# Western Power Pool 2030 Low Carbon, Extreme Weather Study Scope

October 6, 2022

## Objective

The 2030 Low Carbon, Extreme Weather study ("Study") is an effort by a group of transmission owners and transmission planners operating in four western U.S. states and the province of Alberta to evaluate issues of common interest, which can best be studied jointly. The objective of the Study is to identify whether near-term transmission constraints exist under low carbon resource requirements and extreme weather. If constraints exist, the Study will identify solutions that may be implemented by 2030.

The participants initiated this Study as a way to facilitate joint sharing of information, increase the efficiency of the planning process in addressing longer-term outlook transmission requirements, and communicate to impacted utility planners, utility operators and regional stakeholders any identified concerns and potential solutions.

## Relationship to Other Study Efforts

The purpose of the Study is to evaluate specific conditions and scenarios that are not otherwise already studied through other coordinated efforts. While the participants may freely utilize the Study results to inform other planning analyses, the Study is not intended to fulfill or replace any other transmission planning or resource planning requirements. Specifically, this Study will not address the full suite of NERC TPL-001-4 / TPL-001-5 requirements and Study results are provided in addition to, but not replacing, the participants' FERC Order 890 and 1000 regional planning requirements and NorthernGrid Enrolled Party tariffs. This Study in no way obligates NorthernGrid members to perform future studies as described in this Study scope document.

This Study is not a resource adequacy or economic congestion study. While a goal of the Study is to provide additional context around transmission and resource issues during extreme and highly constrained conditions, the Study is information in nature only and will not result in a regional transmission, local transmission, action, or construction plan.

## Study Participants

The Study Participants are Avista, Bonneville Power Administration, Chelan PUD, Montana-Alberta Tie Line (MATL), Idaho Power, NorthWestern Energy, Portland General Electric, Puget Sound Energy, Seattle City Light, Snohomish PUD and Tacoma Power.

## Stakeholder Participation

Study participants seek to engage state utility commissions, neighboring utilities and other stakeholders in scope development, assumptions, draft results and proposed solutions through multiple workshops. The goal of stakeholder participation is to help focus, inform and enhance the Study.

## Study Horizon

The Study selected a planning year of 2030 to include expected clean energy public policy requirements and expected public policy driven electrification of carbon emitting sectors such as, water and space

heating along with transportation. Load forecasting assumptions will include any known or expected customer preference assumptions (e.g. electric ferries, buses, aviation). The Study will also incorporate best estimates of demand side management, time of use pricing and smart charging that are anticipated to be implemented.

## Planned Projects

Transmission projects with in-service dates prior to 2030 will be evaluated for inclusion or exclusion from the initial case by the utility or utilities most impacted by the project. Known projects from neighboring utilities outside of the Study footprint will be similarly evaluated. Projects with in-service dates of 2030 or later will be initially offline or removed from cases and evaluated as potential mitigation.

Participant Integrated Resource Plan (IRP) preferred portfolio resources, including resource additions and retirements, will be evaluated for inclusion or exclusion from the initial case by each respective participant. The assumed initial case resources will be documented in the Study report. Resource additions or retirements with action dates of 2030 or later will not be initially modeled but may be evaluated as potential mitigation. Future resources without specific siting locations in IRPs may be modeled at representative buses as determined by Study participants. Any such model assumptions used in the Study will not be indicative of preferred siting, ease of interconnection or feasibility of interconnection.

## Low Carbon Assumptions

The Study will incorporate Public Policy requirements and goals such as Washington CETA and Oregon HB 2021, along with individual utility IRP goals and Load & Resource Forecasts, to represent a low carbon future for 2030. As a result of the combined requirements and goals, it is anticipated that electrification of vehicles and heating sources will have a significant impact on load profiles and distribution, as well as changing the coincidence of load peaks across the wider system. The assumptions used in the Study will also incorporate increased inverter-based resource interconnections, distributed energy resources, energy efficiency and demand-side management.

## Scenarios

### Extreme Heat

The Study will evaluate an extreme heat scenario representing a heat dome event on the west side of the Cascades (“Pacific NW”), concurrent with a widespread peak summer condition in the intermountain (“Inland”) region. This scenario case will be developed by modifying the WECC 32HS1a power flow base case to represent 2030 projected load conditions based on a combination of historic load data and stressed (e.g. 1-in-20) utility load forecasts.

