U.S. DEPARTMENT OF ENERGY

Transmission Reliability Program

Peer Review Report

2004

January 27-29, 2004
Marriott at Metro Center
Washington, D.C.

Prepared by Sentech, Inc.

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TRANSMISSION RELIABILITY PROGRAM OVERVIEW

The Transmission Reliability Program was reestablished by Congress in 1999 to conduct research on the reliability of the Nation's electricity infrastructure during the transition to competitive markets under restructuring. This Program was integrated into the new DOE Office of Electric Transmission and Distribution (OETD) in August 2003. The Transmission Reliability Program develops advanced real time control systems and evaluates electricity market/system reliability interactions to enable full technical and economic integration of all electric supply technologies into the transmission and distribution system. Transmission Reliability activities will provide the necessary system controls and market analyses to support the large-scale deployment of distributed energy resources into the distribution system, and provide market competition down to the individual customer level.

Federal Role in Transmission Reliability:

- Perform reliability technology research and development in the absence of market-based incentives for the power sector to perform this R&D.
- Conduct third-party evaluations of electricity market designs and develop technology-based electricity policy options.

The Program's approach for improving the electricity delivery infrastructure is to develop and apply advanced computing, sensing, power electronics, communications, and control technologies to provide real time system control for reliable, efficient operation of the nation's electric power system under both normal and emergency operating conditions.

The Transmission Reliability Program performs analyses and develops technologies in four program areas: Real Time Grid Reliability Management, Load as a Resource, Reliability and Markets, and Reliability Technology Issues and Needs Assessment.

- *Real Time Grid Reliability Management (RTGRM)*
  Objective: Develop and apply a new generation of methods and technologies for optimizing the utilization of the North American power grid under restructuring while maintaining system reliability. RTGRM develops technologies leading to automated system reliability assessment and control, based upon real time system measurements. High-speed communications and distributed intelligent controllers will adjust power electronic network management devices, and actively suppress disturbances with only limited human supervision. Information from RTGRM will enable reliable operation of the electric grid, and efficient operation of competitive power markets. Near term, this activity is developing data collection and visualization tools that will provide system operators with a real time view of grid conditions, and longer term allow assessment of operator compliance with grid reliability standards.

- *Load as a Resource*
  Objective: Improved reliability and system efficiency through responsive demand. This activity assesses the capabilities of load to participate in electricity markets as a reliability resource. This activity will demonstrate the value of load as a resource through field evaluation where load responds to price signals or as an ancillary service such as spinning reserves.

- *Reliability and Markets*
  Objective: Determine the appropriate balance between ideal economic market mechanisms and traditional utility operating practices that will provide inexpensive and reliable energy for consumers. Reliability and markets evaluates options to strike the appropriate balance between ideal economic market mechanisms and traditional utility operating practices that will provide inexpensive and reliable electric services for consumers. This activity engages in interdisciplinary research involving power system engineering and market economics, and responds to the need for a strong Federal role to provide unbiased, third-party policy options on restructuring for Federal and State decision-makers. This activity is conducting market auction behavioral experiments that indicate how generators and demand response will react to alternative electricity market designs. These experiments are an accurate and low-cost method for analyzing proposed market designs before they are implemented. A near term priority in this activity will examine how loads can participate in energy and reliability services markets.

- *Reliability Technology Issues and Needs Assessment*
  Objective: Identify the R&D needs for a reliable electricity delivery infrastructure consistent with the requirements of competitive electric markets. This area identifies emerging critical issues for electric reliability, analyzes these issues to identify gaps in reliability R&D, and prioritizes and initiates planning for needed Federal research and technology development. This activity is working with industry stakeholders to develop a framework for grid reliability performance and reliability indicators.

The Transmission Reliability Program is working with the electricity industry to define and implement a research and development program in these four areas to maintain and enhance the reliability of the power system while enabling fair and efficient electricity markets. In 2003, the 3M composite core conductor project funded by the Transmission Reliability Program was named a winner of R&D Magazine's 2003 R&D 100 Awards. The project is developing a new high temperature, log sag conductor that is capable of carrying two to three times more power than conventional transmission conductors of the same diameter.

