Proposed Study Scope for the 2022-2023 NorthernGrid Planning Cycle

Member Planning Committee Approval Date: TBD

Executive Summary

This Study Scope outlines the NorthernGrid 2022-2023 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 scope for NorthernGrid's 2022-2023 Transmission Plan was developed using the following process:

- Identification of the Baseline Projects of Enrolled Parties. Baseline Projects are the transmission projects included in the Enrolled Parties' Local Transmission Plans.
- Evaluation of 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 of Power flow and production cost analysis techniques to determine if the modeled transmission system topology meets the system reliability performance requirements and transmission needs.
- Selection of the Regional Combination that effectively satisfies all Enrolled Party Needs into the NorthernGrid Regional Transmission Plan.

Overview of Key Observations:

<u>Regional Summary of Needs</u>

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:

- Avista (AVA)
- Bonneville Power Administration (BPA)
- Chelan PUD (CHPD),
- Idaho Power Company (IPC)
- Montana Alberta Tie Line (MATL)
- NV Energy (NV E)
- 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)

- **Load Forecast**
  - An average of 0.7% annualized load growth for the entire membership was observed between 2026-2032.
  - Altogether, the peak load grew approximately 4.6% from the peak load of the 2030 cycle; with the addition of NV Energy, that overall growth is 19.9%.
  - Nearly all utilities reported 0.5% to 0.7% annualized load growth.
  - With the addition of NV Energy, NorthernGrid is primarily a summer peaking system, with a maximum load of 55,130 MW.
  - The expected winter load for the NorthernGrid footprint is approximately 50,000 MW.
- **Generation Retirements** - Members reported 9,238 MW of generation retirements.
- **Resource Additions** – Members reported 24,067 MW of generation additions.
- **Proposed Member Transmission** - Members are proposing 141 new and upgrade transmission line projects, primarily for local load service and increased reliability.
- **Proposed Regional Transmission** - There are 13 regional projects for consideration.
- **Proposed Non-incumbent Regional** – There are 4 non-incumbent regional projects for consideration: Cascade Renewable Transmission System, Cross-Tie, SWIP North, and Loco Falls Greenline.
- **Proposed Non-Incumbent Interregional** – No interregional projects were submitted to the NorthernGrid region.

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 2032 load and generation dispatch conditions.

Initial analysis of the data submissions indicates that the NorthernGrid region experiences peak loading conditions during the summer; with the next highest load occurring in the winter. The NorthernGrid Study Scope will outline the analysis needed to assess the transmission system for a ten-year future and will include detail on how both reliability and the congestion will be assessed. NorthernGrid plans to use approved Western Electric Coordinating Council (WECC) base cases for the reliability analysis and the Anchor Data Set for the production cost analysis.

The NorthernGrid footprint is vast and covers varied terrain; because of this, both winter and summer conditions are of interest. There have been increasingly more instances of northbound flows over the California-Oregon Intertie (COI) and with the increased electrification in the northwest and solar in the southwest. There is a significant amount of proposed wind in the state of Wyoming.

Cost Allocation

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. PowerBridge submitted the Cascade Renewable project.

Great Basin Transmission submitted developer qualification information which was reviewed by the Cost Allocation Task Force resulting in the approval of Great Basin Transmission as a Qualified Developer for this planning cycle. Great Basin Transmission submitted the SWIP North project.

TransCanyon submitted developer qualification information which was reviewed by the Cost Allocation Task Force resulting in the approval of TransCanyon as a Qualified Developer for this planning cycle. Great Basin Transmission submitted the Cross-Tie.

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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.

The committees for NorthernGrid are as follows:

- **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.

Regional Transmission Plan Development

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 2022- 2032 time period.

The regional plan will be developed over the course of two years, beginning March 31, 2022 and ending December 31, 2023. A summary of the key deliverables in Year 1 and Year 2 is included below. Deliverables not defined by Attachment K are subject to change.

General Schedule and Deliverables

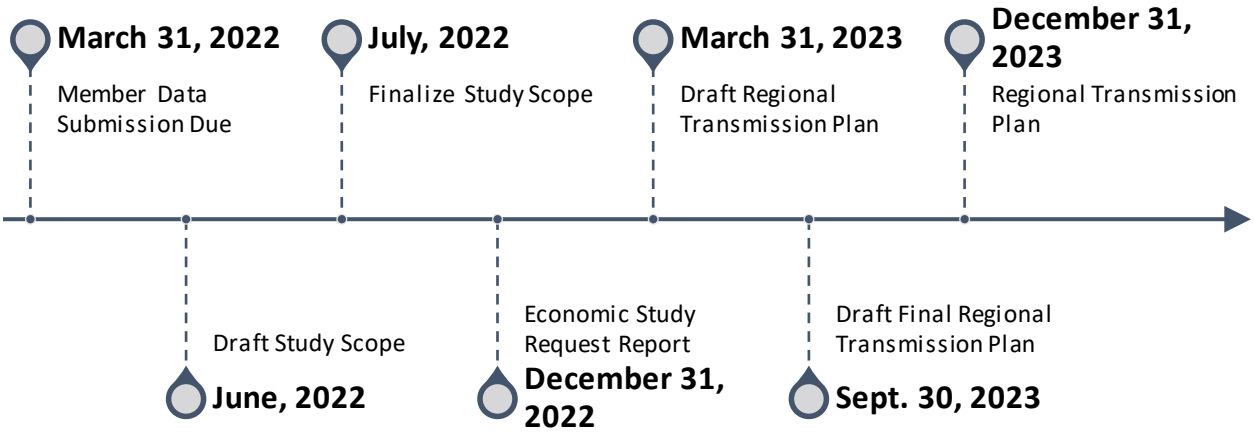

Figure 1: General Timeline of Deliverables

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. There are three main opportunities to provide comment, and they are in response to the following publications: the proposed Study Scope, the Draft Regional Transmission Plan, and the Draft Final Transmission Plan.

Regional Summary of Needs

Current Transmission System

The NorthernGrid system is depicted below in Figure 2: NorthernGrid Balancing Authority Areas and the existing transmission is depicted in Figure 3: Existing NorthernGrid transmission.