In the extreme heat scenario, an imbalance of wind between the Pacific NW and Inland regions will be represented, with minimal wind in the Pacific NW and high wind in select locations throughout the Inland region. Within heavy wind areas, more extreme contingencies may be considered due to potential for forced outages. A low hydro ($10^{th}$ percentile) river availability will be modeled using BPA’s power planning models and other data sources to supplement and/or replace ADS hydro assumptions. The Study will also aim to identify any resources that may have restricted or limited output due to the extreme temperatures, particularly wind turbines and solar generation facilities that have cut out ratings at or below 40° C (104° F).

Operationally "always credible" contingencies will be simulated to validate the performance of the system prior to, and following, any proposed system reinforcements. These contingencies will include single transmission lines and transformers, as well as select bus, breaker, overlapping contingencies and common-mode failure contingencies.

Transmission lines and transformers may be evaluated with reduced ratings, as determined by each individual transmission provider's facility ratings practice, for extreme temperature. These derates will be represented in the Study as alarming at a lower threshold. Facility ratings assumptions used in the Study will be documented in the report.

### Extreme Cold

The Study will evaluate an extreme cold scenario representing an intense cold snap event in the Pacific NW, concurrent with a widespread peak winter condition in the Inland region. This scenario case will be developed by modifying the WECC 32HW1a1 power flow base case to represent 2029-30 projected load conditions based on a combination of historic load data and stressed (e.g. 1-in-20) utility load forecasts.

In the extreme cold scenario, the Pacific NW will be modeled at a light-wind condition. Historic records for wind coincidence with cold temperatures will be modeled for Alberta, Montana, Idaho and surrounding Inland regions. A low hydro ($10^{th}$ percentile) river availability will be modeled using BPA's power planning models and other data sources to supplement and/or replace ADS hydro assumptions. This represents a system condition where the Study footprint is potentially reliant on significant imports from surrounding regions and provides the opportunity to evaluate the impacts of that reliance. The Study will also aim to identify any resources that may have restricted or limited output due to the extreme cold temperatures.

The Study will also seek to include any other lessons learned or issues identified for recent Texas events such as planned maintenance practices and generation availability. The Study may also evaluate impacts due to a lack of availability of natural gas (both generation facilities and natural gas pipeline availability) during the extreme cold, to the extent the system could still operate.

Operationally "always credible" contingencies will be simulated to validate the performance of the system prior to, and following, any proposed system reinforcements. These contingencies will include single transmission lines and transformers, as well as select bus, breaker and common-mode failure contingencies. The Study will additionally evaluate select regionally significant extreme contingencies, based on historical data or other known risks, to simulate more extreme events such as ice storms.

Transmission lines and transformers may be evaluated with either increased or decreased ratings, as determined by each individual transmission provider's facility ratings practice, for the extreme temperature and wind conditions. Facility ratings assumptions used in the Study will be documented in the report.

### Wildfire Events

The Study will evaluate the potential impacts of widespread wildfire events following proactive Public Safety Power Shutoff ("PSPS") measures and extreme outage conditions. The purpose of this analysis will be to evaluate system integrity on a grid-level, the ability to continue to operate the grid following next contingencies and the risk of Cascading, islanding and uncontrolled separation. The Study will assume that local system restoration may be significantly delayed resulting in significant extended customer impacts. This Study will consider impacts on resource availability and the ability to reliably operate in the post-event state. Importantly, the Study may not address locally significant impacts or the effectiveness of individual utility PSPS plans.

Smog produced by wildfire may cause a temperature cooling effect in some locations. The wildfire case will be developed by modifying the WECC 32HS1a power flow base case to represent 2030 projected 80th percentile loads, or as appropriate based on SCADA and state estimator snapshots of recent historic events. This may be approached as a modification of the Extreme Heat case using simple scaling of loads.

Utility records, WECC reporting and other sources for historical information will be consulted for transmission lines and facilities that have been taken out as PSPS and as result of wildfire damages or power system constraints.

Based on recent wildfire events the Study will evaluate a minimum of two extreme outage condition scenarios. Additional scenarios may be evaluated as determined by Study participants and based on results seen in the extreme heat analysis.

Scenario 1: Forced outage of the Cross-Cascades transmission lines approaching BPA Ostrander substation.

- Simulate operationally "always credible" contingencies, determine how much of I-5 thermal generation is required to maintain reliable load service.

Scenario 2: Forced outage of the Cross-Cascades transmission lines approaching BPA Marion substation out of service (such as occurred in September 2020).

