



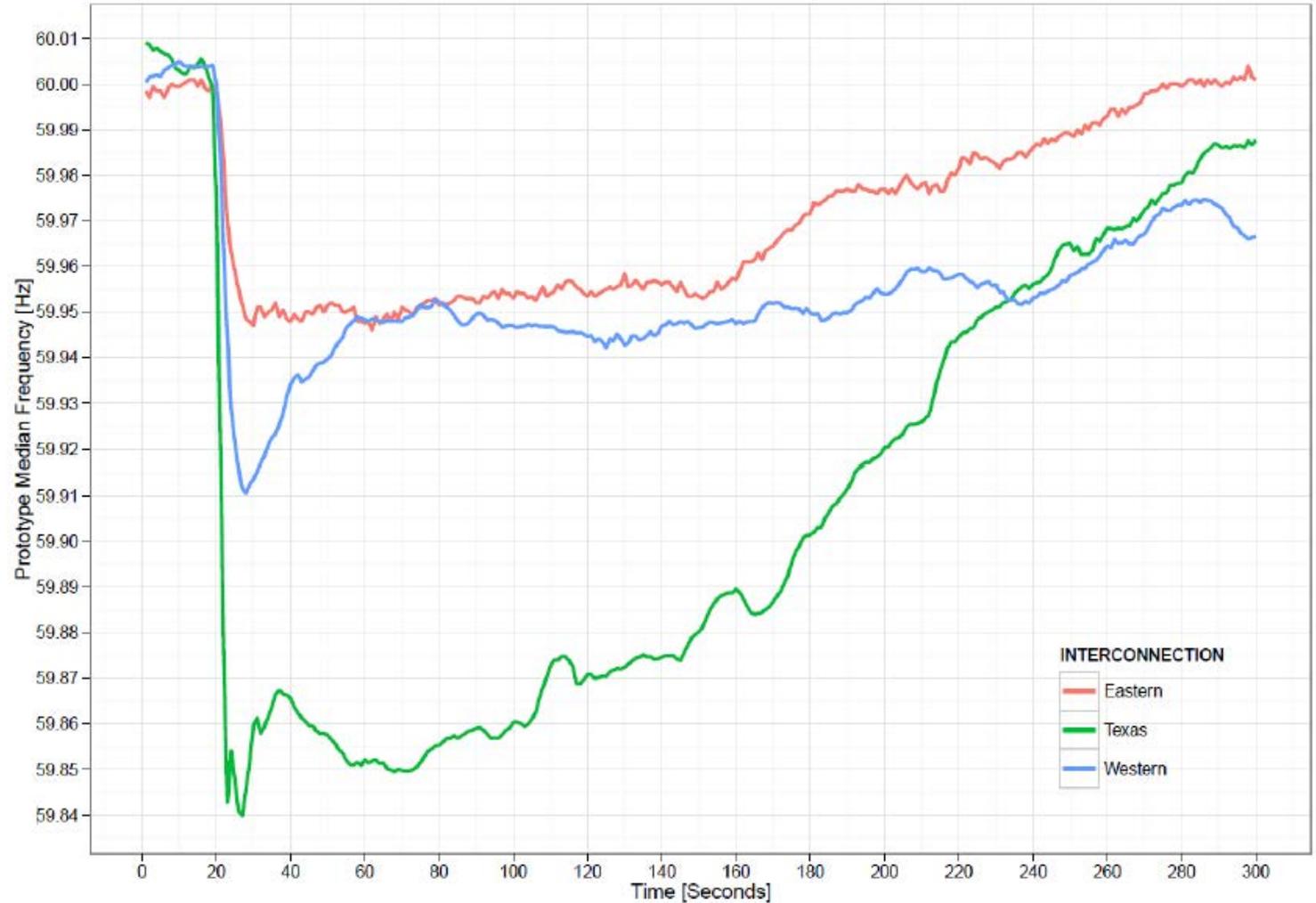
NERC Reliability Standard BAL-003-1 Frequency Response & Frequency Bias Setting

Brad Gordon
(PC) Enhanced Inverters Meeting
June 27th, 2014

- Primary Frequency Control, also known generally as primary frequency response, is the first stage of frequency control and is the response of resources and load to arrest local 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.

