



Final Study Scope for the 2020- 2021 NorthernGrid Planning Cycle

Member Planning Committee Approval Date: September 30, 2020

Executive Summary

This Study Scope outlines the NorthernGrid 2020-2021 regional transmission planning process, as required under FERC Orders No. 890 and 1000, in accordance with each Enrolled Party's Open Access Tariff (OATT) Attachment K – Regional Planning Process and NorthernGrid Planning Agreement.

The NorthernGrid Regional Transmission Plan evaluates whether transmission needs within the NorthernGrid may be satisfied by regional and/or interregional transmission projects. The NorthernGrid Regional Transmission Plan provides valuable regional insight and information for all stakeholders, including developers, to consider and use in their respective decision-making processes.

The study plan for NorthernGrid's 2020-21 Regional Transmission Plan was developed using the following process:

- Identify the Baseline Projects of Enrolled Parties. Baseline Projects are the transmission projects included in the Enrolled Parties' Local Transmission Plans. In future regional planning cycles, the Baseline Projects will also comprise projects included in the prior Regional Transmission Plan that will be reevaluated (there will be no reevaluation for this first Regional Transmission Plan).
- Evaluate combinations of the Enrolled Parties Baseline Projects and Alternative Projects to identify whether there may be a combination that effectively satisfies all Enrolled Party Needs.
- Use Power flow and dynamic analysis techniques to determine if the modeled transmission system topology meets the system reliability performance requirements and transmission needs.
- Select the Regional Combination that effectively satisfies all Enrolled Party Needs into NorthernGrid's Regional Transmission Plan.

Overview of Key Findings:

Regional Summary of Needs

The regional needs were sourced from member data submissions, including load forecasts, resource additions and retirements, projected transmission, and public policy requirements. Data submissions were received from NorthernGrid's 13 members, comprised of Avista (AVA), Bonneville Power Administration (BPA), Chelan PUD (CHPD), Grant County PUD (GCPD), Idaho Power Company (IPC), Montana Alberta Tie Line (MATL), NorthWestern Energy (NWMT), PacifiCorp East and West (PACE and PACW), Portland General Electric (PGE), Puget Sound Energy (PSE), Seattle City Light (SCL), Snohomish PUD (SNPD) and Tacoma Power (TPWR).

- **Load Forecast** – Results indicate an average of 0.5 percent annualized load growth for the entire membership between 2024-2030.

- The range varies significantly between members from declining load of -0.3 to highest growth of 2 percent
- The 2030 NorthernGrid member load peak is forecast to reach 44,225 MW and 43,646 MW winter and summer, respectively.
- **Generation Retirements** - Members reported 6,000 MW of retirements.
- **Resource Additions** - 13,253 MW of renewable resources are replacing the generation retirements.
- **Proposed Member Transmission** - Members are proposing 53 new and upgrade transmission line projects, primarily for local load service and increased reliability.
- **Proposed Regional Transmission** - There are four proposed regional transmission projects, including Antelope – Goshen, Boardman to Hemingway, Gateway South and Gateway West.
- **Proposed Regional Non-incumbent and Interregional** - There are five projects proposed, including Cascade Renewable Transmission System, Cross-Tie, SWIP North, Transwest Express, and Loco Falls Greenline.

Case Analysis

The NorthernGrid Regional Transmission Plan will assess the existing system and committed projects along with combinations of planned and proposed transmission and resource changes for their ability to reliably serve the annual variations in 2030 load and generation dispatch conditions.

Initial analysis of the data submissions indicates that the NorthernGrid region experiences peak loading conditions during the winter and summer. Therefore, a heavy winter and heavy summer condition will be represented. Additionally, high transmission transfers can occur during the shoulder months. A light spring and heavy fall condition will also be evaluated.

Cost Allocation

TransCanyon LLC and Great Basin Transmission, LLC were pre-qualified by NTTG during 2019 for the 2020-21 Regional Transmission Planning cycle. The NorthernGrid Enrolled Parties proposed, and FERC accepted, that their qualification status be accepted by NorthernGrid during this planning cycle. PowerBridge submitted developer qualification information which was reviewed by the Cost Allocation Task Force resulting in the approval of PowerBridge as a Qualified Developer for this planning cycle.

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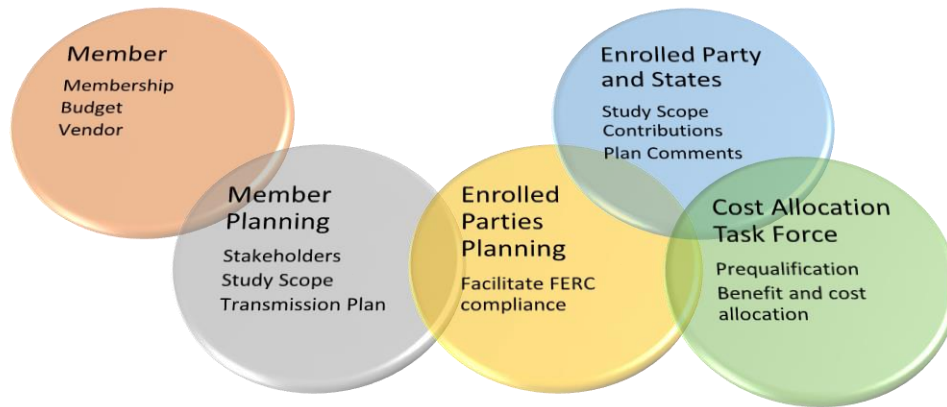
1. Introduction and Purpose Statement

The objective of the transmission planning study is to produce the NorthernGrid Regional Transmission Plan, through the evaluation and selection of regional and interregional projects that effectively satisfies all the transmission needs within the NorthernGrid region. The regional needs were sourced from member data submissions, including load forecasts, resource additions and retirements, projected transmission, and public policy requirements.

NorthernGrid is comprised of three primary committees as shown on Figure 1 below. Summary of committees:

- **The Member Committee (MC)** is composed of NorthernGrid member representatives. The MC is responsible for membership approval, budget development and approval, and vendor management.
- **The Member Planning Committee (MPC)** is composed of transmission planner representatives from all NorthernGrid members. The MPC is responsible for development of the regional transmission plan.
- **The Enrolled Parties Planning Committee** is composed of Federal Energy Regulatory Commission (FERC) jurisdictional utilities. Collectively these members are responsible for regional transmission planning compliance. There are two sub-committees of this primary committee:
 - **The Enrolled Parties and States Committee (EPSC)** is responsible for state engagement in the regional transmission planning process.
 - **The Cost Allocation Task Force (CATF)** is composed of enrolled parties and states representatives and is responsible for cost allocation compliance.

Figure 1: NorthernGrid Committee Structure Overview



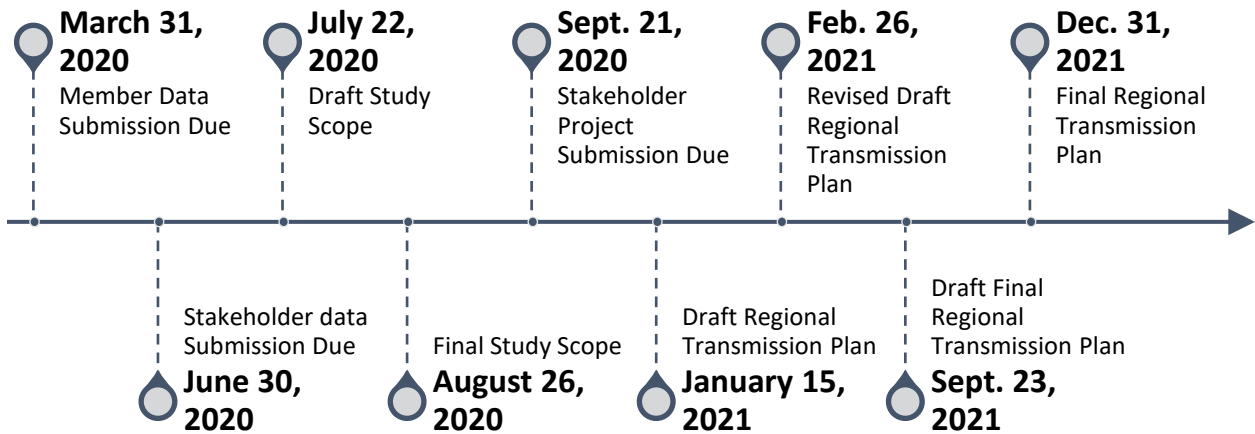
1.1. Regional Transmission Plan Development

1.1.1. Regional Transmission Plan Development Process Overview

NorthernGrid began the process to develop a regional transmission plan by requesting members to submit data pertaining to forecasted loads, resource additions and retirements, transmission additions and upgrades, and public policy requirements. The plan spans the 2020- 2030 time period.

The regional plan will be developed over the course of two years, beginning March 31, 2020 and ending December 31, 2021. A summary of the key steps in Year 1 and Year 2 is included below. The dates shown in the table are approximate and subject to change.

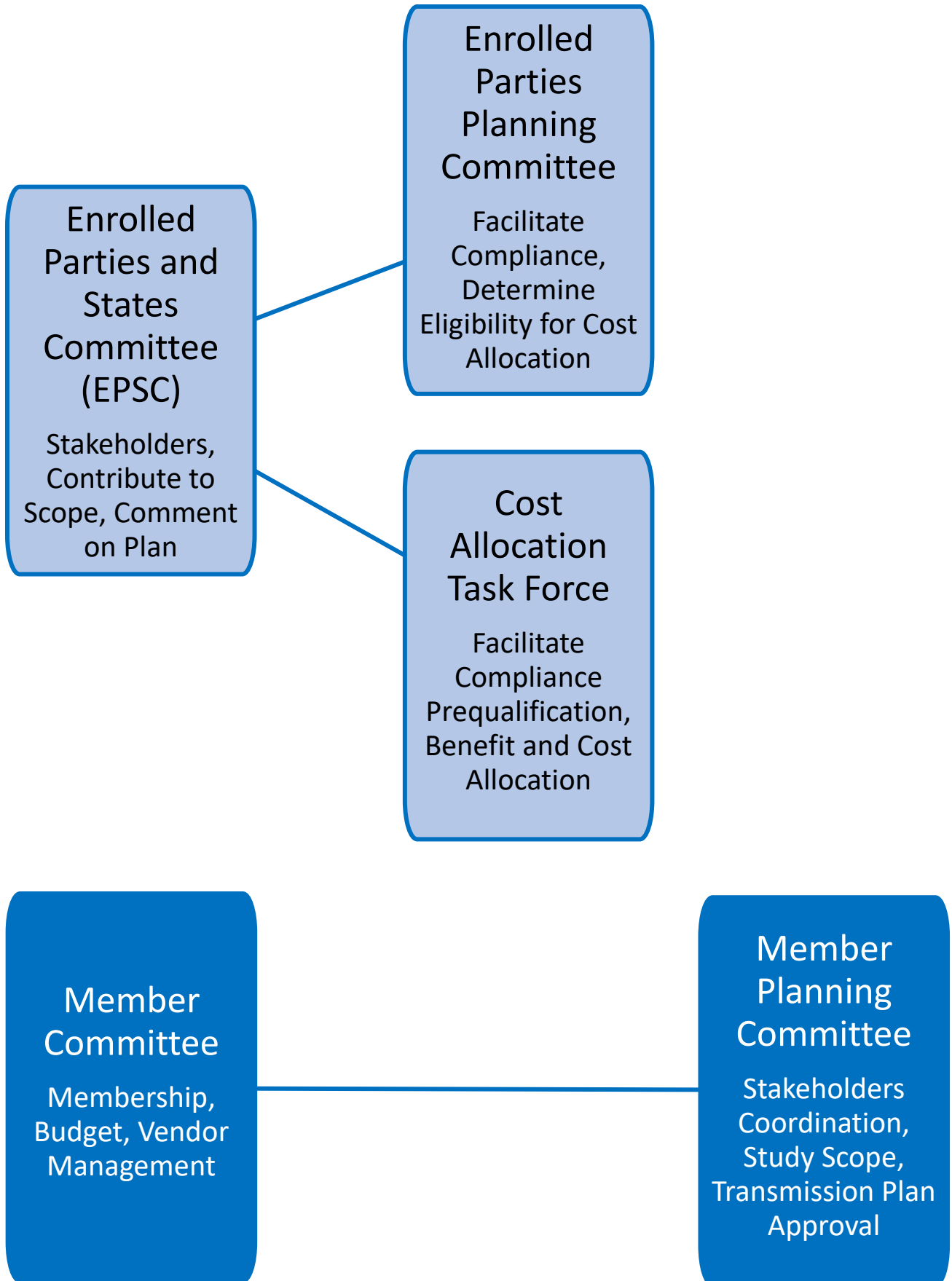
1.1.2. General Schedule and Deliverables



1.1.3. Stakeholder Engagement

Stakeholders are invited to participate in the public meetings and comment periods. They will also have active involvement in the development of the regional transmission plan. The first period for stakeholder comments begins with the publishing of the Draft Study Scope on July 22, 2020. Dates are subject to change, with the exception of September 30, 2021 (draft-final) and December 31, 2021 (final) Regional Transmission Plan.





1.1.4. Next Steps

A Stakeholder meeting was conducted on July 29th following the posting of the Draft Study Scope. The Stakeholder meeting opened a 15-day public review and comment period. This posting also opened a 60-day project submission window. No additional projects were submitted during this window. Analysis began following the Study Scope approval by the MPC on July 22nd.

