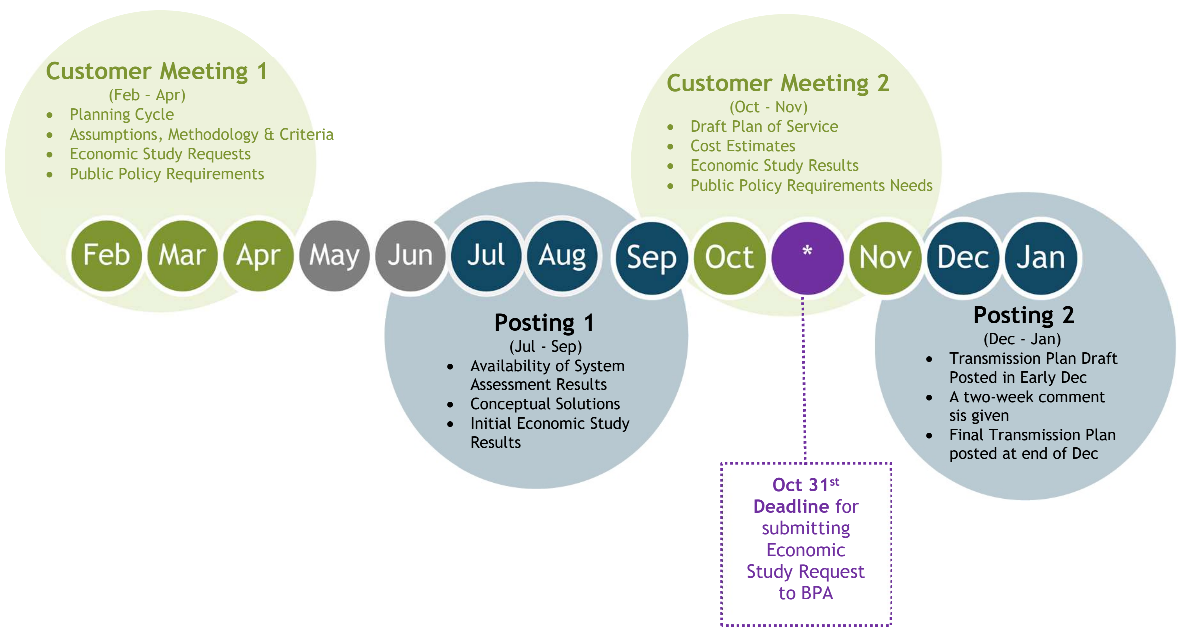


Figure 1 Attachment K Planning Cycle

2.3 Public Meetings and Postings Cycle

Transmission Planning 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.

Figure 2 Attachment K Public Meetings and Postings Cycle Diagram

2.4 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. 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 annual prioritization process.

The Transmission Provider will hold a public meeting to review each request that has been received for an Economic Study and to receive input on such requests from interested persons. The Transmission Provider may review Economic Study Requests as part of its regularly scheduled Planning Meetings as outlined in in Attachment K.

After consideration of such review and input, a determination will be made as to whether, and to what extent, a requested Economic Study should be clustered with other Economic Study requests and whether a study is considered a high priority. High-priority economic studies are funded by BPA. Any studies determined not to be high priority will not be performed by BPA, but BPA may assist in finding an alternate source for performing the studies.

3. Transmission Planning Processes

3.1 Planning Process Overview

The main purpose of Transmission Planning is to identify solutions and develop plans of service to meet the future needs of the BPA transmission system. Transmission Planning identifies transmission projects based on three broad categories: system assessment, customer requests for transmission service on BPA's system, and generator and line and load interconnection customer requests.

Figure 3 Planning Key Drivers Diagram

3.1.1 System Planning

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.

3.1.2 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 the Transmission Service Request and Expansion Process (TSEP).

3.1.3 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).

3.1.4 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 construction agreement are included in this T-Plan. The LLI process is very similar to the generation interconnection process.

Reliability Study Process

System Planning

Verification of Study Need

The NERC TPL-001-4 Standard allows system assessments to be based on the results of qualified past studies if they are still valid.

Base Cases

Transmission Planning's assessment includes the creation of study base cases starting with WECC approved base cases from the latest WECC Study Program. Additional base cases are created as necessary to cover other conditions that may need to be studied.

Technical Studies

The study process ensures all load areas and paths are evaluated to meet all applicable NERC Planning Standards and WECC Criterion.

Corrective Action Plans

If transmission system performance is not adequate to meet NERC and WECC performance requirements, the study process includes the development of corrective action plans as required. These include system additions and upgrades or remedial action schemes, or operating procedures.

Findings

Findings are documented in detailed Planning area and path study reports.

Results

The System Assessment Summary Report is shared with adjacent Transmission Planners and Planning Coordinators after the technical studies are completed, detailed reports are finalized, and the System Assessment Summary report is completed.

Figure 4 Reliability Study Process – System Planning Diagram

3.2 System Planning

Each year, Transmission Planning conducts a comprehensive assessment of BPA's transmission system to ensure compliance with applicable North American Electric Reliability Coordination (NERC) Planning Standards and Western Electricity Coordinating Council (WECC) Regional Criteria. (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 operate reliably over a broad spectrum of system conditions following a wide range of probable contingencies over the near-term (one to five years) and long-term (six to ten years) planning horizon while meeting the established reliability standards. The assessment covers a 10-year planning horizon. To meet NERC Planning Standard TPL-001-4, Corrective Action Plans are developed if studies identify potential performance deficiences. These corrective action plans are required in order to provide acceptable performance for contingency events as well as all lines in-service conditions. With these corrective action plans, BPA's system performance is acceptable and meets the requirements of the TPL-001-4 Standard. Deficiencies in meeting these standards are noted and addressed in the System Assessment Summary Report.

3.2.1 Verification of Study Need

The NERC TPL-001-4 Standard allows system assessments to be based on the results of qualified past studies if they are still valid. A determination is made as to whether a past study shows an adequate transmission plan based on the latest information and is a qualified past study, 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 is 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 results 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 thorough validation of the load forecast and topology used in studies for each load area is done annually to verify the timing of corrective action plans.

3.2.2 Base Cases

The purpose of base case development is to provide sufficient base cases that can be used as the starting point for the technical studies that are required by applicable reliability standards such as Transmission Planning Standard TPL-001-4 and others. The NERC TPL-001-4 Standard outlines a minimum of seven cases.

Transmission Planning's assessment includes the creation of study base cases starting with WECC approved base cases from the latest WECC Study Program. Additional base cases are created as necessary to cover other conditions that may need to be studied. 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 to reflect the corresponding year and season. For the years when new cases are not developed, the previous year's cases are updated for any study needs identified.

Transmission Planning works with BPA's Transmission Grid Modeling (TPMG) group to determine which cases are needed for area planning purposes and the annual System Assessment. Considerable work is completed on base cases outside of Transmission Planning and prior to the planning process. WECC produces approved cases and TPMG reviews and updates those approved base cases (known as seed cases) with the latest information available, including updates to topology, ratings, impedances, and loads.

BPA's Load Forecasting and Analysis group is responsible for activities related to forecasting customer load and resource planning including coordinating, managing, overseeing, and directing research into customer loads. These activities result in forecasts of average and peak loads for BPA transmission long-term planning and power needs.

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

3.2.3 Technical 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 Engineering 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.

3.2.4 Corrective Action Plans

If transmission system performance is not adequate to meet NERC and WECC performance requirements, the study process includes the development of corrective action plans as required. These include system additions and upgrades or remedial action schemes. These plans take into consideration non-wire solutions, existing remedial action schemes, and operating procedures. 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 identified it is coordinated with the non-wires team to determine feasibility of the solutions.

3.2.5 Technical Study Findings

After the study process is complete the findings are documented in detailed area and path study reports. In the event that a previous year's detailed report is still valid, a validation report is 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.

3.2.6 BPA Communicates System Assessment Results

The System Assessment Summary Report is shared with adjacent Transmission Planners (TPs) and Planning Coordinators (PCs) after the technical studies are completed, detailed reports are finalized, and the System Assessment Summary report is completed. These are generally the TPs and PCs that are adjacent to or interconnected with the BPA transmission system. If individual areas or paths are adjacent to particular TPs and PCs and problems are identified, the respective planners for those areas and paths coordinate with those TPs and PCs to resolve common issues.

3.2.7 System Planning Cycle

The System Planning is performed annually. Data collection and modeling occurs at the forefront of the system planning process. Detailed technical studies are performed to gauge the performance of the transmission system with respect to NERC standards and WECC criteria. These studies eventually result in identifying and testing new transmission reinforcements (corrective action plans), where required. When the detailed technical studies are completed, the results are used to develop the System Assessment Summary Report, and the Summary Report is used to document compliance.

Verification of Study Need	Base Cases	Technical Studies	Corrective Action Plan Need Dates Verified	Technical Reports Finalized
August	September	November	November	December

Cluster Study Process

Transmission Service Requests

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.

Determination of Areas

Requests with similar points of receipt that are close enough to cause similar impacts on the transmission system are combined. Similarly, requests with similar points of delivery that are close enough to cause similar impacts on the transmission system are combined. These combinations result in forming Cluster Study areas that are studied together in more detail to identify plans of service that can accommodate the requested service.

Technical Studies

Detailed technical studies 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 in traditional planning methods.

Sub-Grid Check

Following the assessment of Available Transfer Capability (ATC), BPA performs a sub-grid check on each request to consider impacts on other facilities that are not part of the monitored flow gates. The sub-grid checks rely on operational experience and previous studies (such as Generation Interconnection studies) to identify where reliability concerns exist.

Selection of Projects

Based on the study's results potential projects are identified. Plans of service are developed for requests that require system reinforcement.

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.

Figure 5 Cluster Study Process Diagram

3.3 Transmission Service Requests

BPA customers may submit long-term transmission service (TSR) requests. Transmission Planning's tariff obligations for TSRs include Sections 19 and 32 of the BPA Open Access Transmission Tariff (OATT). Section 19 pertains to additional study procedures for firm point-to-point (PTP) and Section 32 pertains to 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 (FAS) procedures for firm point-to-point customers. Sections 19.10 and 32.6 address the Cluster Study (CS) procedures. Transmission Planning conducts the additional studies as prescribed in the OATT.

3.3.1 The Transmission Service Requests Study and Expansion Process (TSEP)

The Transmission Service Requests Study and Expansion Process (TSEP) is BPA's process to manage and respond to Long-Term Firm TSRs on the BPA network. The TSEP is a process to plan for and grant transmission service to Network (NT) customers consistent with BPA's statutory authorities and BPA's tariff obligations while granting timely service to those customers seeking point-to-point (PTP) service. It is intended to be a repetitive and effective process that provides a balance in serving different customer classes (PTP and NT) on a non-discriminatory basis.

3.3.2 Determination of Cluster Study Areas

For all TSRs that require further evaluation TPP determines transmission reinforcements to accommodate the requested service, BPA-TS combines TSRs with similar PORs (i.e., those PORs that are close enough to cause similar impacts on the transmission system); similarly, BPA-TS combines TSRs with similar PODs (i.e. those PODs that are close enough to cause similar impacts on the transmission system). These combinations result in forming Cluster Study areas that are studied together in more detail to identify plans of service that can accommodate the requested service.

Detailed technical studies 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 in traditional planning methods. The result is a more robust transmission expansion plan to meet the expected, as well as requested, obligations of the system.

3.3.3 TSEP Cluster Study

Transmission Planning conducts the Cluster Study analysis of TSRs and determines the transmission reinforcement requirements to accommodate the TSRs. 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. 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.

3.3.4 Cluster Study Process

BPA customers who request transmission service may do so during a limited-time submission window. 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 long-term available transfer capability (LT ACT) 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.

The Cluster Study includes the following fundamental elements:

- Determine which requests could be accommodated by the existing system.
- Determine which requests require system reinforcement.
- Develop plans of service for requests that require system reinforcement.
- Demonstrate that the interconnected transmission system, together with the identified reinforcements, is able to accommodate the requested service.

3.3.5 ATC and Sub-Grid Assessment

BPA performs an Available Transfer Capability (ATC) assessment for each TSR – paired with a sub-grid check – to determine which TSRs can be served by the existing system or which TSRs would need reinforcements to provide the requested service.

The assessment considers BPA's pending queue for long-term firm transmission service after all TSRs are removed for customers that elected not to sign a Customer Service Agreement. Remaining TSRs are evaluated to see if any potential offers of service based on the impacts from requested Points of Receipt (POR) and Points of Delivery (POD) on BPA's Network can be made.

Following the assessment of ATC, BPA performs a sub-grid check on each TSR to consider impacts on other facilities that are not part of the monitored flow gates. The sub-grid checks rely, to the maximum extent possible, on operational experience and previous studies (such as Generation Interconnection studies) to identify where reliability concerns exist.

If the combined ATC assessment and the sub-grid check confirm that the existing system can accommodate the requested service, the TSR is considered for possible authorization. If a TSR has non-*de minimis* impacts that exceed the ATC for any flowrate or has an adverse sub-grid impact, the Cluster Study further evaluates the TSR in order to identify the transmission expansion necessary to provide the requested service.

3.3.6 TSEP 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 TSEP and projects from the previous TSEP, and other reliability or load service projects.

3.3.7 TSEP Cluster Study Cycle

Below is a brief description and diagram of the Commercial Assessment proposed timeline. The Commercial Assessment takes into consideration all known information about each TSR such as status of generator interconnection and/or historical generation patterns, association with rapid load growth or new load, and duplicative requests that may be present in the queue.

This study-based approach can result in some offers of transmission service made possible by maximizing the use of existing transmission system without infrastructure upgrades. Any such offers of transmission service will be made between August and December. Also, any TSRs that are not offered service through the Commercial Assessment by October will be offered Cluster Study Agreements, to identify Plan(s) of Service necessary to offer service.

The upcoming Cluster Study is expected to begin in January and conclude in May at which time a Cluster Study Report is finalized. Transmission Planning produces a Cluster Study Technical Report which provides the findings of the analysis and power flow modeling that is conducted. A Cluster Study determines what transmission expansion, if any, is required to accommodate customer requests for long-term firm transmission service over the Bonneville network. Results of the Cluster Study will be made available in a similar manner as past studies.

TSEP Cluster Study Cycle

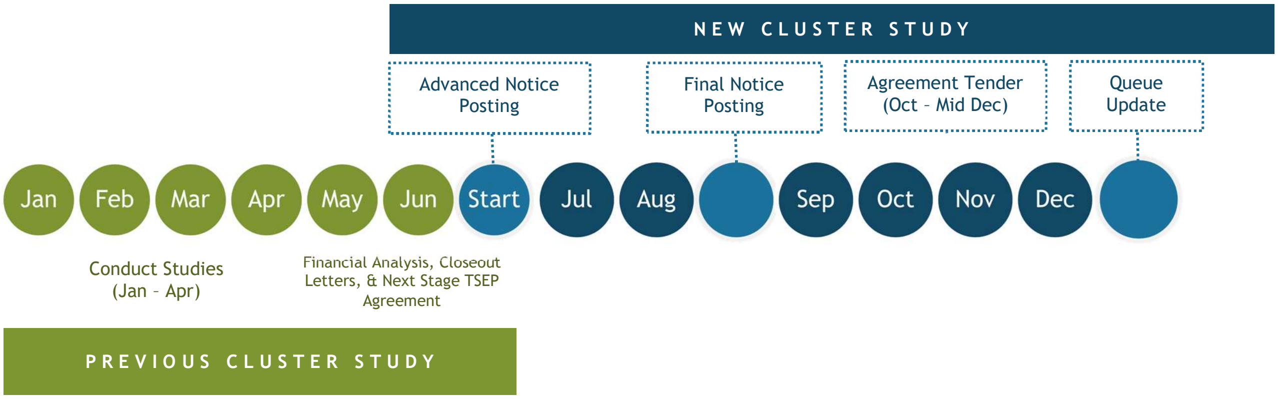


Figure 6 TSEP Cluster Study Cycle Diagram

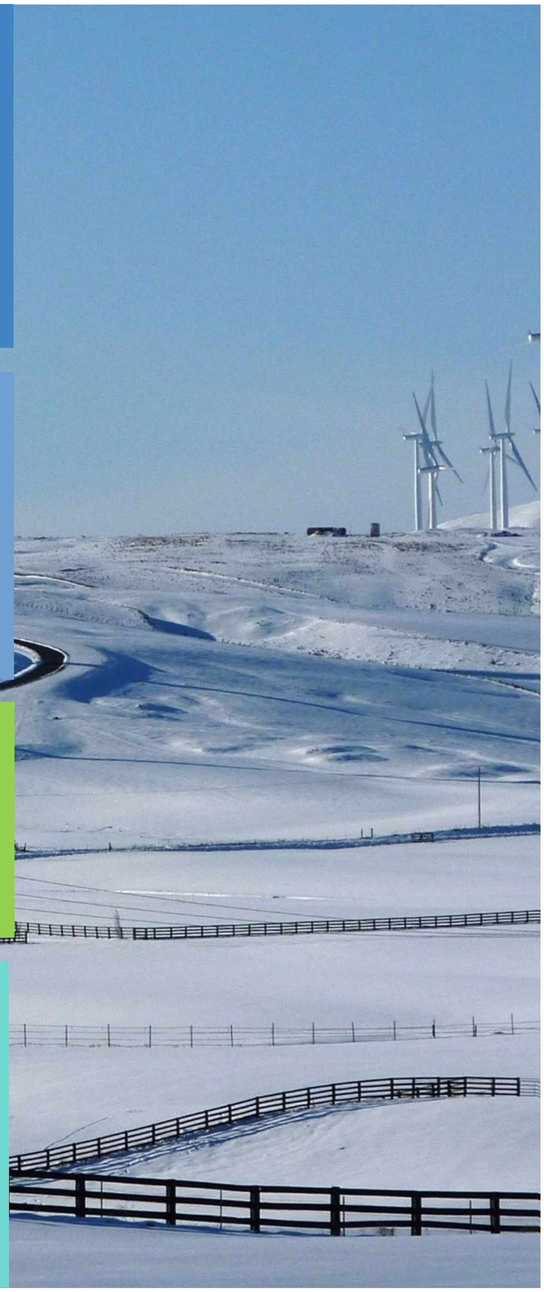
Interconnection Study Process

Interconnection Service Requests

Generation or Line-Load Interconnection Request

When a customer makes a request for a generator or line and load interconnection, Transmission Planning conducts and supports a series of up to three studies which are performed after a customer has signed an agreement for each study:

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



Feasibility Study

The scope of the FES is to provide a high-level preliminary evaluation of the feasibility of the proposed interconnection to the transmission system. 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 or draft project requirement diagram of the project, and determines typical costs and a schedule.

System Impact Study

Transmission Planning performs the ISIS to evaluate the impacts of the proposed interconnection to the reliability of the transmission system. A draft project requirements diagram is developed and a typical cost and schedule are determined.

Facilities Study

Transmission Planning provides a cost estimate to implement the conclusion of the Interconnection System Impact study including costs of equipment, engineering, procurement, and construction. The Facilities study also identifies the electrical switching configuration of the connection equipment, including transformers, switchgear, meters and other station equipment. This information is relayed in the form of a Project Requirements Diagram.

Figure 7 Interconnection Study Process Diagram

3.4 Interconnection Requests

Customers may request new points of interconnection on BPA's transmission system. Customers can also interconnect to existing points of interconnection such as an existing substation. Line or load interconnections (LLI) are typically for new load additions or to allow the customer to shift existing load to different points on their system. BPA customers may also request interconnection service to connect to BPA's system for new generation. Below, the customer driven projects process shows typical or expected timelines for each of the phases of project development process.

BPA Transmission Services provides services for interconnection to the Federal Columbia River Transmission System. BPA receives Generator Interconnection (GI) requests according to Attachment L Large Standard Generator Interconnection Procedures (LGIP) and Attachment N Standard Small Generator Interconnection Procedures (SGIP) of the BPA Open Access Transmission Tariff. The GI projects listed in this T-Plan include large (greater than 20 megawatts) generator interconnection projects.

3.4.1 Interconnection Requests Studies

When a customer makes a request for a generator or line and load interconnection, Transmission Planning conducts and supports a series of up to three studies which are performed after a customer has signed an agreement for each study:

- Interconnection Feasibility Study (FES)
- Interconnection System Impact Study (SIS)
- Interconnection Facilities Study (FAS)

3.4.2 Feasibility Study and Report

The scope of the FES is to provide a high-level preliminary evaulation of the feasibility of the proposed interconnection to the transmission system. 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 or draft project requirement diagram of the project, and determines typical costs and a schedule. A feasiblity study report provides preliminary identification of any thermal or steady state voltage deficiencies; any circuit breaker short circuit capability limits exceeded as a result of the interconnection; and a non-binding estimated cost and a non-binding good faith estimated time to construct facilities required to interconnect 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 LGIP specifies 45 days for BPA Transmission Services to provide the FES report. The FES is followed up with a FES results review meeting conducted by BPA Customer Service Engineering.

3.4.3 System Impact Study and Report

Transmission Planning performs the ISIS to evaluate the impacts of the proposed interconnection to the reliability of the transmission system. In addition to steady state thermal and voltage analysis, voltage stability and transient stability analysis is performed, as well as analysis of short circuit capability limits. A draft project requirements diagram is developed and a typical cost and schedule are determined. The customer pays the study deposit for the ISIS. The ISIS report provides the 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; identification of any circuit breaker short circuit capability limits that could potentially be exceeded as result of the interconnection; and a description and non-binding, good-faith estimated cost and a non-binding, good faith estimated time to construct facilities required to interconnect the project to the transmission system and to address the identified short circuit, instability, and power flow issues. The LGIP specifies 90 days for BPA Transmission Services to provide the SIS report. The ISIS is followed up by a results review meeting with the customer.

3.4.4 Facilities Study and Report

Transmission Planning provides a cost estimate to implement the conclusion of the Interconnection System Impact study including costs of equipment, engineering, procurement, and construction. The Facilities study also identifies the electrical switching configuration of the connection equipment, including transformers, switchgear, meters and other station equipment. This information is relayed in the form of a Project Requirements Diagram. The FAS report provides a description, estimated cost, and schedule for required facilities to interconnect the project to the transmission system, and addresses any short circuit, stability, and power flow issues identified in the ISIS. The LGIP specifies 90 days for BPA Transmission Services to provide the FAS report with a +/- 20% cost estimate, or 180 days to provide a FAS report with a +/- 10% cost estimate. The BPA scoping process is now conducted during the facilities study phase and may extend the time to complete the study. The FAS report is followed up with a FAS results review meeting with the customer.

3.4.5 Interconnection Requests Cycle

The study process of an interconnection requests is a subset of the entire interconnection request project process. Below is a diagram of the general process from initiation to close.

Figure 8 Interconnection Requests Cycle Diagram

4. 2022 System Assessment

The System Assessment demonstrates that Bonneville Power Administration (BPA) has met the North American Electric Reliability Corporation (NERC) Planning Standard TPL-001-4. The NERC Standard TPL-001-4 requires that BPA conduct an annual assessment to ensure that the BPA transmission system is planned to meet the required performance for the system conditions specified in the Standard. At times "the Standard" may be used interchangeably with "NERC Standard TPL-001-4".

The assessment includes BPA's load service areas as well as major network paths and interties across the transmission system. In accordance with the requirements of the Standard, BPA's transmission system was evaluated for the near-term (year two and year five) and the long-term (year ten) planning horizons to determine whether system performance requirements are met. If the studies identify any potential system performance deficiencies, then corrective action plans are developed, as necessary, to address such potential deficiencies.

In accordance with requirement R8 of TPL-001-4, BPA distributes the Planning Assessment results to adjacent Planning Coordinators and adjacent Transmission Planners within 90 calendar days of completing the Assessment, and to any functional entity that has a reliability related need and submits a written request for the information within 30 days of such a request. If a recipient of the Planning Assessment results provides documented comments on the results, BPA provides a documented response to that recipient within 90 calendar days of receipt of those comments.

The NERC Standard FAC-014-2 requires that BPA establish System Operating Limits (SOLs), including Interconnection Reliability Operating Limits (IROLs), consistent with its SOL Methodology. BPA establishes SOLs, including IROLs, consistent with its SOL Methodology for the Planning Horizon.

4.1 System Overview: Planning Areas, Paths, & Interties

The BPA transmission system covers the states of Washington and Oregon, and portions of Idaho, Montana, Wyoming, and Northern California. The system is characterized by mainly 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 with the exception of Grand Coulee, Hungry Horse, and Dworshak. In addition, there are several thermal generators located along the I-5 corridor between Seattle and Portland; and in the lower Columbia River basin between Pendleton and Portland. Wind generation is connected to the system along the lower Columbia River basin in southern Washington, northern Oregon, and the lower Snake River in Washington. Solar resources are connected to the system primarily in central Oregon. 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 eight planning areas and 27 load service areas. The planning and load service areas are based on geographic and electrical proximity. To effectively study the transmission system BPA's main grid is also divided into 13 internal paths and 4 interties for the system assessment. The function of these paths and interties is to transmit bulk power across the system. The distinction between them is that paths are internal to BPA's network and the interties connect BPA's network with other sub-regional systems in the Western Electricity Coordinating Council (WECC) region including British Columbia, Montana, and both northern and southern California.

Planning Areas

Paths & Interties

Planning & Load Areas

Northwest Washington
- Chehalis - Centralia
- Olympic Peninsula
- Seattle - Tacoma
- Southwest Washington

Willamette Valley
- Hood River - The Dalles
- Longview
- North Oregon Coast
- Portland
- Vancouver

Southwest Oregon
- Eugene
- Salem - Albany
- South Oregon Coast

North
- Klickitat
- Mid-Columbia
- Okanogan

Central
- De Moss - Fossil
- Pendleton - La Grande
- Tri-Cities
- Umatilla - Boardman
- Walla Walla

South
- Central Oregon
- Northern California

East
- North Idaho
- Northwest Montana
- Spokane - Colville - Boundary

Idaho
- Burley
- SE Idaho - NW Wyoming

Paths & Interties

- South of Custer
- South of Allston
- Paul Allston (retired 1/26/2022)
- North of Echo Lake
- North of Hanford
- Raver Paul
- Cross Cascades North
- Cross Cascades South
- West of John day
- West of Slatt
- West of McNary
- West of Lower Monumental
- West of Hatwai

- Northern Intertie
- Montana to Northwest Intertie
- Pacific DC Intertie
- California Oregon Intertie

4.2 Methodology

Each of the 27 load areas were assessed under the limiting system conditions for that area. Each area was then 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. BPA also assessed the performance of the 13 paths and 4 interties over the Planning Horizon. This included an evaluation of the total transfer capability (TTC) of the path or intertie. This evaluation confirms that the TTC is sufficient to meet existing obligations over the Planning Horizon or identifies any potential corrective action plans needed to meet applicable standards and criteria to ensure system reliability. The studies conducted for each load area and path includes steady state, voltage stability, and transient stability studies. Short circuit analysis is also conducted annually as part of BPA's Switchgear Replacement Program.

4.2.1 Validation of Past Studies

For each load area and transfer path, either new studies were conducted or past studies were used to ensure that existing and forecast load and expected firm transmission service can be served throughout the planning horizon and that existing or newly identified corrective action plans, such as system reinforcements, are adequate. The NERC TPL-001-4 Requirement 1 states that past studies may be used to support the Planning Assessment if the study is 5 years old or less and no material modifications have occurred to the System represented in the study.

