NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Presentation 1

Review Data Request for Post 2011/12 Winter and 2012 Summer Assessments

Jessica Bian and Matthew Varghese, NERC

ORS Meeting, November 13-14, 2012

RELIABILITY | ACCOUNTABILITY

Agenda

- Transition from RAS to PAS
- Templates for data collection
- Instructions
- Definitions

Transition from RAS to PAS

RAS transitioned ownership of post-seasonal reports to the Performance Analysis Subcommittee (PAS)

RAS willing to continue post-seasonal data collection in the near-term, but strongly recommends operators provide data directly and review the assessment

Templates for Data Collection

ERO-2011-12PS Schedule A - Demand and Capacity - Season					
LINE #	DESCRIPTION	Area 1 Seasonal Peak	Area 1 Date/Hour	Area 2 Seasonal Peak	Area 2 Date/Hour
	Subregion				
1	All-Time Season Peak Demand				
2	Season Peak Demand Forecast				
3	Day-Ahead Peak Demand Forecast				
4	Activated/Deployed Demand Response On-Peak				
5	Actual Peak Demand				
6	Total Available Capacity	Line 7 + Line 8			
7	Total Available CCDR (Controllable-Capacity Demand Response)				
8	Total Available Generation				
8a	Scheduled Outage				
8b	Forced Outage				
8c	Generator Derates				
9	Required Reserves (MW)				
10	Actual Reserves (MW)				
11	Operating Reserve Margin (%)	(Line 9 - Line 8) /(Line 8)			

Instructions

Instructions for Reporting Post-Seasonal Data		
Lines	Description	Where to obtain the data
1	All-Time Summer Peak Demand	NERC Morning Report
2	Seasonal Peak Demand Forecast	NERC Morning Report
3	Day-Ahead Peak Demand Forecast	NERC Morning Report
4	Demand Response On-Peak	Must be gathered
5	Actual Peak Demand	NERC Morning Report
6	Total Available Capacity (MW)	Calculated
7	Total Available Controllable-Capacity Demand Response (MW)	Must be gathered
8	Total Available Generation (MW)	NERC Morning Report
8a	Scheduled Outage (MW)	NERC Morning Report
8b	Forced Outage (MW)	NERC Morning Report
8c	Generator Derates (MW)	NERC Morning Report
9	Required Reserves (MW)	NERC Morning Report
10	Actual Reserves (MW)	NERC Morning Report
11	Operating Reserve Margin (%)	NERC Morning Report - Calculated

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Definitions

Reliability Coordinator Footprint Generation MW Total	
Seasonal Peak MW	Seasonal MW Value (Summer-Winter)
Projected Peak MW	Peak value based on RC or Region definition
Hour	Hour in which peak is expected to occur
	Initially each RC or Region will define the daily net hourly peak as an aggregated hourly or highest instantaneous peak. Both Seasonal and Peak will utilize the same calculation within the RC or Regional footprint.
Reliability Coordinator Footprint Generation MW Totals	
Scheduled Outage MW	Generation scheduled out that was planned. Total of scheduled generation out equals scheduled outage.
Forced Outage MW	Total value of generation forced out for maintenance. Does not include derated units.
Reliability Coordinator Footprint Projected MW Reserves Data	
Type of Reserves	Contingency Reserve available
Required MW	Contingency Reserve requirement in MW for the RC area or, if the reserve requirement is normally achieved through the participation in a Reserve Sharing Group, the Contingency Reserve requirement for the Reserve Sharing Group.
Projected MW	Total anticipated operating reserves available at time of peak in the RC area or the reporting entity footprint. Normally this would be a daily or seasonal assessment number.

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Presentation 2

Revised Situation Awareness Metrics

Jessica Bian and Matthew Varghese, NERC

ORS Meeting, November 13-14, 2012

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Agenda

- ALR3-6 Unforecasted System Operating Limit Violations
- ALR3-7 Emergency Rating SOL Exceedances

ALR3-6 Unforecasted SOLs

During real time daily operation, how many first contingency limit exceedances (SOLs) are identified by TOP or RC during real time operations without day ahead (or months ahead) identification of the same SOL in the day ahead operations plan.

Formula: Count of SOLs identified during real-time operations without day ahead identification of the same SOL in the day ahead operations plan

Quarterly Reports on an aggregate basis by Interconnection Eastern, Western, ERCOT, and Quèbec

http://www.nerc.com/docs/pc/rmwg/pas/metrics/Proposed_ALR_3_6.docx

ALR3-7 Emergency SOL Exceedances

During real time daily operation, how many first contingency SOL limit exceedances (which exceed 100% of emergency limit) are not acted upon (no mitigation plan orders issued) by the TOP or RC within 35 minutes from the first time the SOL exceeded 100% of the emergency limit.

Formula: SOL Emergency_Rating_Exceedance = Number of First Contingency SOL Limit Violations (which exceed 100% of emergency limit) not acted upon within 35 minutes

Quarterly Reports on an aggregate basis by Interconnection Eastern, Western, ERCOT, and Quèbec

http://www.nerc.com/docs/pc/rmwg/pas/metrics/Proposed_ALR_3_7.docx

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Presentation 3

Metric Proposals to Measure Reliability Impact of Variable Generation Integration

Jessica Bian and Matthew Varghese, NERC

ORS Meeting, November 13-14, 2012

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Agenda

- The Need for a VG Metric
- Long Term Load following VG Metric
- Load Following VG Metric Definition & Calculation
- Short Term vs. Long Term metrics
- Short Term Regulation VG Metric
- Regulation VG Metric Definition & Calculation
- Background Information
  - CPS1 Definition
  - CPS1 Data for EI

The need for a VG Metric

VG Metrics measure the supply-demand imbalance due to VG

VG Metrics quantify change in operating reserves due to VG

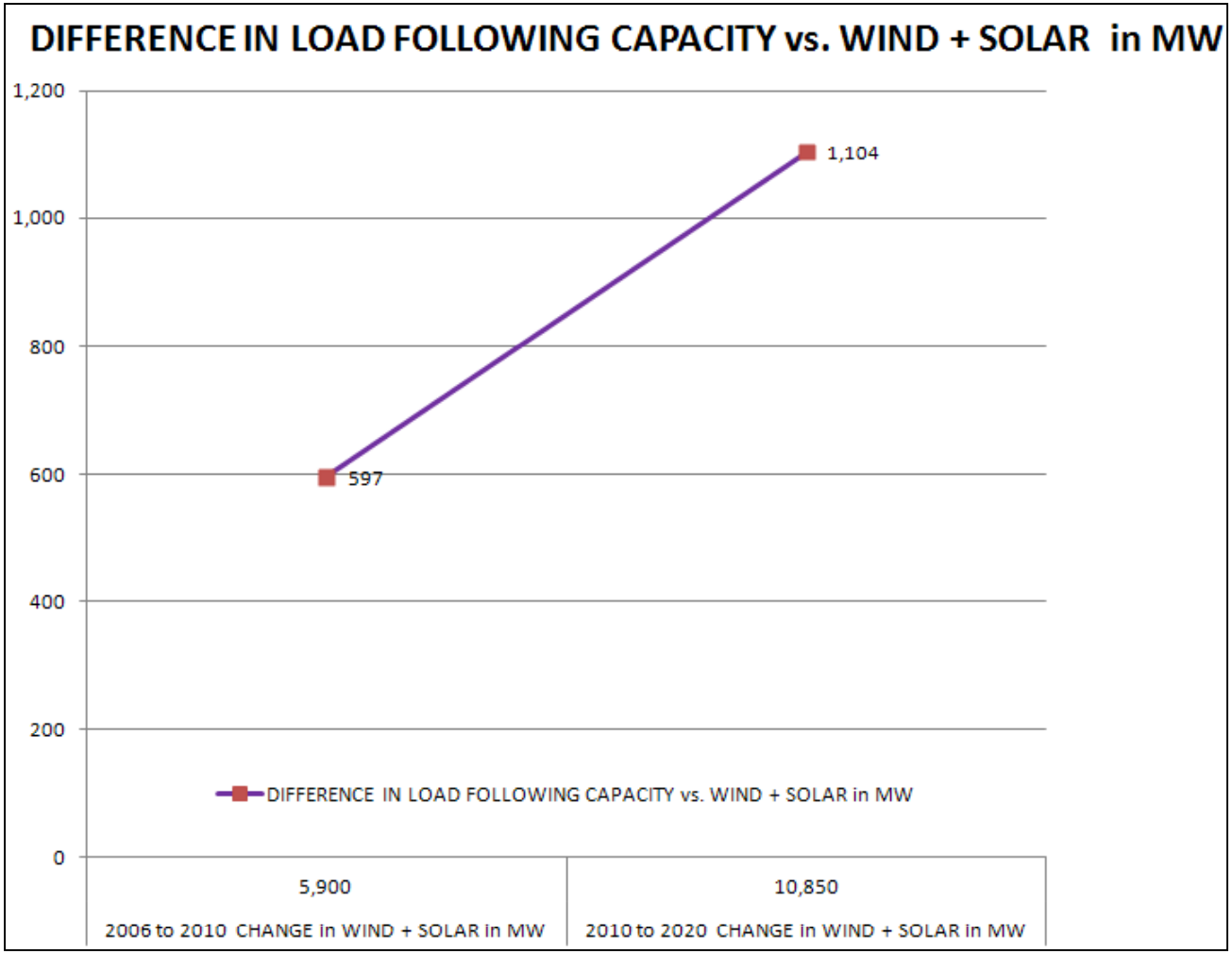
VG Metrics development recommended by IVGTF Task 1-4

http://www.nerc.com/docs/pc/ivgtf/IVGTF_Task_1_4_Final.pdf

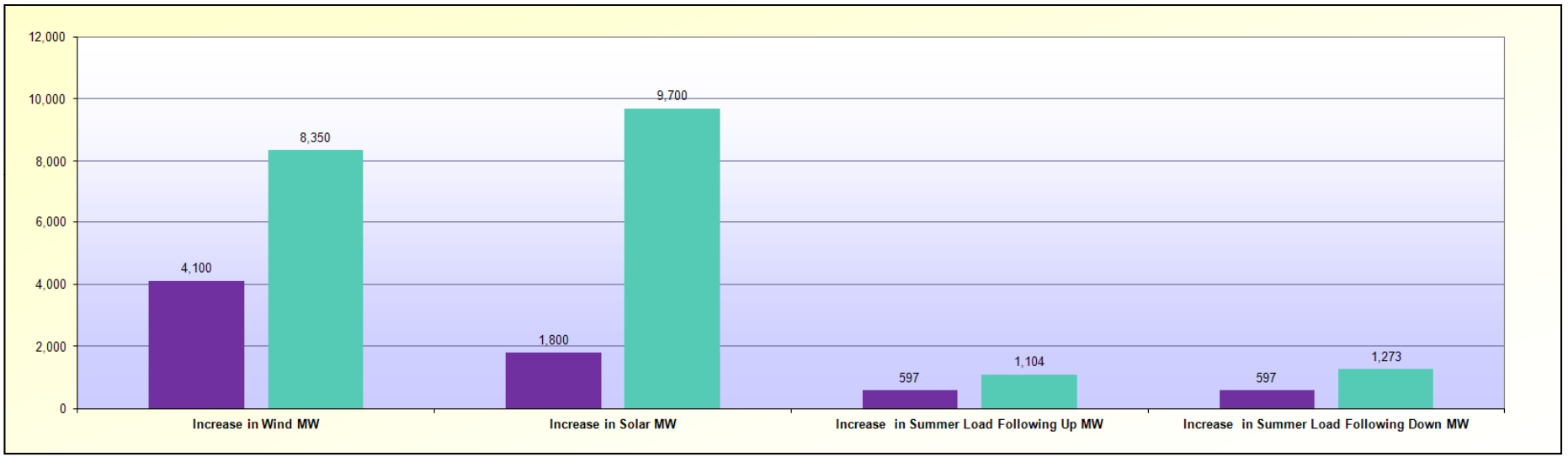
VG Metric – Long Term – Definition

$$\text{Metric} = \frac{\text{Difference in Load following for 10 years}}{\text{Difference in Wind and Solar for 10 years}}$$

2006-2010 & 2010-2020 Pilot Trend



2006-2010 & 2010-2020 Tables

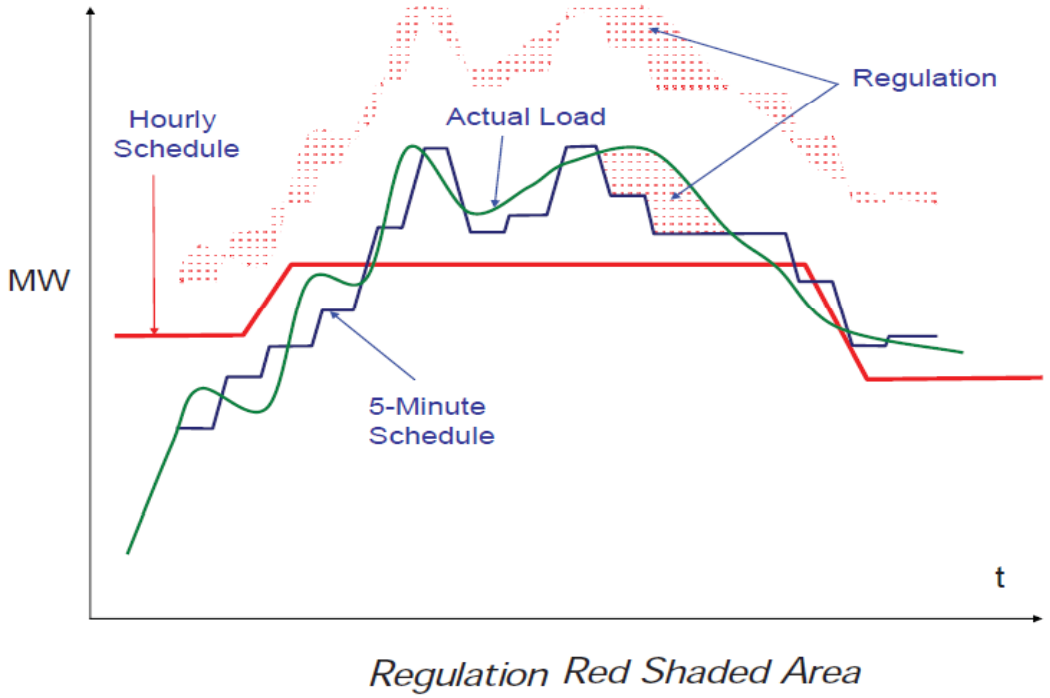


	Increase in Wind MW	Increase in Solar MW	Increase in Summer Load Following Up MW	Increase in Summer Load Following Down MW
2006 to 2010	4,100	1,800	597	597
2010 to 2020	8,350	9,700	1,104	1,273

VG Metric – Long Term vs. Short Term

- Long Term Metric does not reflect time trends of wind
- Regulation (5 min) is preferred to Load Following (1 hr)
- RS recommended that CPS1 reflects Regulation well
- CPS1 can change because of several factors
- Capture change in CPS1 only for a change in wind or solar
- Threshold for change similar to Frequency Event thresholds
- These “events” will be similar to Frequency Response
- Linear regression will calculate the VG metric as the slope

Regulation is reflected in CPS1



Regulation Red Shaded Area

http://www.caiso.com/Documents/Integration-RenewableResourcesReport.pdf PDF Page 87 of 231

VG Metric – Short Term – Definition

Metric = $\frac{\text{Difference in successive CPS1 one minute averages}}{\text{Difference in successive Wind \& Solar 1 minute averages}}$

Trigger for VG Event produces list. Regression will find the slope.

Difference in successive Wind & Solar 1 minute averages > X MW

The X MW will be determined similar to Frequency Event Triggers

Background Information

CPS1 Definition

Definition of CPS1 (Control Performance Standard 1)

The CPS1 equation can be simplified as follows:

CPS1 (in percent) = 100* [2 – (Constant)* (Frequency Error)*(ACE)]

The Scheduled Frequency is 60 Hz - except for ATEC (Time Error Correction)

The largest CPS1 achievable is 200 percent.

This occurs whenever **ACE** or **Frequency Error** is zero.