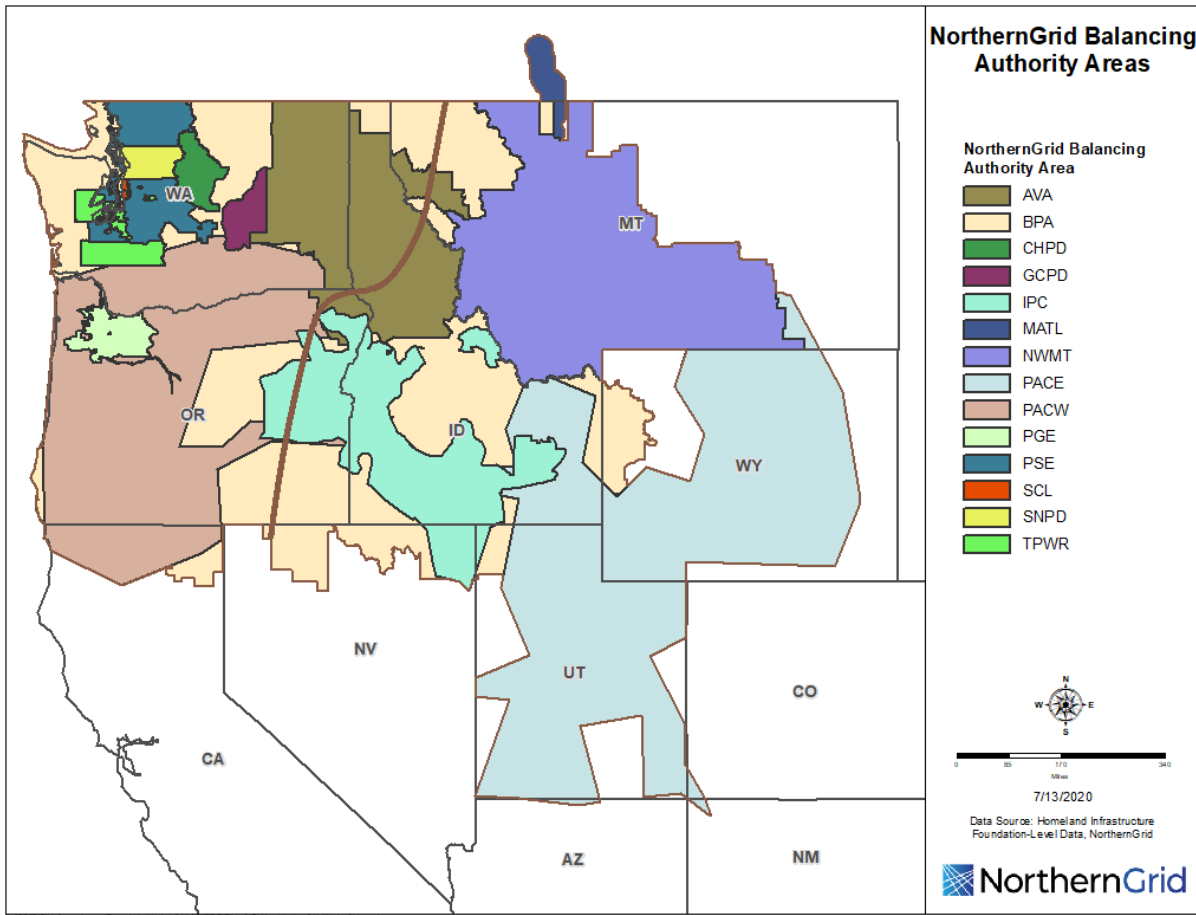
The analysis is forecasted to encompass the second half of 2020 and culminate with the posting of a Draft Regional Transmission Plan around January 15, 2021. The second year allows for data updates, Interregional Transmission Project coordination, Cost Allocation analysis and publication of the Final Regional Transmission Plan before December 31, 2021.

2. Regional Summary of Needs

2.1.1. Data Submission Results

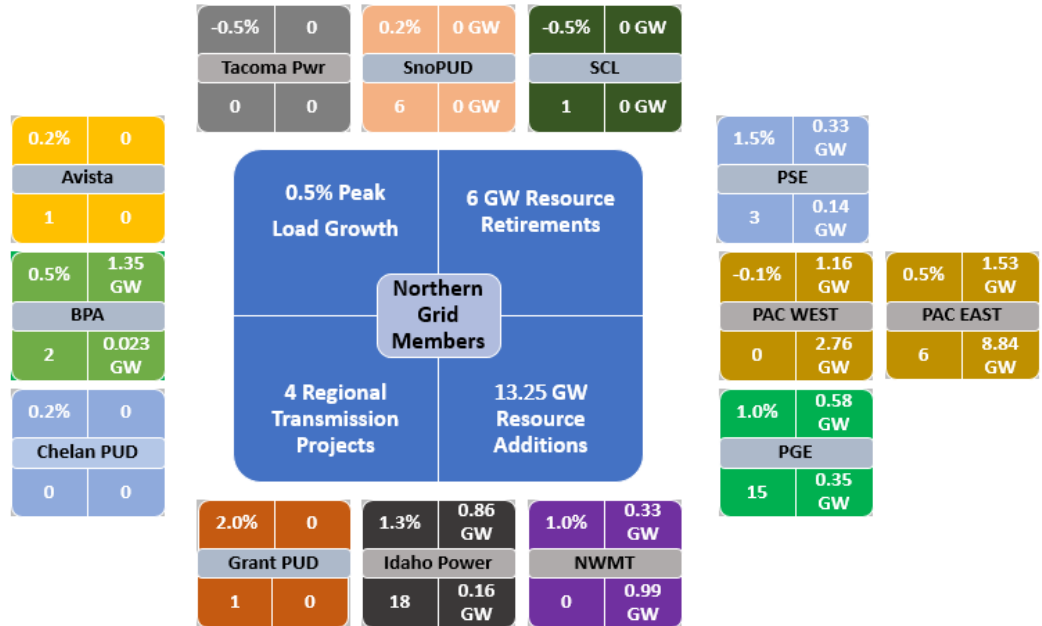
This section summarizes the data submission results that NorthernGrid received from its 13 members. The NorthernGrid is comprised of Avista (AVA), Bonneville Power Administration (BPA), Chelan PUD (CHPD), Grant County PUD (GCPD), Idaho Power Company (IPC), Montana Alberta Tie Line (MATL), NorthWestern Energy (NWMt), PacifiCorp East and West (PACE and PACW), Portland General Electric (PGE), Puget Sound Energy (PSE), Seattle City Light (SCL), Snohomish PUD (SNPD), Tacoma Power (TPWR). The member Balancing Authority Areas (BAA) are illustrated in Figure 2 below. Note, the BPA balancing area spans seven states. Portions of the BPA BAA are covered by other BAAs in order for them to display on the map.

Figure 2: NorthernGrid Member Balancing Authority Areas



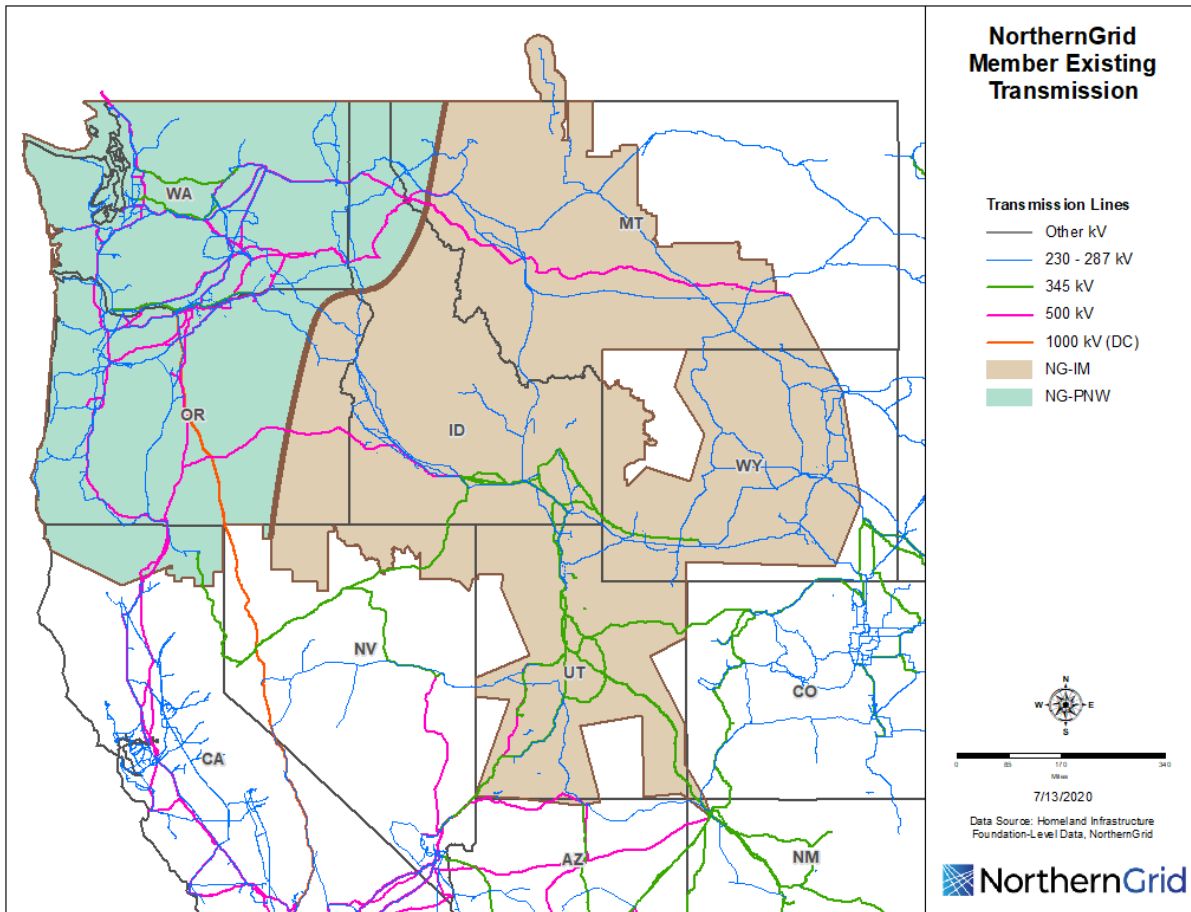
The NorthernGrid members that are registered as Balancing Authority Areas are required to submit a ten-year load and resource forecast to the Western Electricity Coordinating Council (WECC) annually. This forecast includes identification of forecasted generation resources and transmission facilities. The NorthernGrid leverages this submission for the biennial regional transmission plan. Each member submitted their data and the NorthernGrid summarized the data pertinent to the NorthernGrid region: load, generation resource retirements, generation resource additions, and 230 kV and above and 115 kV that members deem relevant transmission additions. A summary of each member’s data submission is shown in Figure 3. In the graphic, each member four-square displays (beginning in the upper left quadrant and continuing clockwise) their local planning data submission for load growth, generation resource retirements and additions along with local and regional transmission projects. Additionally, the center four-square is the regional perspective (summation) for load growth, generation resource retirements and additions, and transmission additions deemed to have regional impact.

Figure 3: Summary of Member Data Submissions



The NorthernGrid regional transmission planning area spans the Pacific Northwest and Intermountain states with two geographic areas. This area contains 973,582 square miles and 51,656 miles of transmission lines. These areas have different peak load characteristics as detailed in the loads section later in the Study Scope. For the purposes of the regional transmission plan data analysis and study case development, the NorthernGrid MPC divided the study area into the Pacific Northwest (NG-PNW) and Intermountain states (NG-IM) areas as shown by the two shaded areas in Figure 4.

Figure 4: NorthernGrid Existing Transmission System with Pacific Northwest and Intermountain West Sub-Areas



Resource Additions and Retirements Summary

The 13,253 MW of generation resource additions are forecasted during the planning horizon with 9,985 MW in the NG-IM and 3,405 MW in the NG-PNW. There are also 6,000 MW of generation resources retirements planned, with most occurring in the NG-IM area.

Projected Transmission Summary

There are four regional transmission projects identified in the data submissions. They are the Antelope to Goshen, Boardman to Hemingway, Gateway South, and Gateway West.

2.1.2. Local Transmission Plans Summary

The NorthernGrid members have projected the need for 53 new and upgraded transmission system projects in the local transmission planning processes. Most of these projects support local load service and reliability. Based on the geographic diversity and short length of these projects, the MPC’s initial review did not identify many opportunities for regional collaboration on these projects.

Please see the appendix for a detailed data table of all the projected transmission projects submitted by NorthernGrid members.

2.1.3. Loads Summary

The 2030 NorthernGrid member load peak is forecast to reach 44,225 MW and 43,646 MW winter and summer, respectively. The NG-PNW area peaks in the winter at 32,014 MW and the NG-IM area peaks in the summer at 16,083 MW. Table 1 summarizes the Member peak loads months within the four seasons.

