



4 0 T H A N N U A L

# Minnesota Power Systems Conference



**November 2-4, 2004**

**Continuing Education and Conference Center**  
*(Formerly the Earle Brown Continuing Education Center)*

**Cosponsored by:**

**Twin Cities Section of IEEE  
College of Continuing Education  
University of Minnesota**

This conference provides electric utility engineers and consultants the opportunity to stay abreast of today's power system technology. The conference emphasizes the unique challenges faced by electric utilities in the Midwest. The conference also serves as a forum for power engineers to meet with their colleagues from other utilities to discuss mutual concerns. Newly created and redesigned concurrent sessions include substations, utility industry futures, delivery systems, project management, relaying, distribution automation, and distributed resources.

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UNIVERSITY OF MINNESOTA

# Program Schedule

Tuesday, November 2, 2004

## GENERAL SESSION

8:15 a.m.-12:00 noon

**Moderator: Philip Spaulding**  
**Co-Moderators: Steve Mohs, Gerry Steffens**

7:15	Check-In Continental Breakfast	10:00	Break
8:15	Welcome <i>Philip Spaulding, Xcel Energy, Inc.</i>	10:30	MINNESOTA Transmission Planning Process <i>Mike Steckelberg, Great River Energy</i>
8:30	Where We're at from a Regulatory Point of View <i>LeRoy Koppendraye, Commissioner, Minnesota Public Utilities Commission</i>	11:00	Impact on Utilities from the August 14 Blackout <i>Dave Hill, North American Electric Reliability Council</i>
9:00	MISO Update <i>Clair Moeller, Midwest Independent Transmission System Operator, Inc.</i>	11:30	What Do We Owe Each Other? Mentoring as Professional Development <i>Holly Nordquist, Xcel Energy; Kim Butler, Mentium, Inc.</i>
9:30	History of the 25HZ System at Minnesota Power <i>Eric Norberg, Minnesota Power</i>	12:00	Lunch

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## CONCURRENT SESSIONS

1:00 – 4:15 p.m.

### SUBSTATION

**Moderator: Mike Klopp**  
**Co-Moderators: Steve Mohs, Al Haman**

1:00	Transformer Fundamentals <i>Kevin Anderson, Delta Star Transformers</i>
1:45	Power Transformers – Methods to Increase Useable Capacity <i>Russ Mattson, Minnesota Power</i>
2:30	Break
2:45	The Influence of Metal Oxide Surge Arresters on High Voltage Clearances <i>Arnie P. Vitol, ABB, Inc.</i>
3:30	A Case Study of the Design, Testing, and Implementation of a Modern Substation Automation System <i>Ralph Kuth, Teshmont Consultants</i>
4:15	Adjourn

### DELIVERY SYSTEMS I

**Moderator: Tom Guttormson**  
**Co-Moderators: Larry Brusseau, Ed Cannon**

1:00	MAPP Reserve Capacity Obligation Study <i>Brian P. Glover, MAPPCOR</i>
1:45	HV Transmission Line Effects on Communication and Pipelines <i>Dave VanHouse, Minnesota Power</i>
2:30	Break
2:45	Southwest Minnesota Wind Generation Transmission Outlet: SVC Installation at Lake Yankton Substation <i>Richard Gonzalez, Excel Engineering, Inc.; John Grimm, Xcel Energy</i>
3:30	Portable 69 kV Line-Sited Fault Location System <i>Dale Krohse, Central Iowa Power Cooperative</i>
4:15	Adjourn

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## EXHIBITOR RECEPTION

4:15-6:00 p.m.

**Wednesday, November 3, 2004**

**CONCURRENT SESSIONS**

**8:30 a.m.-12:00 noon**

**PROJECT MANAGEMENT**

**Moderator: Ivars Vancers**

**Co-Moderators: Brian Newell, Jon Wahlgren**

- 7:30 Continental Breakfast
- 8:30 GRE DC Upgrade Project  
*Karl Mortenson, Great River Energy*
- 9:15 The Rapid City Tie – New Technology Tames the East-West Interconnection  
*Michael Bahrman, Reactive Power Compensation Systems*
- 10:00 Break
- 10:30 Relocating Electric Utilities in a Design-Build Environment  
*Randy Anderton, Rochester Public Utilities*
- 11:15 Xcel Peaking Plants  
*John Larson, Utility Engineering Corp.*
- 12:00 Lunch

