

52nd Annual MINNESOTA POWER SYSTEMS CONFERENCE

November 8–10, 2016

FINAL PROGRAM

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



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Sponsored by:
College of Continuing Education, University of Minnesota

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UNIVERSITY OF MINNESOTA

Program At A Glance

TUESDAY, NOVEMBER 8, 2016

7:00 a.m.	Registration and Continental Breakfast		
	General Session – Grand Ballroom		
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 – Grand Ballroom		
	Substation Room 1	Utility Industry Futures I Ballroom A	Delivery Systems I Room 4
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
1:45	Physical Security Challenges and Responses for High Voltage Transformers	Grid Energy Storage Overview	The Use of Sensors for Distribution and Substation Applications
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
			Understanding the Dynamic Mho Distance Characteristic
			Resistance Coverage of Memory Polarized Distance Elements
			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	Exhibitor Reception (4:30–7:00) – Exhibit Hall A (Lower Level)			
7:00	Adjourn			
WEDNESDAY, NOVEMBER 9, 2016				
7:30 a.m.	Registration and Continental Breakfast			
	Distribution Automation/Communications Ballroom E		Power Generation Room 1	
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 – Grand Ballroom			

WEDNESDAY, NOVEMBER 9, 2016 (continued)

	Civil-Structural Ballroom A	Delivery Systems II Room 4	Relaying II Ballroom E	Metering Room 1
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 Room 4	Tutorial II Room 1		Tutorial III Ballroom A
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 – Grand Ballroom

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, Senior Advisor, Critical Infrastructure & Protection Group, Johns Hopkins University

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, Strategic Director, Transmission & Distribution World; Jim Dukart, Videographer, Transmission & Distribution World

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.

CONCURRENT SESSIONS

1:00–4:30 p.m.

SUBSTATION – Room 1

Moderator: *Steven Mohs*

Co-Moderators: *Bethlyn Cummings, Brianna Swenson*

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 – Ballroom A

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

Tessa Haagenson, 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 – Room 4

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 – Ballroom E

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 – Exhibit Hall A (Lower Level)

4:30–7:00 p.m.

CONCURRENT SESSIONS

8:30 a.m.–noon

DISTRIBUTION AUTOMATION/COMMUNICATIONS – Ballroom E

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 – Room 4

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 – Ballroom A

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

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 – Room 1

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 SO₂ 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.

CONCURRENT SESSIONS

1:00–4:30 p.m.

CIVIL-STRUCTURAL – Ballroom A

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 – Room 4

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 – Ballroom E

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 – Room 1

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 – Room 4

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 – Room 1

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 – Ballroom A

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.

General Information



GUIDEBOOK MOBILE APP

The Minnesota Power Systems Conference has gone mobile! Attendees can plan their days with a personalized schedule and browse concurrent sessions, exhibitors, and venue maps. The app is compatible with iPhones, iPads, and Android devices. Windows Phone and Blackberry users can access the same information via the mobile site: <http://guidebook.com/guide/67020>

iOS and Android users:

- Download 'Guidebook' from the Apple App Store or the Android Marketplace
- Scan the following image with your mobile phone's QR-Code reader



WI-FI INFORMATION

Saint Paul RiverCentre's public Wi-Fi signal is called "RC_FreeWifi" and can be accessed in all areas of the complex. Connect to the signal and then review and accept the terms on the page that auto populates.

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.

ADDITIONAL INFORMATION

Visit the conference website – cce.umn.edu/mnpowersystems for additional information on:

- 2017 call for presentations
- Conference papers and PowerPoints

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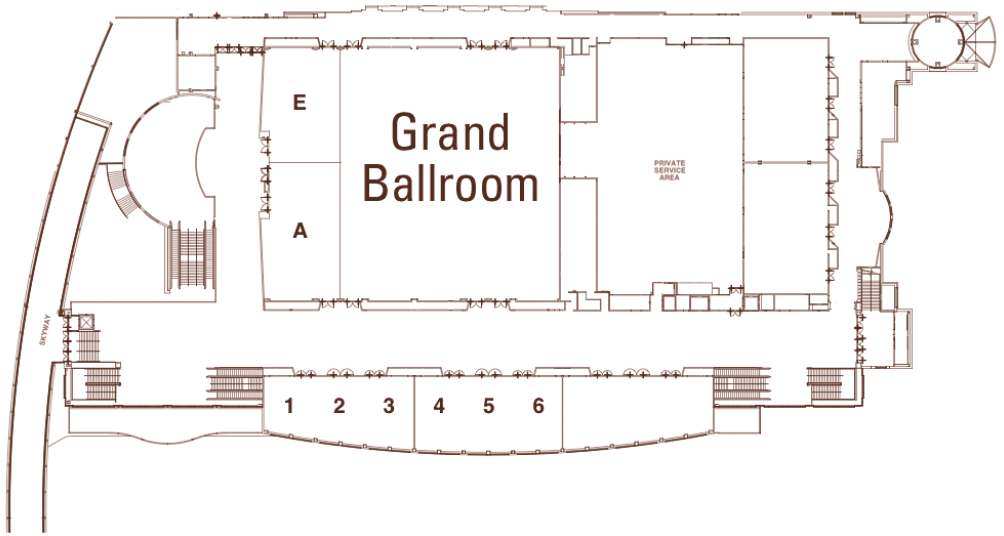
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Notes

Saint Paul RiverCentre

Main Level



Lower Level

