Frequency Regulation Compensation
in the Organized Wholesale Power Markets
Technical Conference
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AGENDA

Panelists

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Jonathan Lowell, Principal Market Design Analyst, ISO New England
Ralph D. Masiello, Sr. Vice President, Innovation, KEMA Inc.
Andrew Ott, Senior Vice President, Markets, PJM Interconnection, L.L.C.
Robb Pike, Director Market Design, New York ISO
Todd Ramey, Executive Director Market Administration, Midwest ISO
DeWayne Todd, Energy Services Manager, Alcoa Power Generating, Inc.
Don Tretheway, Senior Market Design and Policy Specialist, CAISO
Rahul Walawalkar, Vice President, Emerging Technologies and Markets, Customized Energy Solutions Ltd.

9:00 Welcoming Remarks

9:10 Session 1 -- Value of Higher-Quality Frequency Regulation Service in Organized Electric Markets

This session explores the value of new energy technologies that have the potential to respond to a regulation dispatch signal faster, and follow it more accurately, than traditional resources on automatic generation control.

1. Several recent technical studies[1] assert new technologies are capable of following a transmission system operator's regulation control signal more accurately than traditional automatic generation control (AGC) systems. These studies also suggest that these new technologies are able to respond to a regulation dispatch signal that requests faster and more frequent changes in output levels than usually requested of other (traditional generation) resources. Does experience to date support these assertions?

2. Would greater entry of technologies that respond to a regulation dispatch signal faster, and follow it more accurately, potentially lower the total costs of Independent System Operators/ Regional Transmission Organizations (ISO/RTOs)?

3. Would greater entry of technologies that respond to a regulation dispatch signal faster, and follow it more accurately, provide enhanced reliability benefits? If so, what are these benefits and how would they be realized?

4. Can any of the foregoing potential benefits be quantified, or even estimated approximately, in dollar terms? Do market participants or ISO/RTOs possess sufficient information to estimate these benefits? If not, what information unavailable today would be needed to do so? Should ISO/RTOs institute interim tariffs, demonstration projects or pilot programs to collect this information?

10:30 Break

10:45 Session 2 – Performance, Compensation, and Market Design

This session will explore whether existing pricing mechanisms for frequency regulation service reflect the quality of the service provided, and whether reforms are needed.

1. Do existing frequency regulation market designs in the ISO/RTO markets provide compensation and efficient price signals for investment in new technologies that respond to a regulation dispatch signal faster, and follow it more accurately than the traditional resources? Why or why not? How does this vary across ISO/RTO markets?

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[1] R. Walawalkar and J. Apt, *Market Analysis of Emerging Electric Energy Storage Systems,* National Energy Technology Laboratory, Report DOE/NETL-2008/1330 (2008); R. Entriken and N. Taheri, *A Prototype Method for Analyzing Regulation by Limited Energy Storage,* Electric Power Research Institute (2009); Y.V. Makarov, J. Ma, S. Lu, and T.B. Nguyen, *Assessing the Value of Regulation Resources Based on Their Time Response Characteristics,* Pacific Northwest National Laboratory, Report PNNL-17632 (2008); KEMA Corporation, *Benefits of Fast-Response Storage Devices for System Regulation in ISO Markets,* Technical Paper (2008).

2. Compensation design is inherently premised on the ability to measure the service provided by an individual facility. Can an ISO/RTO accurately measure the impact on the system's frequency and its area control error (ACE) that results when an individual facility providing regulation service increases or decreases the power it supplies to the transmission system? Why or why not?

3. Is it appropriate for a resource selected to provide frequency regulation service to be (a) compensated by the ISO/RTO for the capacity it makes available "on call" for regulation service, as well as (b) compensated by the ISO/RTO for any changes in the level of power it supplies in response to the ISO/RTO's regulation control signal? Why or why not?

4. One market design model for compensation component (b) in the above question pays a resource, in part, based on the absolute sum of its changes in the level of power it supplies (or withdraws) in response to the ISO/RTO's regulation control signal over a set time interval. (This is sometimes called a "mileage-based" compensation model.) What are the advantages and disadvantages of this type of regulation market design? How should the "mileage" compensation rate be set? Would the resulting market design send an efficient signal for new investment in resources capable of providing frequency regulation service?

5. An alternative market design model for frequency regulation compensation could compensate a resource, in part, based on how accurately the changes in the resource's real-time power output match the regulation control signal sent to it by the ISO/RTO. (This might be called an "accuracy-based" compensation model). What are the advantages and disadvantages of this type of market design? How would the compensation for "accuracy" be set? Would the resulting market design send an efficient signal for new investment if the ISO/RTO finds it optimal to supply different regulation control signals to resources with different response characteristics?

6. A third market design model for frequency regulation compensation might have two "classes" of service: The current AGC-based regulation service class, and a new fast-response regulation service class that is applicable to resources able to meet a higher performance standard for signal-response speed and accuracy. What are the advantages and disadvantages of this type of regulation market design? How would compensation be set? Would the resulting market design send an efficient signal for new investment in resources capable of providing each class of frequency regulation service?

7. If a storage-based facility is selected to provide regulation service, and responds to an ISO/RTO "regulation down" control signal by charging the storage facility (thus placing a net load upon the network), should the facility be *paid* by the ISO/RTO for incrementally "regulating down", or should the facility *pay* the ISO/RTO for the energy the facility absorbs from the network? How does the answer to this situation align with the alternative market design approaches above?

8. Should the opportunity costs of resources capable of providing frequency regulation service affect which resources are selected to provide this service? If so, should each selected individual supplier receive the same market-clearing price for each unit of capacity it makes available "on call" for regulation service? Do energy-limited technologies that provide frequency regulation service incur an opportunity cost? If so, why?

12:45 Concluding Remarks