



Serving as a National Resource for Improving Power System Grid Reliability

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**Power Systems Engineering
Research Center**

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Collaborating Universities

- **Cornell University** - Robert J. Thomas - Center Director
- **Arizona State University** - Gerald Heydt
- **University of California at Berkeley** - Shmuel Oren
- **Carnegie Mellon University** - Sarosh Talukdar
- **Colorado School of Mines** – P.K. Sen
- **Georgia Institute of Technology** - Sakis Meliopoulos
- **Howard University** - James Momoh
- **University of Illinois at Urbana** - Peter Sauer
- **Iowa State University** - Vijay Vittal
- **Texas A&M University** - Mladen Kezunovic
- **Washington State University** - Anjan Bose
- **University of Wisconsin-Madison** - Robert H. Lasseter
- **Wichita State University** - Ward Jewell

Industrial Members



California ISO	GE Power Systems
ERCOT	Korea Elec. Pwr. Res. Inst.
ISO New England	NxtPhase
New York ISO	Powertech Labs
PJM Interconnection	PowerWorld Corp.
RTE - French TSO	Cooperative Research Network (NRECA)
American Transmission Co.	Siemens, Energy Management and Inf. Sys.
National Grid USA	Steel Tube Institute of North America
ABB	
ALSTOM EAI	
EPRI	

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Industrial Members



U.S. Department of Energy	Institute de recherche d'Hydro-Québec (IREQ)
Alliant Energy	MidAmerican Energy
American Electric Power	Oncor
Arizona Public Service Corp.	Pacific Gas & Electric
CenterPoint Energy	Southern Company
Duke Energy	Salt River Project
Entergy	Tennessee Valley Authority
Exelon	Tri-State G&T
First Energy Corp.	Western Area Power Admin.

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Researchers

- 35 researchers in 3 research areas
- Multidisciplinary, specializing in:
 - power systems, applied mathematics, non-linear systems, power electronics, control theory, computing, operations research
 - economics, industrial organization and public policy.

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Mission

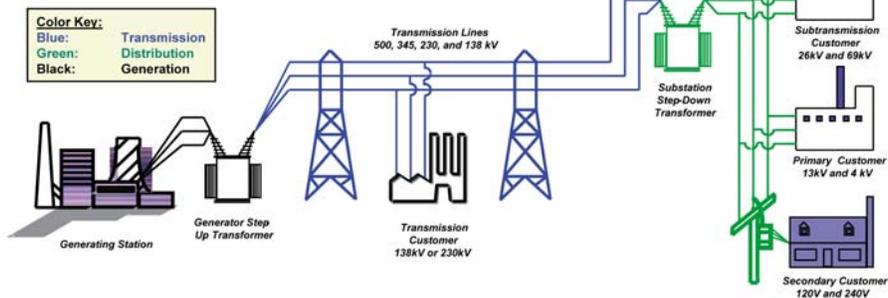
Universities collaborating with industry to:

- Engage in forward-thinking about industry challenges
- Conduct collaborative research for innovative solutions to those challenges
- Facilitate interchange of ideas
- Educate the next generation of power industry engineers

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Power System Overview

Basic Structure of the Electric System



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National Power System Grid Reliability Concerns

- Growing importance of electric reliability
- Significant power system failures
- National studies identifying grid problems
- Lack of investment in infrastructure
- Lack of an integrated solution

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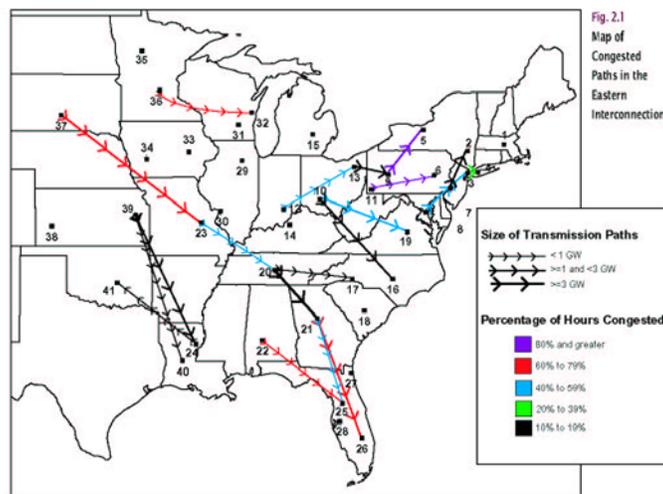
A System Under Stress



- Aging infrastructure
- Increasing loading of components and calls for transmission loading relief (TLRs)
 - A TLR requires changing scheduled transactions
- Investment has declined for the last 25 years
- Declining ability to isolate and remove components from service for maintenance
- More uncertain power flows due to wholesale merchant transactions

