

**NERC**

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

# Frequency Response Technical Conferences – Summary

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- On May 4, 2012 in Docket No. RM06-16-010, FERC granted a one-year extension until May 31, 2013 to submit modifications to BAL-003, *Mandatory Reliability Standards for the Bulk-Power System*, 139 FERC ¶ 61,097 (2012)
- The purpose of these technical conferences is to reach consensus on the proposed modifications to BAL-003

- Frequency Response (FR) is a measurement; Frequency Bias is a setting for Automatic Generation Control (AGC)
- FR is based on *settled* frequency
  - Can be measured consistently across interconnection
  - Can be measured using current EMS technology
  - Can be related statistically to *arrested* frequency
  - 20-52 sec averaging period seeks to separate primary frequency control from AGC
- FR depends on units on line/headroom; deadband, then initial and sustained response of units that can/are able to respond

- FR of Eastern Interconnection is declining, despite growth in size
- Interconnection FR tenets
  - Should not trip first stage of Underfrequency Load Shedding (UFLS)
- Costs of FR: Lost opportunity; operating away from full load or highest efficiency operating point; throttling losses on steam units; wear and tear caused by unit movement

- Whether/how the different physical characteristics of the Interconnections, including historic trends in declining FR, might/should lead to differences in or timing for a FR standard
- Need for a FR standard on a nation-wide basis, specifically in the West
- Balancing Authority (BA) responsibilities/abilities vs. Generator Operator (GOP) responsibilities/incentives
- Inability of nuclear plants to provide FR due to restrictions imposed by the NRC
- Measurement of BAL-003 captures AGC and this represents a trade-off because it's important to capture potential withdrawal

- BAL-003 scope (originally focused on setting Frequency Bias) expanded by FERC Order 693 to include a FR standard
- FR Standard Drafting Team (SDT) recommends an annual (not calendar) cycle for identifying FR events that would be to establish FRO and frequency bias settings
  - FRO based on summation of monthly averages of both peak load and peak generation
  - 2011 Form-714 procedures for collection of data would be used to establish 2013 settings/obligations

- FRO calculation/analysis
  - Clarify that RS will address significant changes between historic FERC Form 714 data and expected BA configuration/composition
  - Add summation signs to clarify peak gen and load are expected to be monthly averages
  - Address treatment of Demand Response explicitly
  - Examine allocation based on minimum loads – consider availability of data sources and technical justification
  - Discussion of non-jurisdictional entities that are not required to submit FERC Form 714 data – expectation that such entities will have the necessary calculations available

- To ensure absolute value of Frequency Bias setting  $> FR$ , which was closer to 1% in 1964
- Assured all BAs participated in frequency control (and Tie-Line Bias); need was replaced by Standards
- If Frequency Bias Setting is set too low – causes withdrawal of FR; if set too high (more than double the natural response) – causes frequency control instability
- Changes in Minimum Bias requirements
  - Eliminated for single BA interconnections (*e.g.*, ERCOT and Hydro Quebec) and for variable bias BAs (except during a frequency event at which time it must be more negative than FRO)
  - May be set at 100-125% of FRM which provides flexibility for tuning AGC on multiple BA interconnections
  - Slowly reduces interconnection 1% minimum

- Slowly reducing interconnection minimum bias should be accompanied with study of its effect on BA performance with respect to other frequency control standards
  - Examine other options or means for setting bias?
- Clarify that for variable bias BAs, there is an expectation that during a frequency event minimum bias will be more negative than its FRO
- Need for FR bias settings at the natural response for BAs – better situational awareness

- The development of a revised BAL-003 Reliability Standard is a priority for FERC and it is necessary for the grid
- Concern expressed regarding role of BAs
- The time to act is now

# The Responsible Entity for Providing Frequency Response

- FRSDT recommends FRO apply to BAs, not GOPs
  - Time restrictions
  - Limitation of Standard Authorization Request (SAR)
- Issues with GOP inclusion
  - May not be capable or have valid reasons not to respond
    - Generator at minimum or maximum, regulatory or environmental limitations, generator may have no governor
  - Magnitude of measurement process would be expanded significantly
    - 106 BAs registered compared to 4,000 to 20,000 generators, depending on size
  - Does not address other technologies that can provide primary frequency control
  - Response required from only a subset of generators; participation by all generators would be more expensive