The size of the **Constant** is equal to **$-10 * B / \varepsilon^2$**

B is the Balancing Authority Bias

Special Case: When a single Balancing Authority is an Interconnection

ACE will always be "in phase" with **Frequency Error**

The Bias terms will cancel out

CPS1 is a function of (Frequency Error) ^{2} and ε^2

Adapted from RS document http://www.nerc.com/docs/oc/rs/NERC%20Balancing%20and%20Frequency%20Control%20040520111.pdf

Eastern Interconnection CPS 1

Eastern Interconnection
NERC CONTROL PERFORMANCE STANDARD SURVEY
Daily Summary for
October 31, 2012

e1	e10
0.018	0.0057

Hour Ending	CPS1 Hourly	CPS1 Daily Avg	Violations	Unavailable Periods	CPS2%	CPS2 % Daily Avg
1:00	115.13		2		66.67%	
2:00	122.73	118.93	1		83.33%	75.00%
3:00	143.22	127.03	1		83.33%	77.78%
4:00	126.09	126.79	3		50.00%	70.83%
5:00	-18.35	97.76	6		0.00%	56.67%
6:00	50.77	89.93	4		33.33%	52.78%
7:00	124.57	94.88	3		50.00%	52.38%
8:00	145.86	101.25	2		66.67%	54.17%
9:00	151.71	106.86	0		100.00%	59.26%
10:00	126.69	108.84	3		50.00%	58.33%
11:00	145.35	112.16	1		83.33%	60.61%
12:00	164.14	116.49	0		100.00%	63.89%
13:00	163.50	120.11	0		100.00%	66.67%
14:00	117.94	119.95	3		50.00%	65.48%
15:00	142.91	121.48	3		50.00%	64.44%
16:00	122.72	121.56	2		66.67%	64.58%
17:00	118.84	121.40	2		66.67%	64.71%
18:00	151.09	123.05	1		83.33%	65.74%
19:00	165.37	125.28	0		100.00%	67.54%
20:00	149.39	126.48	0		100.00%	69.17%
21:00	145.24	127.38	1		83.33%	69.84%
22:00	129.86	127.49	1		83.33%	70.45%
23:00	135.07	127.82	1		83.33%	71.01%
0:00	109.98	127.08	2		66.67%	70.83%
	127.08		42	0	**70.83%**	

Consortium for Electric Reliability Technology Solutions

NERC Applications Status Update

NERC Applications Status For Operating Reliability Subcommittee

Little Rock, AR

November 13-14, 2012

Gil Tam

Electric Power Group

Agenda

- NERC Application Status Summary
  - The IA, RA, and ARR applications were unavailable from 10/29 – 11/4 due to damage to Verizon's cable as result of Hurricane Sandy
- Inadvertent Data Entry Website Implementation
- NERC Application Access Central Webpage
- Intelligent Alarms and Epsilon Summary and Trends

NERC Applications Status Summary

Application	NERC Applications Status and Authorized Users (Many companies have several authorized users)
Resource Adequacy (ACE Frequency)	**Release 7.0** – Current Production version – **170** authorized users.
Inadvertent	**Release 3.5** – Current Production version – **272** authorized users New website design to resolve existing application interface with Window 7 is near completion. EPG and NERC are working to install and test website and target for completion by November. (details on following slide)
Area Interchange Error (AIE)	**Release 1.0** – Current production version – 122 authorized users
Intelligent Alarms	**Release 1.0** – Current production version – **138** authorized users
Frequency Monitoring and Analysis (FMA)	**Release 2.5** – Current production version – **118** authorized users
Automated Reliability Reports (ARR)	**Release 1.0** – Current production version – **63** authorized users Monthly reports through October 2012 and Seasonal reports through Summer 2012 have been posted in ARR website. (ARR website access details on following slide)

New Inadvertent Data Entry Website Implementation

- **EPG has completed software design and sent software to NERC for implementation**
  - NERC IT staff is installing software
  - Testing is in progress
  - Target is to complete and deploy in late November 2012
  - EPG will send notices and user instructions to all authorized users
- **NERC Will Provide Hosting Services**
  - Web Address
  - User Security
  - Data Backup
- **User Training**
  - EPG will schedule and provide a one-hour training session via WebEx

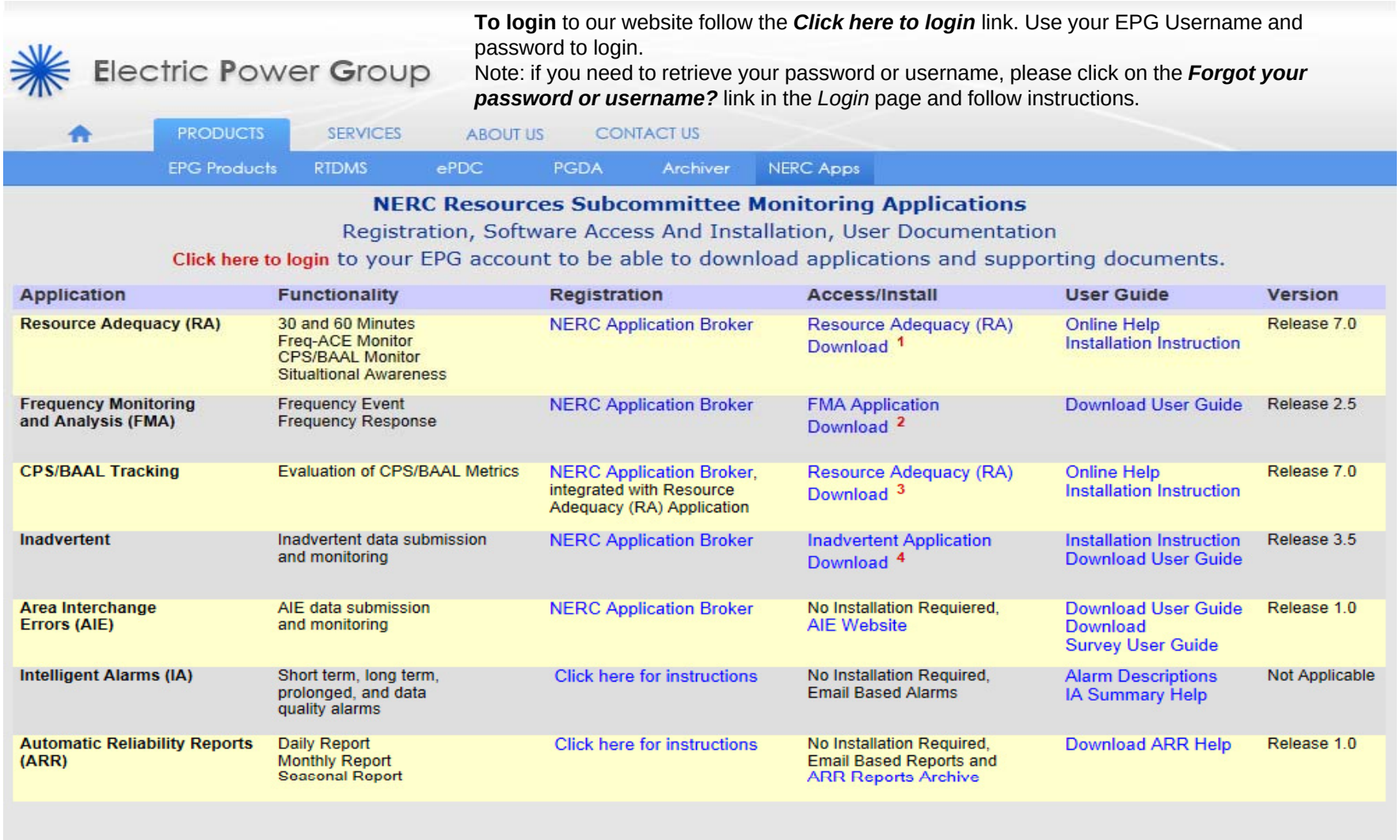
ARR Website Access

- As a subscriber and recipient of the Daily **Automatic Reliability Reports**, you can also access the ARR Monthly, Quarterly and Yearly reports, as well as the archived Daily reports at the following website: https://www.electricpowergroup.net/ARR

  To access the above website, use your **EPG** Username and password to login
  - Note: If you do not already have a password (or forgot your username or password) and need to activate one for the first time, please go to the **EPG** Login Page at https://www.electricpowergroup.net/userAccount/acctLogin.aspx and click on the *Forgot your password or username?* link on *This Page* and follow instructions
- If you have any questions, please contact EPG at 626.685.2015 or via email support@electricpowergroup.com
- You can also use this link to contact EPG: https://www.electricpowergroup.net/contactUs.aspx and use the *Contact Us* form

NERC Application Access Central Webpage

https://www.electricpowergroup.net/NERC



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NERC Resources Subcommittee Monitoring Applications

Registration, Software Access And Installation, User Documentation

Click here to login to your EPG account to be able to download applications and supporting documents.

Application	Functionality	Registration	Access/Install	User Guide	Version
Resource Adequacy (RA)	30 and 60 Minutes Freq-ACE Monitor CPS/BAAL Monitor Situaltional Awareness	NERC Application Broker	Resource Adequacy (RA) Download [1]	Online Help Installation Instruction	Release 7.0
Frequency Monitoring and Analysis (FMA)	Frequency Event Frequency Response	NERC Application Broker	FMA Application Download [2]	Download User Guide	Release 2.5
CPS/BAAL Tracking	Evaluation of CPS/BAAL Metrics	NERC Application Broker, integrated with Resource Adequacy (RA) Application	Resource Adequacy (RA) Download [3]	Online Help Installation Instruction	Release 7.0
Inadvertent	Inadvertent data submission and monitoring	NERC Application Broker	Inadvertent Application Download [4]	Installation Instruction Download User Guide	Release 3.5
Area Interchange Errors (AIE)	AIE data submission and monitoring	NERC Application Broker	No Installation Requiered, AIE Website	Download User Guide Download Survey User Guide	Release 1.0
Intelligent Alarms (IA)	Short term, long term, prolonged, and data quality alarms	Click here for instructions	No Installation Required, Email Based Alarms	Alarm Descriptions IA Summary Help	Not Applicable
Automatic Reliability Reports (ARR)	Daily Report Monthly Report Seasonal Report	Click here for instructions	No Installation Required, Email Based Reports and ARR Reports Archive	Download ARR Help	Release 1.0

To login to our website follow the ***Click here to login*** link. Use your EPG Username and password to login.

Note: if you need to retrieve your password or username, please click on the ***Forgot your password or username?*** link in the *Login* page and follow instructions.

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CERTS CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

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I-Alarms Summary and Trends 2008 to 2012

	Intelligent Alarms as Secondary Control Indicators														
NERC Intelligent Alarm Type	**FTL Low 5-Min** EASTERN=59.95 Hz WESTERN=59.93 Hz ERCOT=59.91 Hz					**FTL High 5-Min** EASTERN=60.05Hz WESTERN=60.07 Hz ERCOT=60.09 Hz					**FAL Low 1-Min** EASTERN=59.908 Hz WESTERN=59.8 Hz ERCOT=59.622 Hz				
Year/Interc.	2008	2009	2010	2011	2012*	2008	2009	2010	2011	2012*	2008	2009	2010	2011	2012*
Eastern	11	9	3	1	2	12	5	1	2	1	0	0	0	1	0
Western	0	0	2	1	2	3	0	0	2	1	0	0	0	0	0
ERCOT	NA	25	4	12	0	NA	58	10	3	1	0	0	0	0	0

	Alarm as Tertiary Control Indicator					Intelligent Alarms as Primary Control Indicator									
NERC Intelligent Alarm Type	**Long Term 60-Min** Average>30 mHz					**Short Term Low** 1-Minute Delta EASTERN<=-35 mHz WESTERN<=-35 mHz ERCOT<=-70 mHz					**Short Term High** 1-Minute Delta EASTERN>=+35 mHz WESTERN>+35 mHz ERCOT>=+70 mHz				
Year/Interc.	2008	2009	2010	2011	2012*	2008	2009	2010	2011	2012*	2008	2009	2010	2011	2012*
Eastern	2	0	1	0	5	294	358	389	509	498	248	291	303	388	354
Western	0	0	4	0	1	94	91	147	127	147	68	53	87	68	76
ERCOT	NA	54	56	8	2	NA	204	73	63	18	NA	218	73	42	7

* Through October 29 2012 Only

Interconnection	FTL & Long Term Alarms	Short Term Alarms
Eastern	Decreased*	Increased
Western	No Change	Increased
ERCOT	Decreased	Decreased

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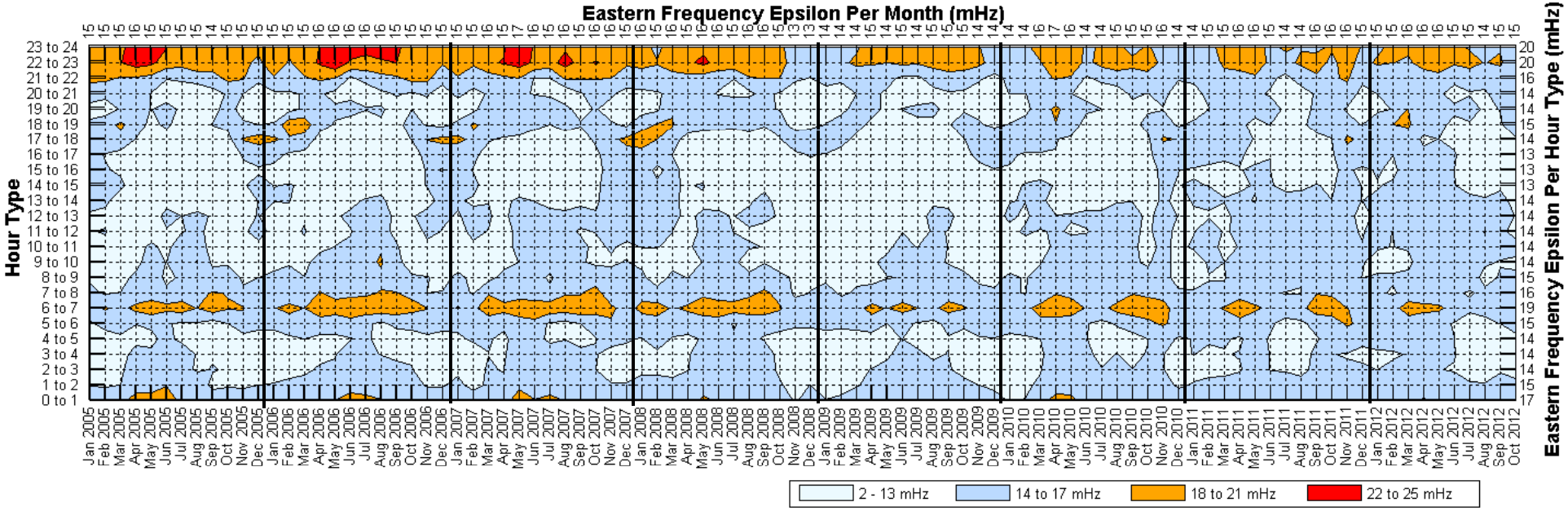
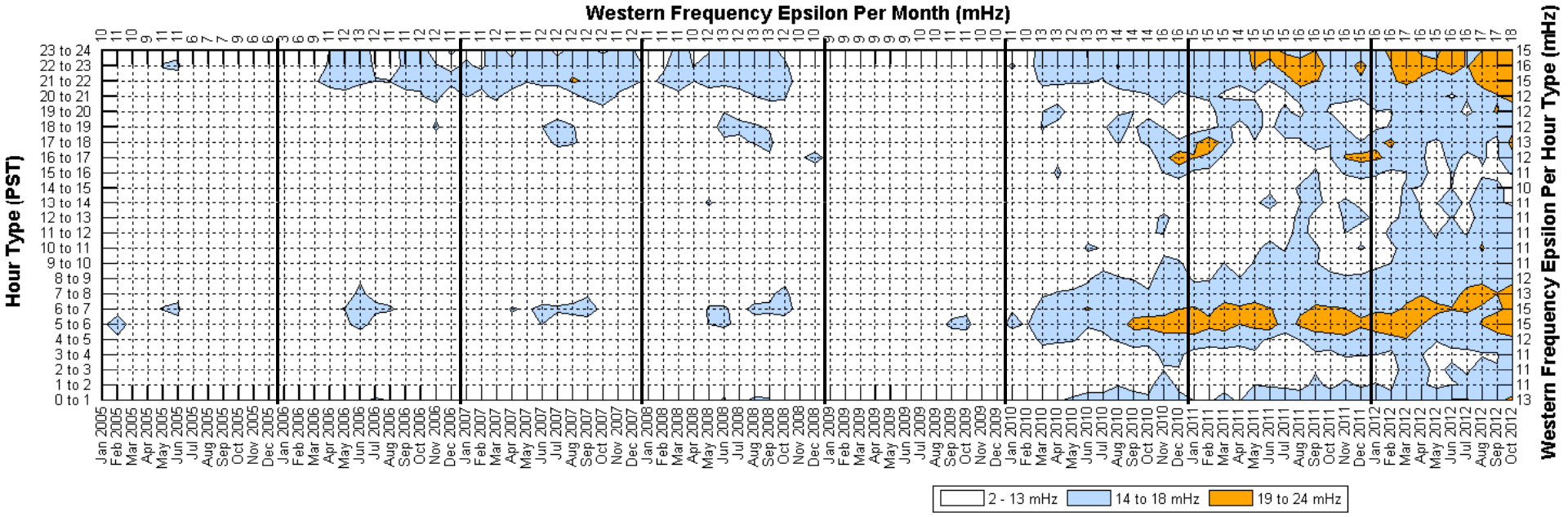
Eastern Interconnections Frequency Deviation (Epsilon) 2005 to 2012



Western Interconnections Frequency Deviation (Epsilon) 2005 to 2012



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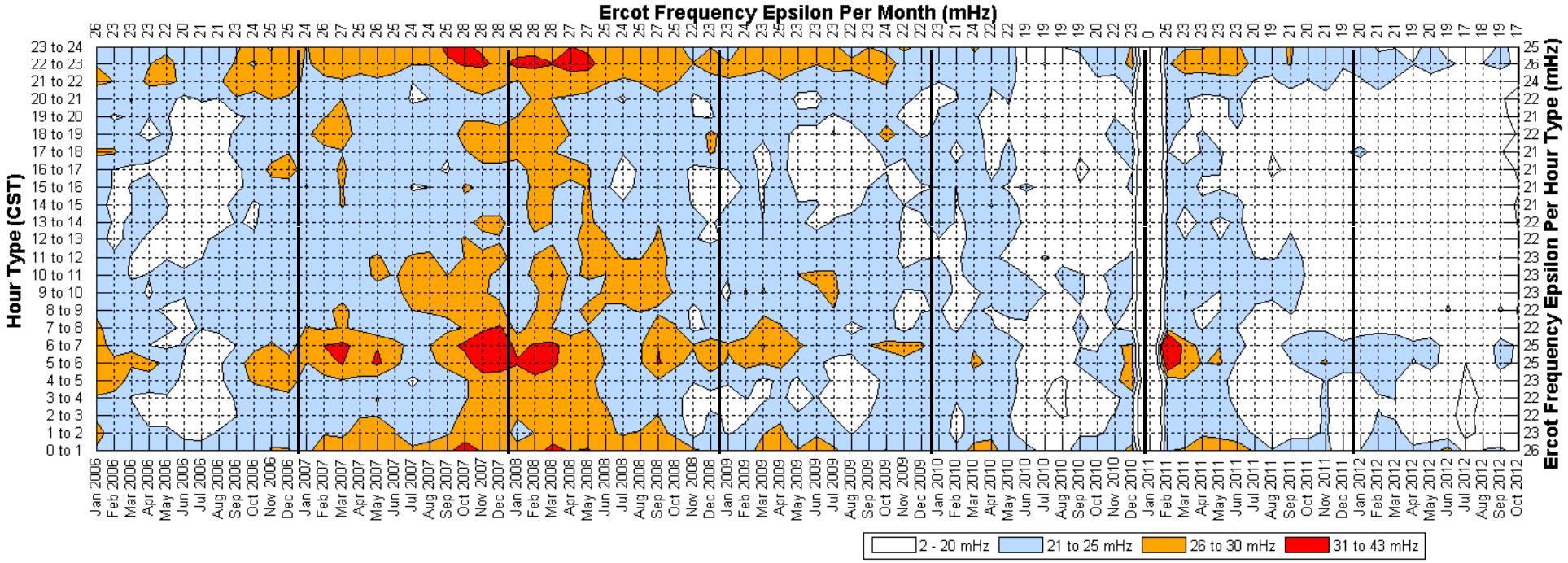
ERCOT Interconnections Frequency Deviation (Epsilon) 2006 to 2012