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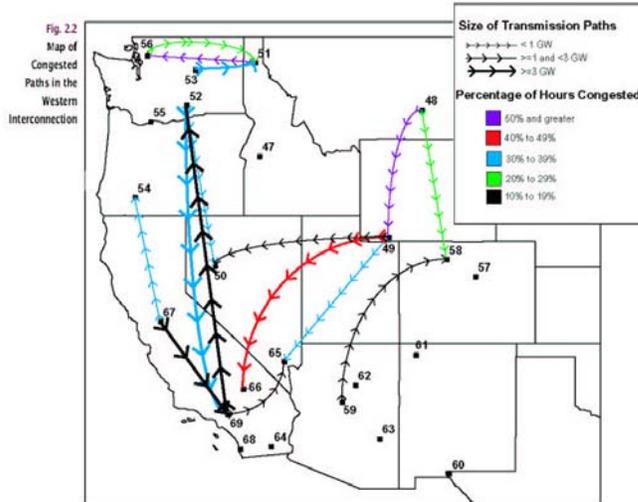
Major Corridor Transmission Congestion in the East



Source: U.S. DOE National Transmission Grid Study

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Major Corridor Transmission Congestion in the West



Source: U.S. DOE National Transmission Grid Study

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Providing a National Resource



- Helped Organize New National Research Initiative
- Participated in National Grid Studies
- Served as International Information Resource on the Blackout of 2003
- Assisted Policy-Makers

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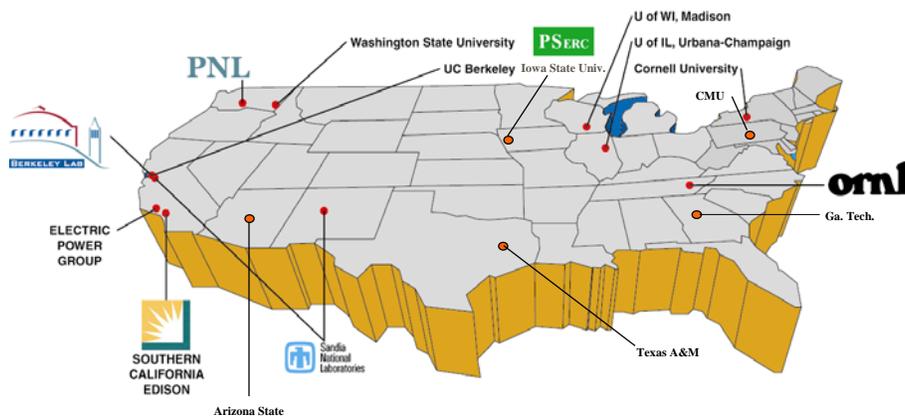
Helped Organize New National Research Initiative



- U.S. DOE Consortium for Electric Reliability Technology Solutions (CERTS) – 1999 to date
- Research to Protect and Enhance the Reliability of the U.S. Grid (<http://certs.lbl.gov>)
 - Real-Time Monitoring and Control
 - Reliability and Markets
 - Distributed Generation
- Participants: National Labs (LBL, PNNL, SNL, ORNL), PSERC, EPG
- \$6M overall; \$1.2M for PSERC
- 19 researchers at 9 universities

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Consortium for Electric Reliability Technology Solutions (CERTS)



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Participated in National Grid Studies



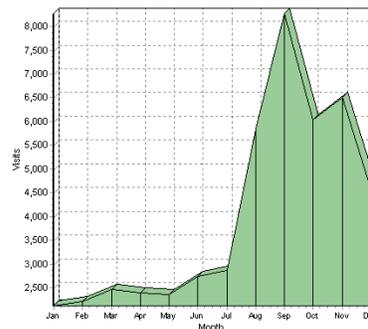
- Department of Energy's Power Outage Study Team (2000)
 - Findings and recommendations to enhance reliability from the outages of the summer of 1999
 - Seven PSERC researchers from four universities
- National Transmission Grid Study (2001-2002)
 - Assessed condition of national grid and made 51 recommendations
 - Four PSERC researchers from three universities
- Blackout of 2003
 - Investigated root causes and developing recommendations
 - Two PSERC researchers from two universities

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Served as International Information Resource on the Blackout of 2003



- Media Interviews (papers, TV, etc.)
- Support of the Investigation Team
- 11 New Background Papers, 3 Instructional Simulations, Presentation on Blackout
- Blackout Info Web Page



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Assisted Policy-Makers

- U.S. DOE's new Office of Electric Transmission and Distribution
- New Independent System Operators
 - California
 - New England
 - New York
 - Pennsylvania, New Jersey, Maryland
 - Texas
- Federal Energy Regulatory Commission
- State Commissions

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How I/UCRC Program Helped

- Facilitated efficient and rapid collaboration
- Attuned researchers to industry and government needs
- Expanded networking among university, industry and government
- Provided support/justification for up-front investment of time
- Gave visibility to universities
- Provided needed administrative support

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Challenges



- Relationship-building critical, but time-consuming
- Responsiveness to the driving need for the national resource
 - Time-criticality
 - Accessible advice/results
 - Balancing responsiveness with leadership
- Time in policy areas, public service and networking not as rewarded in university environment as research
- New administrative hassles