

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Interconnection Criteria for Frequency Response Requirements

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to ensure
the reliability of the
bulk power system

Frequency Response Obligation Tenets

1. Should not trigger first stage of regionally-approved UFLS Systems
2. Unavoidable local tripping of first-stage UFLS systems for severe frequency excursions
 - Protracted faults
 - Systems on edge-of the interconnection
3. Some frequency-sensitive loads may trip
4. Other frequency-sensitivities may be considered in the future
 - Electronically coupled load/resources with common-mode frequency sensitivities (ex. IEEE 1547)

Largest Category C Event (N-2)

Interconnection	Basis	MW
Eastern	Nelson DC Bi-poles 1 & 2	3,854
Western	2 Palo Verde Units	2,740
Texas	2 South Texas Project Units	2,750

Largest Total Plant with Common Voltage Switchyard

Interconnection	Basis	MW
Eastern	Bruce Units 3-8	<u>4,779</u>
Western	3 Palo Verde Units	<u>3,575</u>
Texas	2 South Texas Project Units	2,750

Largest Resource Event in Last 10 Years

Interconnection	Basis	MW
Eastern	August 4, 2007 Disturbance	4,500
Western	June 4, 2004 Disturbance	5,000
Texas	May 15, 2003 Disturbance	3,400

Probability-Based Event Criteria

- Being researched within FRSDT for BAL-003 Field Trial
 - Not ready for initial work

TIS Criteria Initial Recommendation

- For initial use within the BAL-003 Field Trial

Interconnection	Resource Contingency	Basis	MW
Eastern	Largest Resource Event in Last 10 Years	August 4, 2007 Disturbance	4,500
Western	Largest Category C Event (N-2)	2 Palo Verde Units	2,740
Texas	Largest Category C Event (N-2)	2 South Texas Project Units	2,750

- Multiple criteria can be examined
- Basis for criteria may vary between interconnections

BAL-003 Field Trial (5/3/11 – 2/16/12)

- Sets an Interconnection Frequency Response Obligation (IFRO) for each interconnection
- Allocates each BA responsibility for portion of IFRO
 - Evaluate different allocation methods
 - Sample method : $(\text{Peak Gen} + \text{Peak Load}) \div 2$
- Evaluate relationship between responses to:
 - Point B – Historical method
 - Point C – Nadir-based
- Analyze interconnection performance
 - Metrics based on Selected Events
- Explore multiple calculation methods
 - For allocation of FRO to BAs
 - For Metrics

Interconnection Frequency Response Obligation (IFRO)

