

# 52nd Annual **MINNESOTA POWER SYSTEMS CONFERENCE**

**November 8–10, 2016**

**Saint Paul RiverCentre  
175 W Kellogg Boulevard  
Saint Paul, Minnesota**

Sponsored by:  
College of Continuing Education, University of Minnesota

In Cooperation with:  
IEEE, Power and Energy Society, Twin Cities Chapter

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**COLLEGE OF CONTINUING EDUCATION**  

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**UNIVERSITY OF MINNESOTA**

# Program At A Glance

## TUESDAY, NOVEMBER 8, 2016

7:00 a.m.	Registration and Continental Breakfast			
	<b>General Session</b>			
8:00	Welcome and Opening Remarks			
8:15	Clean Power: Now and in the Future			
9:00	Lessons from GridEx and Ukraine			
9:45	Break			
10:15	The Impact of Digital Technology on the Future of Transmission & Distribution			
11:00	The Ethical Practice of Engineering: Case Studies from Administrative and Court Actions			
Noon	Lunch			
	<b>Substation</b>	<b>Utility Industry Futures I</b>	<b>Delivery Systems I</b>	<b>Relaying I</b>
1:00 p.m.	Implementation Considerations for Electronic and Physical Substation Security Improvements for CIP-014	Electric Grid Resiliency Panel	Advanced Grid Intelligence & Security Initiatives at Xcel Energy	Understanding the Dynamic Mho Distance Characteristic
1:45	Physical Security Challenges and Responses for High Voltage Transformers	Grid Energy Storage Overview	The Use of Sensors for Distribution and Substation Applications	Resistance Coverage of Memory Polarized Distance Elements
2:30	Break			
3:00	Substation Yardstone Resistivity—Is it Really 3,000 Ohm-Meters?	Future Grid	Using a Geographic Information System to Create a Load Flow Model	Phase Rolling and the Impacts on Protection

3:45	A Case Study for Substation Lightning Risk Evaluation	Resource Reliability in a Changing Environment	Generating Asset Health Indices Which Are Both Useful and Auditable	High-Speed Communication-Assisted Tripping and Sectionalizing for Distribution Systems
4:30	<b>Exhibitor Reception (4:30–7:00)</b>			
7:00	Adjourn			
<b>WEDNESDAY, NOVEMBER 9, 2016</b>				
7:30 a.m.	Registration and Continental Breakfast			
	<b>Distribution Automation/ Communications</b>	<b>Project Management</b>	<b>Utility Industry Futures II</b>	<b>Power Generation</b>
8:30	Pattern Detection in Distribution Networks Using Complex Event Processing	Mississippi River Crossing—CapX2020	Transmission Utility’s Use of GIS	Camp Ripley Solar Partnership
9:15	NERC CIP in the Real World on a Real Budget	Project Management Advice—Panelists Share Their Insights (the ‘Good’ and the ‘Bad’!)	Detailed Simulation Studies as a Solution to 21st Century Power System Challenges	Columbia Energy Center Air Quality Control System Retrofit
10:00	Break			
10:30	The Importance of Testing Smart Grid IEDs against Security Vulnerabilities	Southern Minnesota Service Territory Sale	Distribution System Demand Management with Microgrids	Coordination of Controls of Renewable Power Plants to Meet Steady State and Dynamic Response Requirements for Voltage Control and Reactive Power Supply
11:15	Wireless Technology and Application	Minnesota Power Restoring Thomson Hydro... for the Next Century	Designing Voltturnus, a Small Hydro Technology	Deer Creek Station— Combined Cycle Generation
Noon	Lunch			

**WEDNESDAY, NOVEMBER 9, 2016 (continued)**

	Civil-Structural	Delivery Systems II	Relaying II	Metering
1:00	Code, Standards, Specifications, & Promises—Why Details Matter in Steel Pole and Tower Fabrication	Consolidated Edison’s Experience with Online Monitoring and Mitigation of Geomagnetic Disturbances	I Bought It But Do I Have To Use It? AKA: My Favorite Function Is The One I Turned Off!	Automating the OMS with the DMS—How to Get There
1:45	Dirt and Steel: The Need for Geotechnical and Structural Collaboration	Interharmonics: What They Are, Where They Come From and What They Do	A Current Story—When Primary Met Secondary	AMI Deployment at a Rural Electric Cooperative
2:30	Break			
3:00	The Dirt on Soil Investigations	History and Application of the MN Stray Voltage Guide	Applications of Automated Protective Relay Testing	Measuring the Bakken: Metering and Monitoring Power Consumption in Western ND and Eastern MT
3:45	River Bank Foundation Design	40 Ohm Ground Fault Impedance—Still Applicable?	Avoiding Dangerous Relay Testing Practices	Meter Data Everywhere, Is It All the Same?
4:30	Adjourn			

