UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Frequency Regulation Metrics to Assess Requirements for Reliable Integration of Variable Renewable Generation	} } }	Docket No. AD11-8-000

COMMENTS OF ISO/RTO COUNCIL

The ISO/RTO Council ("IRC")[1] submits the following comments in response to the Federal Energy Regulatory Commission's ("Commission") January 20, 2011 Notice inviting comments upon a report prepared by the Lawrence Berkeley National Laboratory, entitled, "*Use of Frequency Response Metrics to Assess the Planning and Operating Requirements for Reliable Integration of Variable Renewable Generations*" and its five supporting papers (collectively, the "Report").

Overall, the IRC supports the purpose of the Commission's initiative to develop an objective methodology to evaluate the reliability impacts of renewable resources. However, as to the larger issue of assessing the "head room" available within each of the

[1] The IRC is comprised of the Alberta Electric System Operator ("AESO"), the California Independent System Operator Corporation ("California ISO"), Electric Reliability Council of Texas ("ERCOT"), the Independent Electricity System Operator of Ontario, Inc., ("IESO"), ISO New England, Inc. ("ISONE"), Midwest Independent Transmission System Operator, Inc., ("MISO"), New York Independent System Operator, Inc. ("NYISO"), PJM Interconnection, L.L.C. ("PJM"), Southwest Power Pool, Inc. ("SPP"), and New Brunswick System Operator ("NBSO"). Because they are not subject to the Commission's jurisdiction, AESO and NBSO do not join in these comments. Further, these comments do not constitute agreement or acknowledgement by ERCOT and IESO that they can be subject to the Commission's jurisdiction. The IRC's mission is to work collaboratively to develop effective processes, tools, and standard methods for improving the competitive electricity markets across North America. In fulfilling this mission, it is the IRC's goal to provide a perspective that balances Reliability Standards with market practices so that each complements the other, thereby resulting in efficient, robust markets that provide competitive and reliable service to customers.

Interconnections to accommodate an increased level of renewable resources, the IRC urges the Commission to go beyond the analysis of primary frequency control and instead sponsor a more robust evaluation which would include all reliability needs, obligations, services and performance standards impacted by wind and other renewable resources. This expanded analysis would provide important information for policymakers who, today, are largely adopting renewable portfolio standards without the benefit of a comprehensive Interconnection-wide examination.

I. BACKGROUND

The Commission-funded December, 2010 Report was designed to "present a systematic approach to identifying metrics that are useful for operating and planning a reliable system with increased amounts of renewable generation which **builds on** [*emphasis added*] existing industry practices for frequency control after unexpected loss of a large amount of generation." [2] To this end, the Report recommends:

(1) Better understanding of Interconnection and Balancing Authority-specific requirements for frequency control;

(2) Scheduling of adequate primary and secondary frequency control reserves;

(3) Expanded frequency control capabilities from a mix of resources as follows:
   a. Increased response of existing generators
      i. increased governor response
      ii. more flexible operating capabilities of base-load units
      iii. faster start-up of units
   b. Increased use of demand response
   c. Increased primary response provided by renewable generation
   d. Increased use of energy storage and batteries

(4) Development of comprehensive planning and enhanced operating procedures that explicitly include the interactions between primary and secondary frequency control reserves, including:

[2] The Report, Synopsis, page xiii

a. Training
b. Operating tools
c. Monitoring systems

(5) Evaluation of frequency control requirements to be included in assessments of the US electric power industry regarding additions of new resources and the retirement of existing resources.

II. COMMENTS

A. Further Analysis Should More Explicitly Recognize Existing and Future Generation Capability, as well as the Coordination and Monitoring Role of the Balancing Authority in Current Restructured Electric Markets.

The IRC supports the core concepts behind the recommendations set forth in the Report, but urges the Commission to refrain from being limited by the specifics of those recommendations. The first recommendation (as well as many of the discussions within the supporting documents) contemplates potentially assigning generation-control responsibilities to Balancing Authority's which are not consistent with today's restructured industry.[3] Given the restructuring of wholesale generation pursuant to the Energy Policy Act of 1992, and subsequent Commission and State Commission orders requiring functional separation, in today's environment a Balancing Authority oftentimes does not directly control (or own) generation assets and, as a result, has no independent reserve serving capabilities; recognizing, however, that it is an appropriate role of an ISO or RTO acting as a Balancing Authority to develop rules that allocate responsibilities among market participants or create sufficient market-oriented or other incentives that ensure sufficient reliability services are available to maintain system performance.