Variables to be considered

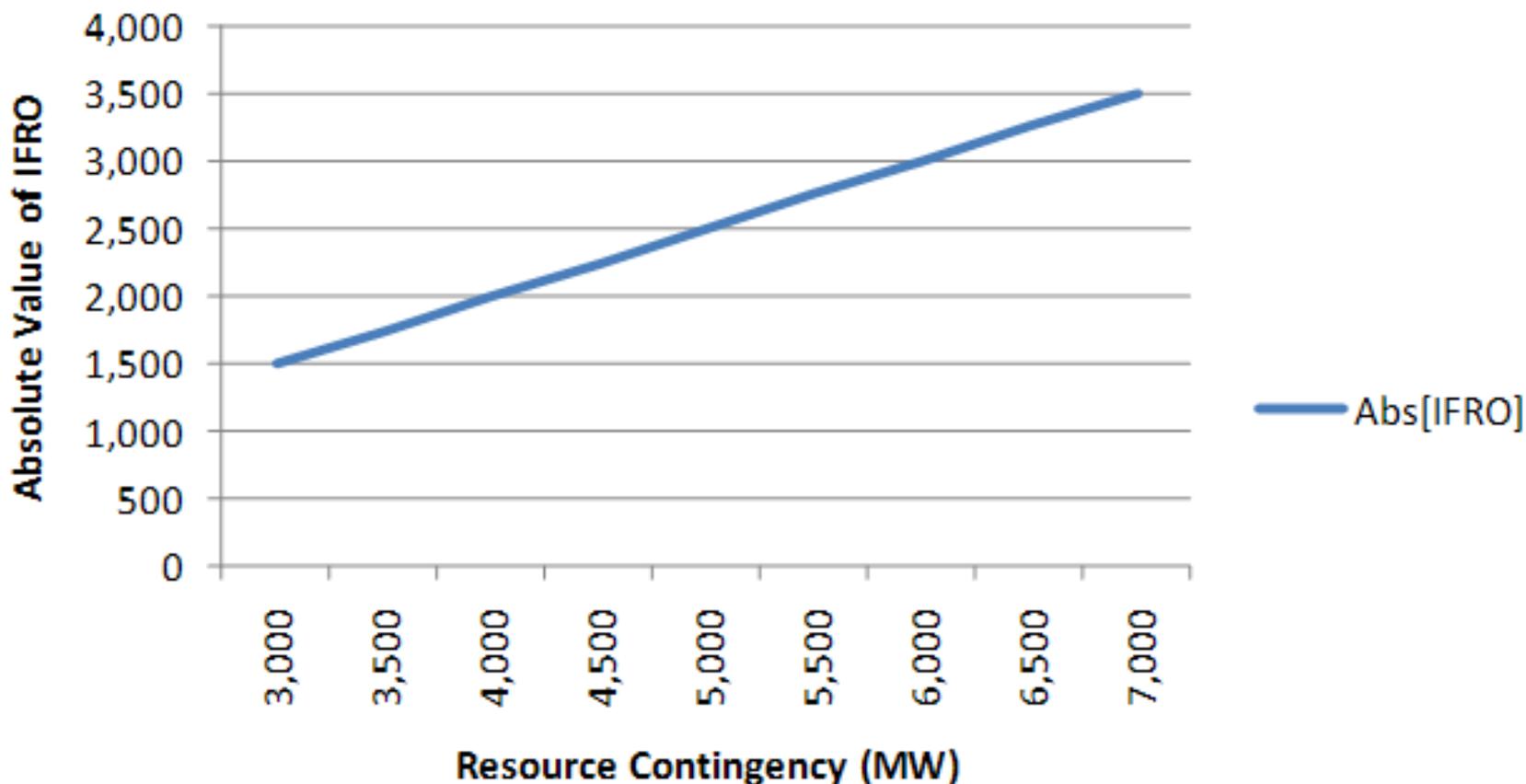
- Highest UFLS Setpoint (approved by RE)
 - Range from 58.5 Hz to 59.7 Hz
- Margin to account for:
 - time error correction
 - variability of load
 - variability of interchange
 - variability of frequency over the course of a day
 - other uncertainties
- Margin can vary between interconnections
 - Ranges proposed from 50 mHz to 200 mHz

IFRO Based on TIS Initial Recommendation

	Eastern	Western	Texas	Québec	
Starting Frequency	60.00	60.00	60.00	60.00	Hz
Highest Regional UFLS Setpoint	59.7	59.5	59.3	58.5	Hz
Margin	0.100	0.100	0.100	0.100	Hz
Maximum Delta Frequency	0.200	0.400	0.600	1.400	Hz
Target Minimum Frequency	59.800	59.600	59.400	58.600	Hz
Resource Contingency Protection Criteria	4,500	2,740	2,750	1,700	MW
Credit for LaaR			1,150		MW
IFRO	-2,250	-685	-267	-113	MW/0.1Hz
Absolute Value of IFRO	2,250	685	267	113	MW/0.1Hz

