Eastern Interconnection Phasor Demonstration

Enhanced Wide-Area Visibility In the Eastern Interconnection for Reliability Management

Transmission Reliability Program Peer Review
Washington, D.C.

Carl Imhoff
Presentation Outline

1. Purpose of Eastern Interconnection Wide Area Measurement Demonstration
2. Review of Wide Area Measurement Systems (WAMS)
3. Benefits of Eastern Interconnection WAMS
4. Proposed Plan
5. Status Update
**EI WAMs Demonstration**

- **GOAL:** Facilitate evaluation and implementation of wide area, high-speed grid measurement in the Eastern Interconnection to enhance grid reliability management

- **BACKGROUND:**
  - DOE has been involved in tools and technology development in the Western system.
  - DOE discussions with EI ISOs and utilities in Fall 2002 resulted in expressions of interest for interconnection level monitoring to address emerging system behaviors
  - EIPP Demonstration initiated in FY03
Wide-Area Measurement System (WAMS)

- Transmission lines and corridors are monitored on a wide-area basis
- Phasor Measurement Units (PMUs) and other measurement devices sample voltage (and current) waveforms
- Phasor Data Concentrators (PDCs) collect and compile PMU data
- Software applications analyze and present results
  - Real-time monitoring of phasor magnitudes and angles
  - Post-disturbance analysis
  - Validation of both steady-state and dynamic grid models
- Future applications enhance grid performance
  - Improved control against voltage collapse
  - Enhanced state estimation
  - Wide-area coordinated protection and control
Phasor Measurement Systems Structure

Critical Grid Locations

Reliability Coordinators

Control Area Operators
Principal Benefits of EIPP WAMS

1. More comprehensive wide-area view of system
2. Rapid assessment of system conditions
3. Improved system models for steady-state and dynamic analysis
4. Enhanced post-disturbance analysis
   • sequence of events
   • what happened first
5. Power swing detection by on-line angle difference monitoring
6. Increased power system performance
7. Higher utilization of existing investments
8. Reduced outage costs
Proposed Plan

Phase I (2003-2004)
• 10-12 Instruments, most are already installed but not connected
• Work out communications issues
• Transfer software tools to users
• Establish relationships

Phase II (2004-2005)
• ~50 Instruments
• Immediate benefits from previous slide realized
• All major corridors covered
• Data available to research community to begin work on projected benefits

Phase III (2006-)
• More than 350 Instruments
• Projected benefits from previous slide realized
• Vendors participating at all levels
• Inexpensive instruments and communications available
Proposed Role of CERTS & DOE

- **PHASE I**
  - CERTS acts as facilitator among stakeholders
  - Provide software tools and training for both operations environment (voltage & frequency profiles, security coordinator tools, etc.) and off-line environment (planning, post-disturbance analysis, model validation, etc.)
  - Provide a “data concentrator” to integrate data and disseminate to participants

- **PHASE II**
  - CERTS engages vendors to incorporate software tools into EMS systems and planning/control environments
  - Continued assistance to stakeholders to resolve hardware or software issues
  - Development of “projected” benefits such as new state estimator

- **PHASE III**
  - CERTS supports technical issues as they arise
BPA StreamReader Display
Oscillations following Alberta separation on August 4, 2000
Synchronized Phasor Technology Applications

Real time Monitoring and Alarming of regional angle differences against predefined thresholds
AEP Kanawha River bus frequency for Aug14 Blackout
12:00-16:10 EDT

KNRV Kanawha River Bus KV1 FreqL
LcaseID=AEPpmu030814_krNBP1 casetime=09/22/03_14:36:45
Proposed PDC Locations (Phase 1)

- Chattanooga (TVA) - TVA Installation
  - October 2003

- Schenectady (NYISO) - NYISO Installation
  - February 2004

- Both installations coordinated with reliability councils and ISOs to serve broad regional needs
Status Update

- Meetings with Major System Operators
  - Sept 2002 through May 2003
- Development of Project Plan
  - April 2003 through June 2003
- Procure/Program/Deploy 1st Phasor Data Concentrator at TVA
  - October 2003
- Preliminary integration of phasor / PPSM data from several existing EI instruments (WAMs outreach)
- EIPP Roadmap Meeting in DC - October 29, 2003
- Form EIPP Working Group - November 2003
- Procure/Program/Deploy 2nd PDC at NYISO - February 2004
- Discussions underway with AEP and Ameren for PDC linkage
EIPP Working Group

- **Vision** – improve power system reliability through wide-area measurement, monitoring and control
- **Participating Organizations (as of December 2003)**
  - USDOE (Chair, Phil Overholt)
  - AEP
  - Ameren
  - CERTS
  - Entergy
  - FERC
  - MISO
  - NERC
  - NYISO
  - NYPA
  - PJM
  - Southern Company
  - SPP
- **Task Team Organization**
  - Phase 1 Implementation
  - Real-Time Applications
  - Off-Line Applications
  - Business Management
  - Standards & Performance
Next Steps

- Accelerate the Working Group activities based upon urgency established by the August 2004 outage and subsequent investigation.
- Prioritize FY04 funding to ensure that initial network is established as quickly as possible.
- Work with industry to determine options for rapid implementation and expansion pending outcomes of Phase 1 and the upcoming Outage Report recommendations.