

***Consortium for  
Electric  
Reliability  
Technology  
Solutions***

**NERC  
Frequency  
Monitoring and  
Analysis (FMA)  
Project**

**NERC Frequency Monitoring and Analysis (FMA) Application  
Frequency Response Standard Drafting Team Meeting  
(FRSDT)**

By: Carlos Martinez – CERTS  
Dallas, Texas – December 12, 2007

# *Outline*

- *NERC Frequency Data Collection and Analysis System (FDCAS) Original Specification*
- *FMA Data Collection and Transmittal*
- *FMA Visualization Interface*
- *FMA Frequency Response Events*
- *Project Timeframes*

# *NERC Frequency Data Collection and Analysis (FDCAS) Function*

*The North American Electric Reliability Council (NERC) desires to collect and analyze frequency data from each of the three designated NERC Interconnections and the Hydro Quebec system. The requirements are for the design and implementation of a system to gather, transmit, process, store, and provide access to this frequency data. There are two major requirements:*

- 1. Data collection and transmittal*
- 2. Data processing, storage, access and system interface*

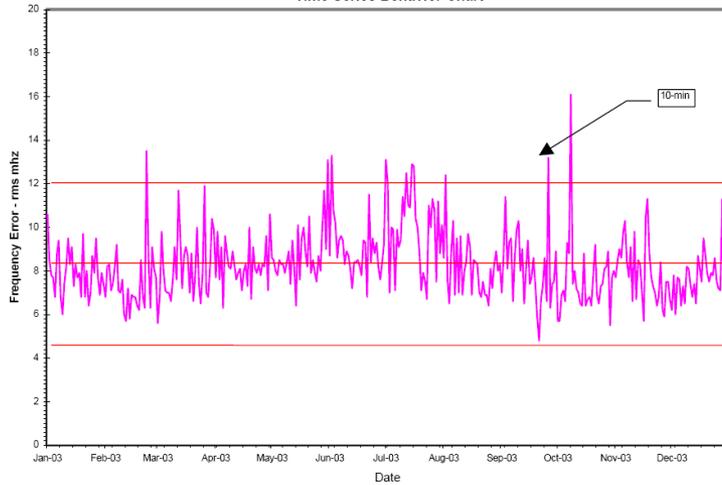
# *NERC Frequency Data Collection and Analysis (FDCAS) Specification*

# *NERC Frequency Data Collection and Analysis (FDCAS)*

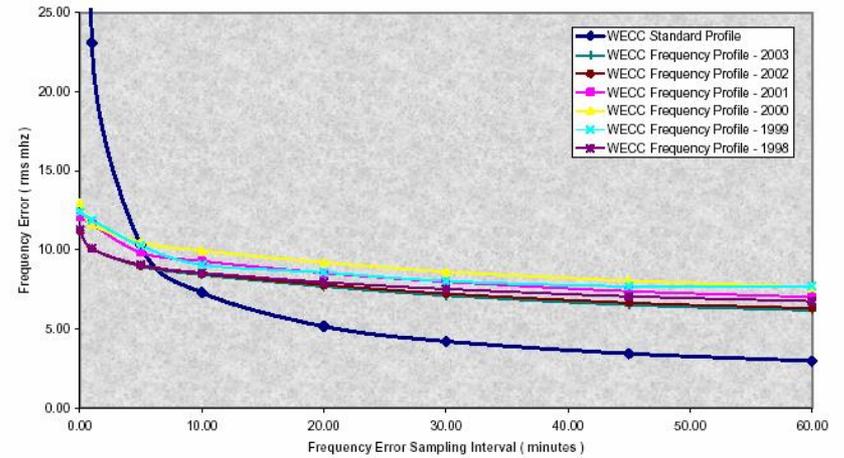
- Automatically transmit frequency data from 12 sites: three sites each for each of NERC's three Interconnections and three sites within the Hydro Quebec system.*
- Synchronize the frequency sampling intervals, time stamp information and any other time information required (calibrated to sources traceable to the National Institute of Standards and Technology (NIST)).*
- Collect absolute frequency data to a resolution of three decimal places (i.e. 1 milliHz).*
- Archive frequency data for each of the interconnections at a minimum sampling rate of once per second maintaining a resolution of three decimal places (i.e. 1 milliHz).*
- Maintain on-line archive frequency data for a minimum of five (5) years.*
- Include report production and database query capabilities that offer standard periodic reports and event driven reports based on archived data for each interconnection and Hydro Quebec. These are subscriber reports that are automatically generated.*
- Provide database query and report writing tools to generate both graphic and tabular format reports.*
- Allow authorized users as approved by the NERC Resources Subcommittee to view and query frequency database contents.*
- Import and merge existing NERC archived frequency data into the master data set.*

