NERC
NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Frequency Response Technical Conference

Measurement of Frequency Response

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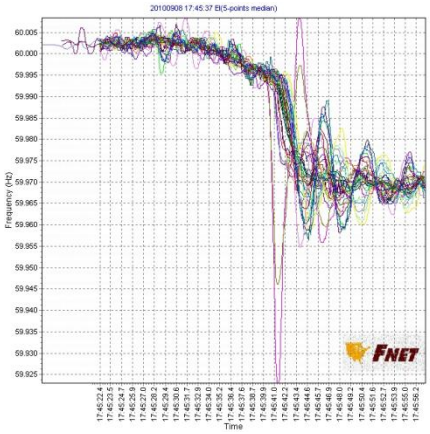
Agenda

- Use of “B value” as the metric
- Median as the measure of annual performance
- Measurement error and data variability
- Proposed Interconnection target obligations
- Estimating your BA’s obligation
- Supplemental discussion (answers to other recently asked questions)
  - Comparison of US-Europe frequency performance
  - Comparison of Interconnections
  - FRS measurement window

B-Value vs. Point C

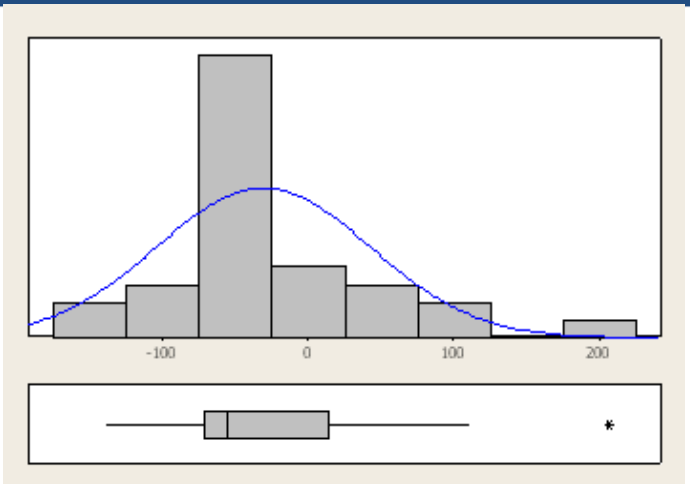
- Much like dropping a stone in a pond, point C is different throughout an Interconnection for the same event and occurs at different times
- The B value is nearly identical among all BAs for the same event
- The ratio of C-B is generally consistent among events within an Interconnection
- Given this, we can use the B value as a metric and apply a correction ratio to measure encroachment on UFLS



Median as the Measure

- The standard uses the median response of about 25 events annually as the measure of a BA's performance
- The frequency response calculation has a very low signal to noise ratio, particularly in a multi-BA Interconnection
  - Governor response is easily masked by minute to minute changes in load
  - Noise causes outliers that corrupt the estimate of frequency response
  - The outliers are not symmetrical and will inflate or underestimate beta
- The median is the preferred measure of central tendency in a population with outliers