The Transmission Reliability budget is as follows:

Distributed Energy Systems	**FY 1999**	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**	**FY 2005 Request**
Transmission Reliability	2.5	2.4	5.0	4.7	5.2	4.4	10.7

The Transmission Reliability Program is implemented through a DOE National Laboratory/industry/university partnership called the Consortium for Electric Reliability Technology Solutions (CERTS). CERTS was formed to develop and commercialize new methods, tools, and technologies to protect and enhance the reliability of the U.S. electric power system under the emerging competitive electricity market structure.

Members of CERTS include:

- Lawrence Berkeley National Laboratory
- Electric Power Group
- Oak Ridge National Laboratory
- Power Systems Engineering Research Center (PSERC)
- Sandia National Laboratories
- Pacific Northwest National Laboratory

For additional information on CERTS, see http://eetd.lbl.gov/certs.
(Overview information taken from "Transmission Reliability Program" website <http://electricity.doe.gov>)

THE PEER REVIEW

The U.S. Department of Energy's Transmission Reliability Program conducted an independent peer review of its projects on January 27-29, 2004, at the Marriott Hotel at Metro Center in Washington DC. The results of the review are an important element of management's plans to continually adjust and improve the Department's Transmission Reliability program, and to provide valuable feedback to researchers.

The review was structured into 4 areas:

A. Real Time Grid Reliability Management
B. Load as a Resource
C. Reliability and Markets
D. Reliability Technology Issues and Needs Assessment

The Panel

The review covered 26 presentations as shown in the Agenda at Appendix A. Participation as a reviewer required that there be no financial relationship with DOE or the presenting research organizations, or conflict of interest with same. The names and affiliations of the review panel are listed below:

Reviewer	***Affiliation***
Diane Barney	N.Y. State Department of Public Service
Dale Bradshaw	Tennessee Valley Authority (TVA)
Hung-po Chao	Electric Power Research Institute (EPRI)
Rick Counihan	E2I - Electricity Innovation Institute
Dale Krummen	American Electric Power (AEP)
Dave Sharma	Federal Energy Regulatory Commission (FERC)

Review Criteria

The reviewers evaluated the principal investigator's work on the basis of their oral presentation and written documentation. Previous work that had concluded or new proposals were not evaluated. Past work or new project proposals were only considered in placing current work in context relative to the purpose and objectives of the project or the plans for completion.

An evaluation form for each project was provided in workbooks distributed to the reviewers. The forms were organized in the order of project presentations. Review criteria, outlined on the form, included:

1) ***Value in relation to programmatic goals?***

2) ***What is the technical merit of the work?***

3) ***Does the project place the correct emphasis on transfer of technology to stakeholders?***

4) ***What is the overall performance of this project?***

The evaluation form for each project is the reviewers' official record of evaluation, both quantitative and qualitative. A numerical score for each of the four criteria was selected from the rating tables on a scale of 1-10. The rating scale is:

Excellent:	9 – 10
Good:	6 – 8
Marginal:	3 – 5
Unsatisfactory:	1 – 2

Space for written comments was provided on the evaluation form. Specific comments on the strengths and weaknesses of a project and recommendations to improve a project were strongly encouraged.

Guidelines

Oral Presentations: Principal investigators were urged to prepare their oral presentations in order of the evaluation criteria to assist reviewers in scoring. Each presentation was allotted for 40 minutes total time, of which 10 minutes of that time was reserved for questions from the review panel.

Comments & Results

Completed evaluation forms were given to the peer review monitor, which calculated quantitative scores and transcribed written comments verbatim. Panel comments and scores for each presentation were then consolidated on one sheet. Following are the general comments from the peer reviewers and a summary of the scores resulting from the review.

The general comments of the R&D projects are as follows:

- Peer reviewers found that the overall R&D program is outstanding. The projects reviewed in the meeting map well with the long-term roadmap objectives. Reviewers further observed that given the budget constraints faced by the program, the projects are producing good results.