# NERC FDCAS Frequency Performance Charts (Attachment-A NERC Functional Specification)

**WECC Daily Frequency Performance  
Time Series Behavior Chart**

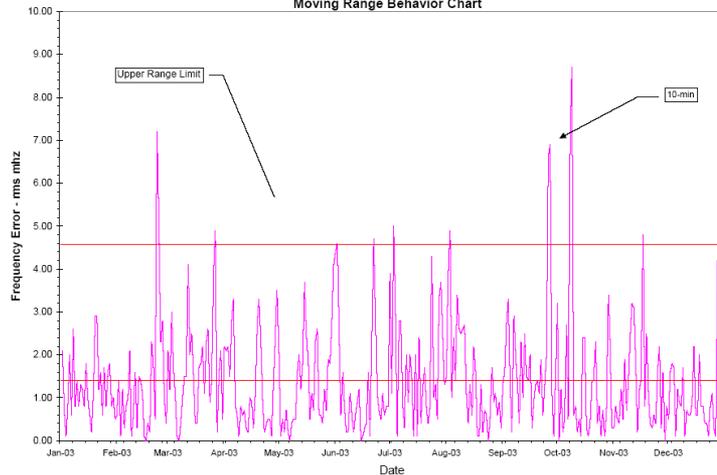


**WECC Frequency Error Profile  
(1998 - 2003)**

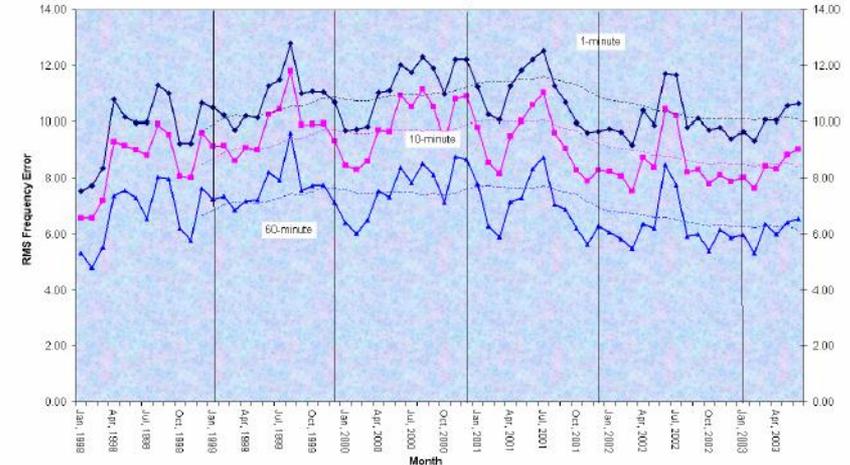


Note: Frequency error = actual frequency - scheduled frequency based on 2-second samples. WECC time error and frequency error data is not supplied by the official WECC Time Monitor.