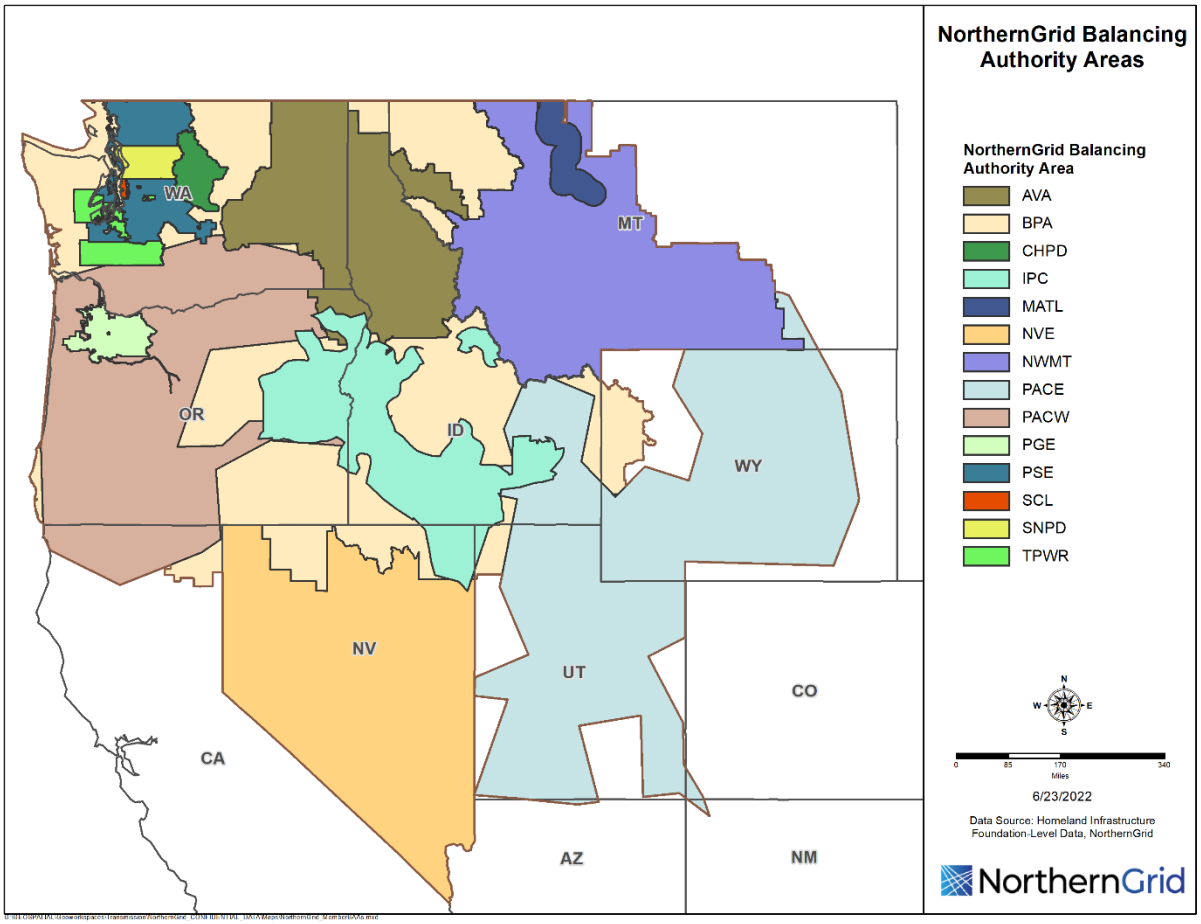

Figure 2: NorthernGrid Balancing Authority Areas

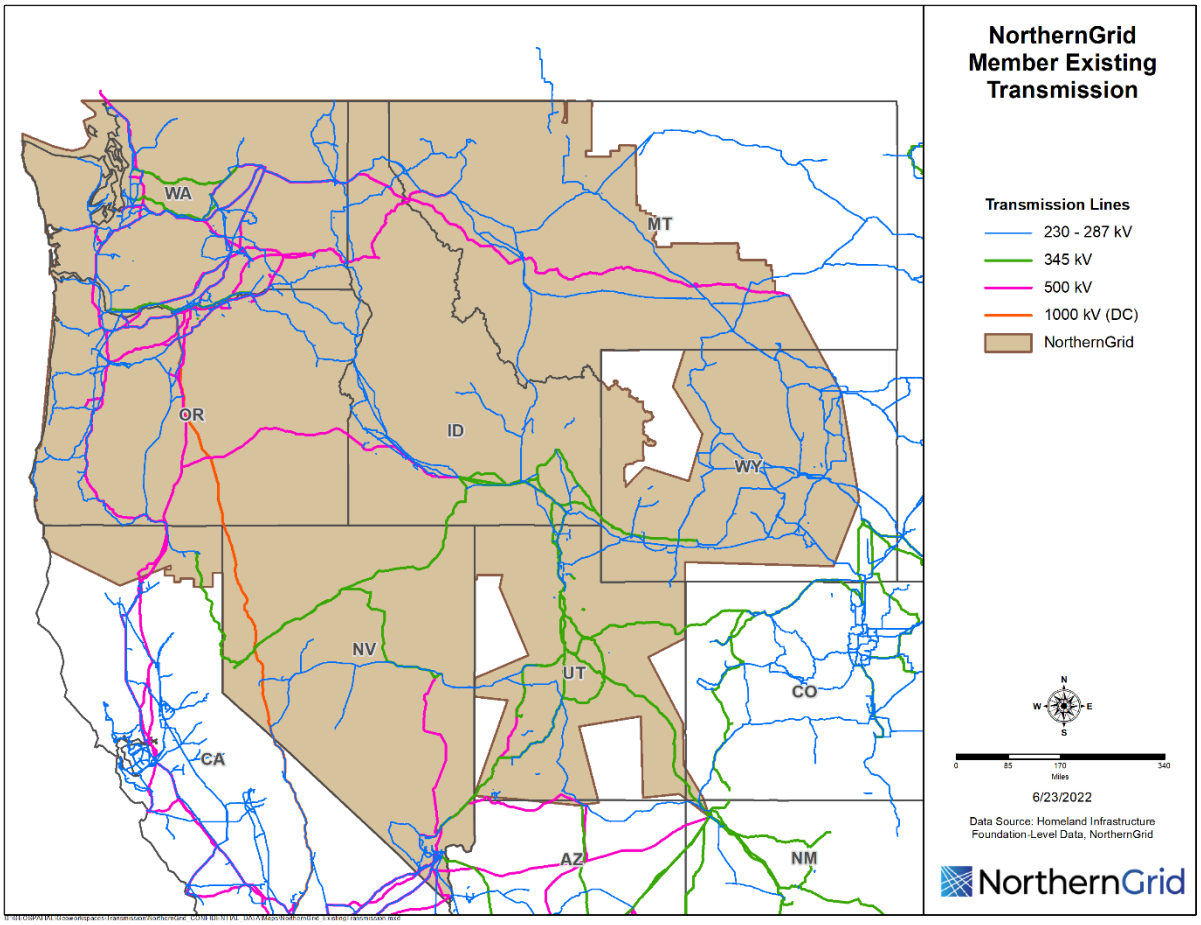

Figure 3: Existing NorthernGrid transmission

Data Submission Summary

This section summarizes the data submission results that NorthernGrid received from its 13 members. The NorthernGrid is made up of Avista (AVA), Bonneville Power Administration (BPA), Chelan PUD (CHPD), Idaho Power Company (IPC), Montana Alberta Tie Line (MATL), NV Energy (NV E), 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). The member Balancing Authority Areas (BAA) are illustrated in Figure 7 below.

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 transmission additions. A summary of each member's data submission is shown in Figure 4: NorthernGrid Summary.