- Peer reviewers identified that technology transfer needs to be addressed. The reviewers suggested that the program send some of researchers out of their laboratories and universities and into control rooms and technical meetings with ISOs and RTOs to gain a better feel of the realities of the issue rather than raw, plain R&D.

- Peer reviewers recommended that researchers coordinate their R&D work with industry (such as ISOs, and utilities), so that R&D projects can produce useful and practical results and products that can be used by the industry.

- Peer reviewers suggested researchers work with FERC (and EEI) to resolve data confidentiality issues so that the utility industry can benefit from the results of the program's research.

- Peer reviewers stressed the importance of project integration. It is crucial to pull all projects and resources, such as DOE, EPRI, industry, utilities, etc., together to create results and develop intangible assets that can benefit the industry.

- Peer reviewers emphasized the importance of developing a method to disseminate research results to the industry and utilities. Additionally, reviewers suggested that leveraging previous work done by others is important in order to minimize redundant effort.

- Peer reviewers commented that some of the projects should be focusing on producing tools to be used by control area operators to help these operators make smart decision and to get a better measure of reliability margins. Additionally, reviewers stressed that training should be provided along with the new tools. The reviewers felt that educating industry and training operators, rather than publishing papers for intellectual audiences, will provide a greater impact.

- Peer reviewers commented that most of the R&D projects in the program are software oriented, such as real-time monitoring. Reviewers suggested more analysis in the transmission reliability area and more funding for hardware oriented projects.

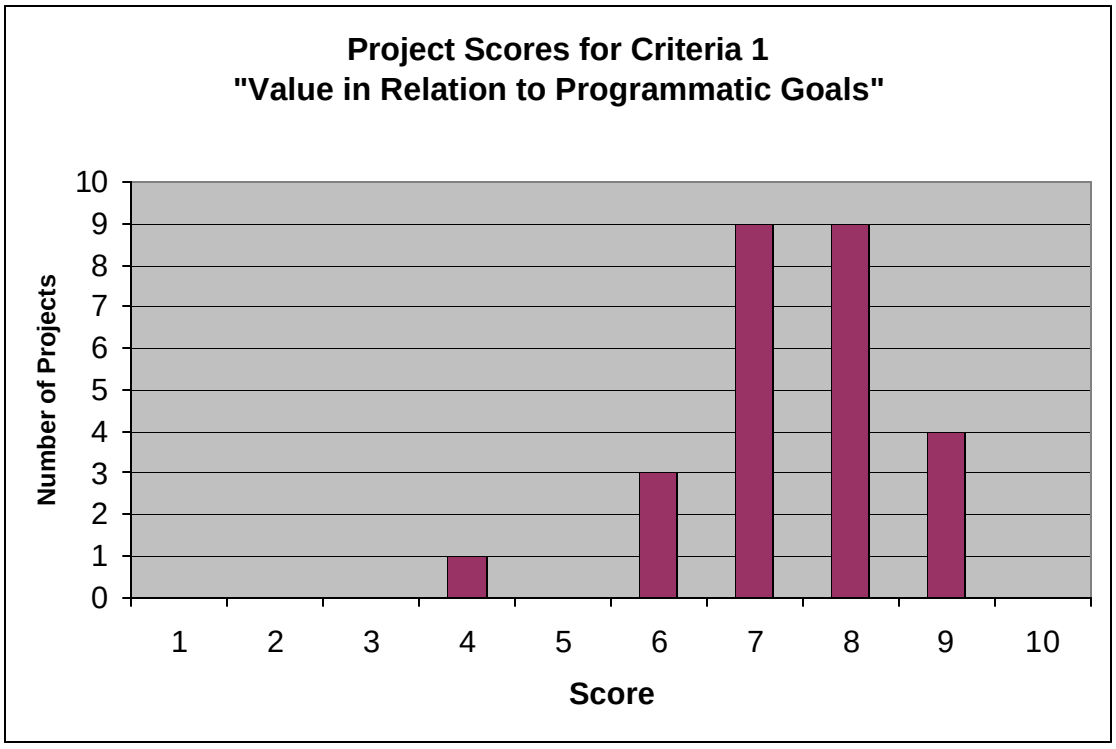
SCORES

Criteria 1 – "Value in Relation to Programmatic Goals"

The median score for the overall review was 7.85 or "Good."