[3] Report at 91: "Ultimately, the specific procedures could be expressed as measurable obligations for each balancing authority or each type of generation. Balancing authorities or reliability coordinators, in turn, could be responsible for confirming the capability and availability of the resources providing each form of frequency control."

In this regard, the recommendation of the Report that the "frequency control capabilities of the interconnection should be expanded" begs the question of how this is best accomplished. Any examination of this question must recognize and accommodate divergent business models that operate in organized markets as well as under more traditional vertically-integrated utilities. Vertically-integrated utilities are in a better position to rely on more traditional integrated resource planning to command development of sufficient resources that would provide the needed frequency response capabilities. In contrast, areas operated under organized markets use regional planning processes and wholesale markets to disseminate information and provide economic incentives that support the availability of needed reliability services from any qualified market resource – whether generation, demand response, or other innovative technologies.

The IRC has supported and continues to fully support the inclusion and expansion of all assets – traditional and renewable, supply-side and demand-side, and those yet to be installed. Given that focus, the IRC recognizes the inherent value of this particular Report, but supports a more expanded approach to future studies that would include an assessment of the roles and requirements of all current NERC functional entities. To the extent the Report implies that improved generator performance requirements can simply be ordered by the Balancing Authority, such a proposal is inconsistent with overall market design. For example, the Commission is evaluating in its Frequency Response Notice of Proposed Rulemaking[4] appropriate performance-based compensation incentives that can accomplish these goals and should be the focus of the

[4] *Frequency Regulation Compensation in the Organized Wholesale Power Markets,* Docket Nos. RM11-7-000; AD1-11-000.

recommendations coming out of this initial analysis. Accordingly, the Commission should work with the IRC and others to examine further the proposed recommendations in light of today's market-based structures.

Balancing Authorities have a role in coordinating and monitoring entities (traditional generation, renewable resources, or others) which provide various levels of frequency response. As reliability metrics are developed, Balancing Authorities will have the wide area view of frequency response providers in their area to determine the frequency response margin and actions that may be needed to secure and maintain system reliability related to frequency response.

In summary, the IRC is concerned that the report's emphasis on Balancing Authority actions will create a misdirected obligation where the Balancing Authority must provide a service for which they have few "command and control" tools to dictate the requested result.

B. The Report Should Further Recognize the Unique Characteristics of the Three Interconnections.

The Report rightly focuses on evaluations of the three independent Interconnections. However, the Report indicates that the level of analysis of the Eastern Interconnection was different than that utilized for the Texas and Western Interconnections, apparently, because of the lack of reconcilable data for the Eastern Interconnection as a whole. Clearly, further modeling work for the Eastern Interconnection is needed, and, in the absence of such modeling, the IRC urges the Commission to refrain from determining the suitability of any metrics which would rely upon analysis of the Western and Texas Interconnections. Although the Report does assess each Interconnection by itself, the conclusions (particularly for the Eastern Interconnection) are driven by the needs and actions of the other two Interconnections (in

large part, because as the Study reports, the Eastern Interconnection model was not accurate enough for the needs of the Study). Clearly, the size and characteristics of the Texas Interconnection makes it much more sensitive to condition changes such as loss of supply, while the unique Western Interconnection also has aspects not common with the Eastern Interconnection. Those characteristics have driven ERCOT and WECC to do more intensive modeling and impose more obligations than the Eastern Interconnection, but should not form the basis of determining the propriety of any generally applicable metrics.

C. Identification of a Reliability Metric for Frequency Response

The IRC suggests that FERC support the industry in the next step to utilize the concepts introduced in this Report to identify fundamental reliability measures to assess the reliability margin associated with frequency response. The IRC's observation is that the Report did not define a core frequency need and appears to embrace the need for additional primary response resources rather than further analyzing the cause of the reduction in the capability and the variety of resource solutions that might be available. The concept that reduced primary response is indicative of a correlation that more primary response is needed should be technically justified. The IRC suggests that further analysis is needed of the actual reliability impacts associated with a reduction in the frequency response capabilities of each Interconnection and a more robust analysis of potential solutions to resolve those identified impacts.