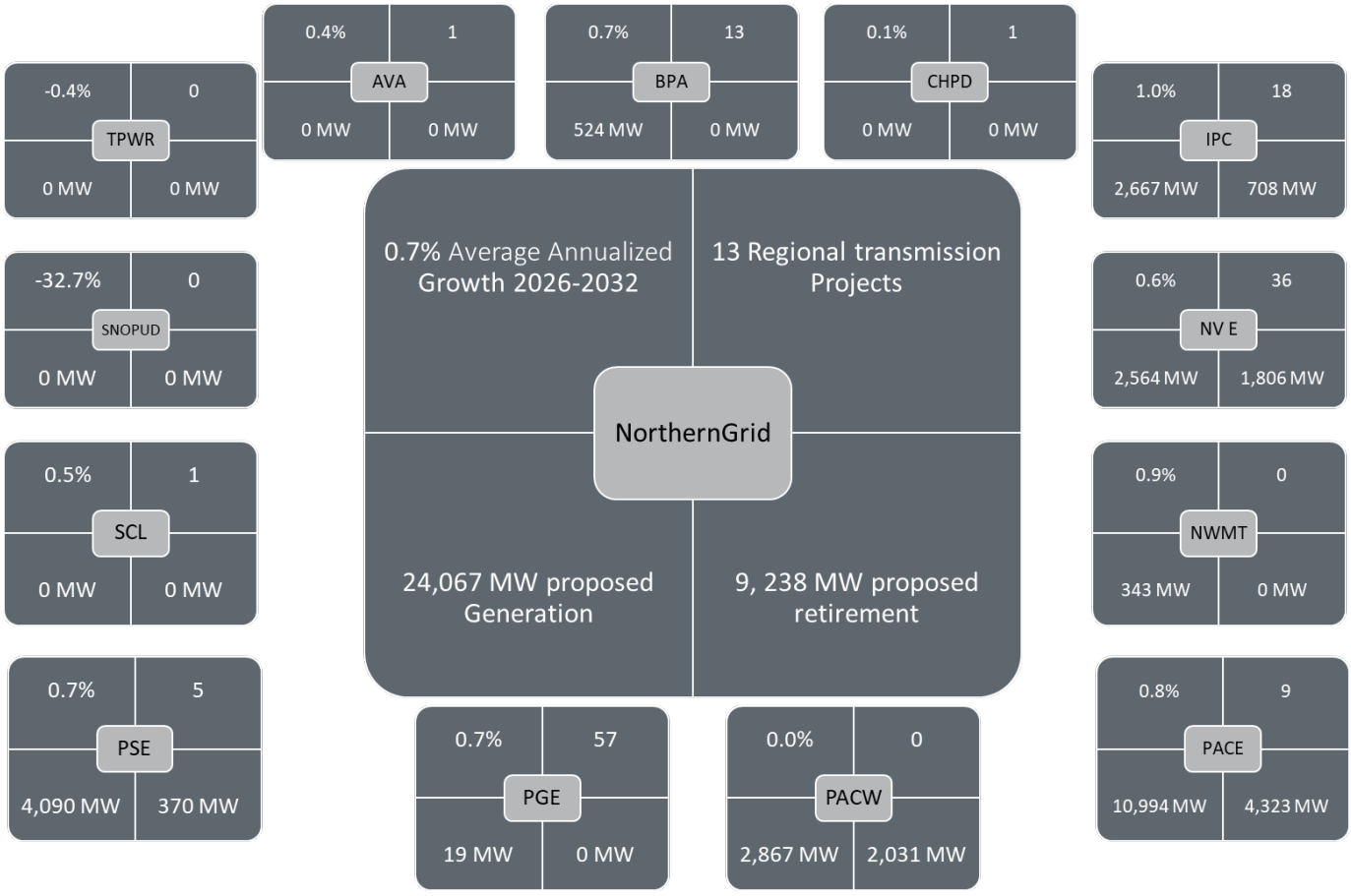

Figure 4: NorthernGrid Summary

Observations:

1. Overall, the NorthernGrid is predicted to grow at an average of 0.7% annually.
2. Some utilities lowered their load expectations from the 2020-2021 cycle. This decrease in load forecast may be due to expectations on distributed energy resources installations and increased energy efficiencies.
3. The 13 regional projects have been grouped by the MPC based on dependencies inherent in the projects.
4. There is a net generation increase predicted for the NorthernGrid footprint.

Local Summary

The NorthernGrid members have projected the need for 141 new and upgraded transmission system projects in the local transmission planning processes. These projects primarily support local load service and reliability and have not been deemed to be "regionally significant".

Loads Summary

Table 1: NorthernGrid Load Values; shades of green denote seasons

	January	February	March	April	May	June	July	August	September	October	November	December
2030 (MW)	44,266	42,261	39,304	36,659	36,645	40,055	43,383	43,109	37,892	36,699	40,860	44,595
2032, WITHOUT NV E (MW)	44,099	42,601	40,172	37,061	37,029	42,208	44,870	44,358	39,379	37,611	40,686	44,472
2032, WITH NV E (MW)	49,657	47,970	**45,593**	43,102	45,055	52,116	**55,130**	54,488	**48,509**	44,202	45,796	**50,000**

Key Observations:

- The summer peak loading is 55,130 MW; the winter peak loading is 50,000 MW. The distinction is primarily due to the addition of NV Energy, which is a summer-peaking utility.
- The spring seasonal peak is 45,593; the fall seasonal peak is 48,509 MW.

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, NWMT 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.

Resources Summary 2022-2032

As stated in the introduction of the Study Scope, there are approximately 24 GW of resources being developed within the NorthernGrid region along with approximately 9 GW of resources being retired.

All future resources are based on member resource planning processes. The Enrolled Parties determine resource additions through the development of their Loads and Resources needed for base case development. In some instances, the Integrated Resource Planning (IRP) requirements needed to meet state mandate may inform the development of the Loads and Resources data. Many of the resource

additions presented are based on the existing IRP preferred portfolio which may change during subsequent biennial planning cycles.

