

Consortium for
Electric
Reliability
Technology
Solutions

DOE
Situational
Awareness for
Resources
Adequacy

DOE Situational Awareness Application Using NERC Resources Adequacy Wide-Area Real Time Monitoring Application

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July 2006



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Presentation Outline

- *Bulk Power System Reliability Components*
- *NERC ACE-Frequency for Load-Generation Resources Adequacy*
 - *Architecture*
 - *Utilization*
- *DOE Situational Awareness for Resource Adequacy*
 - *Implementation Plan*
 - *Approach, Design and System Conditions Definition*
 - *Major Functional Components*
 - *Visualization Solution*
 - *Research Plan*
- *Questions/Answers*

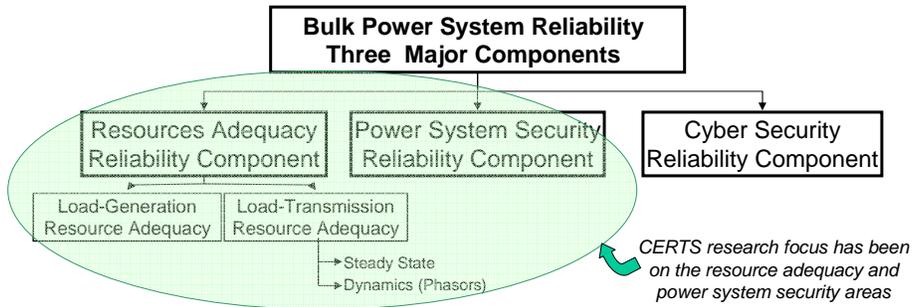


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Bulk Power System Reliability Components



- CERTS application platform is designed for real-time monitoring and analysis of resource adequacy and probabilistic assessment of power system security
- CERTS wide-area real time monitoring applications are being used by NERC reliability coordinators for monitoring load – generation resource adequacy, and in test use in the Western and Eastern interconnection for load – transmission resource adequacy monitoring



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NERC Wide-Area Real Time ACE-Frequency Monitoring for Resource Adequacy



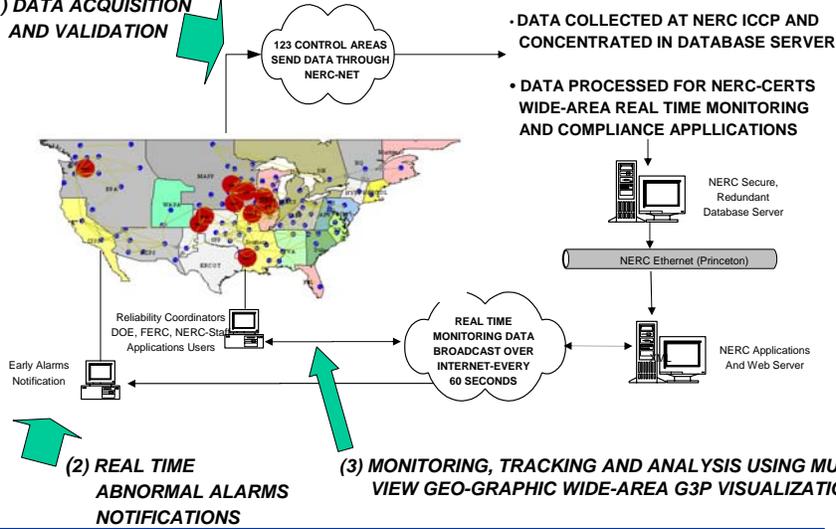
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ACE-Frequency for Load-Generation Resource Adequacy - Architecture

(1) DATA ACQUISITION AND VALIDATION



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ACE-Frequency for Load-Generation Resource Adequacy - Utilization

A B C D

Act on Early Warning Frequency Alarms

Select Jurisdiction (s) Violating Performance Metric Threshold Now

Identify Balancing Authorities Contributing to Jurisdiction Violation

Zoom-In and Evaluate Problem Magnitude and Duration For Worst Balancing Authorities

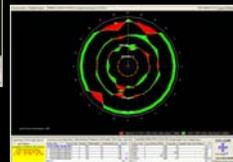
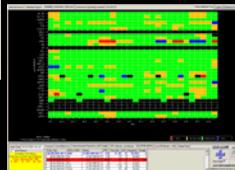
Subject Line

High Frequency Trigger Limit Violation 60.055 Hz

Message

FTL HIGH - EAST 8/23/2005 11:34:00 PM (EDT)
Frequency has reached or exceeded FTL of 60.05 Hz for more than 5 minutes.

