Forced Oscillation Initiation and Damping Location Within the TVA Area

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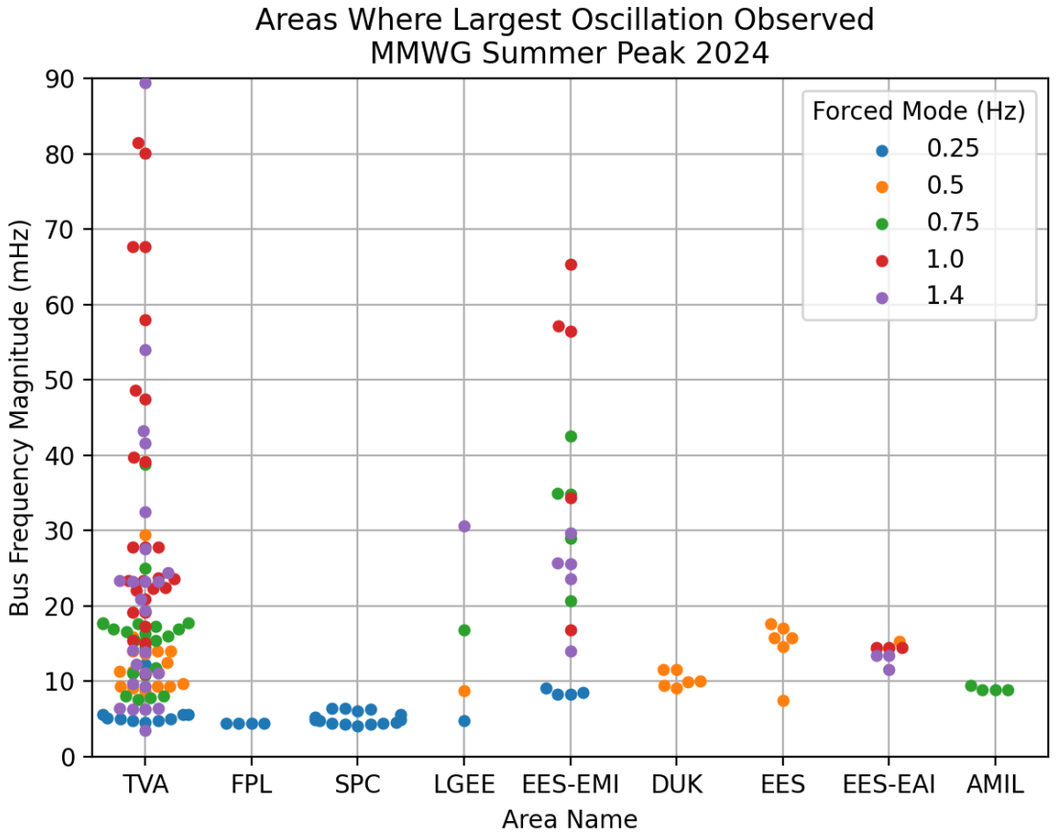
Critical Location Forced Oscillation

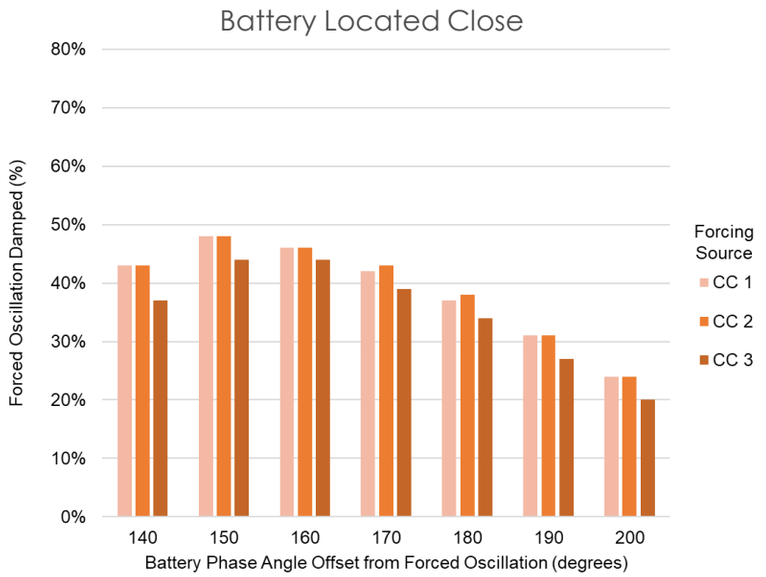
- Objective:
  - Identify critical generators for initiating forced oscillations
- Technical Approach:
  - Inject 200 MW_{pp} oscillations via governor
  - Individually study all TVA machines greater than 200 MW
  - Oscillations modes from 0.25 Hz to 1.4 Hz
- Results:
  - Observe largest bus frequency magnitude resulting from machine oscillation
  - Peak oscillations occurred within TVA more frequently
  - 1.0 Hz mode generally produced larger oscillations

