

Loss of Wind Resource Study Scope

Introduction

By the end of 2007 there could be approximately 1000 MW (nameplate) of wind capacity connected directly or indirectly to the Public Service of Colorado transmission network. Existing and future projects are listed below.

The high penetration level has raised questions regarding maintaining reliable operations. The RMRG total operating reserve quota for the PSCO Control Area is 289 MW. PSCO Merchant (PSCM) will never dispatch into the 289MW of required reserves except for DCS events.

Study Objectives

Determine what Excess Operating Reserves (Spinning and Non-Spinning) PSCM must maintain to guarantee reliable operations for the PSCO Control Area given high wind penetration.

Methodology

1. Historical data from the four existing PSCO wind sites will be scaled up in proportion to the future wind installations to develop an estimate of future wind patterns.
2. The resources available to respond to wind drop-offs are the following:
 - First: Any Excess Spinning Reserves Required by the PSCO Control Area. (Assume these resources respond within 10 minutes)
 - Second: Any Excess Operating Reserves Required by the PSCO Control Area. (Assume these resources respond within 15 minutes)
 - Third: An unlimited amount of frame CT generation. (Assume these resources respond within 30 minutes)

Any wind drop-offs that cannot be offset by the above three resource types will result in ACE. In the base case, this study will assume that no Required Excess Reserves (categories 1 and 2 above) are available, and will estimate the resulting distribution of ACE excursions.

3. System transmission models will be used to determine whether the base case ACE distribution creates unacceptable reliability risks.
4. If the base case (no Excess Reserves) results in unacceptable reliability risks, the study will test a variety of proposed Excess Reserves Requirements. The study will estimate the resulting ACE distributions, and test whether they create unacceptable reliability risks.
5. The lowest proposed Excess Reserve Requirement that produces an acceptable ACE distribution will be the study's recommendation for the PSCO Control Area Excess Reserves Requirement.

Assumptions

The following assumptions have been made in developing the above methodology.

1. The study only examines Excess Spinning and Non-Spinning Operating Reserves. It does not contemplate a requirement for Excess Regulation-Down.

This is based on the assumption that wind generation implicitly contains 1-for-1 regulation down capability; it can be curtailed in cases of reliability-threatening system over-generation.

2. The study states that Required Excess Reserves are the only resources available to respond to wind deviations within the first 30 minutes. This is based on the following assumptions:

- PSCM will carry WECC/RMRG-required Spinning and Operating Reserves, and will never intentionally dispatch into required reserves except to respond to DCS events. Since wind deviations (for practical purposes) will never qualify as DCS events, only reserves carried in excess of the WECC/RMRG requirements will be available to respond.

- PSCM will not incur costs to carry reserves in real-time, or to plan for reserves in the long-term, unless these reserves are required by industry standards (NERC, WECC, RMRG) or by local reliability-based requirements justified by the PSCO Transmission Operator.

3. The study assumes that various resources are capable of responding to wind on a variety of timeframes. The timeframes are based on the following assumptions:

- Excess Spinning Reserves in 10 minutes: Resources qualified to provide Spinning Reserves have been tested and have shown the ability to provide full response within 10 minutes.

- Excess Non-Spinning Reserves in 15 minutes: Resources qualified to provide Non-Spinning Operating Reserves have been tested and have shown the ability to provide full response within 10 minutes. However, they must be activated through a manual decision and action by the human operator. Therefore, we allow an extra 5 minutes for the operator to recognize the wind falloff, decide to activate resources, and order activation.

- Additional CTs in 30 minutes: PSCM has over 1000MW of CTs that are capable of starting between 15 and 30 minutes from the operator's order. The 30-minute assumption is an average, considering that some units can respond faster than 30 minutes but there may be some delays for the operator to recognize a wind falloff, decide to activate resources, and order activation.

Not to be included in Study Scope:

The study will assume that there are no purely financial costs associated with failure to carry adequate excess reserves.

- PSCM will never dispatch into required reserves except for a DCS event, so there will be no RMRG costs.

The study will not evaluate the cost of various strategies the Control Area could take to successfully meet an Excess Reserves Requirement.

- Transmission investment decisions may use this study's conclusions as an input, but such decisions will be evaluated in future studies.

- Resource planning decisions may use this study's conclusions as an input, but such decisions will be evaluated in future studies.

- System dispatch decisions will be made using real-time information to meet the requirement as economically as possible.

Other items to address in the Study

This study should be repeated based on higher levels of wind penetration, to provide inputs for longer-term Transmission and Resource planning studies.

Disclaimers

Commercially-sensitive transmission data (power flow cases, etc) cannot and will not be shared with Marketing.

The study's suggested Reserves Requirements will be based on the best information and techniques presently available. It is understood and accepted that future experience will result in revisions to the requirements. They will be used for long-term planning decisions and short-term operational decisions until better information is available.