DOE/OE Transmission Reliability Program

Grid Reliability Performance Metrics Using Phasor Data and Model-less Algorithms, Prototype Development and Field Test

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**Project Objective**

**LOAD-GENERATION CONTROL**  
**RELIABILITY PERFORMANCE**  
**REALTIME MONITORING**  

**GRID RELIABILITY PERFORMANCE**  
**PHASOR BASED AND MODELESS**  
**REALTIME MONITORING**

**PROJECT OBJECTIVES**

**ALL APPLICATIONS IN PRODUCTION**

**RESEARCH, PROTOTYPE AND FIELD TEST**
Project Analytics Approach

1. DATABASE & ACCESS FOR HOST GRID PHASOR RAW DATA FOR TRANS.ZONES
2. RAW DATA TO GRID RELIABILITY PERFORMANCE INFORMATION USING MODELESS ALGORITHMS
3. PROTOTYPE FOR MONITORING WITH MULTI-VIEW, GEO-GRAPHIC VISUALIZATION
Accomplishments to be Completed in FY 2013

- Deliver to MISO the Extended Prototype Functional Specification
- Complete Research, Test and Validation of Grid Post-Disturbance Reliability Metrics
- Deliver to MISO the Software for Grid Performance Modeless Metrics During Pre and Post Disturbance
- Deliver to MISO the Design, Prototype Software to for Realtime Grid Monitoring Multi-View Visualization
- Deliver to MISO the Prototype Field Test Plan and User Guide
Deliverables Completed in FY2013

**COMPLETED:** DATABASE AND ACCESS METHODS FOR HANDLING OFF-LINE MISO GRID PHASOR DATA

Note: Stations names are fictitious because of Data Confidentiality
COMPLETED: RESEARCH AND DESIGN OF A MULTI-VIEW VISUALIZATION FOR REALTIME GRID MONITORING BY SECURITY COORDINATORS

TRANSMISSION ZONE

All Lines In Zone

1-Line in Zone

Voltage Margin

Stability Margin

Thermal Margin

Phasor Voltage and Current Magnitude and Angle
Deliverables Completed in FY2013

- **Completed** — Off-line test and validation of grid reliability performance metrics using model-less pre-contingency algorithms
- **Completed** — Develop model-less post-contingency algorithms
- **Completed** — Initial testing of model-less post-contingency algorithms
Realtime Grid Monitoring Visualization
Multi-View Layout to be Delivered in FY2013

Click Name-Bar to Expand to Full Display

GEO-GRAPHIC, HEATMAPS FOR GRID METRICS FOR ALL LINES IN TRANSMISSION ZONE

TABULAR-TABLE WITH METRICS AND RAW DATA FOR ALL LINES

DATA REPLAY CONTROLS
Realtime Grid Monitoring Visualization Prototype to be Delivered in FY2013
Realtime Grid Monitoring Visualization

Navigation to be Delivered in FY2013

Performance Margins for both terminals of each line

Voltage-Current phasor data for each line terminal selected by User
Realtime Grid Monitoring Visualization
Navigation to be Delivered in FY2013

Zooming into Margin for User Selected Transmission Line on Heatmap or Map

Zooming into Statistical Pattern for User Selected Transmission Line on Heatmap or Map

BarPlot
LinearPlot
Statistical Plot

BarPlot
LinearPlot
Statistical Plot

CERTS
Consortium for Electric Reliability Technology Solutions
Risks Factors Affecting Timely Completion

- **Grid Phasor Data Quality** — Experience using phasor measurements is demonstrating the need for better phasor data quality filters and estimation of grid performance metrics uncertainties

- **Completion of Prototype Deployment at MISO**
  MISO personnel and IT Contractors availability

- **Effectiveness of Post-Contingency algorithms**
  MISO data and computations will provide important validation results

- **Acceptance of Grid-Metrics and Visualization by MISO Security Coordinators** — Security Coordinators availability for working, testing and give feedback on Prototype
Possible Follow-on Work for FY14 Funding

- Complete the Field Demonstration with MISO for improving models, performance metrics, monitoring visualization, and tracking Automatic Reliability Reports
- Expand realtime monitoring visualization for integrating graphics for Post-Contingency reliability metrics
- Research and develop prototype for Automatic Reliability Reports including Pre and Post Disturbance Grid performance metrics
- Research identification and definition of a grid reliability composite index using this project grid performance metrics and MISO reliability coordinators experience during the Field Test