**THURSDAY, NOVEMBER 10, 2016**

7:30 a.m.	Registration and Continental Breakfast			
	Tutorial I	Tutorial II	Tutorial III	
8:30	Transmission Lines and Power Flow Analysis	Predictive Maintenance for Improved Grid Performance	Relaying 101	
10:00	Break			
10:30	Transmission Lines and Power Flow Analysis	Predictive Maintenance for Improved Grid Performance	Relaying 101	
Noon	Adjourn			

# Program Schedule

Saint Paul RiverCentre  
175 West Kellogg Boulevard  
Saint Paul, Minnesota

**TUESDAY, NOVEMBER 8, 2016**

## GENERAL SESSION

8:00 a.m.–noon

Moderator: *Michael Ebert*

Co-Moderators: *Scott Hoberg, Larry Brusseau, Douglas Brown*

### **Welcome and Opening Remarks**

*Michael Ebert, AMEC Foster Wheeler*

### **Clean Power: Now and in the Future**

*Mac McLennan, CEO, Minnkota Power Cooperative, Inc.*

This talk covers the challenges of generation decision making with ever-changing rules and societal expectations including the challenges of meeting the needs in a carbon-managed world.

### **Lessons from GridEx and Ukraine**

*David Halla, Chief of Operations, Electricity Information Sharing and Analysis Center (E-ISAC)*

How lessons learned from NERC's biannual exercise, GridEx, and the cyber-attack on Ukraine's distribution system, increase resilience in the North American grid.

### **The Impact of Digital Technology on the Future of Transmission & Distribution**

*Rick Bush, Editor, Transmission & Distribution World Magazine*

We are rapidly moving to a digital future. This requires we re-envision what makes up our delivery system. It also requires that we re-envision how we equip the next generation workforce.

### **The Ethical Practice of Engineering: Case Studies from Administrative and Court Actions**

*Kodi Verhalen, Associate, Briggs and Morgan*

Model Rules, Codes of Ethics, and Minnesota Rules of Professional Conduct will be reviewed. The presentation will then analyze several administrative actions by state boards of licensure, followed by several court cases where a PE's actions or a PE's license were the primary focus.

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## CONCURRENT SESSIONS

1:00–4:30 p.m.

## SUBSTATION

Moderator: *Chuck Healy*

Co-Moderators: *Steven Mohs, Bethlyn Cummings*

### **Implementation Considerations for Electronic and Physical Substation Security Improvements for CIP-014**

*Robert Hope, Burns & McDonnell*

CIP-014 has ushered in an atmosphere where the threat environment and those mitigating security measures can be new to utilities. Detailed replanning and execution are key to overall implementation success.

## **Physical Security Challenges and Responses for High Voltage Transformers**

*James McIver, Siemens Transformers USA*

Several “resilient transformer” approaches have been developed in cooperation with participating transmission owners. Increased interaction between asset owner and manufacturer can achieve enhanced physical security using modified power transformers.

## **Substation Yardstone Resistivity—Is it Really 3,000 Ohm-Meters?**

*Bryan Beske, American Transmission Company; John Edlebeck, Coleman Engineering Company*

A review of current industry standards and practices, identifying and quantifying material properties that impact yardstone resistivity, and review of testing results from over 100 samples will be presented.

## **A Case Study for Substation Lightning Risk Evaluation**

*Stephen Chuang, AMEC Foster Wheeler*

A sample substation is presented for risk evaluation analysis of lightning strikes to unshielded sections. Approaching the design from a practical perspective of using existing or minimal lightning shielding structures to achieve substantial but not complete coverage will also be discussed.

## **UTILITY INDUSTRY FUTURES I**

Moderator: *Mike Steckelberg*

Co-Moderators: *Will Lovelace, Michael Marz*

### **Electric Grid Resiliency Panel**

*Scott Adams, American Transmission Company; Mike Jensen, Xcel Energy; Kristian Ruud, MISO; Kenneth Barry, EPRI*

A resilient grid is designed to prevent and recover from extensive natural or man-made outages. The panelists will define “Electric Grid Resiliency” and what is being done to improve it.

