Due to COVID-19 precautions, all attendees must wear masks to all classes & events (except when eating and drinking), even if they have been vaccinated. Hand sanitizer stations will be set up in various places. Please refrain from hand shaking and observe social distancing as much as possible. Thank you for your understanding & commitment to safety, a hallmark value of the NC Electric Meter School & Grid Technology Conference for generations.

90th Annual NC Electric Meter School and Grid Technology Conference

Embassy Suites
Kingston Plantation
Myrtle Beach, South Carolina
June 12-16, 2022

Offered by the Office of Professional Development
North Carolina State University, Raleigh, North Carolina
Electricity metering has been in existence for over 100 years. Metering has continued to evolve in functionality and complexity over this period. The NC Meter School has long served the purpose of providing a place where the metering discipline, skills, changes, products, and practices are learned and discussed. The industry has progressed with today’s technology, and metering interfaces have become varied and often directly related to other grid technologies. The NC Electric Meter School and Grid Technology Conference will continue to be current and proactive.
The North Carolina Electric Meter School and Grid Technology Conference includes topics and products related to electric metering and the electrical grid as follows:

**Electricity Metering**
All aspects of metering to include installation, removal, testing, maintenance, and management practices. Examples may include any metering quantity measurement for revenue or other operational purposes.

**Revenue**
Tariffs, rate practices, and other aspects associated with the accurate measurement of electricity. Examples may include any method or equipment to read, record, and/or verify accurate metering.

**Communications**
Remote communications, including many forms and technology options, related to metering and/or other electrical equipment operations. Examples may include metering and other electrical grid hardware that requires communications between devices or from field to host. May also include modems, fiber, cellular, local, or other means of communications media or methods; tools or equipment.

**IT/Computer/Programmable Devices**
Metering and other grid operational/support systems or equipment. Examples may include metering devices and associated equipment to upload/download programs/configurations; diagnostic equipment; and associated tools and methods.

**Security**
Physical, cyber, and data protection options to safeguard the revenue and operational integrity of the electrical system. Examples may include pre- and post-energy tampering security methods and systems.

**Renewable/Alternative Energy**
Metering interfaces to measure power at these different types of facilities. Examples may include solar, wind or other alternative means of generation.

**Generation, Transmission, and Distribution**
Equipment and practices associated with any aspect of the electric grid, including but not limited to AMI (advanced metering infrastructure). Examples may include relay; substation; metered data from generation, transmission, and other distribution/grid management systems.

**Customer Service**
Services or equipment to provide enhanced customer service options for the customer that may be from within the meter or associated metering data, or other services past the meter. Examples may include metering data or pre-pay.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Information</td>
<td>5-6</td>
</tr>
<tr>
<td>Registration &amp; Fees</td>
<td>6</td>
</tr>
<tr>
<td>Cancellation &amp; Substitution</td>
<td>7</td>
</tr>
<tr>
<td>Meter Calibration</td>
<td>7</td>
</tr>
<tr>
<td>Banquet</td>
<td>7</td>
</tr>
<tr>
<td>Accommodations</td>
<td>7</td>
</tr>
<tr>
<td>Mission &amp; Steering Committee</td>
<td>8</td>
</tr>
<tr>
<td>About the Tracks</td>
<td>9, 10</td>
</tr>
<tr>
<td>Conference Schedule</td>
<td>11-23</td>
</tr>
<tr>
<td>Manufacturer Programming Sessions</td>
<td>24</td>
</tr>
<tr>
<td>2022 Program Committee</td>
<td>25</td>
</tr>
<tr>
<td>Hall of Fame</td>
<td>27</td>
</tr>
</tbody>
</table>
Purpose and Mission

The North Carolina Electric Meter School and Grid Technology Conference provides you with an excellent opportunity to learn all aspects of metering in a school environment. The basic principles are provided for metering personnel with interest in single phase or polyphase equipment.

You will gain valuable exposure to metering applications and the processing of information gathered from metering, presented in advanced and management levels of instruction. Advanced and management level attendees will take away knowledge of problems, resources, and solutions helping to meet the changing environment of the electric industry.

Metering and utility personnel can increase their knowledge of substations and distribution equipment through two tracks. Information will be presented from utility experience as well as vendor perspectives.