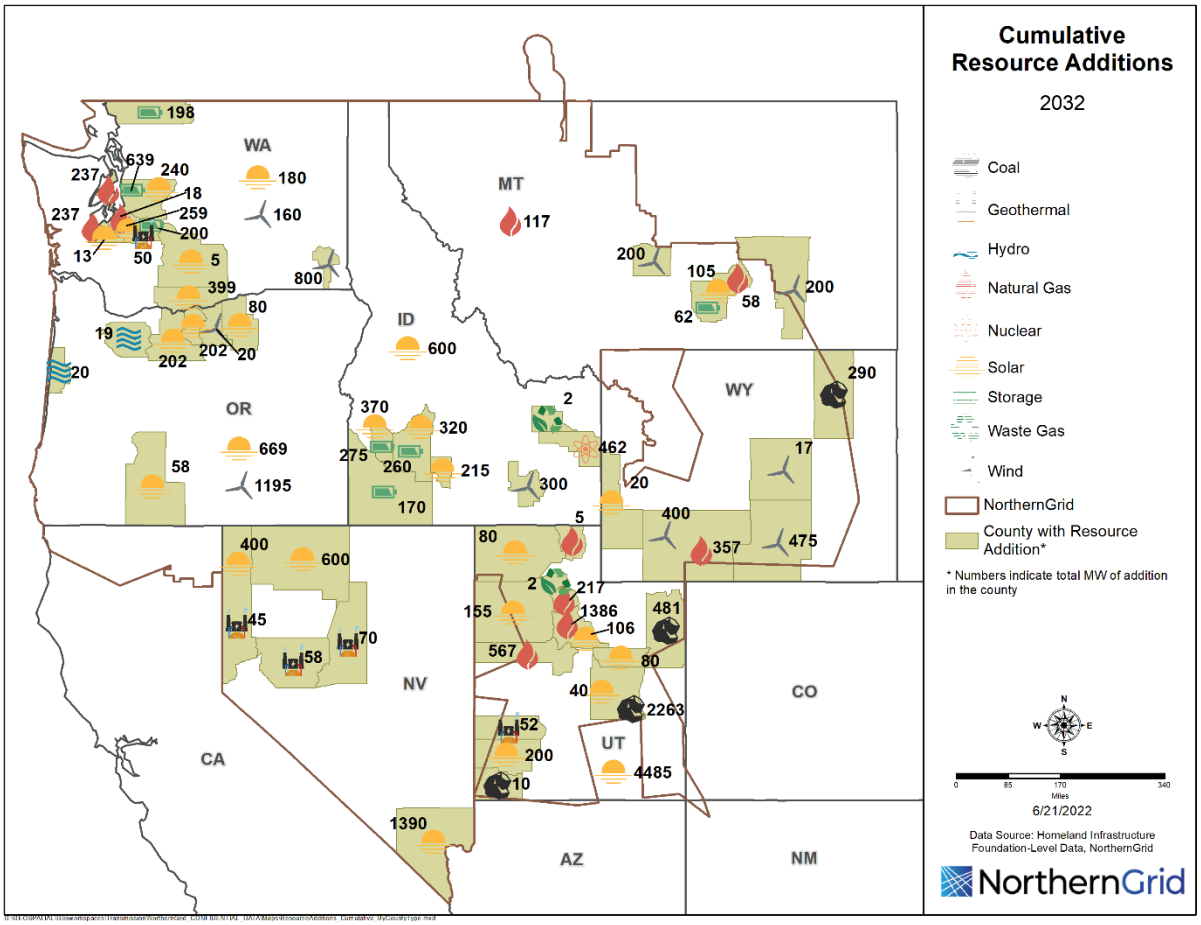

Figure 5: Cumulative Resource Additions

Figure 5: Cumulative Resource Additions above shows the proposed generation additions by type and by geographic area. Appendix A: Generation Changes lists the entire breakdown of resources; the majority of the proposed resources are renewable in nature.

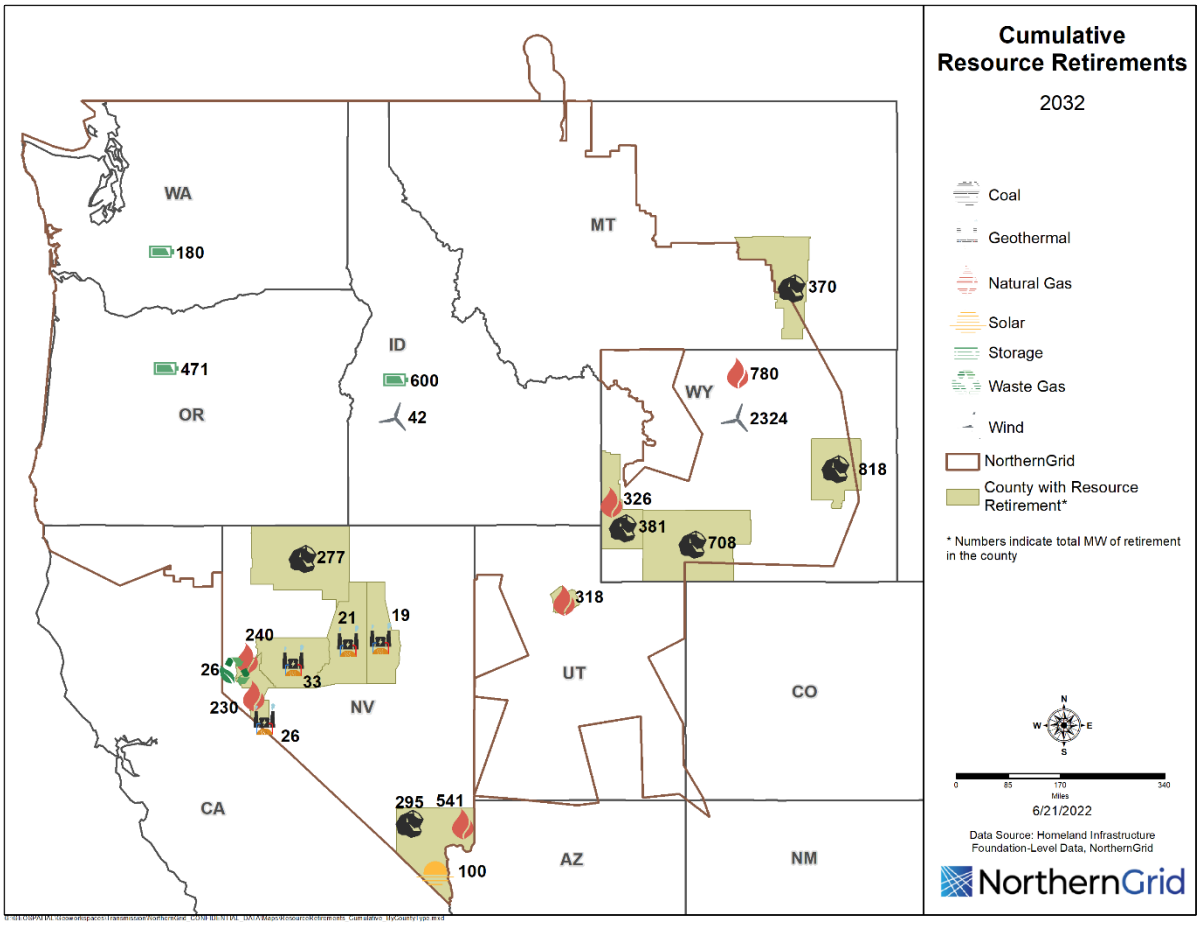

Figure 6: Cumulative Resource Retirements

The resources retirements submissions are primarily coal or natural gas. In some instances, generic resources that have been identified in IRPs have been identified as retired before 2032 and are marked as "MWH".

Transmission Service Obligations

Like loads, resources, and public policy, transmission service obligations may drive transmission development. The NorthernGrid members are encouraged to submit all transmission service 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. A complete summary of the firm transmission service agreements is provided in Appendix B: Transmission Service.

Regional Transmission Projects

Enrolled Parties as well as Developers submitted the regional projects depicted in Figure 7: Proposed Projects, Enrolled and Non-Incumbent.