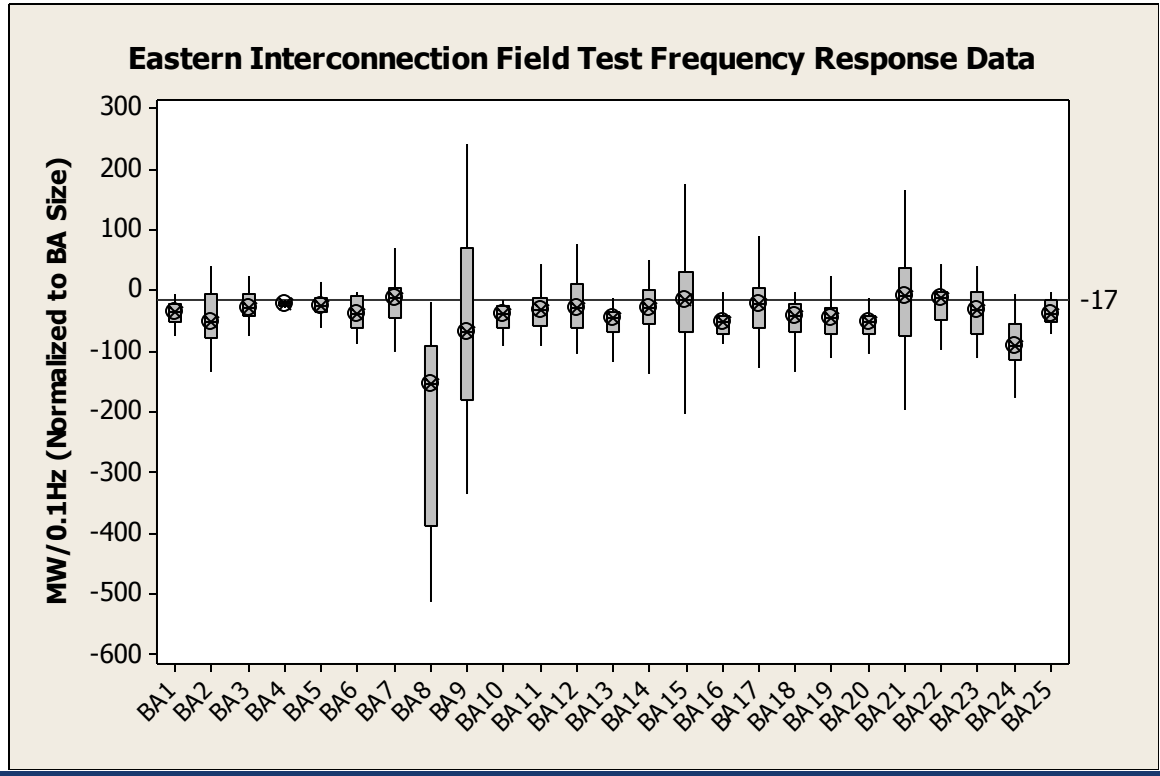
Error induced by Noise



- This graph is typical calculated performance for an Eastern Interconnection BA
- Notice that some values are actually positive
- For the 27 BAs that submitted field trial data, for about 35% of the individual observations, the calculated response is corrupted by the noise to the point of showing low BA frequency response even though Interconnection performed adequately

