DOE/OE Transmission Reliability Program

Reliability Standards Analysis and Assessment

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Reliability Standards Analysis and Assessment

Background:

- NERC Resources Subcommittee and Frequency Working Group are responsible for reliability standards development and monitoring performance
- NERC has requested CERTS support for research and analysis
- Research activity related to standards development and testing is continuing
- Current activities include
  - Frequency Event Detection and Reporting
  - Frequency Control Performance Report
  - Performance assessment of the new Balancing Authority Ace Limit (BAAL) standard
  - Analysis function is planned to be transitioned to NERC Staff

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Reliability Standards Analysis and Assessment

Objective:

Perform analysis to assess grid performance and standards development

- Perform grid reliability metrics analysis using data collected in CERTS applications as requested by the Resources Subcommittee

- Analyze collected data to assess reliability performance at different levels – Interconnection, Reliability Coordinator, Balancing Authority

- Perform analysis, testing, and monitoring of current and proposed reliability standards

Analysis Presented to and Used by NERC Resources Subcommittee and RS-Frequency Working Group

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Reliability Standards Analysis and Assessment

Tasks:

- Monthly frequency response event collection and analysis
- Monthly frequency device check
- Provide quarterly frequency control performance report and time error correction report for all four interconnections

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Frequency Response Event Collection and Analysis

Background

- FERC Order No. 693 directed the ERO to define the number of Frequency Response surveys that were conducted each year and to define a necessary amount of Frequency Response
- The RS initiated the Standards Authorization Request (SAR) for BAL-003 to put a measurement process in place so the adequacy of Frequency Response and the underlying issues can be objectively analyzed to enable informed decisions.

Accomplishment

- Worked closely with the NERC RS-FWG to define methodologies, test thresholds and formalize collection process in order to capture all significant frequency events for all four interconnections
- Submitted frequency events monthly report to the NERC RS-FWG. These monthly summary reports are posted at the NERC RS website under “Candidate Frequency Events”.
- Captured over **1500** events since 2012 for all four interconnections. Around **500** events are used for Reliability Standard BAL-003-1 and around **500** events are used for Measure-4.
- Collected events data are used for FRS Form 1, Standard BAL-003-1, NERC Frequency Response Annual Analysis Report and State of Reliability Report

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2015 Frequency Event Counts and Frequency Response

- Time Range: Dec 2014-Nov 2015
- Event Type:
  - Detected Event: detected by predefined thresholds
  - Additional NERC SA Reported Event: reported by NERC S/A because they did not meet the significant event threshold criteria highlighted in pink
  - Additional Low Event:
    - EI and the ERCOT: with Point C method highlighted in yellow
    - Quebec: Additional low events detected by lower threshold highlighted in grey
  - Candidate Event= Detected Event+ Additional NERC SA Reported Event+ Additional Low Event
  - Measure-4 Event: Selected by FWG from Candidate Event
  - BAL-003 Event: Selected by FWG from Candidate Event

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2015 Event Counts Summary

Yearly Total Based on Event Type

2015 Event Type	Detected Event Count	Additional NERC SA Reported Event Count	Additional Low Event Count	Total Event Count
Eastern				
Candidates Events	140	73	32	245
M4 Events	36	0	0	36
BAL3 Events	30	0	0	30
Western				
Candidates Events	46	10	0	56
M4 Events	21	0	0	21
BAL3 Events	25	0	0	25
ERCOT				
Candidates Events	55	9	10	74
M4 Events	34	0	0	34
BAL3 Events	35	2	0	37
Quebec				
Candidates Events	43	2	7	52
M4 Events	28	0	1	29
BAL3 Events	28	0	1	29

- Eastern and Western : None pink and yellow event are selected for M-4 and BAL-003
- ERCOT: Two pink events are selected for BAL-003
- Quebec: One grey event is selected for M-4 and BAL-003