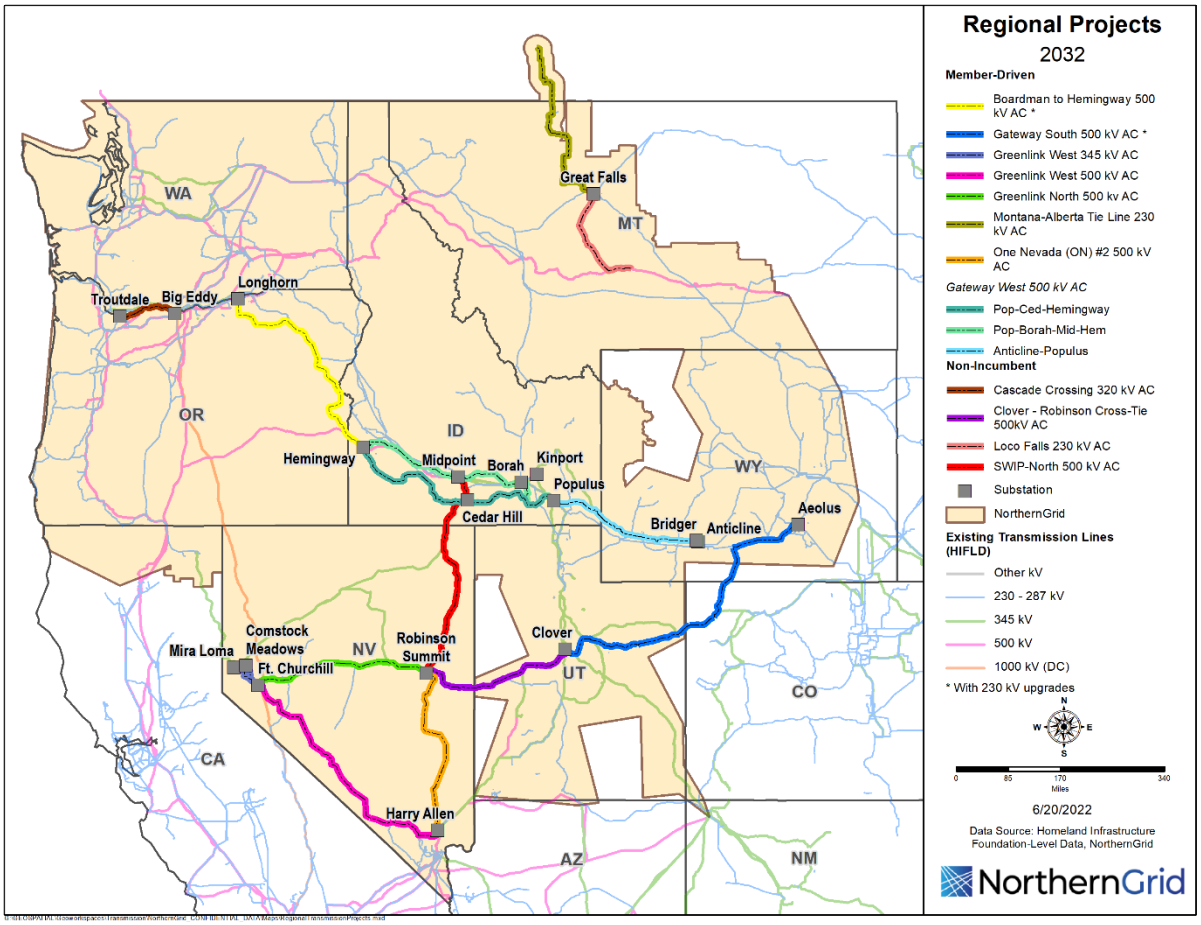

Figure 7: Proposed Projects, Enrolled and Non-Incumbent

Enrolled Party Transmission Projects

The thirteen projects submitted by the Enrolled parties are as follows:

Boardman to Hemingway- Boardman to Hemingway 500 kV line, Hemingway to Bowmont and Bowmont to Hubbard 230 kV lines. This includes two sections of series compensation. The Oregon end of the line was terminated at the Longhorn station, which is near the town of Boardman, Oregon. While the figures do not visually display the 230 kV facilities associated with the B2H project, the 230 kV facilities are included in the model for B2H as they are needed to integrate B2H into Idaho Power's system. The B2H project was selected into the 2020-2021 NorthernGrid Regional Transmission Plan.

Gateway West- A suite of four project segments were evaluated for Gateway West. These are:

- Populus-Cedar Hill-Hemingway 500 kV
- Populus-Borah-Midpoint-Hemingway 500 kV
- Midpoint-Cedar Hills 500 kV
- Anticline-Populus 500 kV

Of the Gateway West projects, only the Populus-Cedar Hill-Hemingway and Anticline-Populus 500 kV lines were selected into the 2020-2021 NorthernGrid Regional Transmission Plan.

Gateway South- Aeolus to Clover 500 kV Line. Based on guidance from PacifiCorp, the Windstar-Shirley Basin 230 kV line (part of Gateway West) has the same in-service date as the Aeolus-Clover project for simplicity.
The Gateway South project was selected into the 2020-2021 NorthernGrid Regional Transmission Plan.

One Nevada #2- 500 kV #2 from Harry Allen to Robinson Summit. Also includes upgrades to the 345 kV system.

MATL- MATL proposed a conversion of the MATL to direct current. The rating will increase to a maximum of 500 MW. MATL was not selected into the 2020-2021 Regional Transmission Plan.

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. For the 2022-2023 planning cycle, none of the submitted non-incumbent projects were deemed interregional.

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 are no proposed generation resources associated with the transmission line.

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 are no proposed generation resources associated with the transmission line.

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).

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. The SWIP-North Project connects the Midpoint 500 kV substation to the Robinson Summit 500 kV substation with a 500-kV single circuit AC transmission line. With the addition of NV Energy into the NorthernGrid footprint, the SWIP project is now fully within the NorthernGrid footprint. 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. Appendix XXX provides a 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.

Load Changes

The load changes across the region are varied; in some instances, load expectations are for growth and in others, load expectations are for declining load. Figure 8: Annual Summer Load Growth and Figure 9: Annual Winter Load Growth graphically display the different load expectations by summer.