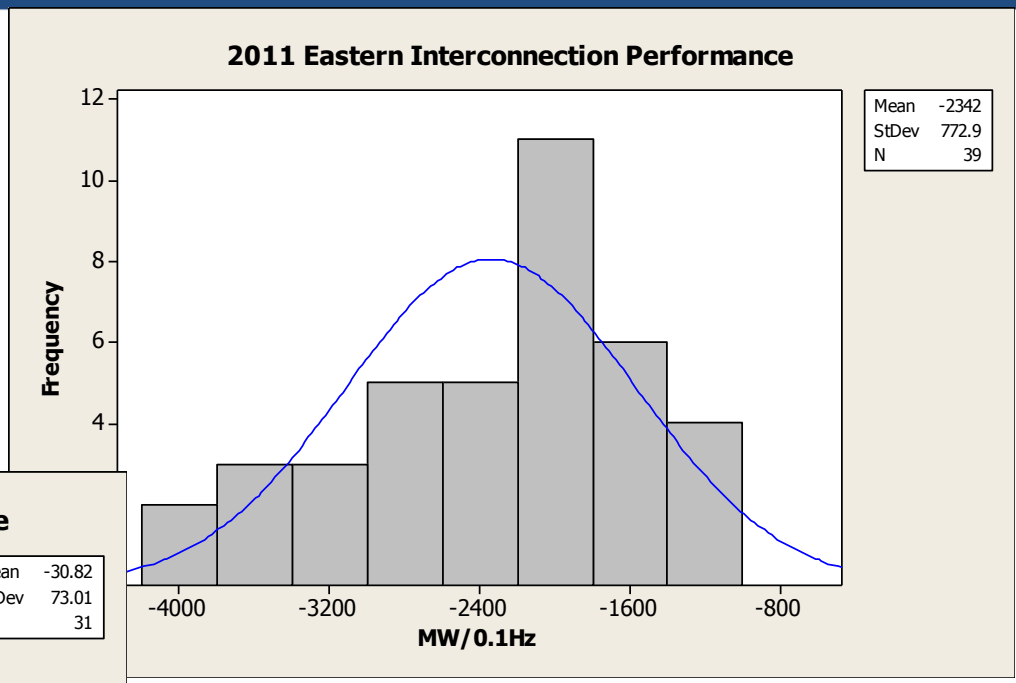
BA Data Variability

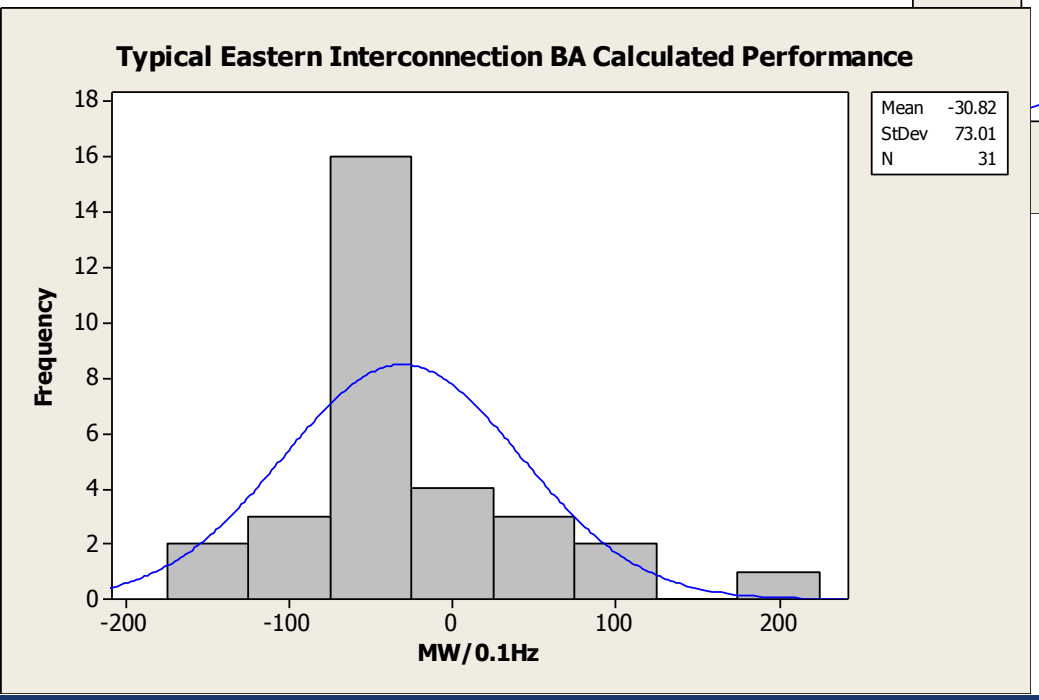
- The graph below shows actual (normalized) data provided by BAs for the field trial
- Note that median performance is OK across the board
- Refer to the previous slide that showed Interconnection performance was acceptable as well for the same period



BA vs. Interconnection

Measurement quality increases when performance is aggregated to the Interconnection level





NERC and the Resources Subcommittee will monitor Interconnection performance for trends

Proposed Interconnection Targets

- The drafting team was asked for further technical justification of the Interconnection target obligations
- The table below outlines the new targets

Interconnection	East	West	Texas	HQ	
Target Protection Criteria	4500	2740	2750	1700	MW
Credit for Load Response		-400	-1400		MW
Prevailing UFLS First Step	59.5	59.5	59.3	58.5	Hz
Frequency Margin (tenths)	5	5	7	15	0.1Hz
Typical C-B Ratio	1.08	1.37	1.24	2.15	
Necessary Frequency Response	-972	-641	-239	-244	MW/0.1Hz
FRO with Reliability Margin (25%)	**-1215**	**-801**	**-299**	**-305**	MW/0.1Hz

Estimating your FRO

1. Use the proposed FRO for your Interconnection (previous slide)
2. Multiply this value by:

$$\frac{\text{Your BA's Bias Setting}}{\text{Your Interconnection's Total Bias}}$$

You can find Bias Setting values at:
www.nerc.com/docs/oc/rs/2012%20CPS2%20Bounds%20Report%20Final(Update20120419).pdf

You can find candidate frequency events at:
www.nerc.com/filez/rs.html

Questions

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Other recently asked questions