Load-Generation resources under inadequate balance.



DOE Situational Awareness for Resource Adequacy



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Utilization of NERC-CERTS Monitoring Applications for DOE Situational Awareness

- *NERC-CERTS ACE-Frequency Monitoring Application for load generation resource adequacy was installed at DOE in 2005.*
- *CERTS is adapting the current application and monitoring platform to meet DOE's needs for Situational Awareness Monitoring for Resource Adequacy.*
- *CERTS plan for DOE Situational Awareness Monitoring is:*
 - *Implement load generation resource adequacy monitoring in July 2006*
 - *Research and recommend plan to incorporate additional components for situational awareness monitoring, including forecast of inadequate generation, regional impacts to customers and localities, system vulnerability to extreme weather events, resource adequacy trends, and transmission/voltage inadequacy*



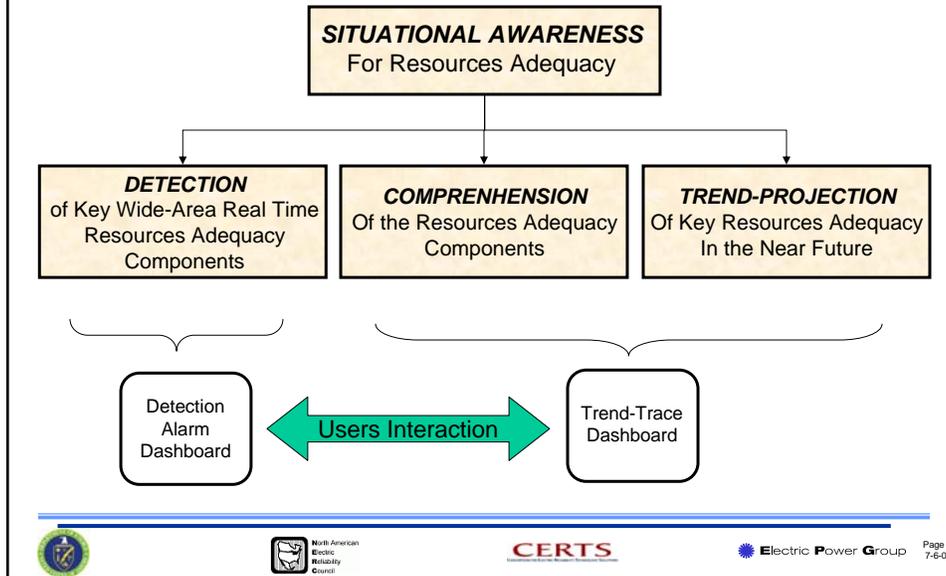
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DOE Situational Awareness Approach



DOE Situational Awareness System Design

Addresses Load-Generation Inadequacy Only. Transmission Inadequacy Not Included –
Requires Research and Development.