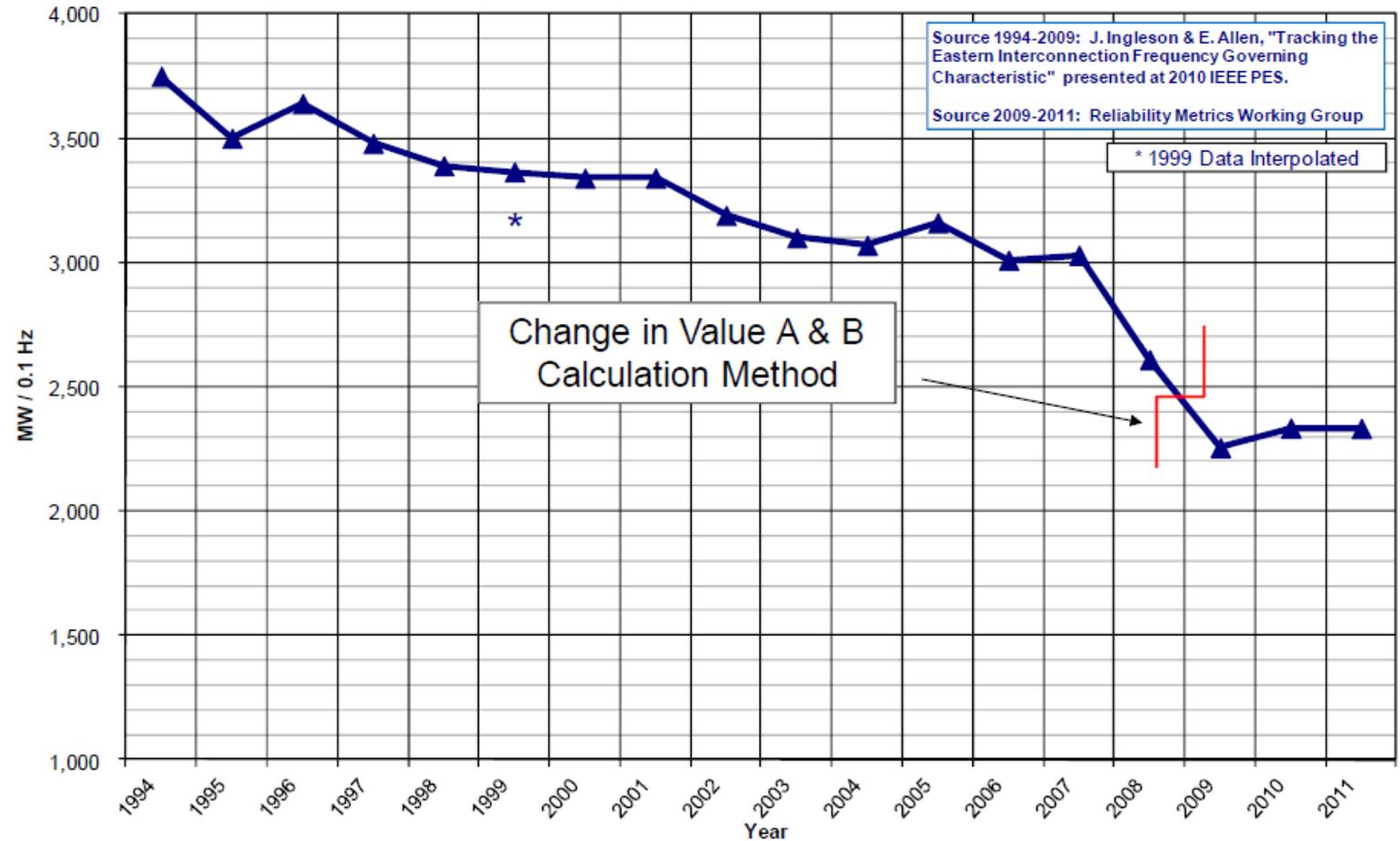
Primary Frequency Control comes from automatic generator governor response, load response (primarily motors), and other devices that provide an immediate response based on local control systems

Evidence of frequency response withdrawal seen in the Eastern Interconnection



Eastern Interconnection Mean Primary Frequency Response

Projections of frequency response decline from 1994 to 2008 with slight improvement since 2009 (due at least in part to improved data & calculation methods?)



Interconnection Frequency Response Obligation (IFRO)