4.2.2 Criteria

The BPA transmission system is planned to meet applicable NERC Transmission Planning System Performance Standard TPL-001-4. Contingency events and the required performance for those events are established in Table 1 of the NERC TPL-001-4 Standard. The following table includes the Categories of Contingency Events from the NERC Standard.

TPL-001-4 Category Events		
Normal System	P0	No Contingency
Single Contingency	P1	Single contingency of an element* or DC mono-pole
Single Contingency	P2	Bus section or internal breaker fault, or line section with no fault
Multiple Contingency	P3	Loss of generator plus an element* with system adjustment in between
Multiple Contingency	P4	Multiple elements* caused by stuck breaker
Multiple Contingency	P5	Multiple elements due to non-redundant relay failure
Multiple Contingency	P6	Loss of two single elements* with system adjustment in between
Multiple Contingency	P7	Loss of two circuits on common structure, or DC bi-pole

Note: Element refers to: a generator, transformer, transmission circuit, or shunt device.

Figure 9 NERC TPL-001-4 Category Events List

Category P3 and Category P6 multiple contingencies both involve loss of an element, followed by system adjustment, followed by loss of a second element. Category P3 is specifically for loss of a generator followed by a second contingency of a transmission element, whereas Category P6 is loss of a transmission element followed by a second contingency of another transmission element. For most load areas, federal generation is located remotely from the load and is delivered across transmission facilities into the areas. For those load areas that do have generation sources internal to the area, the external transmission facilities that also feed those areas are generally larger than the local generation. Therefore the transmission outages under P6 are normally more severe than generation outages under P3. For load areas that do have a large single generator unit internal to the area, base case sensitivities with that generator offline were evaluated. For paths, major generation tends to be on the sending end of the major transmission paths where loss of a generator reduces power flow across the paths and therefore P3 contingencies produce less severe impacts than P6. Category P6 contingencies produce more stressed conditions for paths, which produce more severe results for the BPA transmission system. Therefore, the path studies focused on Category P6 contingencies.

4.3 Assumptions

The following are general assumptions for the studies conducted that support the 2022 System Assessment. The 2022 system assessment largely relied on results of studies from the 2021 and 2020 system assessments, where validation of these past studies did not identify any material changes to the assumptions and confirmed that the 2021 or 2020 assessment results are still valid. The assumptions described in this section were used for the 2022 system assessment. Any additional assumptions or sensitivities that are specific to particular load areas or paths are described in the section of the report associated with that particular load area or path.

4.3.1 Base Cases

The NERC Planning Standard TPL-001-4 requires that the steady-state portion of the assessment be conducted for the following base cases (R2):

- System peak Load for year one or year two (R2.1.1)
- System peak Load for year five (R2.1.1)
- System Off-Peak Load for one of the five years in the Near-Term Planning Horizon (R2.1.2)
- System peak Load for one of the years in the Long-Term Planning Horizon (R2.2.1)

The base cases used for the 2022 System Assessment adequately covered these scenarios and required sensitivities. The base cases used for the steady state portion of the 2022 System Assessment originated from the latest available WECC approved base cases for the Near Term and Long Term Planning horizons, covering both peak and off-peak loads. The load forecasts and network topology in these base cases were validated using the latest forecasts and best available customer information. Load forecasts and topology for those WECC cases were then modified to represent the following study cases:

2022 System Assessment Steady State Base Cases					
Starting WECC Case	Study Year	Modified Study Case	Season	Load Level	Notes
22HSP1-OP	2022	23LSP	Spring	Off-Peak	Near term (2-year) expected light spring
22-23HW2	2022	23HW	Winter	Peak	Near term (2-year) expected winter peak
23HW3	2022	23HS	Summer	Peak	Near term (2-year) expected summer peak
27HW2	2027	27HW	Winter	Peak	Near term (5 year) expected winter peak
27HS2	2027	27HS	Summer	Peak	Near term (5 year) expected summer peak
30-31HW1	2031	31HW	Winter	Peak	Long-term (6-10 year) expected winter peak
31HS1	2031	31HS	Summer	Peak	Long term (6-10 year) expected summer peak

Figure 10 Steady State Base Case Assumptions Table

The 2022 System Assessment was largely based on qualified past studies from the 2021 and 2020 System Assessments.

The NERC Planning Standard TPL-001-4 requires that the Near-Term Transmission Planning Horizon portion of the Stability analysis include the following base cases (R2.4):

- System peak Load for one of the five years (R2.4.1)
- System Off-Peak Load for one of the five years in the Near-Term Planning Horizon (R2.4.2)

The base cases used for the 2022 System Assessment adequately covered these scenarios and required sensitivities. The base cases used for the stability portion of the 2022 System Assessment included the following because the assessment was largely based on qualified past studies from the 2021 and 2020 System Assessments.

2020 System Assessment Transient Stability Base Cases					
Starting WECC Case	Study Year	Modified Study Case	Season	Load Level	Notes
19LSP1	2022	22LSP	Spring	Off-Peak	Near term (2-year) expected light spring
19HW3	2022	22HW	Winter	Peak	Near term (2-year) expected winter peak
19HS3	2022	22HS	Summer	Peak	Near term (2-year) expected summer peak
24HW2	2025	25HW	Winter	Peak	Near term (5 year) expected winter peak
24HS2	2025	25HS	Summer	Peak	Near term (5 year) expected summer peak

Figure 11 Transient Stability Base Case Assumptions Table

4.3.2 Loads and Transfers

As required by the NERC Reliability Standards, the transmission system is planned for expected load conditions over the range of forecasted system demands. Normal summer and winter peak loads were based on a 50% probability of exceedance. Light Spring load reflected the Off-peak loading condition. Historical load levels for peak and off-peak load conditions were also examined to make sure the loads represented in the base cases were reasonable.

Also, as required by the NERC Reliability Standards, the transmission system is planned to meet known commitments for long-term firm transmission services. At a minimum, the expected long-term firm transmission service commitments were modeled in the studies. For the path studies, system transfers beyond the long-term firm transmission obligations was modeled in order to determine system total transfer capability limits in the planning horizon for each path.

4.3.3 Resources

The base cases modeled, at a minimum, those resources with firm transmission service. Beyond that, other resources were modeled as needed to meet the forecast customer demands (load forecast) and expected firm transmission service.

There is over 7,000 MW of wind generation interconnected and less than 500 MW of solar generation interconnected throughout the northwest. This is reflected in the WECC base case models. However, the peak load reference cases used for the load area assessment assumed minimal renewable generation on-line. This assumption was made because of the intermittent nature of wind and lack of significant solar 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 typically creates more limiting conditions for the load areas. For load areas and transmission paths which are affected by renewable generation, sensitivities are conducted with wind or solar generation at full output.

4.3.4 Topology and Future Projects

At the start of the Assessment, the transmission system topology was reviewed and updated with the latest available information for the near term (one to five years out) and long term (six to ten years out) planning horizons. The topology includes both existing and planned facilities. For the individual load areas, local utilities were coordinated with in order to acquire the latest information about their proposed projects, including schedules and level of commitment whenever possible. Since adding conceptual projects to the assessment could mask future system problems, which is the focus of the studies, most future proposed projects were not included in the near term base cases. The only future projects that were included in the near term were those where 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 were modeled which may not have budget approval, but were considered likely to proceed. By including mainly projects that utilities are actively pursuing, the next level of reinforcement needs can be identified and prioritized. The assessment includes reactive power resources to ensure that adequate reactive resources are available to meet system performance. The assessment also includes the effects of existing and planned protection systems and control devices.

4.3.5 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 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.

5. Transmission Planning Landscape

Transmission Planning's goal is to provide a reliable, flexible, environmentally responsible, and cost effective transmission system. The planning process is conducted 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. As Transmission Planning strives to have a regionally coordinated system 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.

5.1 Regulatory

5.1.1 FERC Notice of Proposed Rulemaking – Interconnection Reform to Address Queue Backlogs

In 2022, FERC issued a proposed rule focused on expediting the current process for connecting new electric generation facilities to the grid. The notice of proposed rulemaking (NOPR) Docket No. RM22-14 aims to address significant current backlogs in the interconnection queues. The NOPR reforms have three broad goals: implement a first-ready, first-served cluster study process; increase the speed of interconnection queue processing; and incorporate technological advancements into the interconnection process. Comments were due October 13th, 2022 and reply comments were due November 14, 2022. BPA provided comments in the docket.

This Interconnection Reform NOPR builds on Commission Order Nos. 2003 and 2006 where it first required public utility transmission providers to adopt its standard procedures and agreements for interconnecting large and small generating facilities, and Order No. 845 that revised those procedures and agreements. The electricity sector has transformed significantly since the issuance of Order Nos. 2003 and 2006. The growth of new resources seeking to interconnect to the transmission system and the differing characteristics of those resources have created new challenges for the generator interconnection process. These new challenges are creating large interconnection queue backlogs and uncertainty regarding the cost and timing of interconnecting to the transmission system.

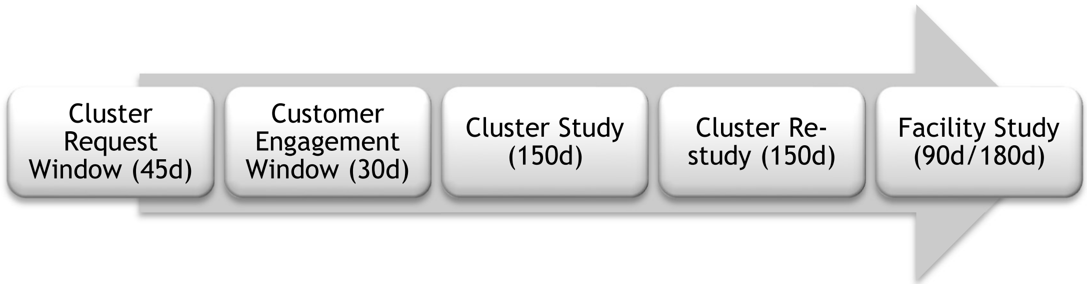
The proposed rule items listed below include many, but not all, of the reform issues:

Reforms to Study Process

- **Public Interconnection Information**
  Transmission providers will be required to post on their website an interactive visual represenatation of estimated capacity available at each bus in the transmission provider's footprint. The interactive visual representation will show the estimated impact of the addition of a proposed generating facility. Interconnection customers will be able to input details of a proposed generating facility, including megwatt amount, voltage level, and point of interconnection. The website will automatically generate a table of results showing the impact of that new generating facility on existing facilities. The pro forma large generation interconnection process (LGIP) does not contain a process by which an interconnection customer can obtain information at a specific location or point of interconnection about potential interconnection costs prior to submitting an interconnection request. As a result, at the outset of the generator interconnection process, interconnection customers typically have little insight into the interconnection capacity available at various points on the transmission system. Furthermore, interconnection customers face limited financial commitments to enter and stay in the interconnection queue and few requirements to prove the commercial viability of proposed generating facilities. Therefore, developers often submit multiple interconnection requests for proposed generating facilities at various points of interconnection, not all of which are expected to reach commercial operation, as an exploratory mechanism to obtain information to allow them to choose the most favorable site.

- **Informational Interconnection Study**
  Interconnection customers may request up to five informational interconnection studies at a time, with a $10,000 deposit per requests. Each informational interconnection study must be completed in 45 days.

- **Implement a first-ready, first-served cluster study process**
  Eliminate the first-come, first-served study process currently required and use a first-ready, first-served cluster study process. Transmission providers would conduct larger interconnection studies encompassing numerous proposed generating facilities, rather than separate studies for each generating facility. This ensures ready projects can proceed through the queue in a timely manner and transmission providers would impose additional financial commitments and readiness requirements on interconnection customers.



- **Customer Increased Financial Commitments and Readiness Requirements**
  These reforms include study deposit amounts, demonstration of site control, commercial readiness milestone, and withdrawal penalities.

- **Allocation of Cluster Study Costs, Network Upgrades and Shared Network Upgrades**
  Ninety percent of cluster study costs will be distributed to interconnection customers on a pro-rata megwatt basis and ten percent of the cluster study costs will be distributed to interconnection customers on a per-capita basis based on number of generating facilities in the cluster. Network-upgrade costs will be allocated among a cluster using a proportional impact method and provided in the tariff. Shared Network Upgrades is later-in-time customers will reimburse earlier-in-time interconnection customers for network upgrades.

Reforms to Improve Queue Processing Speed

- **Eliminate the reasonable-effort standard**
  Eliminate the reasonable efforts standard for processing interconnection requests and impose firm deadlines and establish penalties if transmission provider fails to complete interconnection studies on time. Proposed penalties is $500 per day when trasmission provider fails to meet study deadlines. Penalities capped at 100% of total study deposits. Other potential criteria is proposed such as a 10-grace period and mutually agreed 30-day extenstion to study.

- **Establish a standard for affected systems**
  Establish a standard, uniform, affected system study process for all jurisdictional transmission providers. Create a pro forma affected system study agreement and facilities construction agreement. Require that transmission providers study all affected system interconnection requests as requests for Energy Resource Interconnection Service (ERIS).

Reforms to Incorporate Technological Advancements to Interconnection Process

- **Increase flexibility in the generator interconnection process**
  Require transmission providers to allow more than one resource to co-locate on a shared site behind a single point of interconnection and share a single interconnection requests. Allow interconnection customers to add a generating facility to an existing request without automatically losing their position in the queue.

- **Incorporate technological advancements into the interconnection process**
  Require transmission providers to consider alternative transmission solutions if requested by the interconnection customer. Transmission Providers must consider advanced power flow control, transmission switching, dynamic line ratings, static synchromous compensators, and static VAR compensators. Transmission provers may file an annual information report on alternative transmission solutions.

- **Update modeling and performance requirements for system reliability**
  To address the unique characteristics of the changing resource mix, certain modeling and performance requirements for non-synchromous generating facilities are proposed. Interconnection customers must provide accurate models of the generating facility with the interconnection requests.

5.1.2 Regional Transmission Organization (RTO)

What is a Regional Transmission Organization?

A Regional Transmission Organizations (RTO) is an organization formed at the approval of the Federal Energy Regulatory Commission (FERC). FERC Order Nos. 888 and 889 are where the Commission suggested the concept as one way to provide non-discriminatory access to transmission. In the later Order No. 2000 the Commission encouraged the voluntary formation of RTO. Order 2000 provides twelve characteristics and functions that an entity must satisfy in order to become a RTO.

In areas where a RTO is established it coordinates, controls, monitors the operation of the electric power system either in a single state or multiple states. RTOs operate the transmissions systems and develop innovative procedures to manage transmission equitably. Historically, wholesale power trade typically occurs through bilateral transactions. Whereas, a RTO operates as a centralized market that serves as a clearing house for all electricity needed to serve customer demand. The RTO sends electricity to meet demand while choosing the lowest cost.

Source: FERC Website

The majority of electricity markets are operated by RTOs, but there is currently no RTO in the west outside of California. Western states have begun examining the benefits of a RTO in their state to boost clean energy to solve transmission needs.

ODOE Regional Transmission Organization Study: Oregon Perspectives

Oregon Senate Bill 589 (2021) required the Oregon Department of Energy (ODOE) to identify the opportunities, challenges, and barriers to Oregon entities participating in a Regional Transmission Organization (RTO). The findings of this study, from recent literature and a broad range of stakeholders, reveals there is widespread agreement among stakeholders on the value of increased regional coordination and collaboration. However, it also identified a need to balance competing interest across different types of utilities, state and federal entities, and other interested stakeholders to achieve a common objective for clean energy goals inside and outside of Oregon. Stakeholders identified important questions that would need to be addressed through RTO design such as BPA's unique statutory considerations.

Serious consideration of RTO formation has occurred multiple times over the last several decades in the northwest, "but the current momentum toward increased regionalization has a unique sense of drive and urgency." The momentum is predicated by the formation of the energy imbalance market (EIM), robust expansion of the EIM, regional compliance frameworks for ensuring resource adequacy and BPA joining the EIM.

Momentum to Increase Regionalization

Source: Regional Transmission Organization Study: Oregon Perspectives

While there are RTOs currently operating in the United States, each has unique elements, rules, and governance structures. Even though each RTO is unique FERC Order 2000 provides twelve characteristics and functions that an entity must satisfy to become a RTO. The report provides broad common interest among Oregon stakeholders in building on the current momentum to explore more regional collaboration.

The following perspectives evolved:

- **Balanced Market Design:** RTO governance and market design must balance competing interests.
- **Economic Benefits:** RTO formation could economically benefit Oregon retail customers.
- **Incremental Regionalization:** Momentum toward increased regional cooperation is evident.
- **Transmission Operational Benefits:** RTO formation could bring operational benefits to the transmission system but would not necessarily solve cost allocation, siting, and permitting challenges.
- **Low-Cost Renewable Energy:** Significant renewable energy development is expected to occur in Oregon and the region with or without an RTO, but an RTO may create new low-cost opportunities.
- **State Role and Policy:** The state can play an important role to support the interests of Oregon stakeholders by representing their perspectives in regional forums. Careful design of the RTO is necessary to prevent erosion of state authority.
- **Legal Prohibitions:** The committee identified no legal prohibitions to RTO formation.

There is broad interest among stakeholders on building regional collaboration and coordination to manage the industry issues. The report concludes, "[t]here is no pre-existing, multi-state forum designed to address these issues to identify an optimal path forward. But it is also clear that no single state – nor single entity or small collection of utilities – could reconcile these challenges on its own." Formation of a RTO requires a nuanced approach to balance various stakeholder perspectives in order to bring benefits to Oregon customers.

5.2 State Legislation

5.2.1 State's Clean Energy Bills

Oregon Clean Energy House Bill 2021

Electric companies are required to develop clean energy plans and electricity service suppliers to report information for meeting clean energy targets. This bill requires retail electricity providers to reduce greenhouse gas emissions associated with electricity sold to Oregon consumers.

2030 – Reduce greenhouse gas emissions to 80 percent below baseline emissions levels.
2035 – Reduce greenhouse gas emissions to 90 percent below baseline emissions.
2040 – Reduce greenhouse gas emissions to 100 percent below baseline emissions levels.

Washington's Clean Energy Transformation Act (CETA)

In 2019 the Washington State Legislature passed a set of bills creating an ambitious, multi-decade agenda that changes how electric and natural gas utilities acquire resources and provides energy services to Washington business and consumers. CETA requires the state's electric utilities to fully transition to clean, renewable and non-emitting resources by 2045. Washington's investor-owned utilities must develop and implement plans. The law provides safeguards to maintain affordable rates and reliable service. It also requires an equitable distribution of the benefits from the transition to clean energy for all utility customers and adds and expands energy assistance programs for low-income customers.

The act sets the following mandatory targets:

2025 – All electric utilities must eliminate coal-fired generation serving Washington state customers.
2030 – All electric utilities must be greenhouse gas neutral
2045 – All electric utilities must generate 100% of their power from renewable or zero-carbon resources.

California's Clean Energy Bill

As California faces severe drought conditions and risk of wildfires, California lawmakers passed legislation that codifies new benchmarks to get California to 90 percent clean electricity by 2035 and 95 percent by 2040, which is a stepping stone toward its already established goal of 100 percent clean electricity by 2045. The $54 billion is to be spent over five years on electric vehicles, public transit, climate and drought resistance programs, and to decarbonize the state's electrical grid. The closure of California's Diablo Canyon nuclear plan is postponed to help stabilize the state's grid as the plant provides an estimated 6-9 percent of the state's electricity and was set to close in 2025. Previous laws called for the use of 60 percent renewable energy by 2030.

2035 – 90 percent clean electricity
2040 – 95 percent clean electricity
2045 – 100 percent clean electricity

5.2.2 State's Renewable Portfolio Standards

A Renewable Portfolio Standard (RPS) is a regulatory mandate to increase production of energy from renewable sources such as wind, solar, biomass and other alternatives to fossil and nuclear electric generation. States created these standards to diversify their energy resources, promote domestic energy production and reduce emissions. This RPS mechanism places an obligation on regulated utilities to produce a specified fraction of electricity from renewable energy sources. Standards are typically measured by the percentage of retail electric sales. Below are general requirements by select states.

- California's requirement is 44 percent by 2024, 52 percent by 2027, and 60 percent by 2030 for investor-owned and municipal utilities. Finally requiring 100 percent clean energy by 2045.
- Washington's requirement is 15 percent by 2020 for investor-owned utilities and retail suppliers. The Clean Energy Act of 2019, a new clean energy electricity standard, requires utilities eliminate coal-fired generation by 2025, be greenhouse gas neutral by 2030, and generate 100 percent of power from renewable or zero-carbon resources by 2045.
- Oregon's requirement is 25 percent by 2025 and 50 percent by 2040 for utilities with 3 percent or more of the state's load; 10 percent by 2025 for utilities with 1.5-3 percent of the state's load; and 5 percent by 2025 for utilities with less than 1.5 percent of the state's load.
- Montana's requirement is 15 percent by 2015.
- Idaho and Wyoming have no standard.

5.3 Markets

5.3.1 Western Energy Imbalance Market (WEIM)

The Western Energy Imbalance Market (WEIM) was launched in 2014 by the CAISO and interest has grown as more utilities join the EIM. It is a voluntary market that provides a sub-hourly economic dispatch of participating resources for balancing supply and demand every 5 minutes. The EIM is a real-time wholesale energy trading market that enables participants anywhere in the west to buy and sell energy when needed. The WEIM has experienced robust growth with 19 balancing authorities now participating in the market. In May 2022 BPA and Tucson Electric Power joined the WEIM. CAISO exuberantly states the substantial benefits, which rose to $2.39 billion since the market was launched in 2014, demonstrates the value the market offers in operational and environmental efficiencies.

Building on the success of the WEIM, the ISO is collaborating with stakeholders to develop an extended day-ahead market (EDAM). By optimizing diverse generation resources and transmission connectivity on a day-ahead bases across the WEIM's side geographic footprint, market participants and consumers may realize greater reliability, economic and environmental benefits.

5.3.2 Western Markets Exploratory Group (WMEG)

The Western Markets Exploratory Group has grown to 25 members serving 16 million customers after 11 utilities joined the group. Six of the new members are from the Northwest – Bonneville Power Administration, Avista, NorthWestern Energy, Tacoma Power, and the Chelan and Grant county public utility districts. The group is evaluating a staged approach to organizational regional market structures that can benefit customers and help participants meet carbon emissions-reduction goals. The group is exploring the potential for new market services including day-ahead energy sales, transmission system expansion, and other power supply and grid offerings. That path could be up to and including as a regional transmission organization.

5.4 Regional Entities & Current Events

5.4.1 Western Power Pool (WPP) & Western Resource Adequacy Program (WRAP)

The Western Power Pool (WPP), formerly known as the Northwest Power Pool, is fundamentally a reserve sharing group among its members. Membership is voluntary and comprised of major generating utilities serving the Northwestern U.S., British Columbia and Alberta. Smaller, principally non-generating utilities in the region participate indirectly through the member system with which they are interconnected. The WPP provides the benefits of coordinated operations. NWPP activities are largely determined by major committees – the Operating Committee, the PNCA Coordinating Group, the Reserve Sharing Group Committee, and the Transmission Planning Committee.

Western Resource Adequacy Program (WRAP)

Members of the WPP initiated discussions in 2019 that led to a cooperative process to address regional resource adequacy. Based on recent trends of clean energy legislation, retiring coal plants and increasing integration of renewable resources, along with extreme load events, participants in the initiative are evaluating the potential for generation capacity shortfalls facing the West. The WRAP is intended to ensure there is sufficient generating capacity available to meet the region's forecasted peak hourly demand (including contingency reserves) through coordination, established metrics and transparency among participants. BPA has participated in the development of the WRAP since its inception.

In 2021 WPP choose the Southwest Power Pool (SPP) to provide program operator services for the WRAP. In September 2021 BPA committed to participating in the non-binding forward showing phase (Phase 3A) of the WRAP. As a Load Responsible Entity, BPA is supportive of the regional effort being organized and administered by the WPP to design a program that strengthens resource adequacy.

The WRAP published its draft tariff in July 2022. When WRAP files the tariff with FERC, the filing triggers the start of the FERC process. Below is a snapshot of the Resource Adequacy Development timeline.

5.4.2 NorthernGrid Transmission Group & Regional Transmission Plan

FERC approved the merger of Columbia Grid and Northern Tier Transmission Group to form NorthernGrid (NG), a vast transmission planning region stretching across eight Western states. The NG is the outcome of a single transmission planning region, facilitating regional transmission planning, enabling one common set of data and assumption, identifying regional transmission projects through a single stakeholder forum, and eliminating duplicate administrative processes. Participants include Bonneville, investor-owned and consumer-owned utilities in California, Idaho, Montana, Oregon, Utah, Washington and Wyoming.

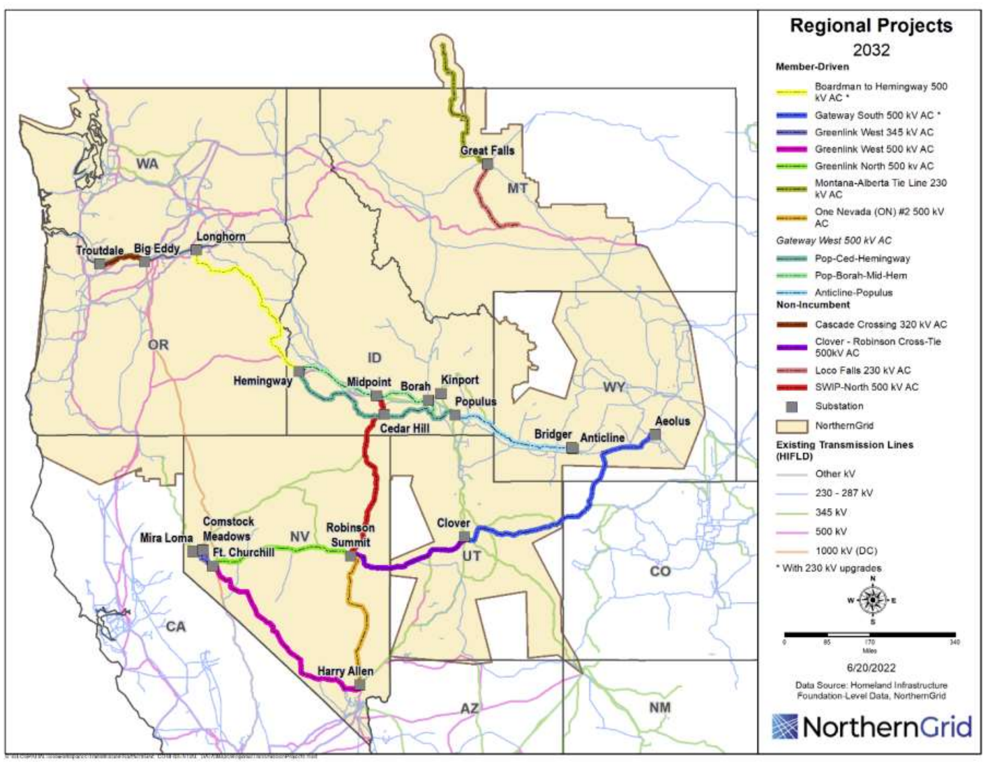
Draft Study Scope 2022-2023 Cycle

The Study Scope outlines the NG 2022-2023 regional transmission planning process, as required under FERC Order Nos. 890 and 1000, in accordance with each Enrolled Party's Open Access Tariff (OATT) Attachment K – Regional Planning Process and NG Planning Agreement. The NG's Transmission Plan evaluates whether transmission needs within the NG may be satisfied by regional and/or interregional transmission projects. The Regional Summary of Needs states there are 13 regional projects for consideration and no interregional projects were submitted to the NG region. Members report 9,238 MW of generation retirements and 24,067 MW of generation additions. Members are proposing 141 new and upgrade transmission line projects, primarily for local load service and increased reliability.

