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Independent System Operator

Eastern Interconnection Planning Collaborative (EIPC) Frequency Response Working Group (FRWG) 2020 Report

Aashish Murti

Planning Engineer, System Modeling

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Background

- NYISO is a member of the Eastern Interconnection Planning Collaborative (EIPC)
- NYISO and other EIPC members participated in the Frequency Response Working Group (FRWG)
- This presentation summarizes the EIPC 2020 Final Report Frequency Response Working Group available on the EIPC website[1]

[1]The 2020 FRWG Report can be found on the EIPC website at: EIPC FRWG 2020 Final Report 2020-10-21

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Scope

- The rapidly evolving generation resource mix demands the technical analysis of transmission planning issues to provide for the Eastern Interconnection frequency response to loss of generation events without the activation of under frequency load shedding (UFLS)
- The report evaluates the impact of a possible future generation mix by benchmarking historical events and simulating severe resource contingency events
- The EIPC coordinated with the Frequency Response Working Group (FRWG) members to gather accurate representation of the Eastern Interconnection resource mix, load and interchange values
- Mitigation solutions and recommendations were provided based on the simulation results

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Key Steps

- Step 1: Benchmarking Historic Frequency Events
- Step 2: Developing the Year Five Low Inertia Case
- Step 3: Simulating Resource Contingency Events
- Step 4: Study Results
- Step 5: Mitigations
- Step 6: Recommendations

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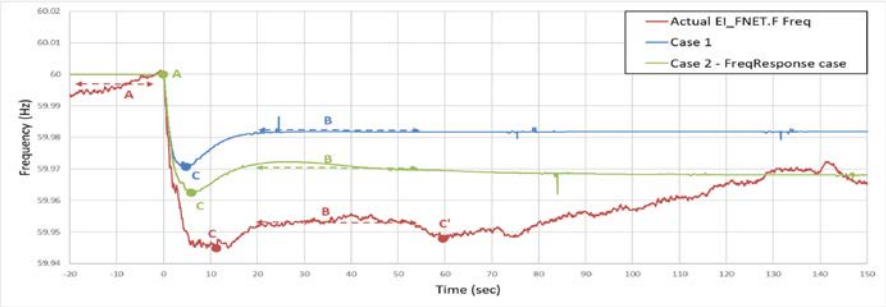
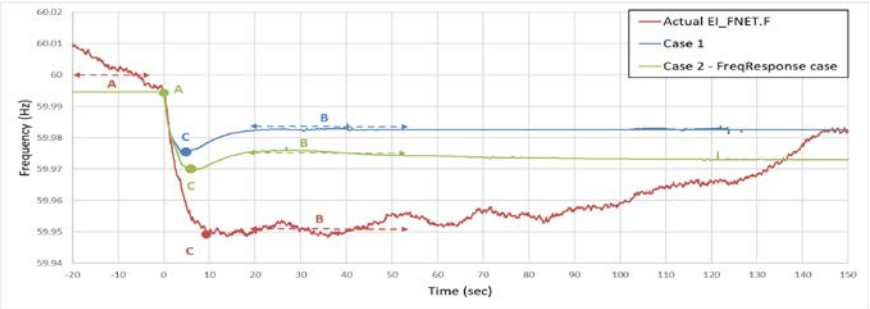
Step 1: Benchmarking Frequency Historic Events

Study Case selection for the study

- Event 1: EI March 10, 2019 Frequency Event
- Event 2: EI March 15, 2019 Frequency Event





- Simulated minimum post frequency point “C” for Case 2 closer to the actual frequency event.
- Hence, selected as the base case to benchmark Case-2 MMWG 2019SLL Final case (Frequency Response IDV applied) to the historic events.

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Step 1: Benchmarking Frequency Historic Events

Event selection for the study

- Event 1: EI March 10, 2019 Frequency Event
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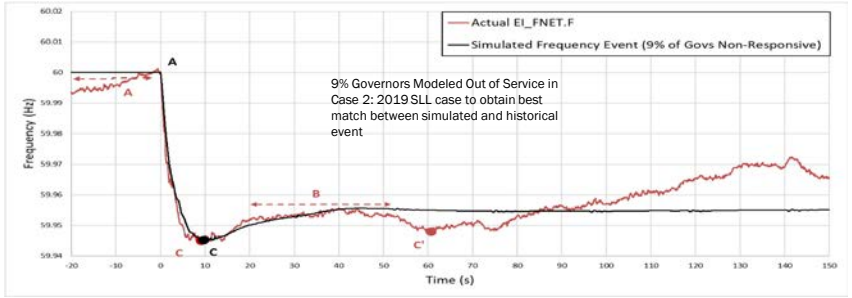