- Issues with GOP inclusion (continued)
  - Transmission Tariff Interactions (imbalance penalties charged due to differences between schedule and actual)
  - Tariff/compensation issues will arise
  - Ancillary services rules
- A separate SAR for generator control can be submitted, if deemed appropriate (meanwhile, review Generator Verification)
- A Generator Owner/GOP perspective
  - Use commonly understood terminology - how will unit respond to frequency (not what are droop and deadband settings or PSS/E input variables); “emergency” ratings (vs. “Pmax”), including for how long (*and* with what incentives) – essential for communicating requirements
  - Move to process-based configuration control guidelines (also continuous model improvement – see also NERC initiatives related to MOD standards), and support with training

- A load aggregator perspective
  - Load can provide frequency control, sometimes by relying on inherent storage in end-use processes – currently, centrally to provide AGC; but also potentially, locally/autonomously to provide FR
- A BA (that operates a centralized market) perspective
  - An FR market product would appear to be similar to Synch Reserves and Regulation and significantly different from Energy, Capacity, and Black Start
- A wind generator perspective
  - Address problem; Be technologically neutral; Use economic incentives; No retroactive requirements

- American Wind Energy Association (AWEA) notes that the Eastern Interconnection has the lowest penetration of wind and solar
- AWEA notes that generators differ in their capabilities and costs for providing FR
  - Some loads can provide FR, most cannot
  - Some new wind turbines can't supply the capability
  - A standard should be technology neutral
- AWEA believes that incentives are better than mandatory requirements for reliably obtaining FR capability
- AWEA states that obtaining reliability resources and maintaining reliability should be a BA responsibility
  - BA can select from available FR resources to assure reliability
  - BA is the entity that is aware of current system needs and capabilities

- Enbala supports ensuring that the NERC standard does not define the technology that should provide the response
- Enbala notes that BA's procure what they need on an economic basis
- Enbala states that BA's should be assigned responsibility to ensure that sufficient FR is available
- Modify tariffs and or develop market mechanisms to support the economic selection

- Rules for negotiation between BA and GOP (and other providers) for acquisition of reliability-related services (in this case FR) are not defined in the standard (but are a topic that has been addressed in other standards)
  - At what point in time should this issue be addressed? Some believe the standard must come first. Others are concerned that the issue must be addressed at least in parallel. Note: this issue is outside scope of drafting team.
- Since Interconnection performance currently is better than that proposed for the standard, there is time for BAs to learn and develop tools/approaches to enable them to continue to ensure compliance, and address economic and other considerations
- Issues to address in defining (and measuring/verifying) the characteristics of FR products or of FR provision in general – how much should be addressed in the standard (or in a guideline or in a tariff)?
  - Appropriateness of larger step responses w.r.t. adequacy of base of continuous response
  - Local sensing and control (esp. if islanding might occur and w.r.t. speed of response)
  - Deliverability of FR

- Point C is different throughout an Interconnection for the same event and occurs at different times
- B Value is nearly identical among all BAs for the same event
- Ratio of C-B is generally consistent among events within an Interconnection
- Measurement methods (point B, median of 25 events) seek to take into account characteristics of available measurement technologies (including variability among them for, say, generators vs. ties) and address measurement error (due to signal-to-noise problems)
- Technical elements/justification for Interconnection FRO include:
  - Target protection criteria
  - Credit for load response
  - Frequency margin associated with prevailing UFLS first step
  - Statistical relationship between Point C and Point B
  - Reliability margin
- Average performance today is in excess of what is proposed for standards; there is no historic basis for expecting performance to get worse in the near term
- Median is preferred measure of central tendency in population with outliers

- Present both interconnection and BA performance following defined 25 events
- Continued statistical work may improve basis for calculation of IFRO, such as reliance on median, C-B ratio, etc. – need to continue to collect data
- Rationale for median of actual performance as the basis for a minimum requirement – noise in data vs. variability in actual BA performance
- Study susceptibility of FL UFLS to events external to FL