Data Table 1: Member Peak Load Months for All Seasons

Season	Winter	Spring		Summer		Fall	
Month	January	March	May	July	August	September	November
NG-PNW	31,960	28,332	24,729	27,300	27,604	24,553	29,455
NG-IM	12,306	10,972	11,915	16,083	15,505	13,339	11,406
NG Total	44,266	39,304	36,645	43,383	43,109	37,892	40,860

Key Findings:

- During the winter season, both NG-PNW and NG-IM have a peak in January, with gray shading.
- The spring, summer and fall have differing months when the peak load occurs for the two sub-areas, with gray shading. The winter, spring and fall peak is driven by the dominant NG-PNW cold weather load. Conversely, the summer season NorthernGrid peak load occurs along with the high NG-IM irrigation and air conditioning load.
- Modeling the winter peak and summer peaks will provide the NorthernGrid Members the ability to analyze their peak loading conditions.
- The spring and fall loading conditions between the two areas differ significantly with the NG-PNW having larger variation due to early and late cold winter weather conditions.

NG-PNW load is consistently greater than twice the Inter-Mountain load. Figure 5 and Figure 6 graphically illustrate by BA the annual winter and annual summer peak load and peak load growth between 2024-2030. Additional NorthernGrid region winter and summer peak load is geographically represented in substation load bus heat maps in Figures A1 and A2 in Appendix A.

Figure 5: Annual Winter Load Growth

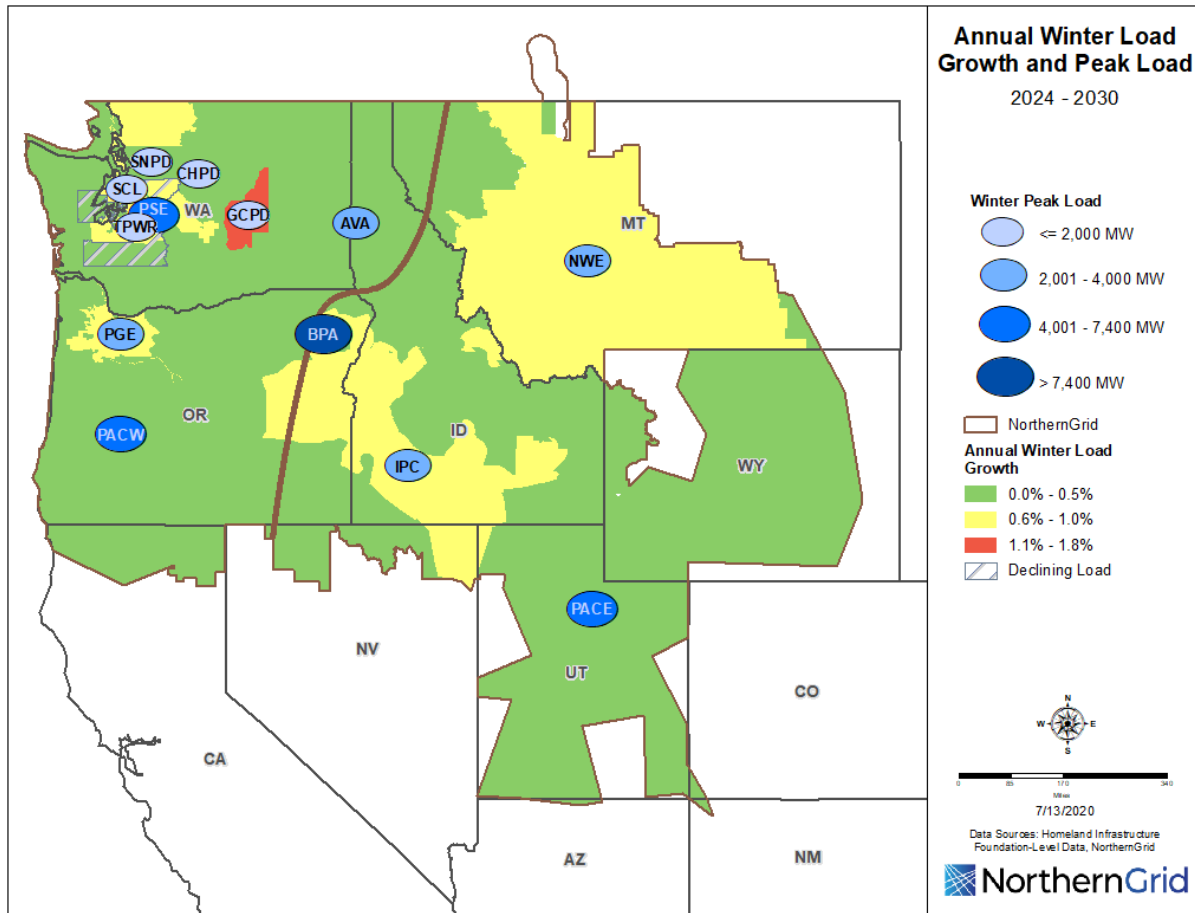
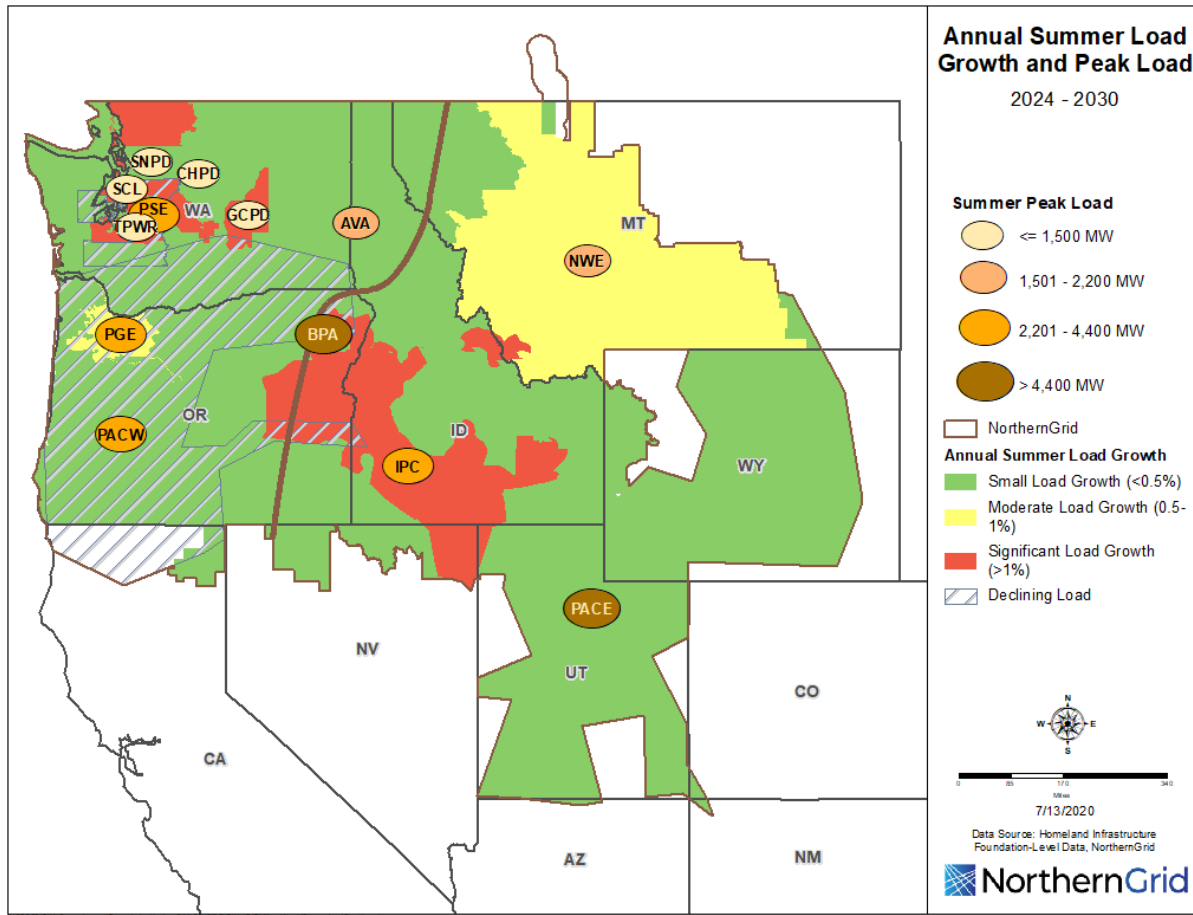


Figure 6: Annual Summer Load Growth



A majority of the NorthernGrid area is forecasted to have minimal peak load growth. Moderate winter and summer peak loads are predicted by PGE. However, the Puget Sound area outside of the major population centers of Seattle and Tacoma anticipate moderate winter and high summer load growth driven by increased air conditioning installations. GCPD projects high growth through all seasons due to data centers. Similarly, NWE forecasts moderate peak load growth in both winter and summer. Finally, IPC is expecting moderate winter and high summer peak load growth as its population continues to expand.

Key Findings:

- There is an average of 0.4 to 0.5 percent peak load growth for the entire NorthernGrid membership.
- GCPD is the only member expecting some significant growth at 1.6 up to 1.8 percent from 2024-2030
- A few NorthernGrid members are at 0.65 to 0.7 percent growth while the others have forecasted low load growth.
- PACW has noted declining load growth for 2024 out to 2030.

Please see the appendix for a detailed data table with information about each member's annual winter and summer peak load growth forecasts.

Existing and planned demand response resources summary

The demand response for the period is forecasted to remain the same with IPC providing 390 MW and PACE 450 MW. PacifiCorp has an additional 504 MW of interruptible demand and TPWR has 64 MW.

2.1.4. Resources Summary 2020-2030

As stated in the introduction of the Study Scope, there are 13.25 GW of resources being developed within the NorthernGrid region. About 11.6 GW are planned by PacifiCorp along with nearly 1.5 GW of batteries. More than 75 percent of resource development is forecast for the NG-IM area.

The resource additions reflected on the following map and in Appendix A Table A2 are preliminary in nature, representative only and are subject to change. Each future resource location modeling is based on current preliminary information that is subject to change. All future resources are based on member resource planning processes. The Enrolled Parties determine resource additions through an Integrated Resource Planning (IRP) process under state mandate. Many of the resource additions presented are based on the existing IRP preferred portfolio which may change during subsequent biennial planning cycles. IRP resource additions are subject to procurement request for proposals which may change the final resource location and in-service date.

Figure 7a represents forecasted generation resource additions by county location and fuel type and figure 7b shows generation resource additions year-over-year between 2020-2030.

