

Advanced Monitoring Technologies for Grid Reliability, Market Efficiency, and Grid Security

CERTS Briefing for
Kevin Kolevar, Director
Office of Electricity and Energy Assurance
Department of Energy

Washington, D.C.

April 26, 2005

by

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Consortium for Electric Reliability Technology Solutions (CERTS)

- CERTS was organized in 1999 as a partnership among universities, the private sector, and Department of Energy national labs. Consortium includes four labs (Lawrence Berkeley, Oak Ridge, Sandia, Pacific Northwest), Power Systems Engineering Research Center (consortium of universities led by Cornell), and Electric Power Group.
- CERTS Industry Advisory Board includes ISOs, utilities, regulators, generators.
- CERTS research leverages public and private resources, including funding by the Department of Energy, Transmission Reliability Program, and the California Energy Commission Public Interest Energy Research Program.
- CERTS research is focused on addressing gaps in tools, technologies, systems, market rules, and management processes needed to manage the reliability of the electric grid and efficient market operations.

CERTS Industry Advisory Board

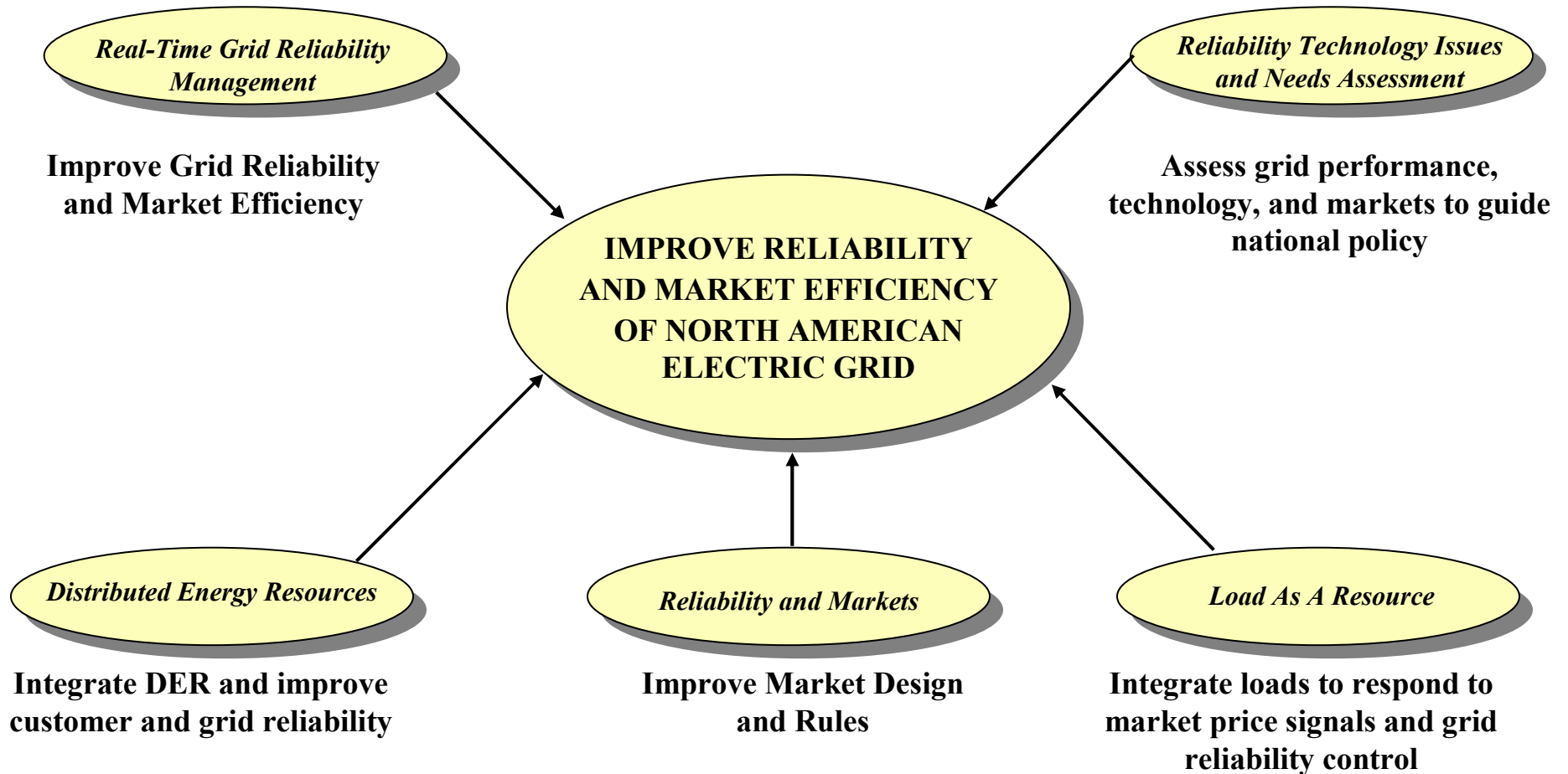
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CERTS Mission