- *Provides a color-coded status of system condition*
 - Normal Green
 - Alert Yellow
 - Emergency Orange
 - Load Shed Red
- *System condition status is provided at three geographical levels*
 - Interconnection
 - Reliability Region
 - Reliability Coordinator
- *System condition displays are based on system status; alarms are based on duration of each condition*
- *Alarms are broadcast to subscribers determined by DOE indicating system condition, geographical location, and duration*
- *Performance reports can be generated upon user request for 30, 60, or 90-days*

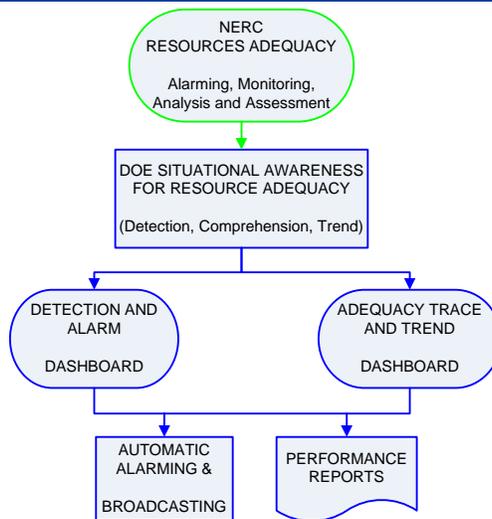
DOE Situational Awareness Application System Condition Definition

Status	Color	Condition	Alarm
Normal	Green	Normal	None
Alert	Yellow	The risk and impact of a second contingency becomes greater than acceptable. Reliability Coordinators are required to coordinate and take preventive actions	Identify, Display and Broadcast Alert Alarms to: <ul style="list-style-type: none"> Indicate under/over generation for 15-minutes with inadequate corrective action Indicate violation of NERC standard if situation persists for a total of 30-minutes If condition persists for more than 30-minutes indicates operation in a zone where the risk of a second contingency becomes greater than acceptable and customers could be dropped manually or automatically
Emergency	Orange	Interconnections are exposed to unacceptable level of risk. Customers load has or could be dropped manually	Identify, Display and Broadcast Manual Load Drop Emergency Alarms to: Indicates violation of low/high frequency limit and system exposure to manual load shedding.
Load Shed	Red	Load has already being automatically dropped by under-frequency relays. Restoration procedures in place	Identify, Display Automatic Load Shedding Alarms and Customers Dropped Indicates under/over generation has violated a low/high frequency limit where under-frequency relays will automatically shed load

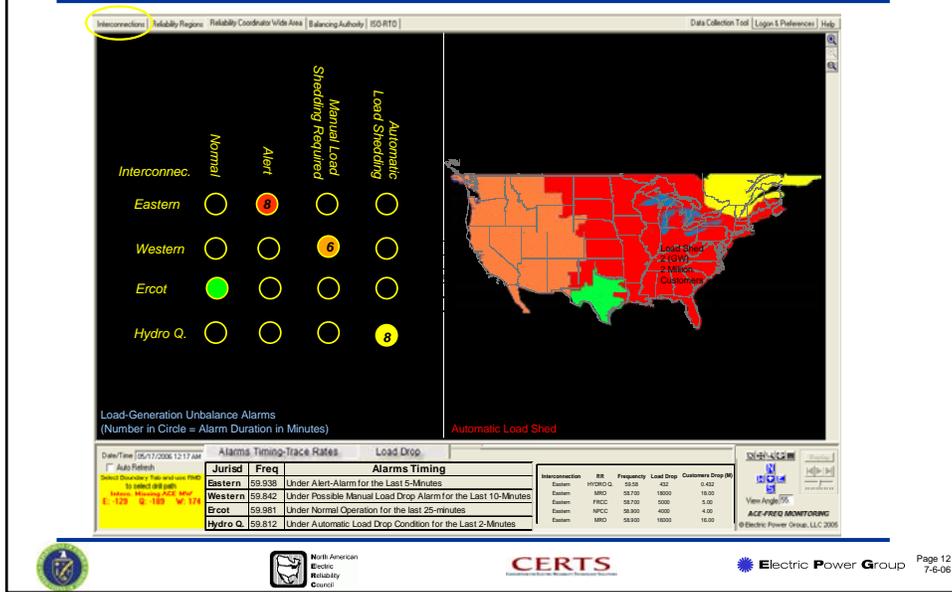
NOTES: (1) DOE-SA, at present, does not provide information on system events resulting from inadequate transmission/voltage as was the case in August 2003. It requires research, design, development to implement. (2) While DOE-SA does not provide information related to transmission/voltage inadequacy, the generation inadequacy information provides enough intelligence that if in use, it could have mitigated if not prevented August 2003 outage.