Regional Transmission Plan

The regional plan will be developed over the course of two years, March 2022 through December 2023. The image below shows the key deliverables.

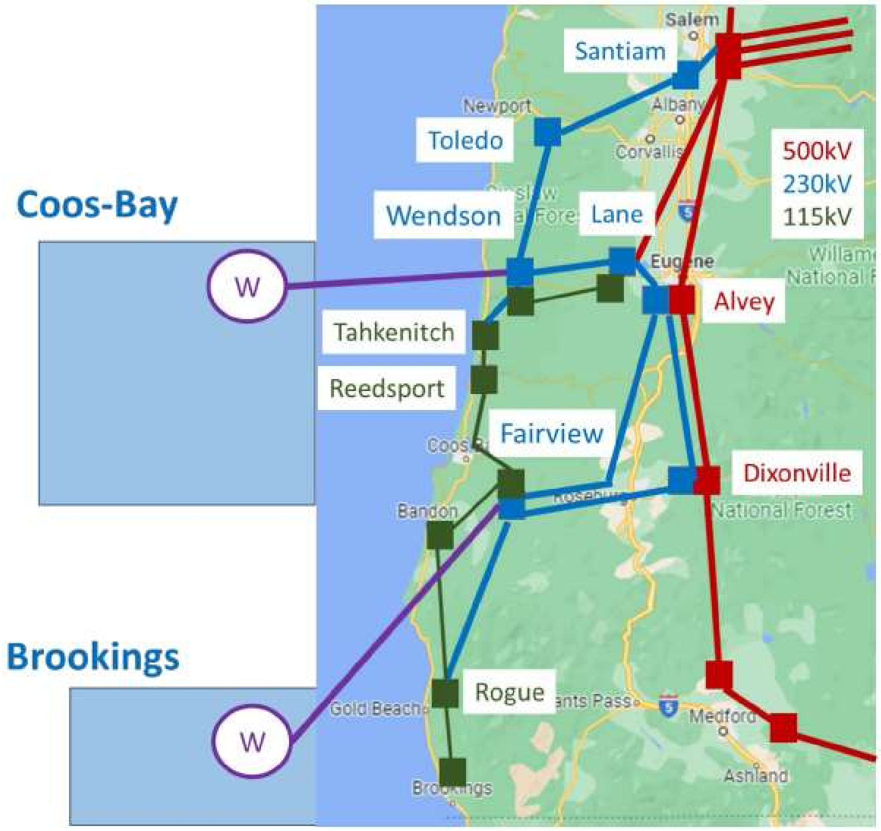
NG Regional Projects



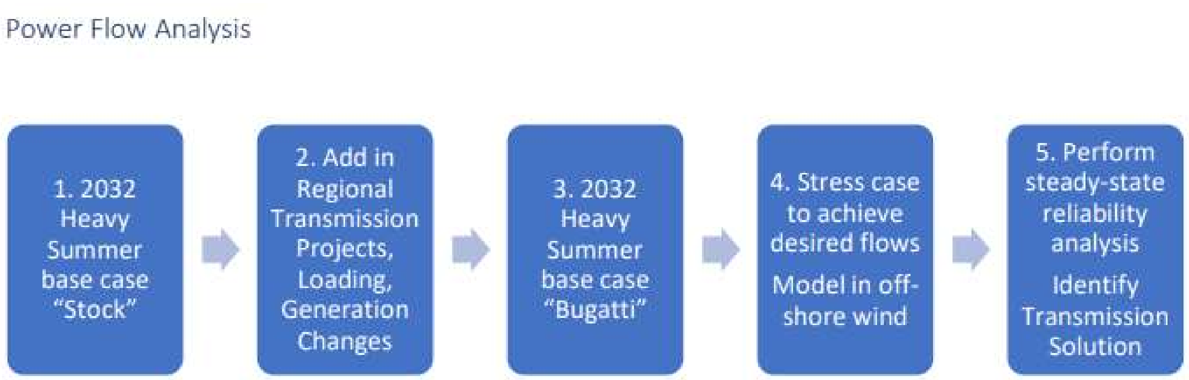
Study Scope for Offshore Wind in Oregon

In March 2022 the Oregon Public Utility Commission along with the Oregon Department of Energy jointly submitted to the NG planning region a request for both economic and reliability analysis of the impacts to the transmission system for a 3 gigawatt (GW) capacity wind farm on the Oregon coastline. High-level details include 3 GW of wind split with 1,800 MW interconnected at the Fairview substation near Coos Bay, OR and 1,200 MW at the Wendson substation near Florence, OR. The planned in-development date is December 2032. The evaluation shall include an identification of transmission system upgrades necessary to accommodate the power flow capacities of key existing transmission cooridors and paths to enable the full deliverability of the power to load with minimal curtailment of generation due to transmission constraints. A report of the Economic Study Request, methology, and findings is expected to be completed by March 2023. This economic study report will be a stand-alone report that will be included as an appendix to the Regional Transmission Plan.

The points of interconnection were selected to be the points that will allow the emphasis of the analysis to remain on the impact to the NG region. The Wendson 230 kV substation is one of the closest opportunities to interconnect to the transmission grid at the 230 kV level. The Fairview substation, while not the closest geographically to the Brookings wind pocket, is the closest for the purose of the Economic Study Request. The Rogue substation was studied as a point of interconnection in the BPA TSEP program and so was not selected as the southern point of interconnection for study analysis.



The power flow process depicts the process needed to determine the transmission solution that will alleviate any observed reliability violations under the conditions considered. The image below shows the power flow analyses that will be needed to evaluate these off-shore wind requests.



Source: NorthernGrid

6. Major Transmission Projects

Major transmission expansion projects with a plan of service shown in the map below include: Puget Sound Area Northern Intertie (Raver 500/230 kV Transformer Addition), Schultz – Wautoma 500 kV Series Capacitors Addition, South Tri-Cities Reinforcement, and the Schultz-Raver TSEP 2020. The Raver 500/230 kV Transformer Addition is in the construction phase. The transformer is in service and the rest of the project will be completed in 2024. This section provides more detailed information about each of these major transmission projects. Estimated project costs are direct costs (overheads are not included).

6.1 South Tri-Cities Reinforcement

This planned project reinforces the South Tri-Cities Area to address near-term operations and maintenance issues as well as provides operating flexibility in the rapidly growing Tri-Cities area in Washington. The area is compliant with planning standards for the loss of any single element. However, loss of two sources to the area may result in substantial loss of load. This hinders the ability to take any transmission facilities in the area out for maintenance during the summer since plans must be in place to address the potential loss of a second element. Also, requests for additional load service and generation interconnection depend on this reinforcement.

The plan of service loops the Ashe-Marion 500 kV line into a new Webber Canyon substation. A new Webber Canyon 500/115 kV transformer then connects 17 miles of 115 kV line to Badger Canyon substation.

- Expected Energization is 2025.
- Estimated costs is $96.7 million.
- The project is in the scoping phase.

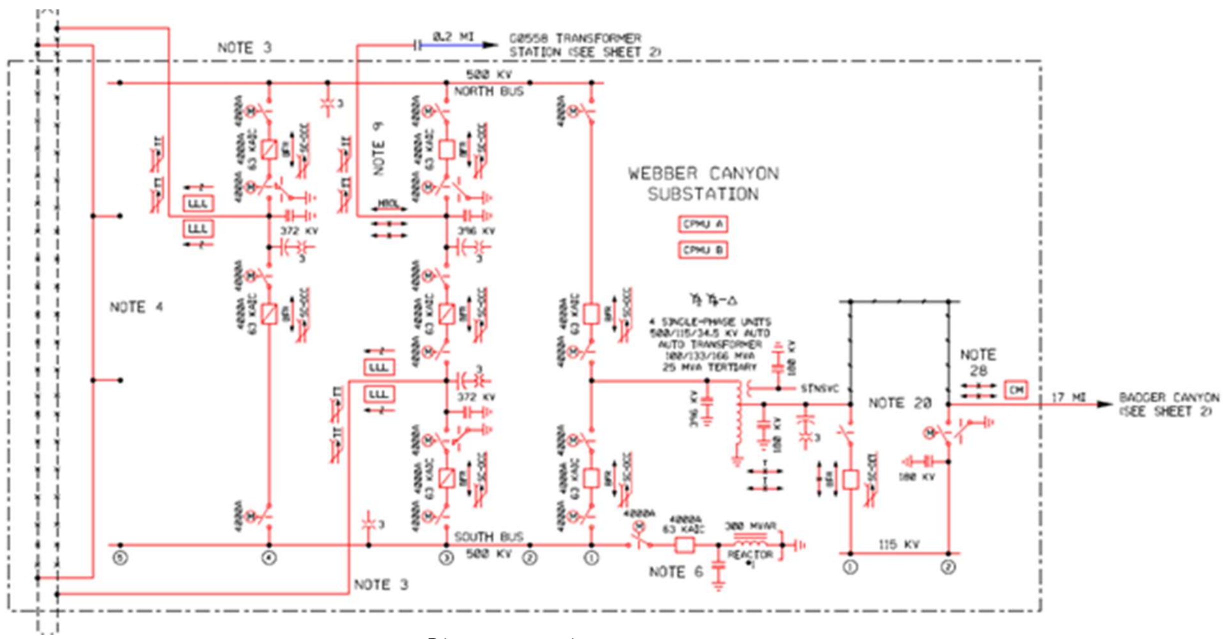


Diagram continues on next page.

South Tri-Cities Reinforcement Project continued

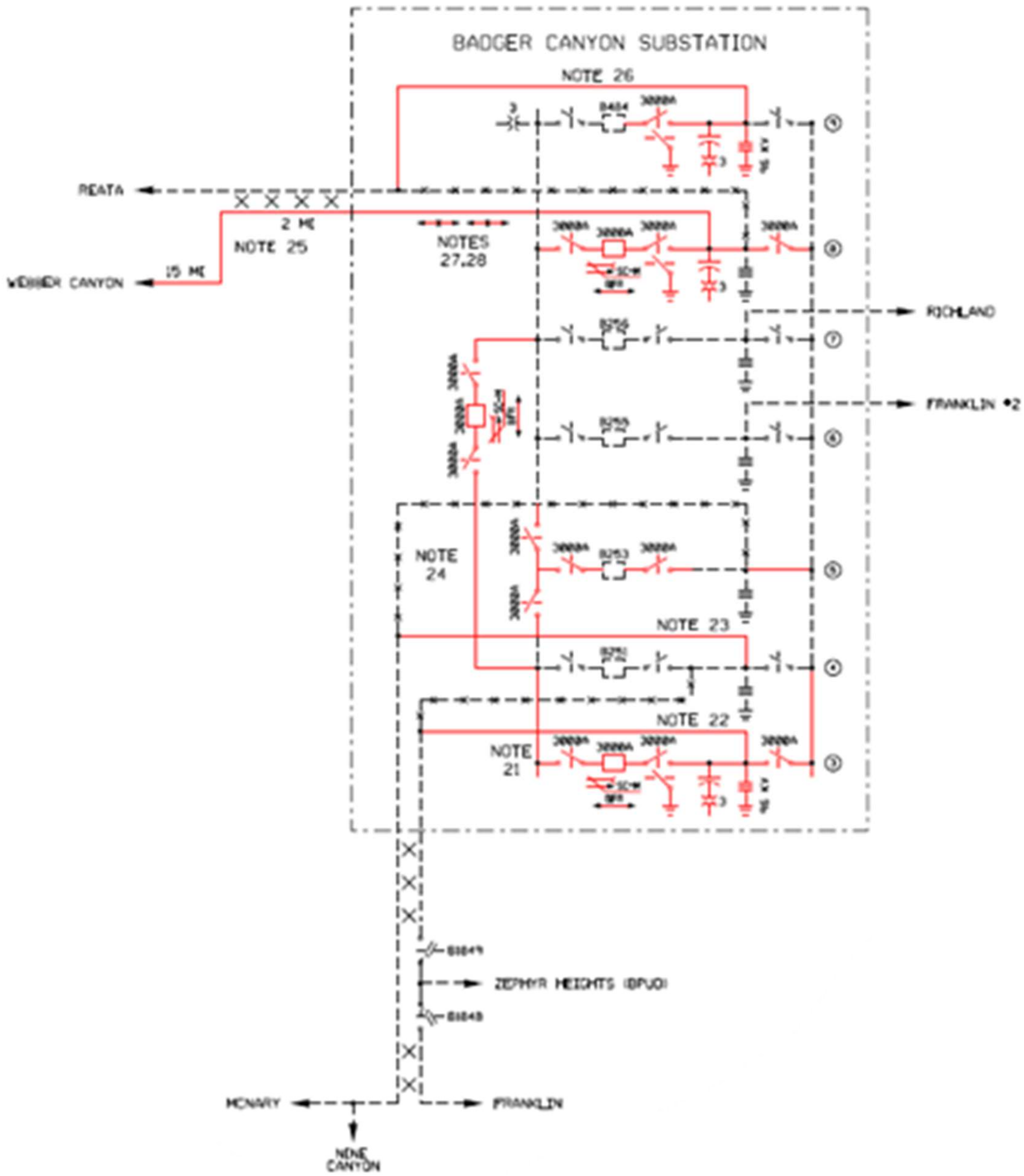


Figure 12 South Tri-Cities Reinforcement Project

6.2 Raver 500/230 kV Transformer Addition

The plan of service is to install a 500/230-kV 1300 MVA transformer at Raver substation. A new 230kV substation will be developed adjacent to the existing 500kV substation. The high side of the new transformer will terminate at Raver 500 KV. The project will also reconfigure the Tacoma-Raver 500 KV lines by removing jumpers and re-terminating the Tacoma-Raver #2 circuit into Covington 230 KV and Raver 230 KV Substations. The Tacoma-Raver #2 line will be renamed and operated as the Raver-Covington #3 230 KV line. The plan of service also requires reconfiguring the Covington 230 KV bus, adding a new sectionalizing breaker and two bus tie breakers.

This project is primarily for load service to Tacoma and Covington Substations and has no significant impact to the WECC transmission system. It has been studied as part of a sub-regional Puget Sound Area Study team through Columbia Grid.

- The transformer was energized in 2021 and the rest of the project is expected to be energized in 2024.
- Estimated cost is $100 million.
- This project is in the construction phase.

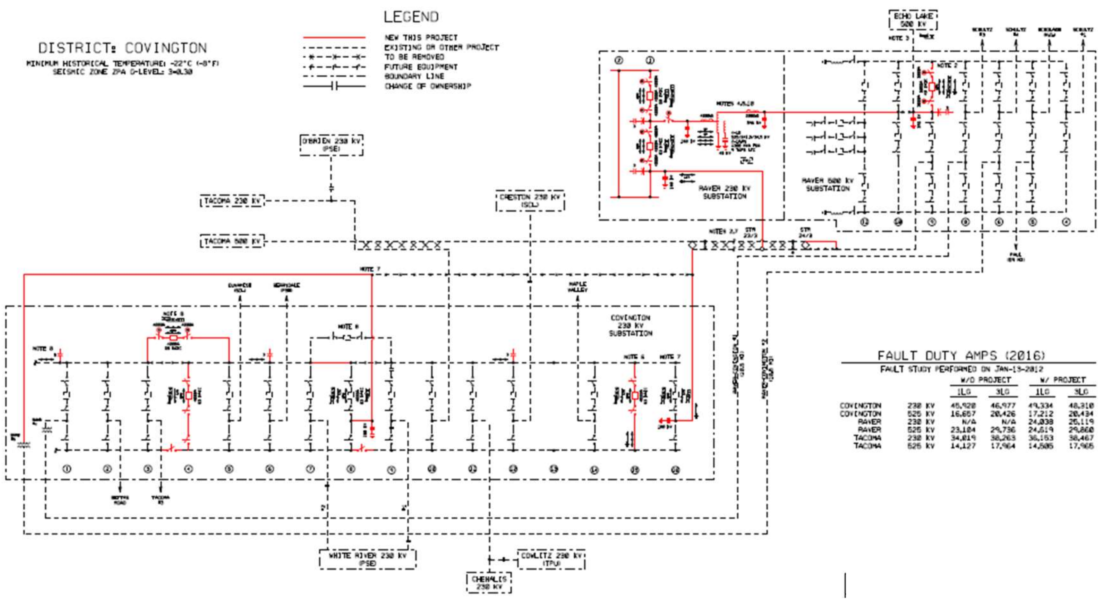


Figure 13 Raver 500/230 kV Transformer Addition Project

6.3 Schultz-Raver Series Capacitors TSEP 2020

This project is needed to provide additional west of cascades north capacity. Series capacitors will be added at Schultz on the Schultz-Raver 500 kV #3 and #4 lines. This project will provide flexibility on the West of Cascades North path.

- The project expected energization is 2025-2026.
- Estimated cost is $50 million.
- The project is in design phase.

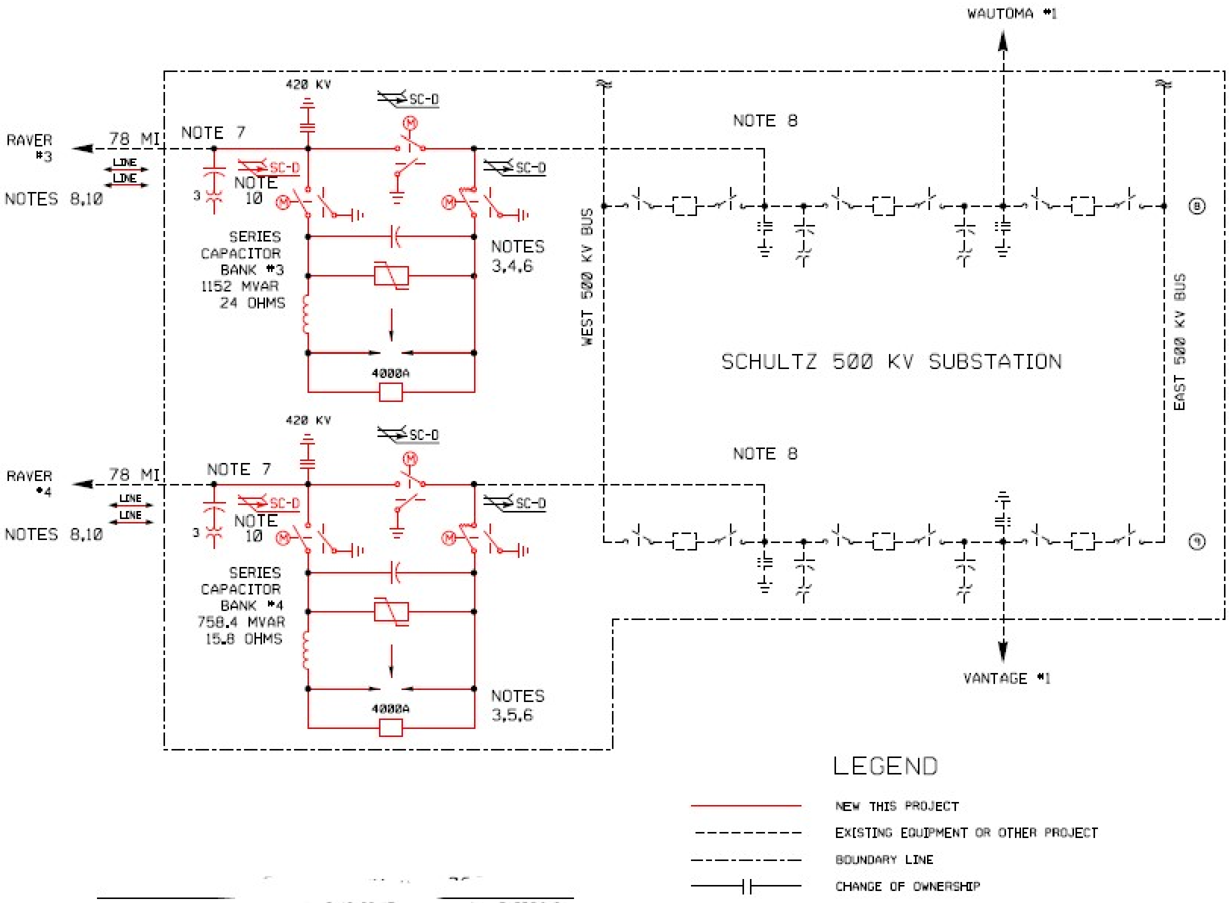


Figure 14 Schultz-Raver Series Capacitors TSEP 20202

6.4 Schultz-Wautoma 500 kV Series Capacitor Addition

This project is necessary to increase South of Allston (SOA) available transfer capability and improve operations and maintenance flexibility for SOA. The project will add 1152 Mvar, 24 OHM series capacitor (rated 4000A at 500 kV) on the Schultz-Wautoma line at the Wautoma substation.

- Expected energization is 2024.
- Estimated cost is $30 million.
- The project is in the design phase

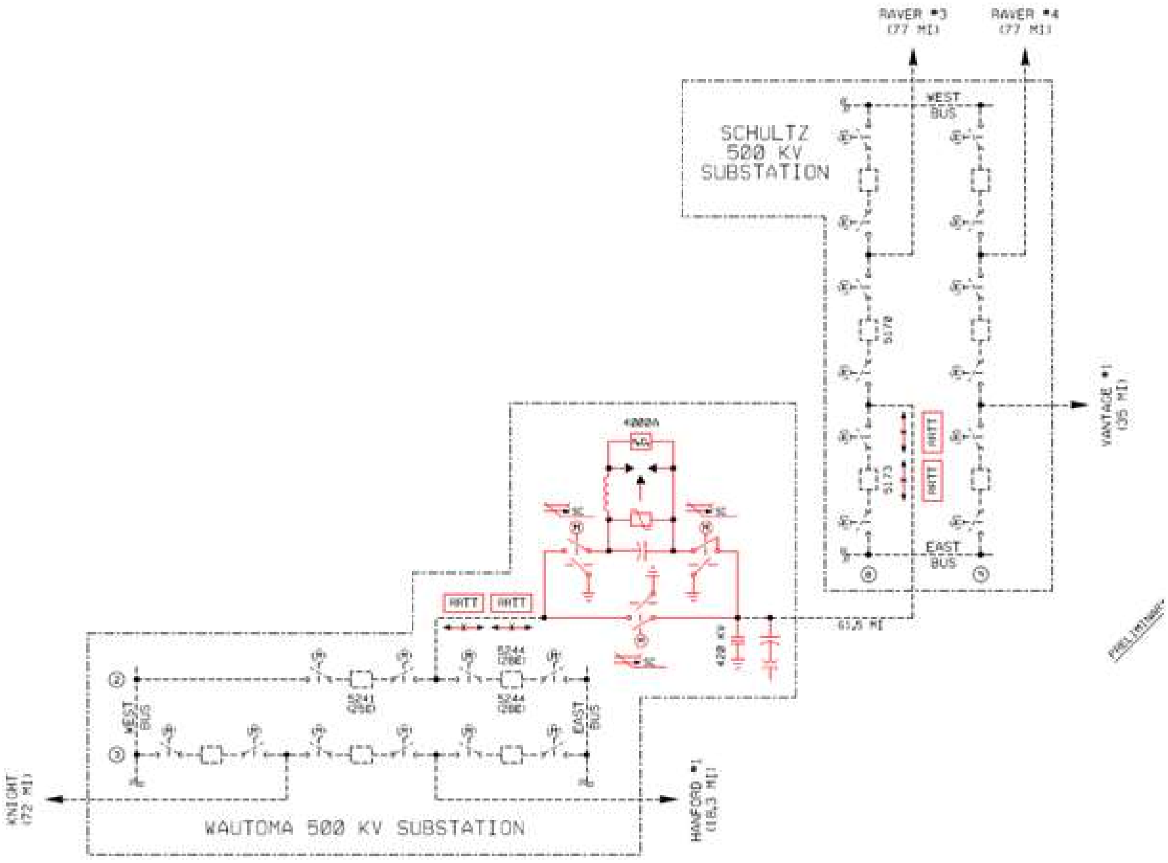


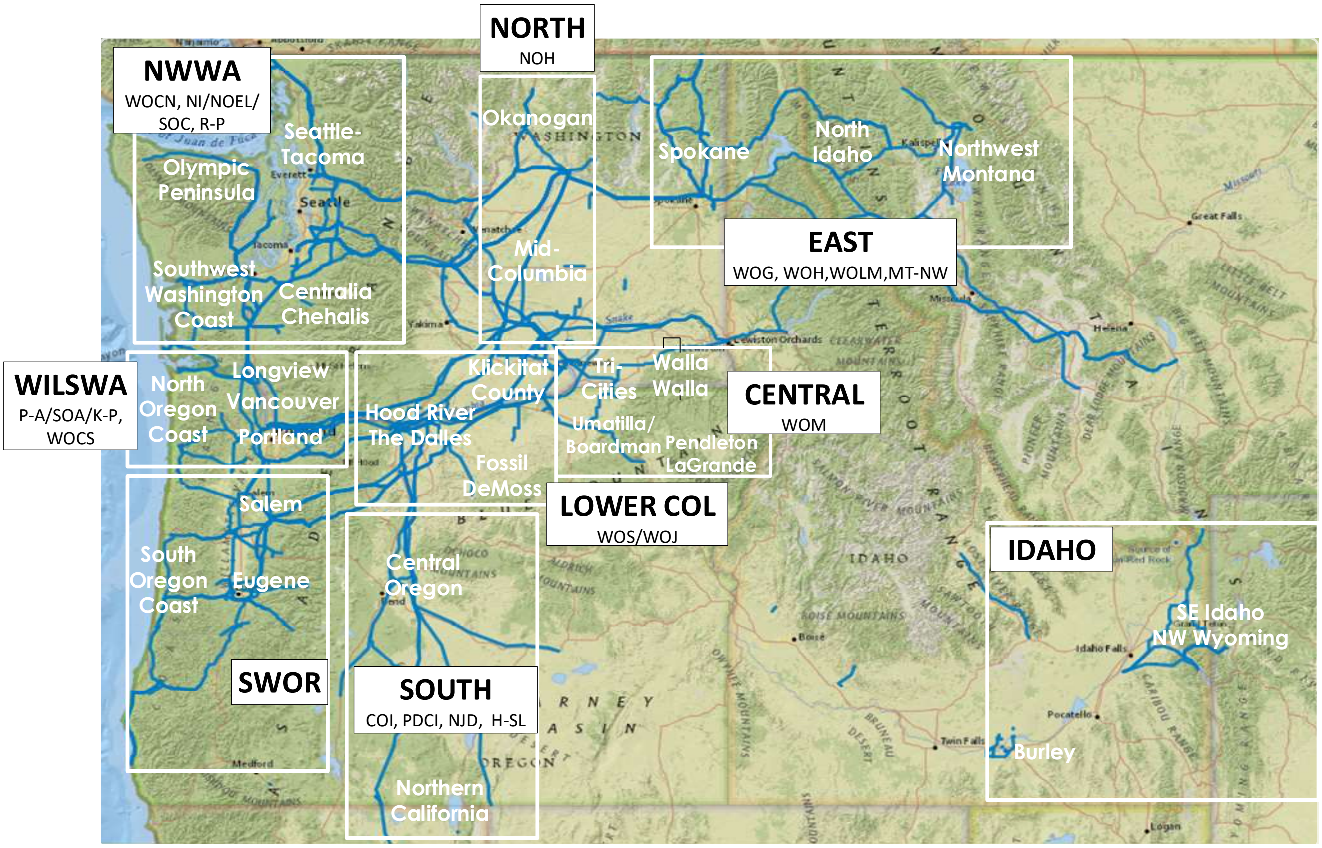
Figure 15 Schultz-Wautoma 500 kV Series Capacitor Addition Project