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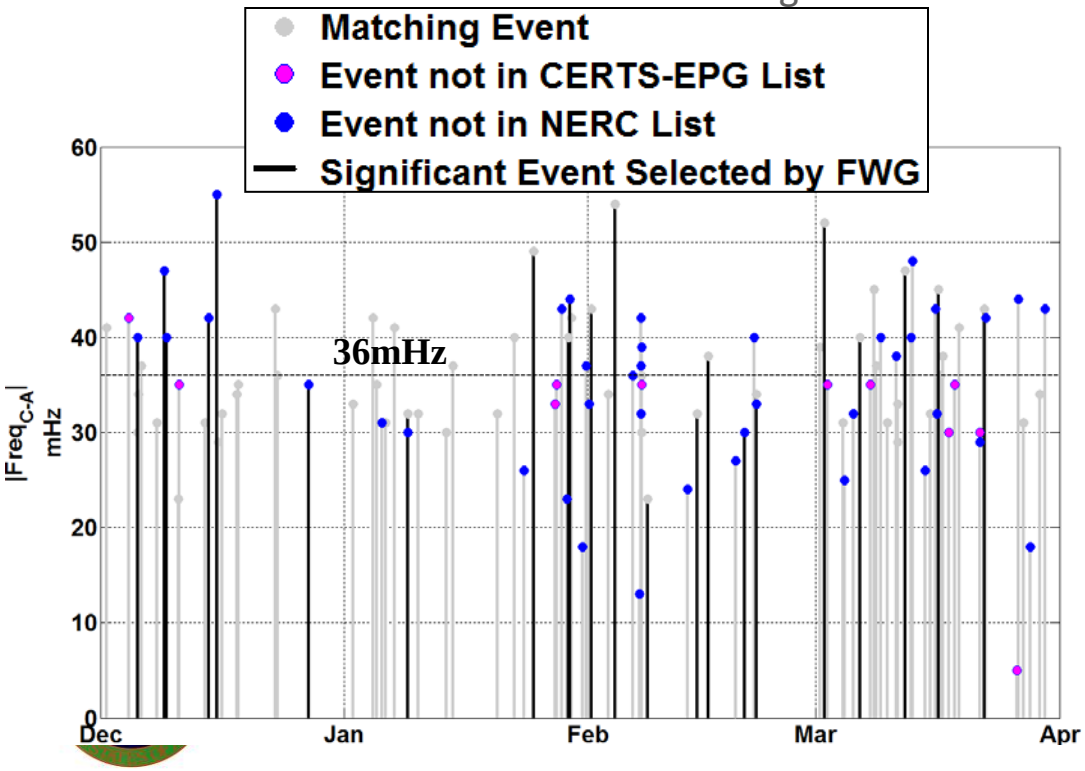
CERTS-EPG and NERC Work Transition Status

- Target: Last report (June report) will be provide on July
- NERC staff performed parallel work since December 2015
- NERC and CERTS-EPG events detection mismatch analysis
  - Almost all the events not found in CERTS-EPG list are small events which are lower than the detection threshold 36mHz
  - NERC event list missed 8 significant events selected by frequency working group



Counts Summary for Dec 2015-Mar 2016			
	Total Event	CERTS -EPG Missing	NERC Missing
Detected Events	107	11	41
FWG Selected Significant Events	22	0	8

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Quarterly Frequency Performance Control Report

- On an quarterly basis, EPG uses the 1-minute NERC frequency data to prepare frequency control performance report for submittal to the NERC Resources Subcommittee for their review
  - Monthly CPS1, CSP2,
  - Yearly frequency deviation profile
  - Last 6 years frequency histogram
  - Hourly average of frequency deviation
  - Daily performance for RMS1, RMS10 and RMS60 of frequency deviation
  - Yearly RMS1 and RMS10 Profile of frequency deviation
  - Daily RMS1 of frequency deviation
  - Daily average of frequency deviation
  - Quarterly Time Error Report
- Last funded report presented on RS January meeting