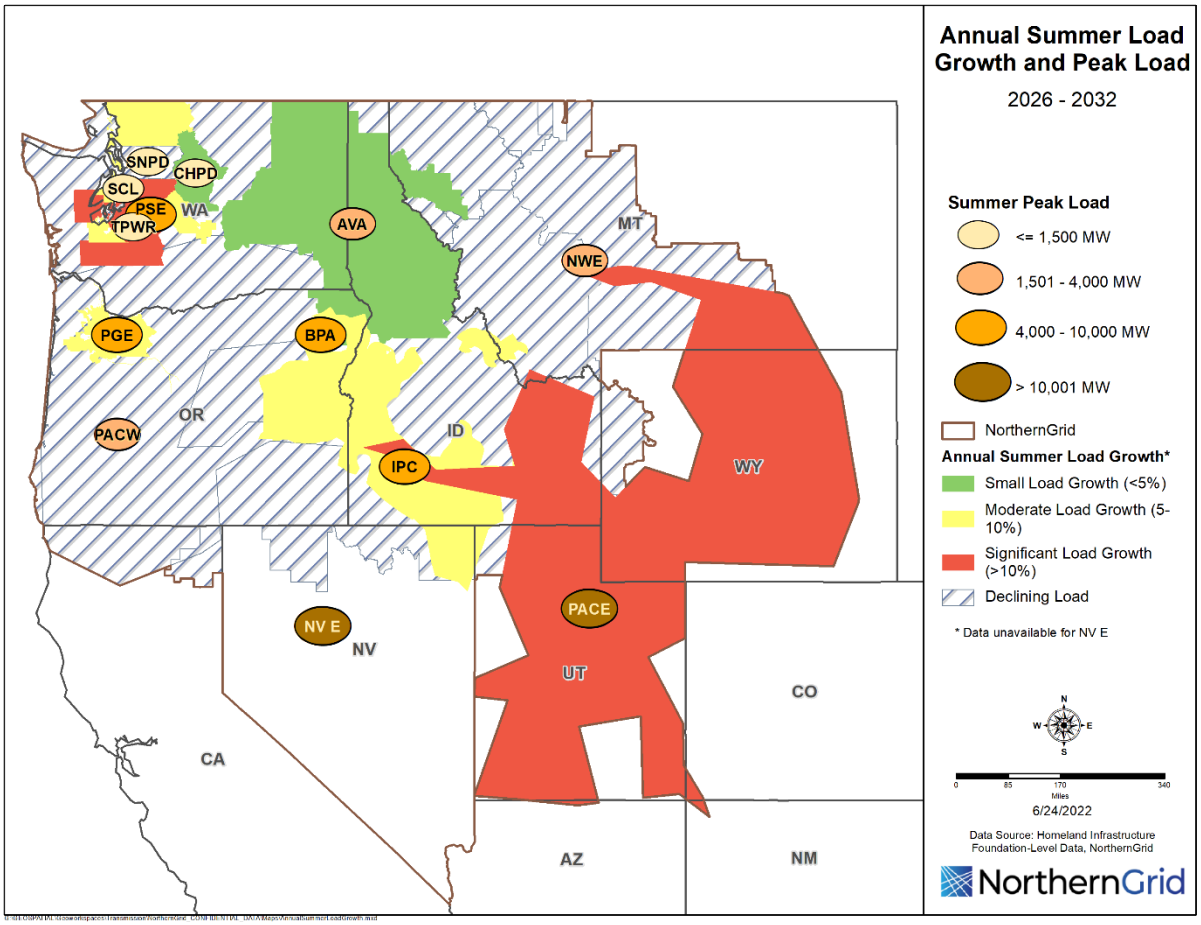

Figure 8: Annual Summer Load Growth

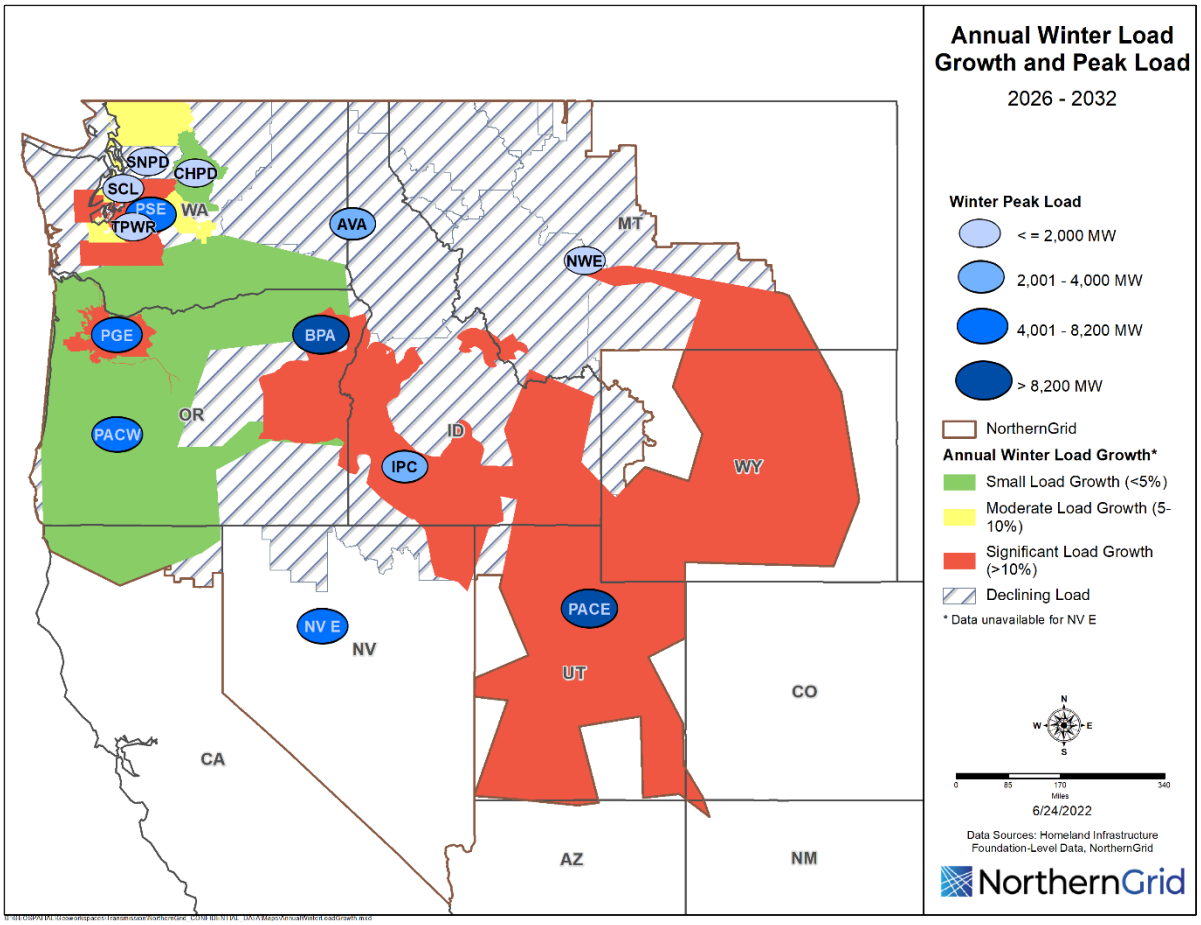

Figure 9: Annual Winter Load Growth

Table 2: Summary of Enrolled Party loads and resources Submittal

	NG	AVA	BPA	CHPD	GCPD	IPC	NVE	NWMT	PACE	PACW	PGE	PSE	SCL	SNOPUD	TPWR
% Growth 2026-2032	4.6%	2.5%	5.1%	0.9%	15.4%	7.3%	4.1%	6.1%	5.3%	0.3%	4.9%	5.0%	3.2%	1.2%	-2.6%
% Change from Previous Cycle	19.9%	3.1%	-19.9%	3.3%	20.9%	15.2%		-2.5%	9.2%	0.1%	8.6%	12.0%	-5.7%	-32.7%	18.3%
% Change from Previous	1.8%														

Cycle - NV E															
Number of Transmission Projects	13	1	13	1	1	18	36	0	9	0	57	5	1	0	0
MW Proposed Generation (MW)	24067	2226	524	0	0	2052	2564	343	10994	2867	19		0	0	0
MW Proposed Retirements (MW)	9238	0	0	0	0	2326	1806	0	4323	2172	0	370	0	0	0

Public Policy Requirements Summary

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 states within the NorthernGrid region.