The number of projects and relevant percentage by rating category are:

Excellent (9-10): 4 projects (16%)
Good (6-8): 21 projects (81%)
Marginal (3-5): 1 project (4%)
Unsatisfactory (1-2): none

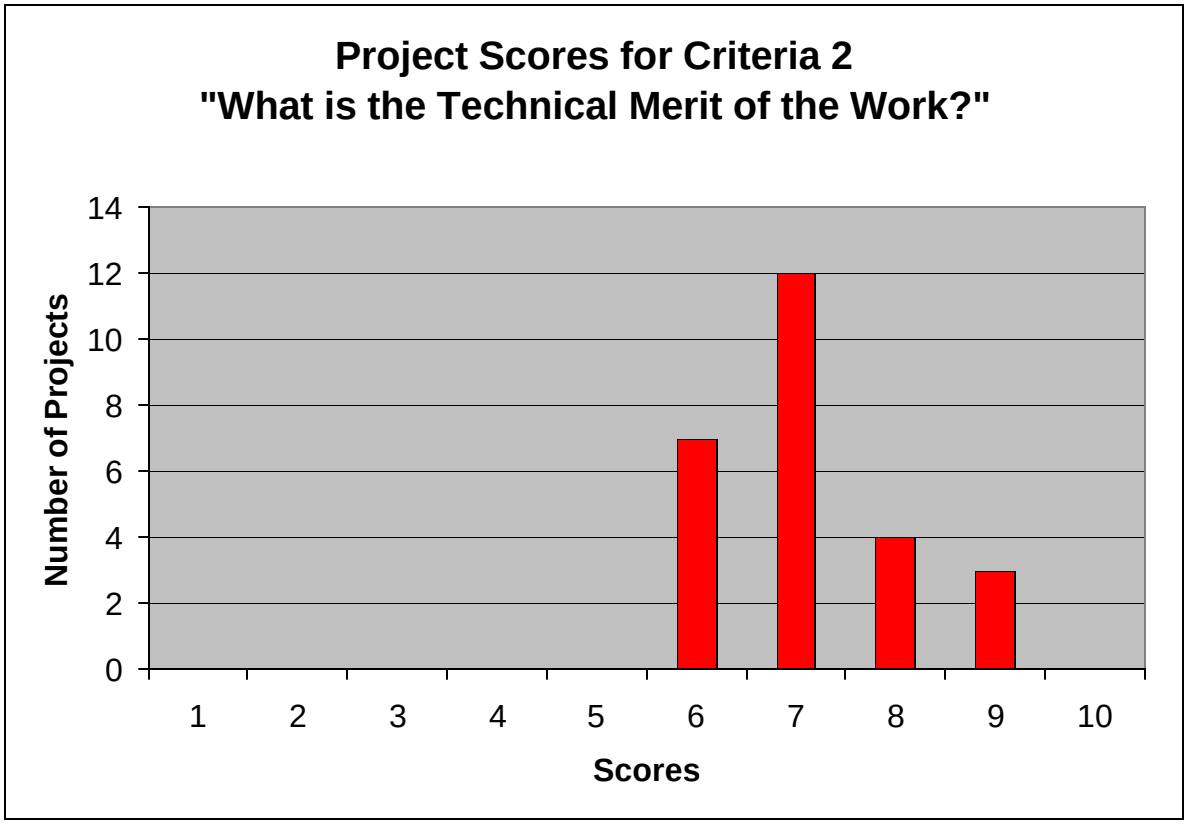


Criteria 2 – "What is the Technical Merit of the Work?"

The median score for the overall review was 7.22 or "Good."