**WECC Daily Frequency Performance  
Moving Range Behavior Chart**

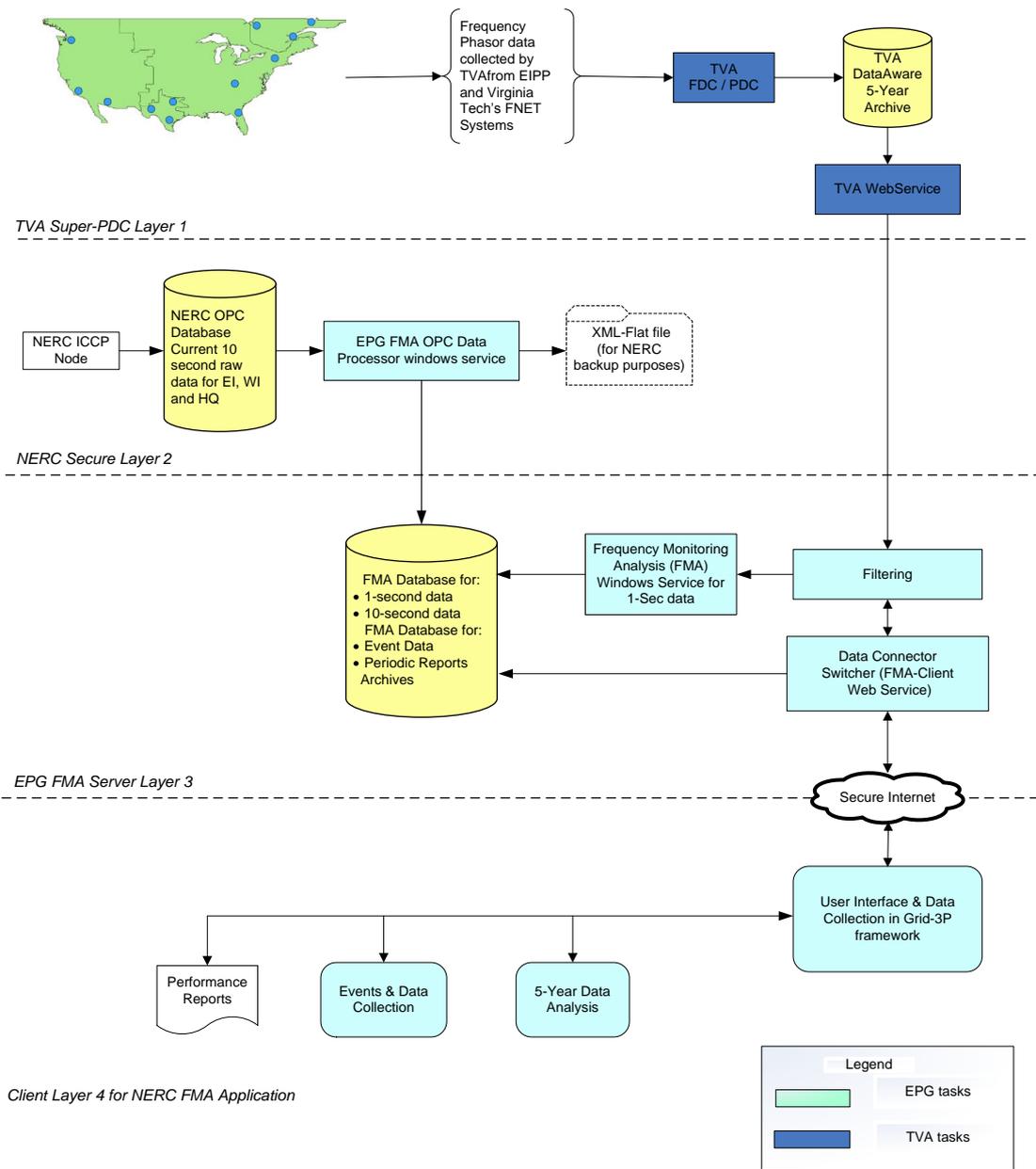


**WECC Monthly Frequency Error and 12-month Rolling Trend  
Jan.1998 to present**

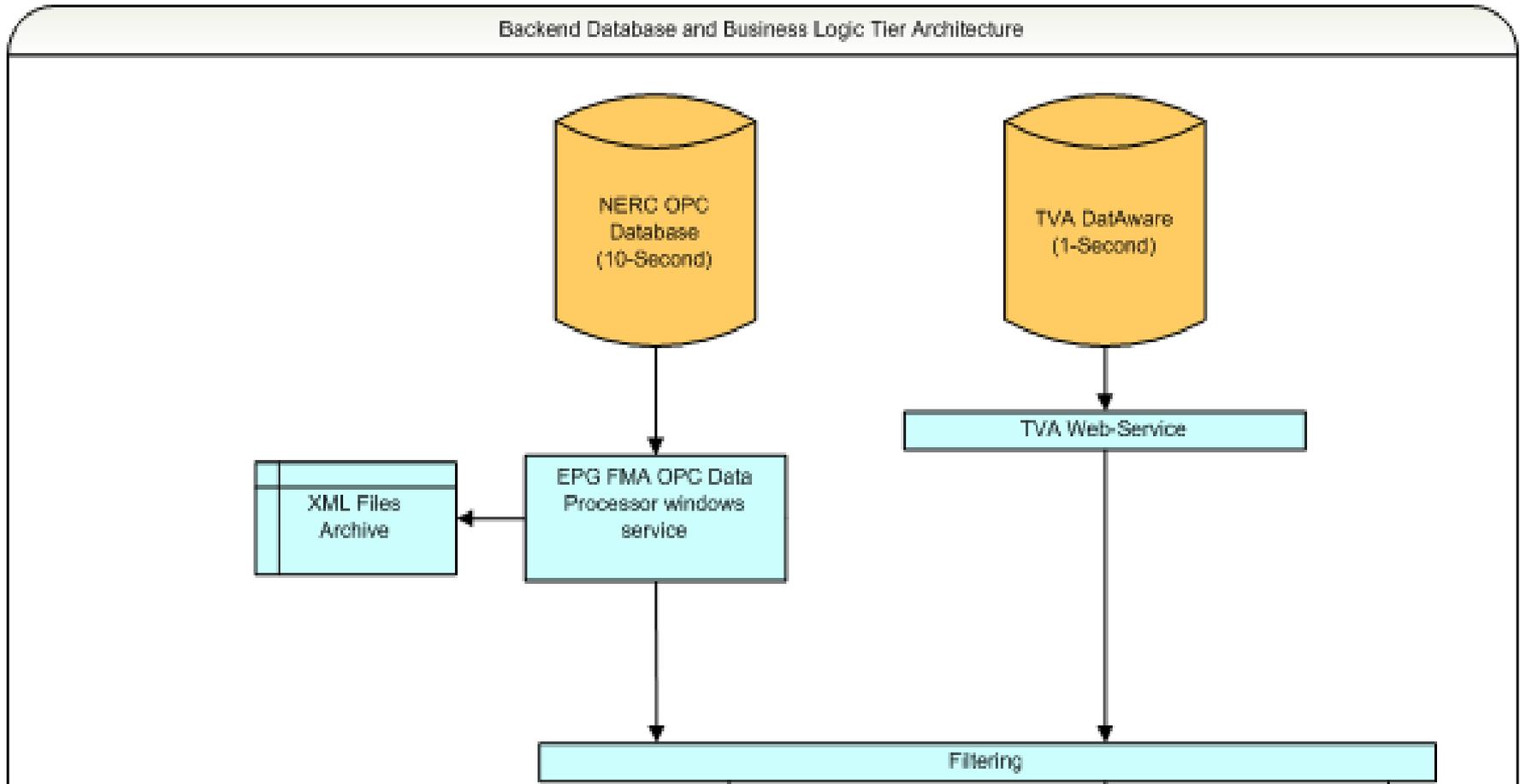


NOTE: dashed lines represent 12-month moving average for same color of sampling interval. Frequency error = actual frequency - scheduled frequency based on 3-second samples. WECC time error and frequency error data is not supplied by the official WECC Time Monitor. It is supplied "as is" with no warranty implied.

