



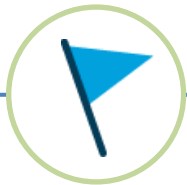


Manual 12 Update Primary Frequency Response Performance Measurement

Operating Committee

January 8th 2019

Danielle Croop, Sr. Engineer

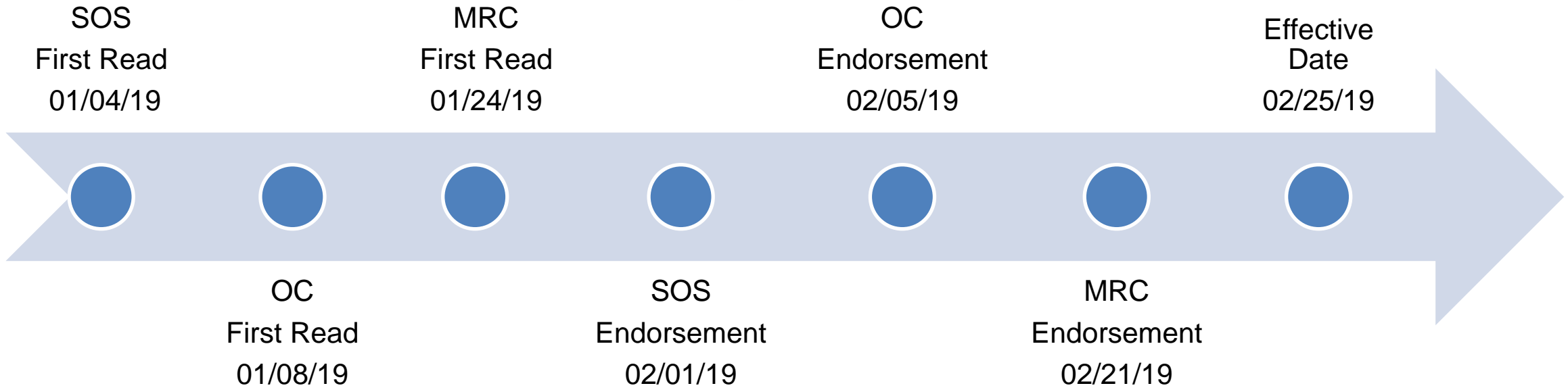
Operation Analysis & Compliance

Action Required	Deadline	Who May Be Affected
<p>Endorse update to Manual 12 on Primary Frequency Response Performance Measure</p> 	<p>02/09/2019</p> 	<p>All Stakeholder</p> 

- FERC issued Order No 842
 - Puts PFR requirements on all newly interconnecting large and small resources
 - Incorporated into PJM ISAs as of 10/1/18, requirements being added to PJM Manual 14D
- PJM discussed performance evaluations at length at the PFRSTF
 - Outcome of PFRSTF was for PJM to continue to monitor unit PFR performance during 2019 using criteria described in PFRSTF and document in PJM Manual 12

- New Section 3.6 added to Manual 12 to address Primary Frequency Response (PFR) Performance Measurement
- Section 3.6.1 Generator Primary Frequency Response Evaluation
 - Details frequency response calculation for high & low frequency events
 - Addresses when a resource will be evaluated for PFR and when a resource will not be evaluated
 - Details follow-up process for identified non-performance

- Section 3.6.2 Event Selection
 - Details event selection criteria for performance evaluation and quarterly review process



- Appendix

3.6 Primary Frequency Response

Primary frequency response is the first stage of frequency control and is the response of generator governors and loads to arrest locally detected changes in frequency.

Primary frequency response is automatic, is not driven by any centralized system, and begins within seconds after the frequency changes, rather than minutes.

Primary frequency is essential for reliability of the Interconnection and is

- the first line of defense
- critical for system restoration
- needed for accurate modelling and event analysis
- necessary for compliance to BAL-003-1

3.6.1 Generator Primary Frequency Response Evaluation

Generating resources' expected performance will be calculated using the primary frequency control calculation, taking into account the droop, deadband, and operating requirements in Manual 14D, Section 7.1, Dispatching of Generation. Verification of droop and deadband settings should be performed by resource owner

- Frequency below governor deadband:

$$MW_{PrimaryControl} = \left[\frac{(HZ_{actual} - 60 + DB)}{(60 * Droop - DB)} \right] * (FrequencyResponsiveCapacity) * (-1)$$

- Frequency above governor deadband:

$$MW_{PrimaryControl} = \left[\frac{(HZ_{actual} - 60 - DB)}{(60 * Droop - DB)} \right] * (FrequencyResponsiveCapacity) * (-1)$$

Where Frequency Responsive Capacity represents the available operating capacity of the generating resource at the time of the event.

When resources are ramping prior to an event, response will be offset by that ramp rate. The ramp rate will be calculated for a resource 10 minutes prior to the event start and the expected response will be adjusted for this ramp as below:

$$Actual\ Response = (AvgMW_{20-52sec} - AvgMW_{-16-0sec}) - Ramped\ MW\ during\ event$$

Exclusions to the frequency response performance evaluation will include:

- nuclear generation
- offline during the event
- have no available headroom/footroom
- assigned regulation
- have an active eDART ticket for governor outage.

If PJM determines a unit is not providing primary frequency response based on the performance evaluation, PJM will work with the Generation Owner and review additional variables to support performance improvements, including but not limited to, telemetry, operating scenarios, generator hold points and non-functioning governor equipment.

3.6.2 Event Selection

PJM will evaluate generators during periods of large system frequency deviations. PJM targets 2-3 frequency events per month for evaluation, but no set number of events will be defined, since events are based on system conditions. Selected events and event selection criteria will be reviewed quarterly with the Operating Committee for continued performance and applicability. The criteria required for event selection:

- Frequency goes outside +/- 40mHz deadband
- Frequency stays outside +/-40mHz deadband for 60 continuous seconds
- Minimum/Maximum frequency reaches +/- 53mHz

A quarterly review will look at an average performance over a 12 month window. PJM will require a minimum of 3 applicable events for a resource to perform the performance review (event selection will go back further than 12 months if needed in this case). Each event will be evaluated separately and the performance will be averaged for responsive/non-responsive determination. 50% or greater average performance will be considered frequency responsive.