Conduct needed public interest research on reliability technology solutions, tools, models, systems, and management processes needed in competitive electric markets for improving reliability and market efficiency of the U.S. electric grid to:

- Improve reliability of U.S. electric grid
- Reduce vulnerability to widespread grid outages and system collapse
- Improve efficiency of competitive electric markets
- Reduce transmission congestion and bottlenecks
- Mitigate ability to exercise market power
- Enable large-scale integration of distributed energy technologies
- Facilitate demand response to improve grid reliability and efficiency
- Provide customers flexibility and choice of technologies and on-grid or off-grid energy management solutions
- Enable monitoring and comparative performance assessments of grid reliability and market efficiency
- Develop technology road map for the grid of the 21st Century

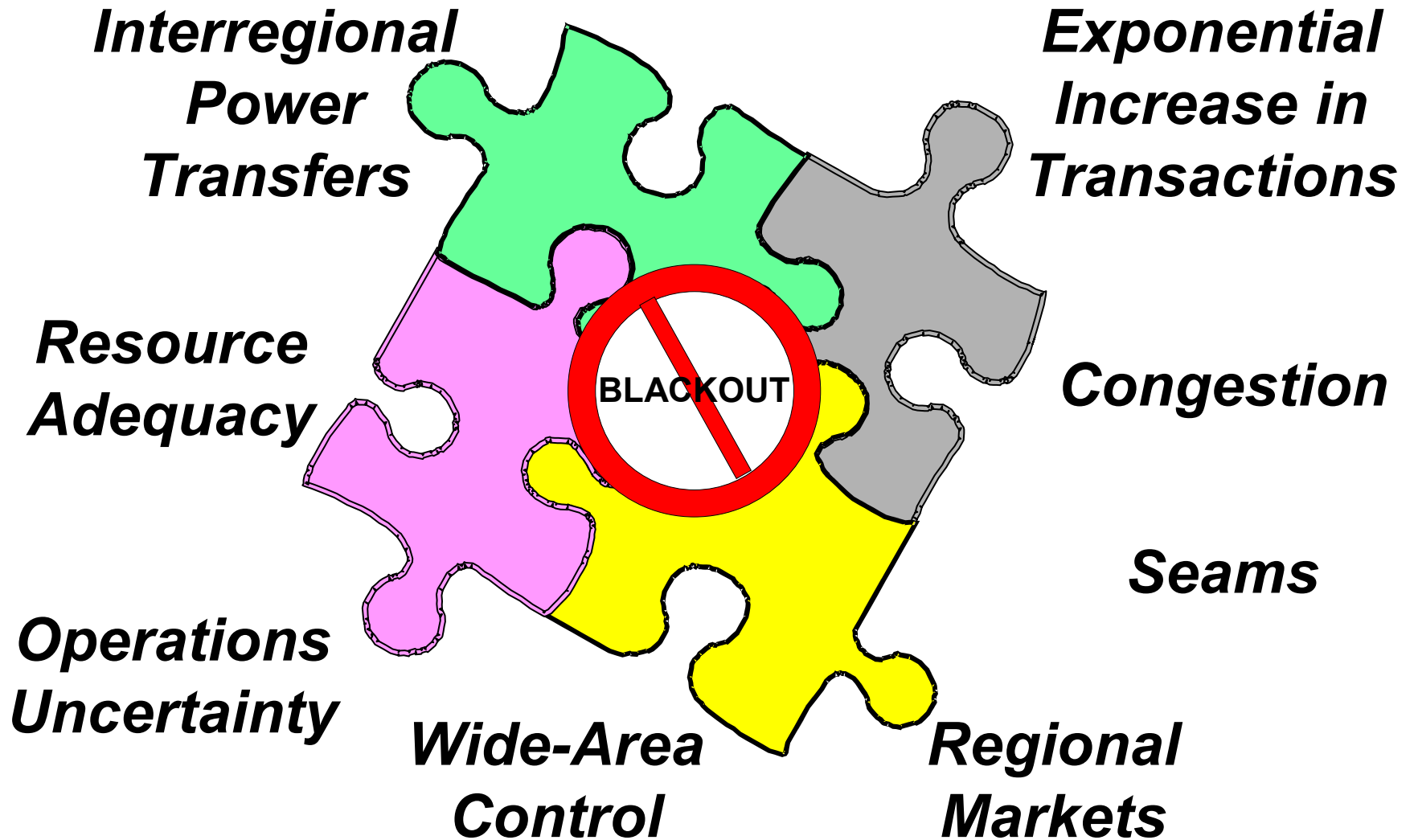
CERTS Major Research Areas



CERTS Research Leverages Public and Private Resources

- DOE – OEEA Funding
- CEC Funding
- ISO/Utility Funding
- Industry Support for Beta Test Beds
- NERC, ISOs, Utilities' In-Kind Contributions

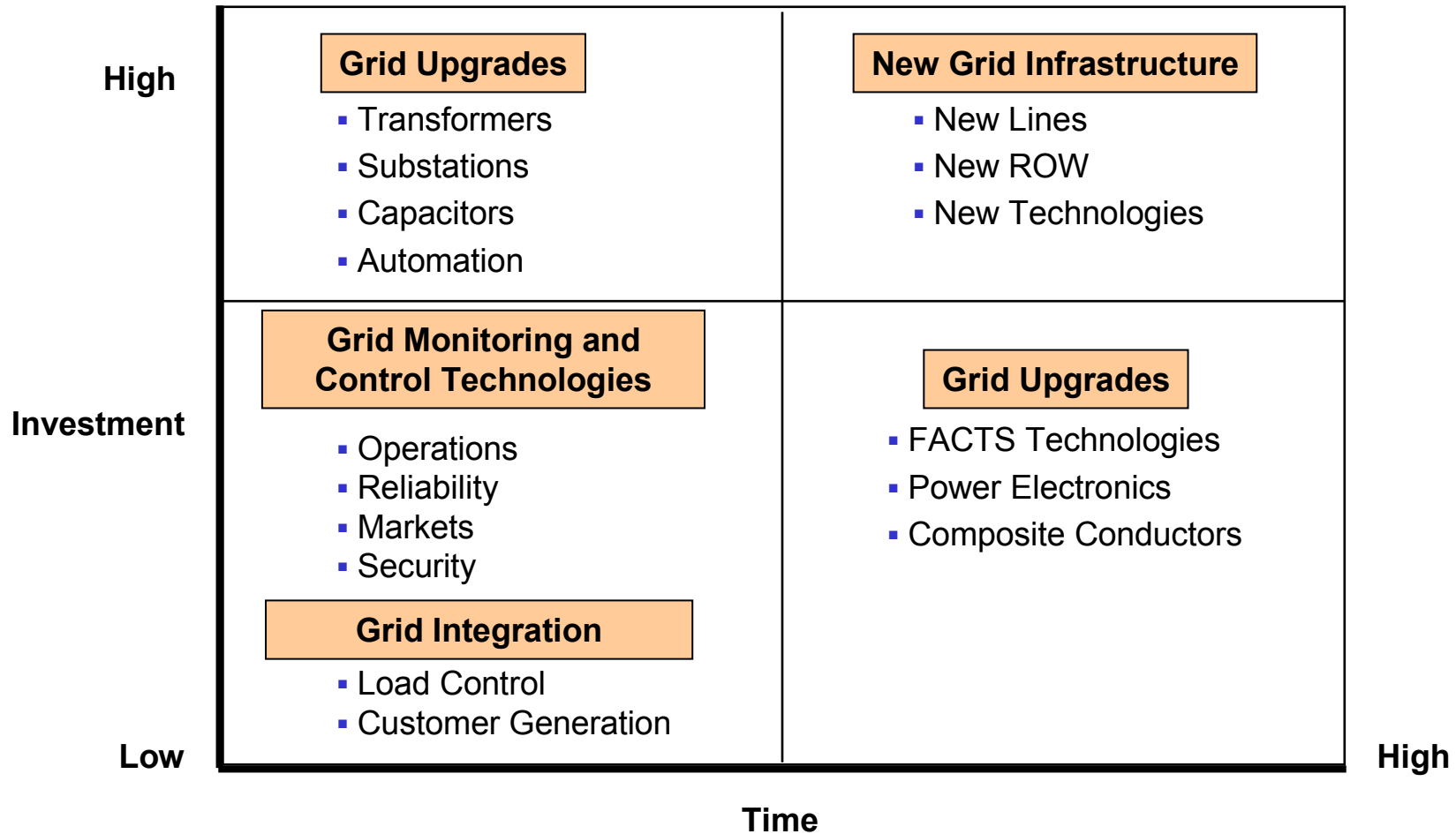
Meeting Reliability and Market Efficiency Needs in the Current Operating Environment