The number of projects and relevant percentage by rating category are:

Excellent (9-10):	3 projects (12%)
Good (6-8):	23 projects (88%)
Marginal (3-5):	none
Unsatisfactory (1-2):	none

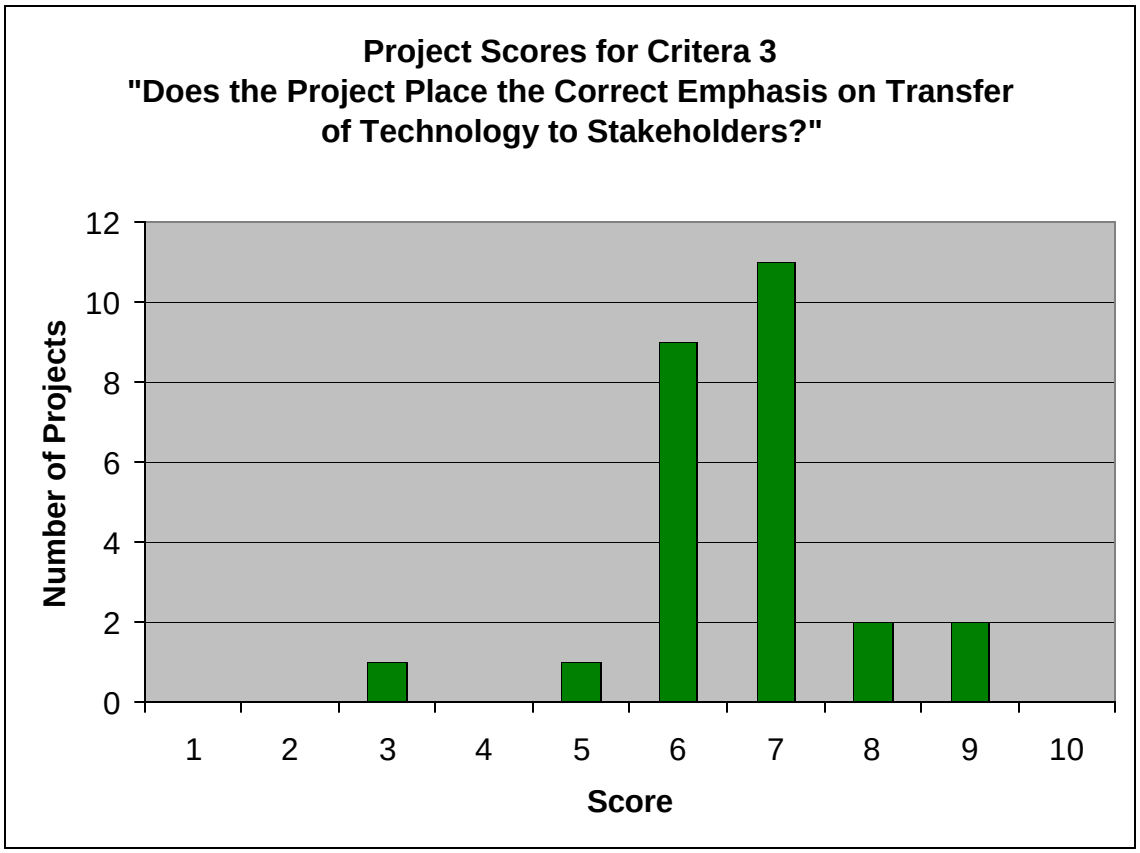


Criteria 3 – "Does the Project Place the Correct Emphasis on Transfer of Technology to Stakeholders?"

The median score for the overall review was 7.08 or "Good."

The number of projects and relevant percentage by rating category are:

Excellent (9-10): 2 projects (8%)
Good (6-8): 22 projects (84%)
Marginal (3-5): 2 projects (8%)
Unsatisfactory (1-2): none

