



# Colstrip Transmission Study Update:

*Answering the technical questions about using the Colstrip transmission system for new resources.*

**Prepared for: Montana Wind and Transmission Working Group**

# Overview

- Caveats and Disclaimers
- Background
- Previous Studies and Conclusions
- 2016 NTTG Study Request
- Remedial Action Schemes (RAS)
- Synchronous Condensers
- Discussion



# Renewable Northwest

- Established in 1994 as the Renewable Northwest Project
- Mission to promote the expansion of environmental responsible renewable energy resources in the Northwest
- Staff of 10 experts in regional energy policy across the spectrum from generation and transmission to distributed resources, integration, and storage
- Nearly 60 member organizations across the spectrum from industry to advocacy, for-profit to non-profit



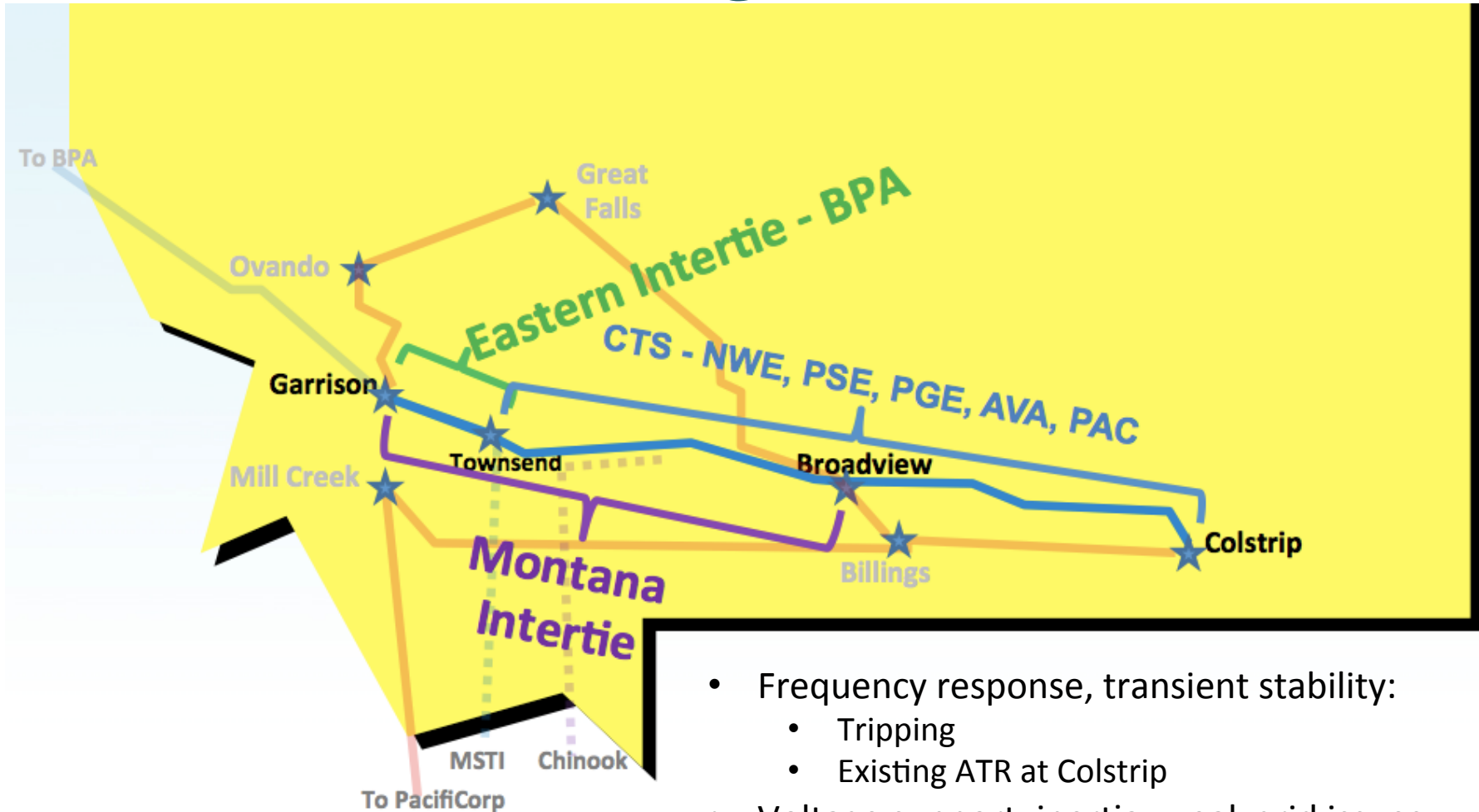
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Northwest

# Caveats and Disclaimers:



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# Background:



- Frequency response, transient stability:
  - Tripping
  - Existing ATR at Colstrip
- Voltage support, inertia, weak grid issues



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# Previous Studies #1: NTTG 2014-15 Public Policy Study

## Question:

- Looked at a case where Colstrip 1&2 are retired
  - 610 MW of new wind was built.
    - Two 305 MW wind plants capable of being tripped individually.
    - Connected at Broadview
- Steady-state power flow analysis only!
  - Assumed ATR would perform the same as today.