No data in January 2011

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Any questions regarding the NERC/CERTS applications please contact:

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Presentation 5

Effects of Geomagnetic Disturbances on Bulk Power Systems

Frank Koza
Vice-Chair, NERC GMD Task Force
Executive Director, Operations Support, PJM

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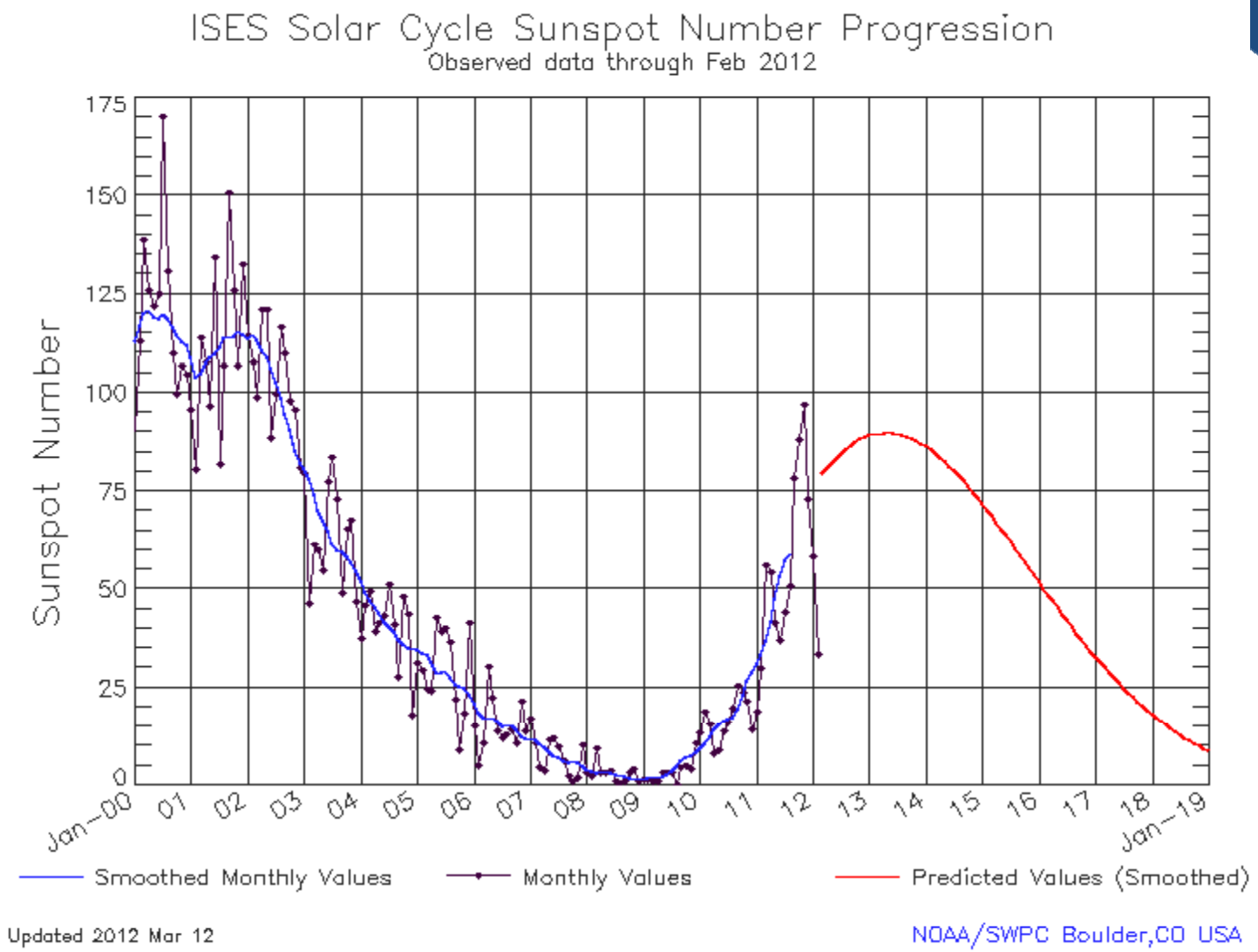
Solar Cycle 24

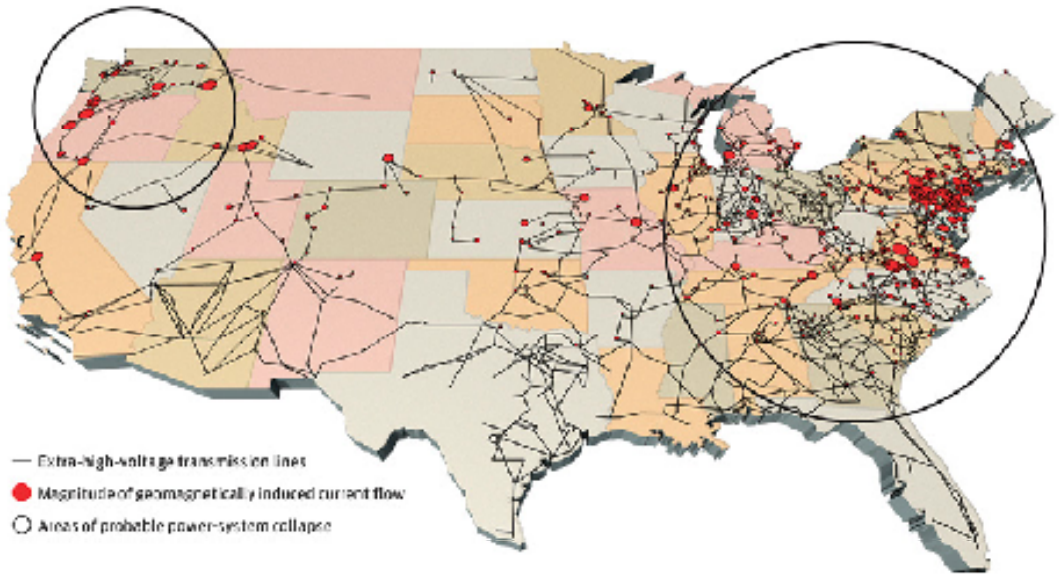


Doomsday GMD Scenario

"Linked to the celestial spectacle are enormous fluctuations of the magnetic field in Earth's magnetosphere, which are causing immense flows of electric current in the upper atmosphere over much of the planet. Those huge currents disturb Earth's normally quiescent magnetic field, which in turn induces surges of current in electrical, telecommunications, and other networks across entire continents. Streetlights flicker out; electricity is lost. A massive planetary blackout has occurred, leaving vast swaths of North and South America, Europe, Australia, and Asia without power.

Within a few months, the crisis has deepened. In many areas, food shortages are rampant, drinking water has become a precious commodity, and patients in need of blood transfusions, insulin, or critical prescription drugs die waiting. Normal commerce has ground to a halt, replaced by black markets and violent crime. As fatalities climb into the millions, the fabric of society starts to unravel."

PJM—Center of the Scenario



Source: Peter Warner/Storm Analysis Consultants; Map: John MacNeill

According to the scenario..

- Based on a projected 5,000 nT/min storm, large numbers of EHV transformers will fail
- Since transformers are custom-built and not sourced domestically, recovery could take years

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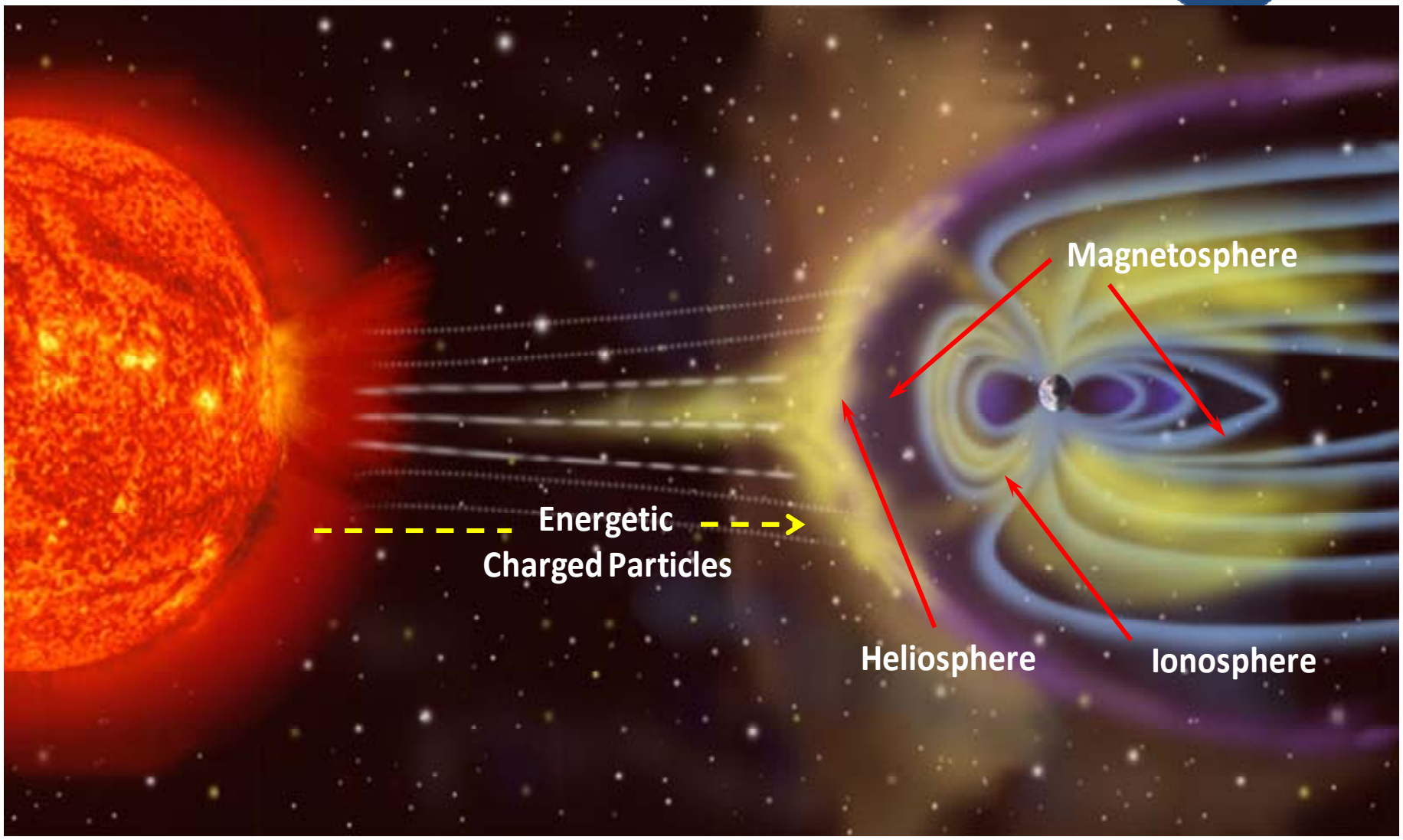
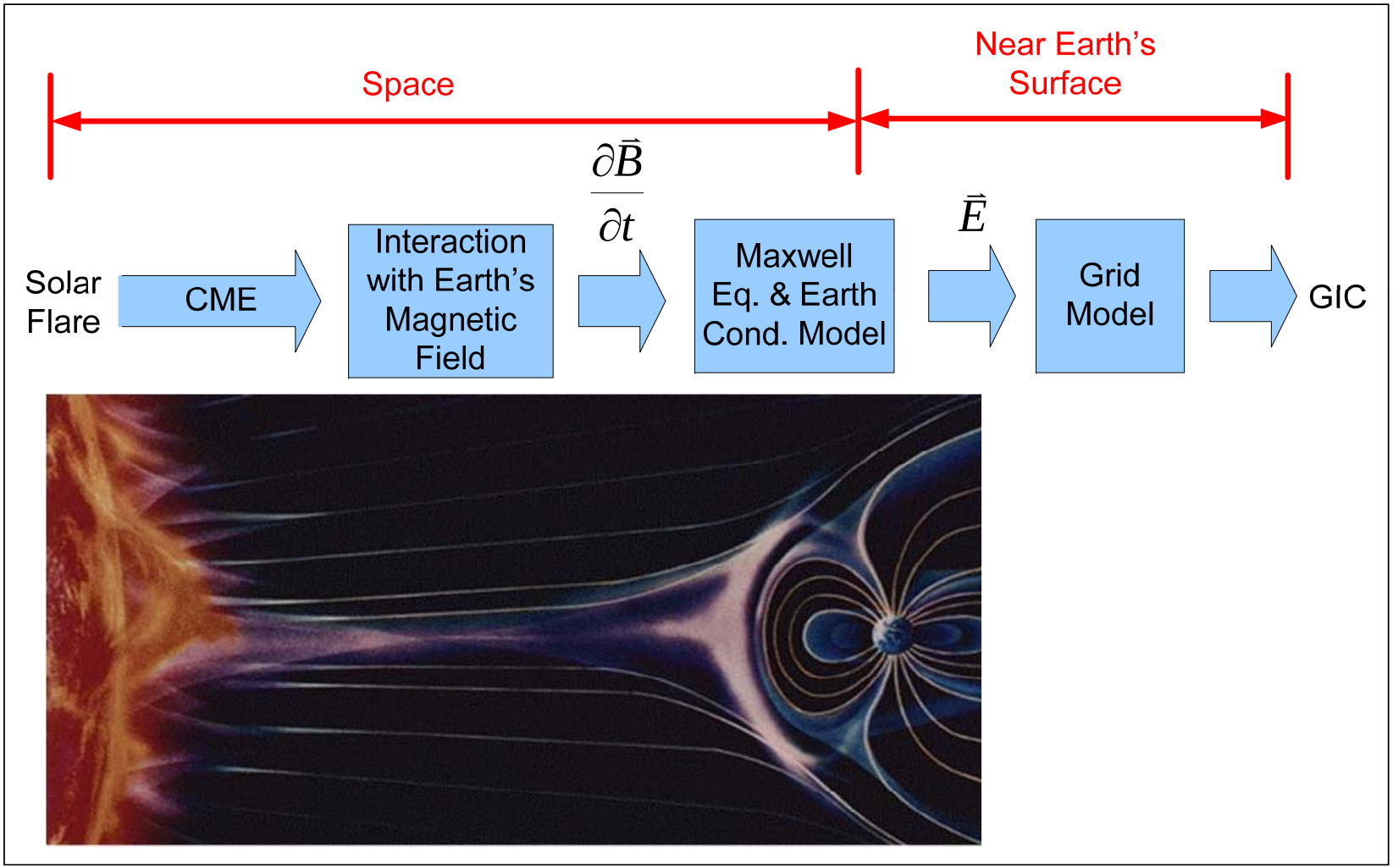
Coronal Mass Ejections



