



**NTTG Study Plan  
for the  
2014 - 2015 Public Policy Consideration Scenario**

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## 1. Executive Summary

During Quarter 1 of the NTTG 2014-2015 Regional Planning Cycle, the Renewable Northwest Project ("RNP") submitted a Public Policy Consideration (defined in the NTTG Funder's Attachment K) request for a scenario analysis study for the NTTG 2014-15 transmission planning cycle. This study plan outlines the Northern Tier Transmission Group ("NTTG") study process to assess the 2020 retirement of Colstrip Power Plant ("Colstrip") units 1 and 2 and integration of replacement wind resources at the Broadview substation. The results of the analysis may inform the 2014 - 2015 and future Regional Transmission Plans, but will not result in the inclusion of additional projects in the 2014 - 2015 Regional Transmission Plan.

## 2. Study Assumptions

Request from RNP: Retire Colstrip units 1 & 2 (305 MW net per generator after accounting for auxiliary load) and replace with 610 MW of wind in Montana.

Assumptions:

- 100% of the 610 MW will be exported on Path 8,
- The 610 MW of new wind at Broadview substation will be modeled as two 305 MW wind farms; the entirety of one farm can be tripped at a time,
- The wind farms are connected to the Broadview 500kV transmission bus through radial feeds,
- This change occurs in 2020, and
- No new transmission lines or facilities, beyond those already planned for operations in the year 2020.
- For any contingency that results in a loss of generation, generators in the Western Interconnection will be re-distributed according to their participation factor to account for the loss.

## 3. Base cases

Two of the five base cases that were derived for the NTTG Regional Transmission Plan development will be used for the PPC analysis. The cases are:

- Summer Peak (peak coincident NTTG summer load condition), and the
- NW-MT Case (Path 8 high slow condition).

For each of the selected base cases, there will be three scenarios:

- No changes to Colstrip, this case will be considered the "baseline,"
- Both Colstrip units 1 and 2 offline, and
- Both Colstrip units 1 and 2 offline with the addition of the 610 MW wind at the Broadview substation.

#### **4. Power Flow Analysis/Study Criteria**

Power flow studies will be evaluated under steady-state (N-0), single (N-1) and credible double contingency (N-2) conditions to ensure the transmission system meets the system performance requirements defined in the planning standards.

##### *Steady-State (N-0) Conditions*

Under steady-state conditions, bus voltages must be maintained between 0.95 p.u. and 1.05 p.u., unless specific minimum operating voltage requirements exist. All line and transformer loadings must be below normal continuous ratings.

##### *Single Contingencies (N-1)*

- Colstrip – Broadview 500 kV A or B line
- Broadview – Garrison 500 kV #1 or #2 line
- Garrison – Taft 500 kV #1 or #2 line
- Taft-Bell 500 kV line
- Taft-Dworskak 500 kV line
- Taft-Hot Springs 500 kV line
- Broadview 500/230 kV bank #3
- Garrison 500/230 kV
- Loss of 1 large Colstrip unit
- Langdon-Cranbrook 500 kV outage
- Antelope - Brady 230 kV line
- Mill Creek - Antelope 230 kV line
- Mill Creek - Garrison 230 kV line
- Mill Creek - Anaconda (BPA) 230 kV line
- Mill Creek – South Butte 230 kV line
- Mill Creek - Dillon Salmon 161 kV line
- Dillon Salmon - Big Grassy 161 kV line
- Big Grassy - Jefferson 161 kV line
- Hemingway - Summer Lake 500 kV line
- Hemingway – Boardman 500 kV line
- Statewide N-1, 100 kV and above

##### *Credible Double Contingencies (N-2)*

- Colstrip – Broadview 500 kV A and B lines (Category D)
- Broadview – Garrison 500 kV #1 and #2 lines
- Garrison – Taft 500 kV #1 and #2 lines
- Colstrip – Broadview –Garrison 500 kV, one circuit each segment
- Broadview – Garrison - Taft 500 kV, one circuit each segment
- Garrison – Taft – Bell 500 kV, one circuit each segment

### *Performance Criteria*

The power-flow simulation performance results will be measured against the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) system performance criteria. Specifically, the NERC Reliability Standards TPL-001 and TPL-002 b requires transmission facilities to operate within normal and emergency limits.

- Changes in bus voltages are allowed provided they remain above 0.9 p.u. and below 1.1 p.u. Changes in bus voltages from pre- to post-contingency conditions must be less than 5% for single (N-1) contingencies, and 10% for double (N-2) contingencies for neighboring regions.
- All equipment must be at or below their normal ratings under normal system conditions.
- All line, series capacitors, and transformer loadings must be at or below their emergency rating (or normal rating if no emergency rating is given), for both N-1 and N-2 contingencies.

### *Performance Violation Mitigation Method*

Should a contingency cause thermal overloads, then an exploration of tripping either wind, coal or a combination of both will take place to alleviate the overload(s). It is assumed at this time that the tripping of either wind, coal or a combination of both will completely alleviate any overloads that may be observed during the study. The amount of generation tripped will be based on expected responses based on Northwestern Energy's experience with the Acceleration Trend Relay ("ATR") remedial action scheme.

For this power flow analysis, the study team will trip generation based on the expected response from the ATR given historical performance. The ATR is a computer based relay which is designed to protect the Colstrip generators and to prevent unstable events from disrupting the interconnected grid in the Western Interconnection when faults and line outages occur on the Colstrip transmission system. The ATR is calibrated to prevent the violation of the WECC dynamic voltage dip performance criterion which assures stable performance. The device monitors the real-time speed and acceleration of the four Colstrip units. It uses this information to assess the dynamic performance of the units and thus detect unstable events in progress. When a contingency occurs that could cause an unstable result, the ATR trips generators as necessary to restore the system to a stable operating condition. As stated above, this study will be done strictly with power flow and simulated ATR response, dynamics analysis will be required to verify the ATR performance for the contingencies that result in performance violations.

## **5. Results Reporting**

In the event that tripping either wind, coal or a combination of both alleviates overloads observed on the 500 kV system during contingency, then the following steps will take place and be documented:

- Initial overloads.
- Results of tripping wind only.
- Results of tripping coal only.
- Results of tripping a combination of wind and coal.