**DELIVERY SYSTEMS II**

**Moderator: Mark Harvey**

**Co-Moderators: John Johanson, Pat Hayes**

- 7:30 Continental Breakfast
- 8:30 Distribution Asset Optimization – The Results to Date at Xcel  
*Steve Bubb, Itron*
- 9:15 Transmission Reliability Indices  
*Michelle Wood, Xcel Energy*
- 10:00 Break
- 10:30 Combination of Technologies Gives Best Distribution Asset Control  
*Mark Dixon, Electric Co., Inc.*
- 11:15 Basslink System Protection Scheme: System-wide Teleprotection for Fast Generation/Load Balancing  
*Phillip Miller and Gary Roskos, Open Systems International, Inc.*
- 12:00 Lunch

**CONCURRENT SESSIONS**

**1:00 – 4:15 p.m.**

**RELAYING**

**Moderator: Nathan Germolus**

**Co-Moderators: Jon Wahlgren, Al Haman**

- 1:00 Bus Protective Relaying, Methods, and Applications  
*Gerard Gustafson, Basler Electric*
- 1:45 Out-of-Step Protection Fundamentals and Advancements  
*Ken Behrendt, Schweitzer Engineering Laboratories*
- 2:30 Break
- 2:45 Phasor Measurement for System Optimization  
*Roger Hedding, ABB Inc.*
- 3:30 Coordinating Long Reaching Impedance Elements with Load  
*Tom Ernst, Minnesota Power*
- 4:15 Adjourn

**DISTRIBUTION AUTOMATION**

**Moderator: Dan Nordell**

**Co-Moderators: Craig Turner, Denny Branca**

- 1:00 The Growing Pains of Applying Remote-Indicating Fault Detectors  
*James Kucera, Xcel Energy*
- 1:45 SNC Reducing SAIDI - Two Major Feeder Automation Projects in North America  
*Craig Befus, S&C Electric*
- 2:30 Break
- 2:45 Powerline Broadband – Part I  
*Dan Sturm, Rochester Public Utilities*
- 3:30 Powerline Broadband – Part II  
*Gary Box, ARIA Corporation*
- 4:15 Adjourn

**Thursday, November 4, 2004**

**CONCURRENT SESSIONS**

**8:30 a.m. - 11:45 a.m.**

**TUTORIAL - SUBSTATION COMMUNICATIONS**

**Moderator: Dan Nordell**

**Co-Moderators: Brian Newell, Tom Guttormson**

- 7:30 Continental Breakfast
- 8:30 Ethernet in Substation Automation Applications -  
Issues and Requirements  
*Marzio Pozzuoli, RuggedCom Inc.*
- 9:15 Digital Transducer Systems and Digital Multiplexing  
Fundamentals (T1/SONET)  
*Mark Adamiak, GE Multilin*
- 10:00 Break
- 10:15 IEC 61850 – Concepts and Applications  
*Mark Adamiak, GE Multilin*
- 11:00 Substation Communication Technology Choices  
*Dan Nordell, Xcel Energy*
- 11:45 Adjourn

**DISTRIBUTED RESOURCES**

**Moderator: Dave Peterson**

**Co-Moderators: Roger Simundson, Gerry Steffens**

- 7:30 Continental Breakfast
- 8:30 State Wind Study Results  
*Matt Schuerger, Energy Systems Consulting Services*
- 9:15 Animal Waste to Electricity (cow power)  
*Neil Kennebeck, Dairyland Power Cooperative*
- 10:00 Break

**UTILITY INDUSTRY FUTURES**

- 10:30 The Self Healing Network  
*Masoud Amin, Institute of Technology,  
University of Minnesota*
- 11:00 The Case for Green Power: Is Coal Really So Bad?  
*Dr. Michael Ropp, South Dakota State University*
- 11:45 Adjourn
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# Topic Descriptions

## GENERAL SESSION

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### Where We're at from a Regulatory Point of View

*LeRoy Koppendrayner, Commissioner, Minnesota Public Utilities Commission*

By taking a hands-on advisory role to the Midwest Independent System Operator (MISO) Organization of Midwest States (OMS) has assumed a larger stake in making sure there's a long term benefit to the ratepayers; however, having said that, we do not take any less seriously our parochial interest of protecting the rates of our native load customers. Some of the lower cost utility rates were made possible by long term state and utility investment which belong to the consumers in those respective areas.

### MISO Update

*Clair Moeller, Midwest Independent Transmission System Operator, Inc.*

An update of status, goals, events, processes, and changes at the Midwest Independent System Operator affecting the regions electric utilities.

### History of the 25Hz System at Minnesota Power

*Eric Norberg, Minnesota Power*

Each company has a unique and rich history. A unique aspect for Minnesota Power is our 25Hz System, which existed from 1905 until the 1980's. This paper describes the hydro and 25Hz system origins, its evolution, and its phase-out.