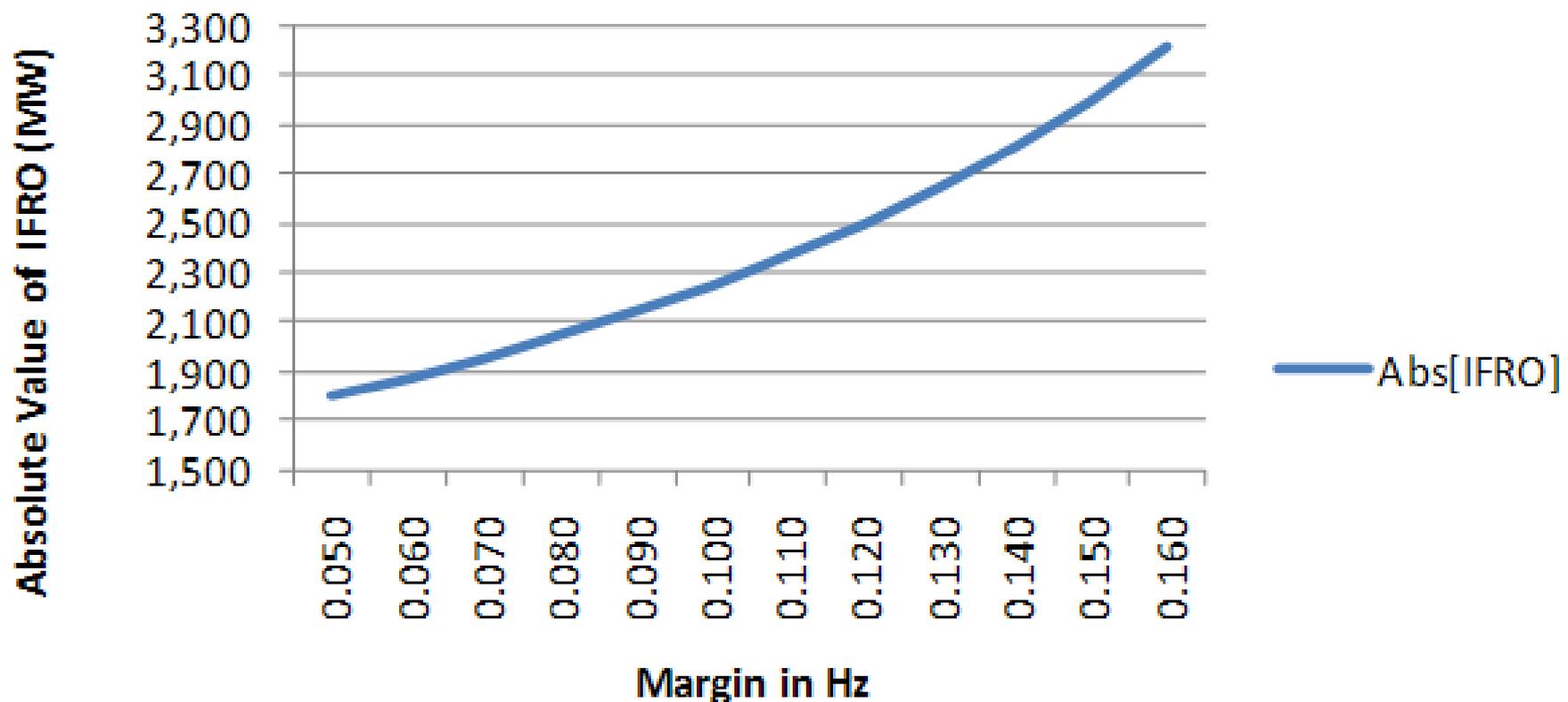
Size of Resource Contingency

**Eastern Interconnection
IFRO Sensitivity to Resource Contingency**



Size of Margin

Eastern Interconnection IFRO Sensitivity to Margin



- Interconnection stability analysis to verify maximum sustainable resource and load-loss
- Locational limitations for the contingencies that might affect acceptable frequency performance
- Probabilistic method for determining criteria
- Modify criteria for final BAL-003 Standard

A stylized map of North America is shown in a light blue color. Overlaid on the map is a green grassy field with several blades of grass. The map and grass are semi-transparent, allowing the background colors to show through. A dark blue horizontal bar is positioned across the middle of the slide, containing the text "Questions?".

Questions?