Department of Energy
Transmission Reliability Program Review

Reliability and Markets
2002 Program and Program Plans

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by

Robert J. Thomas

Cornell University

Power Systems Engineering Research Center

CERTS
Consortium for Electric Reliability Technology Solutions

Reliability Challenges for Markets

- Congestion/Transmission Load Relief - both on a day to day basis through real-time market rules and in the long run by creating correct market signals for construction of new interconnections.

- Reduce Unanticipated Transmission Loading and Flow Patterns – by developing new tools that can better anticipate flows created by market activity

- Eliminate Occurrences of Inadequate Reserves and Other Ancillary Services – by creating and testing market design principles designed to include multidimensional markets.

Develop tools and technologies for market design and testing

- Modeling and simulation of market rules
- Empirical analysis
- Development of computational methods
- Experimental economics
- Market behavior and impact on system performance

Markets cannot be designed and operated without regard to the engineering needs of the network.

Some past activities of the R&M group

- Contribute to definition and measurement of ancillary services
- Evaluate market rules and inputs on reliability
- Evaluate performance of day-ahead and balancing markets
- Evaluate impacts of market clearing price rules on prices and volatility
- Presentations to:
  - FERC
  - NERC
  - PJM
  - CAISO
  - NYISO
  - NARUC
  - CalPX Blue Ribbon
  - NY PUC
- Contributed to NYISO Demand Response Program Design

CERTS – Reliability and Markets

Vision/Goal: *To develop a comprehensive set of integrated market/engineering design principles and tools for a restructured electricity business.*

Research Objective

To work with an ISO client on a problem of significant market design. To produce tools and methods necessary for one substantial integrated design example relying on:

Theoretical analysis focusing on conceptual abstract modeling and analysis, employing techniques of operations research, systems analysis, micro economics, stochastic modeling, game theory, auction theory.

Empirical analysis focusing on the gathering and interpretation of empirical data and on estimation and validation of theoretical models, using econometric methods, financial engineering approaches, statistical analysis and data mining.

Computational methods employing numerical methods and agent based models to simulate and forecast market outcomes under realistic modeling of the electrical power system in conjunction with behavioral models of economic agents that control various aspects of the system and interact in the market place.

Experimental economic approaches, employing controlled laboratory experiments with live and artificial agents in order to explore decision patterns under alternative rules and system conditions and to test behavioral assumption upon which such rules are founded.

CERTS – Reliability and Markets

Research Roadmap

2002 Engage the NYISO in a process for collaborating on an integrated energy, demand-side, and reserve market design

Deliver the requirements analysis and the functional specifications for such designs

Deliver preliminary theoretical and experimental underpinnings for the designs

Create, as funding permits, the databases, computational and theoretical tool specifications necessary to support the design and the design process

2004 Continue the design and put testing processes in place

Continue analytical work to support validation

Create a prototype

2004 Put market in operation

Monitor, test and evaluate performance, make changes where needed.

Reliability and Markets - Roadmap

System Planning Operation and Monitoring

GOAL: INTEGRATED MARKET DESIGN: THEORY, EXPERIMENTS AND TOOLS

Advanced Design and Monitoring Tools

Development of analytical tools and PowerWeb platform for experimentation

- Unit Commitment
- Price Spikes
- Unit Witholding
- Collection of Market Data

1999-2001

Market assessment theory and experiments:

- Market Power
- Congestion Management
- Price Volatility

2000-2004

Develop designs for multi-dimensional markets:

- Energy and Demand
- Energy and Reserves
- Energy and Environmental
- Composite Markets

2002-2006

Prototype New Market Design and Evaluation Tools

- Automated market monitoring
- Tools for evaluating new market ideas

2004-2008

FY02 - Key Projects/Deliverables:

- Experiments – Markets for energy, demand, locational reserves, congestion mitigation
- Theory – Spot and forward markets, and transmission rights to mitigate market power
- Tools – Coordinated system for testing market designs