Figure 7a: Resource Additions 2020-2030

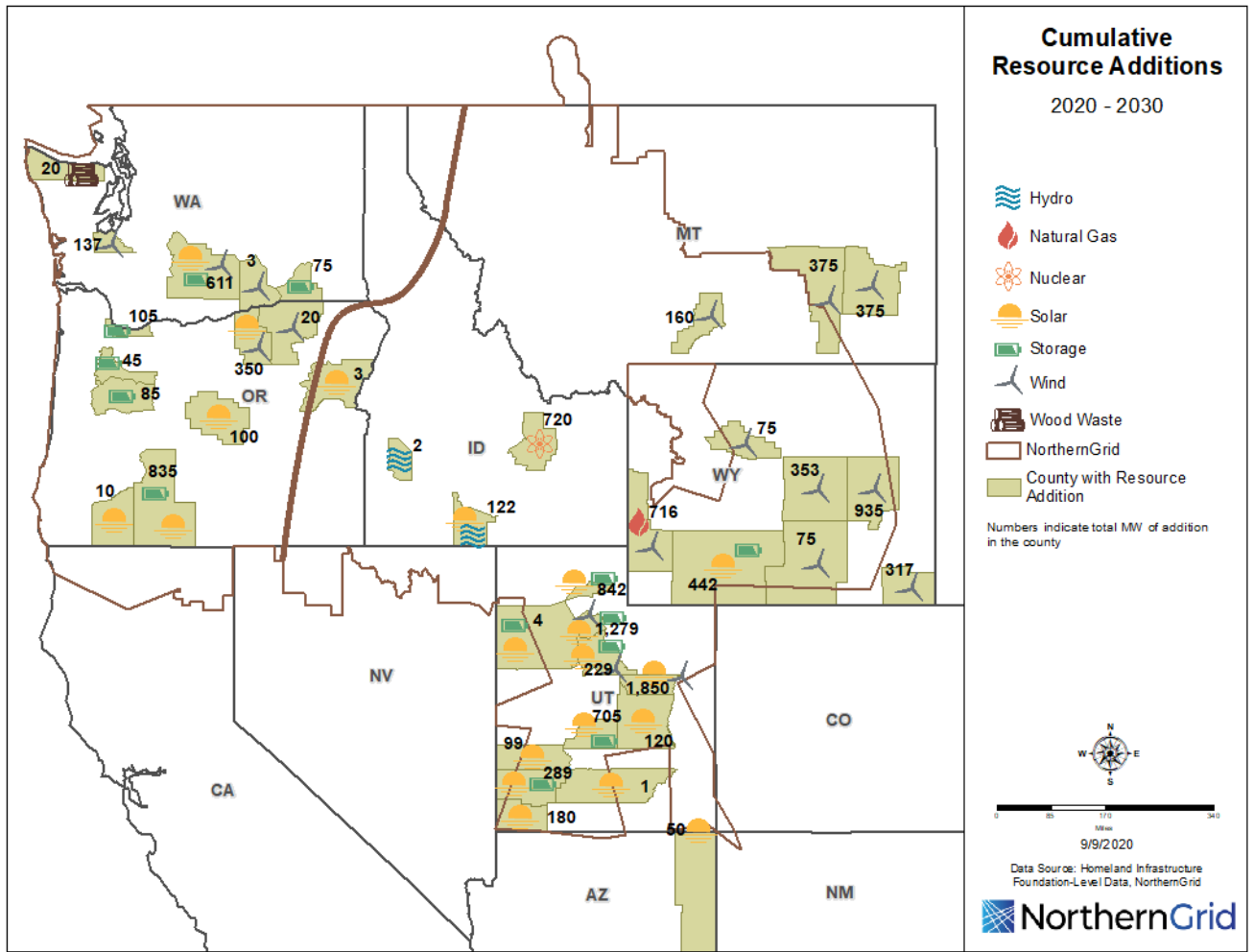
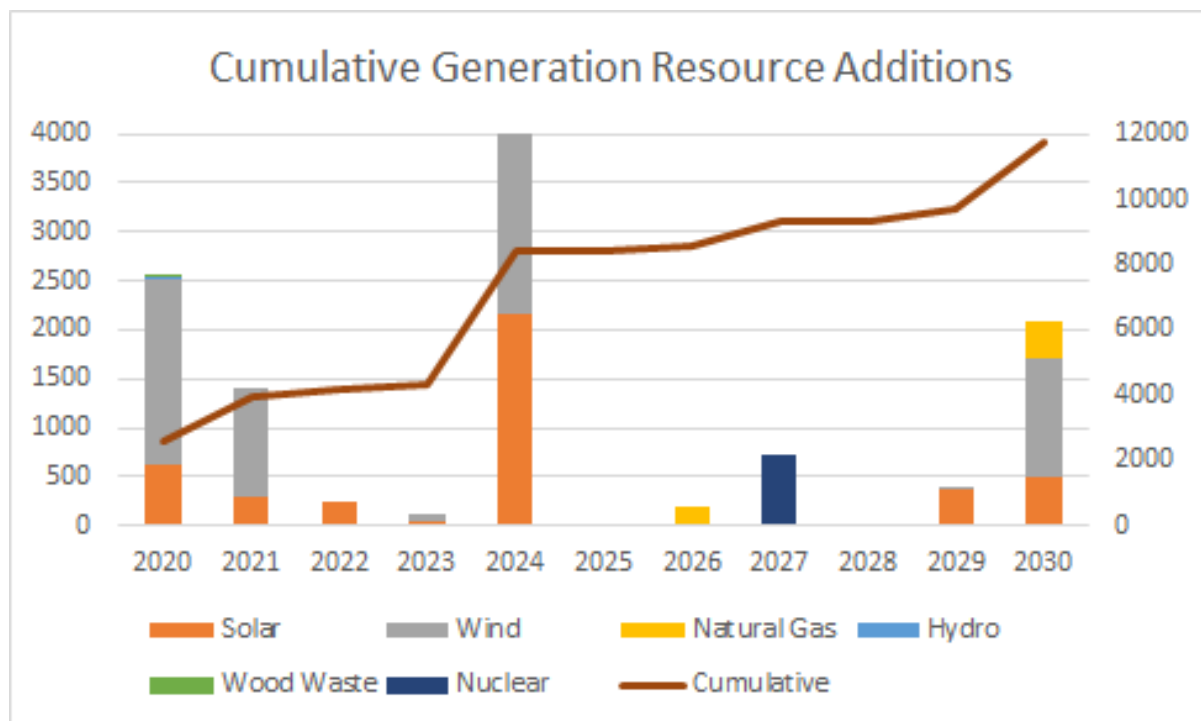


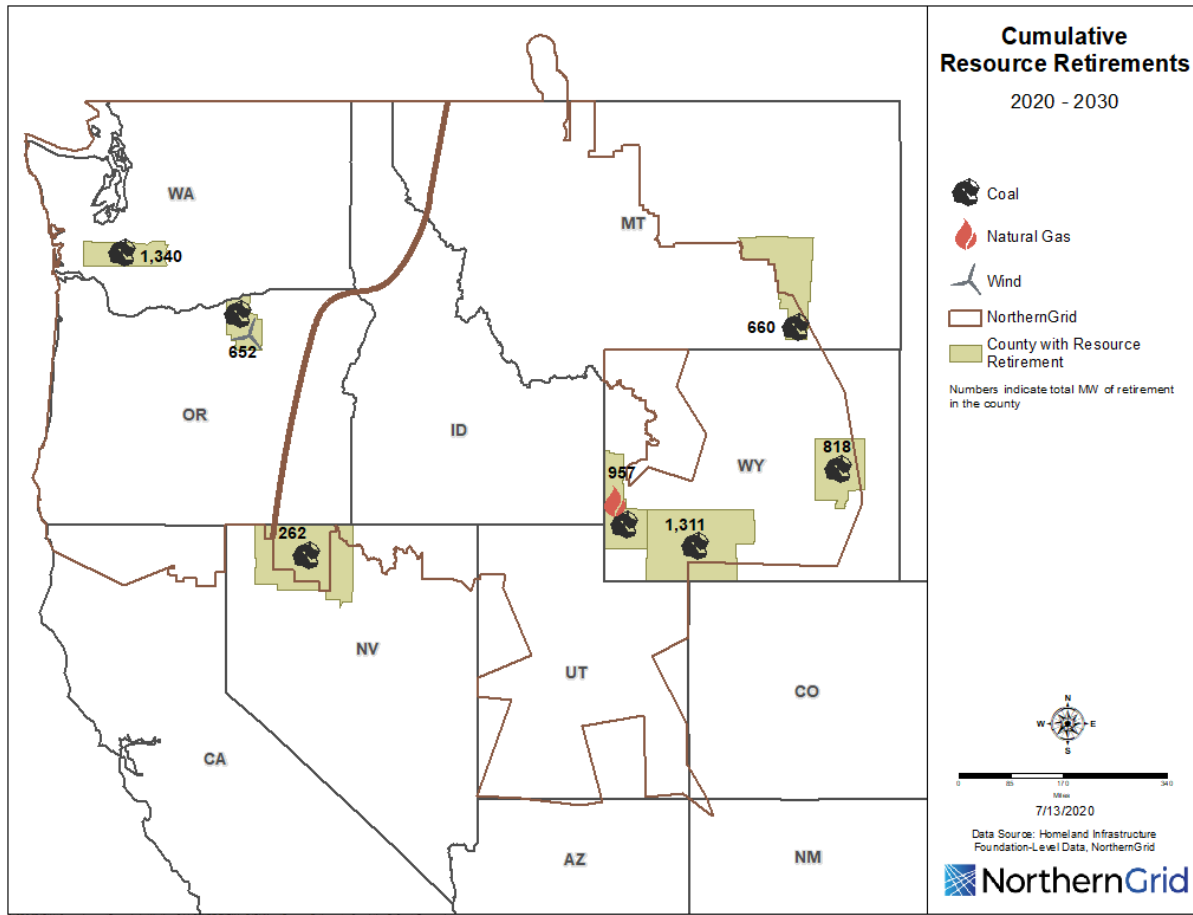
Figure 7b: Resource Additions by Fuel Type Year-Over-Year Between 2020 – 2030 and Cumulative



The Montana and Wyoming wind models typically simulate high output during the hours when the NorthernGrid members experience their daily system peak conditions. Similarly, simulations for NG-IM solar produce output at fifty percent, or more, of rated output when NorthernGrid member load reaches peak conditions. Additionally, there are forecasts for multiple energy storage project additions.

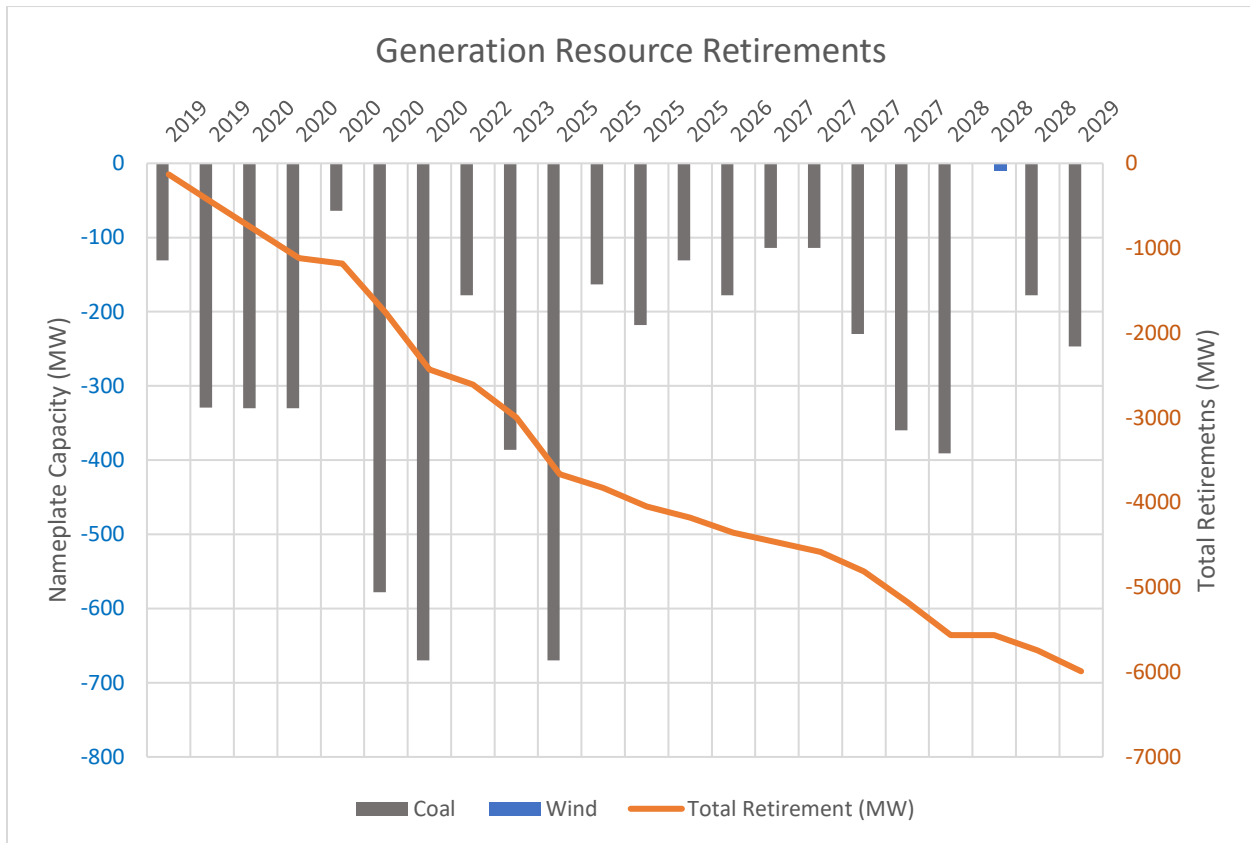
There are 6,000 MW of retirements planned between 2020 - 2030. Figure 8a represents forecasted generation resource retirements by county location and fuel type and figure 8b shows forecasted generation resource retirements year-over-year between 2020-2030. The bars in Figure8b represent a per plant per unit retirement and the line illustrates the cumulative retirements.

Figure 8a: Resource Retirements 2020-2030



Please see the appendix for detailed data tables with information about the proposed resources additions and retirements, fuel type, county locations, and commission year.

Figure 8b: Resource Retirements 2020-2030



Summary of Key Findings Related to Resource Additions and Retirements

- Significant resource additions and retirements planned in the NG-IM area presenting a shift from baseload dispatchable generation resources to variable generation resources.
- Modeling of the capacity output of these resources for reliability needs to consider wind and solar profiles. The Western Electricity Coordinating Council (WECC) Anchor Data Set (ADS) Production Cost Model (PCM), as described in Section 4.1.7, provides annual wind and solar profiles for modeling the variability associated with these generation resource.
- 1550 MW of energy storage was submitted with most projects located with a renewable resource. These energy storage amounts are shown on the Cumulative Resource Additions Map but are separated in the resource summation for they do not generate energy, but only time shift the delivery of energy to the system.

2.1.4 Transmission Service Obligations

Like loads, resources, and public policy, transmission service obligations may drive transmission development. The NorthernGrid members are encouraged to submit all data that is used in the

development of their local transmission plan so that it may be considered during the development of the regional transmission plan. Only one member, IPC, submitted their transmission service reservations as shown in data Table 2.

Data Table 2: Transmission Service Submission

Effective Date	MW	Service Type	POR	POD	Upgrades Required	Additional Info
01/01/26	500	Network	Northwest	IPCO	Yes	IPCO market purchases from the Northwest – summer
01/01/26	200	Network	Northwest	IPCO	Yes	IPCO market purchases from the Northwest – winter
01/01/26	250	Firm	Northwest	BPA SEID	Yes	FCRPS to BPA Southeast Idaho Load - summer
01/02/26	550	Firm	Northwest	BPA SEID	Yes	FCRPS to BPA Southeast Idaho Load - winter

2.1.5. Enrolled Parties Needs

The FERC jurisdictional regional transmission planning tariff requires a summary of enrolled parties data submissions. A summary is provided below based on the requirement of the FERC Order 1000 cost allocation determination of whether proposed projects meet enrolled party needs.