### Minnesota Transmission Planning Process

*Mike Steckelberg, Great River Energy*

The State of Minnesota requires a public process during the planning of new or upgraded transmission lines (100kV and above). This presentation will describe the requirements of the statute and report on the results of the public process since the requirements went into effect on August 1, 2001.

### Impact on Utilities from the August 14 Blackout

*Dave Hilt, North American Electric Reliability Council*

An update of current and future events, directions, and processes at the North American Electric Reliability Council brought about by regulation, the changing electric utility world, and events such as the 8-14-2003 blackout.

### What Do We Owe Each Other? Mentoring as Professional Development

*Holly Nordquist, Xcel Energy; Kim Butler, Mentium, Inc.*

This session will present something new for our profession – a way of thinking (and doing) in terms of what we “owe” each other in order to keep our field fresh and populated with the best talent there is. Mentoring is a key strategy for building leaders and managers, and the presenters will be discussing the benefits of a mentoring relationship. Also presented will be ways to take this important development opportunity back to your organizations.

## SUBSTATION

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### Transformer Fundamentals

*Kevin Anderson, Delta Star Transformers*

This presentation describes transformer core and coil construction types built for utilities and industry. Stacked (core-form) and wound (shell-form) cores, along with cylindrical, rectangular, layer, and disk winding types will be discussed. Comparisons will also be made on a thermal, structural, electrical, and economical basis.

### Power Transformers – Methods to Increase Useable Capacity

*Russ Mattson, Minnesota Power*

This paper discusses various methods to increase capacity of existing substation transformers. The objective in marginally increasing transformer capacity is the deferral of large capital investment. Minnesota Power has experienced significant delays in capital expenditure by using these methods and specific cases will be presented.

### The Influence of Metal Oxide Surge Arresters on High Voltage Clearances

*Arnie P. Vitols, ABB, Inc.*

The insulation withstand of substation equipment is selected based on usually expected over voltage conditions. The protective characteristics of the metal oxide surge arrester play a significant roll in selecting clearances to reduce the risk of insulation failure to an economically and functionally acceptable level. The surge arrester must be mounted with respect to grounded objects and to other surge arresters in adjacent phases in such a manner that it does not increase the total risk of insulation failure.

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## **A Case Study of the Design, Testing, and Implementation of a Modern Substation Automation System**

*Ralph Kuth, Teshmont Consultants*

This presentation describes the design, testing, and implementation of a modern substation automation system for a 63kV transmission substation located in the southern interior of British Columbia, Canada. The automation system design makes use of Bay Controllers, which integrate the control, and protection of individual bays into a single Intelligent Electronic Device (IED), a practice that is still very new to the North American electrical industry.

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## **DELIVERY SYSTEMS I**

### **MAPP Reserve Capacity Obligation Study**

*Brian P. Glover, MAPPCOR*

This paper presents the results of a multi-area generating capacity adequacy assessment performed by the Composite System Reliability Working Group (CSRWG) for the Mid-Continent Area Power Pool's (MAPP's) United States (US) thermal system. The impact of transmission resource limitations within the MAPP region on the system reserve margin has been studied. In addition, the generating unit forced outage rate uncertainty, extreme hot summer loading conditions, and the load forecast uncertainty are explicitly modeled in the study. The basic objective of this study was to determine the Reserve Capacity Obligation (RCO) for the MAPP-US thermal system for the years 2003, 2006, 2009, and 2012. Similar studies have been performed in 1991 and 1994, and one of the purposes of this study was to determine whether or not the recommendations from the previous studies were still valid. The results of the study confirmed the current RCO level for the MAPP-US thermal system.

### **HV Transmission Line Effects on Communication and Pipelines**

*Dave VanHouse, Minnesota Power*

Corridor sharing between transmission lines and other linear infrastructure such as railroads and pipelines is becoming a common practice. AC interference along these shared corridors can lead to equipment failure and create safety hazards. This paper will briefly address some of the issues associated with the Arrowhead-Weston 345 kV line, which will corridor share with both railroads and pipelines. It will also address other AC interference issues that must be taken into account to insure that the transmission line will not adversely impact operations of other near-by facilities.

## **Southwest Minnesota Wind Generation Transmission Outlet: SVC Installation at Lake Yankton Substation**

*Richard Gonzalez, Excel Engineering, Inc.;*  
*John Grimm, Xcel Energy*

The Lake Yankton Static VAR Compensator (SVC) installation is one of a series of electric transmission system improvements under way for increasing generation outlet capacity from the Buffalo Ridge area of southwest Minnesota, an area of extensive wind generation development. This paper describes the planning, specification, construction, and testing of the SVC, and provides a "before" and "after" comparison of transmission system voltage regulation performance achieved.