### **Grid Energy Storage Overview**

*Steve Emling, MEPPi*

This presentation will review the market and policy drivers for energy storage, as well as different energy storage technologies and how they can be used to solve both emerging and traditional grid challenges.

### **Future Grid**

*Laureen Ross McCalib, Great River Energy*

Customer desires, environmental regulations, market changes, and new technologies are reshaping the electric utility industry, with words like Future Grid, the Integrated Grid, Grid Modernization, and Re-regulation. Utility generation, transmission, distribution, and information technology systems will all play a part in these changes.

### **Resource Reliability in a Changing Environment**

*Thomas Butz, Power System Engineering*

Resource Reliability is currently defined primarily using peak load and capacity. With changes in the resource mix and the potential impact of the Clean Power Plan (CPP), how do we know that the system will maintain and even improve reliability?

## **DELIVERY SYSTEMS I**

Moderator: *Al Haman*

Co-Moderators: *Philip Spaulding, Denny Branca*

## **Advanced Grid Intelligence & Security Initiatives at Xcel Energy**

*Brian Amundson, Xcel Energy*

Xcel Energy will discuss its vision, strategy, and initial steps to modernize the electric distribution grid. This initiative is essential to accommodate higher penetration of distributed resources and enable advanced functionality.

## **The Use of Sensors for Distribution and Substation Applications**

*Dan Lysaker, Xcel Energy*

Distribution sensor technology and usage has grown tremendously in recent years. This presentation will explore the various sensor technologies and use-cases across the electric utility industry and at Xcel Energy.

## **Using a Geographic Information System to Create a Load Flow Model**

*James Pachan, STAR Energy Services*

Electrical distribution and transmission system models are important tools for utility engineers. Exporting the electrical connectivity data from a GIS system into Milsoft's WindMil engineering analysis software can greatly improve model accuracy and save the engineer time.

## **Generating Asset Health Indices Which Are Both Useful and Auditable**

*Tony McGrail, Doble Engineering*

This presentation reviews the derivation of practical asset health indices and some of the pros and cons in their development. Demonstrating a justifiable index is key to extracting value — whether in terms of maintenance, replacement, or rate case development.

## **RELAYING I**

Moderator: *Dave Bisel*

Co-Moderators: *Jake Bernhagen, Michael Ebert*

## **Understanding the Dynamic Mho Distance Characteristic**

*Donald Fentie, Schweitzer Engineering Laboratories, Inc.*

The dynamic properties of the mho element are explored using familiar phasor diagrams and visual aids. Real-time expansion is explored for a variety of fault types and locations.

## **Resistance Coverage of Memory Polarized Distance Elements**

*Pratap Mysore, HDR Engineering, Inc.*

This paper presents calculations to determine the actual resistance coverage at any fault location on the lines protected by memory polarized distance elements. The paper also discusses the dependence of the resistance coverage on the source to line impedance ratio (SIR) and the type of fault.

## **Phase Rolling and the Impacts on Protection**

*Denglin (Dennis) Tang, Burns & McDonnell*

The presentation will show the impacts of the phase-rolling event (phases swapped by mistake). The analytical study will also be presented due to the lack of such analysis tool/software in the market.

## **High-Speed Communication-Assisted Tripping and Sectionalizing for Distribution Systems**

*Steve Turner, Beckwith Electric Company*

Demonstrates communication-assisted tripping and sectionalizing to quickly isolate faults, reduce clearing times, and simplify complex coordination. Implementation of schemes for distribution systems are included and operational history highlights impact on reliability of utility distribution networks.

## **EXHIBITOR RECEPTION**

4:30–7:00 p.m.

## CONCURRENT SESSIONS

8:30 a.m.–noon

### DISTRIBUTION AUTOMATION/COMMUNICATIONS

Moderator: *Tom Guttormson*

Co-Moderators: *Rick Johnson, Dan Nordell*

#### **Pattern Detection in Distribution Networks Using Complex Event Processing**

*Foued Barouni, Eaton Corporation*

This presentation will introduce a novel approach for spatiotemporal pattern detection in a distribution grid using Complex Event Processing. With this approach, a user will have a better capability to detect interesting situations. An Outage Management System will simultaneously correlate events reported by different Sensors and enhance the user's decision capabilities.