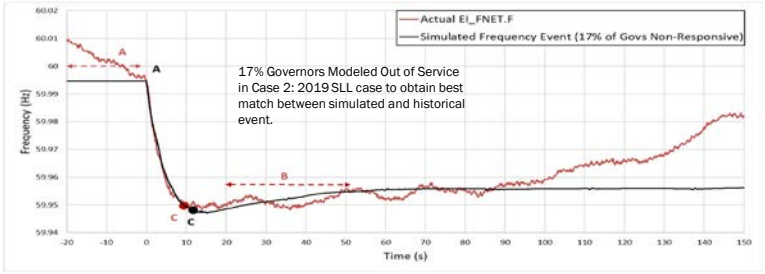

- FRWG selected Event 2: March 15, 2019 Frequency Event as the benchmark event to develop the year five low inertia case

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Step 2: Developing 5 Year Out Low Inertia Case

- **2023 SLL dynamics case development**

  - Low inertia year five case developed using MMWG 2018 Series 2023 SLL case as the base case
  - Files (IDVs) received from FRWG members were applied to the base case to update the case with projected generation mix, load and interchange levels.
  - FRWG selected the 15th March, 2019 event as the benchmark event for developing the year five case. Hence, the 17% governor participation reduction was captured in the finalized year five case

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Step 3: Simulating Resource Contingency Events

- Resource Contingency Events Definition

Event #	Event Name	MW Loss
1	Most Severe Single Contingency Event	2,299
2	Largest 10-Year Generation Trip Event	3,852
3	Historic 4,500 MW Generation Trip Event	4,307
4	10,000 MW Benchmark Test	10,001

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Step 4: Study Results

- Resource Contingency Events Simulation Results

Resource Contingency Event Simulation Results		
Three frequency events that were benchmarked	Most Severe Single Contingency Event (MSSC)	Satisfactory Frequency Response-59.8 Hz > UFLS (59.6Hz)
	Largest 10-Year Generation Trip Event	
	Historical 4,500 MW Trip Event	
Benchmark Test	Benchmark 10,000 MW Generation Trip Event	Min Frequency- 59.52 Hz < UFLS (59.6 Hz)

- With governors turned off or disabled based on the benchmarking analysis, generation dispatch changes similar to the lowest observed Eastern Interconnection inertia, and future changes to synchronous generation expected in the next five years, all three frequency events exhibited satisfactory frequency response with a minimum nadir of 59.80 Hz and are significantly far away from the initial Under-Frequency Load Shedding (UFLS) set point of 59.6 Hz.

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Step 5: Mitigations

- No mitigations were required for the three primary historic events
- For the more conservative 10,000 MW Benchmark Test, the following mitigations were identified:
- Mitigation Solution 1: Governor Participation Reduction
  - Changing the non-responsive governor participation from 17% to 7% in the year five case raises the frequency nadir above 59.6Hz
- Mitigation Solution 2: Generation MW Loss Reduction
  - Reduction in generation MW loss from 10,000 MW to 8,597 MW raises the frequency nadir above 59.6Hz

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Step 6: Recommendations

- **Recommendation 1: Gross Pmax Values**
  - Model data submitters should use gross MW capability for PMAX and model generator auxiliary load in the cases
- **Recommendation 2: Governor Modeling**
  - The Eastern Interconnection Reliability Assessment Group (ERAG) Multiregional Modeling Working Group (MMWG) should emphasize the importance of appropriate selection and coordination of the frequency and turbine-governor related model parameters such as governor droop, governor dead band, and maximum turbine power for generator model data submissions
- **Recommendation 3: Frequency Responsive Dynamics Files**
  - MMWG should consider the benefits of including load-frequency response characteristic models as part of the annual MMWG dynamics update process

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Conclusion

- The analysis and simulation in this study demonstrated that EI would have sufficient system inertia over the next five years. However, maintaining frequency in the Eastern Interconnection with the compounding effects of increasing non-synchronous generation and planned retirements, warrants continued study.

- From the benchmarking analysis, it was observed that the frequency response sensitivity to changes in governor modeling is greater than changes in total system inertia at the current resource mix levels. FRWG will continue to focus on improvements in the accuracy of the governor models in the study cases.

- Results of the analysis were shared with NERC for inclusion in the 2021 NERC Long-Term Reliability Assessment (LTRA)

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Questions?

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