7. Transmission Needs by Planning Areas

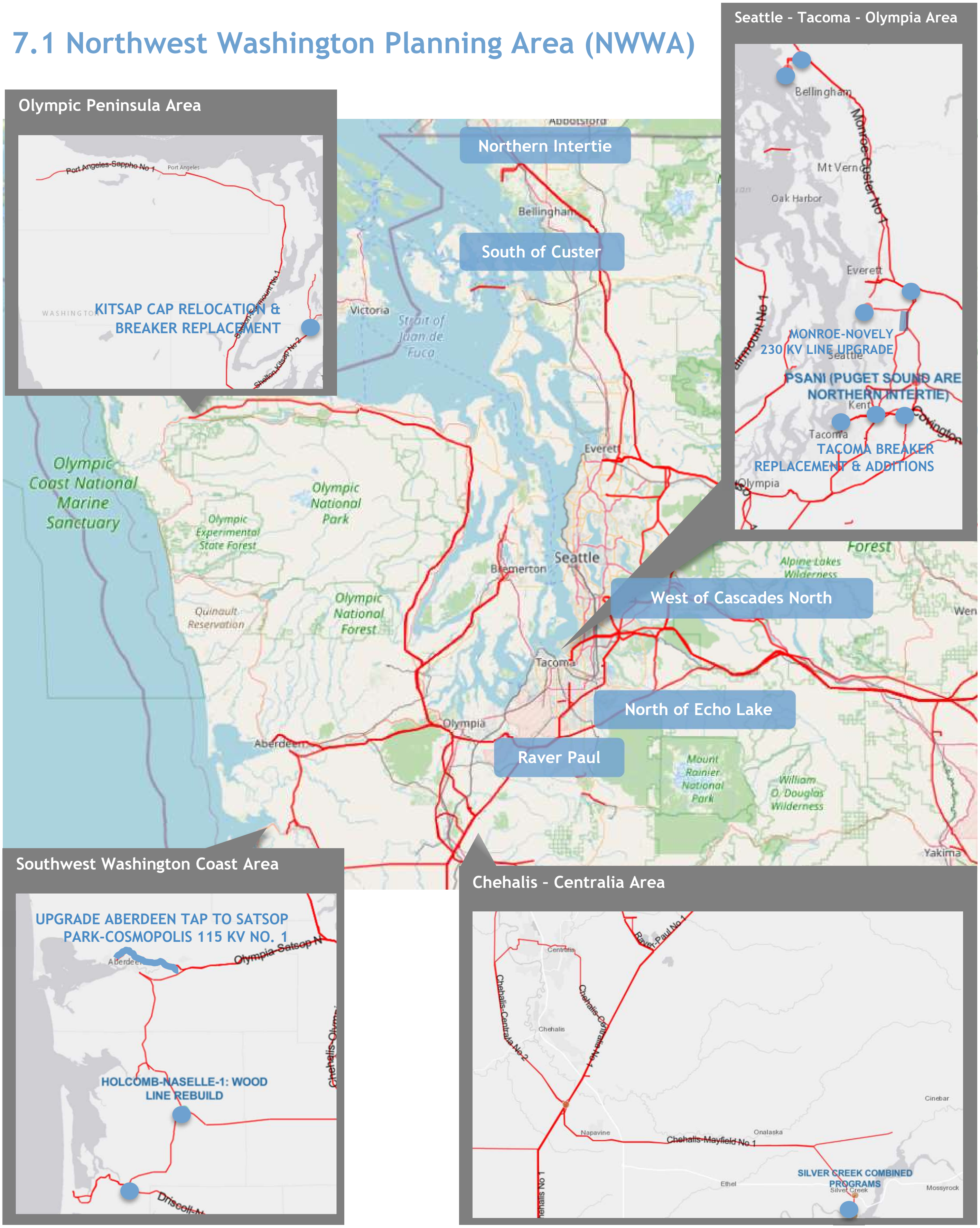
On an annual basis, Transmission Planning provides a ten-year plan for reinforcements to BPA's transmission system and this is provided in accordance with Attachment K of the BPA Open Access Transmission Tariff. This section provides a narrative description of the transmission needs identified through the transmission planning process, the preferred alternative, an estimated cost, and estimated schedule for completion of the preferred alternative. It also reflects 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. This section provides the proposed new facilities organized by type of project. The types of projects include the following.

- Projects required to provide load service and meet Planning Reliability Standards,
- Projects to improve operational or maintenance flexibility,
- Projects required to meet requests for transmission service,
- Projects required to meet requests for Generator Interconnection service, and
- Projects required to meet requests for Line and Load Interconnection service.

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 assessment findings. Estimated Project Costs are direct costs (overheads are not included). Where official cost estimates have not been developed, the indicated project cost reflects the best information available, based on typical costs of similar projects. The major load centers in the Pacific Northwest are located west of the Cascade Mountains including Seattle and Portland. For study purposes, prior system assessments divided the transmission system into load service areas. For the 2022 system assessment, the load service areas are grouped into eight planning areas based on geographic and electrical proximity.



7.1 Northwest Washington Planning Area (NWWA)



Planning Area Description

The Northwest Washington (NWWA) Planning Area contains four load service areas, one intertie, and four internal transmission paths. The load areas include Seattle-Tacoma, Olympic Peninsula, Southwest Washington Coast, and Centralia-Chehalis. The five paths included in the NWWA planning area are the Northern Intertie (NI), North of Echo Lake (NOEL), South of Custer (SOC), Raver-Paul (R-P), and West of Cascades North (WOCN). The planning area extends north to the Canadian border, west to the Pacific coast, east to the Cascades mountain range, and south to the Longview and North Oregon coast areas.

7.1.1 Chehalis / Centralia Area

The Chehalis/Centralia 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
- 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
- Chehalis-Raymond 115 kV line 1

Local Generation and Load

Local generation serving the load area includes:

Generation	Fuel	Maximum MW	Owner
Mossy Rock	Hydro	378	Tacoma Power
Mayfield	Hydro	182	Tacoma Power
Cowlitz	Hydro	70	Lewis County PUD
Packwood	Hydro	28	Energy Northwest
Yelm	Hydro	10	City of Centralia

Centralia - Chehalis Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
169	283	177	266	181	267

Proposed Plans of Service

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.
- Estimated Cost: $11,300,000
- Expected Energization: 2025

Recently Completed Plans of Service

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

7.1.2 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 Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
742	1284	786	1266	788	1292

Proposed Plans of Service

Kitsap 115 kV Shunt Capacitor Relocation

- Description: This project moves one group of 115 kV shunt capacitors from the south bus to the north bus section at Kitsap substation.
- Purpose: This project is required to maintain voltage schedules on the Kitsap Peninsula transmission system.
- Estimated Cost: $4,000,000
- Expected Energization: 2023

Recently Completed Plans of Service

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

7.1.3 Seattle/Tacoma/Olympia Area

The Seattle/Tacoma/Olympia area is located in northwestern Washington State and has a large footprint, spanning from Bellingham and the Canadian border, all the way south to the Tacoma/Olympia metro area; and spans east from the Puget Sound to the foothills of the Cascade Mountains. The Seattle/Tacoma load area can be divided into 2 sub-areas: Seattle/Bellingham/Everett and Tacoma/Olympia. It is the largest load area in the entire Pacific Northwest and one of the largest load areas in the entire WECC Interconnected System. It includes major metropolitan areas surrounding North Tacoma, Greater Seattle Metro Area, Everett, and Bellingham. The area includes Pierce, Thurston, North Lewis and South King counties. 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. 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

Major customers served in this area include: Puget Sound Energy (PSE), Seattle City Light (SCL), Snohomish County PUD (SNPD), Tacoma Power Utilities, and Whatcom County PUD. This area has a large amount of local generation including thermal plants (over 1,400 MW) and hydro plants (approximately 975 MW) with a combined total of more than 2,300 MW.

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 area has approximately 750 MW of local generation.

Seattle - Tacoma - Olympia Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
7729	9163	6956	9007	7057	8954

Proposed Plans of Service

Monroe-Novelty 230 kV Line Upgrade

- Description: This project upgrades the Monroe-Novelty 230 kV line from 60 to at least 80 degree C.
- Purpose: This project improves reliability for the Puget Sound load area.
- Estimated Cost: $2,500,000
- Expected Energization: 2023

Recently Completed Plans of Service

Raver 500/230 kV Transformer (PSANI)

- Description: This project added a 1300 MVA, 500/230 kV transformer at Raver Substation. This project was part of the overall Puget Sound Area/Northern Intertie (PSANI) Regional Reinforcement Plan. This was 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: $100,000,000
- Energization: The transformer was energized in 2021 and the rest of the project is expected to be energized in 2024.

Tacoma 230 kV Series Bus Sectionalizing Breaker
(This project is combined with Tacoma 230 kV Bus tie Breaker project below.)

- Description: This project added 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: $12,200,000
- Energization: This project was energized in 2022.

Tacoma 230 kV Bus Tie Breaker
(This project is combined with the Tacoma 230 kV Series Bus Sectionalizing Breaker project above.)

- Description: This project added 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: See above.
- Energization: This project was energized in 2022

7.1.4 Southwest Washington Coast Area

The Southwest Washington Coast Load Area includes all lines and substations from the I-5 corridor west to the Pacific Ocean and north of Chehalis to Aberdeen and Olympia substations. The 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. Smaller communities include Cosmopolis, Pe Ell, and Naselle.

The customers in this area include:

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

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 Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
231	375	203	329	202	329

Proposed Plans of Service

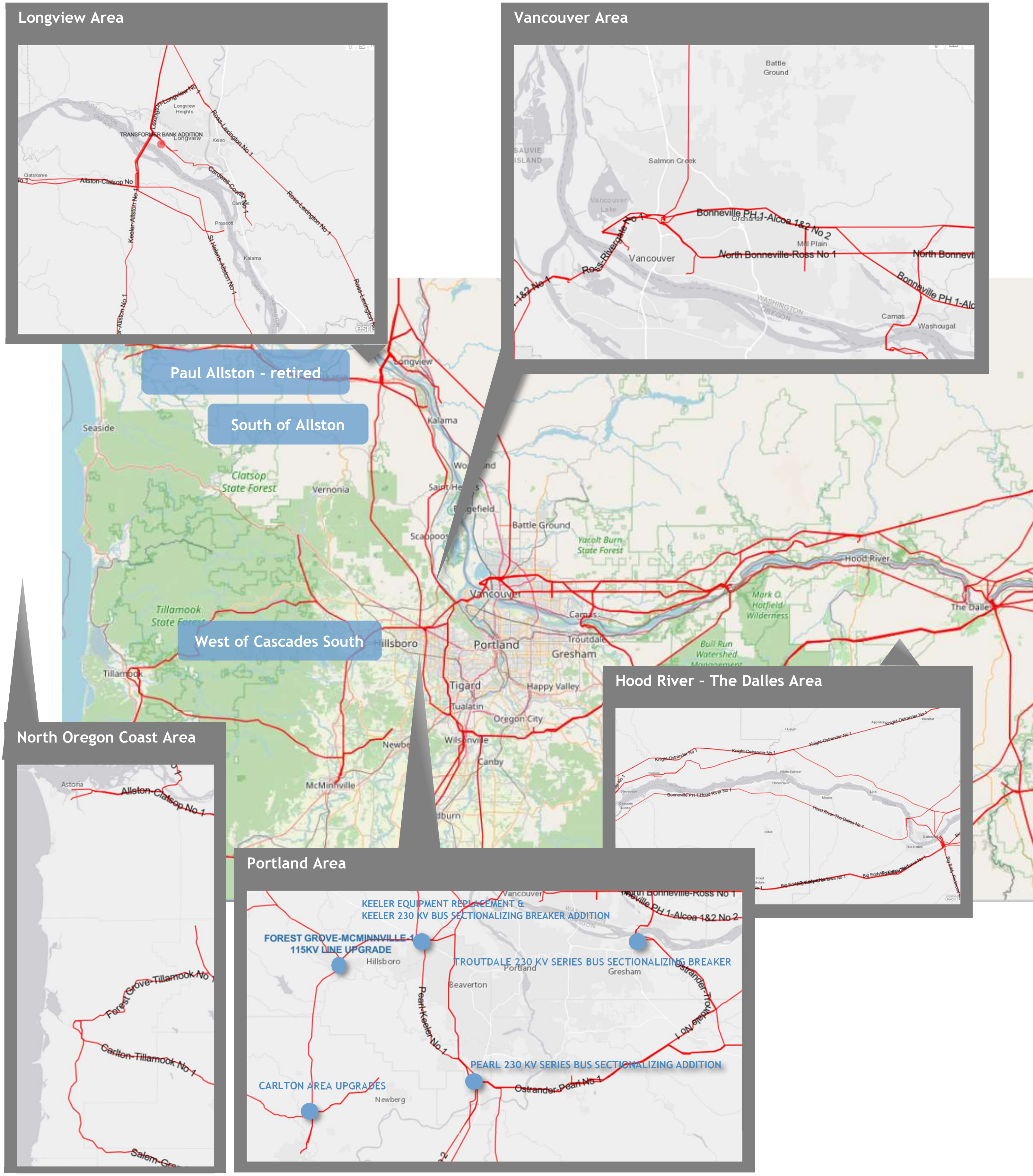
Aberdeen Tap to Satsop Park – Cosmopolis 115 KV Line Upgrade

- Description: Rebuild the section between Aberdeen Tap and Structure 1/3 (0.06 mi) to increase the line's capacity.
- Purpose: This project is required to maintain reliable load service to the Southwest Washington Coast area.
- Estimated Cost: $551,000
- Expected Energization: 2023

Recently Completed Plans of Service

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

7.2 Willamette Valley Southwest Washington Planning Area



Planning Area Description

The Willamette Valley Southwest Washington (WILSWA) Planning Area spans western Washington from Longview to Vancouver, and western Oregon from Astoria to Salem. WILSWA contains 5 load areas (Hood River/The Dalles, Longview, N.OR Coast, Portland and Vancouver). Customers include Portland General Electric (PGE), PacifiCorp (PAC), Cowlitz County PUD, Clark County PUD, Northern Wasco County PUD (NWCPUD), North Pacific Paper Company (NORPAC), Columbia River PUD (CRPUD), Tillamook PUD (TPUD), City of McMinnville, City of Forest Grove, Klickitat PUD, Skamania PUD and Wasco Electric Co-Op.

7.2.1 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
- Wasco Electric Cooperative

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 – Quenett Creek 1 and 2 230 KV lines
- Big Eddy – The Dalles 115 kV line

Local Generation and Load

Generation serving this area includes:

- USACE Bonneville Powerhouse (224 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 Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
272	286	493	473	653	663

Proposed Plans of Service

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

Recently Completed Plans of Service

L0380 Quenett Creek Substation Addition

- Description: This project adds a new Quenett substation to accommodate new industrial load in the area.
- Purpose: This project is associated with interconnection L0380.
- Estimated Cost: $60,000,000
- Expected Energization: 2021

7.2.2 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 loads in this area include residential, commercial and a large industrial component.

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 Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
665	830	562	731	562	731

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.

7.2.3 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:

- PacifiCorp
- Portland General Electric
- Tillamook Public Utility District
- West Oregon Electrical Coop
- Wahkiukum Public Utility District
- Clatskanie Public Utility District

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

- Allston-Driscoll #2 115 kV line
- Clatsop 230/115 kV transformer
- Astoria-Driscoll #1 115 kV line
- Forest Grove-Tillamook #1 115 kV line
- Carlton-Tillamook #1 115 kV line
- Grand Ronde-Boyer #1 115 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)

North Oregon Coast Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
173	274	177	267	180	271

Proposed Plans of Service

High-Side Breaker and Switchgear Associated with the Clatsop Transformer Replacement

- Description: This project add a 230 kV 3000 amp breaker, BFR and three 2000 amp disconnect switches at Clatsop substation.
- Purpose: This project is to improve operations and maintenance flexibility at Clatsop.
- Estimated Cost: $1,600,000
- Expected Energization: 2026

Recently Completed Plans of Service

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

7.2.4 Portland Area

The Portland Load Area is located in northwestern Oregon and covers loads in the counties of Clackamas, Columbia, Multnomah and Washington. It includes major metropolitan communities surrounding the greater Portland Metro area, including Troutdale, Gresham, Sandy, Beaverton, Hillsboro, Tigard, Tualatin, Oregon City, and Wilsonville. The Portland area extends north to the Columbia River and south to Salem, Oregon. It extends west to Tigard, Oregon and east to the Cascade Mountain range. Loads are primarily residential and commercial with a smaller industrial component. Recent history of loads in this area has become nearly dual peaking seasons (winter loads are slightly higher than summer); however the summer peak is forecast to surpass the winter peak within the 10 year Planning Horizon.

The Portland area transmission system serves PacifiCorp (PAC) in North and East Portland and Portland General Electric (PGE) customers located in Multnomah, Clackamas, and Washington counties in Northern Oregon. The Portland load service areas are served via four major flow gates in Southwest Washington and Northwest Oregon; Keeler-Pearl, South of Allston (SOA), Paul-Allston, and West of Cascades South (WOCS).

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. 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 Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
4475	4136	5269	5017	5670	5368

Proposed Plans of Service

Carlton Upgrades

- Description: This project adds four additional circuit breakers at Carlton substation: two each at the 115 and 230 kV buses. The Forest Grove–McMinnville 115kV line will be looped into the Carlton 115 kV bus creating the Forest Grove–Carlton and Carlton–McMinnville 115 kV lines.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $15,550,000
- Expected Energization: 2023

Forest Grove – McMinnville 115 kV Line Upgrade

- Description: This project upgrades the Forest Grove – McMinnville 115 kV line.
- Purpose: This project improves operations and maintenance flexibility.
- Estimated Cost: $1,000,000
- Expected Energization: 2023

Troutdale 230 kV Series Bus Sectionalizing Breaker Addition

- Description: This project adds a new 230 kV bus sectionalizing breaker at Troutdale Substation in series with the existing sectionalizing breaker.
- Purpose: This project is required to maintain reliable load service to the area.
- Estimated Cost: $3,490,000
- Expected Energization: 2025

Keeler 230 kV Bus Sectionalizing Breaker Addition (L0452)

- Description: This project adds a 230 kV bus sectionalizing breaker at Keeler Substation.
- Purpose: This project is required to maintain reliable load service to the area.
- Estimated Cost: $10,000,000 (This estimate includes other sustain work which is being coordinated with the bus sectionalizing breaker addition.)
- Expected energization: 2026

Also Listed in the West of Cascades South Path Section
Pearl-Sherwood 230 kV Corridor Reconfiguration and Series Bus Sectionalizing Breaker Addition

- Description: This will be a joint project with PGE. It includes splitting the existing BPA/PGE Pearl-Sherwood #1 and #2 230 kV jumpered circuits and terminates them into separate bays at Pearl and Sherwood. It also splits the existing BPA/PGE Pearl-McLoughlin-Sherwood 230 kV 3-terminal line into a new Pearl-Sherwood #3 230 kV line and a new Pearl-McLoughlin-Sherwood 230 kV three terminal line. This project will also add a new 230 kV series bus sectionalizing breaker at Pearl Substation.
- Purpose: This project is required to maintain reliable load service to the Portland Area.
- Estimated Cost: $10,000,000
- Expected Energization: 2027

Also Listed in the South of Allston Path Section
Keeler 500 kV Expansion and Transformer Addition

- Description: This project will add 500 kV breakers at Keeler substation in order to reconfigure the Keeler 500 kV bus layout into a double-breaker-double-bus arrangement. This project also adds a second 500/230 kV Transformer bank at Keeler substation.
- Purpose: This project will maintain reliable load service in the Portland area and improve operations and maintenance flexibility for the South of Allston path.
- Estimated Cost: $41,300,000
- Expected Energization: 2027

Recently Completed Plans of Service

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

7.2.5 Vancouver Area

The Vancouver area transmission system serves customers in Clark County in Southwest Washington. 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, La Center, and Battleground. Loads are primarily residential and commercial with a smaller industrial component.

The customers in this area include:

- Clark Public Utilities (Clark)
- PacifiCorp (PAC)

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:

Portland/I-5 Area	Nameplate MW	Fuel Type	Owner
Bonneville Dam	1,310	Hydro	BPA/USACE
Beaver	490	Gas	Portland General Electric
Centralia	1,400	Coal	TransAlta
Chehalis	520	Gas	PacifiCorp
Grays Harbor	650	Gas	Invenergy LLC
Mint Farm	320	Gas	Puget Sound Energy
Port Westward 1	380	Gas	Portland General Electric
Port Westward 2	230	Gas	Portland General Electric
River Road	260	Gas	Clark PUD
Mayfield	182	Hydro	Tacoma Power
Mossy Rock	378	Hydro	Tacoma Power
Merwin	135	Hydro	PacifiCorp
Swift	305	Hydro	PacifiCorp
Yale	145	Hydro	PacifiCorp

Vancouver Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
1018	1075	776	1004	803	1039

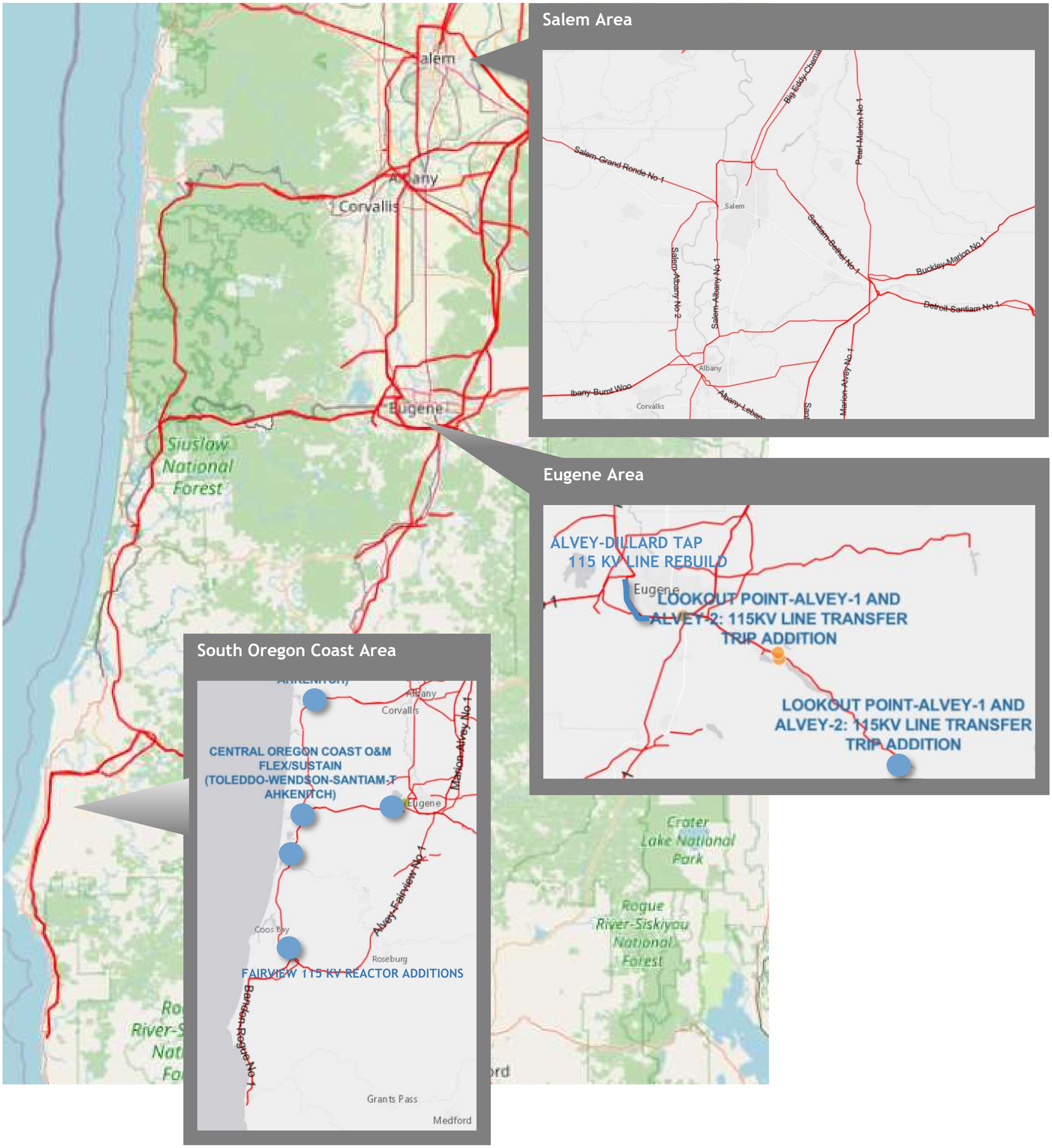
Proposed Plans of Service

There are no proposed plans of service for this area.

Recently Completed Plans of Service

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

7.3 Southwest Oregon Planning Area (SWOR)



Planning Area Description

The Southwest Oregon (SWOR) Planning Area covers the Eugene, the Salem/Albany, and the South Oregon Coast load areas. All load areas within this Planning Area are historically winter peaking. The historical peak winter loads for Eugene, Salem/Albany, and the South Oregon Coast load areas are 881MW, 895MW, and 471 MW respectively. Local generation in the area includes hydroelectric facilities along the eastern Willamette Valley and cogeneration plants.

7.3.1 Eugene Area

The Eugene Area includes the cities of Eugene and Springfield in western Oregon as well as the surrounding communities. This load area includes the Central Willamette Valley in Oregon's Lane County. 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 the South Oregon Coast area to the south and west of Eugene. The major population areas include cities of Eugene and Springfield, and the communities of Cheshire, Junction City, Harrisburg, Walterville, Pleasant Hill and Oakridge. The Eugene area load is winter peaking, primarily driven by residential and commercial heating load, though some industrial loads also exist in the area such as wood product mills.

