Transmission Services

Transmission Planning

2019 Transmission System Assessment Assumptions and Methodology

March 2019

Executive Summary

Attachment K is a FERC requirement for sharing information about the planning process and developing a transmission expansion plan that covers a 10-year planning horizon. This plan identifies projected transmission reinforcements based on forecasted load growth, projected firm transmission service commitments, interconnection requests, and BPA's annual System Assessment. The System Assessment examines the performance of the transmission system under a variety of system conditions and compliance with NERC's TPL-001-4 Reliability Standard.

This document describes the assumptions and methodology used for the current System Assessment.

Introduction

One of the primary objectives outlined under FERC Order 890 Attachment K is the development of a Transmission Plan that meets the Transmission Provider's reliability, safety, economic and environmental objectives in the most cost-effective manner. The goal of the Transmission Plan is to identify projected long-term transmission needs and system reinforcements on the Transmission Provider's system to meet the NERC TPL-001-4 Reliability Standard.

The process to develop the Transmission Plan includes the following:

- Perform an annual assessment of BPA's transmission system performance for Near Term (1-2 and 2-5 years out) and Long Term (6-10 years out) timeframes.
- Develop system reinforcement plans expected to allow BPA's Transmission System to meet applicable Planning Criteria and Standards throughout BPA's 10-year planning horizon.
- Address reliability needs as well as interconnection and transmission service requests on the Transmission Provider's system.
- Consider plans and proposed projects developed by neighboring systems, and sub-regional and regional planning processes.
- Develop plans of service from a one-utility perspective that meet economic, environmental, public policy obligations, and other objectives of the system.

Attachment K requires that BPA, in coordination with stakeholders and other interested persons, shall perform a system reliability assessment (System Assessment). The System Assessment determines the ability of the BPA system to serve its network load obligations and other committed long-term transmission obligations within the planning horizon. This document describes the assumptions and methodology used for the current System Assessment.

Planning Assumptions

The major assumptions that form the basis of the System Assessment study are load forecasts, generation, and existing transmission facilities as well as planned future transmission upgrades and additions. The NERC Standard TPL-001-4 permits the use of current or qualified past studies for the System Assessment.

BPA utilizes approved base cases developed by the Western Electricity Coordinating Council (WECC) to represent the Near Term and Long Term planning horizons for the System Assessment. BPA updates these cases as necessary and establishes the system patterns to study, including generation dispatch and loading on interties and flow gates.

The 2019 System Assessment primarily utilizes qualified past studies from the 2017 and 2018 System Assessments. The base cases for those studies originated from WECC approved base cases representing the following years and seasons:

Base Cases

- 2019 Summer peak load conditions (Near Term)
- 2019 Winter peak load conditions (Near Term)
- 2019 Spring off-peak load conditions (Near Term)
- 2023 Summer peak load conditions (Near Term)
- 2023 Winter peak load conditions (Near Term)
- 2028 Summer peak load conditions (Long Term)
- 2028 Winter peak load conditions (Long Term)

BPA updates these base cases with the latest network topology, potential future resources, and seasonal load forecasts.

Validation

The NERC Standard TPL-001-4 requirement R2.6 allows qualified past studies to be used to support the current System Assessment if the past studies are 5 years old or less and no "material changes" have occurred to the system since the past study. Studies older than 5 years may be used if a technical rationale can be provided to demonstrate that the results of an older study are still valid.

The 2019 System Assessment primarily utilizes qualified past studies from the 2017 and 2018 System Assessments. To ensure the 2017 and 2018 studies are still valid for 2019, several factors were considered, including:

- Load forecast – The load forecast assumed in the past studies are compared with the latest forecast for each load area. If there are no significant differences between them, then the past studies are still valid in terms of the load forecast.

- Historical Peak Loads – Historical data for summer and winter peak loads is analyzed to see if loads in the area reached any new peaks since the past studies were completed. If there were no new peak loads recorded, then the past studies are still valid in terms of the peak area load.

- Topology – The network topology (transmission and generation) modeled in the past studies is compared with the latest network topology information to determine any major changes. If there have been no major topology changes since the past studies were completed, then the past studies are still valid in terms of network topology.

Applying these factors ensured that the studies from 2017 and 2018 were qualified past studies to use as the basis for the 2019 system assessment.

Planning Criteria

BPA plans the transmission system to meet the performance criteria contained in the NERC TPL-001-4 Reliability Standard and the WECC Reliability Criteria (TPL-001-WECC-CRT-3.1). These require that the transmission system be planned to supply projected customer demands and firm transmission services over the range of forecasted system demands. System performance has to meet the standards under a wide variety of conditions including the loss of single or multiple transmission elements such as transmission lines, transformers, and generators. The system must remain stable and both thermal and voltage levels must be within applicable ratings under these conditions.

Load Modeling

The transmission system is planned to meet the performance criteria contained in the NERC TPL-001-4 Reliability Standard over a range of forecast demand levels. To comply with these requirements, BPA utilizes peak load forecasts over a 10-year horizon. Any material changes to the load forecast information for both winter and summer seasons is identified annually with customer input and incorporated into the model.

