



# ColumbiaGrid 2016 System Assessment Study Plan

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*December 15, 2015*

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## Introduction

The foundation for the Biennial Transmission Expansion Plan is the ColumbiaGrid System Assessment, which is an evaluation of whether or not the planned transmission grid can meet established reliability standards (Primarily NERC and WECC Transmission Planning standards) and to identify Order 1000 Needs from the Order 1000 Potential Needs that were suggested to ColumbiaGrid. Any deficiencies in meeting these standards are noted in the System Assessment and then addressed either by the Planning Coordinators or Transmission Planners themselves or through ColumbiaGrid Study Teams. This document provides details on the planned process used at ColumbiaGrid to produce the 2016 System Assessment study results. In addition, it provides a summary of the approach that ColumbiaGrid will use to identify Order 1000 Needs.

Details specific to the 2016 System Assessment, such as selected cases, planned projects included in the cases, and current status, can be found in the “2016\_SystemAssessment\_StuyPlanDetails.xlsx” excel file available upon request.

## System Assessment Timeline

Below is an approximate timeline for the System Assessment that shows details for data preparation and results processing. A detailed timeline is distributed each study cycle.



## Study Case Development

### Study Years & Base Cases

The information regarding the study scenarios from Transmission Planning (TPL) standard TPL-001-4 were used to identify the study scenarios as listed in the table below.

Study Year	Loading Condition		Study Scenarios			
	Peak Load	Off-Peak Load	Steady State Base	Steady State Sensitivity	Short Circuit	Transient & Voltage Stability
Year One or Year Two	X	X	X	X	X	X
Five Year	X		X	X		
Long-Term	X		X			X

TPL-001-4 requires steady state analysis to be done on base assumption cases for year one or year two peak load, year five peak load, one to five year off-peak load, and long term peak load. To meet the steady state requirements ColumbiaGrid initially develops two base assumption cases for each of the peak load cases (heavy summer 2, 5, and 10 year cases and heavy winter 1, 5, and 10 year cases) and one 2 year off-peak case for the System Assessment. TPL-001-4 also requires sensitivity cases to be studied for the one or year two peak load, year five peak load, and one to five year off-peak load cases. These cases are included in Biennial Plan and are built off the System Assessment base assumption cases. These cases are built off of approved WECC cases. The process starts in November by determining the study years for the cases and selecting base cases.

### Determining Study Years

Study years are determined based off of the projected end of the System Assessment process which is mid-summer of the Assessment year. The table below shows how the study years for the System Assessment cases are determined. The off-peak case study year is determined annually based on the availability of approved WECC cases.

	Summer Cases	Winter Cases	Summer Example	Winter Example
Year One or Year Two	Study Year +2	Study Year +1	2015 + 2 = 2017	2015/16 +1 = 2016/17
Five Year	Study Year +5	Study Year +5	2015 + 5 = 2020	2015/16 +5 = 2020/21
Long-Term	Study Year +10	Study Year +10	2015 + 10 = 2025	2015/16 +10 = 2025/26

### Selecting Base Cases: (November)

Typically the strategy used for selecting base cases is to select recently approved WECC cases that closely represent current system topology and the desired seasonal system conditions. The previous year's System Assessment cases may be selected as the new base cases if case availability is limited or it

is viewed as a better starting point than the WECC cases and the previous year's cases were built from WECC cases. The topology and resources for these cases are adjusted to create the study cases. These cases will be selected by the members at the beginning of each study cycle.

### **Building Study Cases: (December-January)**

After base cases are selected, the study cases are developed with the intention of completing them prior to building the contingency lists in February.

### **Base Topology: (December)**

Based on historical WECC base case development scheduling, the most ideal case topology to build the base system topology is the most recent heavy summer and light summer operating cases. These cases are typically built right before the start of the System Assessment process. The assumption is that the topologies of these cases are the most accurate. Starting in mid-November the base topologies for all other base cases should be updated by the members to match as closely as possible to these cases. The goal is to finalize the base topology by the end of December.

### **Ten Year Plan: (December)**

The ColumbiaGrid Ten-Year Plan comprises a list of projects planning participants are committed to build in the coming years to address known transmission deficiencies. The projects in the ten-year plan fill a variety of needs such as serving load, integrating new resources, or facilitating economic transfers. To be included in the plan, the projects need to be committed projects that are typically in the permitting, design, or construction phases. The projects in the plan may have been generated in a variety of forums such as earlier System Assessments, studies completed by the study teams, or individual planning participant studies.

Also starting in mid-November the Ten-Year Plan is reviewed and should be finalized by the end of December. Starting in January the base cases should be adjusted to match the finalized project list. To maintain data quality the Ten-Year Plan will not be adjusted after it has been finalized unless the change would invalidate the System Assessment if it is not done. Participating members would make this determination.

### **Loads: (January)**

In January the members will also be asked to direct ColumbiaGrid on how to adjust loads for the System Assessment cases. The preferred options to do this are to either provide a file that updates the loads for each of the cases to the desired levels or to provide specific levels for ColumbiaGrid to scale their loads. Unless directed otherwise ColumbiaGrid would scale a participant's load by scaling only the loads designated as scalable in the base case until all of that participant's loads reach the desired level. A constant P/Q ratio would be maintained. Any expected changes to block loads for scaling should also be provided.