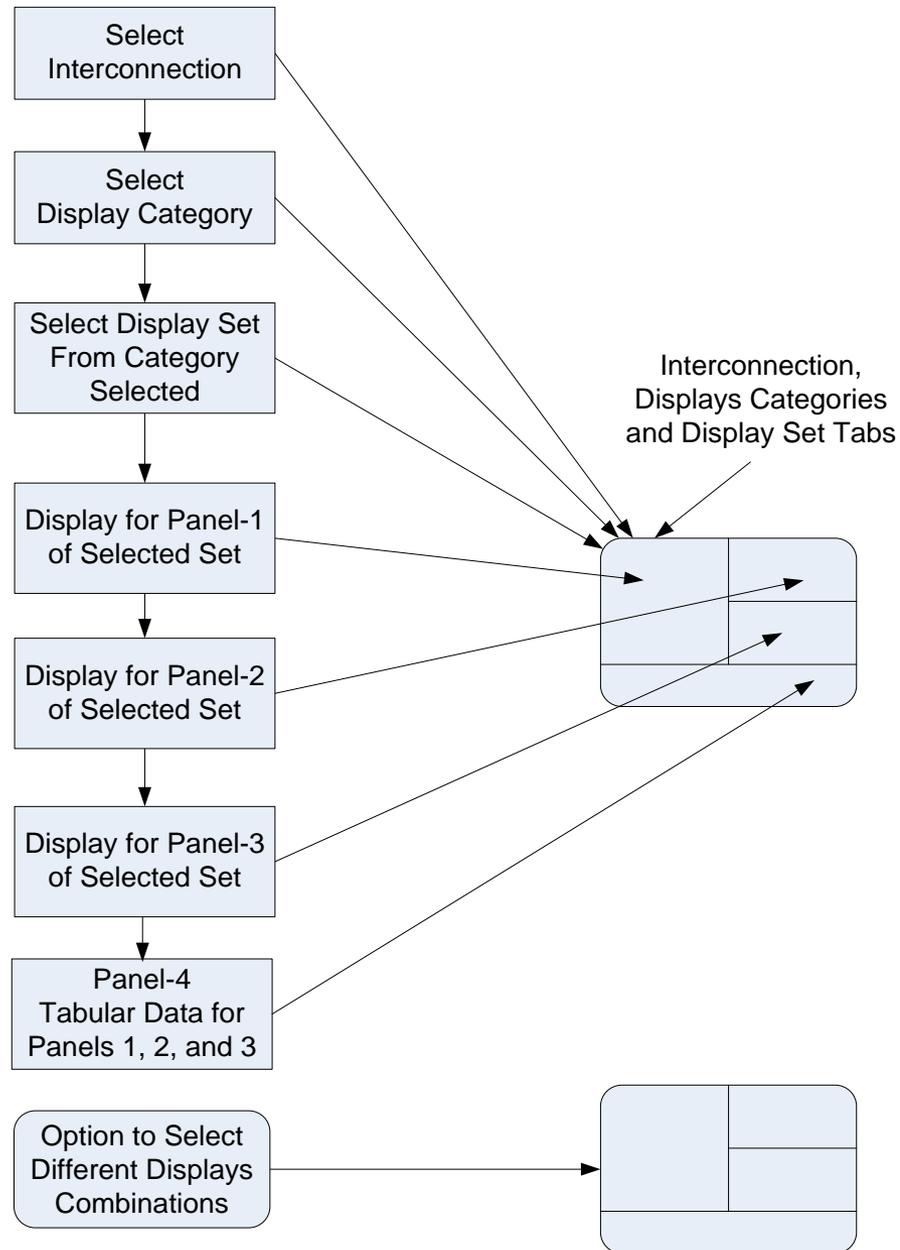
# NERC FMA Project Four Layer Architecture and Data Flow