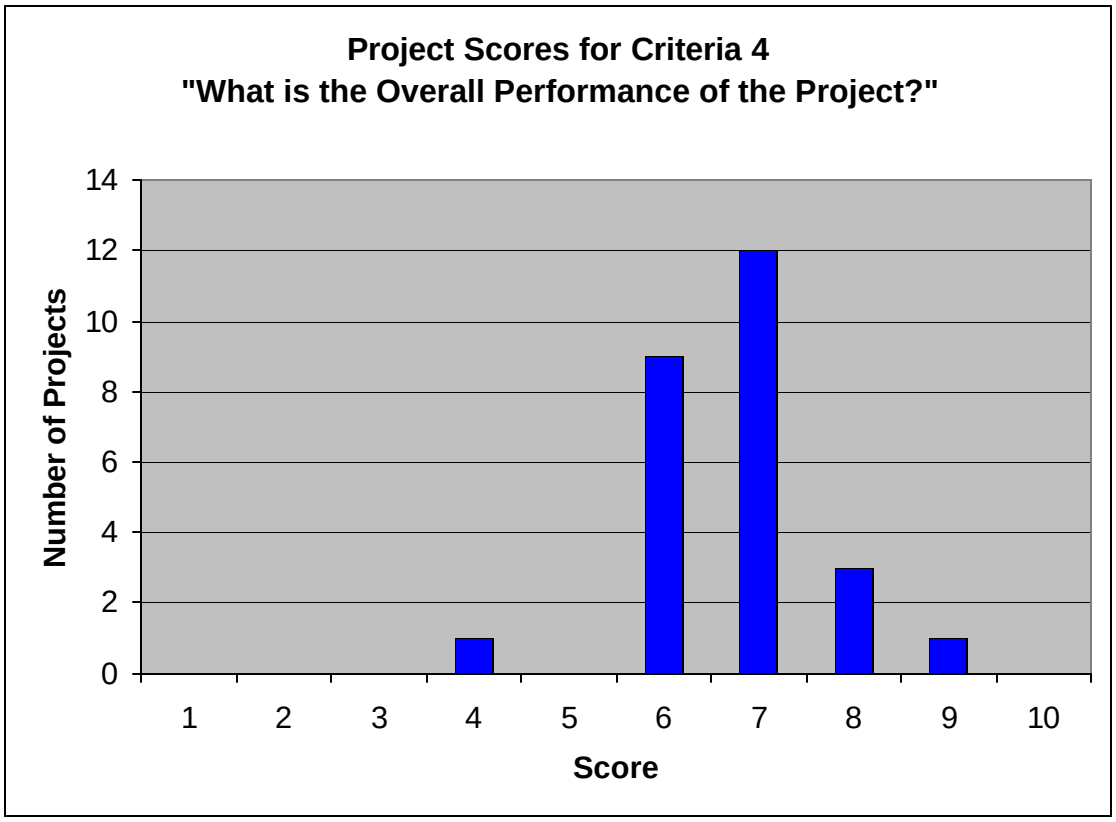


Criteria 4 – "What is the Overall Performance of the Project?"

The median score for the overall review was 7.25 or "Good."

The number of projects and relevant percentage by rating category are:

Excellent (9-10):	1 project (4%)
Good (6-8):	24 projects (92%)
Marginal (3-5):	1 project (4%)
Unsatisfactory (1-2):	none



APPENDIX A

U.S. Department of Energy
Transmission Reliability Program Peer Review
January 27-29, 2004

AGENDA

Tuesday, January 27th

8:30 - 9:00 a.m. Continental Breakfast

9:00 - 9:10 a.m. Welcome - Phil Overholt, U.S. DOE Office of Electric Transmission and Distribution

9:10 - 9:25 a.m. DOE Perspectives – Jimmy Glotfelty, Director, U.S. DOE Office of Electric Transmission and Distribution

9:25 - 9:40 a.m. Other Perspectives – Shelton Cannon, Deputy Director, Office of Markets, Tariffs and Rates, Federal Energy Regulatory Commission

Time	Real Time Grid Reliability Management
9:40 - 9:50 a.m.	Introduction to Real Time Grid Reliability Management - Carl Imhoff, PNNL
9:50 - 10:20 a.m.	NERC Tools - Wide Area Real Time Monitoring - Carlos Martinez, Electric Power Group
10:30 - 11:00 a.m.	Real Time Tools Outreach – Carlos Martinez, Electric Power Group
11:10 - 11:20 a.m.	Break
11:20 - 11:50 a.m.	Eastern Interconnection Phasor Project – Carl Imhoff, PNNL
12:00 - 12:30 p.m.	Roadmap for Real Time Control – Jeff Dagle, PNNL
12:40 - 1:40 p.m.	Lunch (on your own)
1:40 - 2:10 p.m.	Overview of Framework for Tools to Archive and Analyze Real Time Grid Data – Carlos Martinez, Electric Power Group
2:20 - 2:50 p.m.	WAMS Outreach Projects in FY03 – John Hauer, PNNL
3:00 - 3:10 p.m.	Break
3:10 - 3:40 p.m.	WAMS Outreach Project: Sharing of Knowledge & Technology – John Hauer, PNNL
3:50 - 4:20 p.m.	WAMS Outreach Project: WECC Model Validation – John Hauer, PNNL
4:30 p.m.	Adjourn

