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:

$$MW_{\Pr imaryControl} = \left[\frac{(HZ_{actual} - 60 + DB)}{(60 * Droop - DB)} \right] * (Frequency \operatorname{Re} sponsive Capacity) * (-1)$$

- Frequency above governor deadband:

$$MW_{\Pr imaryControl} = \left[\frac{(HZ_{actual} - 60 - DB)}{(60 * Droop - DB)} \right] * (Frequency \operatorname{Re} sponsive Capacity) * (-1)$$

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
- units offline during the event
- units that have no available headroom/footroom
- units that are assigned regulation
- units that 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.