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)
NERC FMA Project Four Layer Architecture and Data Flow

Frequency Phasor data collected by TVA from EIPP and Virginia Tech’s FNET Systems

TVA FDC / PDC

TVA DataAware 5-Year Archive

TVA WebService

NERC ICCP Node

NERC OPC Database
Current 10 second raw data for EL, WI and HQ

EPG FMA OPC Data Processor windows service

XML Flat file (for NERC backup purposes)

FMA Database for:
- 1-second data
- 10-second data
- FMA Database for:
- Event Data
- Periodic Reports Archives

EPG FMA OPC Data Processor windows service

Frequency Monitoring Analysis (FMA) Windows Service for 1-Sec data

Data Connector Switcher (FMA-Client Web Service)

Secure Internet

User Interface & Data Collection in Grid-SP framework

Performance Reports

Events & Data Collection

5-Year Data Analysis

Legend

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPG tasks</td>
<td>EPG tasks</td>
</tr>
<tr>
<td>TVA tasks</td>
<td>TVA tasks</td>
</tr>
</tbody>
</table>
FMA Data Flow (1-Sec and 10-Sec)
FMA Visualization Navigation

1. Select Interconnection
2. Select Display Category
3. Select Display Set From Category Selected
   - Display for Panel-1 of Selected Set
   - Display for Panel-2 of Selected Set
   - Display for Panel-3 of Selected Set
   - Panel-4 Tabular Data for Panels 1, 2, and 3
4. Option to Select Different Displays Combinations
5. Interconnection, Displays Categories and Display Set Tabs
FMA Frequency Response Visuals

NERC Frequency Monitoring and Analysis (FMA) Application, Version 1.0

FMA User Login
- Time Zone: Eastern Standard Time
- UserName: FMAUser
- Password: ********

Login
Forgot Password - Click Here!

If you encounter any difficulties while using this application, please contact Support at Electric Power Group.

Electric Power Group, located in Pasadena, California
- Tel: (626) 685-2015
- Fax: (626) 685-2039
- contact@electricpowergroup.com

NERC
North American Electric Reliability Corporation

CERTS
Conservation for Electric Reliability Technology Solutions

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**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: Wed, Aug 22, 2007 10:08:03 PM
- End date/time: Wed, Aug 22, 2007 10:08:03 PM

**FREQUENCY RESPONSE CALCULATION**

- **PMU Location:** NPCC
- **Actual Net Interchange immediately before disturbance (Point A):** 1000 MW
- **Actual Net Interchange immediately after disturbance (Point B):** 1200 MW
- **Change in Net Interchange:** 0 MW
- **Generation (-) lost causing the disturbance:** -200 MW
- **Interconnection Response:** [ ] MW
- **Change in Interconnection frequency from Point A to Point B:** 0.02 Hz
- **Frequency Response:** 0.02 MW / 0.1 Hz

**OTHER INFORMATION**

- **Frequency bias values:** [ ] MW / 0.1 Hz
- **Frequency at Point A:** 60.003 Hz
- **Frequency at Point B:** 59.945 Hz
- **Frequency at Point C:** 59.925 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 : 0.0074813333333 Hz
Frequency Response : 659200.0000021039030475947471 Hz

OTHER INFORMATION

Frequency Bais Values : 65920 MW/0.1 Hz
Frequency at Point A : 59.9520623333333 Hz
Frequency at Point B : 59.944581 Hz
Frequency at Point C : 59.9430563333334 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
FMA Develop and Delivery Time Frames

- April 2007: Functional Specification was released
- May 2007: Design Specification was released
- December 2007: Development
- January 2008: Factory Test
- April 2008: Field Trial Test
- Final Delivery