Key Accomplishments

- Power Outage Study Team – Assessment of 6 Outages That Occurred in 1999
- National Transmission Grid Study
- August 14, 2003 Blackout Investigations
- Market Design Assessments – CAISO, PJM, NYISO
- Load As A Resource Technology and Program Assessments – NYISO, ISO-NE
- Microgrid Test Bed
- ISO Bottlenecks Assessment
- Real Time Grid Monitoring Tools
 - Area Control Error (ACE)-Frequency Monitoring System in use by NERC Reliability Coordinators
 - Real-Time Dynamics Monitoring System with Phasors – CAISO Prototype; EIPP Prototype
 - Real Time Voltage Monitoring and VAR Management System – CAISO Prototype
 - Grid-3P Platform Application for Real Time Monitoring – PJM, TVA
- Eastern Interconnection Phasor Project
- Outreach and Collaboration with Utilities, TransCos, ISOs, NERC, FERC, Vendors, Researchers

Grid Solutions Framework



DOE Emergency Operations Center

Real Time Monitoring

- Wide Area
- Operations
- Markets

CERTS Platform – In Use

Management and Policy Reporting

- Transmission Outages
- Power Plant Outages
- Customer Outages
- Utilization and Reserves

Need Definition and Development

Security Monitoring and Vulnerability Assessment

- Indices
- Alerts
- Alarms
- Preventive Actions

Research & Development

CERTS Tools Address Key Blackout Recommendations

Blackout Causes

- Failure to maintain adequate reactive power support
- Failure to ensure operation within secure limits
- Inadequate operator training
- Failure to identify emergency conditions and communicate that status to neighboring systems
- Inadequate regional-scale visibility over the bulk power system

Blackout Recommendations

- Develop reliability related tools and technologies
- Adopt better real time tools for operators and reliability coordinators
- Strengthen reactive power and voltage practices
- Improve quality system modeling data and data exchange practices
- Required use of time synchronized data recorders

CERTS Tools

- Resource Adequacy – **ACE-Frequency, AIE, CPS**
- Generation Control Adequacy -- **Real-Time Dynamics Monitoring System™** (RTDMS)
- Transmission Adequacy – **RTDMS**
- Reactive Adequacy – **VAR Management**
- Scheduling Adequacy – **NERC Inadvertent**
- Wide Area Visibility – **Grid-3P™**

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CERTS Real Time Reliability and Security Monitoring Tools and Users

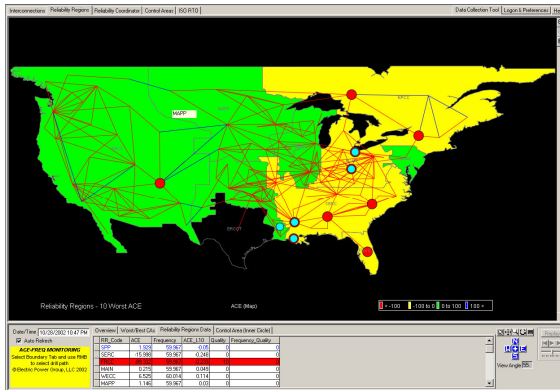
- Resource and Control Adequacy -- ACE-Frequency, AIE, CPS
 - NERC Wide-Area Reliability Coordinators
- System Control and Transmission Adequacy – RTDMS
 - Eastern Interconnection Monitoring Using Phasors
 - Western Interconnection Monitoring and Control Using Phasors
 - EIPP Utilities and RTOs
 - CAISO, BPA, and Large WECC Utilities
- Scheduling Adequacy -- NERC Inadvertent Exchange Monitoring
 - Utility, ISO, RTO Control Area Schedulers
- Reactive Adequacy -- Voltage Monitoring
 - CAISO
- Wide Area Visualization – Grid-3P
 - NERC Reliability Coordinators, RTOs, CAISO