# *FMA Data Flow (1-Sec and 10-Sec)*



# FMA Visualization Navigation



# FMA Frequency Response Visuals

NERC Frequency Monitoring and Analysis (FMA) Application, Version 1.0 built upon GRID-3P®

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graph TD; FMA[Frequency Monitoring and Analysis] --- FP[Frequency Performance]; FMA --- FR[Frequency Response]; FMA --- FE[Frequency Events]; FMA --- FT[Frequency Trends];
```

### FMA User Login

Time Zone:

UserName:

Password:

[Forgot Password - Click Here !](#)

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If you encounter any difficulties while using this application, please contact Support at Electric Power Group.  
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Electric Power Group, located in Pasadena, California  
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[contact@electricpowergroup.com](mailto:contact@electricpowergroup.com)  
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**NERC**  
NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

**CERTS**  
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

**Electric Power Group**

Grid-3P, US Patent 7,233,843  
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# FMA Frequency Response Events Editor

Frequency Response Events Editor
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Interconnection selection:

Eastern    Western

ERCOT    Quebec

Frequency/ACE Range

Frequency range:  Hz to  Hz

ACE Range:  MW to  MW

Time frame selection

Start date/time:

End date/time:

Get Events

Event hhmss\_mmddyyyy

Event hhmss\_mmddyyyy

Event hhmss\_mmddyyyy

Event hhmss\_mmddyyyy

Event hhmss\_mmddyyyy

Event hhmss\_mmddyyyy

**Frequency**

Y-axis: 59.92, 59.94, 59.96, 59.98, 60.00, 60.02, 60.04, 60.06, 60.08, 60.10

X-axis: 0, 2, 4, 6, 8, 10, 12, 14, 16

Point A: 60.003 Hz

Point B: 59.945 Hz

Point C: 59.925 Hz

### FREQUENCY RESPONSE CALCULATION

PMU Location:	<input type="text" value="NPCC"/>	
Actual Net Interchange immediately before disturbance (Point A):	<input type="text" value="1000"/>	MW
Actual Net Interchange immediately after disturbance (Point B):	<input type="text" value="1200"/>	MW
Change in Net Interchange:	<input type="text" value="0"/>	MW
Generation (-) lost causing the disturbance:	<input type="text" value="-200"/>	MW
Interconnection Response:	<input type="text"/>	MW
Change in Interconnection frequency from Point A to Point B:	<input type="text" value="0.02"/>	Hz
<b>Frequency Response:</b>	<input type="text" value="0.02"/>	<b>MW / 0.1 Hz</b>

### OTHER INFORMATION

Frequency bias values:	<input type="text"/>	MW / 0.1 Hz
Frequency at Point A:	<input type="text" value="60.003"/>	Hz
