IOWA STATE UNIVERSITY
Electric Power Research Center

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Electric Power Research Center (EPRC)

Overview: EPRC is a catalyst for collaboration among ISU faculty, the power industry, state agencies, national labs, federal agencies and national trade associations, on research and technology transfer to solve the most challenging problems of the electric grid. EPRC power industry members jointly select and fund projects of common interest to the group. EPRC and members also participate in DOE and NSF grants, as well as grants from non-profits and state agencies.

History: EPRC began in 1963 as the Power Affiliate Research Program, founded to advance education and research in electric power systems, and strengthen industry ties to the ISU power program.

Governance and Budget: EPRC is advised by a Technical Advisory Committee (TAC) of industry members. Its budget comes from member fees, grants and continuing education courses. Funds are used primarily to fund graduate student research and develop professional education for technology transfer.

Meetings: EPRC meets with its members twice a year to provide research updates and choose new projects. ***The spring EPRC conference will be May 21-23, 2019, in Ames.***

Membership: Full Membership is an annual contribution of $25,000 or more and allows the member to appoint a representative to the TAC with one full vote per $25,000 block. A Contributing Membership level is flexible, typically at least $5,000. A Contributing Member has a representative at the TAC meetings and has a fractional vote proportional to their level of contribution.

Current Members: EPRC has nine industry members: Alliant Energy, the Central Iowa Power Cooperative, the City of Ames, the City of Bloomfield, the City of Cedar Falls, Corn Belt Power Cooperative, ITC Midwest, MidAmerican Energy, and the Midcontinent Independent System Operator (MISO).

Research teams: include faculty from Electrical and Computer Engineering (power engineering and cyber security), Industrial and Manufacturing Systems Engineering, Materials Science and Engineering, Mechanical Engineering, Civil, Construction and Environmental Engineering, Statistics, Economics, and Geological and Atmospheric Sciences. Industry advisors participate in developing and reviewing projects.

Research topics: Research reflects challenges arising from a rapidly changing power industry and changes in standards and markets. Recent projects include development of new tools to improve grid reliability and security, optimization of generation resource planning focusing on renewable integration, studies of risk management in wholesale and retail power markets, improvement of meteorological models for wind forecasting, design of new aluminum composite conductor, the impact of smart grid developments on markets and transmission planning, development of condition-based maintenance tools, and resiliency planning for distribution systems.

EPRC-funded Projects 2010-2019

Power System Operation and Planning
2010-2011	Generation Expansion Planning: Portfolio Optimization
2010-2012	Analysis of very low frequency oscillations
2010-2011	Optimal allocation of dynamic VAR sources for enhancing power system dynamic security
2010-2011	Embedded sensor network and decision algorithms for robust power system
2011-2013	Optimal online control strategies to maintain high voltage security in large scale power systems
2012-2014	Measuring stress across an area of a power system with area angles
2013-2015	PMU-based real time short term stability monitoring transmission planning and defense plans
2014-2016	Fast monitoring of voltage collapse and cascading outages with PMUs
2015-2017	Opportunities and Benefits for Deploying VSC-Based HVDC
2015-2017	Assessing the impacts of geomagnetic disturbances on Midwest transmission system reliability
2015-2017	Real-time monitoring and control of long-term voltage stability with high wind penetration via local linear regression
2015-2017	Development of integrated software to study impact of distributed generation on grid reliability

Projects 2016-2019
2016-2018	*Impacts of power transformer overload ratings on transformer reliability and life*
2016-2018	*Power Grid Resilience: Assessment, Enhancement and Outage Management*
2018-2019	*Battery Modeling and Operational Support*

Markets
2010-2012	Financial and Operational Risk Management for Restructured Wholesale Markets
2010-2012	Forecasting sales of PHEVs and PHEV users' recharging behavior
2010-2013	Integrated retail and wholesale power system operation with smart-grid functionality
2012-2014	Risk assessment of unit commitment cost under uncertainty
2015-2016	Integrated Distribution and Transmission Effects of Demand-Response Initiatives

Wind modeling
2010-2011	Impact of wind power on control performance standards and frequency regulation contributions of DFIG wind generators
2010-2011	Design of a meteorological model ensemble forecasting system for improved wind energy forecasting
2011-2013	Resource to backbone transmission design for very high wind penetration
2013-2015	Wind turbine generator and wind power plant modeling
2014-2016	Leveraging a geographic information system in high wind penetration transmission design

Projects 2016-2018
2016-2018	*Functional assessment of DFIG and PMSG-based wind turbines for grid support applications.*

Materials
2011-2013	Developing high conductivity, ultralight hi-strength aluminum composite conductor.
2013-2015	Phase 2 development of a stronger, lighter, more conductive high voltage transmission conductor material.