CERTS Capabilities to Support DOE

- Provide industry expertise on grid, markets, and operations
- Provide overview of industry operations, monitoring, infrastructure, data, and metrics
- Implement CERTS Monitoring Platform
- Develop reliability metrics and market metrics
- Perform cost/benefit/performance analyses
- Define management and policy reporting
- Scope requirements for security and vulnerability assessment
- Develop security monitoring system road map
- Work with key industry organizations such as NERC
- Research, prototype, and implement security monitoring system
- Collect security metrics, analyze, simulate, and assess security effectiveness

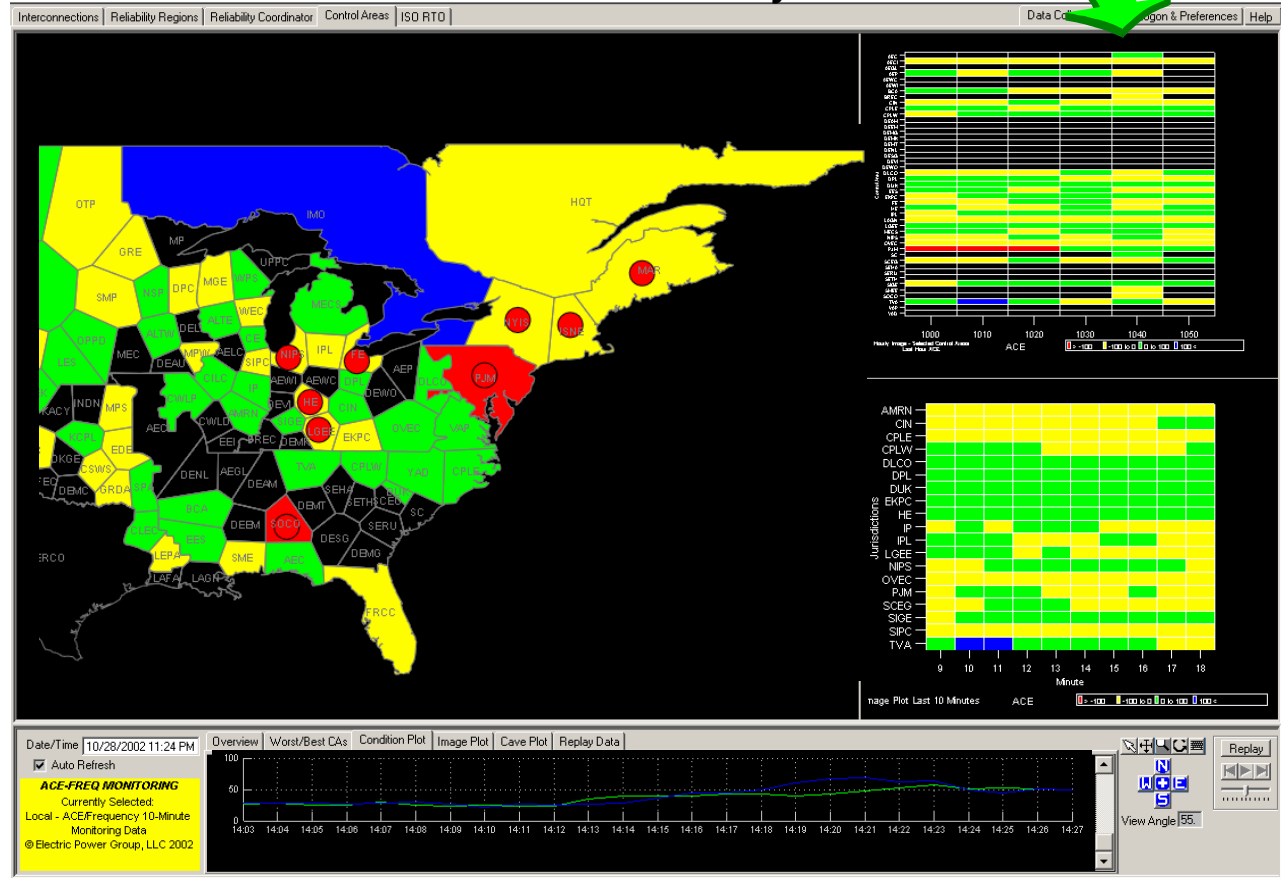
Real-Time Security Monitoring Application -- Illustrative

Tracking of Composite Security Indices



Real-Time Monitoring of Composite Security Indices

Coordination with NERC's Reliability Coordinators



Actions, Phone Numbers, Emails

*Demonstration
of
Real Time Grid Monitoring
Applications*