Wind Generation Frequency Response

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Frequency Response Need

- To date, we have not required frequency response from wind
  - Have had enough responsive generation online
  - Penetration levels of wind do not overtake total generation
- As more wind is integrated, there will be times that the wind output replaces too much frequency-responsive generation
  - Prior to this, frequency response will need to be available on wind generation
  - Risk of under-frequency load shedding if we miss this target
- Unknown at this time what level of wind penetration will cause frequency response issues in WECC
- Also need frequency response available when islanded

Interconnection Requirements

- BPA has updated interconnection requirements
  - Require frequency responsive capability on all new wind facilities
  - Require ramp rate control on all new wind facilities
  - Many more data points required than currently receiving
- At this time, not requiring installed wind facilities to retrofit with frequency response, still need the data from all wind facilities in our system.

When to Enable Frequency Response

- Studies are still being run to determine WECC frequency response with greater levels of wind penetration
- These studies need to find two points
  - At what level of installed wind will WECC possibly run into frequency response issues.
  - At what level of regional installed wind will WECC possibly run into frequency response issues when in an islanded state.
- Following this, BPA will need to calculate when the wind inside the BPA BA will need to turn on its frequency response.
  - Will not be needed continuously, there will probably be enough responsive generation online during on peak hours to meet the frequency response need

Amount of Frequency Response

- Will want enough frequency response to fully respond to a 0.3 Hz frequency deviation.
  - All turbines will need to be feathered by 10% of capacity.
  - This meets the 5% droop requirement for a 0.5 Hz deviation
  - Wind governors should also have 36 mHz deadband, no need to continuously response to minor frequency deviations

How to Enable Frequency Response

- First method, BPA limits wind output to enable wind frequency response for negative frequency deviations
  - BPA currently has the communications set up to automatically limit wind output when in-hour balancing reserves have been exhausted. This could be utilized to limit wind output in order to have the response available by the wind facilities
  - Will need to set a flag to notify wind generators to turn on their governor response capability
- Issue: How will BPA know the amount to limit wind in order to achieve the response required
  - Requiring either estimated output from wind facility, if available
  - Requiring wind speed and direction data if estimate not available.

How to Enable Frequency Response

- Second method: have wind facilities limit output based on their control algorithms
  - BPA sends signal when frequency response is required
  - Wind facilities limit output to level needed to provide response required
- Do wind facilities have the capability of turning on and off governor response? If not, can leave governor response on, but will only see response for over frequency events
- If EMS of facility has a limit in place, will the governor response over-ride the limit or will the facility either not respond or return to limit immediately after response?