Geomagnetic Disturbances



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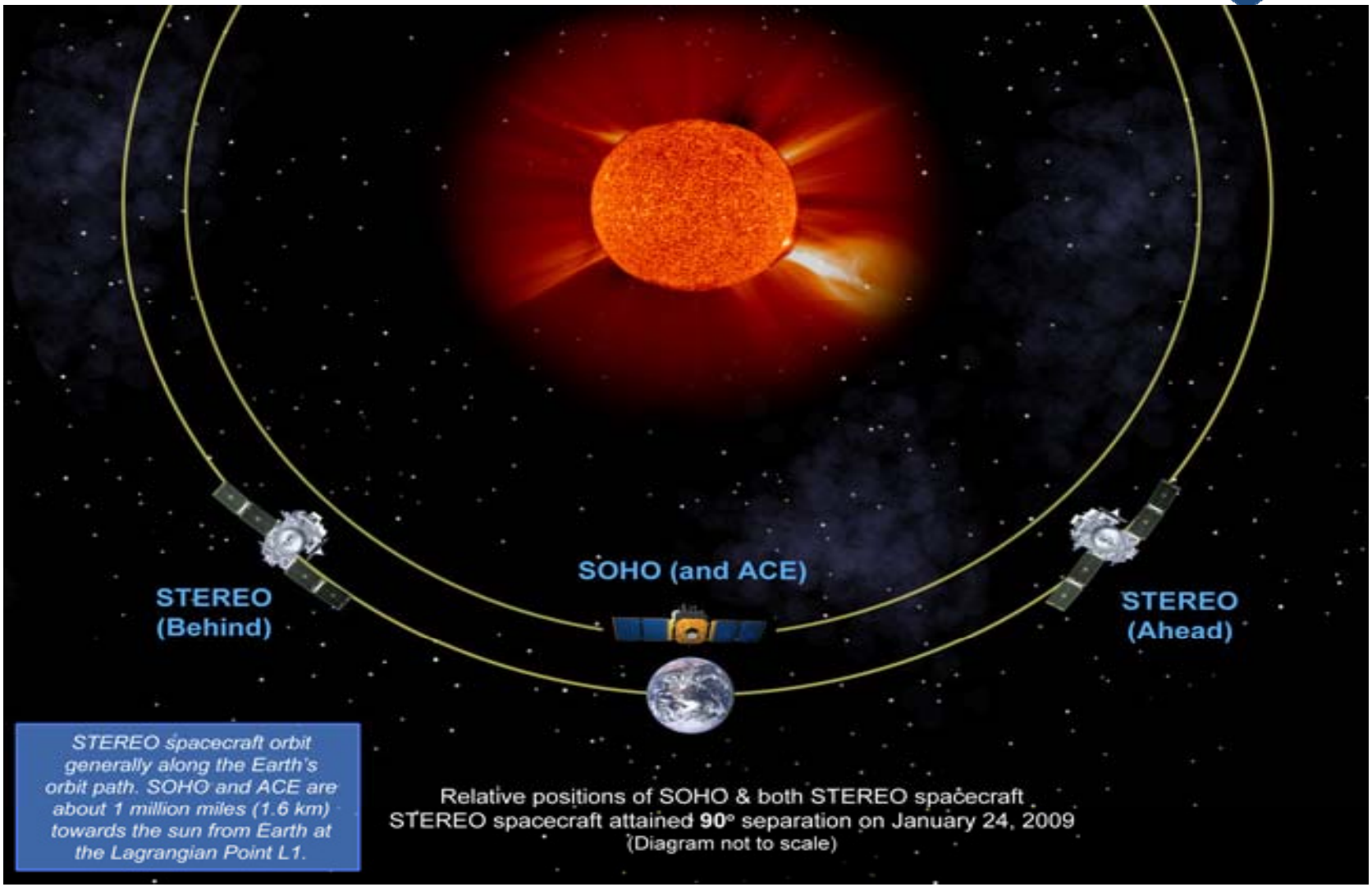
GMD Detection



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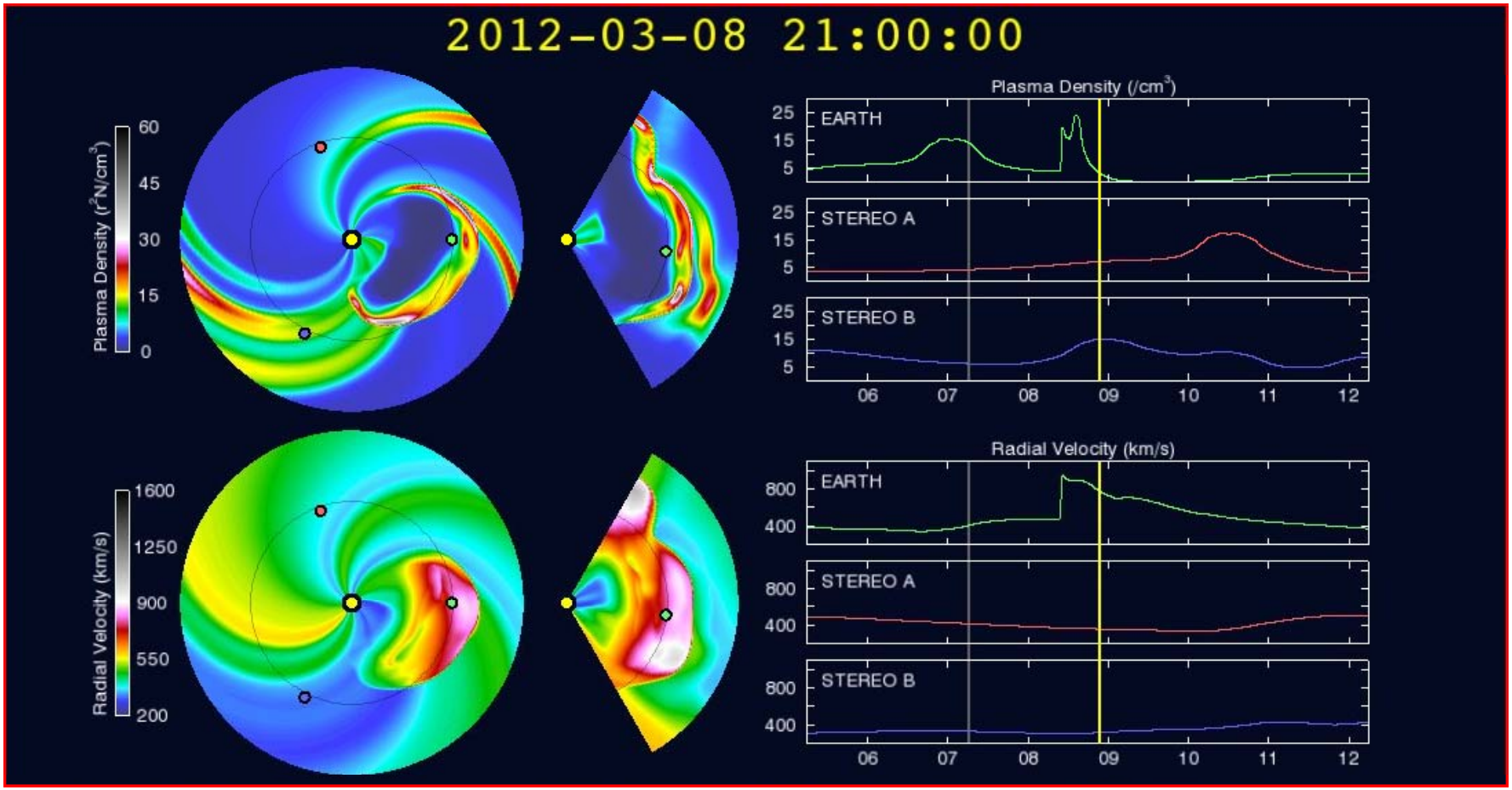
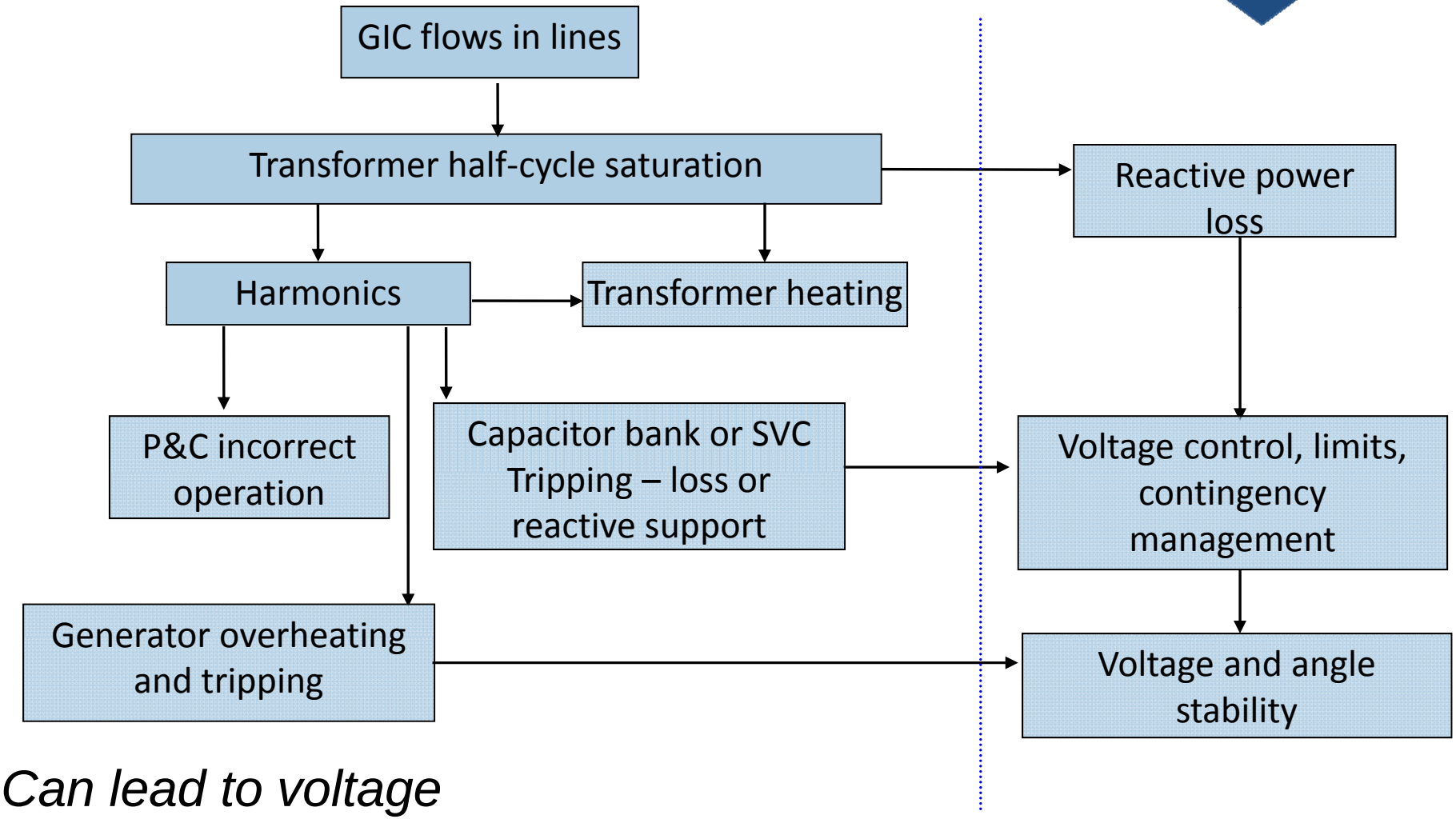
NASA Solar Wind Prediction



Source: WSA-Enil Solar Wind Tool

Effects of GIC in HV Network



Can lead to voltage collapse and blackout

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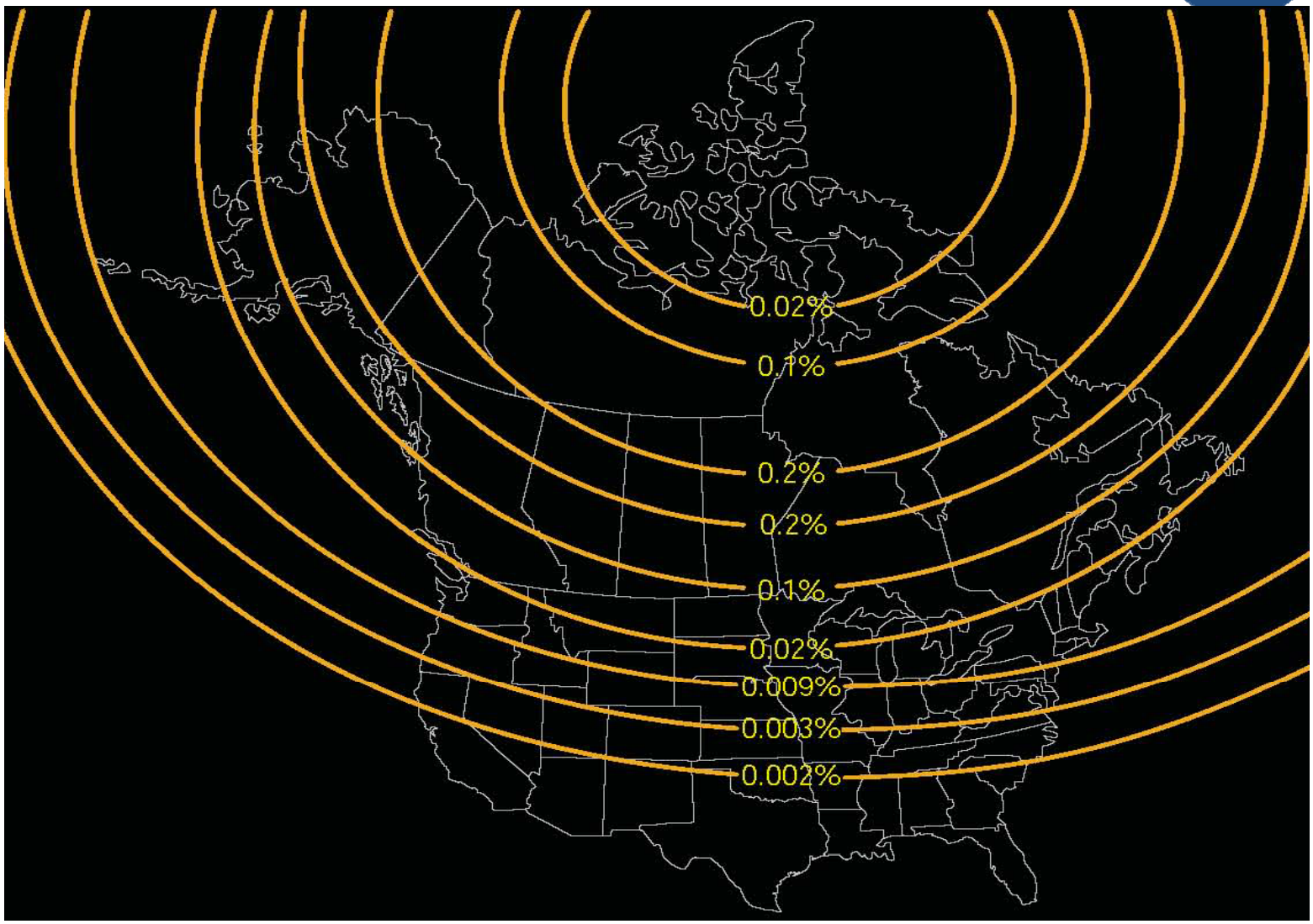
GMD Probability >300nT/min



GMD Task Force Report

Major Conclusion	• Most likely result from a severe GMD is the need to maintain voltage stability to avoid voltage collapse and blackout
Major Conclusion	• System operators and planners need tools to maintain reactive power supply
Major Conclusion	• Some transformers may be damaged or lose remaining life, depending on design and current health

GMDTF—Phase 2

Task Teams working on the following:

- **Team 1** – Vulnerability Assessment
- **Team 2** – Equipment Modeling
- **Team 3** – GIC Modeling
- **Team 4** – System Operating Practices

Team 4 – Sys Ops Practices

Task Team #4 working on the following:

- **NERC Alert Review**
- **Operating Procedures Template**
- **Notification Process**
- **Operator Training Template**

FERC NOPR on GMD

NERC required to:

- **Stage 1** -- Create a NERC standard(s) (within 90 days!) to require transmission entities to have operating procedures to deal with GMD
- **Stage 2** -- Create a NERC standard(s) (within 6 months!) to address the need for assessments of the transmission system to identify facilities that are vulnerable to GMD and develop mitigation strategies.

PJM Response to the NOPR

- PJM has had an operating procedure since shortly after the HQ Blackout in 1989 (FERC Stage 1 Req't)
- PJM Transmission Owners have installed Ground Induced Current (GIC) detectors at a number of facilities (and more are on the way)
- PJM, in cooperation with the PJM Planning Committee, is working on a proposal to conduct a vulnerability assessment of the PJM system (Target completion: Second Quarter of 2013) (FERC Stage 2 Req't)

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Questions?