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 2032.
- 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.

Key Observations

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

Case Analysis

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 2032 loads and resource, types of analysis, performance criteria, paths to monitor, case checking and tuning (reactive devices, phase shifting transformers) and contingencies. This process is designed to meet Order 890 and 1000 planning requirements and is not intended to evaluate market efficiencies.

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 2032 loads and resource generation dispatch conditions.

Change to Databases to be utilized

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 and TOP specific standards. 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 criteria also allow 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 Appendix XXXX.

Base Case Conditions

SUM: Summer Peak loading conditions. High southbound flows on the COI and PDCI. High eastbound Northwest to Idaho flows. Southbound MATL flows.

WIN: Winter Peak loading conditions. Typical seasonal dispatch for the generation resources. Northbound MATL flows.

CAL-X: California export case. High northbound flows on the COI and PDCI.

WY: High Wyoming wind export case. Westbound flows coming out of Wyoming.

Evaluation of Regional Transmission Project Combinations

To determine whether transmission needs within the NorthernGrid may be satisfied by regional transmission projects, NorthernGrid evaluates the proposed regional and interregional (if any) 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 Appendix C: Full list of the Regional Combinations.

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.

Cost Allocation

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.

Qualified Developers

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.

Great Basin Transmission submitted developer qualification information which was reviewed by the Cost Allocation Task Force resulting in the approval of Great Basin Transmission as a Qualified Developer for this planning cycle. Great Basin Transmission submitted the SWIP North project.

TransCanyon submitted developer qualification information which was reviewed by the Cost Allocation Task Force resulting in the approval of TransCanyon as a Qualified Developer for this planning cycle. TransCanyon submitted the Cross-Tie.

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: Generation Changes

Table 3: Generation Additions and Retirements by Utility

Utility	Generation Addition	Generation Retirement
AVA	0	0
BPA	524	0
CHPD	0	0
GCPD	0	0
IPC	2667	708
NV E	2564	1806
NWMT	343	0
PACE	10994	4323
PACW	2867	2031
PGE	19	0
PSE	4090	370
SCL	0	0
SNOPUD	0	0
TPWR	0	0
Total	24,067	9,238

Table 4: Generation Additions and Retirements by Type

Utility	AVA	BPA	IPC	NV E	NWMT	PACE	PACW	PGE	PSE	SCL	SNOPUD	TPWR	CHPD	GCPD
AB	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BIT	0	0	0	0	0	2744	0	0	0	0	0	0	0	0
DFO	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GEO	0	0	0	174	0	52	0	0	50	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MSW	0	0	0	0	0	2	0	0	0	0	0	0	0	0
MWH	0	0	705	0	62	0	0	0	1037	0	0	0	0	0
NG	0	0	357	0	175	2175	0	0	492	0	0	0	0	0
NUC	0	0	0	0	0	462	0	0	0	0	0	0	0	0
OBG	0	0	0	0	0	2	0	0	0	0	0	0	0	0
OTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SOL	0	302	0	0	0	0	0	0	0	0	0	0	0	0
SUB	0	0	0	0	0	290	0	0	0	0	0	0	0	0
SUN	0	0	905	2390	105	5166	1512	0	911	0	0	0	0	0
WAT	0	0	0	0	0	0	0	18.9	0	0	0	0	0	0
WAVE	0	20	0	0	0	0	0	0	0	0	0	0	0	0
WDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WH	0	0	0	0	0	10	0	0	0	0	0	0	0	0
WND	0	202	700	0	0	92	1355	0	1600	0	0	0	0	0

Winter Cap	Net winter capacity
Primary Fuel	The most predominant type of energy that fuels the generator: ANT ... Anthracite Coal BIT..... Bituminous Coal LIG ..... Lignite Coal SGC..... Coal-Derived Synthesis Gas SUB ..... Subbituminous Coal WC ..... Waste/Other Coal (including anthracite culm, bituminous gob, fine coal, lignite waste, waste coal) RC..... Refined Coal DFO..... Distillate Fuel Oil (including diesel, No. 1, No. 2, and No. 4 fuel oils) JF ..... Jet Fuel KER..... Kerosene PC .... Petroleum Coke PG .... Gaseous Propane RFO ... Residual Fuel Oil (No. 5, No. 6 fuel oils, and bunker C fuel oil) SGP ... Synthetic Gas from Petroleum Coke WO ... Waste/Other Oil (including crude oil, liquid butane, liquid propane, naphtha, oil waste, re-refined motor oil, sludge oil, tar oil, or other petroleum-based liquid wastes) BFG ... Blast Furnace Gas NG .... Natural Gas OG .... Other Gas (specify in comments) AB .... Agriculture Byproducts MSW ... Municipal Solid Waste OBS ... Other Biomass Solids (specify in comments) WDS ... Wood/Wood Waste Solids (including paper pellets, railroad ties, utility poles, wood chips, bark, and wood waste solids) OBL ... Other Biomass Liquids (specify in comments) SLW ... Sludge Waste BLQ ... Black Liquor WDL ... Wood Waste Liquids excluding Black Liquor (including red liquor, sludge wood, spent sulfite liquor, and other wood-based liquids) LFG ... Landfill Gas OBG ... Other Biomass Gas (including digester gas, methane, and other biomass gases; specify in the comments field) SUN ... Solar WND ... Wind GEO ... Geothermal WAT ... Water at a Conventional Hydroelectric Turbine, and water used in Wave Buoy Hydrokinetic Technology, Current Hydrokinetic Technology, and Tidal Hydrokinetic Technology; Pumping Energy for Reversible (Pumped Storage) Hydroelectric Turbine NUC ... Nuclear (including Uranium, Plutonium, Thorium) PUR ... Purchased Steam WH.....Waste Heat not directly attributed to a fuel source TDF .....Tire-Derived Fuels MWH ... Electricity used for energy storage OTH.....Other (specify in comments) UKN ... Unknown (specify in comments)

Figure 10: WECC Fuel Codes

Appendix B: Transmission Service

BA	Terminal From Location	Terminal To Location	Voltage Operating (kV)	Reservation	Year	Reservation	Year
PACE	Windstar	Shirley Basin	230			11	2024
PACE	Anticline Substation	Populus Substation	500			12	2027 (tentative)
PACE	Populus (near Downey), ID	Midpoint (near Shoshone), ID	500			12	2030 (tentative)
PACE	Populus (near Downey), ID	Hemmingway (near Murphy), ID	500			12	2030 (tentative)
PACE	Aeolus, near Medicine Bow, WY	Clover, near Mona, UT	500			10	2024
IPCO	Walters Ferry, ID	Boardman, OR	500	6	2013	6	2026
CHPD	Rocky Reach	Chelan	100-120	1	1918	4	2023
PGN	Salem, OR	Woodburn, OR	230	12	2024	12	2024
PGN	Hillsboro, OR	Hillsboro, OR	230	3	2022	10	2024
PGN	Hillsboro, OR	Hillsboro, OR	230	3	2022	5	2024
PGN	Portland, OR	Beaverton, OR	230	3	2021	10	2024
PGN	Portland, OR	Rainier, OR	230	12	2020	10	2024
PGN	Hillsboro, OR	Hillsboro, OR	230	5	2025	5	2024
PGN	Oregon City, OR	Woodburn, OR	230	12	2024	12	2024
PGN	Salem, OR	Woodburn, OR	115	12	2027	12	2027
PGN	Hillsboro, OR	Hillsboro, OR	115	4	2026	4	2027
PGN	Hillsboro, OR	Hillsboro, OR	115	3	2021	4	2022
PGN	Hillsboro, OR	Beaverton, OR	115	3	2021	7	2022
PGN	Hillsboro, OR	Hillsboro, OR	115	12	2022	5	2023