### **Portable 69 kV Line-Sited Fault Location System**

*Dale Krohse, Central Iowa Power Cooperative*

This presentation will describe a self-contained fault locating system suitable for use anywhere on the CIPCO 69 or 34.5 kV systems. The discussion will include reasons for using such a system, how the system was designed, installation of the system, and experience to date.

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## **PROJECT MANAGEMENT**

### **GRE DC Upgrade Project (CU HVDC Converter Upgrades – Challenges and Opportunities)**

*Karl Mortenson, Great River Energy*

The CU HVDC transmission system is 25 years old and its reliable operation continues to be critical. In the last several years, three major life extension projects have been done. Experiences with these should help others facing similar challenges with aging equipment. Completing them successfully has required careful planning and project management to meet tight project schedules, particularly extremely short outages to do the actual installation and commissioning. A major project to replace the converter control equipment that was completed last spring will be described in detail.

### **The Rapid City Tie – New Technology Tames the East-West Interconnection**

*Michael Bahrman, Reactive Power Compensation Systems*

A Back to Back Direct Current Intertie was installed by Basin Electric Power Cooperative near Rapid City, South Dakota. The paper will present the justification used for the DC Tie, the performance studies that were done to insure appropriate operation within the overall system requirements, and recent operational performance. The unique main circuit design will be presented and its reasons for development and ultimate application to a weak system network. The installation provides a reliable power connection in the East-West Intertie interface.

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## Relocating Electric Utilities in a Design-Build Environment

*Randy Anderton, Rochester Public Utilities*

In November 2002, Minnesota/DOT awarded its largest ever design-build highway contract to reconstruct 11 miles of Highway 52 in Rochester. The major difference with the new design-build method is the unavailability of final highway construction plans prior to the start of actual construction. Since this process is fundamentally different from that of a standard highway project, it presents many new challenges for utility companies. Highway 52 (ROC52) was a pilot project and it appears that design-build may become the standard for Minnesota/DOT in the future.

## Xcel Peaking Plants

*John Larson, Utility Engineering Corp.*

Angus Anson and Blue Lake Combustion Turbine Power Projects consist of one and two combustion turbine additions, respectively. Each combustion turbine is an aftermarket GE 7FA with a nominal capacity of 160MW. Utility Engineering will present the permitting support, procurement effort, and detailed engineering design performed for each project, plus construction in progress. The project began in January 2004, with construction and start-up scheduled for completion in June 2005.

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## DELIVERY SYSTEMS II

### Distribution Asset Optimization – The Results to Date at Xcel

*Steve Bubb, Itron*

The electric distribution system of Xcel Energy is a large, complex, and dispersed system that is a critical factor determining the quality and reliability of the utility's service. In the past, practical and scalable tools have been unavailable to accurately assess the utilization of the widely distributed assets of the system. Xcel Energy has implemented Itron's Distribution Asset Optimization (DAO) model to significantly enhance efficiency and reliability of this distribution system. The DAO model uses readily available utility data in new and creative ways to expose a robust and granular picture of the utilization of Xcel Energy's distribution assets.

### Transmission Reliability Indices

*Michelle Wood, Xcel Energy*

In the aftermath of the August 2003 blackout, there has been much discussion regarding transmission reliability. In the changing world of transmission, measuring reliability has become a hot topic. Presentation will be a review of traditional distribution reliability metrics as they apply to transmission, exploration of the other transmission metrics currently in use, and introduction of some new metrics that are being proposed for transmission.

## Combination of Technologies Gives Best Distribution Asset Control

*Mark Dixon, Electric Co., Inc.*

Combining advanced technologies for distributed local intelligence, communications, and centralized control, enhances control of Volt and VAR assets, as well as provides better analysis, planning and operation of these valuable assets. This paper illustrates how a combination of local intelligence and remote control, along with a centralized VAR dispatch program, allows the greatest flexibility in Volt/VAR management that is part of distribution automation.

## Basslink System Protection Scheme: System-wide Teleprotection for Fast Generation/Load Balancing

*Phillip Miller and Gary Roskos, Open Systems International, Inc*

The Basslink project is to install an undersea DC line in the Bass Straight to allow Tasmania to connect with the Australian power grid and to enter the National Electricity Market. Loss of this link under various operating conditions requires fast, distributed load or generation shedding to keep the Tasmanian system from collapsing. The Basslink System Protection Scheme is a hardware/software solution that determines a course of action based on information from the transmission EMS database and sends transfer-trip signals to appropriate sites to shed specific blocks of load or generation.