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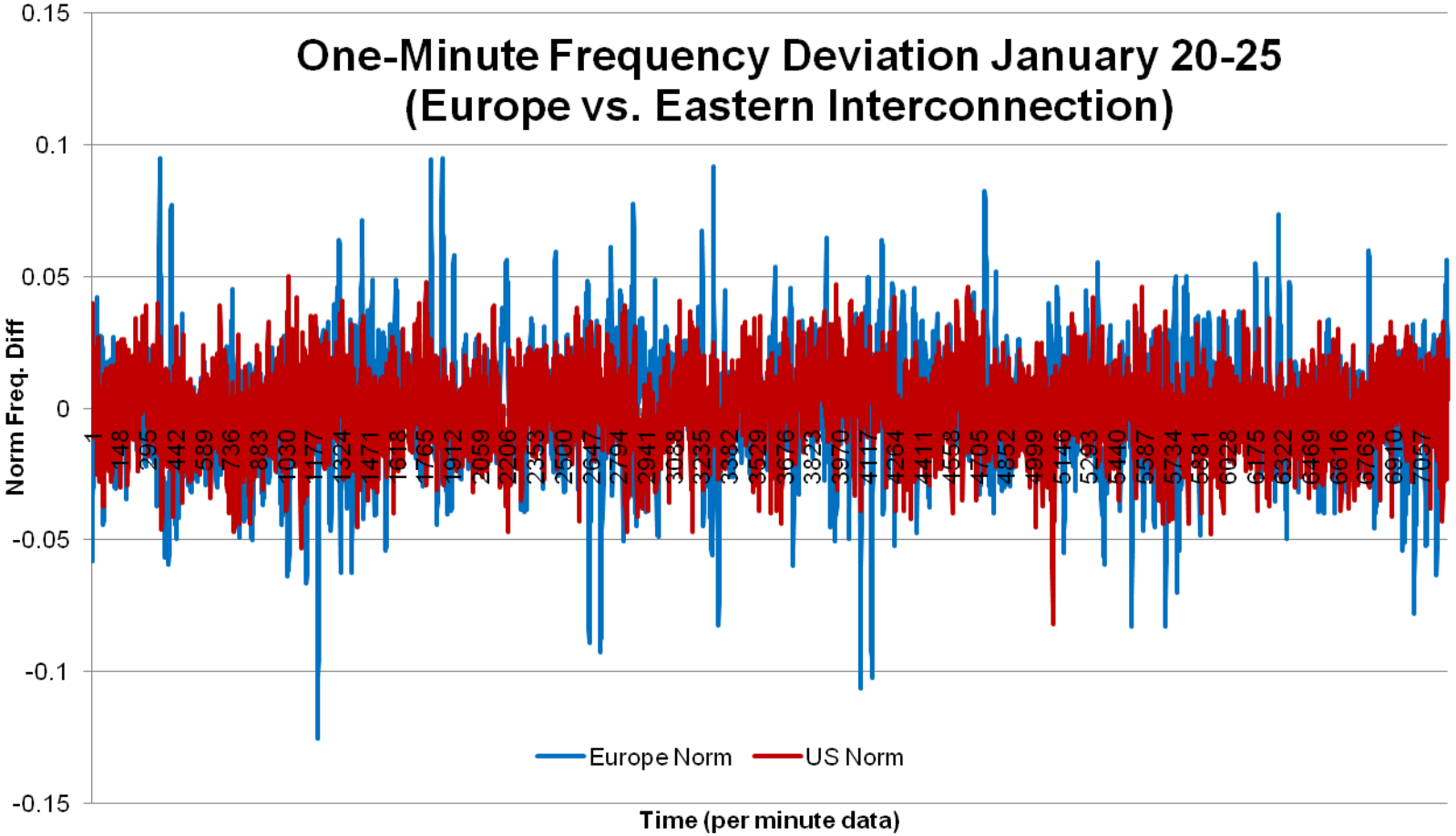
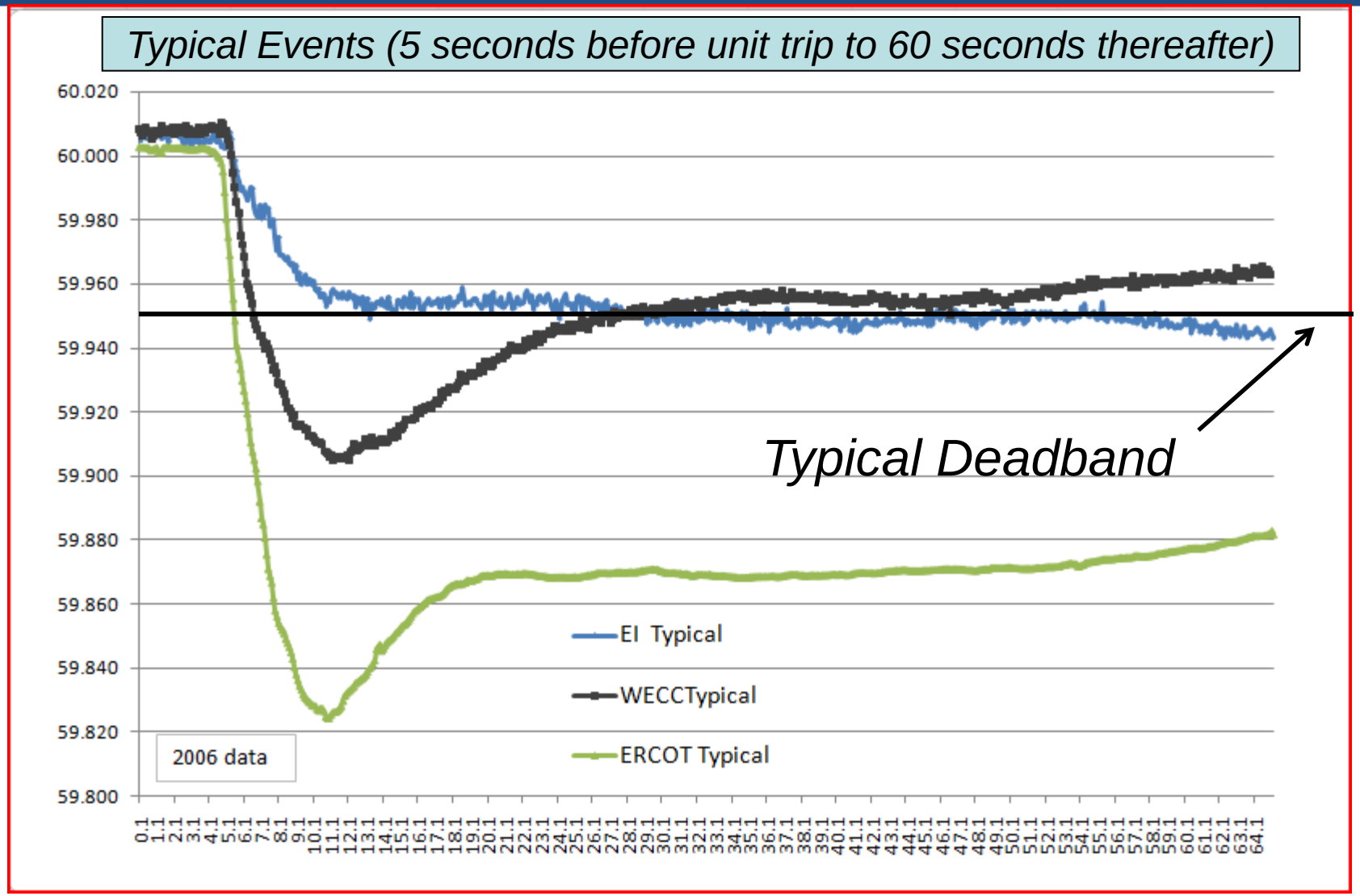
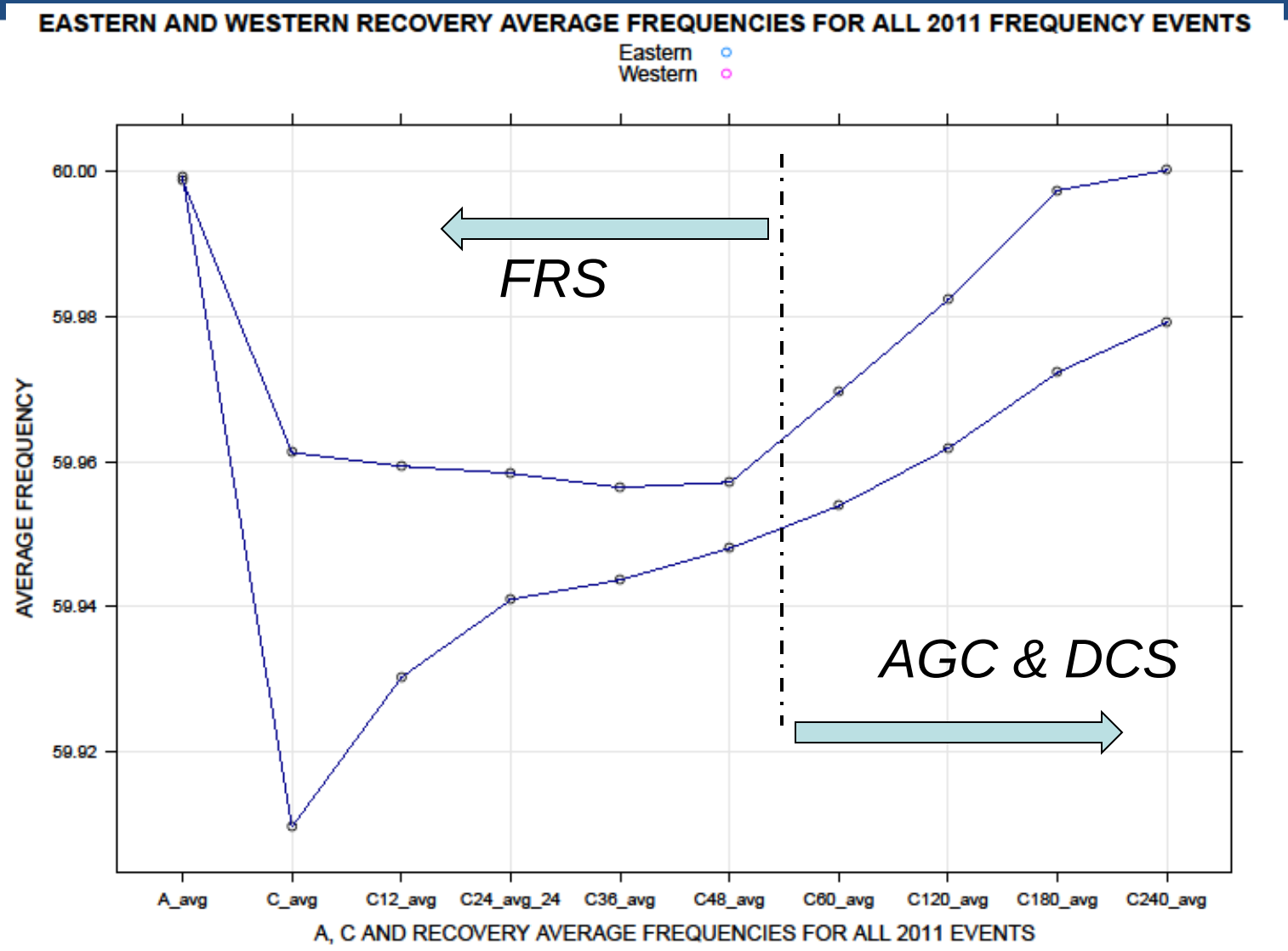
Europe vs. US (EI)



2010 comparison by the Resources Subcommittee

Interconnection Comparison




EASTERN AND WESTERN RECOVERY AVERAGE FREQUENCIES FOR ALL 2011 FREQUENCY EVENTS
Eastern
Western
AVERAGE FREQUENCY
60.00
59.98
59.96
59.94
59.92
FRS
AGC & DCS
A_avg
C_avg
C12_avg
C24_avg_24
C36_avg
C48_avg
C60_avg
C120_avg
C180_avg
C240_avg
A, C AND RECOVERY AVERAGE FREQUENCIES FOR ALL 2011 EVENTS