PGN	Oregon City, OR	Oregon City, OR	115	11	2022	11	2027
PGN	Portland, OR	Portland, OR	115	6	2019	7	2026
PGN	Portland, OR	Portland, OR	115	3	2022	6	2022
PGN	Clackamas, OR	Gresham, OR	115	11	2029	11	2029
PGN	Clackamas, OR	Oregon City, OR	115	11	2022	11	2027
PGN	Hillsboro, OR	Hillsboro, OR	115	4	2021	6	2024
PGN	Hillsboro, OR	Hillsboro, OR	115	12	2022	6	2025
PGN	Hillsboro, OR	Hillsboro, OR	115	4	2021	6	2024
PGN	Salem, OR	Salem, OR	115	12	2027	12	2027
PGN	Portland, OR	Portland, OR	115	4	2022	5	2022
PGN	Portland, OR	Portland, OR	115	6	2019	4	2024
PGN	Hillsboro, OR	Hillsboro, OR	115	12	2023	11	2024
PGN	Hillsboro, OR	Hillsboro, OR	115	3	2022	5	2024
PGN	Hillsboro, OR	Hillsboro, OR	115	11	2024	11	2024
PGN	Hillsboro, OR	Hillsboro, OR	115	3	2022	11	2024
PGN	Hillsboro, OR	Hillsboro, OR	115	3	2022	5	2024
PGN	Gresham, OR	Gresham, OR	115	12	2024	11	2029
PGN	Gresham, OR	Portland, OR	115	3	2021	4	2026
PGN	Portland, OR	St Helens, OR	115	6	2025	6	2025
PGN	Portland, OR	Portland, OR	115	10	2021	9	2022
PGN	Portland, OR	Portland, OR	115	6	2019	11	2025
PGN	Portland, OR	Portland, OR	115	3	2021	4	2026
PGN	St Helens, OR	St Helens, OR	115	6	2025	6	2025

PGN	Hillsboro, OR	Hillsboro, OR	115	12	2022	4	2027
PGN	Oregon City, OR	Tualatin, OR	115	3	2025	4	2025
PGN	Wilsonville, OR	Sherwood, OR	115	12	2024	12	2024
PGN	Wilsonville, OR	Wilsonville, OR	115	12	2024	12	2024
PGN	Tualatin, OR	Tualatin, OR	115	3	2024	4	2024
PGN	Woodburn, OR	Salem, OR	115	9	2025	9	2025
PGN	Woodburn, OR	Woodburn, OR	115	1	2027	1	2027
PGN	Woodburn, OR	Woodburn, OR	115	3	2026	3	2026
PGN	Woodburn, OR	Woodburn, OR	115	1	2027	1	2027
PGN	Portland, OR	Portland, OR	115	4	2022	5	2022
PGN	Aloha, OR	Beaverton, OR	115	9	2024	9	2024
PGN	West Linn, OR	Wilsonville, OR	115	3	2025	4	2025
PGN	Sherwood, OR	Tualatin, OR	115	3	2024	4	2024
PGN	Woodburn, OR	Salem, OR	115	3	2026	3	2026
PGN	Beaverton, OR	Portland, OR	115	3	2021	11	2025
SCL	Mass	Denny	115			9	2025
PSEI	Sammamish WA	Renton WA	230	1042			
PSEI	Sammamish WA	Renton WA	230	1042			
PSEI	Sedro Woolley WA	Bellingham WA	115	336			
PSEI	Electron, WA	Enumclaw, WA	115	336			

Appendix C: Full list of the Regional Combinations

RC Name	Seasonal Case	CCX	B2H	GWW D.3	GWW E1	GWW E2	GWW D.1	GWS F	ON#2	GNLK N-W	Cross-tie (link to	SWIP-N	Loco Falls	MATL
BLMP – Baseline Member Projects	SUM, WIN, CAL-X, WY		x	x	x	x	x		x	x				x
BLNP – Baseline No Projects	SUM, WIN, CAL-X, WY													
RC1	SUM, WIN, CAL-X, WY	x												
RC2	SUM, WIN, CAL-X, WY		x											
RC3	SUM, WIN, CAL-X, WY			x										
RC4	SUM, WIN, CAL-X, WY					x								
RC5	SUM, WIN, CAL-X, WY						x							
RC6	SUM, WIN, CAL-X, WY								x					
RC7	SUM, WIN, CAL-X, WY									x				
RC8	SUM, WIN, CAL-X, WY										x			
RC9	SUM, WIN, CAL-X, WY											x		
RC10	SUM, WIN, CAL-X, WY													x
RC11	SUM, WIN, CAL-X, WY	x	x	x	x	x	x		x	x	x	x	x	x
RC12	SUM, WIN, CAL-X, WY		x	x		x	x							
RC13	SUM, WIN, CAL-X, WY	x	x	x		x	x							
RC14	SUM, WIN, CAL-X, WY		x	x		x	x					x		
RC15	SUM, WIN, CAL-X, WY	x	x	x		x	x					x		
RC16	SUM, WIN, CAL-X, WY		x	x	x		x							
RC17	SUM, WIN, CAL-X, WY		x	x		x	x							x

RC18	SUM, WIN, CAL-X, WY							x	x	x	x		
RC19	SUM, WIN, CAL-X, WY								x	x	x		
RC20	SUM, WIN, CAL-X, WY							x		x	x		
RC21	SUM, WIN, CAL-X, WY							x	x		x		
RC22	SUM, WIN, CAL-X, WY							x	x	x			
RC23	SUM, WIN, CAL-X, WY								x	x			
RC24	SUM, WIN, CAL-X, WY								x		x		
RC25	SUM, WIN, CAL-X, WY						x	x	x	x	x		
RC26	SUM, WIN, CAL-X, WY							x	x				
RC27	SUM, WIN, CAL-X, WY						x		x	x	x		
RC28	SUM, WIN, CAL-X, WY						x	x		x	x		
RC29	SUM, WIN, CAL-X, WY						x	x	x		x		
RC30	SUM, WIN, CAL-X, WY						x	x	x	x			
RC31	SUM, WIN, CAL-X, WY						x		x	x			
RC32	SUM, WIN, CAL-X, WY						x		x		x		
RC33	SUM, WIN, CAL-X, WY						x	x	x				
RC34	SUM, WIN	x	x										
RC35	SUM, WIN, CAL-X, WY											x	x

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