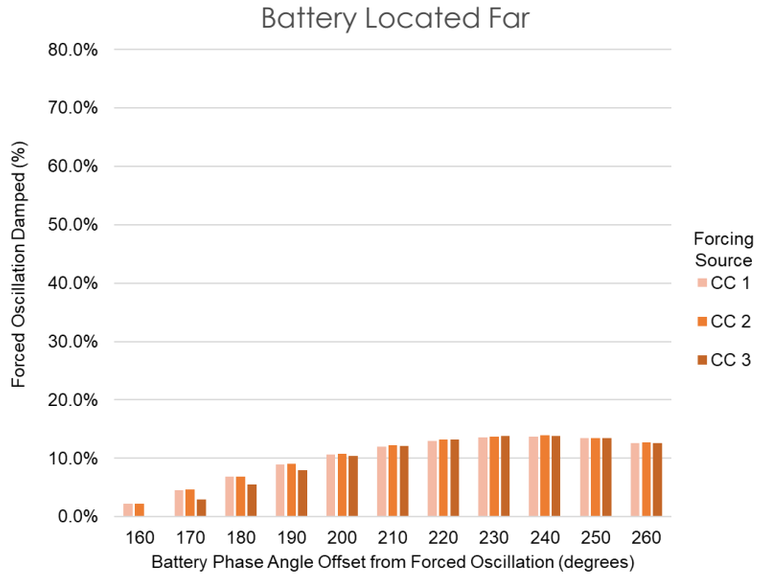


Battery Storage Damping Feasibility Study

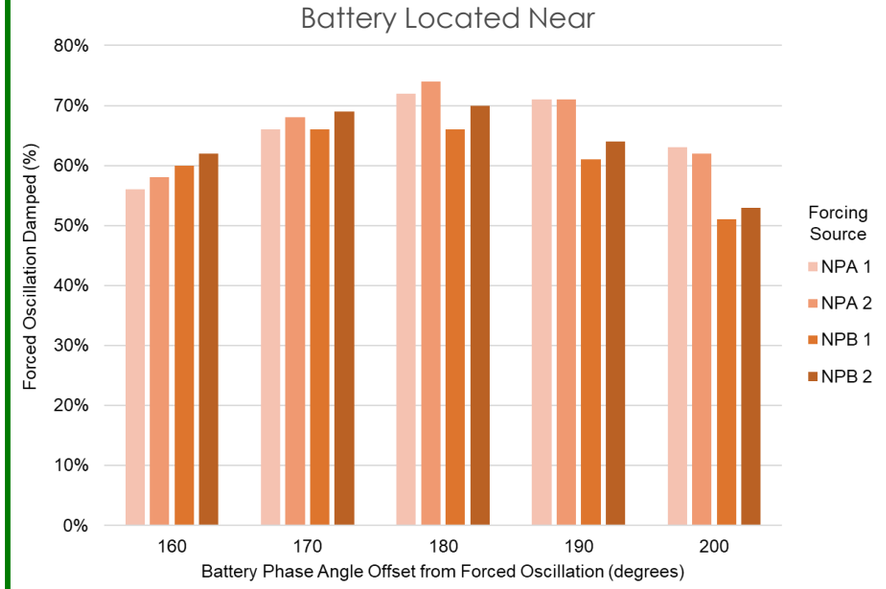
- Objective:
  - Assess damping effectiveness by battery energy storage system
- Technical Approach:
  - Battery injects anti-phase oscillation of 200 MW
  - Case 1: Combined-cycle plant
  - Case 2: Two nuclear plants
- Results:
  - Battery phase angle impacts damping
  - Oscillations reduced but effectiveness varies on a case-by-case basis

Case 1: Combined-Cycle Plant Oscillation Damping





Case 2: Nuclear Plant Oscillation Damping



Acknowledgements

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