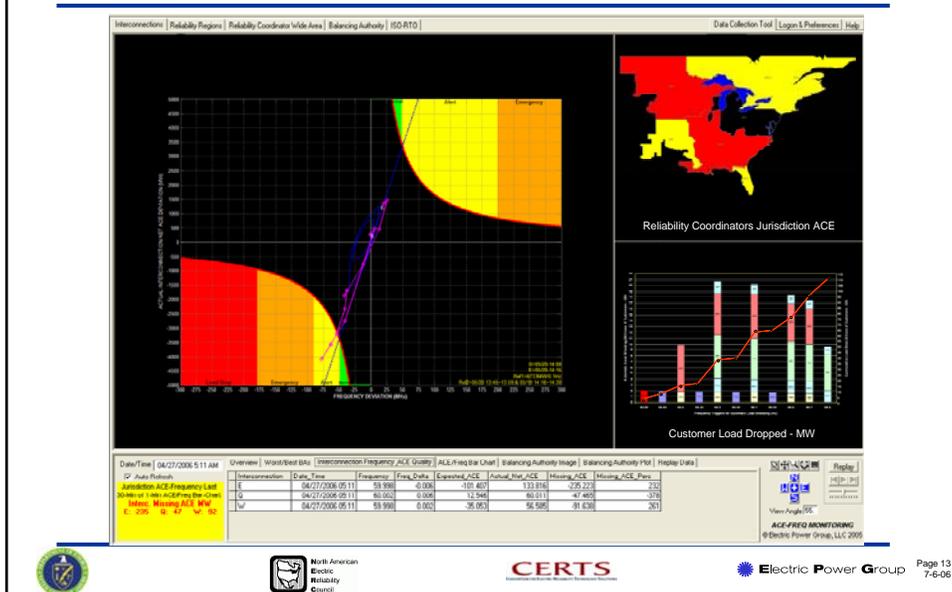
DOE Situational Awareness Major Functional Components



DOE Situational Awareness System Condition Monitoring -- Summary Dashboard



DOE Situational Awareness System Condition Tracking



DOE Situational Awareness Research and Development Plan

Type of Event	Discussion	Plan
1. Inadequate Generation Forecast – Planned Load Shed in anticipation of generation shortage due to high loads or/and outages of major generation or transmission	System Operators (SO) define level of system emergency and resort to manual load shed after exercising system alerts with calls for conservation, load management, and other load reducing actions	<ul style="list-style-type: none"> ▪ Need information on forecast loads, available generation, status of transmission. ▪ Requires research, problem definition, access to offline data and development of DOE prototype
2. Regional Impact – Assessment of geographical footprint and number of customers impacted by or exposed to electric system event	Current Reliability Regions load shed guides will be expanded for Reliability Coordinators to improve accuracy of customers dropped	<ul style="list-style-type: none"> ▪ Need to refine load estimation algorithms and correlation with regions in DOE SA being developed for implementation in July 2006
3. System Vulnerability – Extreme Weather Events (hurricanes, storms, lightning) that threaten electric power system	Integrate weather event information with DOE SA	<ul style="list-style-type: none"> ▪ Research sources of weather data ▪ Correlate weather data with DOE SA
4. Resource Adequacy Trends – Compare current trends with most recent historical references to improve assessments	Improve situational awareness assessment by comparing current traces with most recent historical references	<ul style="list-style-type: none"> ▪ Research most suitable references ▪ Research appropriate visualization ▪ Integrate in phase-2 DOE-SA
5. Transmission/Voltage Inadequacy with potential for emergency conditions and/or power outages	August 2003 Outage resulted from transmission outages leading to voltage collapse	<ul style="list-style-type: none"> ▪ Research needed to develop a TLR based transmission and voltage adequacy monitoring system and integrate with DOE SA