#### **NERC CIP in the Real World on a Real Budget**

*Eric Stranz, Siemens Digital Grid*

Protection and Control System cost-effective design strategies for network isolation, access points, and device security with consideration to NERC CIP V5 (from enterprise to process).

#### **The Importance of Testing Smart Grid IEDs against Security Vulnerabilities**

*Mark Adamiak, GE Energy Connections*

The subject of cyber security is vast and it covers many aspects. This paper focuses on one of these aspects — IED firmware system testing from the security point of view.

#### **Wireless Technology and Application**

*Paul Mercier, Phoenix Contact*

This presentation will show you the different types of wireless technologies available, how they can be deployed in industrial applications, and different aspects to consider when looking to deploying a wireless system.

### PROJECT MANAGEMENT

Moderator: *Greg Owen*

Co-Moderators: *Bethlyn Cummings, Chuck Healy*

#### **Mississippi River Crossing — CapX2020**

*Grant Stevenson, Xcel Energy*

Construction of the CapX2020 Mississippi River crossing required special project management focus including work from barges, special design considerations and managing risks not typically experienced in transmission line construction.

#### **Project Management Advice — Panelists Share Their Insights (the 'Good' and the 'Bad!')**

*Kelly Bloch, Xcel Energy; Cassie Polman, Great River Energy; Jason Hoskins, Ulteig Engineers, Inc.; Denny Branca, Eaton Corporation*

Why do some projects run smoothly and others struggle? Often, project management is the key differentiator. Panelists will share their advice and experiences in managing electric utility projects. Each panelist represents a different stakeholder's point of view: IOU Utility PM, Public Power PM, Consulting Engineering PM, and Technology Supplier PM.

#### **Southern Minnesota Service Territory Sale**

*Kristi Robinson, STAR Energy Services LLC*

In 2015 Alliant Energy sold its Minnesota electric distribution assets to 12 distribution cooperatives. The intricacies of the sale, the regulatory process, and the operational coordination for the transfer of service providers took communication, hard work, and



patience. This presentation will discuss this historic service territory transfer for 45,000 electric consumers in southern Minnesota.

### **Minnesota Power Restoring Thomson Hydro... for the Next Century**

*Christopher Rousseau, Minnesota Power*

Constructed between 1905 and 1907, the Thomson Hydro Station was devastated by a significant flood event in 2012. This presentation will briefly revisit the flood event and specifically focus on the restoration efforts to reconstruct the 72MW station, including civil, mechanical, electrical, and geotechnical engineering specialties.

## **UTILITY INDUSTRY FUTURES II**

Moderator: *Michael Marz*

Co-Moderators: *Jay Morris, Douglas Brown*

### **Transmission Utility's Use of GIS**

*Andy Schmidt, Great River Energy*

GIS has helped the utility with better decision making, project collaboration, maintenance, and future system planning. GIS use is presented with focused on location based analysis, collaboration, visualization, and communication.

### **Detailed Simulation Studies as a Solution to 21st-Century Power System Challenges**

*Michael Ropp, Northern Plains Power Technologies*

This presentation will discuss the use of detailed time-domain computer modeling of distribution circuits and low-inertia power systems as part of the solution to a number of pressing issues brought on by distributed resources, new reliability requirements, and proliferation of low-inertia systems.

### **Distribution System Demand Management with Microgrids**

*Vijay Bhavaraju, Edward Buck, Eaton Corporation*

Microgrid technologies under development allow optimal management of diverse, islandable distribution systems. This discussion covers the application of these technologies in addressing geographically distributed loads and sources specifically for resiliency.

### **Designing Volturnus, a Small Hydro Technology**

*Ted Christopher, Verterra*

Volturnus uniquely harnesses the untapped energy of rivers to produce electricity efficiently and cost-effectively, without the construction of a dam. Learn step-by-step how it was designed.

## **POWER GENERATION**

Moderator: *Scott Hoberg*

Co-Moderators: *Will Lovelace, Dave Bisel*

### **Camp Ripley Solar Partnership**

*Kristopher Spenningsby, Minnesota Power*

The Minnesota National Guard and Minnesota Power have partnered on a 10 MW solar project located at Camp Ripley. This presentation will discuss the Project and the Partnership.