## Resources: (January)

All generation patterns for the System Assessment cases will initially be set to the associated seasonal WECC base case. Initial adjustments to this pattern should only be the results of corrections to better represent expected generation patterns (such as adjusting wind generation output levels) or justified changes such as a new resource or the retirement of an existing resource. Balancing of the area will be done via interchange adjustments (typically from California).

## Interchanges: (January)

Interchanges are used to balance the case and stress the case. This is primarily done with the interchanges with Canada and California. The remaining interchanges are typically untouched. The California interchange is used to balance the system and the Canadian interchange is used to stress the system. Currently, the Canadian interchange is set to 2300 MW North-to-South for summer peak cases and 1500 MW South-to-North for winter peak cases to reflect current firm transmission service commitments on the Westside Northern Intertie (Path 3). Interchange adjustments are also done in January.

## Finalizing the Study Cases: (January)

After the loads, resources, and interchanges are adjusted the study cases will be sent out for final review. If the cases are accepted by the members they will be used to build the contingency files starting in February.

## Contingencies

### TPL Contingencies & Automatic Actions: (February)

After the study cases have been finalized contingency files should be provided to comply with TPL-001-4 and WECC criterion TPL-001-WECC-CRT-2.1. A detailed description of what is needed to be submitted is described in the “ColumbiaGrid System Assessment Contingency Methodology” paper. It is suggested that a base list is created for the One-Year cases and then provide individual change files for each Ten-Year Plan project or change files for each of the 5 year and the 10 year cases. This occurs in February so processing and reviewing contingency results can occur in March and April.

### Processing Contingencies

This section describes the method used to process contingency lists.

### Limit Monitoring

The following limit monitoring settings are used for System Assessment contingencies:

- Seasonal normal and post contingency/emergency branch thermal limits are monitored based on WECC’s convention (i.e. summer normal = limit A, summer emergency = limit B, winter normal = limit C, winter emergency = limit D, etc.)
- Radial lines and buses are not monitored.
- Only elements in Area 40 (Northwest) are monitored.

- Branch violations are only flagged if branch flow increases by more than 1%.
- Bus violations are only flagged if bus voltages change by more than 0.02 per unit.
- Bus voltage monitoring settings are supplied by participants.
- Bus voltage change of greater than 5% (based on WECC criteria).
- Voltage angle change of more than 5 degrees across branches opened in a contingency. Only angles more than 30 degrees are reported.

### **Post Contingency Solution Settings**

The post contingency solution settings differs from the default pre solution settings by not allowing most switched shunts, LTCs, and phase shifters from operating to mimic the system conditions right after the contingency occurs. SVC devices and automatically controlled shunts are allowed to operate. Participants must provide which shunts are automatically controlled to properly model the post contingency system condition. Post contingency solution settings are used for any contingency that has a solution embedded into the contingency definition. This allows participants to document the system condition for PRC-023 for N-1-1 conditions.

### **Results Review Methodology: (March-April)**

Initially all study cases are reviewed of violations without outages (N-0 conditions). Any voltage violations or facility overloads that could not be resolved through tuning the cases are provided to the participants and reported in the System Assessment.

The provided TPL-001-4 and WECC criterion TPL-001-WECC-CRT-2.1 contingencies are then processed. All results are managed in an Access database, reviewed for accuracy and provided to participants for review. The results are pared down for additional study by the following criteria:

- N-1-X: All contingencies results with an initial outage conditions (i.e. P3 or P6) are studied for informational purposes only. Results are shared with all participants but no mitigation is suggested for these outages.
- Single System: Events where the outage facility and the overloaded facilities were owned by the same utility are assumed to be the responsibility of that utility to mitigate and are not reported in the System Assessment. The System Assessment focuses on joint issues where the outages and associated violations are owned by multiple participating utilities and joint transmission planning may be needed.

The remaining violations and any unsolved outages are further explored for validity. All violations that are confirmed to be valid violations are reported in the System Assessment.

### **Identify Order 1000 Needs: (January-June)**

Order 1000 Potential Needs that were submitted to ColumbiaGrid will be evaluated the possibility to be included in the upcoming System Assessment. In this planning cycle, the process started on January 18, 2015 when ColumbiaGrid sent notifications requesting suggestions regarding Order 1000 Needs to be submitted to ColumbiaGrid prior to the Order 1000 Needs Meeting that was held on February 5, 2015.

Any Order 1000 Potential Needs that were received will be discussed during the Order 1000 Needs Meeting.

Following the completion of the Order 1000 Needs Meeting, the process continues with the evaluation of the Order 1000 Potential Needs to identify Order 1000 Needs that are vetted during the System Assessment process. As part of the evaluation process, ColumbiaGrid will implement applicable screening studies of the Order 1000 ColumbiaGrid Planning Region using the Order 1000 Planning criteria and Order 1000 Needs Factors to identify Order 1000 Needs from the Order 1000 Potential Needs. The results of the validation are reported in the System Assessment and Need Statement documents that will developed as part of the System Assessment.