RELIABILITY | ACCOUNTABILITY

SPP Reliability: PTDF Report

November 13-14, 2012

Robert Rhodes

rrhodes@spp.org 501.614.3241

Southwest Power Pool

PTDF Information:

Statistics from September-October, 2012

Flowgate: Valliant – Lydia 345 kV (5220)
3 TLRs issued

Flowgate: Red Willow – Mingo 345 kV (5221)
2 TLRs issued

Flowgate: Nebraska City – Cooper 345 kV (6030)
3 TLRs issued

Flowgate: Temp 40 Iatan – Stranger Creek 345 kV flo Iatan – St Joseph 345 kV (Temp 40)
3 TLRs issued

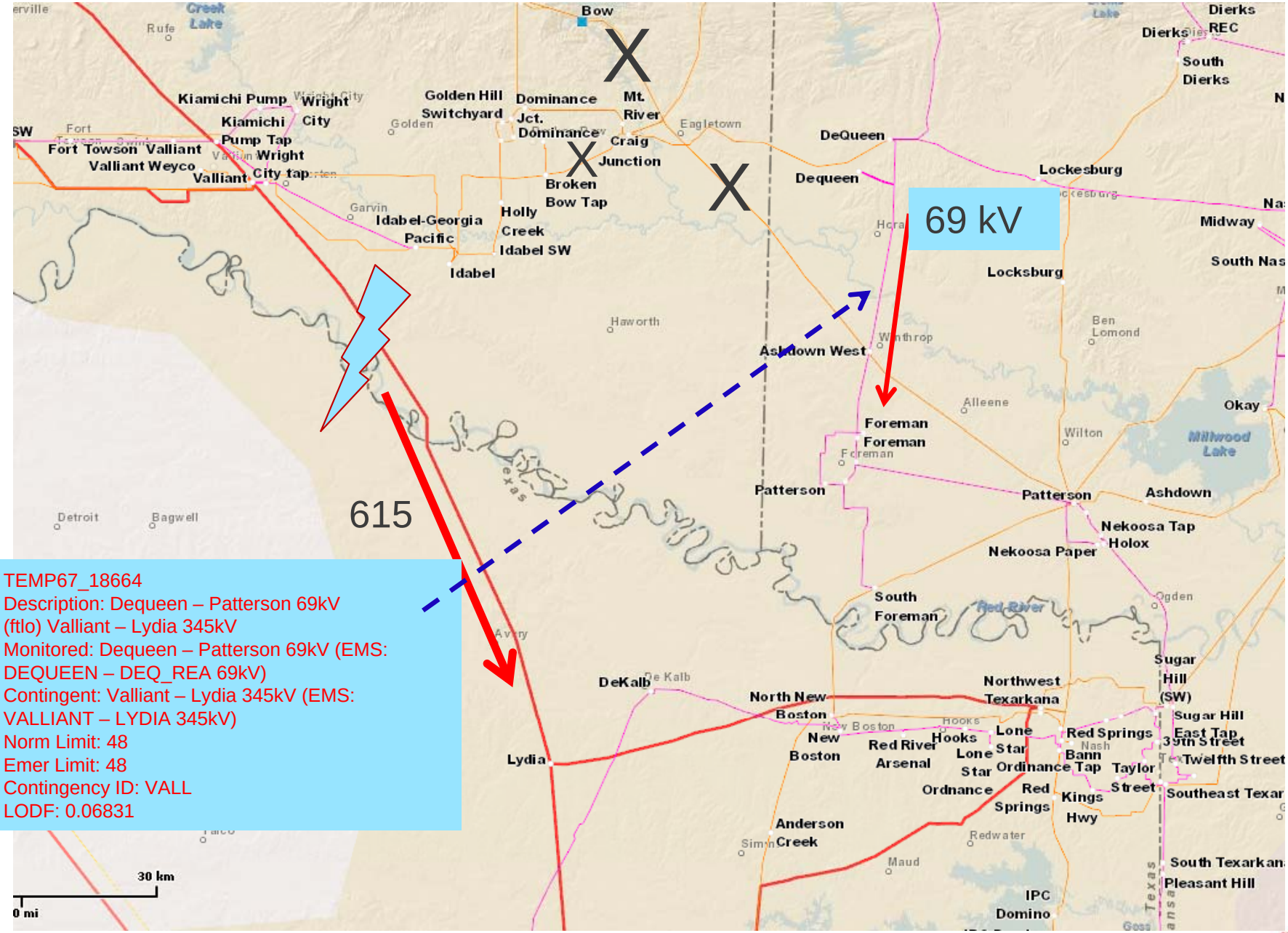
FG 5220 Valliant-Lydia 345 kV

TLR_Date	ReturnToZero	TLR_Level
10/25/2012 12:30:00 PM	10/25/2012 1:00:00 PM	3b
10/25/2012 2:00:00 PM	10/25/2012 9:00:00 PM	5a

FG 5220 Valliant-Lydia 345 kV

- Used to Control North to South flows
- 138 kV Outages of Craig – Ashdown, Craig - Broken Bow, and Craig - Broken Bow Tap, caused many Sub Transmission (69kV) Contingencies to appear on AEP RTCA for loss of Lydia – Valliant 345 kV
- Controlled FG to 500 MW to alleviate
- TEMP67_18664 Dequeen – Patterson 69kV flo Valliant – Lydia 345kV built to monitor.

FG 5220 Valliant-Lydia 345 kV



TEMP67_18664
Description: Dequeen – Patterson 69kV (ftlo) Valliant – Lydia 345kV
Monitored: Dequeen – Patterson 69kV (EMS: DEQUEEN – DEQ_REA 69kV)
Contingent: Valliant – Lydia 345kV (EMS: VALLIANT – LYDIA 345kV)
Norm Limit: 48
Emer Limit: 48
Contingency ID: VALL
LODF: 0.06831

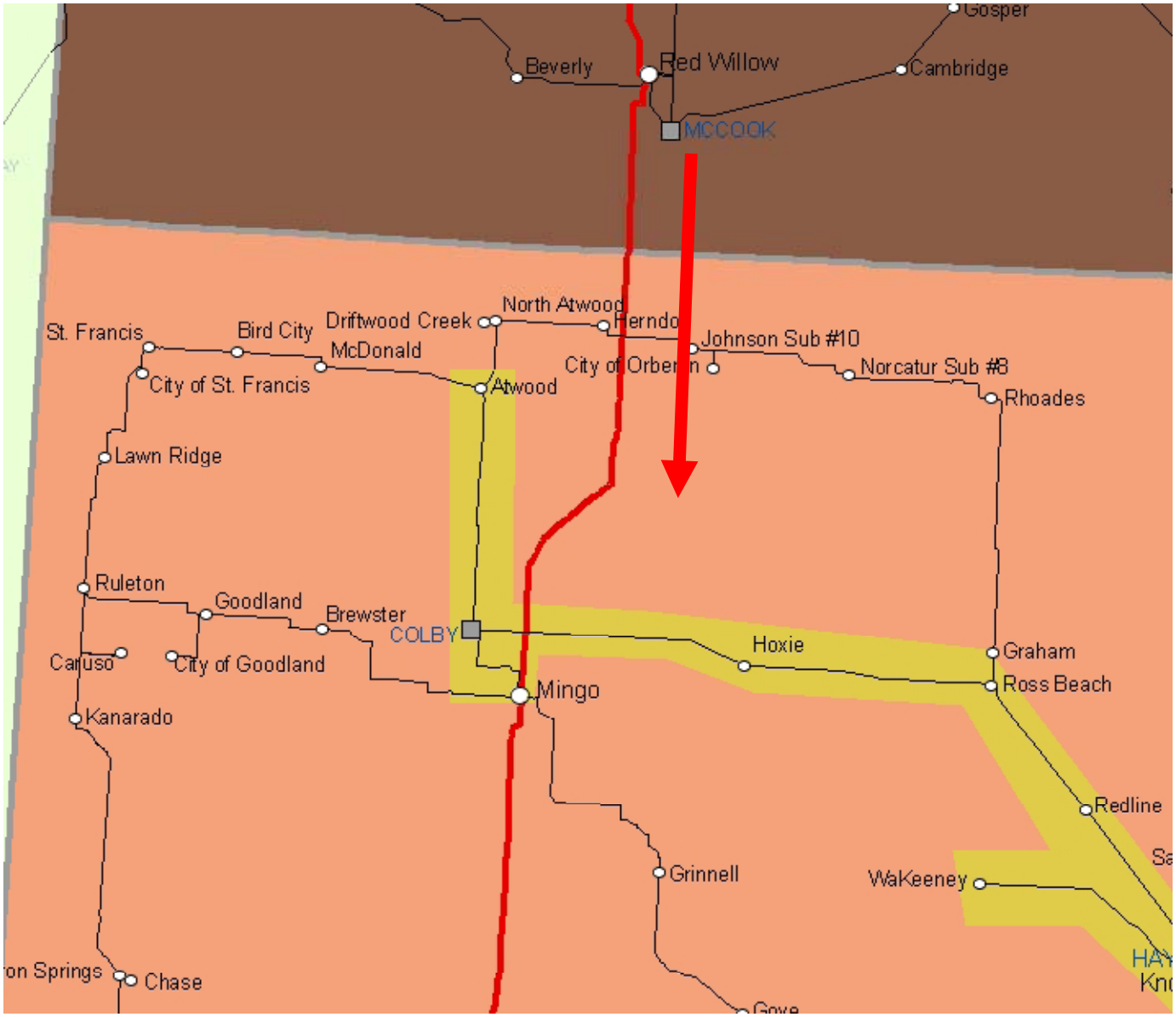
FG 5221 - Red Willow-Mingo 345 kV

TLR_Date	ReturnToZero	TLR_Level
9/21/2012 16:35:00 PM	9/21/2012 21:00:00 PM	5b
9/26/2012 11:00:00 AM	9/26/2012 7:00:00 PM	3a

FG 5221 - Red Willow-Mingo 345 kV

- Red Willow-Mingo 345 kV PTDF is used to maintain voltage on the 115kV system in the SECI control area. Large North to South flows requires large amounts of reactive power at the Mingo substation where there is little reactive resources causing low voltage on surrounding 115 kV system.
  - The normal limit is 717 MW, but for this situation we run it at under 600 MW

FG 5221 - Red Willow-Mingo 345 kV



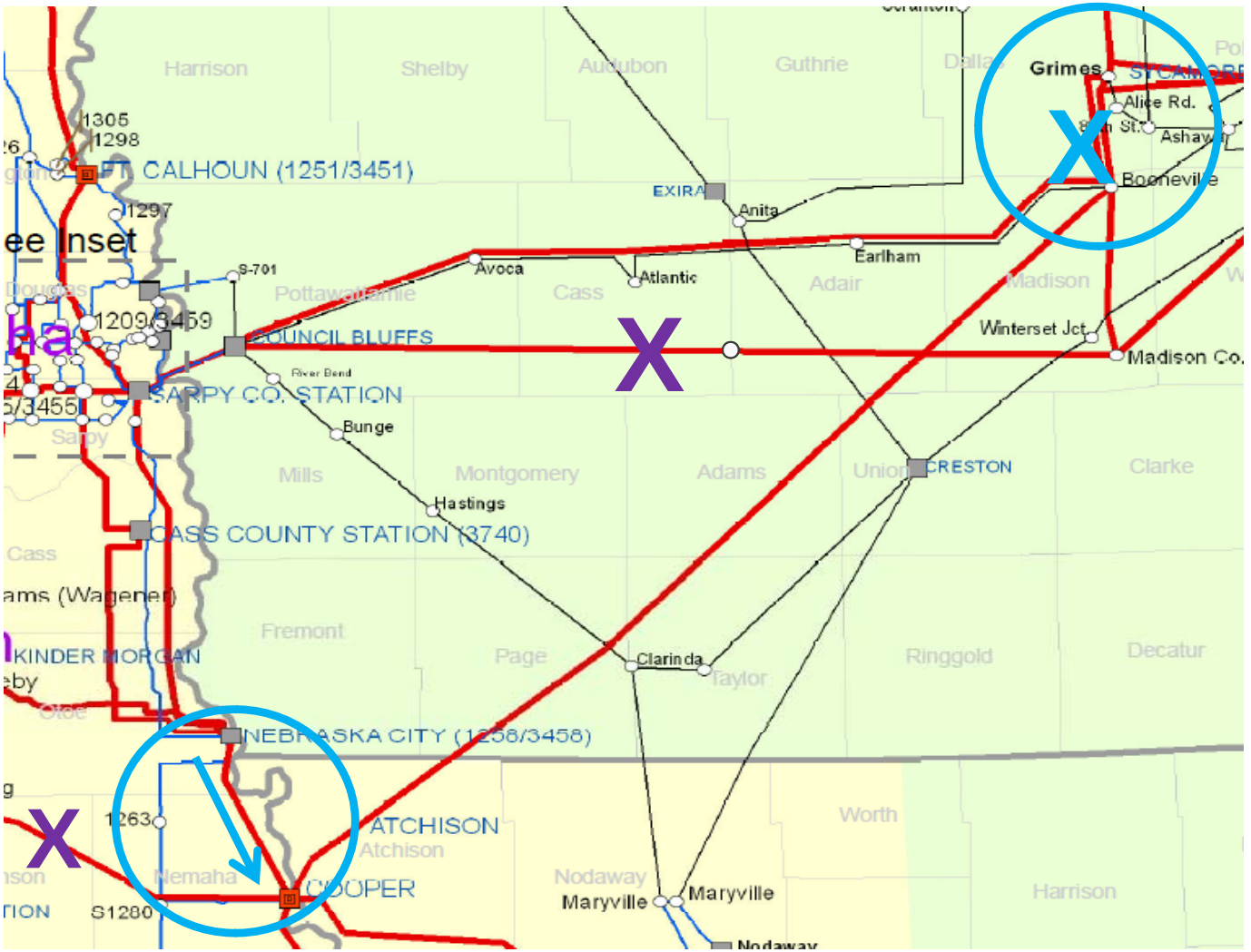
FG 6030 Nebraska City – Cooper 345 kV

TLR_Date	ReturnToZero	TLR_Level
10/24/2012 11:45:00 PM	10/25/2012 5:00:00 AM	5b
10/25/2012 3:25:00 PM	10/26/2012 12:45:00 AM	5a
10/29/2012 1:00:00 AM	10/29/2012 8:00:00 AM	3a

FG 6030 Nebraska City – Cooper 345 kV

- Used to control heavy North to South flows during an outage of Cooper unit and Cooper – Mark Moore 345 kV
- Used as proxy for FG 18661 Temp 66: Nebraska City – Cooper 345 kV flo Fallow Avenue – Grimes 345 kV
  - Monitored Element of FG 18661
  - FG 18661 had not been made Market Coordinated by MISO

FG 6030 Nebraska City – Cooper 345 kV



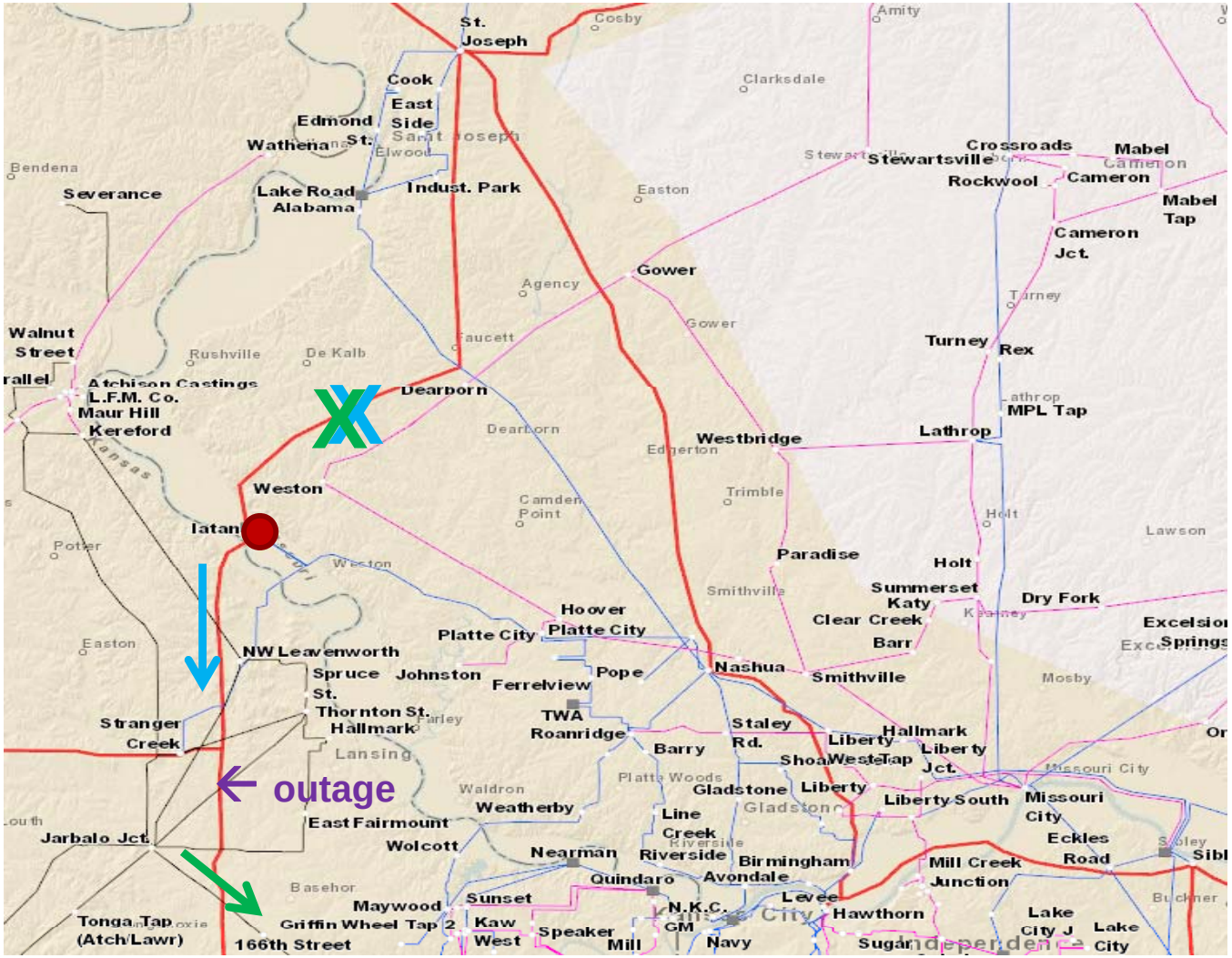
FG 17699: Temp 40 Iatan – Stranger Creek 345 kV flo Iatan – St Joseph 345 kV

TLR_Date	ReturnToZero	TLR_Level
9/13/2012 14:25:00 PM	9/13/2012 18:30:00 PM	3b
9/20/2012 12:00:00 PM	9/20/2012 14:00:00 PM	3a
9/22/2012 16:00:00 PM	9/22/2012 19:00:00 PM	3a

FG 17699: Temp 40 Iatan – Stranger Creek 345 kV flo Iatan – St Joseph 345 kV

- Used as proxy to control RTCA contingency Jarbalo – 166 St 115 kV flo Iatan – St Joseph 345 kV
  - Contingency showed up due to outage of Stranger – Craig 345 kV
  - FG was built the following day (Temp 65)
  - Iatan outlet issue

Temp 40 and Temp 65



Consortium for Electric Reliability Technology Solutions

CERTS Research Supporting Reliability Performance Standards

NERC Interconnections Frequency Control Performance and Timeline for Frequency Response Standard