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## RELAYING

### Bus Protective Relaying, Methods, and Applications

*Gerard Gustafson, Basler Electric*

This paper serves as a review of the application of bus protective relaying. Several methods of bus protective relaying are described and compared, with mainstream emphasis. The methods discussed include high impedance unrestrained differential, low to moderate impedance unrestrained differential, low impedance restrained differential, interlocked line and transformer relaying, over-current relaying, and others. Subjects include configuration, theory of operation, and guidelines for use of each scheme.

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## **Out-of-Step Protection Fundamentals and Advancements**

*Ken Behrendt, Schweitzer Engineering Laboratories*

Power systems in the U.S. have experienced a number of large disturbances in the last 10 years including the largest blackout, which occurred on August 14, 2003, in the Midwest and north-east U.S. and impacted many millions of customers. The July 2, 1996 and August 10, 1996 major system disturbances also impacted several million customers in the western U.S. All of these disturbances caused considerable loss of generation and loads and had a tremendous impact on customers and the economy in general. These system disturbances reveal the need for properly applied out-of-step protection schemes to prevent, or limit, the impact of system disturbances. This presentation will describe the philosophy and application fundamentals of out-of-step protection in transmission systems.

## **Phasor Measurement for System Optimization**

*Roger Hedding, ABB Inc.*

As a result of the August 2003 blackout utilities are being asked to increase their monitoring capabilities to get a better picture of what is happening on their system. One such tool to do this monitoring is the Phasor Measurement Unit (PMU). This presentation describes what PMUs are and discusses their potential uses on an electric utility system. Some examples are given of current applications.

## **Coordinating Long Reaching Impedance Elements with Load**

*Tom Ernst, Minnesota Power*

Long reaching impedance elements used for remote back-up and line overload protection are widely known to be susceptible to false tripping due to load encroachment. Yet, in two recent major large-area power outages these elements have false tripped on post-contingency load. This presentation looks at the root causes of load encroachment tripping for various types of impedance elements and identifies a methodology for coordinating pick-up with load to minimize the potential for load encroachment tripping.

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## **DISTRIBUTION AUTOMATION**

### **The Growing Pains of Applying Remote-Indicating Fault Detectors**

*James Kucera, Xcel Energy*

Xcel Energy has installed several hundred distribution fault indicators equipped with radio transmitters on its distribution system. Those devices use the communications component to alert personnel in the Control Center if fault current has passed the installation point on the distribution system. This information is used to better dispatch field personnel for trouble shooting and power restoration, and has definite known limitations. This paper discusses the operation, accuracy, and drawbacks of those installations.

## **SNC Reducing SAIDI – Two Major Feeder Automation Projects in North America**

*Craig Befus, S&C Electric*

Two strategic projects to install feeder automation equipment to minimize customer minutes of interruption are currently underway in the U.S. and Canada. This presentation will discuss the motivation behind these efforts and will focus on distributed intelligence technology being deployed to automate a large scale distribution system. We will review the results of these feeder automation employments thus far, and share operational benefits that have been achieved. In addition to the feeder equipment being deployed, the presentation will examine the communication architecture being used for monitoring control of the feeder automation hardware.

## **Powerline Broadband – Part I**

*Dan Sturm, Rochester Public Utilities*

This presentation will provide an overview of the Broadband Power Lines (BPL) technology trial project jointly being performed by Hiawatha Broadband Communications (HBC) and Rochester Public Utilities (RPU). Subtopics will include a brief history of the partnership, business case and analysis, public relations issues, local and state political challenges, technological and interference issues, summary of project results, and the outlook for a market trial and commercial deployment.

## **Powerline Broadband – Part II**

*Gary Box, ARIA Corporation*

Any deployment of Broadband over Power Lines will bring with it a whole new set of challenges for utilities in the areas of radio frequency interference (RFI) and electromagnetic compatibility (EMC). This paper will review some recent experiences and studies with the goal of putting these challenges into perspective.

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## **TUTORIAL – SUBSTATION COMMUNICATIONS**

### **Ethernet in Substation Automation Applications – Issues and Requirements**

*Marzio Pozzuoli, RuggedCom Inc.*

Discussion of the use of Ethernet as a physical and data link layer to provide communication services to substation IEDs and protective relays. The discussion includes consideration of the electromagnetic and climatic environment of substations, which has led to the development of new standards by both IEC and IEEE for communications equipment in substations. Also included is a discussion of key Ethernet standards which are useful for serving time-critical devices such as protective relays and network-connected instrument transformers.