The customers in this area include:

- PacifiCorp (PAC)
- Eugene Water and Electric Board (EWEB)
- Springfield Utility Board (SUB)
- Emerald Public Utility District (Emerald)
- Several Electric Cooperatives: Blachly-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 Marion-Alvey 500 kV line and Marion-Lane 500 kV line
- From the south by the Alvey-Dixonville 500 kV line

Local Generation and Load

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

- EWEB Carmen/Trailbridge (93.3 MW)
- USACE Cougar (28 MW)
- EWEB Weyco (37.7 MW)
- EWEB Seneca (19.8 MW)
- EWEB Leaburg (13.8 MW)
- EWEB Walterville (9.7 MW)
- USACE Lookout Point (138 MW)
- USACE Hills Creek (34 MW)
- USACE Dexter (16 MW)

The Eugene area load forecast is:

Eugene Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
640	896	710	944	721	954

Proposed Plans of Service

Lookout Point – Alvey No. 1 and 2 Transfer Trip Addition
- Description: Installation of a Transfer Trip on the Alvey – Lookup 115 kV Lines 1 and 2 is needed to maintain stability for the local generation in the event of faults near the Alvey Substation.
- Purpose: This project is required to maintain reliable load service to the area.
- Estimated Cost: $3,000,000
- Expected Energization: 2025
-

Alvey – Dillard Tap 115 kV Line Rebuild
- Description: This project rebuilds the first 3.3 miles of the Alvey-Eugene 115 kV line.
- Purpose: This project is required to maintain reliable load service to the load area.
- Estimated Cost: $1,300,000
- Expected Energization: 2027

Recently Completed Plans of Service

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: $18,200,000
- Expected Energization: 2022

7.3.2 Salem / Albany Area

The Salem/Albany load area serves the Central Willamette Valley between the Portland and Eugene areas to the north and south, respectively. The area includes the cities Salem, Albany, and Corvallis, and the smaller communities of Monmouth, Independence, Silverton, Stayton, and Lebanon. Customers served include Portland General Electric (PGE), PacifiCorp (PAC), Salem Electric Cooperative (SEC), Consumers Power Inc. (CPI), Emerald PUD (EPUD), City of Monmouth (COM), and the U.S. Bureau of Mines located in Albany (DOE).

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 Inc. Emerald PUC serving the rural areas

The load area is served by the following major transmission paths or lines:
- From the east by the Big Eddy-Chemawa 230 kV line
- From the north by the (PGE) McLoughlin-Bethel 230 kV line and the Pearl-Marion 500 kV line 1

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

Generation internal to the Salem/Albany area includes:
- Foster Generator Units 1 & 2 (22 MW) – USACE
- Green Peter Generator Units 1 & 2 (92 MW) – USACE
- Adair Generator Unit 1 (5.5 MW) – Power Resources Co-op's
- Evergreen Bio (10 MW) – PAC

Other local generation includes:
- Detroit Generator Units 1 & 2 (120 MW) – USACE
- Big Cliff Generator Unit 1 (22 MW) – USACE
- Covanta (15 MW) – PGE (Near Chemawa 57 kV and Monitor 57 kV

Salem - Albany Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
861	895	929	936	958	958

Proposed Plans of Service
There are no proposed plans of service for this area.

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

7.3.3 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 and Eugene areas to the east and north.
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:

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

Local Generation and Load
There is no local generation in this area.

South Oregon Coast Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
252	505	280	468	284	472

Proposed Plans of Service

Toledo 69 kV and 230 kV Bus Tie Breaker Additions (Combined with the project below.)

- 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 at Toledo.
- Estimated Cost: $4,500,000
- Expected Energization: 2024

Wendson 115 kV Bus Tie Breaker Addition (Combined with the project above.)

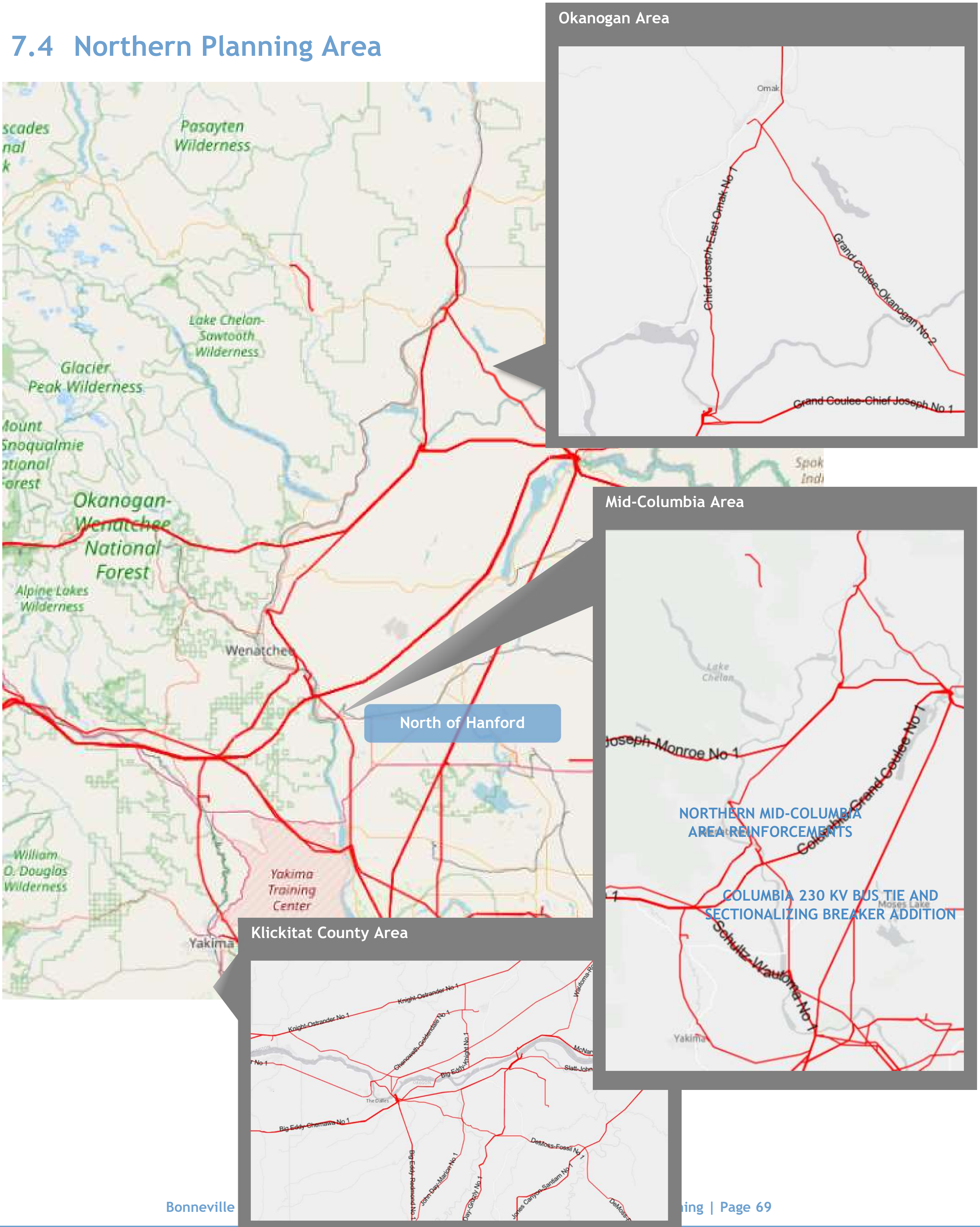
- Description: This project adds a 115 kV bus tie breaker at Wendson Substation.
- Purpose: This project improves operations and maintenance flexibility at Wendson.
- Estimated Cost: See Toledo's estimated cost above.
- Expected Energization: 2024

Recently Completed 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 maintain acceptable voltage schedules in the South Oregon Coast area.
- Estimated Cost: $17,700,000
- Expected Energization: 2022

7.4 Northern Planning Area



Planning Area Description

The Northern Planning Area contains three load areas and one internal transmission path. The load areas are Klickitat County, Mid-Columbia, and Okanagan. The internal path is North of Hanford (NOH). The NOH path is bi-directional (north to south and south to north) and is adjacent to the Northern area 230 kV sub-grid system. The planning area extends north to the Canadian border, west to the Cascade Mountains, east to the Spokane area, and south to the Tri-Cities area. Customers in the Planning area include Chelan County PUD, Douglas County PUD, Grant County PUD, PacifiCorp, Avista, Puget Sound Energy, Okanagan PUD, Okanagan Cooperative, Nespelem Valley Electric, Ferry County PUD, and Klickitat County PUD.

7.4.1 Klickitat County Area

The Klickitat County area is located in south central Washington and is comprised of Klickitat County PUD and various generation projects interconnected to their transmission system.

The Klickitat County PUD BES system contains two distinct regions with a normally open emergency tie line between Linden and Dooley substations. The first region interconnects generation radially to BPA's Rock Creek 500/230 kV substation. BPA's Wautoma-John Day 500 kV line is looped into Rock Creek 500 kV substation. Klickitat County PUD owns 230 kV lines from Rock Creek to Dooley, Rock Creek to White Creek, and Rock Creek to the Juniper Canyon 1 wind project that interconnect wind generation radially to Rock Creek substation.

Generation sources include the Windy Point, Tuolmne Wind, Dooley, Juniper Canyon, Goodnoe Hills, White Creek, and Harvest wind projects.

The second region is interconnected radially to BPA's Harvalum 230 kV substation. Harvalum substation is connected to BPA's 230 kV line that runs from McNary to Big Eddy substation. Klickitat County PUD owns the 230 kV line from Harvalum to their EE Clouse 230/115 kV substation that interconnects generation at 230 kV and serves their load at 115 kV.

Generation sources include the 303 MW Goldendale Energy Project and 50 MW Linden Wind project. Additional load is served at Lyle and Spearfish substations at 69 kV and is fed from BPA's Chenoweth 115 kV substation.

Local Generation and Load

Klickitat County Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
64	77	87	104	90	108

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.

7.4.2 Mid-Columbia Area

The Mid-Columbia (Mid-C) Load Area stretches over 100 miles along the Columbia River in Central Washington, from Chelan and Douglas County in the north to Grant County in the east and Yakima County in the west. The Mid-C load area is divided into three sub-areas; west, north, and east. To the west is the Yakima County load served by PacifiCorp, and load served by BPA customers in the Ellensburg and surrounding area (load served by the Columbia-Ellensburg, Ellensburg-Moxee, and Moxee-Midway 115 kV lines). To the north is load served by Douglas and Chelan County PUD. To the east is load served by Grant County PUD and a pocket of Avista load located in Central Washington connected to Chelan and Grant PUD.

The customers in this area include:

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

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

- 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 Mid-C area has five Columbia River hydroelectric facilities, two wind farms and five local generation plants with a combined maximum output of 5,560 MW. This generation plays a major role in serving the regional as well as local load since the Mid-C area generation has significantly more capacity than area load. The Mid-C generation in conjunction with Upper Columbia generation is coordinated hourly to optimize the use of the Columbia River.

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)
- Grant 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:

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

Mid-Columbia Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
2373	2616	2237	2617	2384	2706

Proposed Plans of Service

Northern Mid-Columbia Area Reinforcement

- 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: $14,700,000
- Expected Energization: 2023

Columbia 230 kV Bus Tie and Bus Sectionalizing Breaker Addition (Combined with project above.)

- 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: See above
- Expected Energization: 2023

Recently Completed Plans of Service

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

7.4.3 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)
- Nespelem Valley Electric
- Ferry County Public Utility District

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

- Chief Joseph-East Omak #1 230 kV line
- Grand Coulee-Okanogan #2 115 kV line
- Grand Coulee-Foster Creek #1 115 kV line
- Wells-Foster Creek 115 kV line (Douglas)

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 Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
169	232	188	285	196	291

Proposed Plans of Service

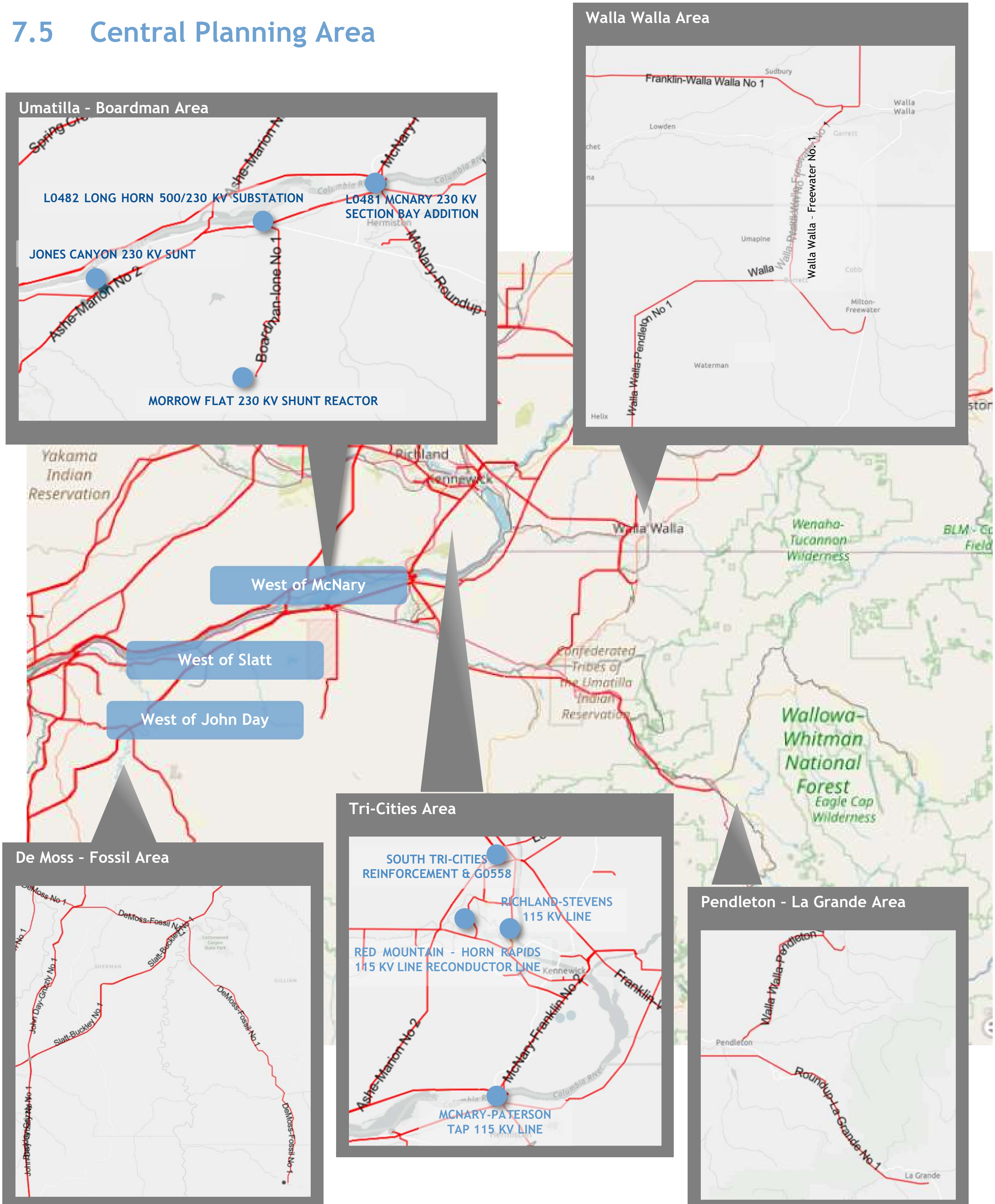
There are no proposed projects for this area at this time.

Recently Completed Plans of Service

Grand - Coulee - Foster Creek (Nilles Corner) 115 kV Line Upgrade

- Description: This project will remove impairments on the Grand Coulee-Nilles Corner section of the Grand Coulee-Foster Creek #1 115 kV line to facilitate increasing the maximum operating temperature of the line to 80 °C.
- Purpose: This project is required to maintain reliable load service to the Okanogan Load area during peak summer conditions.
- Estimated Cost: $700,000
- Expected Energization: 2023

7.5 Central Planning Area



Planning Area Description

The Central Planning Area covers south central and southeast Washington, and north central and northeast Oregon, and adjacent areas in western Idaho. This includes the major cities of Richland, Kennewick, Pasco, Pullman, and Walla Walla in Washington, and Pendleton, Hermiston, La Grande, and Umatilla in Oregon, and Lewiston and Moscow in Idaho along with the surrounding areas.

7.5.1 De Moss / 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).

De Moss - Fossil Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
29	44	26	34	26	34

Proposed Plans of Service

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

Recently Completed Plans of Service

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

7.5.2 Pendleton / La Grande Area

This area includes the eastern Oregon communities of Pendleton and La Grande. The Pendleton/La Grande load area is located in northeastern Oregon and extends east to the Idaho border and north to the Columbia River.

The customers in this area include:

- Oregon Trail Electric Cooperative
- PacifiCorp
- Umatilla Electric Cooperative
- Columbia Power Cooperative Association
- 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

There is no generation inside the Pendleton/La Grande cut-plane. Horizon Wind Energy's Elkhorn Wind Power Project is adjacent to BPA's Pendleton/La Grande study area.

The local generation includes:

- Horizon's Elkhorn Valley Wind Project (110 MW)

Pendleton - La Grande Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
151	139	150	140	148	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.

7.5.3 Tri-Cities Area

The Tri-Cities/Boardman Load Area study covers loads in the Benton and Franklin counties of Washington State, and the western portion of Walla Walla County. It includes the cities of Pasco, Kennewick, Richland, Boardman, and surrounding communities. The customers served in this area include Benton County PUD, Benton REA, Big Bend Electric Co-Op, City of Richland, Columbia REA, Franklin County PUD, South Columbia Basin Irrigation District, and DOE Richland.

The customers in this area include:

- Benton County Public Utility District
- Benton Rural Electric Association
- Big Bend Electric Cooperative
- City of Richland
- Columbia Rural Electric Association
- Franklin County Public Utility District
- U.S. Bureau of Reclamation (South Columbia Basin Irrigation District)
- U.S. Department of Energy (Richland Operations)

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

- From the east by:
  - the Lower Monumental-McNary 500 kV line tapped at Sacajawea with a 500/115 kV transformer
- From the north by:
  - the Midway-Benton 230 kV line and Benton 230/115 kV transformer
  - the Midway-Benton 115 kV line
  - the Midway-Ashe 230 kV lines through Hanford, the Ashe-White Bluffs 230 kV line and White Bluffs 230/115 kV transformer
- From the south by:
  - the McNary-Franklin 230 kV line and Franklin 230/115 kV transformer
  - the McNary-Badger Canyon 115 kV line
  - the Horse Heaven 230/115 kV transformer
- From the west by:
  - the Grandview-Red Mountain 115 kV line

Local Generation and Load

The local generation is hydroelectric and wind generation. The nuclear Columbia Generating Station (1100 MW) is physically located in the Tri-Cities area, but is not electrically connected to the local load area. Therefore it is not considered part of the local generation.

- USACE Ice Harbor Hydro (Snake River; 700 MW)
- USBR Chandler Hydro (Yakima River; 12 MW)
- Scooteney, Glade & Ringold Hydro (Irrigation system; 11 MW total)
- NextEra Energy Resources Stateline Wind (90 MW)
- Energy NW Nine Canyon Wind (90 MW)

Tri-Cities Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
1331	1009	1402	1068	1477	1200

Proposed Plans of Service

McNary-Paterson Tap 115 kV Line

- Description: This project adds a new 115 kV PCB at McNary 115 kV substation and adds approximately 2 miles of new 115 kV line.
- Purpose: This upgrade is needed to provide reliable load service to the Tri-Cities area.
- Estimated Cost: $13,200,000
- Expected Energization: 2023

Red Mountain – Horn Rapids 115 kV Line Reconductor

- Description: This project is to reconductor the Red Mountain – Horn Rapids 115 kV section of BPA's Red Mountain – White Bluffs 115 kV transmission line to mitigate a bottleneck and maintain reliability load service.
- Purpose: This upgrade is needed to provide reliable load service to the Tri-Cities area.
- Estimated Cost: $3,600,000
- Expected Energization: 2024

Richland-Stevens Drive 115 kV Line

- Description: This project adds a new 115 kV line terminal and three miles of new 115 kV line.
- Purpose: This upgrade is needed to provide reliable load service to the Tri-Cities area.
- Estimated Cost: $12,500,000
- Expected Energization: 2024

G0558 South Tri-Cities Reinforcement Webber Canyon

- Description: The plan of service loops the Ashe-Marion 500 kV line into a new Webber Canyon substation. A new Webber Canyon 500/115 kV transformer then connects 17 miles of 115 kV line to Badger Canyon substation.
- Purpose: This upgrade is needed to provide reliable load service to the Tri-Cities area.
- Estimated Cost: $96,700,000
- Expected Energization: 2025

Recently Completed Plans of Service

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

7.5.4 Umatilla - Boardman Area

The Umatilla Load Area covers loads in the Umatilla and Morrow Counties of Oregon State. It includes the cities of Hermiston, Umatilla, Boardman and surrounding communities.

The customers served in this area include the Umatilla Electric Co-Op, Columbia Basin Electric Co-Op, and PacifiCorp. Significant generating resources in the Hermiston/Boardman area include the Hermiston Generating Plant, Horn Butte Wind Farm, and Echo Wind Farm.

The Umatilla load area is comprised of load served from McNary, Boardman, Morrow Flat, Dalreed, Hat Rock, and Cold Springs substations.

Local Generation and Load

Umatilla - Boardman Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
815	516	*	*	*	*

* The Umatilla/Boardman forecast peak load depends on how much of the requested load interconnection moves forward. Load interconnection requests are being studied as part of the Interconnection Process.

Proposed Plans of Service

L0481 McNary Terminal Addition

- Description: This project adds a new 230 kV line terminal at McNary substation for a new UEC connection.
- Purpose: This project is associated with interconnection L0481McNary 230 kV Bay Addition.
- Estimated Cost: $4,800,000
- Expected Energization: 2024

L0482 Boardman Area Reinforcement - Longhorn 500/230 kV Substation Addition

- Description: This project adds a 230 kV source to the Boardman area by looping the McNary – Coyote Springs 500 kV line into a new 500/230 kV substation, with UEC connections to the 230 kV yard.
- Purpose: This project is associated with interconnection L0482 Longhorn 500/230 kV substation.
- Estimated Cost: $143,000,000
- Expected Energization: 2024

Morrow Flat 230 kV Shunt Reactor Addition

- Description: This project adds a 230 kV shunt reactor (40 MVAR) at Morrow Flat Substation.
- Purpose: This Project is required to compensate for high voltages at Morrow Flat caused by the Morrow Flat-Blue Ridge line as well as the collector system capacitance when the output of wind generation is low.
- Estimated Cost: $2,900,000
- Expected Energization: 2024

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: $13,000,000
- Expected Energization: 2025

Recently Completed Plans of Service

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

7.5.5 Walla Walla Area

The Walla Walla load area is located in southeastern Washington and northeastern Oregon. This area includes the Washington city of Walla Walla and the Oregon community of Milton-Freewater to the south.

The customers in this area include:

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

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

The area has the following wind generating resources in the area:

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

Local Generation and Load

The local generation in this area includes:

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

Walla Walla Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
91	77	134	109	137	112

Proposed Plans of Service

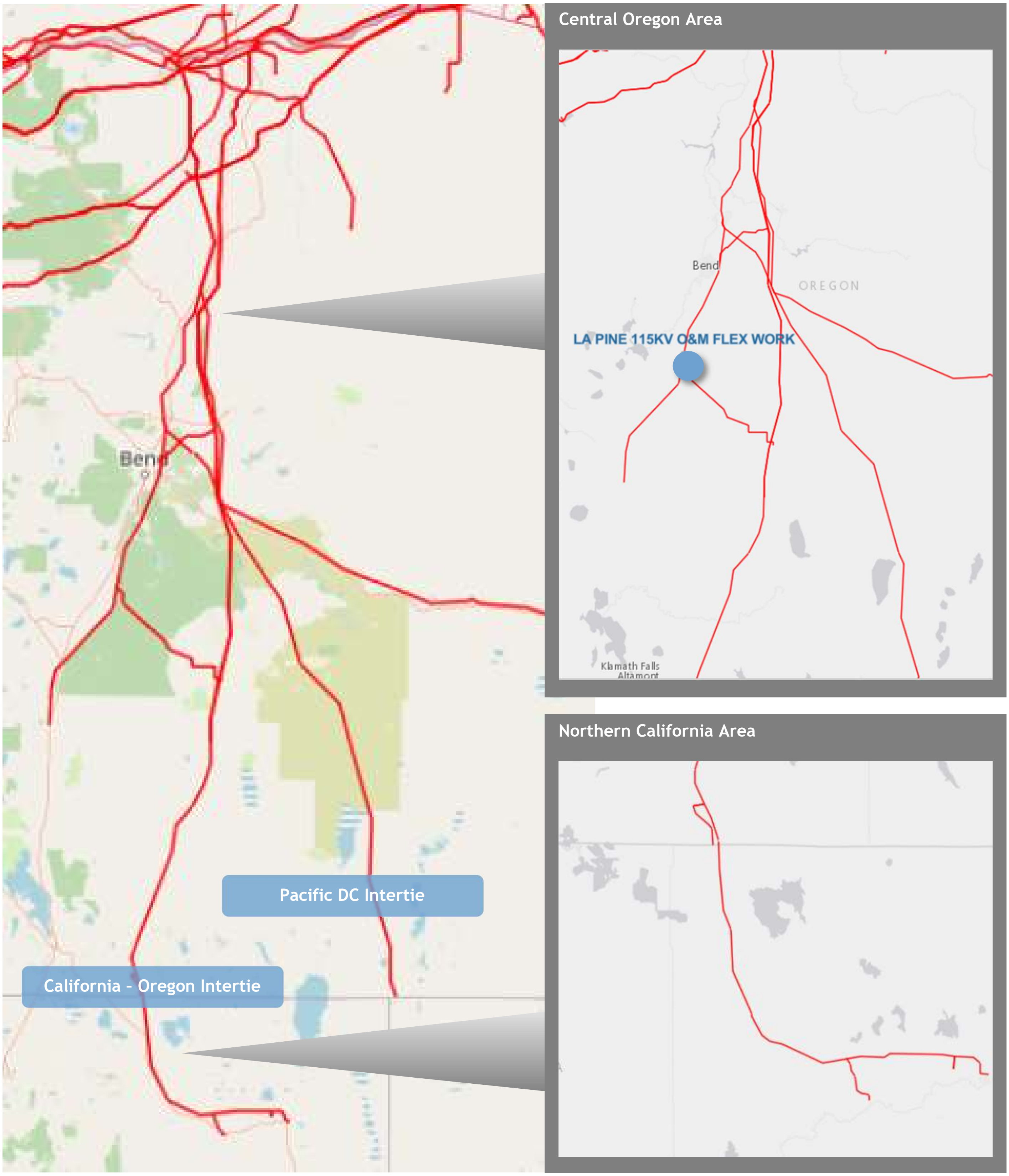
Tucannon River 115 kV MVAR Shunt Reactor

- Description: A 15 MVAR shunt reactor will be added at Tucannon River 115 kV substation.
- Purpose: This project is required to provide voltage control for multiple contingencies involving the Tucannon River-North Lewiston 115 kV line.
- Estimated Cost: $3,500,000
- Expected Energization: 2025

Recently Completed Plans of Service

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

7.6 Southern Planning Area



Planning Area Description

The Southern Planning Area contains two load service areas and two interties. The load areas are Central Oregon (COR) and Northern California (NCA). The interties are the California Oregon Intertie (COI) and the Pacific Direct Current Intertie (PDCI).

7.6.1 Central Oregon Area

The Central Oregon Area is located east of the Cascade Mountains and includes Redmond (to the west), Prineville (to the east), and Bend, La Pine, and Sun River (to the south).

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 and the BPA Ponderosa-Pilot Butte 230 kV line
- Pilot Butte – La Pine 230 kV line

Local Generation and Load

The largest resources in the area are PGE's hydroelectric plants: Round Butte Dam, Pelton Dam, and the Pelton Reregulating Dam, for a combined total of approximately 470 MW. In addition, PacifiCorp has recently energized various solar generation projects in the area for a combined total of approximately 100 MW. PAC also owns a few smaller generation projects in the area (each less than 5 MW).