For: NERC Operating Reliability Subcommittee

By: Carlos Martinez – CERTS/ASR

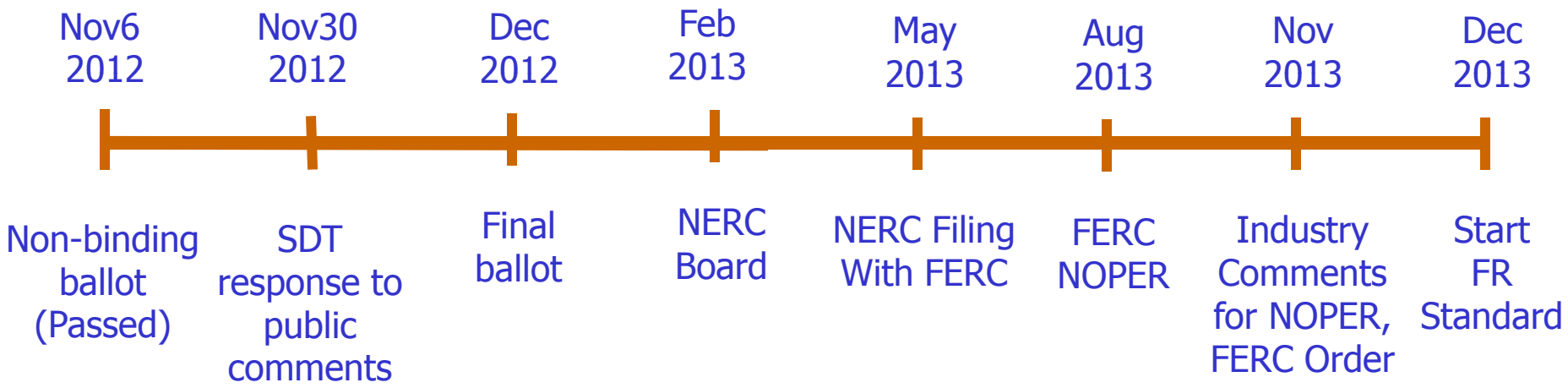
Little Rock, Arkansas, November 13, 2012

Presentation Outline

- *Timeline for the NERC Frequency Response standard*
- *Overview of Interconnections 2008-2012 Frequency Control performance assessment and datasets*
- *Eastern interconnection 2012 Frequency Regulation metrics identification and quantification*
- *Interconnections 2008-2012 Events Frequency Response metrics statistics*

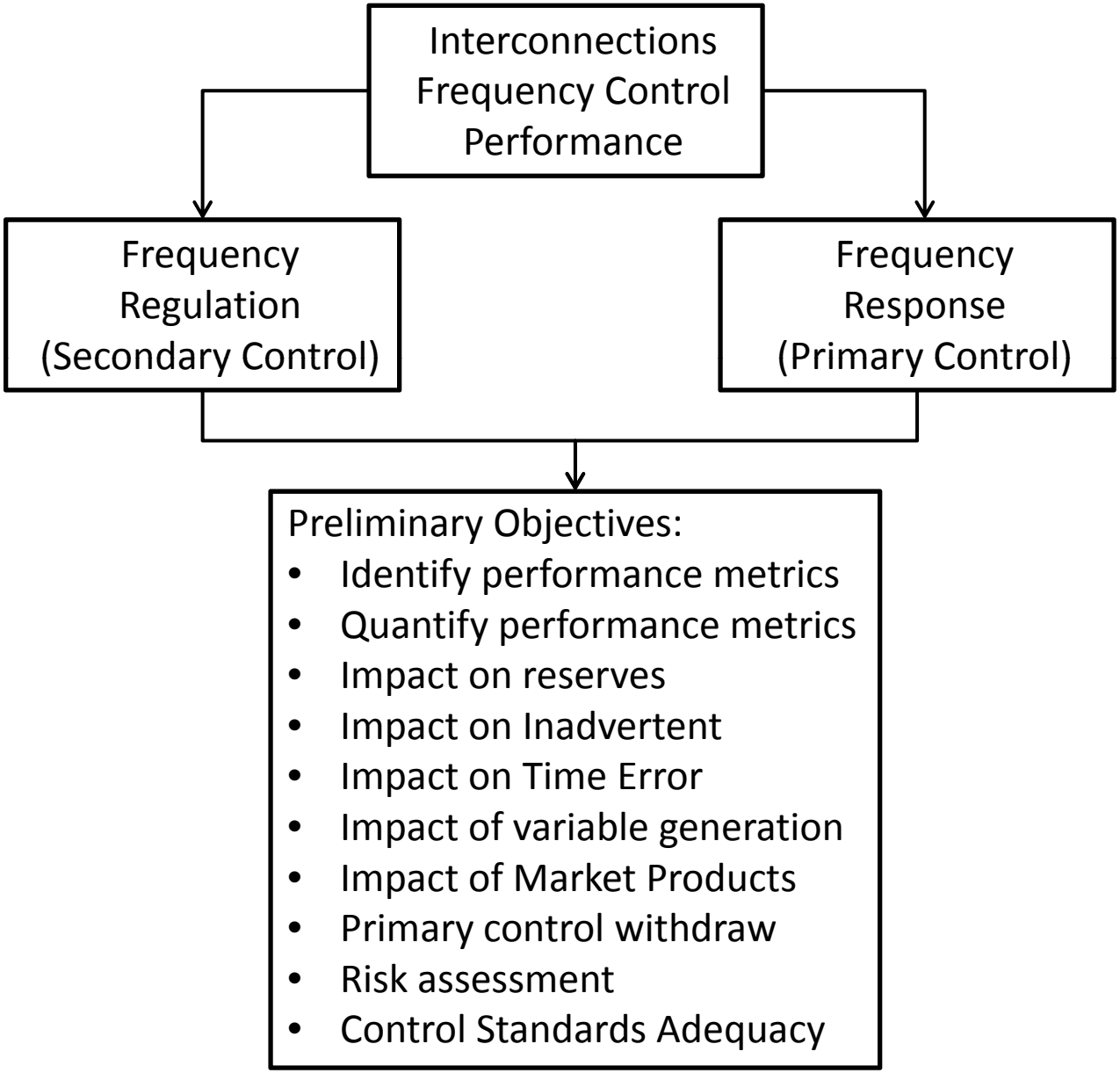
Estimated Timeline for NERC Frequency Response Standard

Estimated Timeline for NERC Frequency Response Standard

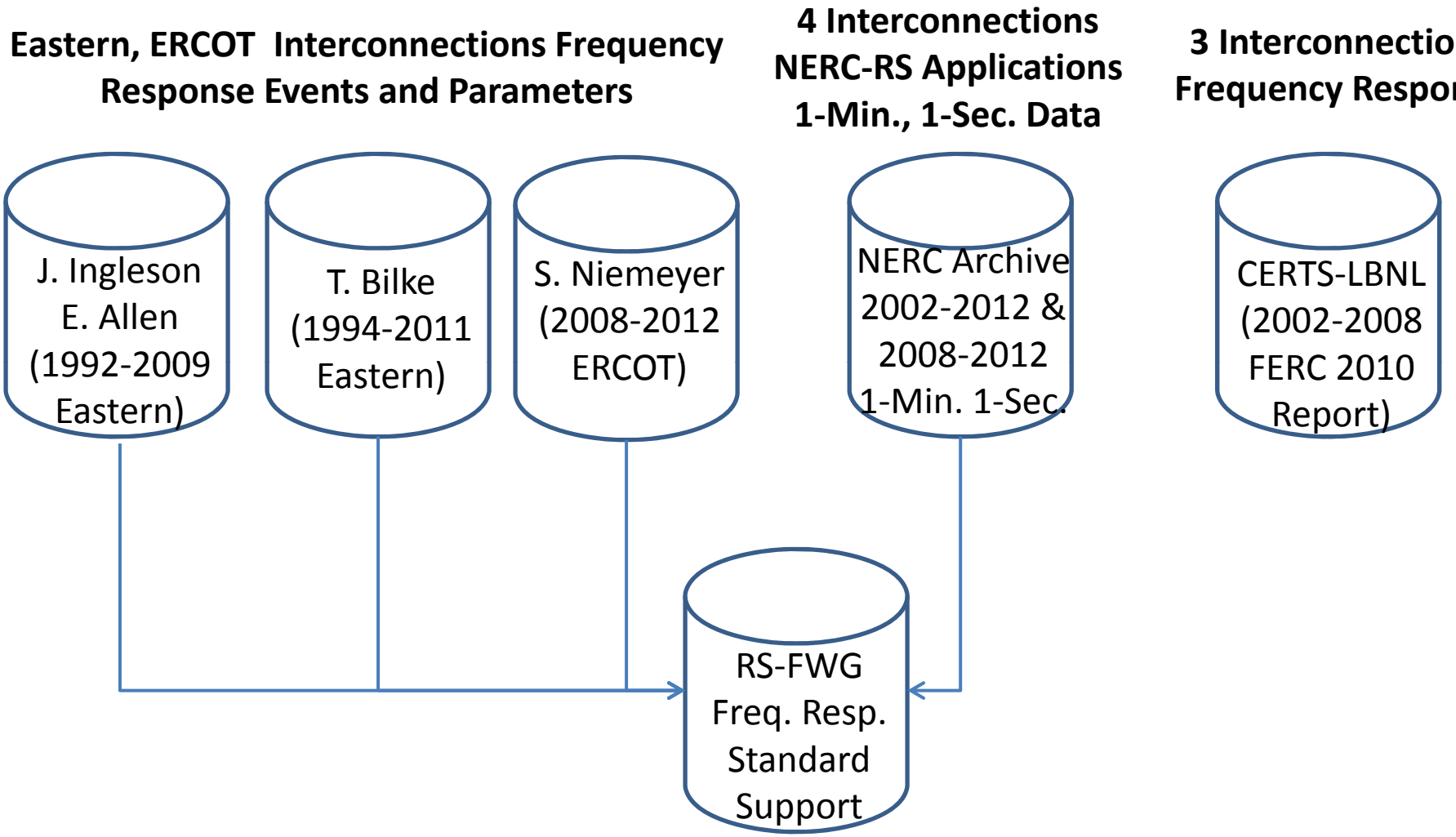


Interconnections 2008-2012 Frequency Control Performance Assessment Study

NERC Interconnections 2008-2012 Frequency Control Performance – Assessment

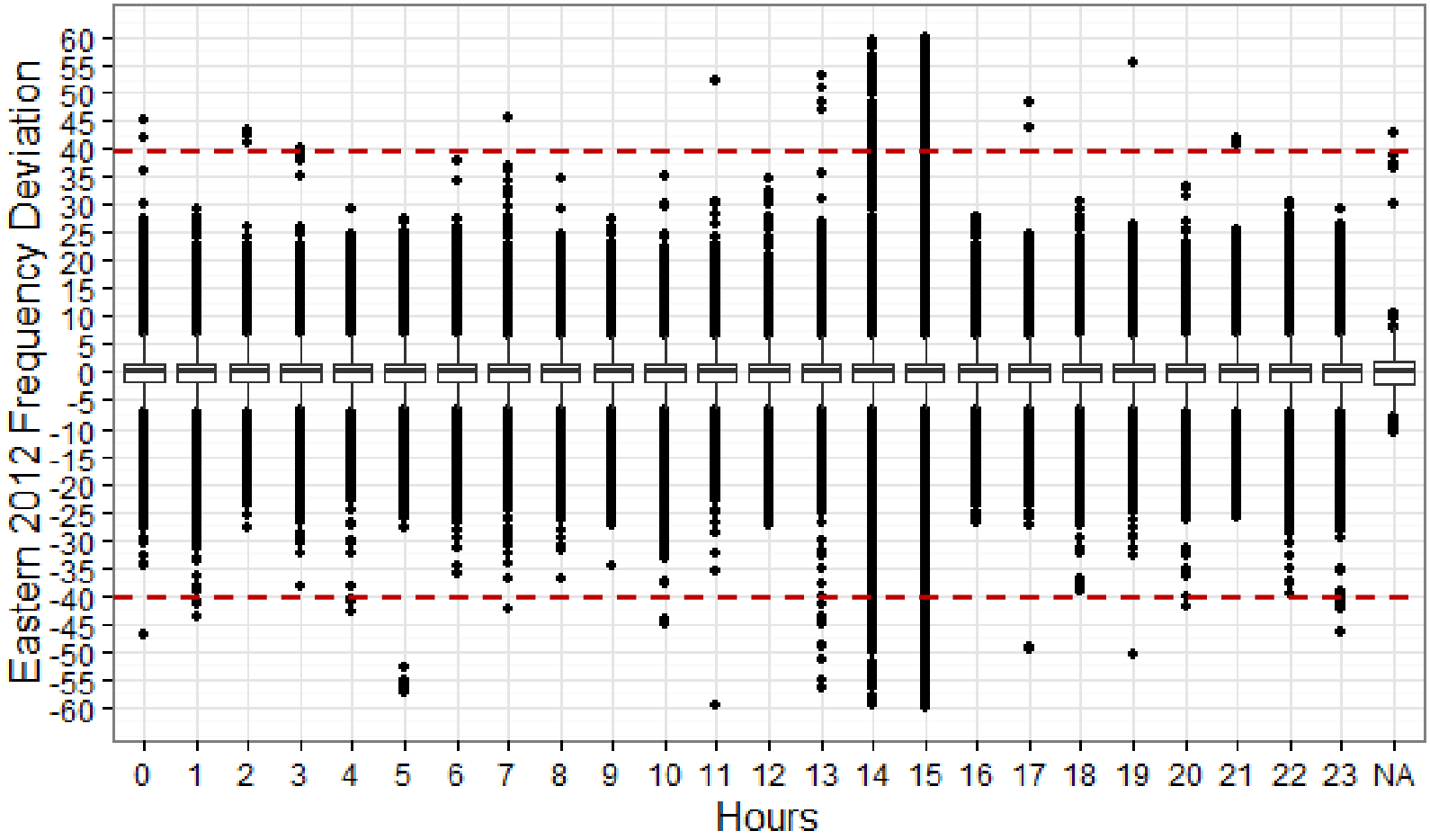


Known Interconnections Historical Datasets



Eastern 2012 Frequency Regulation Metrics Identification and Quantification

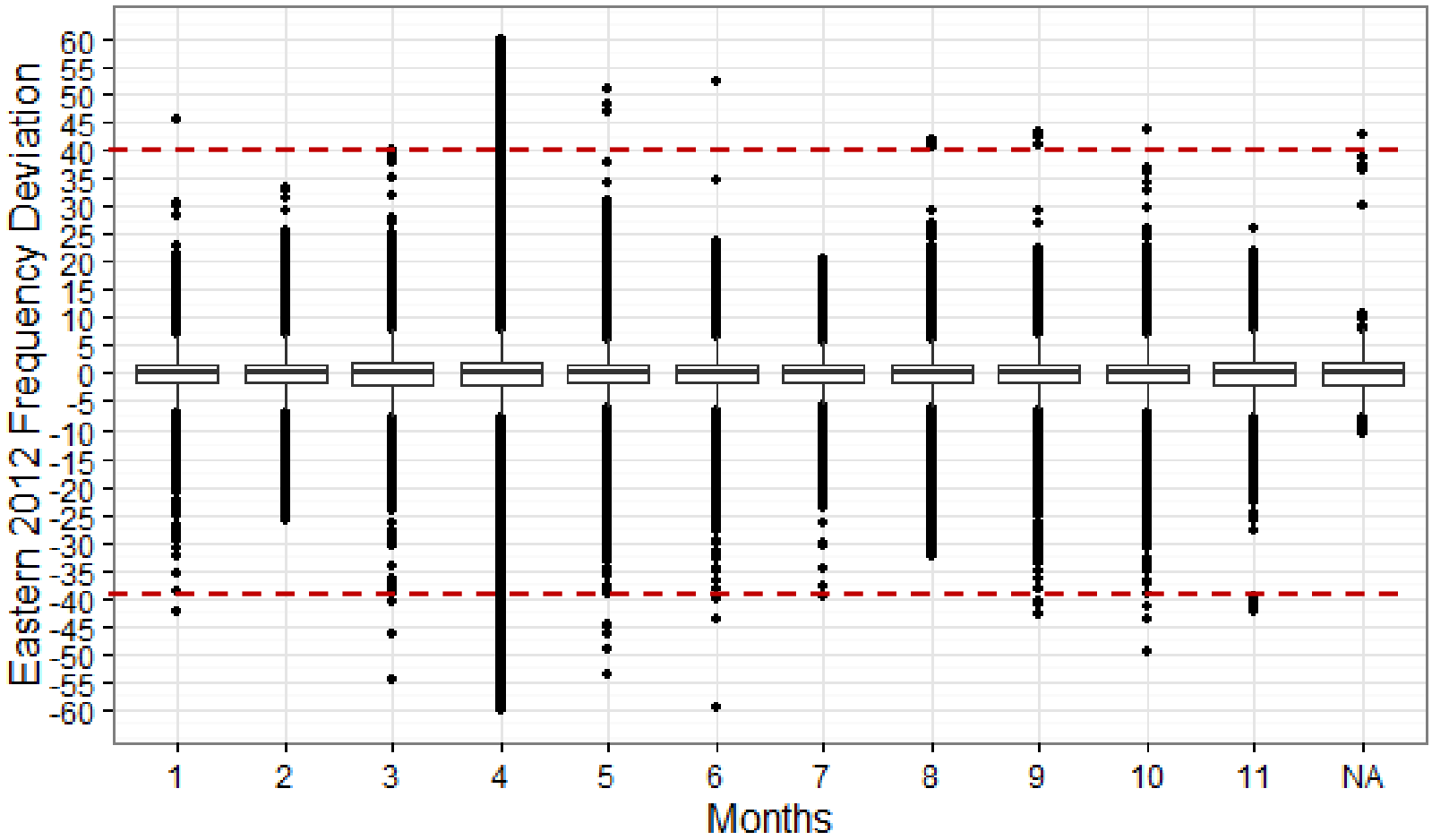
Eastern 2012 Frequency Deviation Metric Pattern and Statistics per Hour Type



OBSERVATIONS:

- Data quality ??
- Hours 14, 15, 16 ??
- Hour 7, morning pk.
- Duration impact

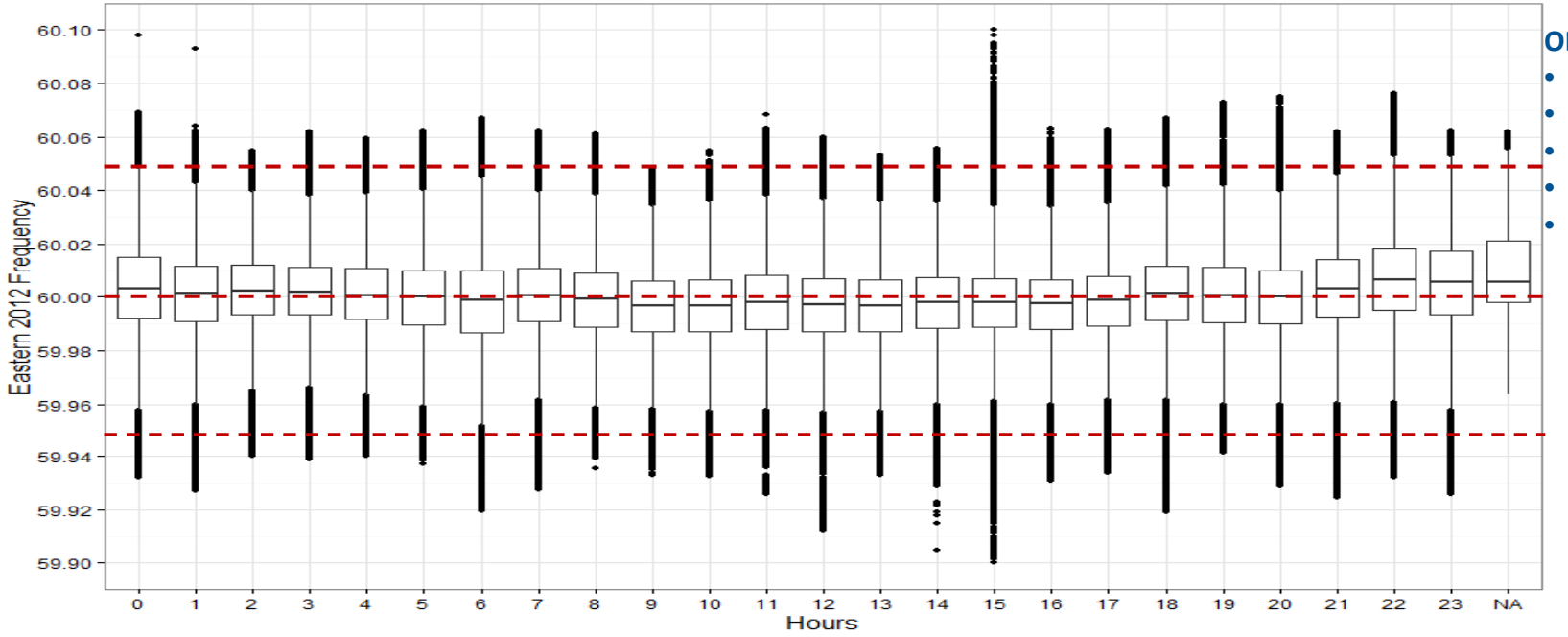
Eastern 2012 Frequency Deviation Metric Pattern and Statistics per Month Type



OBSERVATIONS:

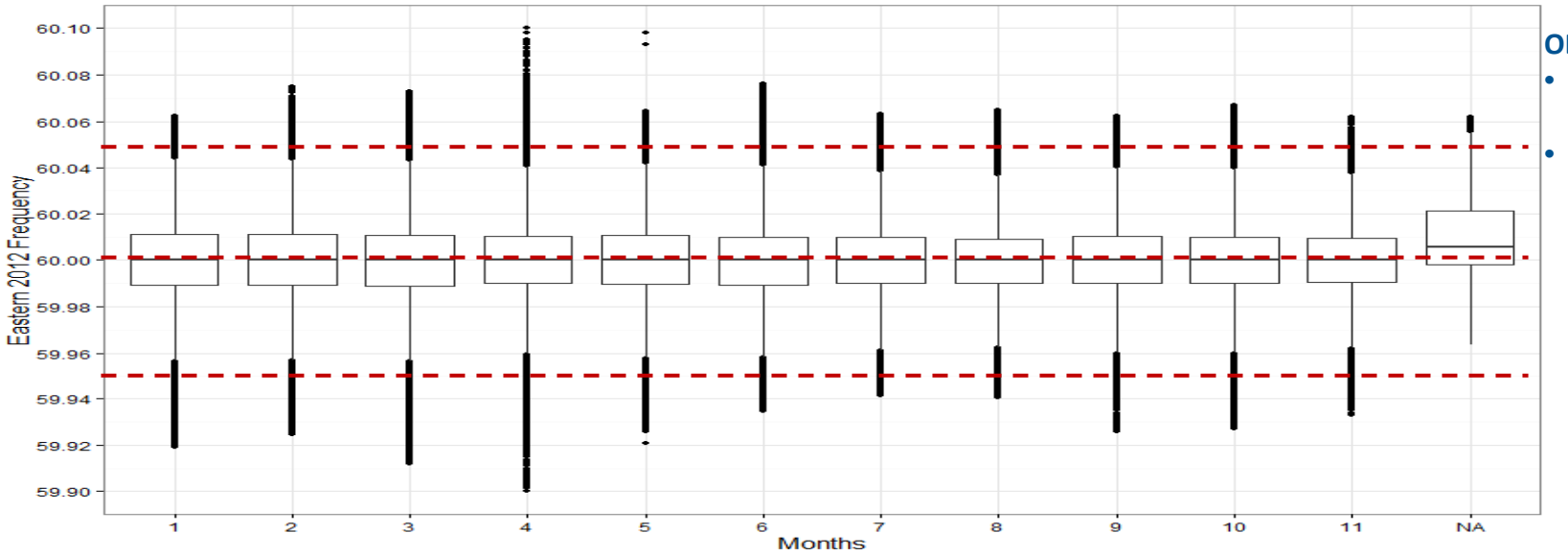
- Above 60: 22 to 4
- Below 60: 10 to18
- Most abnormal: 16
- Most variable: 23

EASTERN 2012 FREQUENCY STATISTICS PER HOUR/MONTH – 1 SECOND DATA



OBSERVATIONS:

- Above 60: 22 to 4
- Below 60: 10 to18
- Most abnormal: 16
- Most variable: 7, 23
- Duration impact ??

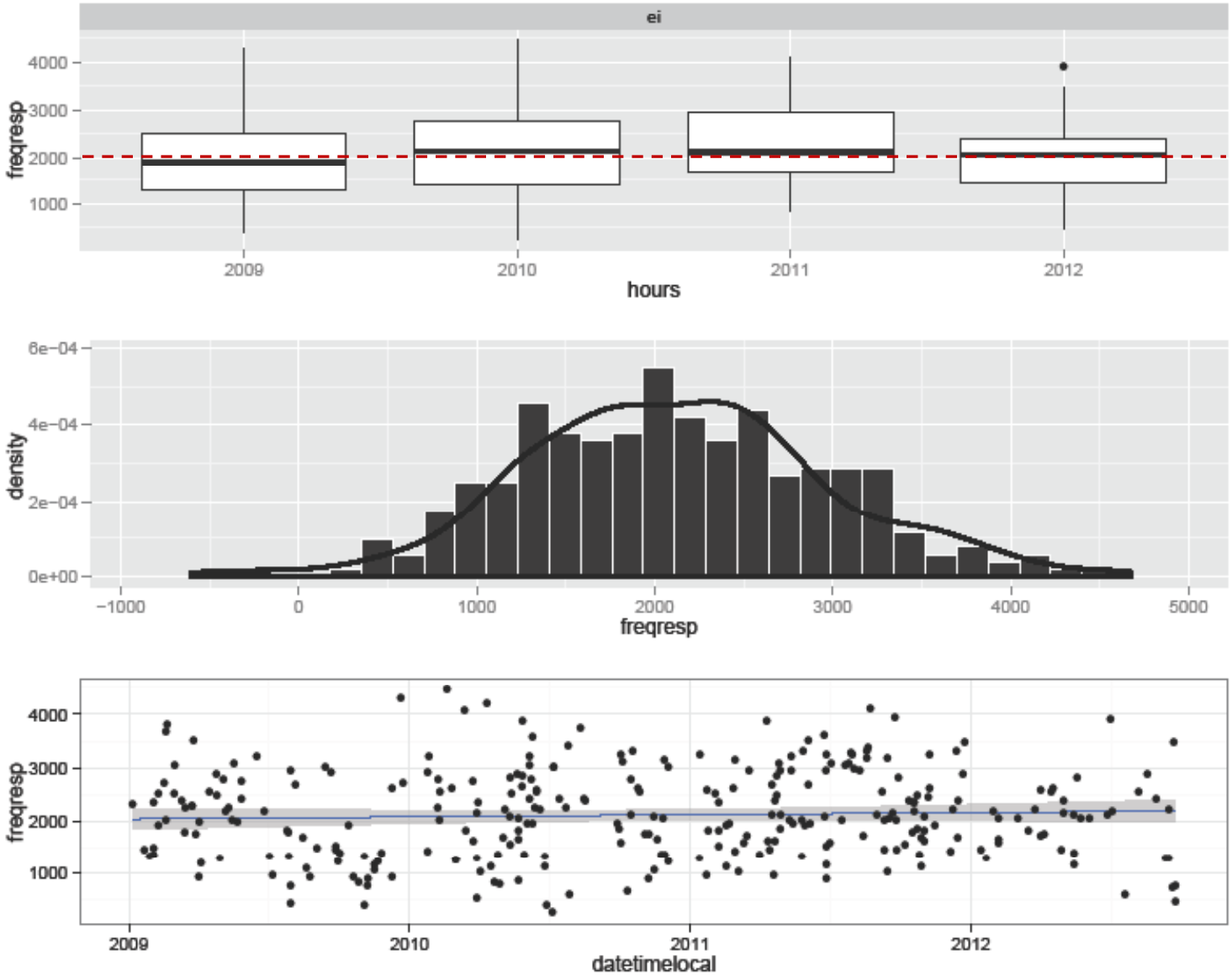


OBSERVATIONS:

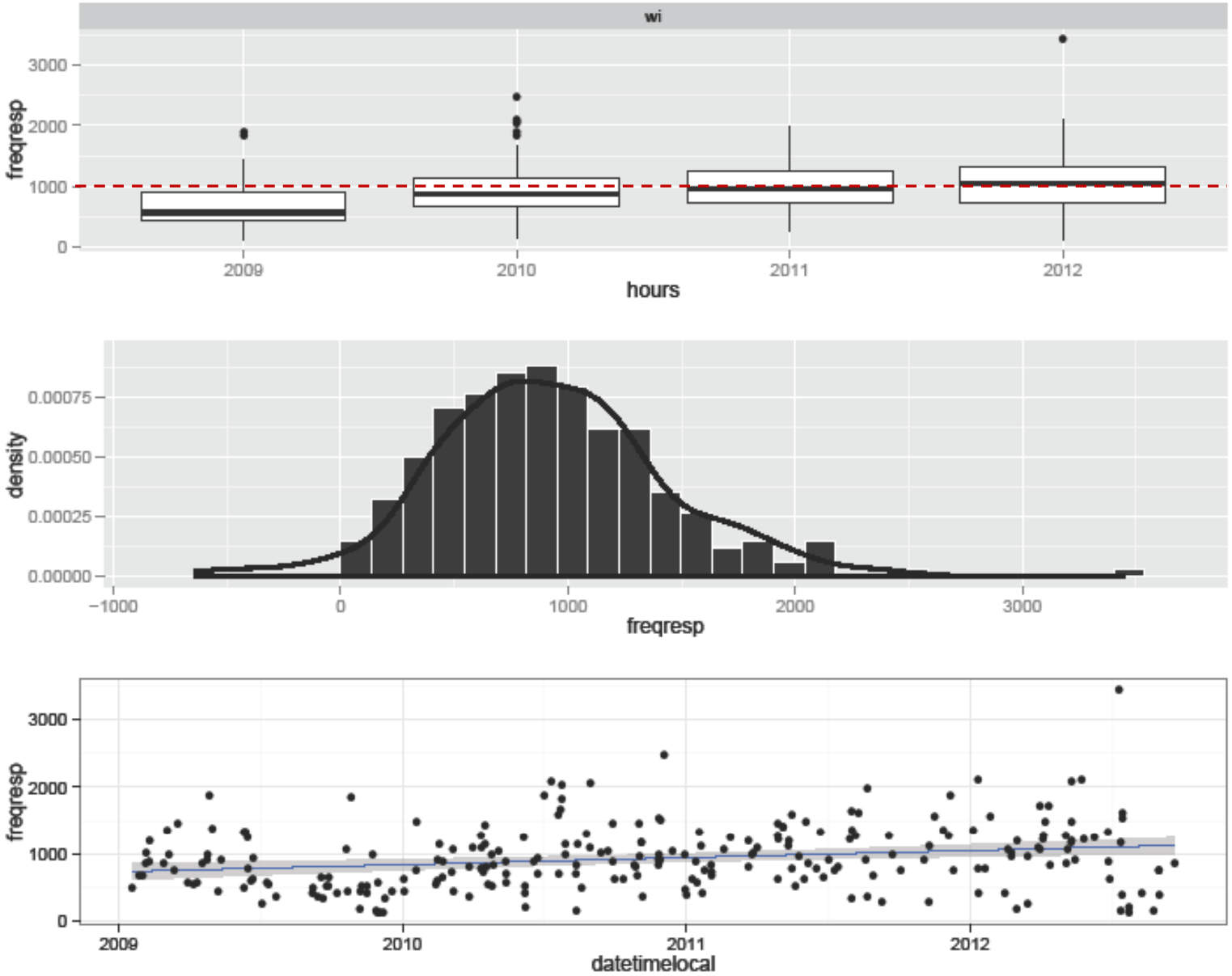
- Most abnormal: Apr
- Most variable: Jan, Feb, Mar

NERC Interconnections 2009 to 2012 Events Frequency Response Statistics

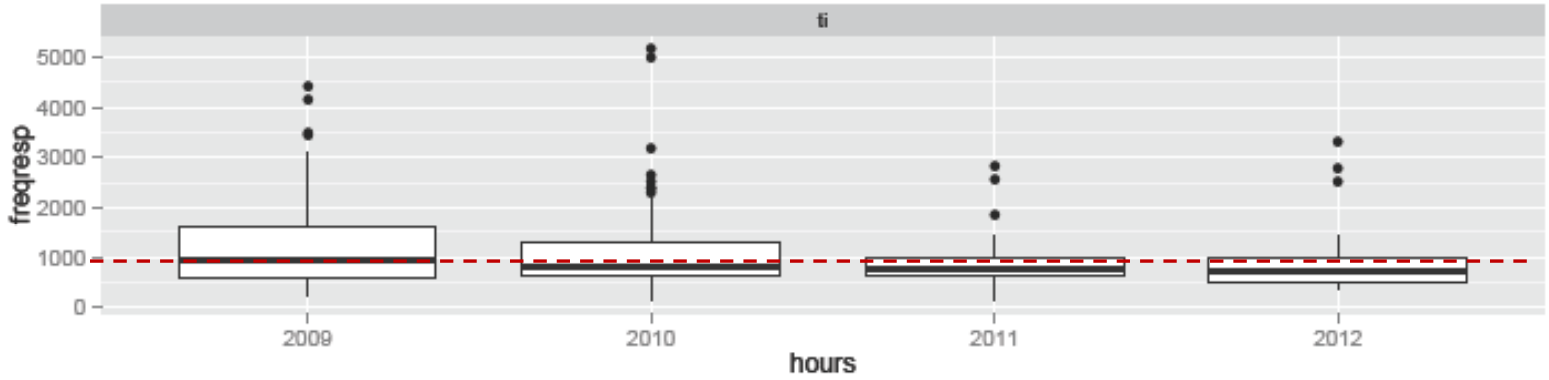
Eastern 2009-2012 Frequency Response Statistics