Wednesday, January 28th

8:00 - 8:30 a.m. Continental Breakfast

Time	Real Time Grid Reliability Management
8:30 - 9:00 a.m.	Integrated Security Analysis – Pete Sauer, PSERC/University of Illinois
9:10 - 9:40 a.m.	Feasibility of Real Time Control – Anjan Bose, PSERC/Washington State University
9:50 - 10:10 a.m.	Break
10:10 - 10:40 a.m.	Criticality and Risk of Large Cascading Blackouts – Ian Dobson, PSERC/University of Wisconsin and Ben Carreras, ORNL
10:50 - 11:20 a.m.	PowerGrid Simulator – Chika Nwankpa, Drexel
11:30 - 12:30 p.m.	Lunch (on your own)
Time	Load as a Resource
12:30 - 12:40 p.m.	Introduction to Load as a Resource – Marilyn Brown, ORNL/Mark Levine, LBNL
12:40 - 1:10 p.m.	New York ISO 2002 Demand Response Programs: Evaluation Results – Chuck Goldman, LBNL
1:20 - 1:50 p.m.	Value of Demand Responsive Load – Chuck Goldman, LBNL
2:00 - 2:30 p.m.	Technical Assistance to the New England Demand Response Initiative (NEDRI) – Chuck Goldman, LBNL
2:40 - 2:55 p.m.	Break
2:55 - 3:25 p.m.	Ancillary Services From Aggregations of Small Responsive Loads – Brendan Kirby, ORNL
3:35 - 4:05 p.m.	Spinning Reserve from Load – John Kueck, ORNL
4:15 p.m.	Adjourn

Thursday, January 29th

8:00 - 8:30 a.m. Continental Breakfast

Time	Reliability and Markets
8:30 - 8:40 a.m.	Introduction to Reliability and Markets – Robert Thomas, PSERC/Cornell University
8:40 - 9:10 a.m.	Testing Multi-Dimensional Markets for Electricity and Ancillary Services Using PowerWeb – Tim Mount, PSERC/Cornell University
9:20 - 9:50 a.m.	The Effect of Customer Participation in Electricity Markets: An Experimental Analysis of Alternative Market Structures – Dick Schuler, PSERC/Cornell University
10:00 - 10:15 a.m.	Break
10:15 - 10:45 a.m.	Agent-Based System Planning Tools – Sarosh Talukdar, PSERC/Carnegie Mellon University
10:55 - 11:25 a.m.	Market Monitoring Tools – Bernard Lesieutre, LBNL
11:35 - 12:35 p.m.	Lunch (on your own)
Time	Reliability Technology Issues and Needs Assessment
12:35 - 12:45 p.m.	Introduction to Reliability Technology Issues and Needs Assessment – Vikram Budhraja, Electric Power Group
12:45 - 1:15 p.m.	Grid Reliability Metrics – Jim Dyer, Electric Power Group
1:25 - 1:55 p.m.	Transmission Bottlenecks – Joe Eto, LBNL
2:05 - 2:20 p.m.	Break
2:20 - 2:50 p.m.	Indices for Measurement of Reliability and Power Quality – John Kueck, ORNL
3:00 - 3:30 p.m.	ORNL Test Facility - John Stovall, ORNL
3:40 - 4:10 p.m.	Composite Core Conductor – Herve Deve, 3M
4:20 p.m.	Adjourn

APPENDIX B

U.S. Department of Energy

Transmission Reliability Program Peer Review

January 27-29, 2004

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