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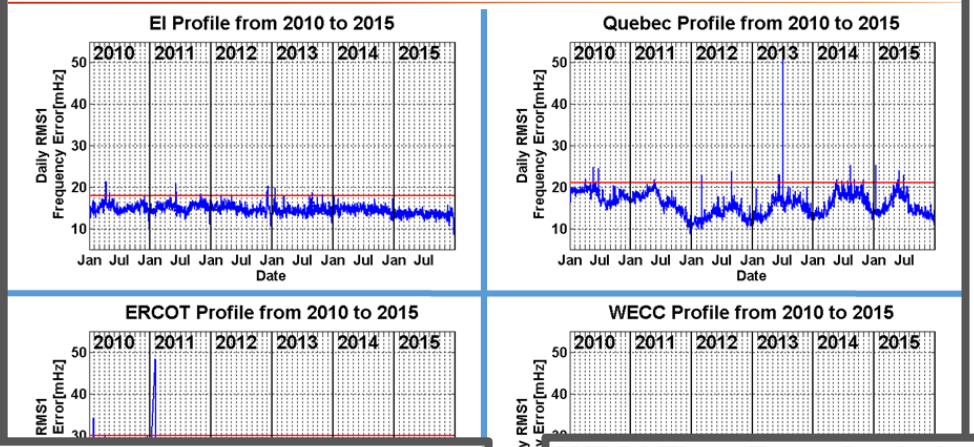
2015 Forth Quarter Frequency Control Performance

Highlights

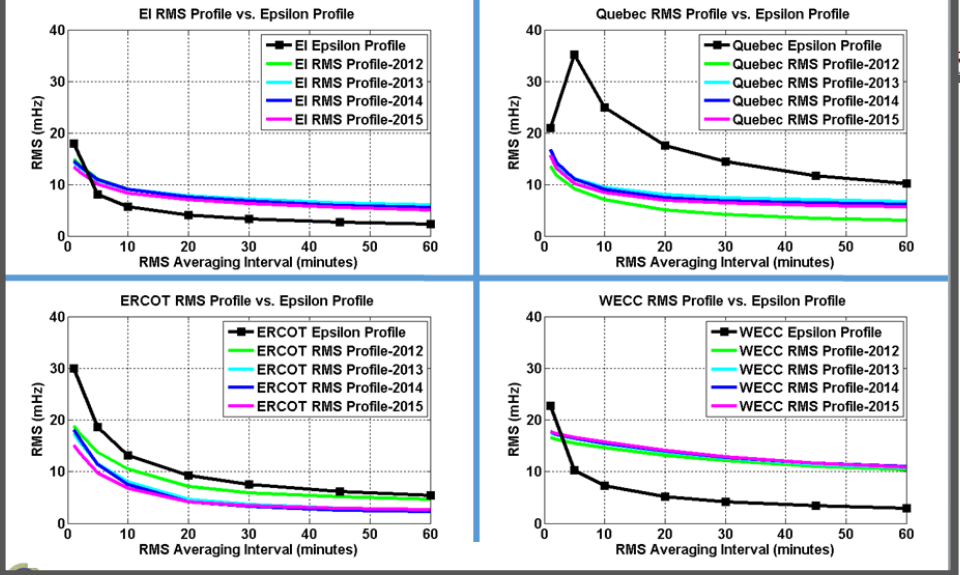
Interconnections 2010 to 2015 Daily RMS1 Profile



RS has obligation to review the frequency control performance trend

2012 to 2015 Yearly RMS Profile

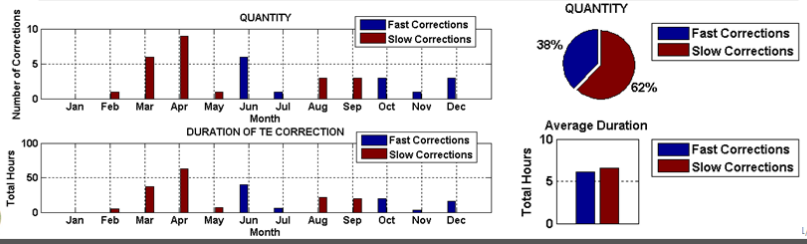
Yearly RMS 1, RMS 5, RMS 10, RMS 20, RMS 30, RMS 45, RMS 60 Compared with Their Target Values