### **Columbia Energy Center Air Quality Control System Retrofit**

*Bob Newell, Alliant Energy*

The Columbia Energy Center is comprised of two nominally rated 525 MW units, built in the 1970's. Due to the Wisconsin Mercury Rule and a settlement agreement with the US EPA, new SO<sub>2</sub> and mercury controls were required to be installed and operational by January 1, 2015. This presentation outlines the development and execution of the project and operational history since start-up of the new equipment.

## **Coordination of Controls of Renewable Power Plants to Meet Steady State and Dynamic Response Requirements for Voltage Control and Reactive Power Supply**

*Daniel Feltes, Siemens Power Technologies International*

This paper addresses the control of voltage and reactive power using as an example an actual wind facility consisting of four wind farms and demonstrates the coordination of the controls including OLTC taps, capacitor banks, and the wind farm controllers.

## **Deer Creek Station—Combined Cycle Generation**

*Gavin McCollam, Basin Electric Power Cooperative*

Brief history and lessons learned from the design and construction of the Deer Creek Station, Basin Electric's only combined cycle power generation facility.

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## **CONCURRENT SESSIONS**

1:00–4:30 p.m.

### **CIVIL-STRUCTURAL**

Moderator: *Rick Johnson*

Co-Moderators: *Brianna Swenson, Bethlyn Cummings*

### **Codes, Standards, Specifications, & Promises—Why Details Matter in Steel Pole and Tower Fabrication**

*Wesley Oliphant, ReliaPOLE Inspection Services Company*

This presentation will focus on the potential significant structural reliability consequences when steel pole and tower suppliers fail to comply with codes, standards, and specifications, and even their own promises of certain performance when fabricating poles and towers for transmission lines.

### **Dirt and Steel: The Need for Geotechnical and Structural Collaboration**

*Marlon Vogt, Ulteig Engineers*

Successful utility projects rely on both solid foundations and properly designed structures. Projects benefit when both disciplines collaborate. This presentation will illustrate the benefits of collaboration with relevant case studies.

### **The Dirt on Soil Investigations**

*John Edlebeck, Coleman Engineering Company*

Subsurface soil investigations are not limited to characterizing subsurface soils for foundation design. A subsurface investigation, if properly developed, can offer much more to support not only the foundation engineering, but also grounding design and construction bidding.

### **River Bank Foundation Design**

*Luke Karels, Duane Phillips, Stanley Consultants, Inc.*

The presentation of design alternatives for transmission structure foundation installation in proximity of river banks and poor soil conditions will be discussed. In addition, there will be a walkthrough review of the mechanisms behind foundation design in poor soil conditions, a review of several examples of geotechnical conditions, and discussion on alternatives related to river crossing design.

## DELIVERY SYSTEMS II

Moderator: *Denny Branca*

Co-Moderators: *Mike Steckelberg, Dave Peterson*

### **Consolidated Edison's Experience with Online Monitoring and Mitigation of Geomagnetic Disturbances**

*Gary Hoffman, Advanced Power Technologies*

This paper will discuss the theory behind how these systems operate and the performance of these GMD monitoring systems at Consolidated Edison, and will provide actual results and the implementation of IEEE Std C57.163-2015 "Guide for Establishing Power Transformer Capability while under Geomagnetic Disturbances" in the deployment of Consolidated Edison's solution.

### **Interharmonics: What They Are, Where They Come From and What They Do**

*Michael B. Marz, American Transmission Company*

Interharmonics are increasing to levels of concern without adequate industry guidelines. This presentation discusses the definition of interharmonics, their sources, and how they impact power systems.

### **History and Application of the MN Stray Voltage Guide**

*Al Haman, STAR Energy Services*

This presentation offers basic principles of stray voltage on dairy farms and introduces the 2015 MN Stray Voltage Guide. Testing protocols and highlights within the Guide will be discussed.

### **40 Ohm Ground Fault Impedance — Still Applicable?**

*Tom Guttormson, Connexus Energy*

40 ohms has been used to represent ground fault resistance when calculating minimum distribution system fault currents. This presentation will review publications and testing to vet the continuing viability of this standard.

## RELAYING II

Moderator: *Neil Stiller*

Co-Moderators: *Dave Bisel, Jake Bernhagen*

### **I Bought It But Do I Have to Use It? AKA: My Favorite Function is the One I Turned Off!**

*Tom Ernst, GE Grid Solutions*

Microprocessor relays were labeled multifunction with their introduction in the '80s, mainly because they were packaged multiphase and multizone. But with today's products it seems like "multi" should be changed to "mega". Do you really need all that stuff and, if not, how do you decide what to use and what to set aside?