Table 3: Enrolled Parties Data Submission Summary

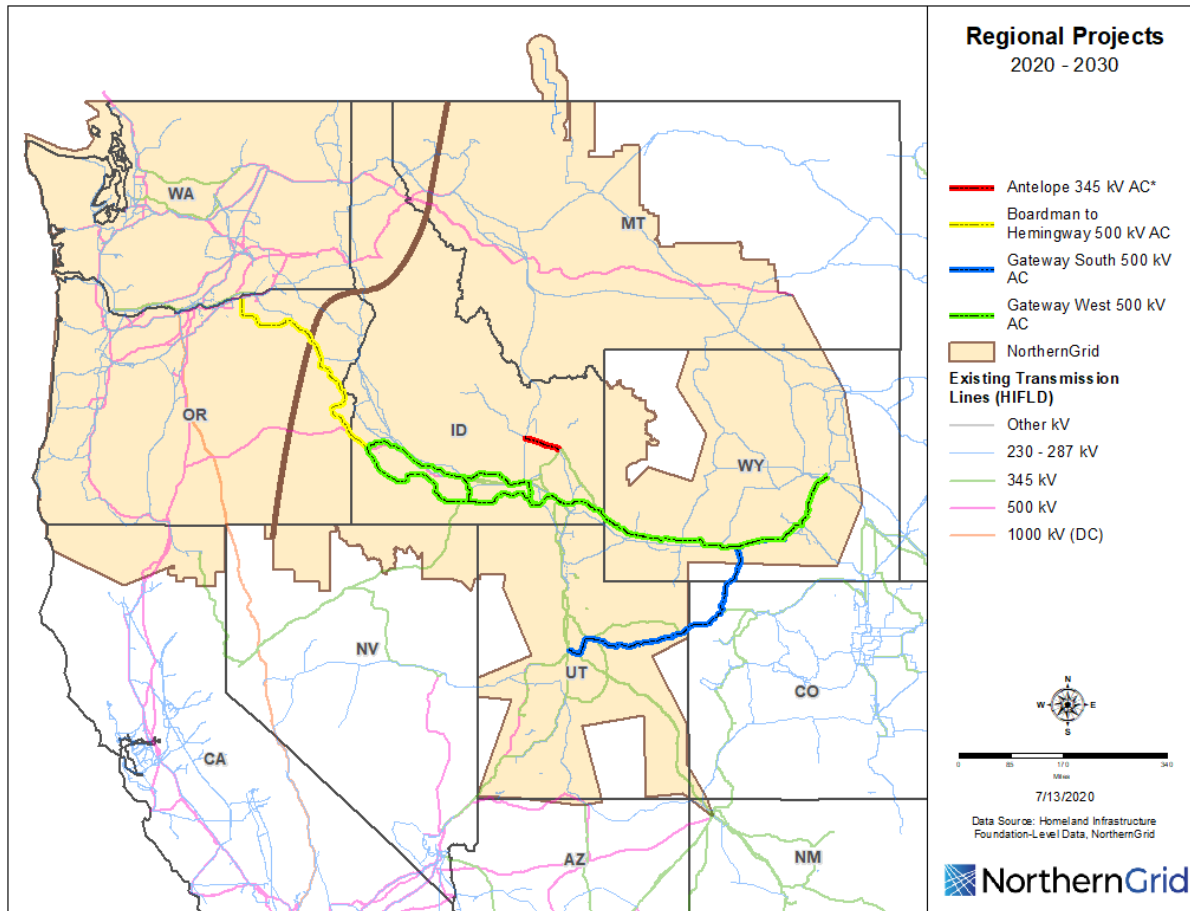
Member	2030 PEAK-LOAD				Generation Resources		Transmission
	Winter	Spring	Summer	Fall	Additions	Retirements	Additions or Upgrades
AVA	2325	2110	2178	2090	0	0	1
IPC	2903	2999	4374	3287	155	860	18
NWMT	2031	1816	2141	1874	990	330	0
PGE	3652	3371	3949	3473	350	578	15
PSE	5047	4363	4151	4915	137	330	4
PACE	7372	7244	9568	7035	8840	1527	6
PACW	4013	3500	3763	3642	2768	1160	0
Enrolled Parties	27343	25401	30124	26316	13030	4157	44
Peak Month	27343	24220	29771	25460			

2.1.6. Member Regional Transmission Projects

1. Antelope to Goshen 345 kV Transmission Line

- The transmission facilities submitted to NorthernGrid for modeling the UAMPS generation addition near Antelope substation are preliminary in nature as detailed technical studies have not been completed. One of the keys assumptions to the single 345 kV line addition between Antelope and Goshen is that UAMPS has indicated that the proposed generation can be tripped for outage of the Antelope – Goshen 345 kV line. As additional facility modeling details for the UAMPS generation addition are available, PacifiCorp will make necessary updates to the NorthernGrid power flow base case model.
- 2. Boardman to Hemingway Transmission Line Project**
 - Boardman to Hemingway 500 kV line, Hemingway to Bowmont and Bowmont to Hubbard 230 kV lines.
 - 3. Gateway South Transmission Project**
 - Aeolus to Clover 500 kV Line.
 - 4. Gateway West Transmission Project**
 - Windstar to Aeolus 230 kV line, Anticline to Jim Bridger, Anticline to Populus, Populus to Borah, Populus to Cedar Hill, Cedar Hill to Hemingway, Cedar Hill to Midpoint 500 kV lines and the existing Borah to Midpoint uprate to 500 kV southwestern Nevada (the Crystal-Eldorado 500 kV AC Project).

Figure 10: Member Regional Transmission Projects



2.1.7. Public Policy Requirements Summary

2.1.7.1. Approach

NorthernGrid evaluated regional transmission needs driven by public policy requirements by first identifying a list of enacted public policies that impact resource and local transmission plans in the NorthernGrid planning region. This data was procured through the NorthernGrid data submission process and polling of members to inquire about enacted policies that are driving their regional transmission needs. NorthernGrid identified enacted public policies in the seven states within the NorthernGrid region.

2.1.7.2. Key Assumptions

- Enacted policies include local, state, and federal policies for the NorthernGrid member service area.
- Analysis focuses on enacted policies that address the type of energy portfolio to be delivered. Focus is on staged policies through 2030.
- Non-enacted policies are not included in the analysis.
- Policies pertaining to energy purchases or corporate goals are not included.

- WECC will provide an initial production cost model, but it is the responsibility of the NorthernGrid members to verify.
- Each member's Integrated Resource Planning process incorporates public policy and the NorthernGrid members evaluate their IRP to determine the data that is submitted.

2.1.7.3. Key Findings

- There are enacted policies in five of the seven states, including the Renewable Portfolio Standards (RPS) that exist in Washington, California, Oregon, Montana, and Utah.
- There are no identified public policy requirements that are driving regional transmission needs in Wyoming and Idaho.

Please see the appendix for a detailed table of all enacted public policies.

2.1.8. Potential Areas of Regional Coordination

Based on the MPC's initial review, there are not many opportunities for regional collaboration because the majority of proposed transmission development supports local load service and reliability.

3. Non-Incumbent Transmission Projects

The NorthernGrid regional planning process allows non-incumbent and merchant transmission developers to submit projects for analysis. Several non-incumbent or merchant transmission projects were received during the submission period. They are further classified into regional and interregional transmission projects based on whether the project terminals are within the region or interconnect between regions, i.e. interregional.

a. Regional Non-Incumbent

1) Cascade Renewable Transmission System

PowerBridge is proposing to construct the Cascade Renewable Transmission System Project. This Project is an 80-mile, 1,100 MW transfer capacity +/- 400 kV HVDC underground cable (95 percent installed underwater) interconnecting with the grid through two +/- 1100 MW AC/DC converter stations interconnecting with the AC grid at Big Eddy and Troutdale substation. There is no proposed generation resource associated with the transmission line.

2) Loco Falls Greenline

Absaroka is proposing a merchant transmission project connecting Great Falls 230 kV substation to the Colstrip 500 kV Transmission System. The project consists of two 230 kV transmission circuits and a new Loco Mountain Substation with 230 to 500 kV transformation. There is no proposed generation resources associated with the transmission line.

b. Interregional Transmission Projects

As illustrated on Figure 11, there are 3 proposed interregional projects. Summaries of each proposed interregional projects are provided below.

1) Cross-Tie Transmission Project

TransCanyon LLC is proposing the Cross-Tie Project, a 1,500 MW, 500 kV single circuit HVAC transmission project that will be constructed between central Utah and east-central Nevada. The project connects PacifiCorp's planned 500-kV Clover substation (in the NorthernGrid planning region) with NV Energy's existing 500 kV Robinson Summit substation (in the WestConnect planning region).

Cross-Tie has proposed 9,891 of total cumulative resource additions as a result of the proposed transmission line. These include wind, solar, and natural gas in the states of Wyoming and Utah. Please see the appendix for a data table of proposed generation associated with the Cross-Tie project. The interregional evaluation plan is located at <https://www.northerngrid.net/resources/cross-tie-itp-evaluation-plan-2020-21>.

2) Southwest Intertie Project North (SWIP)

Great Basin Transmission, LLC ("GBT"), an affiliate of LS Power, submitted the 275-mile northern portion of the Southwest Intertie Project (SWIP) to the California ISO and NorthernGrid. SWIP-North was also submitted into WestConnect's planning process by the Western Energy Connection (WEC), LLC, a subsidiary of LS Power. The SWIP-North Project connects the Midpoint 500 kV substation (in NorthernGrid) to the Robinson Summit 500 kV substation (in WestConnect) with a 500-kV single circuit AC transmission line. The SWIP is expected to have a bi-directional WECC-approved path rating of approximately 2000 MW.

SWIP North has proposed 1,850 MW of new wind generation resources located in Idaho as a result of the transmission line. Please see the appendix for a data table of proposed generation associated with the SWIP North project. The interregional evaluation plan is located at <https://www.northerngrid.net/resources/swip-north-itp-evaluation-plan>.

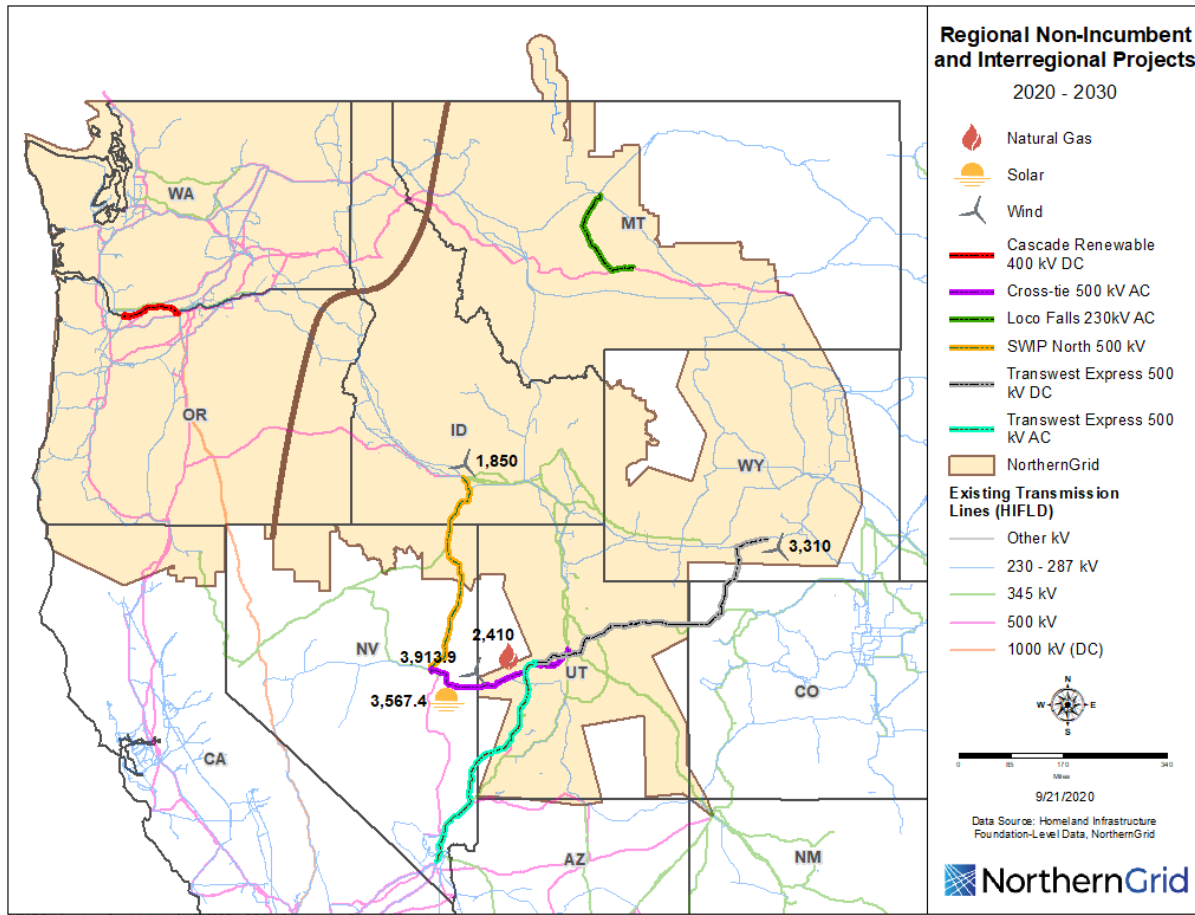
3) TransWest Express

TransWest Express is a 500 kV DC and 500 kV AC transmission project proposed by TransWest. The TransWest Express (TWE) Transmission Project consists of three discrete interconnected transmission segments that, when considered together, will interconnect transmission infrastructure in Wyoming, Utah, and southern Nevada. TransWest has submitted each of the following TWE Project segments as separate ITP submittals:

- A 405-mile, bi-directional 3,000 MW, \pm 500 kV, high voltage direct current (HVDC) transmission system with terminals in south-central Wyoming and central Utah (the WY-IPP DC Project).
- A 278-mile 1,500 MW 500 kV alternating current (AC) transmission line with terminals in central Utah and southeastern Nevada (the IPP-Crystal 500 kV AC Project).
- A 50-mile, 1,680 MW 500 kV AC transmission line with terminals in southeastern Nevada, and southwestern Nevada (the Crystal-Eldorado 500 kV AC Project).