Central Oregon Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
667	704	673	827	700	851

Proposed Plans of Service

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

Recently Completed Plans of Service

La Pine 115 kV Circuit Breaker Additions

- Description: This project adds 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: $8,500,000
- Expected Energization: 2022

7.6.2 Northern California Area

The Northern California (NC) load area is geographically situated on both sides of the California-Oregon border. In previous assessments it was sometimes referred to as Southern Oregon or Alturas, and it was studied as part of the Central Oregon load area. The area is a mix of BPA and PacifiCorp (PAC) owned facilities and loads. The major sources into the area can be traced to Malin, Chiloquin, and Hilltop Substations. The NC area is summer peaking with historical peak load of 112 MW. The load owners in the area include PacifiCorp and Surprise Valley Electric Cooperative. The northern end of Path 76, part of the Northwest AC Intertie, crosses the NCA cut-plane.

Local Generation and Load

Northern California Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
118	87	109	77	109	78

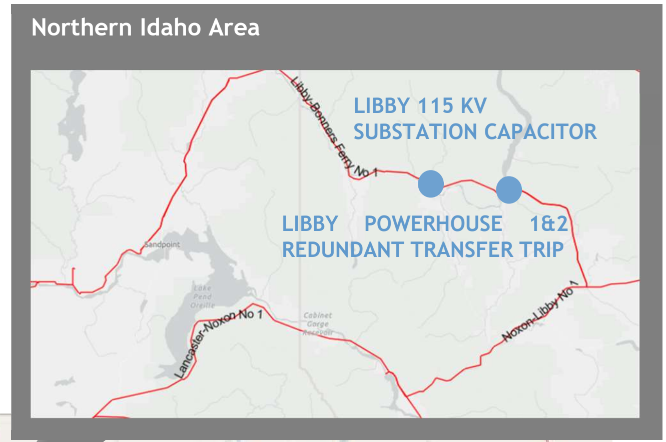
Proposed Plans of Service

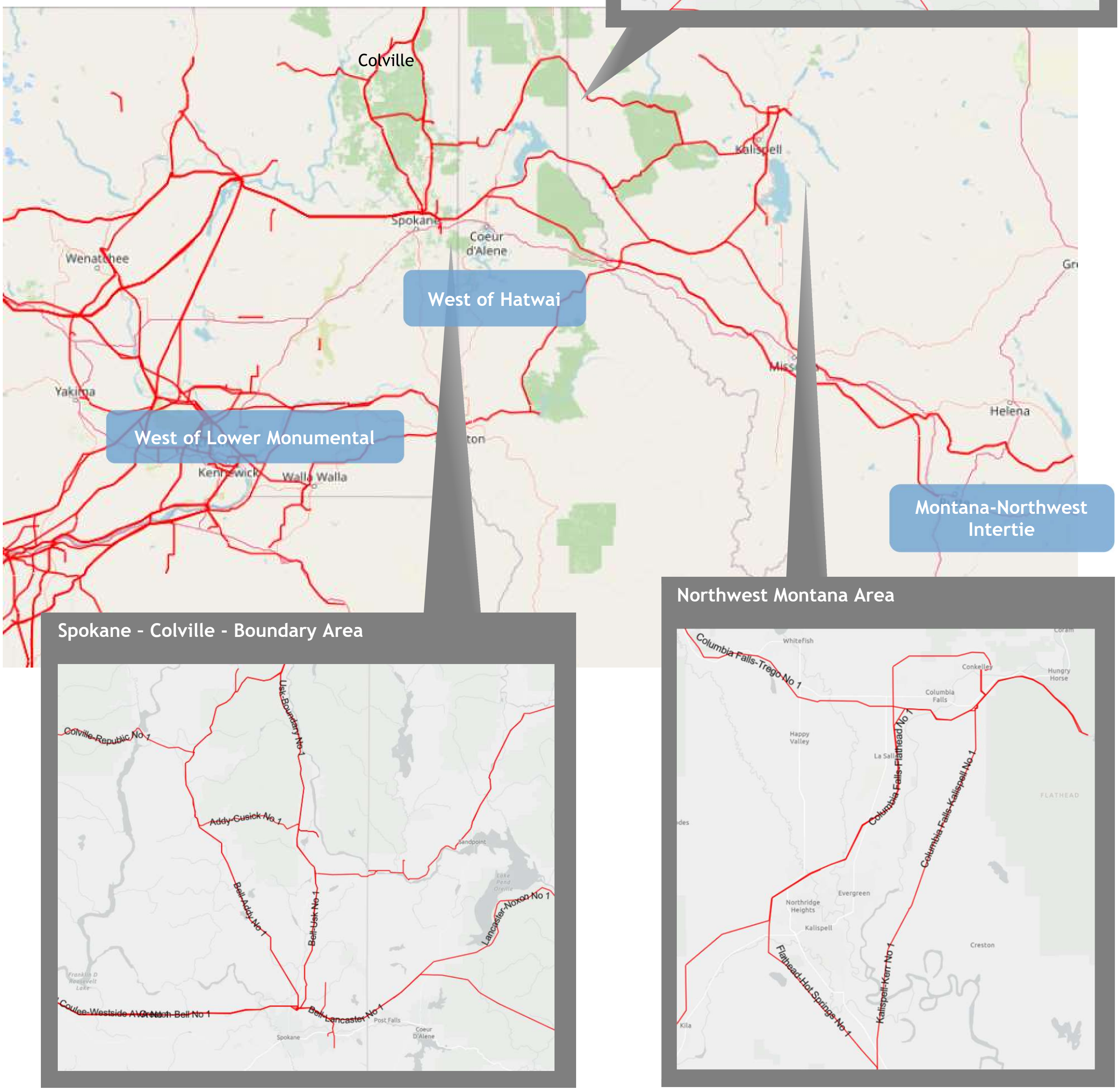
There are no proposed projects for this area at this time.

Recently Completed Plans of Service

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

7.7 Eastern Planning Area





Planning Area Description

The Eastern Planning Area covers portions of northwest Montana including Kalispell and Missoula, north Idaho, and eastern Washington from Spokane to the Canadian border. The load areas within the Planning area are historically winter peaking, although the Spokane area summer loads are forecast to approach winter values in the future. Generation in this area includes mainly hydroelectric facilities in northwest Montana, north Idaho, and northeastern Washington along with some thermal generation around Spokane.

7.7.1 North Idaho Area

The North Idaho area encompasses 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

The local generation in the area includes

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

To a lesser extent the following hydroelectric generation can impact the North Idaho load area:

- USBR Hungry Horse (428 MW)
- Cogentrix Energy Lancaster (301 MW)
- Avista Boulder (25 MW)
- Seattle City Light Boundary (1040 MW)

North Idaho Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
118	193	128	186	130	187

Proposed Plans of Service

Libby Power House 1 and 2 Redundant Transfer Trip

- Description: This project installs redundant transfer trip equipment to the Libby PH-Libby #1 and #2 lines.
- Purpose: Having redundant transfer trip equipment will help protect the transformers and generators at the Libby Power Houses and provide operations and maintenance flexibility.
- Estimated Cost: $500,000
- Expected Energization: 2023

Troy 115 kV Shunt Capacitor Addition (12.6 MVAR)

- Description: This project installs a shut capacitor at the Troy Substation. The capacitor size will be 12.6 MVAR.
- Purpose: This project will maintain reliable load service to the North Idaho area.
- Estimated Cost: $11,000,000
- Expected Energization: 2025

Recently Completed Plans of Service

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

7.7.2 Northwest Montana Area

This area covers loads in Flathead and Lincoln counties in Montana. It 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:

- Hungry Horse – Columbia Falls 230 kV line 1
- Hungry Horse – Conkelley 230 kV line 1
- Columbia Falls – Kalispell 115 kV line 1
- Columbia Falls – Trego 115 kV line 1
- Columbia Falls – Conkelley 230 kV line 1
- Columbia Falls – Flathead 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)
- Avista Cabinet Gorge (263 MW)
- Cogentrix Energy Lancaster (270 MW)
- PPL Global Kerr (194 MW)
- PPL Global Colstrip (2094 MW)
- USACE Noxon (488 MW)
- USACE Libby (600 MW)

Northwest Montana Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
261	391	252	378	255	382

Proposed Plans of Service

Conkelley Substation Retirement

- Description: This project will accommodate the retirement of Conkelley substation. When the substation is retired, all substation facilities will be removed. The existing Libby-Conkelley, Hungry Horse-Conkelley, and Columbia Falls-Conkelley 230 kV lines will be tied together at Conkelley. Also, the existing Libby-Conkelley line will be looped into the Flathead 230 kV substation and a sectionalizing breaker will be added at Flathead. These changes will eliminate the existing Libby-Conkelley and Conkelley-Hungry Horse lines and create a new Libby-Flathead 230 kV line and a new 3 terminal Flathead-Columbia Falls-Hungry Horse 230 kV line.
- Purpose: This project is needed to accommodate the retirement of Conkelley substation.
- Estimated Costs: $27,600,000
- Expected Energization: 2024

Recently Completed Plans of Service

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

7.7.3 Spokane / Colville / Boundary Area

This area includes Pend Oreille, Stevens, and Spokane County. This area is located in eastern Washington State. It extends north to include the Colville Valley and east to include Newport, Washington. 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:

Spokane/Colville Generation	Fuel	Maximum MW	Owner
Boundary	Hydro	1040	Seattle City Light
Box Canyon	Hydro	90	Pend Oreille
Albeni Falls	Hydro	48	USACE
Long Lake	Hydro	88	Avista
Little Falls	Hydro	32	Avista
Dworshak	Hydro	458	USACE
Boulder	Hydro	25	Avista
Post Street	Hydro	10	Avista

Monroe	Hydro	16	Avista
Spokane Waste	Steam Turbine	22	City of Spokane
Northeast	Gas Turbine	68	Avista
Up River	Hydro	18	City of Spokane
Nine Mile	Hydro	24	Avista
Post Falls	Hydro	18	Avista
Kettle Falls	Steam Turbine	52	Avista

Spokane - Colville - Boundary Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
1104	924	901	886	913	900

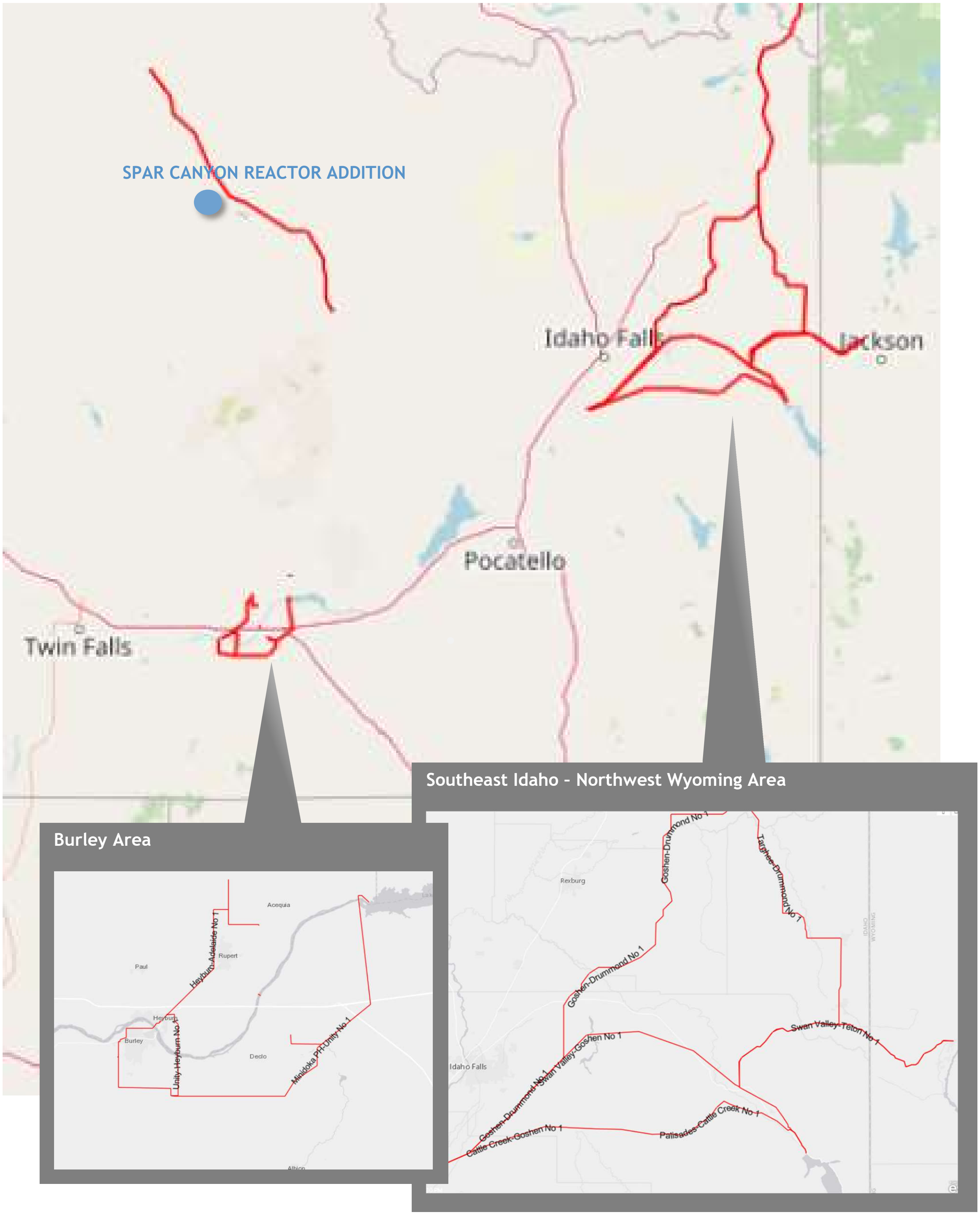
Proposed Plans of Service

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.

7.8 Idaho Planning Area



Planning Area Description

The Idaho Planning Area covers Twin Falls, Pocatello, and Idaho Falls in Idaho and Jackson in Northwest Wyoming. There are two load service areas – Burley Area and Southeast Idaho and Northwest Wyoming Area. The planning area is surrounded by the Caribou National Forest, Sawtooth National Forest, and the Boise National Forest.

7.8.1 Burley Area

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).

Burley Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
207	157	227	164	232	168

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.

7.8.2 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)
- Utah Associated Municipal Power Systems (UAMPS)

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 winter)
- Horse Butte Wind Project (60 MW in summer)

Southeast Idaho - Northwest Wyoming Area Load					
Historical Peak Load (MW)		Five-Year Load (MW), 2027		Ten-Year Load (MW), 2031	
Summer	Winter	Summer	Winter	Summer	Winter
156	301	219	329	238	349

Proposed Plans of Service

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: $5,300,000
- Expected Energization: 2024

Recently Completed Plans of Service

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

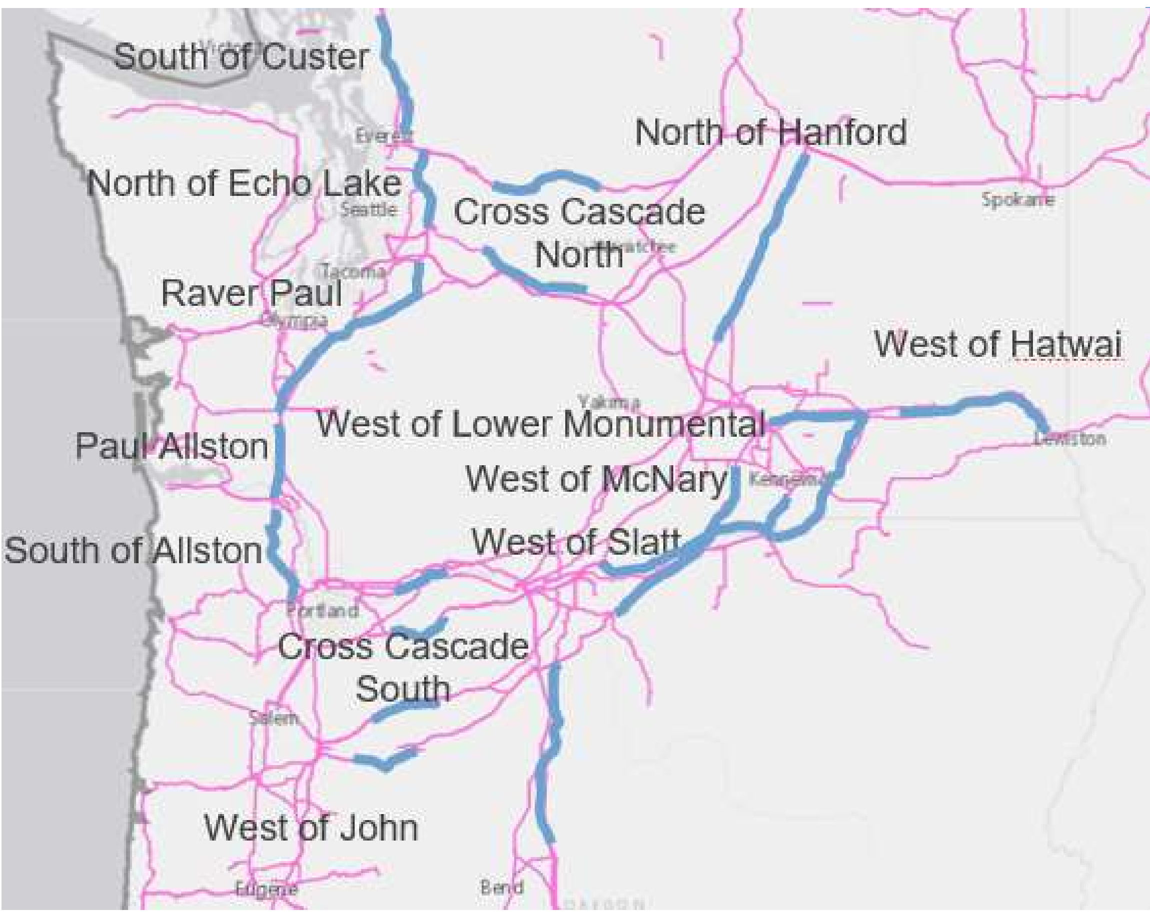
8. Transmission Needs by Path

The Bonneville Power Administration is a nonprofit federal power marketing administration based in the Pacific Northwest. BPA markets wholesale electrical power from 31 federal hydroelectric projects in the Northwest, one nonfederal nuclear plant and several small nonfederal power plants. The dams are operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation. The nonfederal nuclear plant, Columbia Generating Station, is owned and operated by Energy Northwest, a joint operating agency of the state of Washington.

BPA also operates and maintains about three-fourths of the high-voltage transmission in its service territory. BPA's territory includes Idaho, Oregon, Washington, western Montana and small parts of eastern Montana, California, Nevada, Utah and Wyoming.

The BPA transmission system is characterized primarily by hydro generation on the main stem Columbia and lower Snake River that are 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.

The paths and interties are studied with a variety of scenarios that reflect seasonal patterns of flows across BPA's main grid network. The following page describes the typical seasonal patterns across the main grid transmission system. Since the various system patterns occur seasonally and are dependent on weather, they do not all occur simultaneously.



Paths

South of Custer
South of Allston
Paul Allston (retired 1/26/2022)
North of Echo Lake
North of Hanford
Raver to Paul
Cross Cascades North
Cross Cascades South
West of John Day
West of Slatt
West of McNary
West of Lower Monumental
West of Hatwai

Paths and Interties

The paths and interties are studied with a variety of scenarios that reflect seasonal patterns of flows across BPA's main grid network. Since the various system patterns occur seasonally and are dependent on weather, they do not all occur simultaneously.

Winter Scenario

In the winter season, hydro and thermal generation is generally operated to serve peak load. The load in the Pacific Northwest typically peaks in the winter (November-February), although there are some areas that also peak in the summer season (mid-June through September). The winter scenario results in high east-to-west flows on the transmission system crossing the Cascade Mountains, to deliver generation from resources located east of the Cascades, 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.

Spring Scenario

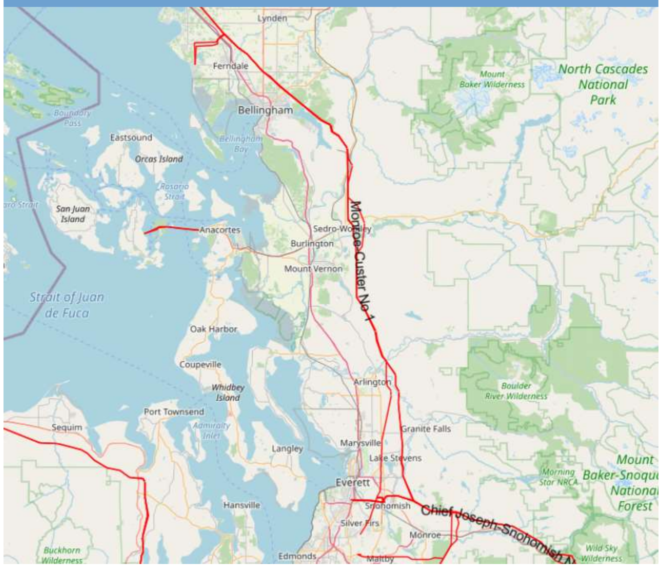
The spring and early summer season (March-June) are when high hydro run-off occurs due to snow melt across the region (spring run-off scenario). During this time, much of the water in the northern Columbia River basin is stored behind Canadian dams, and the hydro generation along the Snake River is peaking.

Combined with moderate spring loads, the run-off scenario 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 for the summer.

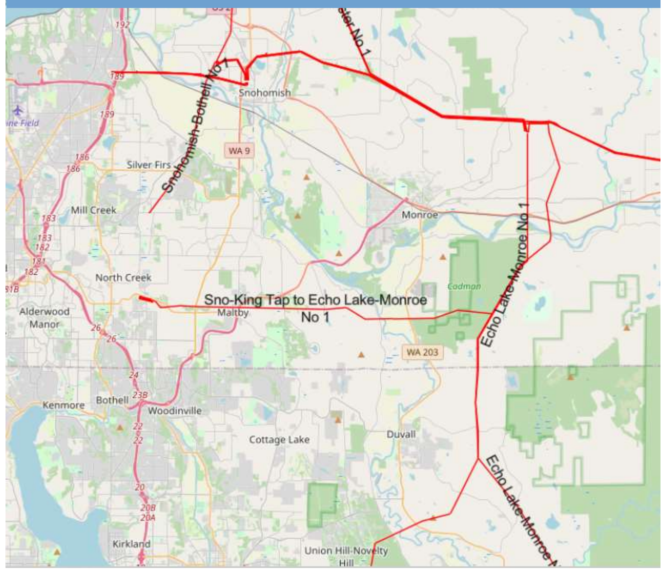
Summer Scenario

During the latter part of summer (July-September), water that was stored in the spring is released through hydro projects in Canada. The late summer scenario 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.

South of Custer Path
Northwest Washington Planning Area

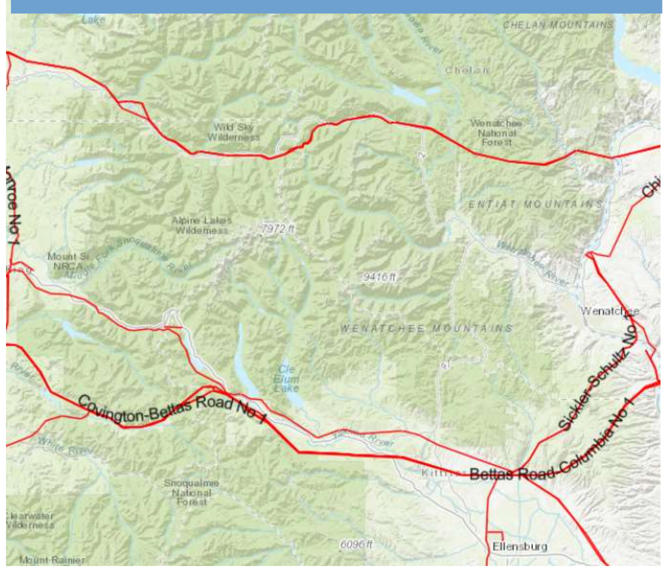


North of Echo Lake Path
Northwest Washington Planning Area

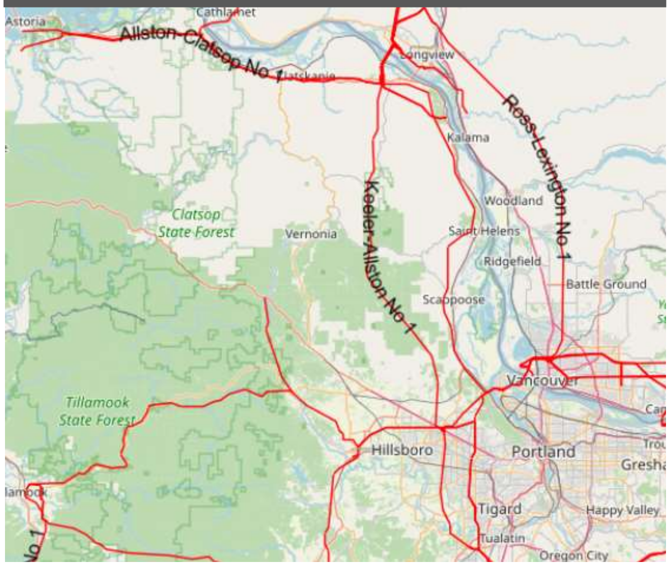


Raver-Paul Path
Northwest Washington Planning Area

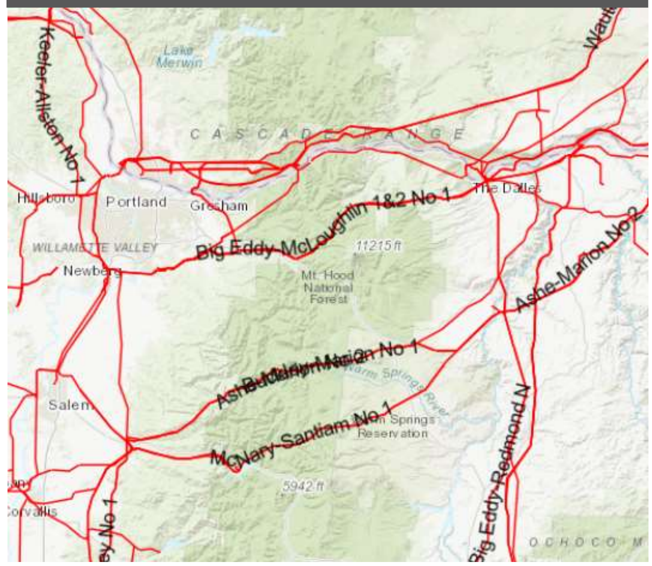
Cross Cascades North Path
Northwest Washington Planning Area