Resource Modeling

Existing generating resources or resources with firm transmission contracts for the Near Term (both 1-2 and 2-5 years) planning horizon are modeled in the studies. The existing resources with firm transmission contracts in the region are adequate to meet peak load and firm export requirements in the Near Term. In the Long Term, if the internal resources (with firm transmission contracts) in the Pacific Northwest system are not sufficient to meet winter peak load levels, diversity in regional peak loads can be leveraged to make up the difference with intertie imports. In the base cases representing the Long Term planning horizon, some proposed future resources may be modeled to meet the forecasted loads.

With several thousand megawatts of installed capacity in the Northwest, wind generation can have a significant effect on transmission system performance. Baseline studies assume zero output from wind generation as loads must be served regardless of wind generation output. The studies also include the impact of higher wind generation output where appropriate for the affected areas.

Firm Transmission Service

The NERC TPL-001-4 Reliability Standard requires an evaluation of the transmission system's capability to accommodate firm transmission service commitments. It also requires the development of plans to address existing long-term firm transmission service commitments during the planning horizon. There should be no loss of load or curtailment of firm transfers for normal system conditions or single element outages, with the exception of up to 75 MW subject to a stakeholder process. Planned and controlled loss of demand or curtailment of firm transfers is allowed for multiple element outages.

Remedial Action Schemes

Remedial Action Schemes (RAS) is a set of fast, automatic, event-based control actions used to ensure acceptable power system performance. For the studies, existing RAS is modeled when appropriate based on the system conditions modeled.

Future Projects

Conceptual projects that may mask existing system issues are typically not included in the base cases. The only future projects included in the studies are those where the sponsoring utilities have made firm commitments to build the project within the planning horizon. Typically, these projects are currently under construction or have funding approval and are included in scheduled work plans. By including only these committed projects, the next level of potential transmission reinforcements can be identified.

Transmission Facility Ratings

BPA transmission facility ratings included in this study are based on the most recent information available. Ratings for neighboring utility facilities are provided by the owner of the facility. Seasonal ratings are applied whenever such information is available.

Sensitivity Cases

From the initial set of WECC-approved base cases, additional base cases are also developed as sensitivities to represent other "stressed" patterns or system conditions. These sensitivities may vary one or more of the following conditions:

- Load level, load forecast, or dynamic model assumptions
- Expected transfers
- Expected in service dates of new or modified Transmission Facilities
- Reactive resource capability
- Generation additions, retirements, or other dispatch scenarios
- Other system conditions unique to specific geographical areas

Planning Methodology

System Assessment

The annual System Assessment uses current or qualified past studies as required by the NERC Reliability Standard. The system with all facilities in service is examined to assess whether the NERC TPL-001-4 Reliability Standard is met. Potentially deficient areas are noted for follow-up and possible corrective action plans.

Next, a comprehensive contingency analysis examines all credible single element outages of transmission facilities for each of the base cases. Outages that result in facility loadings exceeding their thermal ratings or voltages outside of accepted guidelines are identified and reviewed to determine the necessity of additional studies or corrective action plans. In addition to the single element outages, selected credible multiple element contingencies are studied. The System Assessment includes simulations of breaker failures, bus faults, the loss of lines on common towers (double circuit lines), as well as extreme events, such as loss of entire substation(s) and applicable common corridor outages.

The System Assessment includes evaluations of steady state, voltage stability, transient stability, and short circuit performance for compliance with the NERC TPL-001-4 Reliability Standard and WECC Reliability Criteria. For the steady state performance, equipment loadings are required to be within their applicable ratings and voltages within accepted guidelines. For voltage stability performance, the system is evaluated for adequate margin. For transient stability performance, system oscillations must be stable and damped and should meet the voltage performance requirements.

Short circuit studies are performed for the Near Term planning horizon by simulating single phase and three phase faults throughout BPA's network and monitoring the resulting fault current at substations. The fault current is compared with the ratings of the circuit breakers at the substations to determine whether the breakers have adequate interrupting capability. If the calculated short circuit current exceeds the rating of a breaker, a corrective action plan is developed. Typically, BPA will replace the under-rated breaker with one possessing a higher short circuit rating. BPA has an annual switchgear replacement program that incorporates these circuit breaker replacements.

The results of the System Assessment with supporting studies are used to compile a list of areas with potential system deficiencies for further verification and development of solutions. When completed, the availability of a summary of the System Assessment results is posted to the BPA Attachment K web page.

Develop Conceptual Solutions

For those areas where the System Assessment indicated potential deficiencies in performance, conceptual solutions are explored to correct the problems. These plans may include transmission expansion projects, facility upgrades, and/or non-wires solutions such as energy efficiency, distributed generation, redispatch, or demand side management.

Cost Estimates for Conceptual Solutions

Preliminary cost estimates are developed for the conceptual solutions. These preliminary estimates, in addition to technical performance, are considered when determining the most efficient and cost-effective plan of service.

Develop Plan of Service for Preferred Solution

Plans of service are developed for viable conceptual solutions. This development follows a process that includes:

1. Establishing a project team and drafting a preliminary Project Requirements Diagram (PRD).
2. Drafting a Concept Design Document (CDD) with input from several workgroups during project scoping.
3. Finalizing the plan of service and PRD and updating cost estimates.
4. Developing a business case and requesting capital-funding approval for the project.

Projects most likely to be funded and pursued are documented in the BPA Transmission Plan, which is updated annually at the end of each calendar year and posted on the BPA Attachment K webpage at the completion of the planning cycle.