Moreover, the first metric identified in the Report is Frequency Nadir (*i.e.*, the lowest actual or acceptable frequency). However, rather than evaluating that minimum value and the conditions associated with that minimum frequency, the authors move directly to the post-nadir response. There is no evaluation of what caused the lowest

values, such as load change or loss of equipment, and only rhetorical speculation remains.

The IRC agrees that the Frequency Nadir is a good metric for evaluating the impacts of wind resources, but notes that it must not be the only metric. The Frequency Nadir metric must be evaluated in terms of today's functional entities that consider more than just an expanded primary frequency response obligation on the Balancing Authorities as the proposed remedy. The primary control response is a composite of system inertia, load frequency response, and classical response commonly referred to as governor response. Inertia and load-frequency response are characteristics of the system and the loads connected to that system. There are more limited controls over those two characteristics. The IRC believes that there is a more fundamental reliability impact associated with system inertia.

Contrary to the conclusions of the Study, reduced inertia (measured in terms of a lower Frequency Nadir) is not reflected in reduced primary response and the reduced Frequency Nadir cannot be made up by increasing post-contingency response. Furthermore, there is a fundamental reliability impact related to supply-side changes in frequency response. These changes are caused by various factors including: the increased use of sophisticated frequency-related speed controls (which change the characteristic response of rotating machines); and the replacement of larger mass equipment with smaller mass equipment (reducing system inertia); and these changes cannot be resolved by increasing post-contingency response characteristics. Similarly, demand-side changes in load-frequency cannot be resolved by increasing post-contingency response. Both supply-side and demand-side response must perform in a manner that results in an acceptable Frequency Nadir, and that serves as a base for post-contingency responses from primary, secondary and tertiary control obligations and services in returning the

frequency to reliable levels (as a function of the risk of additional contingencies and system changes).

Additionally, it would be helpful if further studies would probe the following frequency-related questions:

- Are the Under-Frequency Load Shedding ("UFLS") settings associated with the findings?
- Are the UFLS relay settings the appropriate target point?
- Who should pay for the response provided?
- Would paying for the energy taken from the Interconnection be a useful process?

D. Expand the Scope of the Report to Include an Assessment of Frequency Response Impacts, as a Whole, on Bulk-Electric System Reliability

The IRC agrees with the Commission's purpose to develop metrics that can be used to objectively track and assess the reliability impacts of renewable generation. Such metrics would not only be useful for assessing the impacts of renewable resources, but would also be useful in assessing other changes impacting the reliability of the Bulk Electric System. The Commission initiative to fund the Report is timely given the changes in the electric power industry.

To this end, the IRC believes the Report's analysis can be expanded in the future. The objective to study and identify frequency response impacts of renewable resources provides an opportunity for a complete reevaluation of frequency-centric reliability issues. As such, the IRC believes that a more fundamental reevaluation of the approach to frequency response may be warranted so as to reevaluate the traditional concepts and obligations of frequency performance. Any such evaluation could include consideration of the following questions:

- What are the reliability boundaries for frequency? Is it one boundary or is it a matrix of boundaries separated by time and risk?

- Which (functional) entity is responsible for ensuring that those boundaries are not exceeded?

- Are these boundaries based on carrying load or maintaining system integrity? Do relay settings serve as the boundary or do they serve as part of the solution?

E. Define What is Meant by Frequency Control

In the Study, the term "frequency control" is used to refer to several different reliability needs. Frequency control is used, euphemistically, to mean governor response; it is also used to refer to control of Area Control Error, and it also is used to mean arresting frequency. Each of these is an independent objective. While it is possible to combine these objectives, such a study should not presume these combinations, especially in an environment where new technologies (*e.g.* batteries), may address one of those aspects (fast response) independent of the other objectives (sustained response).

Generally, although the Report provides a workable start, the IRC believes that the focus on governor response may be too limited a metric. Moreover, the Study's key metric, governor response, can be further enhanced by using:

- Slope of frequency from Points A-B (related to inertia and load frequency response)

- The ratio of change from points A-B vs. A-C (related to resource frequency response)

- Point C statistics by location (a composite of all governor response)

III. CONCLUSION

The IRC supports the Commission's intent to assess each Interconnection in the context of the newest Industry assets and to compare and contrast the reliability needs and obligations of all of today's power system entities. There is no doubt that the Report

is a significant effort on a very sizable issue and, in this regard, the IRC's comments are intended to be constructive and reflect its desire to work with all parties to further refine the analysis in light of these comments.

Respectfully submitted,

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