WECC North-South and East-West Oscillation Mode Study

Statement of Work

Part A - General

A1. Goals of this Contract

The objective of this contract is the evaluation of WECC system oscillation modes. Mode behavior information will be examined from past and present PMU historical data for significant events that have happened in the system to determine mode frequency and damping behavior, and to find out if there is a relationship with system loading. These findings will be compared against member system provided transient stability simulation path studies to determine the level of agreement with PMU measured mode performance at comparable path flows.

Oscillation modes to be evaluated shall include the following:

East-West Modes
1. NE – NW
2. SE- SW

North-South Modes
1. Alberta-BC
2. BC-US
3. N-S Mode A
4. N-S Mode B

A detailed description of these modes is given in various reports and papers listed in Section D of this document. There is particular interest in modes exhibiting low damping behavior as recently observed in the BC-US mode.

A2. Background

Monitoring the system stress is essential to operating the system reliably. Operating the system beyond its safe limits can result in a system breakup and cascading outages as occurred on August 10, 1996 in California and on August 14, 2003 in the East coast. In addition, this and other recent disturbances have shown that events happening in far remote areas can result in system-wide blackouts and demonstrate the need for Wide Area Phasor Measurement systems.

Phasor Measurement is a technology that can provide the system status in real-time and help in reliable system operation. The Synchronized Phasor Measurement (SPM) system obtains data from PMUs in remote locations within a tenth of a second and is available to system operators with minimum delay.
Many utilities and the US Department of Energy are making significant investment in deployment of a production-grade synchrophasor measurement infrastructure across North America. This investment is expected to: provide the benefits in power system reliability improvement; unlock transmission capacity, improve congestion management, and facilitate reliable wind integration and operation. The majority of these benefits will be realized through deployment of real-time situational awareness and control applications.

Wide-Area Situational Awareness (WASA) applications will provide grid operators with actionable information to help them navigate the power system to a secure state and deal effectively with disturbance events. The applications are expected to enhance those used for voltage stability, angular stability, oscillation detection and power-frequency control.

Work to date has focused on examination of typical WECC system North-South oscillation modes including those involving British Columbia, Alberta, the Pacific NW and California. With a wider deployment of synchrophasor measurement equipment through the Western Interconnection Synchrophasor Program (WISP) it will now be possible to provide a more complete evaluation of the N-S mode, and also include the important East – West modes, (both north and south), to validate simulation studies, and provide improved information to dispatching offices and Reliability Centers.

A3. Project Location

The majority of the project work will be performed at the Contractor’s office.

Contractor must be able to:

1. Participate in monthly conference calls arranged with OAWG review team
2. Attend and provide reporting for up to three WECC JSIS meetings

A4. WECC-Furnished Property

The Contractor needs to have a Non-Disclosure Agreement with WECC to receive the data. All data must be returned to WECC upon completion of the project or must be deleted. Those having access to WECC data should be in accordance with NDA requirements.

WECC will provide the following data and information as needed for successful project completion:

1. PMU data from significant events that happened in the system which might be relevant to this contract
2. Relevant PMU data, including system probing tests
3. Results of PSLF contingency analysis studies
4. Results of dynamic simulations for various contingencies
Part B – Technical Approach/Tasks

B1. General Requirements:

The objective of this contract is to evaluate specified oscillation mode historical performance (A1) and compare the findings against these modes as observed in member system path studies.

B2. Methods to be used

The Contractor will use modal analysis tools to determine mode frequency and damping under different conditions as observed in WECC PMU measurement data.

The Contractor will classify mode behavior observed in member system simulation studies. Appropriate modal analysis tools will be applied to simulation study data.

Member systems may be asked to repeat transient stability cases as needed to provide output files of necessary data for modal analysis.

The Contractor shall correlate measured modal behavior with path flows and with modal behavior as observed in member system studies.

The Contractor shall advise WECC staff concerning which contingencies most strongly stimulate the subject modes of oscillations. The WECC staff and/or WECC utility members will provide the consultant with corresponding simulations of all those contingencies.

The Contractor shall advise WECC staff on locations where the study modes are most observable and the best paths to monitor those modes.

B3. Deliverables

The consultant will deliver a report describing the following:

1. WECC system estimated mode performance from historical data
2. WECC modal behavior as estimated from member system studies
3. Correlation between measured modal performance and path flows
4. Correlation between measured modal performance and simulation studies
5. Any correlation among observed modes
6. Mode frequency, damping and mode shape descriptions

B4. Time Schedule

Performance time: 18-24 months from the date the contract is awarded.

B5. Contractor Qualifications
Please provide the following information:

1. Describe in detail your technical approach to evaluation of WECC specified oscillation modes (A1),

2. Describe your experience with Western Interconnection system,

3. Provide references to your publications in the field of oscillation analyses, and especially in the Western Interconnection system.

Those having access to WECC data must be in accordance with NDA requirements.

**Part C – Submittal**

Please limit your documented response to no more than five 11” by 8 ½” pages using a minimum size 12 font.

Please arrange your proposal under the following headings:

1. Statement of Work/Approach
2. Capability and Facilities
3. Time Frame and Deliverables
4. Budget Breakdown
5. Contractor/Team Qualifications
6. Related Publications and Work Experience

**Part D – Reference Material**

The following is a list of references concerning the oscillation modes to be addressed in this study:

1. Modes of Inter-Area Power Oscillations in Western Interconnection, WECC document, version 2014.1
2. ProbeTest2013_FinalV1
3. WECCmodesPaper121218
4.
5.
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