Transwest Express has proposed 3,310 MW of wind generation as a result of the transmission line. Please see the appendix for a data table of proposed generation associated with the transmission project. The interregional evaluation plan is located at <https://www.northerngrid.net/resources/transwest-express-itp-evaluation-plan>.

Figure 11: Regional Non-Incumbent and Interregional Transmission Projects



4. Case Analysis

4.1.1. Methodology and Assumptions Overview

This methodology defines the analysis objectives, conditions (NorthernGrid transmission system path stressing, power flow direction, imports/exports) necessary to assess the ability of the transmission system to support the 2030 loads and resource, types of analysis, performance criteria, paths to monitor, case checking and tuning (reactive devices, phase shifting transformers) and contingencies. Note, this process is designed to meet Order 890 and 1000 planning requirements and is not intended to evaluate market efficiencies.

4.1.2. Analysis Objectives

Develop the NorthernGrid Regional Transmission Plan by assessing the existing system and committed projects along with combinations of planned and proposed transmission and resource changes for their ability to reliably serve the variations in 2030 loads and resource generation dispatch conditions.

4.1.3. Conditions to Represent

As stated above the NorthernGrid region experiences peak loading conditions during the winter and summer. Therefore, a heavy winter and heavy summer condition will be represented. Additionally, high transmission transfers can occur during the shoulder months. The WECC ADS-PCM will simulate the 2030 transmission power flows for all hours. The NorthernGrid MPC will evaluate flows on the path listed in Appendix B Table B1 and select hours reflecting appropriate NorthernGrid transmission system stressing conditions.

4.1.4. Production Cost Model Cases Summary

The production cost model (PCM) is one of the components of the 2030 WECC Anchor Data Set (ADS). The WECC ADS-PCM reflects a ten-year load, resource and transmission topology forecast based on the 2020 load and resource forecast submitted by WECC balancing authority areas. PCM software simulates the hourly loads and calculates an economic dispatch based on the assumed hourly thermal generation heat rates, hydrologic generation conditions, solar generation profiles, and wind generation profiles for each generating facility.

4.1.5. Cases Exported from the Production Cost Model

A volunteer team of MPC planning engineers, the Technical Group, was formed to proposed NorthernGrid regional conditions be analyzed. They proposed the following conditions:

- Peak load
 - NorthernGrid region winter and summer
- High generation
 - Wyoming wind
 - NorthernGrid region Hydroelectric
- High transmission power flow
 - Idaho to Northwest path west to east
 - Borah West path east to west
 - California Oregon Border (COI) path south to north
 - COI and Pacific DC Intertie (PDCI) paths
 - West of Cascades paths east to west

Upon inspection of the PCM hourly data, they identified that the high hydroelectric generation condition occurred with high north to south COI and PDCI transmission flows. The group recommend and the MPC approved the PCM hours shown in Table 4.

Table 4: PCM Export Hours

Condition	Date	Hour Ending
NorthernGrid region summer peak load	July 30	16:00
NorthernGrid region winter peak load	December 10	19:00
High Wyoming Wind	February 1	1:00

High Idaho to Northwest path west to east	July 20	17:00
High Borah West path east to west	September 29	1:00
High COI path south to north	March 10	15:00
High West of Cascades paths east to west	April 3	11:00
High COI and Pacific DC Intertie (PDCI) paths with high hydroelectric generation	June 4	18:00

4.1.6. Case Checking and Tuning

The power flow cases will be checked and tuned based on the case checking Table B2 found in Appendix B.

4.1.7. Types of Analysis

- PCM analysis to produce load and generation dispatch patterns for power flow cases.
- Power flow analysis will be performed consistent with NERC Planning Reliability Standard TPL-001 sections applicable to the long-term planning horizon.
- Voltage stability consistent with WECC criteria and transient stability only on the final plan and only for conditions identified in power flow analysis as requiring further study.
- Short circuit and geomagnetic disturbance analysis will not be conducted.

4.1.7.1. Performance Criteria

The power flow simulations will be monitored for compliance with the North American Electric Reliability Corporation (NERC) Reliability Standard TPL-001-4 and WECC Criterion TPL-001-WECC-CRT-3.2. The reliability standard requires transmission facilities to operate within normal and emergency limits. Then the criterion further defines the default base planning criteria for steady-state, post-contingency, dip, and recovery voltage along with oscillation dampening. The WECC criterion also allows for transmission planners to apply a more or less stringent criterion for their own system provided they gain agreement or allowance, respectively as described in the criterion. Additional NorthernGrid Member voltage criterion are listed in Table C2 Appendix C.

4.1.7.2. Contingencies Included

The NorthernGrid regional study focus is to evaluate alternative regional projects for the selection of the NorthernGrid Regional Plan. As such, the contingencies selected need to be relevant to the transmission configurations under evaluation. Therefore, it is prudent to select the contingencies after the study scope is developed and the scenarios selected. The general guideline for contingency analysis is as follows:

- Facilities 230 kV and above that have regional impact. However, this should not limit members or project sponsors from requesting contingency analysis of facilities less than 230 kV if they believe the lower voltage contingency may have a regional impact.
- The category of contingencies analyzed will generally be P1 and P2 if they are critical for evaluating alternatives. The P4 and P5 category contingencies will be included for 300 kV and above. A limited set of P4, P5, and P7 category contingencies that allow interruption of firm transmission service and loss of non-consequential load may be included if a majority of the MPC agree. Additionally, a limited set of P3 and P6, where the requesting entity defines the system adjustments, may be included if a majority of the MPC agree.
- The contingencies submitted should be aux file format that are linked to the selected base case.
- Voltage stability and transient stability contingencies should be selected after the steady state contingency simulations are completed and after discussions and decisions of the need for such analysis. If there is a need to perform stability studies, invitations should go out to members to submit the contingencies with associated Remedial Action Schemes if needed.

4.1.8. Evaluation of Regional Transmission Project Combinations

To determine whether transmission needs within the NorthernGrid may be satisfied by regional and/or interregional transmission projects, NorthernGrid evaluates the proposed regional and interregional transmission projects independently and in regional combinations. The regional combinations are determined by the MPC based on their knowledge of the NorthernGrid Region. The regional combinations are shown in Table C1 in Appendix C.

5. Impacts on Neighboring Regions

As stated above, the power flow cases represent the entire western interconnection. Therefore, during the power flow analysis NorthernGrid will monitor for NERC standard and WECC criterion violations occurring in the neighboring regions. Upon identification of a violation in a neighboring region, NorthernGrid will coordinate with the region to confirm validity and whether the violation is due to an existing condition. Mitigation plans for a violation will be determined in accordance with the NorthernGrid Member tariffs and planning agreement.

6. Cost Allocation

A. Introduction

Regional project cost allocation is one of the FERC Order 1000 transmission planning reforms. The NorthernGrid FERC jurisdictional entities, the Enrolled Parties, describe the requirements for a project in their OATT Attachment K. The process begins with the sponsor/developer becoming qualified. The following developers submitted information and were determined to be qualified.

B. Qualified Developers

TransCanyon LLC and Great Basin Transmission, LLC were pre-qualified by NTTG during 2019 for the 2020-21 Regional Transmission Planning cycle. The NorthernGrid Enrolled Parties proposed and

FERC accepted that their qualification status be accepted by NorthernGrid during this planning cycle. PowerBridge submitted developer qualification information which was reviewed by the CATF resulting in the approval of PowerBridge as a Qualified Developer for this planning cycle.

C. Benefits and Beneficiary Analysis

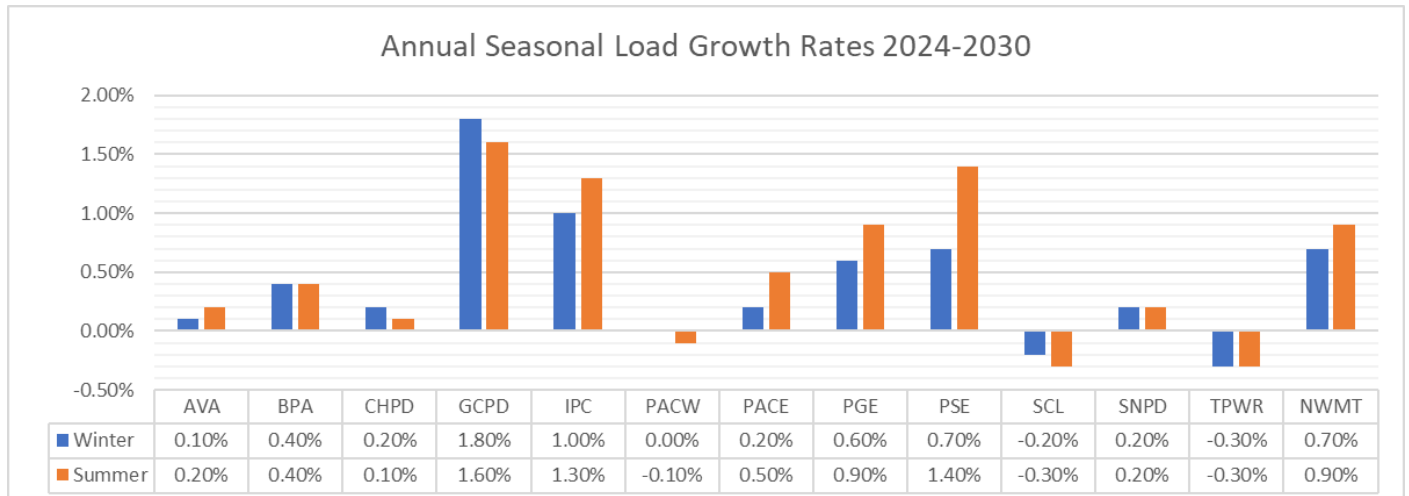
If the sponsored project is selected into the plan as meeting enrolled party or parties need, the project benefits and beneficiaries will be determined. The cost allocation metrics and analysis process is described in each Enrolled Party's OATT Attachment K – Regional Planning Process.

Appendix A

Data Tables

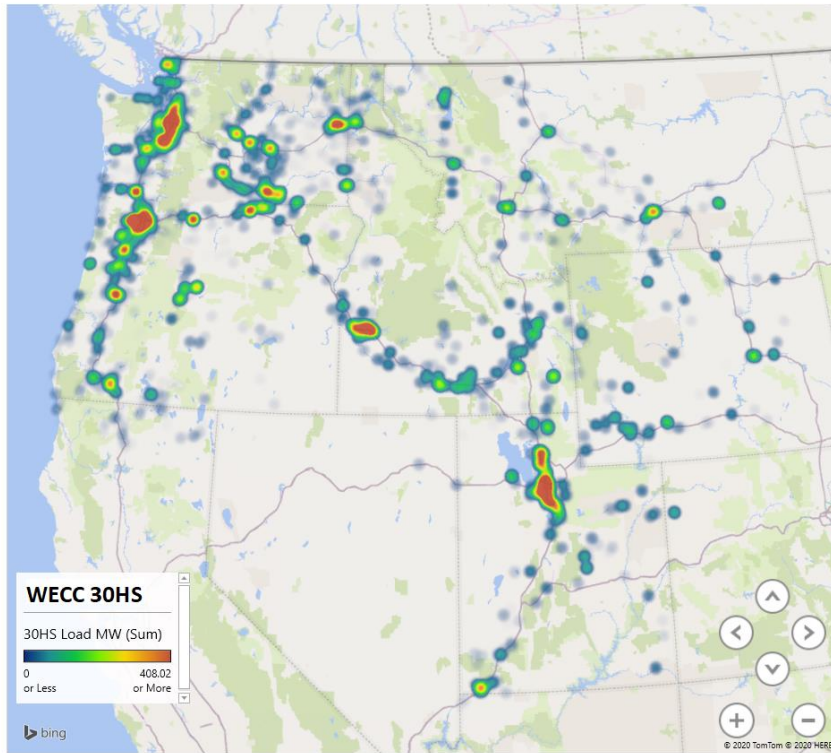
Data Table A1: Annual Winter and Summer Load Growth Values 2024-2030

Member	Winter (Percent)	Summer (Percent)
AVA	0.10	0.20
BPA	0.40	0.40
CHPD	0.20	0.10
GCPD	1.80	1.60
IPC	1.00	1.30
PACW	0.00	-0.10
PACE	0.20	0.50
PGE	0.60	0.90
PSE	0.70	1.40
SCL	-0.20	-0.30
SNPD	0.20	0.20
TPWR	-0.30	-0.30
NWMT	0.70	0.90

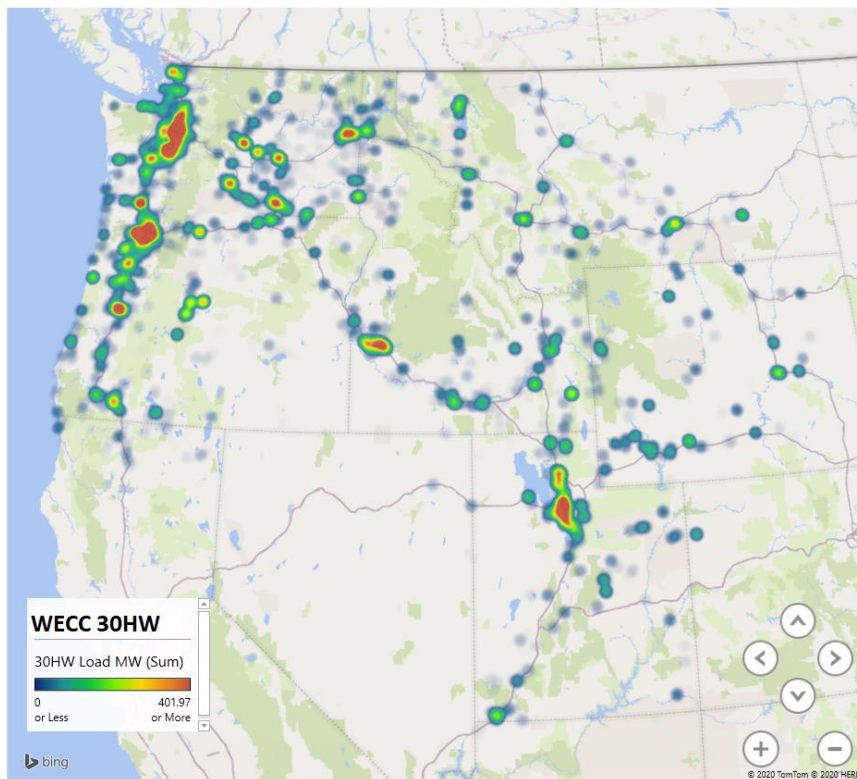


The below maps indicate 2030 summer and winter load distribution in the NorthernGrid Footprint and the colors illustrate high and low load levels.