Frequency at Point B:	<input type="text" value="59.945"/>	Hz
Frequency at Point C:	<input type="text" value="59.925"/>	Hz

# FMA Frequency Response Events Editor

## Frequency Response Events Editor

### Interconnection Selection

- Eastern    Western  
 ERCOT    Quebec

### Frequency/ACE Range

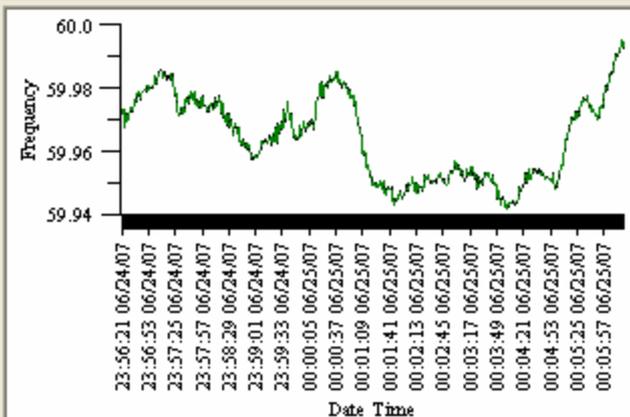
Frequency Range  Hz To  Hz  
 ACE Range  MW To  MW

### Time Frame Selection

Start Date/Time    
 End Date/Time

Get Events

- Event 3726 00:01:21\_06/25/2007
- Event 3727 00:02:29\_06/25/2007
- Event 3728 00:02:47\_06/25/2007
- Event 3729 00:03:26\_06/25/2007
- Event 3730 00:03:45\_06/25/2007
- Event 3731 00:04:26\_06/25/2007
- Event 3732 00:04:58\_06/25/2007
- Event 3507 00:24:13\_06/10/2007
- Event 3471 00:24:33\_06/08/2007
- Event 3675 00:31:43\_06/23/2007



### FREQUENCY RESPONSE CALCULATION

PMU Location   
 Actual Net Interchange Immediately Before Disturbance (Point A)  MW  
 Actual Net Interchange Immediately After Disturbance (Point B)  MW  
 Change in Net Interchange  MW  
 Generation (-) lost Causing the Disturbance  MW  
 Interconnection Response  MW  
 Change in Interconnection Frequency from Point A to Point B  Hz  
**Frequency Response**  **MW / 0.1 Hz**

### OTHER INFORMATION

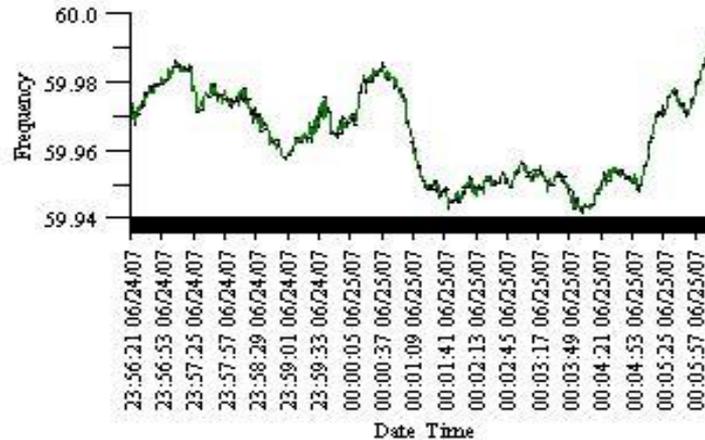
Frequency Bias Values  MW / 0.1 Hz  
 Frequency at Point A  Hz  
 Frequency at Point B  Hz  
 Frequency at Point C  Hz

# FMA Frequency Response Event Summary

## Event Summary

Interconnection : Eastern

Event Time : 00:01:21\_06/25/2007 [EDT]



## FREQUENCY RESPONSE CALCULATION

PMU Location :

Actual Net Interchange Immediately Before Disturbance (Point A) : 32045.5148046686 MW

Actual Net Interchange Immediately After Disturbance (Point B) : 37302.3975359957 MW

Change in Net Interchange : 5256.8827313271 MW

Generation (-) lost Causing the Disturbance : 325.187798 MW

Interconnection Response : 4931.6949333271 MW

Change in Interconnection Frequency from Point A to Point B : 0.007481333333 Hz

Frequency Response : 659200.00000210390304759447471 Hz

## OTHER INFORMATION

Frequency Bias Values : 65920 MW/0.1 Hz

Frequency at Point A : 59.952062333333 Hz

Frequency at Point B : 59.944581 Hz

Frequency at Point C : 59.943056333333 Hz

**DISCLAIMER** - This FMA report is generated using Phasor and SCADA data supplied to NERC. The report depends on the quality and completeness of the data supplied, accordingly, the accuracy of this report cannot be assured. This report is for NERC authorized users only.

**CONFIDENTIAL** - Covered under NERC Data Confidentiality Agreement

Created By Using Grid 3P Application Platform U.S Patent.

# *FMA Develop and Delivery Time Frames*

