Prepared Remarks of Joseph Eto
January 20, 2011
FERC Commission Meeting

Good morning Mr. Chairman and Commissioners.

My name is Joseph Eto. I am a staff scientist at the Lawrence Berkeley National Laboratory. Thank you for inviting me to share the findings and recommendations from my research project with you this morning.

This study is the first to identify frequency response limitations and verify that frequency response metrics are useful for planning and operating the Bulk-Power System reliably in the context of integrating new resources. This approach builds on existing industry practices for controlling frequency after the unexpected loss of a large amount of generation. The study also introduces a set of metrics and tools for measuring the adequacy of frequency response within an interconnection.

Primary frequency response is the main metric used in this study to assess the adequacy of primary frequency control reserves, which are necessary to ensure reliable power system operation. Primary frequency response measures what is needed to arrest frequency decline (i.e., to form a frequency nadir) at a frequency higher than the highest set point for under-frequency load shedding within an interconnection.

The frequency response metrics introduced here can be used to maintain the reliable operation of an interconnection under changing circumstances and to guide and gauge the extent and success of reliable integration of any new resource into an interconnection. The metrics can also be used to plan a path forward when existing resource mixes undergo major changes, such as when conventional plants are retired or de-rated or when other new forms of generation are added such as variable renewable generation.

This study tested and validated frequency response metrics through simulation studies of the generation and transmission infrastructures that power system operators expect to have in place in 2012. Wind is expected to be a major new source of renewable generation for each of the U.S. interconnections in the near term. Wind generation creates challenges for reliable operation of the electric power system in part because the electricity generated from wind is more variable than electricity generated from conventional sources. The purpose of this study was to specifically determine and validate metrics that can be used to assess and plan for reliable integration of any amount of variable renewable resources.

The research team validated the metrics by applying them to simulation studies of the U.S. interconnections. This approach showed that the wind generation capacity projected for 2012 in the Western and Texas interconnections can be reliably integrated. Using a slightly modified approach, it was determined that the projected wind capacity for the Eastern interconnection for 2012 can also be reliably integrated. In general, as resources are added to the grid or removed from it, this tool also can be used to determine changes in primary and secondary frequency controls that will be required in addition to transmission identified by other studies.

Based on our analysis, we make the following recommendations:

1. Efforts should be accelerated now to better understand interconnection- and balancing authority-specific requirements for frequency control, especially in the Eastern Interconnection, considering among other things the frequency response metrics validated in this study.
2. Interconnections must schedule adequate primary and secondary frequency control reserves to both manage variations caused by increased levels of wind generation and withstand the sudden loss of generation, which can occur at any time.
3. The frequency control capabilities of the interconnections should be expanded, as follows:
    a. Expanded use of the existing fleet of generation (improved generator governor performance, increased operating flexibility of baseload units, faster start-up of units, etc.);
    b. Expanded use of demand response that is technically capable of providing frequency control (potentially including smart grid applications), starting with broader industry appreciation of the role of demand response in augmenting primary and secondary frequency control reserves;
    c. Expanded use of frequency control capabilities that could be provided by variable renewable generation technologies (primary frequency control, etc.); and
    d. Expanded use of advanced technologies, such as energy storage and electric vehicles.
4. Comprehensive planning and enhanced operating procedures, including training, operating tools, and monitoring systems, should be developed that explicitly consider interactions between primary and secondary frequency control reserves, and address the new source of variability that is introduced by wind generation.
5. Requirements for adequate frequency control should be evaluated in assessments of the operating requirements of the U.S. electric power system when considering new potential sources of generation and the retirement of existing generation.

This concludes my summary of the study. Let me end this presentation by expressing my gratitude to the Commission for sponsoring this work.