NorthernGrid footprint – Summer 2030 Loads



NorthernGrid footprint – Winter 2030 Loads



The generation resource additions reflected in Table A2 are preliminary in nature, representative only and are subject to change. Each future resource location modeling is based on current preliminary information that is subject to change. All future resources are based on member resource planning processes. The Enrolled Parties determine resource additions through an IRP process under state mandate. Many of the resource additions presented are based on the existing IRP preferred portfolio which may change during subsequent biennial planning cycles. IRP resource additions are subject to procurement request for proposals which may change the final resource location and in-service date. The values shown are nameplate capacity totals for each resource type by year.

Data Table A2: Cumulative Resource Additions by County

County	State	Year	Projects	Solar	Wind	Natural Gas	Hydro	Wood Waste	Nuclear	Storage
Ada	ID	2020	1	0	0	0	2	0	0	0
Apache	AZ	2022	1	50	0	0	0	0	0	0
Baker	OR	2022	1	3	0	0	0	0	0	0
Beaver	UT	2020	1	99	0	0	0	0	0	0
Benton	WA	2020	1	0	3	0	0	0	0	0
Carbon	UT	2020	3	0	750	0	0	0	0	0
Carbon	UT	2021	1	80	0	0	0	0	0	0
Carbon	UT	2024	4	0	1095	0	0	0	0	0
Clallam	WA	2020	1	0	0	0	0	20	0	0
Converse	WY	2020	3	0	533	0	0	0	0	0
Converse	WY	2021	1	0	201	0	0	0	0	0
Converse	WY	2030	1	0	121	0	0	0	0	0
Converse	WY	2024	1	0	80	0	0	0	0	0
Crook	OR	2020	2	100	0	0	0	0	0	0
Emery	UT	2023	1	20	0	0	0	0	0	0
Emery	UT	2020	1	100	0	0	0	0	0	0
Garfield	UT	2020	1	1	0	0	0	0	0	0
Hot Springs	WY	2024	1	0	75	0	0	0	0	0
Iron	UT	2024	2	231	0	0	0	0	0	58
Jackson	OR	2020	1	10	0	0	0	0	0	0
Klamath	OR	2024	2	500	0	0	0	0	0	335
Laramie	WY	2024	2	0	317	0	0	0	0	0
Lincoln	WY	2020	1	0	161	0	0	0	0	0
Lincoln	WY	2026	1	0	0	185	0	0	0	0
Lincoln	WY	2026	1	0	0	370	0	0	0	0
Linn	OR	2028	1	0	0	0	0	0	0	85
Marion	OR	2029	1	0	0	0	0	0	0	45

Morrow	OR	2020	1	0	300	0	0	0	0	0
Morrow	OR	2021	1	50	0	0	0	0	0	0
Multnomah	OR	2029	1	0	0	0	0	0	0	105
Natrona	WY	2024	2	0	353	0	0	0	0	0
Rosebud and Custer	MT	2021	1	0	750	0	0	0	0	0
Salt Lake	UT	2021	2	159	0	0	0	0	0	40
Salt Lake	UT	2030	1	0	1040	0	0	0	0	0
Salt Lake	UT	3031	1	0	0	0	0	0	0	40
Savier	UT	2020	1	80	0	0	0	0	0	0
Savier	UT	2030	2	500	0	0	0	0	0	125
Stillwater	MT	2021	1		80	0	0	0	0	80
Stillwater	MT	2021	1		80	0	0	0	0	80
Sweetwater	WY	2024	2	354	0	0	0	0	0	88.5
Thurston	WA	2020	1	0	136.8	0	0	0	0	0
Tooele	UT	2023	2	3	0	0	0	0	0	1
Twin Falls	ID	2020	1	0	0	0	2	0	0	0
Twin Falls	ID	2022	1	120	0	0	0	0	0	0
Umatilla	OR	2020	2	0	20	0	0	0	0	0
Utah	UT	2020	1	50	0	0	0	0	0	0
Utah	UT	2022	2	64	0	0	0	0	0	16
Utah	UT	2023	2	30	69	0	0	0	0	0
Benton	ID	2027	1	0	0	0	0	0	720	0
Walla Walla	WA	2029	1	0	0	0	0	0	0	75
Washington	UT	2020	2	180	0	0	0	0	0	0
Weber	UT	2024	2	674	0	0	0	0	0	168
Yakima	WA	2024	2	395.2	0	0	0	0	0	98.8
Yakima	WA	2028	1	0	0	0	0	0	0	105
Yakima	WA	2029	2	0	9.8	0	0	0	0	2.45

Data Table A3: Cumulative Resource Retirements by County

Power Plant	Unit	Retirement Year	Capacity	Notes
Valmy (IPC Share)	1	2019	131	Year end
Naughton	3	2019	329	Natural Gas Repower
Colstrip (PSE share)	1	2020	115	January 2 nd
Colstrip (NWMT – Talon share)	1	2020	115	January 2 nd
Colstrip (PSE Share)	2	2020	115	January 3 rd
Colstrip (NWMT - Talon share)	2	2020	115	January 3 rd
Boardman (IPC Share)	1	2020	64	Year end
Boardman	1	2020	578	Year end
Centralia	1	2020	670	Year end
Jim Bridger (IPC Share)	1	2022	178	Year end
Jim Bridger (PAC Share)	1	2023	386	Year end
Centralia	2	2025	670	Year end
Naughton	1	2025	163	Year end
Naughton	2	2025	218	Year end
Valmy (IPC Share)	2	2025	131	Year end
Jim Bridger (IPC Share)	2	2026	178	Year end
Dave Johnston	1	2027	114	Year end
Dave Johnston	2	2027	114	Year end
Dave Johnston	3	2027	230	Year end
Dave Johnston	4	2027	360	Year end
Jim Bridger (PAC Share)	2	2028	391	Year end
Orem Family Wind, LLC	all	2028	10	
Bridger (IPC Share)	3	2028	178	Year end
Naughton	3	2029	247	Natural Gas
Total Retirements 2020 to 2030			6000	

Data Table A4: Enacted Public Policies

Enacted Public Policy	Bill History	Description
Washington Clean Energy Transformation Act (CETA)	Initiative Measure 937 (2006) SB 5400 (2013) SB 5116 (2019)	<p>CETA requires the state's electric utilities to fully transition to clean, renewable and non-emitting resources by 2045. The act sets the following mandatory targets:</p> <ul style="list-style-type: none"> • 2025 – All electric utilities must eliminate coal-fired generation serving Washington state customers. • 2030 – All electric utilities must be greenhouse gas neutral—for example, remaining carbon emissions are offset by renewable energy, energy efficiency, carbon reduction project investments, or payments funding low-income assistance. • 2045 – All electric utilities must generate 100 percent of their power from renewable or zero-carbon resources. <p>RPS Targets:</p> <ul style="list-style-type: none"> • 3 percent by January 1, 2012 • 9 percent by January 1, 2016 • 15 percent by January 1, 2020 and beyond <p>*Annual targets are based on the average of the utility's loads for the previous two years</p>
Montana RPS	SB 415 (2005) – “Montana Renewable Power Production and Rural Economic Development Act” SB 325 (2013) SB 45 (2013)	<p>Montana's renewable portfolio standard (RPS), enacted in April 2005 as part of the Montana Renewable Power Production and Rural Economic Development Act, requires public utilities and competitive electricity suppliers serving 50 or more customers to obtain a percentage of their retail electricity sales from eligible renewable resources according to the following schedule:</p> <ul style="list-style-type: none"> • 5 percent for compliance years 2008-2009 • 10 percent for compliance years 2010-2014

		<ul style="list-style-type: none"> 15 percent for compliance year 2015 and for each year thereafter <p>Two bills in 2013 expanded the RPS to include additional types of projects. SB 325 allows wood pieces that have been treated with chemical preservatives, and that are used at a facility that has a nameplate capacity of 5 MW or less, to qualify. SB 45 allows expansions to existing hydroelectric projects that result in increased generation capacity to qualify.</p> <p>Public utilities of Montana shall proportionately allocate the purchase of both the renewable energy credits and the electricity output from community renewable energy projects that total at least 75 megawatts in nameplate capacity for any given compliance year based on the public utility's previous year's sales of electrical energy to retail customers in Montana.</p>
California RPS	SB 1078 (2002) Assembly Bill 200 (2005) SB 107 (2006) SB 2 First Extraordinary Session (2011) SB 350 (2015) SB 100 (2018)	California's RPS Program Interim Targets: <ul style="list-style-type: none"> 20 percent by December 31, 2013 25 percent by December 31, 2016 33 percent by December 31, 2020 44 percent by December 31, 2024 52 percent by December 31, 2027 60 percent by December 31, 2030 and beyond Planning target of 100 percent renewable and carbon-free by 2045 <p>*Based on the retail load for a three-year compliance period</p>
Oregon RPS	SB 838 (2007) BH 3039 (2009) HB 1547-B (2016)	<p>On March 8, 2016, Governor Kate Brown signed Senate Bill 1547-B (SB 1547-B), the Clean Electricity and Coal Transition Plan, into law. The bill extends and expands the Oregon RPS requirement to 50 percent of electricity from renewable resources by 2040 and requires that coal-fired resources are eliminated from Oregon's allocation of electricity by January 1, 2030.</p> <p>The increase in the RPS requirements is staged:</p> <ul style="list-style-type: none"> 5 percent by December 31, 2011 15 percent by December 31, 2015 20 percent by December 31, 2020 27 percent by December 31, 2025 35 percent by December 31, 2030

		<ul style="list-style-type: none"> 45 percent by December 31, 2035 50 percent by December 31, 2040 *Based on the retail load for that year.
Utah RPS	SB 202 (2008)	Goal of 20 percent by 2025 (must be cost effective) *Annual targets are based on the adjusted retail sales for the calendar year 36 months before the target year.
Idaho	N/A	No applicable enacted policies
Wyoming	N/A	No applicable enacted policies

Data Table A5: NorthernGrid Member Projected Transmission

Company	Project Name	Voltage (kV)	Expected In-Service Year	Status	Primary Driver
AVA	Saddle Mountain Substation	230/115	2021	Under Construction	Reliability & Capacity
BPA	St. Clair - South Tacoma 230 kV Line Upgrade	230	2022	replacement in 2022	Firm transmission service to replace Centralia unit 1 power
BPA	Monroe-Novelty 230 kV Line Upgrade	230	2022	Planned	This project improves reliability for the Puget Sound load area.
SnoPUD	Swamp Creek Switching Station	115	2020	Unknown	Capacity Need
SnoPUD	Stanwood-Camano Projects	115	2023	Unknown	Load Service Project
SnoPUD	Sky Valley - Maltby Line	115	2025	Unknown	Load Service Project
SnoPUD	Getchell Switching Station	115	2024	Unknown	Capacity Need
SnoPUD	Port of Everett Switching Station	115	2025	Unknown	Operational Flexibility/Distribution Capacity
SnoPUD	Beverly to Boeing	115	2025	Unknown	Capacity Need
IPCO	Boardman-Hemingway (B2H) Project	500	2026	Conceptual	Load Service and TSR Obligations
IPCO	Hemingway-Bowmont	230	2026	Conceptual	B2H Integration
IPCO	Bowmont-Hubbard	230	2026	Conceptual	B2H Integration
IPCO	Midpoint to Hemingway #2	500	2024	Conceptual	Congestion, Reliability
IPCO	Cedar Hill to Hemingway	500	2024	Conceptual	Congestion, Reliability

IPCO	Cedar Hill to Midpoint	500	2024	Conceptual	Congestion, Reliability
IPCO	Midpoint to Borah	500	2024	Conceptual	Congestion, Reliability
IPCO	Borah – Kinport	345	2024	Conceptual	Congestion, Reliability
IPCO	Borah - Populus	500	2024	Conceptual	Congestion, Reliability
IPCO	Populus – Cedar Hill	500	2024	Conceptual	Congestion, Reliability
IPCO	Willis-Lansing	138	2019	Completed	Load Service and TSR Obligations
IPCO	Boise Bench - Cloverdale	230	2020	Under Construction	B2H Integration
IPCO	Cloverdale-Locust	230	2020	Under Construction	B2H Integration
IPCO	Beacon Light 138kV	138	2020	Under Construction	Congestion, Reliability
IPCO	Can Ada – Blackcat	138	2020	Under Construction	Congestion, Reliability
IPCO	Cloverdale-Hubbard	230	2021	Planned	Congestion, Reliability
IPCO	Wood River-Ketchum Transmission	138	2021	Delayed - Siting Challenges	Congestion, Reliability
IPCO	Orchard	138	2022	Planned	Congestion, Reliability
PACE	Segment D.1 - Windstar to Aeolus	230	2023	Planned	Transmission service request queues, increased system reliability and integrating resources development.
PACE	Segment D.2 - Aeolus to Bridger/Anticline	500	2020	Planned	Transmission service request queues, increased system reliability and integrating resources development.
PACE	Segment D.3 - Bridger/Anticline to Populus	500	2024	Planned	Transmission service request queues, increased system reliability and integrating resources development.
PACE	Segment E –Populus to Midpoint	500	2024	Planned	Transmission service request queues, increased system reliability and integrating resources development.
PACE	Segment E.2 - Midpoint/Cedar Hill to Hemingway	500	2024	Planned	Transmission service request queues, increased system reliability and integrating resources development.