### **A Current Story—When Primary Met Secondary**

*Swagata Das, Schweitzer Engineering Laboratories, Inc.*

This presentation describes the analysis and resulting investigation that occurred when a CT secondary wire made contact with a transformer bushing, causing an outage at a 138 kV substation.

### **Applications of Automated Protective Relay Testing**

*Josh LaBlanc, Minnesota Power*

In this presentation we will discuss the application of automation in microprocessor protective relay maintenance and commissioning testing. Applications, design, and testing program benefits will be discussed along with Minnesota Power's lessons learned from implementation and use of automated relay testing.

## **Avoiding Dangerous Relay Testing Practices**

*Scott Cooper, OMICRON*

Legacy test methods frequently utilize unrealistic stimuli and disable programmed logic, bypassing the most common cause of digital relay mis-operations in the field. This presentation discusses relay technology and testing strategies based on the technology of the device under test.

## **METERING**

Moderator: *Jay Morris*

Co-Moderators: *Tom Guttormson, Dan Nordell*

### **Automating the OMS with the DMS—How To Get There**

*Jim Weikert, Power System Engineering, Inc.*

The session will lay out a path which you can follow to expand from traditional operations to bring together SCADA, GIS, and AMI data through new OMS and DMS tools.

### **AMI Deployment at a Rural Electric Cooperative**

*Scott Krueger, Runestone Electric Association*

This presentation will summarize the events that started REA looking at AMI systems, the decision process to select a system, experience to-date installing the equipment, and the benefits the system has been able to deliver.

### **Measuring the Bakken: Metering and Monitoring Power Consumption in Western ND and Eastern MT**

*Jeremy Mahowald, Upper Missouri Power Cooperative*

In an area of intense oil and gas growth, there was a need for increasing data, accuracy, speed, and security. A case study on transmission metering and power measurement will cover the solutions needed to measure the Bakken.

### **Meter Data Everywhere, Is It All the Same?**

*Paul Smith, GE Energy Connections*

There are many sources of power system data. This paper compares and contrasts the different methods of collecting power system data and examines why we have redundant sources.

## **THURSDAY, NOVEMBER 10, 2016**

### **CONCURRENT SESSIONS**

8:30 a.m.–noon

### **TUTORIAL I**

Moderator: *Michael Marz*

Co-Moderators: *Mike Steckelberg, Brianna Swenson*

### **Transmission Lines and Power Flow Analysis**

*Greg Mowry, University of St. Thomas*

In this tutorial a brief overview of AC Steady State analysis will be presented followed by an introduction to long and short transmission lines, 2-bus and multi-bus power flow analysis, and stability.

## TUTORIAL II

Moderator: *Tom Guttormson*

Co-Moderators: *Neil Stiller, Will Lovelace*

### **Predictive Maintenance for Improved Grid Performance**

*John Lauletta, Exacter, Inc.*

Predictive Maintenance replaces run-to failure as an effective and cost-saving strategy for improved overhead and underground grid management. Predictive Maintenance requires conditions-based metrics to provide prioritized actionable information. This Tutorial will discuss the measurement of grid conditions, the analytics behind Predictive Maintenance, and case studies demonstrating the measureable circuit performance improvement.

## TUTORIAL III

Moderator: *Larry Brusseau*

Co-Moderators: *Dave Peterson, Dave Bisel*

### **Relaying 101**

*Thomas Ernst, GE Grid Solutions*

This tutorial is aimed at the engineer who is new to protective relaying or is looking for a high-level refresher. It will be interactive with the audience and will cover the basic application principals of protective relaying including zones of protection, coordination, and back-up protection. Real-life examples will be provided.

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# General Information

## ABOUT THE CONFERENCE

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 and serves as a forum for power engineers to meet with their colleagues from other utilities to discuss mutual concerns.

## LOCATION AND ACCOMMODATIONS

The conference will be held at the Saint Paul RiverCentre, 175 W Kellogg Boulevard, Saint Paul, Minnesota. Parking is available for a fee in the RiverCentre parking ramp, which is located on Kellogg Boulevard across the street from RiverCentre.

A block of rooms have been reserved at the Intercontinental Saint Paul Riverfront, 651-292-1900 and the Holiday Inn Saint Paul Downtown, 651-225-1515.