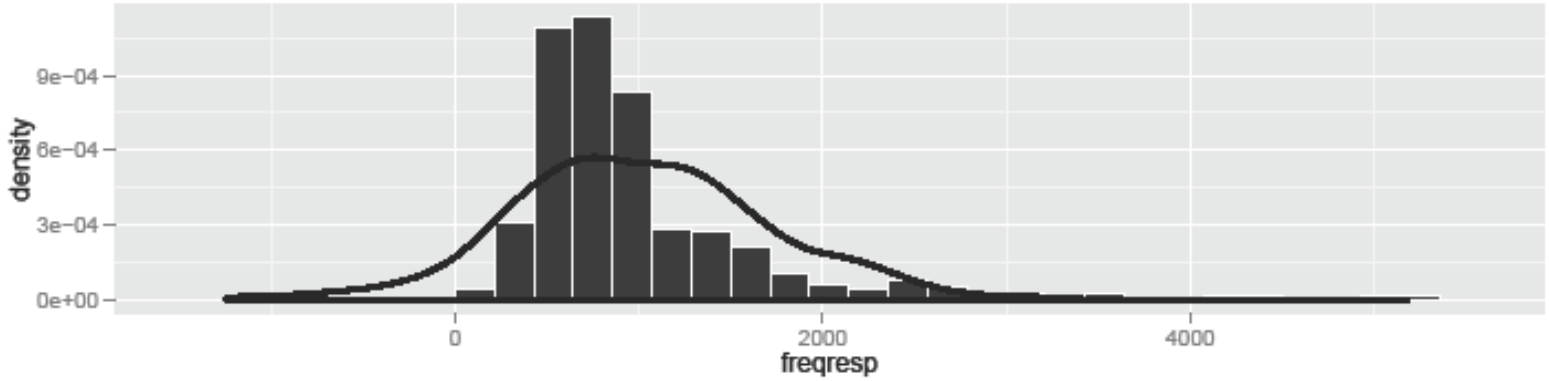


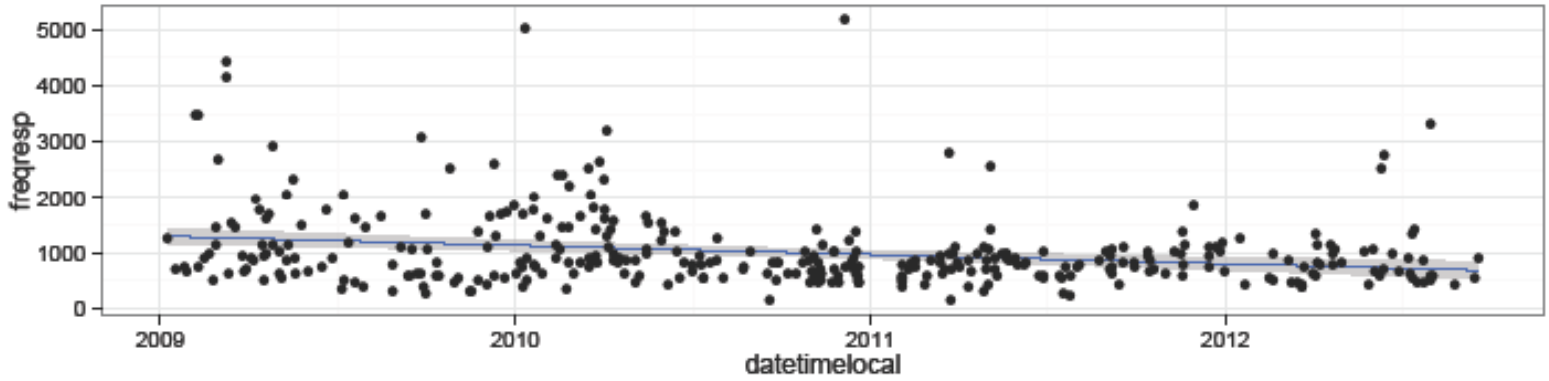
Western 2009-2012 Frequency Response Statistics

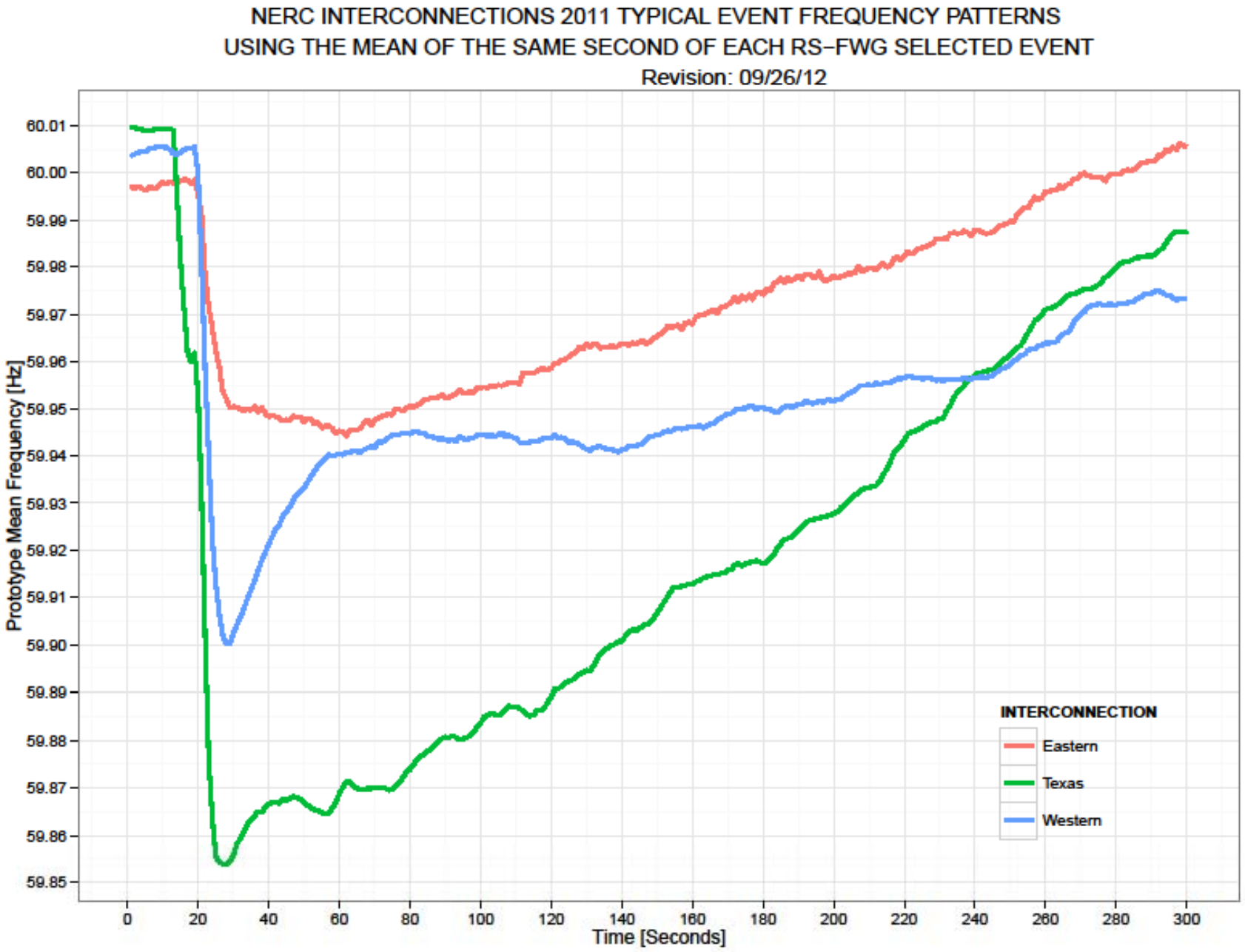


ERCOT 2009-2012 Frequency Response Statistics








NERC INTERCONNECTIONS 2011 TYPICAL EVENT FREQUENCY PATTERNS
USING THE MEAN OF THE SAME SECOND OF EACH RS–FWG SELECTED EVENT
Revision: 09/26/12
Prototype Mean Frequency [Hz]
60.01
60.00
59.99
59.98
59.97
59.96
59.95
59.94
59.93
59.92
59.91
59.90
59.89
59.88
59.87
59.86
59.85
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
Time [Seconds]
INTERCONNECTION
Eastern
Texas
Western

QUESTIONS

Interchange Distribution Calculator Working Group (IDCWG) Update

NERC ORS

Yasser Bahbaz – IDCWG Chair

November 12th , 2012

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

IDCWG Update

- Meetings/Conference Calls
- IDC Change Order Updates
- Other Items
- GTL Update

Implemented

- CO 328 – Intra Hour Tag Curtailments
  - An analysis is being performed to determine if this change order is sufficient to handle the 15-Minute Scheduling correctly.
- CO 346: TLR Auto Acknowledgment
  - IDC is now setup such that each sink impacted Reliability Coordinator can set up to automatically acknowledge the TLR actions based on configurable time intervals after a new TLR instance

Development/Testing

- CO 322: PFV Generation Priority Submissions
  - Will be moved to development once a final methodology is reached at BPS. Will be revised as needed.
- CO 330: Authorization of OATI Use of IDC Data for DOE Studies
  - Same Data is being requested for 2011 ** Not approved by IDCWG.
  - Requesting ORS feedback.
- CO 336: Changes to IDC Factor Calculation Timing
  - This will be moved for development if deemed need after an evaluation on the behavior of status changes is completed by IESO and MISO.
- CO 350 Increase the Initial Limit for NNL Relief Provided During TLR Issuance
- CO 351 – Update the Flowgate GLDF Display to Show PJM Historic Control Areas

Development/Testing

- CO 352: Various Enhancements to the NNL Re-Dispatch Worksheet
- CO 354: Sending IDC TLR ID to SPP Via WebData Interface
- CO 355: Make Informational Flowgates Selectable in Study TLR Mode

Meetings/Conf Calls

- August 15th – 16th (MISO, St Paul)
- October 16th (8 – 5) – 17th (8 – 5)
  - BPS Joint Meeting on 17th (1 – 5)
- November 16th – Conference Call
- January 29th – 30th (8 – 5), OATI Offices in Redwood City.

DRAFT/Evaluation

- CO 326: PFV Metrics
  - Maybe revised after a final methodology is reached at BPS.
- CO 353: PSEC – SOCO Dynamic Tags
- CO 356: TVA RC Requires all IPPs to be a Pseudo Balancing Authority in the IDC
- BOF CO 16: PSSE Version Change

IDCWG Update

Other Items

Entergy Transition to MISO

- Entergy Transition to MISO
  - Entergy is scheduled to transition and become under MISO RC purview on December 1st.
  - IDCWG MISO and ICTE members will coordinate modeling changes effort for December Model.

Location of IDC Model Swing Bus

- Preliminary Analysis showed that the location of Swing Bus doesn't impact TDF or GLDF calculation.
- The analysis were fairly thorough, however, further analysis were requested by members of the IDCWG on other environments of the IDC.
- IDCWG Documentation SDWT is working to clarify all training documents to clarify how best to use GSF and LSFs provided by the IDC.

IDC Reference Document

- IDCWG approved the following recommendation:
  - IDCWG proposes that The Flowgate Administration Reference Document, Parallel Flow Calculation Procedures Reference Document, and Reliability Coordinator Reference Document sections of the NERC Operating Manual sections of the NERC Operating Manual be removed and replaced with a hyperlink to the appropriate document that is posted on the NERC website.
  - The appropriate documents would be the IDC User's Manual and SDX User's Manual.

Web Registry Publication

- IDCWG worked with OATI to validate and debug missing objects in the WebRegistry prior to the go live and publication of the Registry to IDC.
- The webRegistry publication for 11/13/2012 was successfully implemented right before 01:00 CST 11/13/2012 in the IDC.
- Since the implementation of the webRegistry in production until early this morning, the IDC has successfully imported into the IDC more than 450 e-Tags

Web Registry Publication

- After the implementation of the webRegistry in IDC, TLR activity has been conducted without any major issues reported
- OATI reported certain E-Tags with missing object IDs – Further Inquiry of the impact of this issue is outstanding.

IDCWG Update

GTL Update

IDCWG Update

- IDCWG is working with the BPS to draft a IDC GTL User's Manual.
- The intent is to highlight how the current IDC will change to successfully implement BPS requirements as dictated in the whitepaper.
- This document would serve as complimentary material for the NAESB Executive Committee responsible for the approval of the methodology.

IDCWG Update

Vic Howell
Manager, Operations Engineering
WECC RC

Pre-Identified IROL Establishment & Treatment

11/13/2012

ORS Meeting – Little Rock, AR

Background

- September 8th Blackout Report – the WECC RC should recognize that IROLs exist
- Stems from the June 27, 2007 IROL Philosophy letter from Operating Practices Subcommittee (now retired)
- As a result, there are no established criteria for pre-identifying IROLs

Background

- SOL Methodology revised early 2012 contains a process the RC uses to determine when an SOL qualifies as an IROL – Phase I.
- Phase II – a WECC-wide effort to address 19 key issues
- Establish criteria for pre-defined IROLs

ORS Discussion Objective

- To understand how other RCs establish and treat pre-defined IROLs

ORS Discussion Topics

1. Does the IROL define the point where the system "breaks", or does it define the point where the system becomes N-1 insecure?
2. Is the IROL a number, or is it a "condition" (i.e., a number or set of numbers along with a pre-defined set of system conditions)?
3. Are IROLs generally based on stability issues (PV/QV analysis, transient analysis) or something else?
4. When establishing IROLs, is consideration given to the amount of load lost or at risk?

ORS Discussion Topics

5. Do IROLs ensure N-1 security or N-1-1 security?
6. Is an adjustment period allowed (i.e., if an unexpected contingency occurs that leaves the system in an N-1 insecure state, a 30 minute adjustment period is allowed to re-position the system back to an N-1 secure state)?
7. Are pre-defined IROLs updated as you get closer to real-time?
8. Are TPL criteria (such as Category C contingencies) used for establishing IROLs? I.e., do IROLs protect against multiple Facility Contingencies?

Questions?

DEWG Status Update

ORS Meeting
November 13, 2012

DEWG ISN Node Meeting Participation

	10/18/2012	7/12/2012	4/19/2012	1/12/2012	10/20/2011	7/14/2011	4/14/2011	1/13/2011
ALCOA								
Duke	X	X		X	X	X	X	X
ENTERGY			X	X		X		X
ERCOT		X				X		
FPL						X	X	X
HQT	X			X			X	X
IESO	X		X	X	X	X	X	
ISO-NE	X	X	X	X	X	X	X	X
MISO	X	X	X	X	X	X	X	X
NBSO								
NERC	X	X	X	X	X	X	X	X
NYISO	X	X	X	X	X	X	X	X
PJM	X	X	X	X	X	X	X	X
SCEG								
SEPA								
SOCO	X	X	X	X	X			X
SPP	X		X	X	X	X	X	X
TVA	X	X	X	X	X		X	X
WECC		X				X	X	X

Committee Documents

- **Completed review of all DEWG documents**
- **Non-relevant documents retired**
- **Perform yearly review of all active documents**

NERCNet concerns

- **SaskPower applied for NERCNet extension 1st quarter of 2011**
  - Required due to MISO retiring St. Paul ICCP servers
- **Effort not completed as of today**
- **MISO extended MISO's WAN to SaskPower to facilitate data transfer**
- **DEWG is requesting meeting with NERC to discuss this issue along with NERCNet support at upcoming January/2013 meeting**
  - Provide an update to ORS once this meeting occurs

Discuss NERCNet Option 2 requirement

- Currently, no requirements for RC to have the NERCNet Option 2 (backup)
- If Option 1 (Primary) fails, RCs lose data from these sites
- Prohibits network testing as can't switch sites from one option to the other
- DEWG committee is asking ORS for direction on requiring this capability

Current Efforts - DDF

- **Data Definition Files are not being updated on a regular basis**
  - Effort has been delayed due to other efforts
- **Efforts underway to correct this issue**
  - Starting to review who has submitted updated files in the last quarter starting with 3rd qtr, 2011
    - Requirement to submit at least once per every six(6) months

DEWG DDF update

	2012	2012	2011			
	3rd/4th qtr	1st/2nd qtr	3rd/4th qtr			
ALCOA						
Duke	X	X	X			
ENTERGY						
ERCOT	N/A	N/A	N/A	N/A	N/A	N/A
FPL						
HQT						
IESO						
ISO-NE		X	X			
MISO						
NBSO						
NERC	N/A	N/A	N/A	N/A	N/A	N/A
NYISO	X	X	X			
PJM						
SCEG						
SEPA						
SOCO	X	X	X			
SPP	X	X	X			
TVA	X					
WECC	N/A	N/A	N/A	N/A	N/A	N/A

PMU Data Definition Files

- **Version 1 of the PMU data definition file has been approved**
  - Contains meta-data definition for PMU measurements
  - Couldn't reach consensus on a common naming convention for signal names
    - Effort was tabled until new PMU standards are in production
      - Signal name length goes from 16 to 256 characters
- **Validation tool is available to verify PMU DDF file before submittal to NERC ISN repository**
- **NERC ISN repository is available for RC modeling groups to access/submit DDF files**
- **Once NASPI registry is available, this tool is to be retired**
  - Initial effort to scope effort was delayed in 2011

MISO

PMU Real-Time data transfer using NERCNet

- **Currently, no available network for RCs to exchanged Synchrophasor data**
  - NASPINet design is available but no implementation in the near future
  - MISO is seeing 3-6 seconds latency using internet
- **Want to leverage existing NERCNet infrastructure for PMU data transfer**
  - Minimal cost to add this capability
    - Actual usage costs will be assigned to RCs using capability, not intended to be a socialized cost
  - MISO's WAN currently supports ICCP and PMU traffic with no issues (approximately 150 PMUs)
    - Additional bandwidth required

PMU Real-Time data transfer using NERCNet (continued)

- MISO requested approval for test from TWG
  - TWG approved initial test to validate transfer of PMU data
  - Test will be coordinated with all RC control rooms thru TWG/DEWG personnel
  - Initial test will be a single PMU data exchange in each direction
- MISO requested approval for test from TWG
  - TWG approved initial test to validate transfer of PMU data
  - Test will be coordinated with all RC control rooms thru TWG/DEWG personnel

PMU Real-Time data transfer using NERCNet (continued)

- MISO and NYISO are working on plans to perform this test in two phases (short and extended durations)
- Initial confusion on test as DEWG chairman wasn't aware of the two phase request
  - Resolved during conference call November 13th, 2012
- Phase I is currently planned for Thursday, November 15th, 2012 for an eight(8) hour duration
  - Conference bridge to be available during initial test set-up
    - Requesting that each RC participate in call from respective control room
  - Test will consist of one PMU in each direction
    - Terminated if any issue is observed or requested by any RC
- Phase II is tentatively planned to start Tuesday, November 27th, 2012 for a 30 day duration
  - Test will follow the same procedure as noted above

PMU Real-Time data transfer using NERCNet – Next Steps

- After sucessful tests:
  - DEWG and TWG will be asked to approve allowing PMU data on NERCNet
  - ORS to approve – does this need to go any other NERC committees?
- MISO has a requirement to use Synchrophasor data in the Control Room, need a private network to exchange data
- Current NERCNet upgrade to MPLS is behind schedule:
  - Allows ICCP traffic to have a higher priority
  - More capability to monitor network traffic
  - Approximately 75% of option 2 sites (backup) are transitioned, behind schedule
  - Not sure what timeline is for option 1 sites (primary)
- Synchrophasor data is the new tool for control rooms
  - Need network for transmission of this data (not Internet)
  - If it's not NERCNet, then will need to install a new network (expensive)
  - Need to push industry to have capability for Synchrophasor data