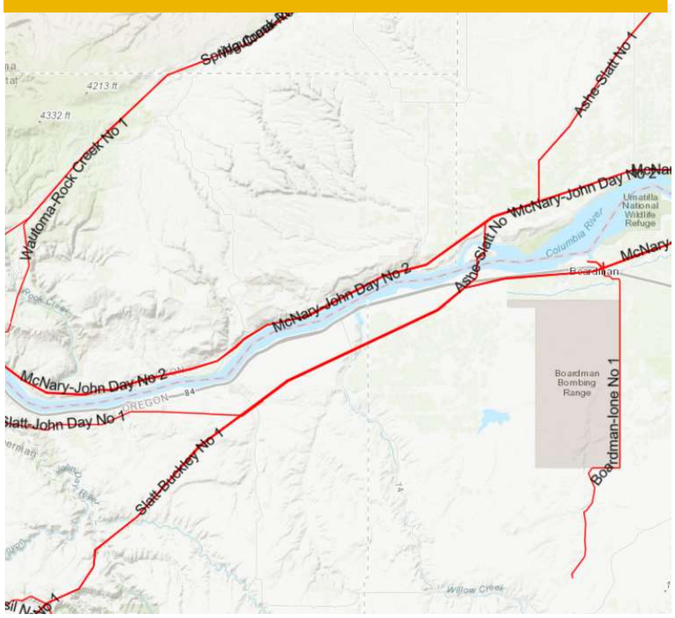
South of Allston Path
WILSWA Planning Area



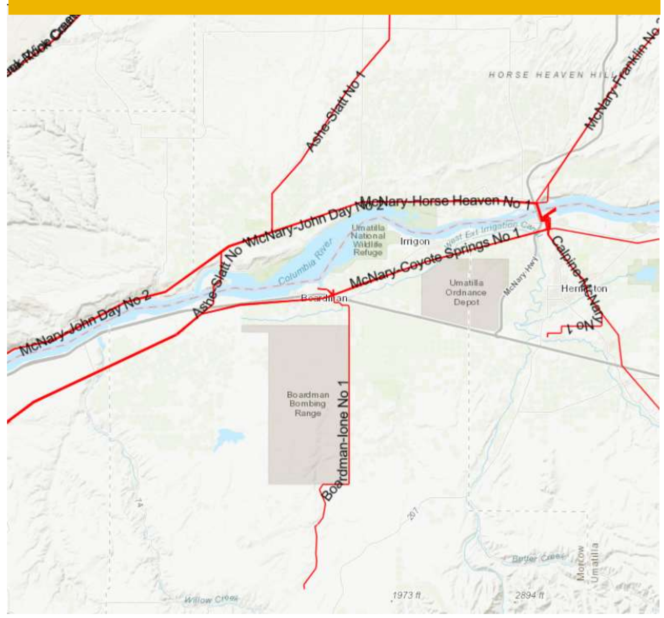
Cross Cascades South Path
WILSWA Planning Area



West of Slatt Path
Central Planning Area

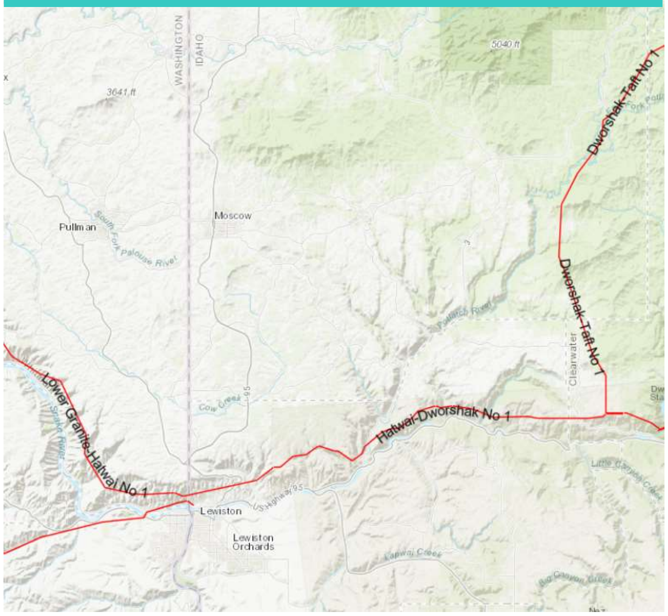


West of McNary Path
Central Planning Area

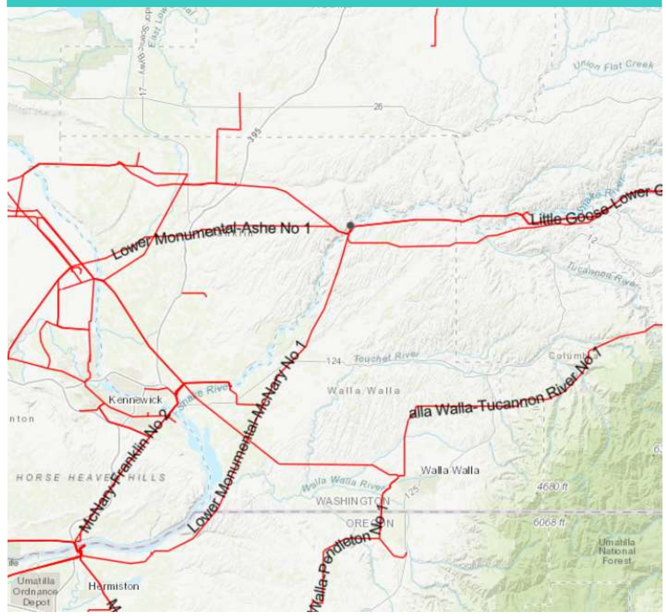


The Paul to Allston path was retired on January 26, 2022.

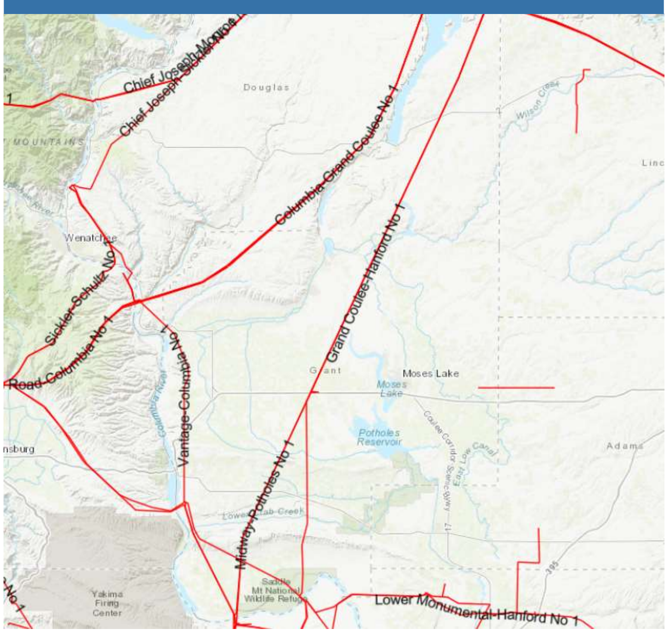
West of Hatwai Path
East Planning Area



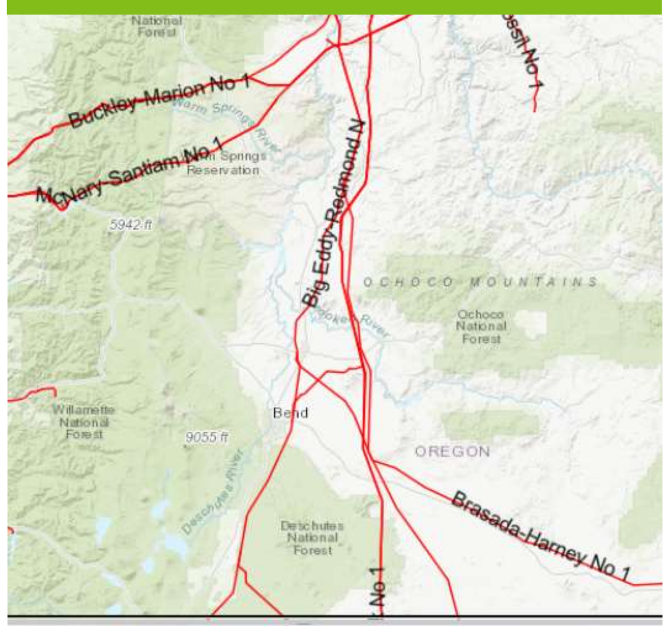
West of Lower Monumental Path
East Planning Area



North of Hanford Path
Northern Planning Area



West of John Day Path
Lower Columbia Planning Area



8.1 South of Custer Path

Description

South of Custer (SOC) is a north-to-south path that connects the northern Puget Sound Area. 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 path at this time.

Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

There are no recently completed plans of service for this path since the last planning cycle.

8.2 North of Echo Lake Path

Description

North of Echo Lake (NOEL) path is a south-to-north path that connects the central Puget Sound Area (PSA).

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 path at this time.

Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

There are no recently completed plans of service for this path since the last planning cycle.

8.3 Raver to Paul Path

Description

The Raver-Paul (R-P) path is located east of Tacoma, WA and spans from near Covington, WA to Centralia, WA. The critical facilities in the area are the Raver, Paul, Covington, Tacoma, Olympia, and Satsop substations. The generation projects in this area are the Centralia, Frederickson LLP, Frederickson (PSE), Grays Harbor, and Chehalis thermal generation projects. In addition, the Fredonia and Whitehorn generation projects impact the area. The load in this area is a mixture of industrial, commercial, and residential loads in Covington, WA, Tacoma, WA, Olympia, WA, and the Olympic Peninsula.

The R-P path is defined as the Raver-Paul #1 500 kV line. Typically, the R-P path sees its highest loading during late spring and early summer off-peak load hours. During late spring and early summer conditions, large amounts of hydro generation on-line in the Northwest and Canada, with moderate loads in the Northwest can occur simultaneously with I-5 Corridor thermal generation off-line due to maintenance schedules and economic factors. This generation pattern results in high flows across the R-P path.

This path includes the following line:

- Raver-Paul 500 kV Line 1

The customers in the area include:

- Puget Sound Energy (PSE)
- Tacoma Power
- Mason County #1 & #3 PUDs
- Jefferson County PUD
- Clallam County PUD
- City of Port Angeles
- Grays Harbor PUD

Proposed Plans of Service

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

Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

Raver 500/230 kV Transformer (PSANI), (Also included in the Seattle, Tacoma and Olympia area.)

- Description: This project added a 1300 MVA, 500/230 kV transformer at Raver Substation. This project was part of the overall Puget Sound Area/Northern Intertie (PSANI) Regional Reinforcement Plan. This was 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: $100,000,000
- Energization: 2021 for the transformer and 2024 for the rest of the PSANI project

8.4 West of Cascades North Path

Description

The West of Cascades North (WOCN) Path spans the northern Cascades Mountain range in Washington State. It connects generation hubs on the Columbia River in eastern Washington to load centers in Puget Sound and western Washington. It is comprised of system elements owned by BPA and PSE, and only flows in the east-to-west direction.

This path consists of the following transmission lines:

- Chief Joseph-Monroe #1 500 kV line (BPA)
- Schultz-Raver #1, #3, and #4 500 kV lines (BPA)
- Schultz-Echo Lake 500 kV line (BPA)
- Chief Joseph-Snohomish #3 and #4 345 kV lines (BPA)
- Rocky Reach-Maple Valley #1 345 kV line (BPA)
- Grand Coulee-Olympia #1 287 kV line (BPA)
- Rocky Reach-Cascade 230 kV line (PSE)
- Bettas Road-Covington #1 230 kV line (BPA)

Proposed Plans of Service

Schultz-Raver Series Caps TSEP 2020

- Description: This project is needed to provide additional west of cascades north path capacity. Series capacitors will be added at Schultz on the Schultz-Raver 500 kV #3 and #4 lines.
- Purpose: This project will provide capacity on the West of Cascades North path.
- Estimated Cost: $50,300,000
- Expected Energization: 2025

Potential Long-Range Needs

Schultz-Raver No. 3 and 4 Reconductor
Schultz-Raver No. 3 500 kV line consists of 77 miles of ACSR 2.5" expanded single-conductor, and Schultz-Raver No. 4 500 kV line consists of 26 miles of ACSR 2.5" expanded single-conductor. This conductor type is now obsolete (replacement parts are no longer available for the compression fittings). BPA's maintenance program plans to replace and upgrade these circuits with modern bundled 500 kV conductor and associated hardware sometime beyond the long term planning horizon. This project is not required at this time to meet NERC TPL-001-4 performance requirements. The expected energization date is beyond the planning horizon.

Recently Completed Plans of Service

There are no recently completed plans of service for this path since the last planning cycle.

8.5 South of Allston Path

Description

The South of Allston (SOA) path is located along the I-5 Corridor west of the Cascade Mountains and spans from near Alston Oregon to Sherwood Oregon. The main grid facilities located in this area are the Allston, Keeler, and Pearl substations. The Southwest Washington and Northwest Oregon load service area includes the cities of Portland, Oregon and Vancouver, Washington, which include high concentrations of industrial, commercial, and residential load.

The highest flow across the SOA path occurs during peak summer load conditions combined with high north-to-south transfers from Canada through the Northwest to the Puget Sound, Portland, and California load areas. The high north-to-south flows occur due to excess generation in Canada and the Northwest and high energy demands in the Northwest and California.

This path includes the following lines:

- Keeler – Allston 500-kV
- Trojan – St. Marys 230-kV (PGE)
- Trojan – Rivergate 230-kV (PGE)
- Ross – Lexington 230-kV (rev)
- St. Helens – Allston 115-kV
- Merwin – St. Johns 115-kV (PACW)
- Seaside – Astoria 115-kV (PACW)
- Clatsop 230/115 kV (rev)

Proposed Plans of Service

Schultz-Wautoma 500 kV Series Capacitors

- Description: This project is necessary to increase South of Allston (SOA) available transfer capability. The project will add 1152 Mvar, 24 OHM series capacitors (rated 4000A at 500 kV) on the Schultz-Wautoma line at the Wautoma substation.
- Purpose: This project will improve operations and maintenance flexibility for SOA.
- Estimated Cost: $30,000,000
- Expected Energization: 2024

Keeler 500 kV Expansion and Transformer Addition

- Description: This project will add 500 kV breakers at Keeler substation in order to reconfigure the Keeler 500 kV bus layout into a double-breaker-double-bus arrangement and a second 500/230 kV Transformer bank at Keeler substation.
- Purpose: This project will improve reliability and operations and maintenance flexibility for the South of Allston path.
- Estimated Cost: $41,300,000
- Expected Energization: 2027

Potential Long-Range Needs

Keeler-Rivergate 230 kV Line Upgrade

- This project will increase the rating of the line. This project was identified as a beneficial upgrade to increase operational and maintenance flexibility for deeper contingencies or extreme events. This long-range project is beyond the planning horizon.

Recently Completed Plans of Service

There are no recently completed plans of service for this path since the last planning cycle.

8.6 West of Cascades South Path

Description

The West of Cascades South (WOCS) path spans the Cascade Mountains in southern Washington and Northern Oregon, serving the Willamette Valley and Southwest Washington (WILSWA) area. The main grid facilities for this path include Marion, Ostrander, Knight, John Day, Wautoma, and Big Eddy substations. The WILSWA area includes the cities of Portland, Vancouver, Eugene and Salem with high concentrations of commercial and residential load.

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 low thermal generation in the Southwest Washington/Northwest Oregon area.

The WOCS path only flows in the east-to-west direction.

This path includes the following lines:

- Big Eddy-Ostrander 500-kV (BPA)
- Knight-Ostrander 500 kV (BPA)
- Ashe-Marion 500 kV (BPA)
- Buckley-Marion 500 kV (BPA)
- John Day-Marion 500 kV (BPA)
- McNary-Ross 345 kV (BPA)
- Jones Canyon-Santiam 230 kV (BPA)
- Big Eddy-Chemawa 230 kV (BPA)
- Big Eddy-McLoughlin 230 kV (BPA)
- Big Eddy-Troutdale 230 kV (BPA)
- Midway-N. Bonneville 230 kV (BPA)
- Round Butte-Bethel 230 kV (PGE)

The highest flows across WOCS occurs during peak summer and winter load conditions in the WILSWA area combined with high generation east of the Cascade Mountains including hydro, wind, and thermal plants.

Proposed Plans of Service

Pearl-Sherwood 230 kV Corridor Reconfiguration and Series Bus Sectionalizing Breaker Project

- Description: This will be a joint project with PGE. It includes splitting the existing BPA/PGE Pearl-Sherwood #1 and #2 230 kV jumpered circuits and terminates them into separate bays at Pearl and Sherwood. It also splits the existing BPA/PGE Pearl-McLoughlin-Sherwood 230 kV 3-terminal line into a new Pearl-Sherwood #3 230 kV line and a new Pearl-McLoughlin-Sherwood 230 kV three terminal line. This project will also add a new 230 kV series bus sectionalizing breaker at Pearl Substation.
- Purpose: This project is required to maintain reliable load service to the Portland Area.
- Estimated Cost: $10,000,000
- Expected Energization: 2027

Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

There are no recently completed plans of service for this path since the last planning cycle.

8.7 Paul to Allston Path

This path was retired on January 26, 2022.

8.8 West of Slatt Path

Description

The West of Slatt path is an east to west path that transfers power from Northeast Oregon and Southeast Washington, east of Slatt substation to the California-Oregon AC Intertie at the John Day substation, the Pacific DC Intertie at Big Eddy substation, and Northwest load centers west of the Cascade Mountains. Transfers across this path usually peak in spring or summer as a result of late spring and early summer hydro run off.

This path is located between Slatt and John Day Substations in Oregon. Monitoring West of Slatt (WOS) is designed to protect the Lower Columbia Basin area from high transfers caused by surplus generation of local wind, hydro and thermal generation. The highest flows on the WOS path are due to surplus generation and are driven by commercial transfers instead of load service. The WOS and West of John Day (WOJ) paths can be impacted by West of McNary (WOM) path flows as well, since all three paths usually peak in spring or summer generation surplus conditions when commercial exports from the Pacific NW are high.

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 path at this time.

Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

There are no recently completed plans of service for this path since the last planning cycle.

8.9 West of McNary Path

Description

The West of McNary (WOM) path is an east to west path that transfers power from Northeast Oregon and Southeast Washington, east of Coyote substation, to the California-Oregon (COI) AC Intertie at John Day substation, the Pacific DC Intertie (PDCI) at Big Eddy substation and Northwest (NW) load centers west of the Cascade Mountains. Transfers across the WOM path usually peak in spring or summer as a result of late spring and early summer hydro run off. Transfers can also peak in winter.

The WOM path is directly impacted by hydroelectric generation at the McNary and Lower Snake River dams; thermal plants at Coyote Springs, Hermiston and Goldendale; wind plants at Jones Canyon, Walla Walla, and Central Ferry, and other renewable energy connected to the 500 kV, 230 kV and 115 kV systems at and east of Coyote substation.

This path includes the following lines:

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

Proposed Plans of Service

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

Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

There are no recently completed plans of service for this path since the last planning cycle.

8.10 West of Hatwai Path

West of Hatwai WECC Path 6 Description

This path is located between northern Idaho (Lewiston area) and eastern Washington. The highest flows on this path typically occur east to west during light load periods in late spring and early summer.

This path includes the following lines:

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

Proposed Plans of Service

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

Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

There are no recently completed plans of service for this path since the last planning cycle.

8.11 West of Lower Monumental Path

Description

This path is between Lower Monumental and McNary Substations. Historically, flow on the West-of-Lower Monumental path (WOLM) peaks during the late spring/early summer (May/June) time frame during spring hydro run-off for both peak and off-peak hours.

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 path at this time.

Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

There are no recently completed plans of service in this path since the last planning cycle.

8.12 North of Hanford Path

Description

This path is located north of Hanford (NOH) substation between Hanford and Grand Coulee. The NOH path is located in central Washington and is a bi-directional path with flows both north-to-south and south-to-north. The NOH path north-to-south peak flow occurs with high Upper Columbia generation, high Mid-Columbia generation, high I-5 Puget thermal generation, and/or high imports from Canada and lower levels on the Lower Snake River and Lower Columbia River hydro generation. High north-to-south flow is typical in the late spring and summer seasons. For thermal limitations the most critical season is summer, when facility ratings are lower. The NOH south-to-north flows are dependent on a number of factors: low or zero generation at the Upper Columbia hydro plants, Grand Coulee pump loads in service, low Puget Sound area generation, and high south-to-north exports to Canada. The primary season for high south-to-north flows on NOH is the in spring and lesser often in the winter. Higher south-to-north flows are most common during light load conditions (off peak hours).

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

The Schultz-Wautoma series capacitor project is physically located along the North of Hanford path, but it is needed to relieve congestion on the South of Allston path. The project is not intended to reinforce the North of Hanford path, but is a significant change for the path. This project is described under the South of Allston Path section.

Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

There are no projects that have been completed for this path since the previous planning cycle.

8.13 West of John Day Path

Description

The West of John Day path is an east west path that transfers power from Northeast Oregon and Southeast Washington, east of John Day substation to the Pacific DC Intertie at Big Eddy substation and Northwest load centers west of the Cascade Mountains. Transfers across the WOJ path usually peak in spring or summer as a result of late spring and early summer run off. This path is located between the John Day Substation and The Dalles Substation in Oregon. Monitoring the West of John Day (WOJ) path is designed to protect for high transfers to Western Oregon load centers and to the northern terminal of the Pacific DC Intertie caused by surplus generation of local wind and hydro. The highest flows on the WOJ path are due to surplus generation and are driven by commercial transfers instead of load service. WOS and WOJ can be impacted by West of McNary (WOM) path flows as well, since all three paths usually peak in spring or summer generation surplus conditions when commercial exports from the Pacific NW are high.

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 path at this time.

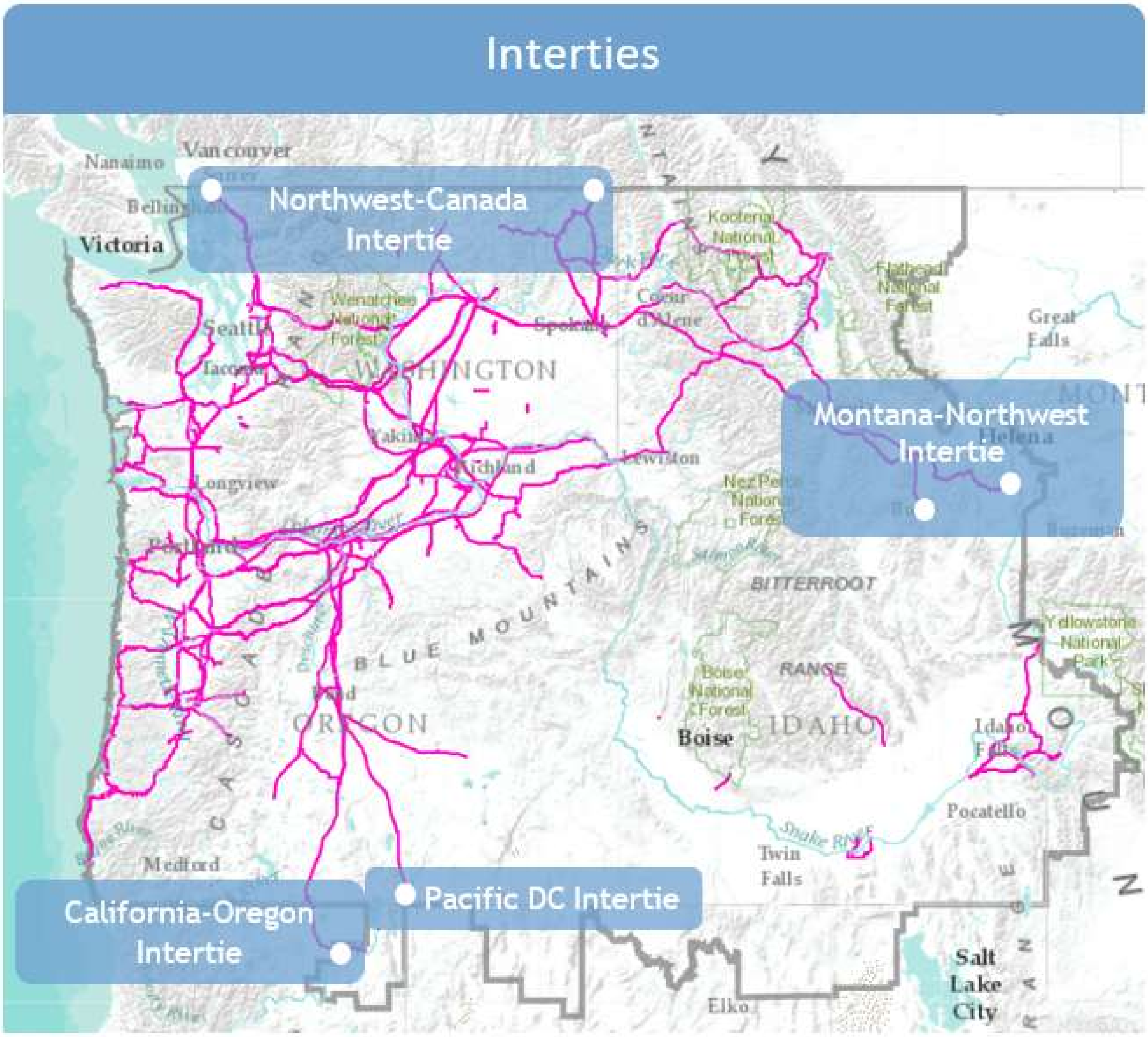
Potential Long-Range Needs

There are none identified for this path at this time.

Recently Completed Plans of Service

There are no recently completed plans of service for this path since the last planning cycle.

9. Transmission Needs by Intertie



9.1 California-Oregon AC Intertie

Description

The California-Oregon intertie (COI), identified as Path 66 by WECC, is the alternating current (AC) Intertie between Oregon and California. It is a corridor of three roughly parallel 500 kV alternating current power lines connecting to the grids in Oregon and California. The combined power transmission capacity is about 4800 megawatts from north to south and 3,675 megawatts from south to north. The critical season for the COI occurs in the summer with high energy demands across the western interconnection and high flows to California due to excess generation in the Northwest and Canada.

The path includes the following lines:

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

Proposed Plans of Service
No projects are proposed for this intertie.

Potential Long-Range Needs
Buckley Air Insulated Substation Addition

- Description: The Buckley 500 kV substation is presently gas insulated and has experienced component failures. These failures have caused prolonged outages of the entire substation resulting in severe transmission constraints that span over six months. The Buckley Gas Insulated Substation (GIS) will run out of the necessary spare parts to continue its operation in the next five years. To address these issues a new conventional Air Insulated Substation (AIS) is required to replace the existing Buckley GIS. The existing Buckley GIS is configured in a ring bus and the replacement AIS will be configured in a double bus, double breaker layout using a breaker and half scheme that will provide opportunities for future system expansion.
- Purpose: This project is needed to maintain reliability in the area.

Recently Completed Plans of Service
There are no recently completed plans of service for this intertie since the last planning cycle.

9.2 Pacific DC Intertie

PDCI Description
The Pacific DC Intertie, identified as Path 65 by WECC, 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. This transmission line transmits electricity from the Pacific Northwest to the Los Angeles area using high-voltage direct current. The Intertie can transmit power in either direction, but power flows mostly from north to south. HVDC lines can help stabilize a power grid against cascading blackouts, since power flow through the line is controllable.

The path includes the following lines:

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

Proposed Plans of Service
No projects are proposed for this intertie.

Potential Long-Range Needs
There are none identified for this intertie at this time.