Frequency Response Initiative Report

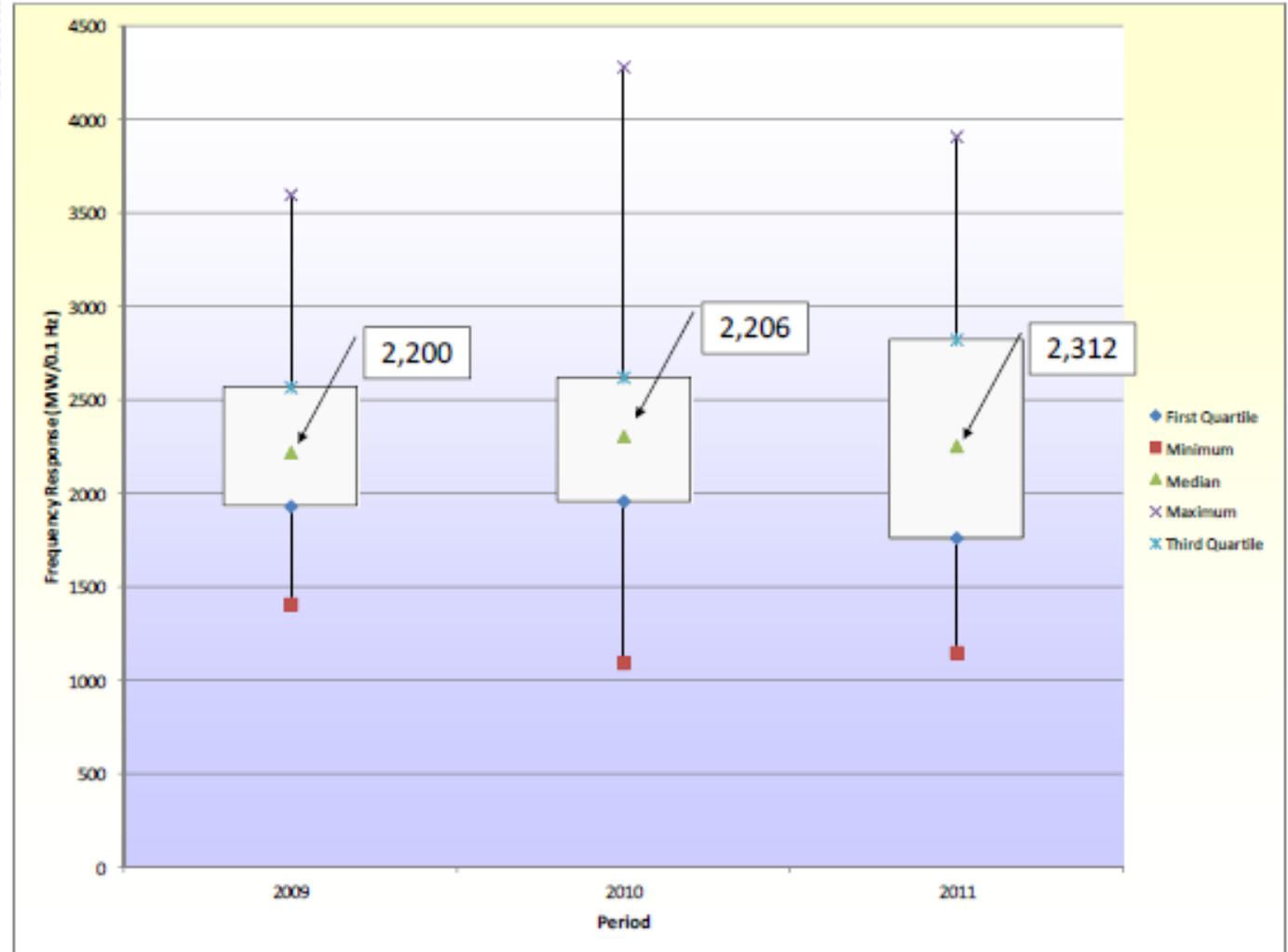
NERC Staff – October 2012

- A frequency event should not trip the first stage of UFLS
- IFRO should protect from largest N-2 event, except EI which is largest event of last 10 years
- Balancing Authorities should be assigned a percentage of the IFRO based on BA load & generation

Table F: Recommended IFROs

	Eastern	Western	ERCOT	Québec	Units
Starting Frequency	59.974	59.976	59.963	59.972	Hz
Max. Delta Frequency	0.449	0.291	0.473	0.949	Hz
Resource Contingency Protection Criteria	4,500	2,740	2,750	1,700	MW
Credit for LR	–	300	1,400	–	MW
IFRO ¹²	-1,002	-840	-286	-179	MW/0.1Hz
Absolute Value of IFRO	1,002	840	286	179	MW/0.1Hz
% of Current Interconnection Performance ¹³	40.6%	71.2%	48.7%	23.9%	
% of Interconnection Load ¹⁴	0.17%	0.56%	0.45%	0.50%	

Eastern Interconnection IFRO of 1002 MW/0.1Hz is approximately 40 – 45% of recent median performance



Order No. 794 approved by the FERC on January 16th, 2014

Applicable to Balancing Authorities

Requirement 2: Effective April 1st, 2015

Each Balancing Authority that ... uses a fixed Frequency Bias Setting shall implement the Frequency Bias Setting determined in accordance with Attachment A, as validated by the ERO, into its Area Control Error (ACE) calculation

...

Requirement 1: Effective April 1st, 2016

Each ... Balancing Authority ... shall achieve an annual Frequency Response Measure (FRM) (as calculated and reported in accordance with Attachment A) that is equal to or more negative than its Frequency Response Obligation (FRO) ...

Requirement 2:

A BA's fixed Frequency Bias Setting will be based on a percentage of the previous year's peak load in lieu of current year's forecast peak load. The first year the percentage will be 0.9% of peak load, replacing 1%, and may be reduced annually by 0.1% increments, to gradually move Frequency Bias Settings closer to natural frequency response.

Initial Assessment: No Compliance Impacts. PJM supports the initiative to reduce over-bias conditions.

Requirement 1:

Each BA will be assigned a Frequency Response Obligation (FRO) which is a percentage of the IFRO. A BA's Frequency Response Measure (FRM) will be the median of the frequency response performance for 20 to 35 frequency events selected throughout the year by the NERC Frequency Working Group. FRM calculations are based on changes in Net Actual Interchange from the event start (Point A) to the average change from 20 to 52 seconds after the event start (Point B).

Initial Assessment: No Near-Term Compliance Impacts. PJM FRM has exceeded the expected FRO during the BAL-003 Field Trial. PJM is completing development of tools to measure frequency response performance at the generator level and will work with GO's to address unit performance and governor settings while continuing to monitor trends and develop tariff and/or market options for ongoing consideration.

Questions?