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## Digital Transducer Systems and Digital Multiplexing Fundamentals (T1/SONET)

*Mark Adamiak, GE Multilin*

Power system measurements have traditionally been made using analog voltage and current devices which require dedicated wiring to connect them to electromechanical or electronic devices for power system indication and protection. IEC 61850 part 9.2 standardizes the emerging practice of digitizing these measurements directly at the sensor and communicating it in real-time to subscribing IEDs. The second portion of this presentation addresses the origins of digital time division multiplexing and takes the audience from the development of T1 through SONET (Synchronous Optical NETwork). The presentation will also examine application limitations, as well as actual implementations.

## IEC 61850 – Concepts and Applications

*Mark Adamiak, GE Multilin*

The Utility Communications Architecture (UCA) for substation communication has now been codified and published as an international standard in IEC 61850. This presentation will highlight the use of IEC 61850 for substation relay and SCADA applications. It will include an overview of the profile components of 61850, a discussion of the services provided by 61850, the use of 61850 services for high-speed power system protection communications, and networking connectivity and security issues.

## Substation Communication Technology Choices

*Dan Nordell, Xcel Energy*

When selecting technologies for constructing both internal and external communication systems for substations the utility engineer is faced with a confusing plethora of commercial offerings. This discussion will seek to bring some order to this chaos and to lend an understanding of the technical characteristics, strengths, and weaknesses of each of the potential choices.

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## DISTRIBUTED RESOURCES

### State Wind Study Results

*Matt Schuerger, Energy Systems Consulting Services*

The 2004 Minnesota Wind Integration Study examined reliability and operating impacts of 1500 MW of wind power serving Xcel Energy in 2010. Reliability impacts were evaluated in the planning horizon by calculating the effective load carrying capability of the wind generation. The operating cost impact of the variability and the uncertainty of the wind generation were evaluated for regulation, load following, and unit commitment. Study methods and results will be presented.

## Animal Waste to Electricity (cow power)

*Neil Kennebeck, Dairyland Power Cooperative*

As part of its renewable energy portfolio DPC is developing a program to turn municipal, agricultural, and commercial food waste streams into electric energy and fertilizer. They have identified 32 farms representing approximately 32,000 dairy cows whose manure will be converted into 25 MW of electrical power, heat for the farm, deodorized fertilizer, and bedding for the cows. Additionally DPC is developing waste to energy projects that will include turkey, chicken, cheese, potato, and onion waste streams and landfill gas, all to be converted to electricity.

## The Self Healing Network

*Masoud Amin, Institute of Technology, University of Minnesota*

Virtually every crucial economic and social function depends on the secure, reliable operation of energy, telecommunications, transportation, financial, and other infrastructures. The world's current electricity infrastructure was designed decades ago to serve analog (continuously varying) electric loads, and thus is unable to consistently provide the level of digital quality power required by our increasing digital manufacturing assembly lines, information systems, and soon, even our home appliances. In the aftermath of the tragic events of September 11, 2001, our critical infrastructures are facing new scrutiny. The specter of terrorism raises a profound dilemma for the electric power industry -- how to make the electricity infrastructure more secure without compromising productivity. Assuming that individual utilities are already undertaking prudent steps to improve physical security wherever possible, technology can make a vital contribution by enhancing the inherent resilience and flexibility of power systems to withstand terrorist attacks, as well as natural disasters.

## The Case for Green Power: Is Coal Really so Bad?

*Dr. Michael Ropp, South Dakota State University*

There seems to be a general sentiment among the public that the utility industry is harming the environment through its use of fossil fuel (especially coal) and nuclear generation technologies. However, the technical literature, at least upon a first reading, seems much less certain. What are the facts? Which viewpoint is the more credible? Does "green power" really solve a problem or is there no problem to solve? This paper presents a critical review of where this long-running debate stands at this time. The author, a renewable energy researcher who has struggled with this question for years, digs into the data, conducts interviews with meteorological and environmental researchers, and shares his findings on what the true effects of fossil fuel and nuclear power usage are on the natural world.

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## LOCATION AND ACCOMMODATIONS

The conference will be held at the Continuing Education and Conference Center (formally the Earle Brown Continuing Education Center), 1890 Buford Avenue, University of Minnesota St. Paul campus, St. Paul, Minnesota 55108. Parking is available adjacent to the Center in lot S104 for \$5 per day and in the Fairground lot S108 for \$3.25 per day.

Convenient lodging for out-of-town participants is available at the Four Points Sheraton Hotel Minneapolis, 1330 Industrial Boulevard, Minneapolis, 612-331-1900 or 1-800-777-3277. The rate is \$84, plus tax, for a single or double room. Participants are responsible for making their own lodging reservations. To receive the special conference rate, please identify yourself as a participant of the Minnesota Power Systems Conference. Reservations must be made by October 10. After this date reservations will be accepted on a space and rate available basis.