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

9.3 Northern Intertie (Canada to Northwest)

Description
The Northwest to British Columbia WECC Path 3, also known as the Northern Intertie (NI), is between the United States and Canada. Bonneville delivers power to Canada over the Northern Intertie, which includes lines and substations from Puget Sound north to the Canadian border. It has a western and an eastern component and is a bi-directional path that is dictated by import and export schedules from Canada. Several Puget Sound Area/Northern Intertie (PSANI) reinforcements were developed jointly between Seattle City Light, Puget Sound Energy and BPA in 2011 as a result of the Regional Puget Sound Area Study Team (PSAST).

The Northern Intertie 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
No projects are proposed for this intertie.

Potential Long-Range Needs
There are none identified for this intertie at this time.

Recently Completed Plans of Service
Raver 500/230 kV Transformer (PSANI), (Also included in the Seattle area.)
- Description: This project added a 1300 MVA, 500/230 kV transformer at Raver Substation. This project was part of the overall Puget Sound Area/Northern Intertie (PSANI) Regional Reinforcement Plan. This was 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: $100,000,000
- Energization: The transformer was energized in 2021 and the rest of the project is expected to be energized in 2024.

9.4 Montana to Northwest Intertie

Montana to Northwest WECC Path 8 Description
This intertie is between Montana and the Northwest. It includes Northwestern Energy, Avista and BPA lines. The highest flows on this path typically occur east to west during light load periods.

This path includes the following lines:

- BPA Kerr – BPA Kalispell 115 kV line
- BPA Broadview – BPA Garrison 500 kV line 1
- BPA Broadview – BPA Garrison 500 kV line 2
- BPA Mill Creek – BPA Anaconda 230 kV line
- BPA Placid Lake – BPA Hot Springs 230 kV line
- Northwestern Thompson Falls – Avista Burke 115 kV line
- Northwestern Crow Creek –Avista Burke 115 kV line
- Northwestern Rattlesnake 230/161 kV transformer
- Northwestern Mill Creek – Garrison 230 kV line
- Northwestern Ovando – Garrison 230 kV line

Proposed Plans of Service
No projects are proposed for this intertie.

Potential Long-Range Needs
There are none identified for this intertie at this time.

Recently Completed Plans of Service
There are no recently completed plans of service for this intertie since the last planning cycle.

10. Transmission Service Requests Reinforcements

10.1 2022 Cluster Study & Proposed Expansion Projects

Bonneville Power Administration (BPA) Transmission Services (TS) initiated the 2022 Transmission Service Request (TSR) Study and Expansion Process (TSEP) as a means of processing and offering service to customers with requests for Long-Term Firm (LTF) transmission service over the BPA Network. As part of the TSEP, BPA performed a Cluster Study to determine what transmission system expansion, if any, is required to accommodate the requested service, as well as whether Conditional Firm Service (CFS) could be reliably offered to requesting customers. BPA initiated the 2022 TSEP Cluster Study in June 2021 and received 144 TSRs that met the eligibility requirements with an associated demand of 11,118 MW. Customers also requested a CFS study for 142 TSRs totaling 10,553 MW. BPA used scenario-based power-flow cases to determine the paths requiring additional study and possible reinforcement. The objective of the scenario-based Needs Assessment is to study a range of scenarios that adequately capture anticipated firm network path utilization. Scenarios were developed based on groupings of TSRs in the long-term transmission pending queue with similarly-situated point of receipt (POR) location and/or expected resource type, and by considering which market and weather conditions may induce the greatest firm transmission utilization from these requests on network paths.

Transmission Service Overview

1. Load Growth

Load growth in Portland and Seattle – high tech industries, transportation and building electrification

3. East Side

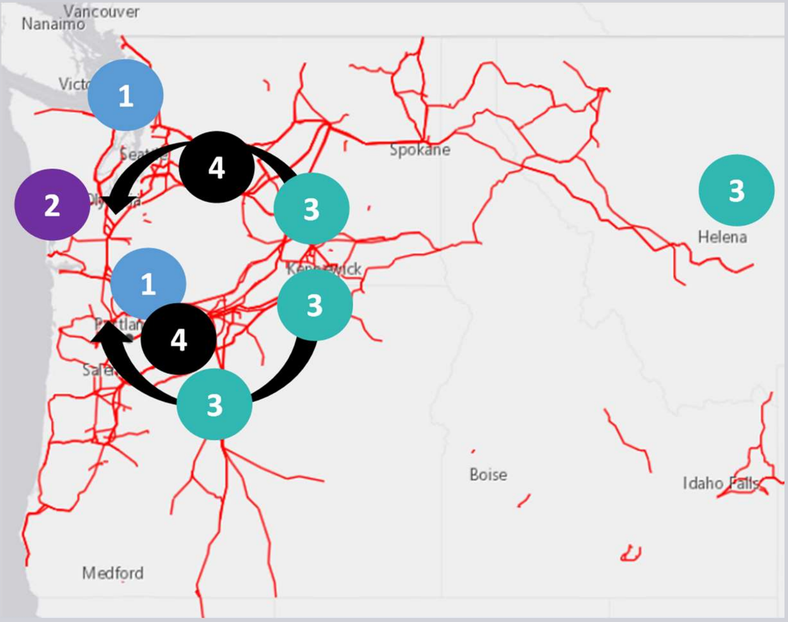
Most wind and solar resources are located on the east side

2. West Side

Reduced operation of 4.5 GW of carbon emitting generators on the west side along the I-5 corridor

4. Flows

Flows on the Cross-Cascades transmission paths and throughout the load centers will increase



10.2 Cluster Study Paths and Areas Identified

BPA identified the following <u>paths</u> which required further examination to determine what reinforcements, if any, were needed in response.

- South of Custer
- North of Echo Lake
- Raver-Paul
- South of Allston
- Cross Cascades North
- Cross Cascades South
- West of Garrison

BPA also identified the following <u>sub-grid areas</u> for further study to assess the need for required reinforcements.

- Mid-Columbia Area
- Northwest Washington Area
- Portland Area
- Central Planning Area
- South Planning Area
- South Oregon Coast Area

10.3 Determination of Cluster Study Areas

Starting with the Needs Assessment results, each path and sub-grid area was assessed individually, leveraging existing reliability studies and limits. A comparison between existing system limits, derived from existing reliability studies, and the requested capacity was then performed for each path and each sub-grid POR/POD. Where existing system capability was not adequate to accommodate the requested service, BPA identified system reinforcements, or projects, that would allow BPA to accommodate the incremental requests for service. In the instances where a new transmission project was identified, reliability studies were performed to ensure the project met the reliability needs of the system and the applicable TSRs. In addition, preliminary scope, cost estimates, and potential energization dates for new projects were also identified.

10.4 Summary of Proposed Reinforcements Identified

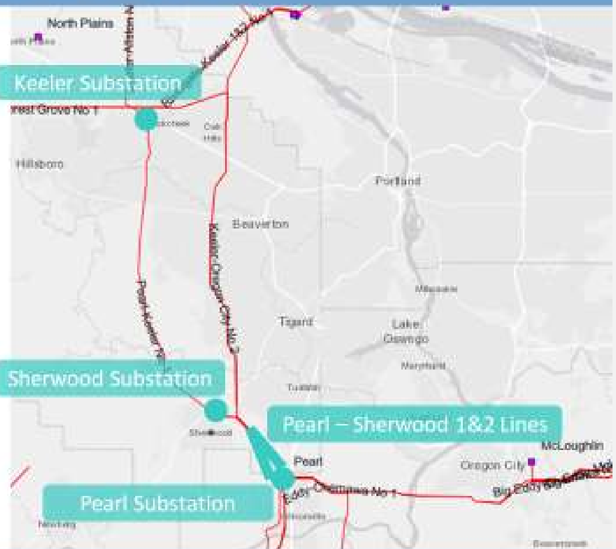
2022 Cluster Study Transmission System Reinforcements Identified			
Area	Project Description	Number of TSRs Affected	TSR MWs Enabled (In Megawatt)
Portland Area	Keeler substation upgrades, Keeler 500/230 Transformer, Pearl-Sherwood Retermination	-	-
Cross Cascades South	Big Eddy-Chemawa 500 kV Rebuild & Reconfiguration	91	7,462
Raver-Paul	Chehalis to Cowlitz Tap 230 kV Rebuild	22	2,171
Cross Cascades North	Schultz-Raver #3 & #4 500kV Reconductor, Schultz-Raver #4 500 kV Series Cap Upgrade (Phase 2); Olympia 230 kV +350/-300 MVAR SVC; Paul 500 kV 221 MVAR Shunt Cap	83	6,452
South of Allston	Ross-Rivergate 230 kV Rebuild	54	4,955
South of Rock Creek	Rock Creek-John Day 500 kV Rebuild	39	1,910

10.5 Proposed Transmission Reinforcements Details

The images below provide description, drivers and status information for proposed reinforcement by select paths and areas alongside a map. The map shows transmission lines and the general location of the proposed reinforcements needed to meet customer needs for LTF transmission service and CFS.

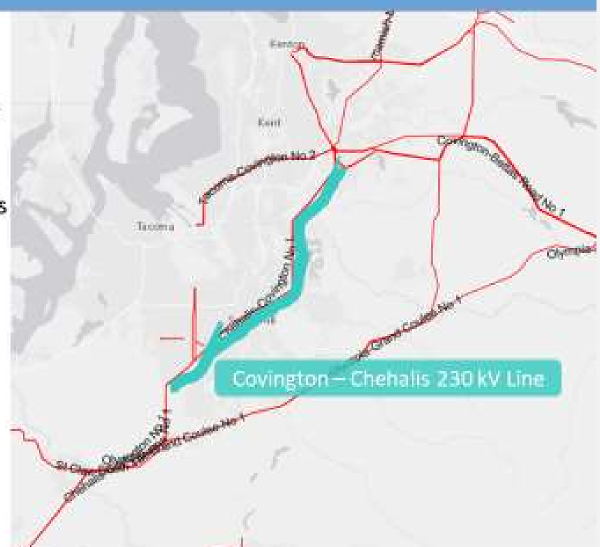
Portland Area

- Description:
  - Add second 500/230-kV transformer at Keeler substation
  - Develop Keeler 500-kV bus into breaker and half configuration
  - Re-termination and upgrades to Pearl - Sherwood 230-kV lines
- Drivers:
  - TPL-001 Reliability Compliance
  - Rapid Load growth in Hillsboro
  - Enabling delivery of renewable resources to Portland
- Status:
  - Identified in 2021 and 2022 System Assessments



Raver – Paul

- Description:
  - Rebuild 53 miles of Cowlitz-Chehalis section of Covington-Chehalis 230kV line
- Drivers:
  - Enabling delivery of renewable resources to Portland
  - Mitigate impact of I5 gas generation retirement
- Status:
  - Identified by 2022 Transmission Service Expansion Process



South of Allston

- Description:
  - Rebuild Ross - Rivergate / Ross - St.Johns 230kV line (7.5 mi)
- Drivers:
  - Enabling delivery of renewable resources to Portland
  - Resiliency of load service in Portland
- Status:
  - First identified in 2017 SOA no-build ADF
  - Identified by 2022 Transmission Service Expansion Process

Cross-Cascades South

- Description:
  - Rebuild existing Big Eddy-Chemawa 230kV line as Big Eddy-Ostrander 500kV (70 mi), Ostrander-Pearl 500kV (20 mi), re-terminate the Pearl - Chemawa 230kV
- Drivers:
  - Enabling delivery of renewable resources to Portland
  - Resiliency of load service in Portland Area
- Status:
  - Identified by 2022 Transmission Service Expansion Process

Cross-Cascades North

- Description:
  - Reconductor Schultz-Raver 3 & 4 500kV lines (100 mi total)
  - Schultz-Raver #4 500kV series capacitor addition
  - Olympia 230kV 350 MVAR Statcom addition
  - Paul 500kV 221MVAR shunt capacitor addition
- Drivers:
  - Enabling delivery of renewable resources to Puget Sound
  - Resiliency of load service in Puget Sound and Olympic Peninsula
- Status:
  - Identified by 2022 Transmission Service Expansion Process

South of Rock Creek

- Description:
  - Rebuild Rock Creek - John Day 500kV line (20 mi)
- Drivers:
  - Enabling integration of renewable resources in Central Washington
  - Economical upgrade to the heart of the 500kV system, enabling overall capacity.
- Status:
  - Identified by 2022 Transmission Service Expansion Process

11. Supplemental Information

11.1 List of Projects by Planning Area

Area	Project Title	Project Number	Expected In-Service Date	Estimated Cost
1	**Northwest Washington Planning Area (NWWA)**			
	Chehalis - Centralia Load Area			
	Silver Creek Substation Reinforcements	P01092	2025	$11,300,000
	Olympic Peninsula Load Area			
	Kitsap 115 kV Shunt Capacitor Modification	P01443	2023	$4,000,000
	Seattle - Tacoma - Olympia Load Area			
	Raver 500/230 kV Transformer (PSANI)	P00094	2021 (Transformer)*, 2024 (Entire Project)	$100,000,000
	Tacoma 230 kV Series Bus Sectionalizing Breaker and Bus Tie Breaker	P02401	2022	$12,200,000
	Monroe-Novelty 230 kV Line Upgrade	P02367	2023	$2,500,000
	Southwest Washington Coast Load Area			
	Aberdeen Tap to Satsop Park – Cosmopolis 115 kV Line Upgrade	P03506	2023	$551,000
	West of Cascades North Path (WOCN)			
	Schultz-Raver Series Caps TSEP 2020	P04364	2025	$50,300,000
	Schultz-Raver No. 3 and 4 Reconductor	P01330	Long-Range	-
	South of Custer Path (SOC)			
	Raver-Paul Path			
	Northern Intertie			
2	**Willamette Valley Southwest Washington Planning (WILSWA)**			
	Hood River - The Dalles Load Area			
	L0380 Quenett Creek Substation Addition	P02256	2021	$60,000,000
	Longview Load Area			
	North Oregon Coast Load Area			
	High-Side Breaker and Gear Associated with the Clatsop Transformer Replacement	P05435	2026	$1,600,000

	Portland Load Area			
	Carlton Upgrades	P01367	2023	$15,600,000
	Forest Grove – McMinnville 115 kV Line Upgrade	P03469	2023	$1,000,000
	Troutdale 230 KV Series Bus Sectionalizing Breaker	P04401	2025	$3,490,000
	Keeler 230 kV Bus Sectionalizing Breaker Addition (L0452)	P04632	2026	$10,000,000
	Vancouver Load Area			
	West of Cascades Path (WOCS)			
	Pearl-Sherwood 230 kV Corridor Reconfiguration & Bus Sectionalizing Breaker Addition (Series)	P04974	2027	$10,000,000
	South of Allston Path (SOA)			
	Schultz-Wautoma 500 kV Line Series Capacitor	P03259	2024	$30,000,000
	Keeler 500 kV Expansion and Transformer Addition	P05449	2027	$41,300,000
	Ross – Rivergate 230 kV Line Upgrade	TBD	Long-Range	-
	Paul-Allston Path (P-A)			
	West of Cascades South Path (WOCS)			
3	**Southwest Oregon Planning Area (SWOR)**			
	Eugene Load Area			
	Alvey 115 kV Bus Sectionalizing Breaker Addition	P02250	2022	$18,200,000
	Lookout Point – Alvey No. 1 and 2 Transfer Trip Addition	P03258	2025	$3,000,000
	Alvey-Dillard Tap 115 KV Line Rebuild	P04286	2027	$1,300,000
	Salem - Albany Load Area			
	South Oregon Coast Load Area			
	Fairview 115 kV Reactor Additions	P01465	2022	$17,700,000
	Central Oregon Coast O&M Flex (Toledo, Wendson, Santiam, Tahkenitch)	P02230	2024	$4,500,000
4	**Northern Planning Area**			
	Klickitat County Load Area			
	Mid-Columbia Load Area			
	Columbia 230 kV Bus Tie and Sectionalizing Breaker Addition and Northern Mid-Columbia Area Reinforcement (Joint Utility)	P00076	2023	$14,700,000

	Okanogan Load Area			
	Grand-Coulee-Foster Creek (NILLES CORNER) Line Upgrade	P03253	2023	$700,000
	North of Hanford Path (NOH)			
5	**Central Planning Area**			
	De Moss - Fossil Load Area			
	Pendleton - La Grande Load Area			
	Tri-Cities Load Area			
	McNary-Paterson Tap 115 kV Line	P02364	2023	$13,200,000
	Red-Mountain – Horn Rapids 115 kV Line Reconductor	P03102	2024	$3,600,000
	Richland-Stevens Drive 115 kV Line	P02365	2024	$12,500,000
	G0558 South Tri-Cities Reinforcement Webber Canyon	P04691	2025	$96,700,000
	Umatilla - Boardman Load Area			
	L0481 McNary 230 kV Bay Addition	P04246	2024	$4,800,000
	L0482 Longhorn 500/230 kV Substation	P04342	2024	$143,000,000
	Morrow Flat 230 KV Shunt Reactor	P04423	2024	$2,900,000
	Jones Canyon 230 kV Shunt Reactor	P03491	2025	$13,000,000
	Walla Walla Load Area			
	Tucannon River 115 KV 15 MVAR Shunt Reactor	P04438	2025	$3,500,000
	West of McNary Path (WOM)			
6	**Southern Planning Area**			
	Central Oregon Load Area			
	La Pine 115 kV Circuit Breaker Additions	P02467	2022	$8,500,000
	Northern California Load Area			
	California to Oregon AC Intertie			
	Buckley Air Insulated Substation	P03999	Long-Range	-
	North of John Day Path (NJD)			
	California to Oregon Intertie (COI)			
	PDC Intertie (PDCI)			

7	**Eastern Planning Area**			
	North Idaho Load Area			
	Libby Power House 1 AND 2 Redundant Transfer Trip	P04231	2023	$500,000
	Troy 115 kV Shunt Capacitor Addition (12.6 MVAR)	P01106	2025	$11,000,000
	Northwest Montana Load Area			
	Conkelley Substation Retirement	P02259	2024	$27,600,000
	Spokane - Colville - Boundary Load Area			
	West of Garrison Path (WOG)			
	West of Hatwai Path (WHO)			
	West of Lower Monumental Path (WOLM)			
	Montana to Northwest Intertie (MT-MW))			
8	**Idaho Planning Area**			
	Burley Load Area			
	Southeast Idaho - Northwest Wyoming Load Area			
	Spar Canyon 230 kV Reactor Addition	P02306	2024	$5,300,000

Note: Projects in bold are newly identified transmission needs based on the most recent system assessment.
* Project or a component of the project is expected to be energized. In some instances a project's expected in-service date maybe revised during development of this report or after it is published. Therefore, a project's expected in-service date may be revised reflecting a later in-service date.

11.2 List of Projects by Path

No.	Project Title	Bundle No.	Expected In-Service Date	Estimated Cost
1	**North of Hanford**			
2	**West of McNary**			
3	**West of Slatt**			
4	**West of John Day**			
5	**Raver to Paul**			
	Raver 500/230 kV Transformer (PSANI)	P00094	See Seattle Area	
6	**South of Allston**			
	Schultz-Wautoma 500 kV Line Series Capacitor	P03259	2024	$30,000,000
	Keeler 500 kV Expansion and Transformer Addition	P05449	2027	$41,300,000
	Ross – Rivergate 230 kV Line Upgrade	TBD	Long-Range	-
7	**West of Cascades South**			
	Pearl – Sherwood 230 kV Corridor Reconfiguration	P04974	2027	$10,000,000
8	**North of Echo Lake**			
9	**South of Custer**			
10	**West of Cascades North**			
	Schultz-Raver Series Caps TSEP 2020	P04364	2025	$50,300,000
	Schultz-Raver No. 3 and 4 Reconductor	P01330	Long-Range	-
11	**West of Hatwai**			
12	**West of Lower Monumental**			

11.3 List of Projects by Intertie

No.	Project Title	Bundle No.	Expected In-Service Date	Estimated Cost
1	**California to Oregon AC Intertie**			
	Buckley Air Insulated Substation	P03999	Long-Range	-
2	**Pacific DC Intertie**			
3	**Northern Intertie**			
	Raver 500/230 kV Transformer (PSANI)	P00094	See Seattle Area	
4	**Montana to Northwest**			

11.4 List of Transmission Service Request Projects

Project Title	Bundle No.	Bundle Status
PUGET SOUND AREA NORTHERN INTERTIE	P00094	Construction
G0367 MAUPIN PROJECT	P03399	Construction
UPGRADE ABERDEEN TAP TO SATSOP PARK-COSMOPOLIS-1: 115KV (TSEP)	P03506	Queue
MONROE-NOVELTY 230 KV LINE UPGRADE	P02367	Scoping
SCHULTZ-WAUTOMA: 500 KV SERIES CAPACITORS	P03259	Design
LAPINE SUBSTATION UPGRADE TSEP 2016	P05322	Queue
MONTANA TO WASHINGTON TSEP 2016	P03902	Scoping
SCHULTZ-RAVER: SERIES CAPS TSEP 2020	P04364	Queue
PEARL-SHERWOOD-MCLOUGHLIN UPGRADE TSEP 2021	P04974	Scoping
BIG EDDY-CHEMAWA-1: 500KV LINE REBUILD TSEP 2022	P05468	Draft
CENTRAL OREGON 500KV UPGRADE TSEP 2022	P05469	Draft
CROSS CASCADES NORTH UPGRADE TSEP 2022	P05470	Draft

11.5 List of Generation Interconnection Projects in Construction

Project ID	Queue Number		Status	Megawatt Total	Generator Type (Including Hybrids)
P01110	G0099		CONSTRUCTION	600	Wind Turbine
P02286	G0238		COMPLETION IN PROGRESS	202	Wind Turbine
P00755	G0242-G0420		CONSTRUCTION	90	Photovoltaic
P03399	G0367		CONSTRUCTION	202	Photovoltaic
P03398	G0368		CONSTRUCTION	101	Photovoltaic
P02303	G0505		CONSTRUCTION	20	Wave
P02300	G0514		CONSTRUCTION	10	Photovoltaic
P02624	G0521		COMPLETION IN PROGRESS	20	Photovoltaic
P03588	G0578		CONSTRUCTION	160	Photovoltaic Energy Storage
P03486	G0586		CONSTRUCTION	100	Photovoltaic
P04116	G0605		CONSTRUCTION	80	Photovoltaic Energy Storage

The list of interconnection projects provided above include only those projects where the plan of service is well-defined, have a project schedule, and are in the construction or completion is in process phase.

11.6 List of Line and Load Interconnection Projects in Construction

Project ID	Queue Number and Project Title	Status
P01374	L0365: PGES BLUELAKE-TROUTDALE-2	COMPLETION IN PROGRESS
P03367	L0372: SOUTHRIDGE SUBSTATION LINE TAP AND METER SET	COMPLETION IN PROGRESS
P02324	L0387: SE RICHLAND CITY OF RICHLAND & BENTON COUNTY PUD	COMPLETION IN PROGRESS
P02478	L0388: CHENOWETH SUBSTATION RIVERTRAIL SUPPORT	COMPLETION IN PROGRESS
P02454	L0389: UEC PHASE II	COMPLETION IN PROGRESS
P02287	L0390: CHICKEN CREEK SUBSTATION	COMPLETION IN PROGRESS
P03037	L0398: KPUD BETTAS ROAD	CONSTRUCTION
P03074	L0414: RUPPERT RD SUBSTATION	COMPLETION IN PROGRESS
P02991	L0415: PACIFICORP PROJECT VITESSE PONDEROSA SUBSTATION - PHASE 1	COMPLETION IN PROGRESS
P03449	L0421: RADAR HILL SUBSTATION	CONSTRUCTION
P03509	L0422: PACIFICORP PROJECT VITESSE 2 PONDEROSA SUBSTATION	CONSTRUCTION
P03631	L0454: MORROW FLAT CAPACITY EXPANSION	COMPLETION IN PROGRESS
P04281	L0468: RURAL SUBSTATION	CONSTRUCTION

The list of interconnection projects provided above include only those projects where the plan of service is well-defined, have a project schedule, and are in the construction or completion is in process phase.

11.7 2022 System Assessment: Long-Term Peak Load Level

2022 System Assessment
Load Level by Planning and Load Area

Planning and Load Areas	Historical Peak Load (MW)		2027 Peak Load Forecast Near Term 5 year (MW)		2031 Peak Load Forecast Long Term 10 year (MW)	
	Summer	Winter	Summer	Winter	Summer	Winter
Northwest Washington Planning Area						
Centralia - Chehalis	169	283	177	266	181	267
Olympic Peninsula	742	1284	786	1266	788	1292
Seattle - Tacoma - Olympia	7729	9163	6956	9007	7057	8954
Southwest Washington Coast	231	375	203	329	202	329
Willamette Valley Southwest Washington Planning Area						
Hood River - The Dalles	272	286	493	473	653	641
Longview	665	830	562	731	562	731
North Oregon Coast	173	274	177	267	180	271
Portland	4475	4136	5269	5017	5670	5368
Vancouver	1018	1075	776	1004	803	1039
Southwest Oregon Planning Area						
Eugene	640	896	710	944	721	954
Salem - Albany	861	895	929	936	958	958
South Oregon Coast	252	505	280	468	284	472
Northern Planning Area						
Klickitat	64	77	87	104	90	108
Mid-Columbia	2373	2616	2237	2617	2384	2706
Okanogan	169	232	188	285	196	291
Central Planning Area						
De Moss - Fossil	29	44	26	34	26	34
Pendleton - La Grande	151	139	150	140	148	141
Tri-Cities	1331	1009	1402	1068	1477	1200
Umatilla - Boardman	815	516	Note 1	Note 1	Note 1	Note 1
Walla Walla	91	77	134	109	137	112
Southern Planning Area						
Central Oregon	667	704	673	827	700	851
Northern California	118	87	109	77	109	78
Eastern Planning Area						
North Idaho	118	193	128	186	130	187
Northwest Montana	261	391	252	378	255	382
Spokane - Colville - Boundary	1104	924	901	886	913	900
Idaho Planning Area						
Burley	207	157	227	164	232	168
Southeast Idaho - Northwest Wyoming	156	301	219	329	238	349
All Areas			24051	27912	25094	28783

11.8 List of Acronyms

Acronym	Title
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
CS	Cluster Study
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
CPP	Clean Power Plan
Cowlitz	Cowlitz Public Utility District
DOE	Department of Energy
Douglas	Douglas County Public Utility District
EIM	Energy Imbalance Market
EL&P	Elmhurst Light and Power

Emerald	Emerald Public Utility District
EPA	Energy Protection Agency
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
Mvar	Mega Volt-Amphere reactive
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
PC	Planning Coordinator
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
PNW	Pacific Northwest
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
PSA	Puget Sound Area
PSE	Puget Sound Energy
PSM	Project Strategy Meeting

PTC	Production Tax Credit
PTP	Point-to-Point
PTDF	Power Flow Distribution Factor
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
SIS	System Impact Study
SMI	Small Generator Interconnection
SOA	South of Allston
SOB	South of Boundary
SGIP	Small Generator Interconnection Process
SPUD	Snohomish County Public Utility District
SVEC	Surprise Valley Electrification Corporation
TI	Technology Innovation
TIP	Technology Innovation Project
TLS	Transmission Load Service
TP	Transmission Planners
TPL	Transmission Planning Standard
T-Plan	Transmission Plan
TPU	Tacoma Power Utilities
TS	Transmission Service
TSEP	Transmission Service Requests and Expansion Process
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