PACE	Gateway South Transmission Project Segment F - Aeolus-Mona	500	2023	Planned	Delivery of network resources to network load. Load growth requirements.
PGE	Blue Lake Phase II	230	2020	Under Construction	Reliability
PGE	Brookwood Substation	115	2021	Planned	Reliability
PGE	Butler Substation	115	2022	Under Construction	Reliability
PGE	Canyon-Urban 115 kV Reconductor	115	2022	Planned	Reliability
PGE	Century Substation	115	2023	Planned	Reliability
PGE	Evergreen Substation	230	2024	Planned	Reliability
PGE	Harborton Reliability Project	230	2026	Under Construction	Reliability
PGE	Helvetia Substation	115	2021	Planned	Reliability
PGE	Main Substation	115	2023	Planned	Reliability
PGE	Mt Pleasant Substation	115	2023	Planned	Reliability
PGE	Murrayhill-St Marys 230 kV Reconductor	230	2022	Planned	Reliability
PGE	Rock Creek Substation	115	2021	Under Construction	Reliability
PGE	Roseway substation	115	2020	Under Construction	Reliability
PGE	SE Portland Conversion	115	2027	Planned	Reliability
PGE	Tonquin Substation	115	2025	Planned	Reliability
PSEI	West Kitsap	115	2029		Reliability
PSEI	Energize Eastside	230	2022		Reliability
PSEI	Sedro-Bellingham #4115-kV	115	2021		Reliability

SCL	Denny Phase 2	115	2022	Conceptual	Reliability
GCPUD	Wanapum – Mountain View 230 kV line	230	2026	Planned	Quincy load growth from data servers

Data Table 7: Regional Non-Incumbent and Interregional Transmission Projects Generation Additions

Project	Fuel Type	Nameplate Capacity	State	County
Cross-Tie	Wind	237	WY	Carbon
Cross-Tie	Wind	230	WY	Carbon
Cross-Tie	Wind	250	WY	Carbon
Cross-Tie	Wind	250	WY	Carbon
Cross-Tie	Wind	250	WY	Carbon
Cross-Tie	Wind	750	WY	Converse
Cross-Tie	Wind	350	WY	Converse
Cross-Tie	Wind	120	WY	Uinta
Cross-Tie	Wind	280	WY	Albany
Cross-Tie	Solar	80	WY	Sweetwater
Cross-Tie	Solar	30	WY	Natrona
Cross-Tie	Solar	80	WY	Natrona
Cross-Tie	Wind	100	WY	Natrona
Cross-Tie	Solar	74.9	WY	Fremont
Cross-Tie	Solar	80	WY	Natrona
Cross-Tie	Solar	80	WY	Natrona
Cross-Tie	Wind	75.9	WY	Carbon
Cross-Tie	Wind	101	WY	Uinta
Cross-Tie	Wind	200	WY	Carbon
Cross-Tie	Wind	400	WY	Carbon
Cross-Tie	Wind	80	WY	Albany
Cross-Tie	Wind	80	WY	Albany
Cross-Tie	Wind	80	WY	Albany
Cross-Tie	Wind	80	WY	Albany
Cross-Tie	Natural Gas	200	UT	SaltLake
Cross-Tie	Natural Gas	280	UT	Juab
Cross-Tie	Natural Gas	245	UT	Juab
Cross-Tie	Natural Gas	535	UT	Utah
Cross-Tie	Natural Gas	625	UT	Utah
Cross-Tie	Natural Gas	525	UT	Sevier
Cross-Tie	Solar	204	UT	Kane
Cross-Tie	Solar	200	UT	Iron
Cross-Tie	Solar	525	UT	Iron
Cross-Tie	Solar	187.5	UT	Iron
Cross-Tie	Solar	200	UT	Emery

Cross-Tie	Solar	200	UT	Emery
Cross-Tie	Solar	200	UT	Emery
Cross-Tie	Solar	136	UT	Kane
Cross-Tie	Solar	240	UT	San Juan
Cross-Tie	Solar	525	UT	Tooele
Cross-Tie	Solar	525	UT	Utah
TOTAL		9891.3		
SWIP North	Wind	1050.00	ID	Lincoln, Jerome, Minidoka
SWIP North	Wind	800.00	ID	Twin Falls
TOTAL		1850.00		
TransWest Express	Wind	3310	WY	Carbon
TOTAL	Wind	3310		

Appendix B

Table B1. Paths to Monitor

Path Number	Path Name	Reason
	West of McNary	B2H East to West Flow
	West of Slat	B2H East to West Flow
	West of John Day	B2H East to West Flow
3	Northwest to British Columbia	
4	West of Cascades – North	
5	West of Cascades – South	Cascade Renewable Transmission
6	West of Hatwai	
8	Montana to Northwest	Loco Falls Greenline
14	Idaho to Northwest	B2H Bi-directional
16	Idaho-Sierra	TWE
17	Borah West	Gateway West
19	Bridger West	TWE
20	Path C	TWE
27	IPP - DC Line	TWE
28	Mona – IPP	TWE
30	TOT 1A	TWE
31	TOT 2A	TWE
32	Pavant-Gondor/IPP – Gonder	TWE
35	TOT 2C	TWE
65	Pacific DC Intertie (PDCI)	B2H West to East Flow
66	California Oregon Intertie (COI)	B2H West to East Flow
71	South of Allston	Cascade Renewable Transmission
73	North of John Day	Cascade Renewable Transmission
75	Hemingway –Summer Lake	B2H Bi-directional
78	TOT 2B1	TWE
79	TOT 2B2	TWE
80	Montana Southeast	Loco Falls Greenline
83	Montana Alberta Tie Line	Loco Falls Greenline
	Midpoint West - III-7	B2H, SWIP-N, Gateway West
	Populus West	Gateway West
	Aeolus West - III-3	TWE
	Aeolus South – III-2	TWE

Table B2. Case Checking and Tuning

Use it as a checklist when reviewing a case.

General	
<input type="checkbox"/>	Check for WECC base case modifications applied
<input type="checkbox"/>	Review general high-level modeling objectives met within (5-10 percent) – target path flows, etc.
<input type="checkbox"/>	Check that intended projects and user-submitted corrections / changes applied
<input type="checkbox"/>	Check that path elements are defined correctly

<input type="checkbox"/>	Check that path limits are appropriate
Voltage / VARs	
<input type="checkbox"/>	Review voltage profiles / reactive resource usage
<input type="checkbox"/>	Check bus voltages against voltage schedules
<input type="checkbox"/>	Review for parallel transformers circulating VARs
<input type="checkbox"/>	Review series capacitor status
<input type="checkbox"/>	Review gen units online with unusually low or high MW or MVar levels
<input type="checkbox"/>	Review generators without reactive capability curves and with large MVar limits
<input type="checkbox"/>	Review area reserve factors for adequacy
<input type="checkbox"/>	Review loads with unusual power factors
<input type="checkbox"/>	Review unusual load levels (>5 percent difference than historic forecasts)
Branches	
<input type="checkbox"/>	Check for base case high facility loading or overloads
<input type="checkbox"/>	Check for seasonal normal-opens applied
<input type="checkbox"/>	Review unusual impedance X/R ratios
<input type="checkbox"/>	Check limits to ensure normal is less than or equal to emergency rating
<input type="checkbox"/>	Check limits to ensure summer <= spring/fall <= winter ratings
Other	
<input type="checkbox"/>	Auto-generate geo mapping of case facility latitude/longitude to review connectivity
<input type="checkbox"/>	Review PDCI/IPP firing angles not at or near limits
<input type="checkbox"/>	Review proper modeling of line relays on multi-section lines and 3-terminal transformers for stability simulations
<input type="checkbox"/>	Check Grand Coulee is not used as the swing unit in contingency analysis and distribute generation make-up across the region
<input type="checkbox"/>	Check appropriate limits for thermal / voltage applied and set in contingency analysis
<input type="checkbox"/>	Check Balancing Authority data mapping
Check = look at data for abnormal conditions or to ensure actions have been taken	
Review = understand the general data set and look into outlying conditions	

Appendix C

Table C1. Regional Combinations

Modeled Projects	B2H [H]	Gateway West (Pop - Ced- Hemingway) [E]	Gateway West (Pop - Borah - Mid - Hem) [E]	Gateway West (Midpoint – Cedar Hill)	Gateway West (Anticline - Populus) [D.3]	Antelope	Gateway South [F]	SWIP-N	Cross-Tie	TransWest Express DC	TransWest Express DC/AC	Loco Falls Greenline	Cascade Renewable Transmission	Case Stressed Conditions
2030 ADS*	X	X	X	X	X	X	X							A B C D E F G H
BLMP**	X	X	X	X	X	X	X							A B C D E F G H
RC1***	X					X								A C D E F
RC2	X					X	X							A C D E F
RC3	X	X			X	X	X							A C D E F
RC4	X	X		X	X	X	X							A C D E F
RC5	X		X		X	X	X							A C D E F
RC6	X	X			X	X								A C D E F
RC7	X	X		X	X	X								A C D E F
RC8	X		X		X	X								A C D E F
RC9						X	X							A C D E F
RC10		X			X	X	X							A C D E F
RC11		X		X	X	X	X							A C D E F
RC12			X		X	X	X							A C D E F
RC13		X			X	X								A C D E F
RC14		X		X	X	X								A C D E F
RC15			X		X	X								A C D E F

RC16						X		X						ABCDEF
RC17		X			X	X	X	X						CDE
RC18	X	X			X	X		X						CDE
RC19	X					X	X	X						CDE
RC20	X	X				X	X	X						CDE
RC21	X				X	X	X	X						CDE
RC22						X				X				ABCDEF
RC23		X			X	X	X			X				CDE
RC24	X	X			X	X				X				CDE
RC25	X					X	X			X				CDE
RC26	X	X				X	X			X				CDE
RC27	X				X	X	X			X				CDE
RC28						X					G			ABCDEF
RC29	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	G			TBD	ABCDEF
RC30						X					G			ABCDEF
RC31	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		G		TBD	ABCDEF
RC32						X						X		ABCDEH
RC33	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD			X	TBD	ABCDEH
RC34						X							X	ABCDEF GH
RC35	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD				X	ABCDEF GH
RC36						X			G					ABCDEF
RC37	TBD	TBD	TBD	TBD	TBD	TBD	TBD	G	TBD				TBD	ABCDEF
RC38						X				G				ABCDEF
RC39	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	G				TBD	ABCDEF

Notes: * WECC ADS Case

** Baseline Member Projects (the WECC ADS case and NWE submitted wind projects)

*** Regional Combination 1

G represents modeling the generation submitted with the proposed project

Table C2. Member Voltage Criteria

Entity	Facility Classification	System Normal P0 (percent)	Post Contingency P1 Events (percent)	Post Contingency P2-P7 Events (percent)
Avista	Avista 115 kV	95-105.2	95-105.2	95-105.2
	Avista 230 kV	101-105.2	101-105.2	101-105.2
	500 kV	99 111	99 111	99 111
	All Other	95 -105	95 -105	95 -105
BPA	Main Grid 500 kV	105-110	100-110	100-110
	Main Grid <500 kV	100-105	95-105	95-105
	Secondary Grid	100-105	95-105	95-105
	Lower Voltage Network	100-105	95-105	95-105
CHPD	Transmission	95-105	90-105	90-105
	Generation	95-106	95-105	95-105
NWMT	230 and 161 kV	95-105	95-105	93-105
	115 and 100 kV	95-105	93-105	90-105
	69 and 50 kV	93-105	93-105	90-105