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## REGISTRATION AND FEES

The fee for the conference is \$225 if received by October 19; if received after October 19, the fee is \$250. The conference fee includes all sessions, two luncheons, refreshments breaks, the exhibitor reception, and the conference proceedings. You are encouraged to register early to take advantage of the lower fee. If you cancel your registration by October 27, a refund, minus \$30, will be issued. If you cancel after this date you will be ineligible for a refund. A full refund will be issued if the conference is cancelled by the University of Minnesota.

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## EXHIBITOR RECEPTION

The exhibitor reception will be held on Tuesday, November 2, from 4:15-6:00 p.m. at the Continuing Education and Conference Center (the same location as the conference sessions). Exhibitors will display brochures and small equipment. All conference attendees are invited to attend this reception to view the exhibits, meet the exhibitors, and enjoy some hors d'oeuvres.

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## CONTINUING EDUCATION UNITS (CEUs)

Participants who attend the entire conference will receive 1.6 CEUs. Participants who attend only Tuesday and Wednesday will receive 1.3 CEUs. One CEU is defined as 10 contact hours of participation in an organized continuing education experience under responsible sponsorship, capable direction, and qualified instruction. A CEU certificate will be sent to each participant after the conference. A permanent record of CEUs earned will be maintained by the University of Minnesota Office of Admissions and Record Transcript Unit.

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## FOR FURTHER INFORMATION

Kay Syme  
College of Continuing Education  
University of Minnesota  
352 Classroom Office Building  
1994 Buford Avenue  
St. Paul, MN 55108  
Phone: 612-624-4938  
Fax: 612-624-6225  
E-mail: [conferences4@cce.umn.edu](mailto:conferences4@cce.umn.edu)

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## CALL FOR PAPERS FOR 2005 CONFERENCE

Deadline for title and abstract submission for MIPSYCON 2005 is *January 3, 2005*. Notification of acceptance will be mailed by *June 2005*. The deadline for final paper submission for accepted speakers is *August 13, 2005*.

If you would like to be considered for the 2005 program, please submit an abstract of approximately 300 words to: Kay Syme, College of Continuing Education, University of Minnesota, 352 Classroom Office Building, 1994 Buford Avenue, St. Paul, MN 55108, E-mail: [conferences4@cce.umn.edu](mailto:conferences4@cce.umn.edu).

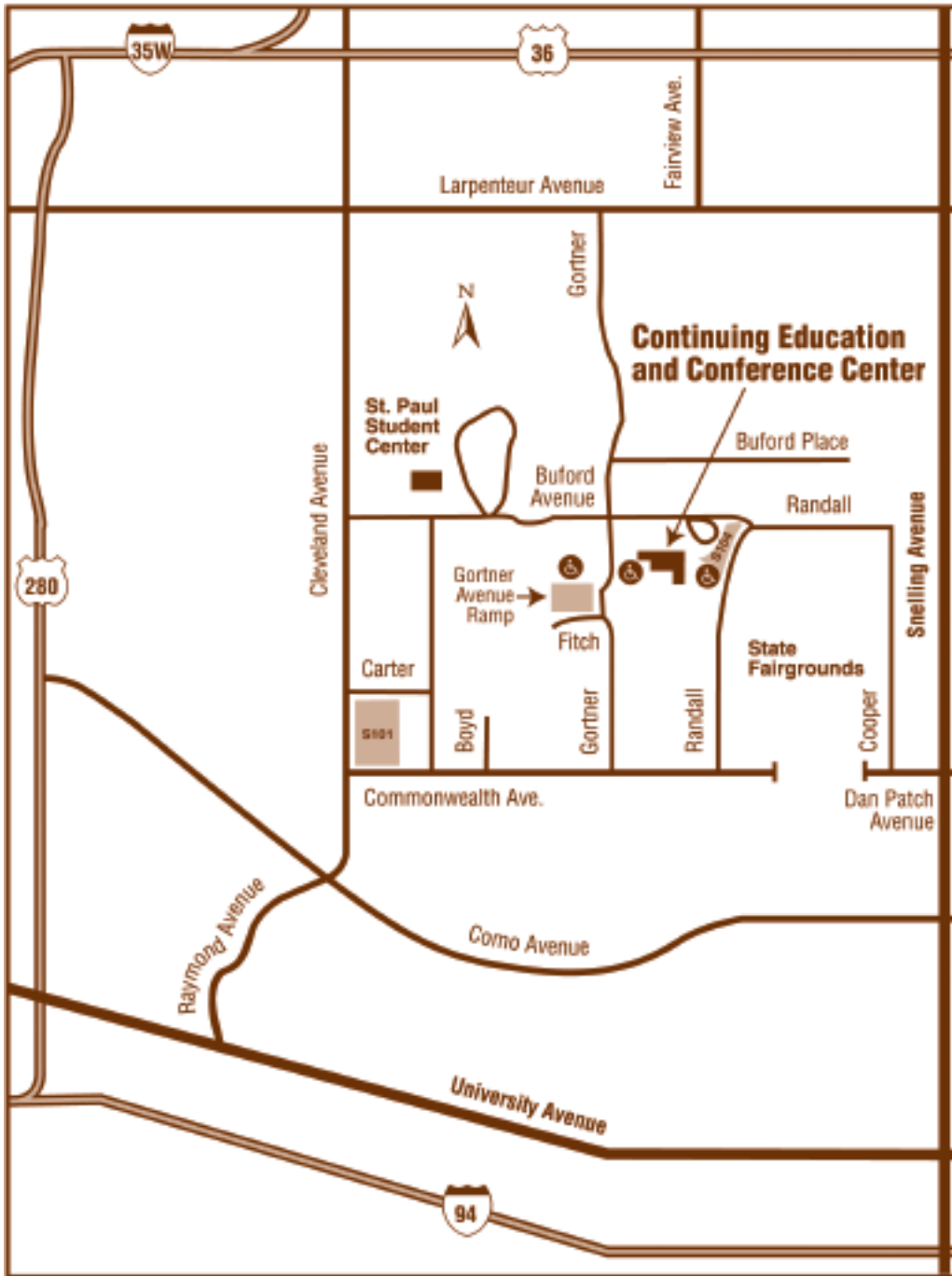
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# Continuing Education and Conference Center