- Simulate operationally "always credible" contingencies, determine how much of I-5 thermal generation is required to maintain reliable load service

## Existing Data Analysis

The participants will determine the extreme load level to be modeled by season. SCADA historical data and state estimator snapshots may be used as data sources to help inform the baseline case assumptions. Then the WECC 2032HS1, 2031-32HW1, and 2033LSP1 load levels will be analyzed and adjusted to the agreed extreme. Resources identified in the WECC 2022 Load and Resource data submission that have been added to buses in 2032ADS-Seed_Case will be dispatched based on 1.) the Production Cost Model (PCM) resource dispatch matching the power flow case hours, or 2.) a dispatch level specified by the participants.

### Topology

- As determined by each transmission provider, the Study may consider evaluating certain existing planned projects as not being in-service initially, and then evaluating the ability to bring such projects online if the Study shows a need.
- Any planned generation facility retirements or modifications included in utility IRPs for 2030 will be included in the Study. If the Study identifies system constraints resulting from these planned generation facility retirements or modifications during extreme conditions, the constraints will be documented and potential mitigation options identified.
- The Study will consider preferred portfolio resources in 2032ADS-Seed_Case offline initially if case can accommodate and may need to model these preferred portfolio resources online in the initial case due to gas and wind resource availability assumptions. The Study will model transmission upgrades needed to integrate these preferred portfolio resources with the broader transmission grid and document these assumed integration upgrades, but will not seek to determine or model specific generation facility interconnection requirements.

### Stressed Conditions

- The Study will consider appropriate interchanges with California and British Columbia based on historic data and entitlement obligations. This may include reduced exports in line with historic peak conditions and any expected changes due to continued energy policy needs. The area interchange assumptions and adjustments made to areas external to the Study footprint will be documented in the Study. While this is not a resource adequacy Study, the Study will seek to identify transmission constraints driven by resource availability internal to the Study footprint. Any potential need for increased reliance on neighboring systems will be documented and mitigation options internal to the Study footprint will be identified as alternatives to this increased reliance.
- Historic data sources for loads and resources may include all or some of the following:
    - PCM data to determine high coincidence conditions.
    - SCADA, PI-historian and other historical data records from participants
    - Temperature data from NOAA and other national weather data sources.

## Identification of Transmission Mitigations and Solutions

The participants will propose transmission solutions to resolve reliability issues and transmission availability constraints. Transmission mitigations available by 2030 may include, but are not limited to, transmission rebuilds within existing rights-of-way, transformer additions/replacements, bus reconfigurations and upgrades, other flow control measures. The Study may also identify planned resource retirements or modifications that could result in reliability issues during the evaluated conditions. If the Study identifies system constraints resulting from these planned generation facility retirements or modifications during extreme conditions potential mitigation options may include, but are not limited to, resource additions, resource replacement or transmission reinforcement. Additionally, the ability to charge energy storage solutions will be evaluated to determine if the transmission system is adequate to both deliver power during peak times and supply storage resources during other hours.

The Study may also help to identify further transmission solutions that could provide longer-term mitigation but may require additional time beyond 2030 to fully plan, design, permit and construct.

The proposed mitigations and solutions will be evaluated in the scenarios for effectiveness and limitations. Stakeholder input will be sought on the proposed solutions and used to form the Study results and reporting.

## Major Study Milestones

The Study will focus first on evaluation of the extreme heat and extreme cold scenarios and will use the results of those analyses to inform the model assumptions of the wildfire scenario.

### Scoping

- Initial Stakeholder Engagement Workshop: August 18, 2022
- Draft Scope: September 8, 2022
- Stakeholder Scoping Workshop: September 22, 2022
- Pre-Final Study Scope: October 6, 2022
- Final Study Scope: October 20, 2022

### Extreme Summer and Extreme Winter

- Initial Case Development: November 2022
- Initial Results: December 2022
- Develop Initial Mitigation Solutions: January 2023
- Stakeholder Workshop on Initial Results and Proposed Solutions: February 2023
- Analysis with Proposed Solutions: March 2023
- Draft Final Results and Report Workshop: April 2023
- Final Report: May 2023

### Wildfire

- Develop Case from Extreme Summer Scenario: March 2023
- Initial Results, Develop Initial Mitigation Plans: May 2023
- Stakeholder Workshop on Initial Results and Mitigation Plans: June 2023
- Final Analysis: July 2023
- Draft Final Results and Report Workshop: August 2023
- Final Report: September 2023