WECC Time Error Statistics 2015 Summary

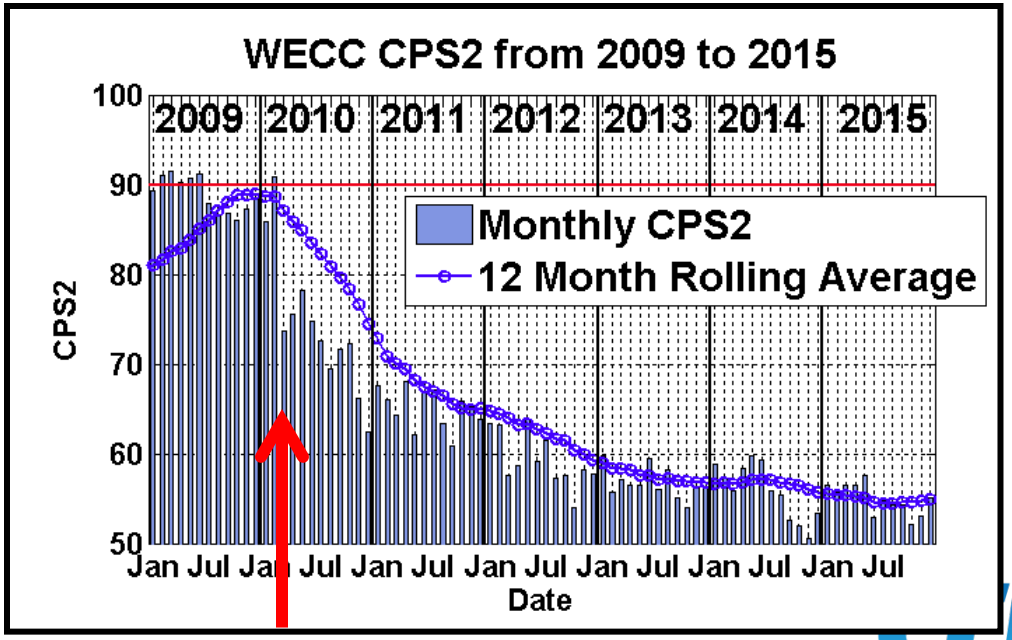
Annual Totals (YTD)

Total Number of Time Error Corrections	37	
"Fast" Time Error Corrections	14	
"Slow" Time Error Corrections	23	
Net Total Duration of TE Correction (Hrs)	237.45	Hours
"Fast" Time Error Corrections	85.5	Hours
"Slow" Time Error Corrections	151.9	Hours
Average Duration of Time Error Corrections(Hrs)	6.42	Hours
"Fast" Time Error Corrections	6.11	
"Slow" Time Error Corrections	6.61	
Actual "Time Error" Correction Achieved	272.06	Seconds 4.5minutes



New Standard BAAL (Balancing Authority ACE Limit)

- New standard BAAL to replace current CPS2 in July 2016
- WECC CPS2 has been decreasing since 22 WECC BAs participated in field trial with CPS2 waiver on March 2010
- NERC RS needs CERTS-EPG help to monitor frequency control performance
- CERTS-EPG helped NERC BAAL standard drafting group since 2005



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Next Steps

- Continue to produce and deliver monthly frequency response event report to NERC-RS and the industry as CERTS-EPG has done during the last 4 years until NERC is really ready
- Support the NERC Resource Subcommittee (RS) for the implementation of New Standard BAAL and monitor the BA performance

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Q & A

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