To receive the special conference rate of \$160 for the Intercontinental Saint Paul Riverfront and \$129 for the Holiday Inn Saint Paul Downtown, identify yourself as a participant of the Minnesota Power Systems Conference. The room block deadline is **October 6, 2016**.

## REGISTRATION AND FEES

The fee for the conference is \$375 if received by October 18; if received after October 18 the fee is \$425. The conference fee includes all sessions, continental breakfasts, luncheons, refreshments breaks, and the exhibitor reception. If you cancel your registration by October 31 a refund, minus \$30, will be issued. If you cancel after this date you will not be eligible for a refund.

## EXHIBITOR RECEPTION

The exhibitor reception will be held on Tuesday, November 8, from 4:30–7:00 p.m. Conference attendees are invited to attend this reception to view the exhibits, meet the exhibitors, and enjoy some hors d'oeuvres and cash bar.

## CONTINUING EDUCATION UNITS (CEUs)

Participants who attend the entire conference will receive 1.5 University of Minnesota, College of Continuing Education CEUs. Participants who attend only Tuesday and Wednesday will receive 1.2 CEUs. One CEU is defined as 10 contact hours of participation in an organized continuing education experience. 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.

## PROGRAM INFORMATION

612-624-4972    cceconf4@umn.edu

## REGISTRATION INFORMATION

612-625-2900    cceinfo@umn.edu

## ADDITIONAL INFORMATION

Visit the conference website – [cce.umn.edu/mnpowersystems](http://cce.umn.edu/mnpowersystems) for additional information on:

- Exhibitor information and registration
- 2017 call for presentations
- Conference papers and PowerPoints

Disability accommodations will be provided upon request. This publication is available in alternative formats upon request.  
Call 612-624-3492.

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# 2016 MIPSYCON Planning Committee

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IEEE Power and Energy  
Society Twin Cities Chapter  
Chair

### **Dave Bisel**

Schweitzer Engineering  
Laboratories

### **Denny Branca**

Eaton Corporation

### **Douglas Brown**

Siemens Power Technologies  
International

### **Larry Brusseau**

Corn Belt Power Cooperative

### **Bethlyn Cummings**

Ulteig Engineers

### \* **Michael Ebert**

Amec Foster Wheeler

### **Kristi Fischer**

University of Minnesota

### **Tom Guttormson**

Connexus Energy

### **Al Haman**

STAR Energy Services

### **Chuck Healy**

Electro Tech

### **Scott Hoberg**

Minnesota Power

### **Rick Johnson**

Otter Tail Power Company

### **Will Lovelace**

Minnkota Power Cooperative

### **Michael Marz**

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### **Steve Mohs**

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### **Jay Morris**

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Basin Electric Power  
Cooperative

### **Dave Peterson**

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### **Philip Spaulding**

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### **Mike Steckelberg**

Great River Energy

### **Neil Stiller**

Rochester Public Utilities

### **Brianna Swenson**

Alliant Energy

### **Marie Villano**

University of Minnesota

### **Helen Weber**

University of Minnesota

### **Bruce Wollenberg**

University of Minnesota

\* Planning Committee Chair

# Registration

CF0425 HW  
Please print or type

**52nd Annual Minnesota Power Systems Conference**

**November 8-10, 2016**

Name (Last) (First) (M.I.)

Business Address (Street/P.O. Box) City State ZIP

E-mail

Company/Institution Title/Position

Daytime Telephone

## Conference Fee

- \$375, Conference Participant Early Fee (received by October 18)  
 \$425, Conference Participant Fee (received after October 18)  
 \$200, Speaker Fee (if attending entire conference)

## Meal Options

- I am requesting vegetarian lunches.  I am requesting gluten-free lunches.  
 I am requesting vegan lunches.

## Tutorial Options

- I plan to attend the Transmission Lines and Power Flow Analysis Tutorial  
 I plan to attend the Predictive Maintenance for Improved Grid Performance Tutorial  
 I plan to attend the Relaying Tutorial  
 I don't plan to attend the Tutorials

## 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).  
 Visa  MasterCard  Discover  American Express

Credit card number Expiration date

Name as printed on card (please print)

Signature of cardholder

## How to Register

### Register Online:

cce.umn.edu/mnpowersystems  
The most secure form of registration

### Fax to (with credit card information):

612-624-5359  
This fax will be received in a secure location

### Mail to (with credit card information):

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