1890 Buford Avenue, St. Paul, MN 55108 • 612-624-3275



- = Parking facilities
- ♿ = Handicapped access and parking

## Directions

From I-694: Take 35W south to the Cleveland Avenue exit (Note: exit to the left). Follow Cleveland Avenue to Larpenteur Avenue. Go east (left) on Larpenteur to Gortner, turn south (right) on Gortner and go to Buford Avenue. Turn east (left) on Buford Avenue.

From I-35W: Take the Highway 36 exit and turn south on Cleveland Avenue to Larpenteur Avenue. Go east (left) on Larpenteur to Gortner, turn south (right) on Gortner and go to Buford Avenue. Turn east (left) on Buford Avenue.

From downtown St. Paul: Go west on I-94 to Snelling Avenue. Go north on Snelling Avenue to Larpenteur Avenue. Go west (left) on Larpenteur to Gortner, turn south (left) on Gortner and go to Buford Avenue. Turn east (left) on Buford Avenue.

From downtown Minneapolis: Go east on I-94 to MN-280, exit number 236. (Note: exit to the left). Merge onto MN-280 north. Exit at Larpenteur Avenue. Take Larpenteur east (right) to Gortner (3rd traffic light). Turn south (right) on Gortner and go to Buford Avenue. Turn east (left) on Buford Avenue to the parking area.



## 2004 MIPSYCON PLANNING COMMITTEE

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University of Minnesota  
St. Paul, Minnesota

**Denny Branca**  
Xcel Energy, Inc.  
Minneapolis, Minnesota

**Larry Brusseau**  
MAPP  
Saint Paul, Minnesota

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Department of Electrical  
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*\*Planning Committee Chair*

## 40th Annual Minnesota Power Systems Conference

**November 2-4, 2004**

Name \_\_\_\_\_

(Last)

(First)

(M.I.)

Social Security Number (for CEUs) \_\_\_\_\_

Business Address (Street/P.O. Box) \_\_\_\_\_

City

State

Zip Code

E-mail \_\_\_\_\_

Daytime phone \_\_\_\_\_

Fax \_\_\_\_\_

Company/Institution \_\_\_\_\_

Title/Position \_\_\_\_\_

Home Telephone \_\_\_\_\_

**I do not want to be listed on the participant list.**

### Conference Fee

Enclosed is \$225 in full payment of the conference registration fee (received by October 19).

Enclosed is \$250 in full payment of the conference registration fee (received after October 19).

### Method of Payment

Enclosed is a check or money order payable to the University of Minnesota.

The fee will be paid by my employer. Enclosed is a purchase order.

Payment should be charged to my credit card (check one).

Type of Credit Card: \_\_\_\_\_ Visa \_\_\_\_\_ MasterCard \_\_\_\_\_ Discover/Novus \_\_\_\_\_ American Express

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If your check is returned because of insufficient funds or closed account, or because you have made a stop payment request, you will be charged a check handling fee of \$20.

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Information Center 176795  
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