# NTTG 2014-15 Public Policy Study

## Conclusion:

*“Under **idealistic** conditions, it **may** be possible that two 305 MW sources of wind generation... ....**might** replace the net output (610 MW) of the coal-fired generation at Colstrip. **However**, given a Colstrip 1 and 2 plant retirement, it is very likely the response of the ATR may change. **The results of this analysis do not suggest or imply that a one-for-one substitution of wind for coal is feasible without further analysis.**” (March, 2015)*

# Previous Studies # 2:

## Northwestern Energy “EPA 111-D Consideration: Retirement of CS units 1&2”

### Question:

- Looked at a case with Colstrip 1&2 retired
- Included various replacement scenarios:
  - All wind (300 MW)
  - All gas (300 MW)
  - Wind (300 MW) and gas (300 MW) mix
  - Broadview, Colstrip, and Alkali Creek interconnections
- Did the steady-state **and** the dynamic analysis.

# Northwestern Energy “EPA 111-D Consideration: Retirement of CS units 1&2”

## Conclusion:

- “The transmission system responded similarly to outages for all eight cases, both steady-state and dynamically, and was capable of achieving 2200 MW of exports on Path 8.”
- “The path capacity would not change and frequency concerns would lessen.”
- “The addition of an alternate resource in place of coal will have an effect on the response of the ATR and **may very well necessitate** the design of a new RAS.”
- “Again, these result neither suggest nor imply that a one-for-one substitution of coal at Colstrip for another type of generation is feasible without further study or possible system upgrades.” (April, 2015)

# Previous Studies #3:

## Western Wind and Solar Integration Study Phase 3 (NREL)

### Question:

- High mix of wind and solar around the WECC, including Montana
- Looked at high penetrations of renewables with and without one of the Colstrip units running
- Stability analysis, three-phase fault at the Broadview 500 KV bus.

# Previous Studies #3:

## Western Wind and Solar Integration Study Phase 3 (NREL)

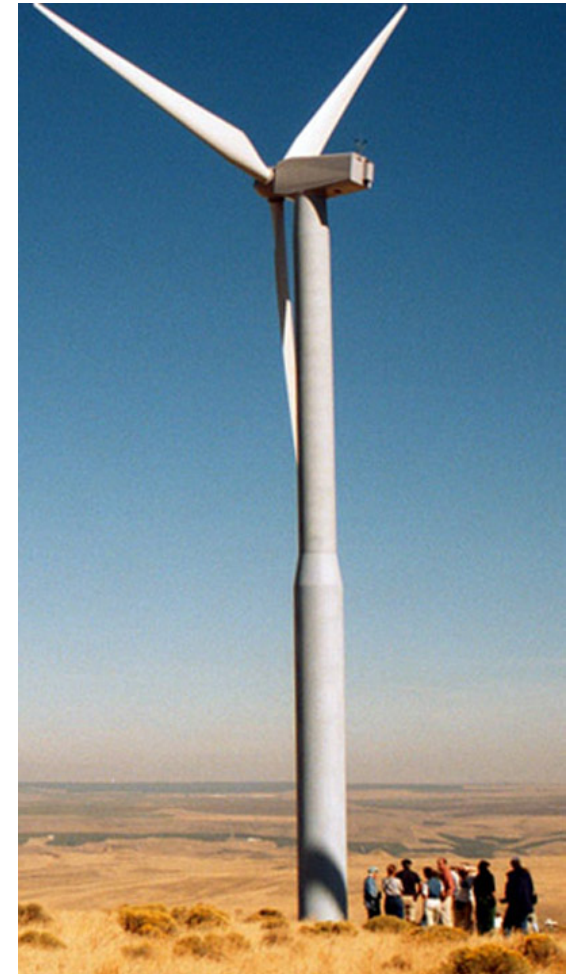
### Conclusion:

- “The angle change shows that the acceleration of the [Colstrip] units is lower in the Hi-Mix case, a significant consideration because of the specialized type of stability protection used there [ATR].”
- “This result suggests that stability is not degraded in the Hi-Mix case, and arguably is slightly improved ... .. **But it does not show conclusively** that the stability will inevitably improve.”

(April, 2015)

# Current 2016 NTTG Study Request:

- Scenario with CS Units 1,2,& 3 retired.
- Includes dynamic stability analysis.
- Replace with wind (1494 MW):
  - 250 MW Natural Gas
  - Synchronous Condenser
- Results mid-2017



# Additional Data Points:

- **What is the cost of a new RAS?**
  - Previous NWE Interconnection Studies -- \$1-4 M
    - (Projects # 31, 99, 101, and 115)
- **What is the cost of a Synchronous Condenser?**
  - ERCOT 2014 Study new 200 MVA SC= \$43M
  - FirstEnergy converting 1257 MW coal plant to 5 synchronous condensers for \$60M
  - Including a “clutch” on gas plants can provide inertia and voltage support to the grid even when they are not generating.
- **Capability of modern wind turbines:**
  - Synthetic inertial response
  - Voltage support even when not generating
- “Potential Mitigation of Dynamic Reliability Challenges with High Levels of Variable Energy Resources,” GE Energy Consulting, Western Interstate Energy Board. April, 2015

# Going Forward:

- There is a need for clear and complete studies from experts about the challenges and the solutions for transitioning all or part of the CTS to carry new resources.
  - At what point do we face which problems.
  - What are the solutions and the expected costs.



# How do we get there:

- Robust NTTG 2016 Study Report
- BPA and NWE working together
- Leadership to drive results



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# Questions and Discussion:



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