Annually, the North Carolina Electric Meter School and Grid Technology Conference brings together meter personnel from the electric utility industry to present important information on common problems, standard practices, procedures, and new technologies. The school is open to any and all persons interested in this opportunity.

Attention: Professional Engineers

The North Carolina Electric Meter School and Grid Technology Conference is an approved sponsor of continuing professional competency activities for qualifying North Carolina Professional Engineers and Registered Land Surveyors. Upon course completion, each participant may receive 18 Professional Development Hours (PDHs).

Note: These PDHs are only for participants with a North Carolina Professional Engineering license. Other states may approve these courses. It is the responsibility of the attendees to check with their respective certifying agencies to see if they will accept this training.
About the 90th Conference

The 90th Annual North Carolina Electric Meter School and Grid Technology Conference is coordinated by the Office of Professional Development and will take place June 12-16, 2022. All events will be held at the Embassy Suites at Kingston Plantation, Myrtle Beach, SC.

The program committee attempts each year to design the advanced and management tracks so that individuals find it worthwhile and profitable to attend. The conference includes discussions and presentations on metering practices, new equipment, and new developments.

The single phase and polyphase tracks require a calculator with scientific functions. Individuals planning to attend the single phase or polyphase track are also encouraged to bring a copy of the *Handbook for Electricity Metering* to the school. For information on this publication contact EEI, 202.508.5000.

Registration & Fees

Registration for the School & Conference will be held in the lobby of the Embassy Suites, Myrtle Beach, SC, from 5-7 p.m. on Sunday, June 12; from 8 a.m. to 4 p.m. on Monday and Tuesday, June 13 and 14, and 8 a.m. to noon on Wednesday, June 15.

**Early bird registration fee:** $520 through May 27

**After May 27 and walk-in fee:** $620

The registration fee includes the welcome reception on Sunday evening, networking socials and lunches Monday-Wednesday, breaks and continental breakfasts Monday-Thursday.

Single Day: A single day registration fee is available at $370 per person per day (includes lunch on that day, except Thursday).

More Information: For more information or to register online, visit the conference website at go.ncsu.edu/ncems

If you are a person with a disability and desire any assistive devices, services, or other accommodations to participate in this course, please contact the Office of Professional Development at 919.515.2261 or email ContinuingEducation@ncsu.edu to discuss your needs at least 2 weeks in advance of the program.

Cancellation & Substitution

If your plans should change, you may designate a substitute to attend in your place at any time. In the event that you need to cancel your registration, you may do so with a full refund if you inform us by email by May 27. **No reimbursement will be made for cancellations made after May 27 or if you fail to attend.** Non-paid no shows who registered by phone, fax, internet, or mail will be billed.
Reference Standard Calibration Check

An added benefit is being offered to you during the conference at no additional charge. After registering, and while attending the conference, please stop by the Winchester room reserved by Radian Research/WECO to have your reference standard(s) tested against a Radian NIST traceable 0.01% reference standard. You will receive a printed and/or electronic “Report of Calibration” which provides the accuracy of your standard at all common loading conditions.

If you think you are up to the challenge, test your meter calibration knowledge by taking a fun quiz. In addition, receive a packet explaining the importance of regular calibration of your equipment.

Accommodations

Headquarters for the 2022 North Carolina Electric Meter School and Grid Technology Conference will be:

**Embassy Suites Hotel at Kingston Plantation**
9800 Queensway Blvd.
Myrtle Beach, SC 29572

Kingston Plantation offers a variety of accommodations. (Lodging is NOT included in the registration fee.) To review the various types of accommodations and to make reservations online, please visit go.ncsu.edu/ncems and click on the Accommodations tab.

After reviewing the options online, if you prefer, you may call 800.876.0010 and mention code CEM for lodging at Embassy Suites, code EMS for Hilton and Royal Palms or code NCM Kingston Plantation to receive special NC Electric Meter School rates. The room block will be released on May 10 unless it fills prior to the release date.

Banquet

A special 90th anniversary banquet for conference participants and their guests will be held on Wednesday evening, June 15 at the Embassy Suites. The banquet is included in the registration fee. Guest tickets are available at $65 each. Youth tickets for those ages 15-18 are available for $37.50 each. Tickets for children up to age 14 are available at no fee. Dress is casual. A social will begin at 6 p.m. followed by the banquet at 7 p.m.

COVID-19 Precautions

Due to COVID-19 precautions, all attendees must wear masks to all classes and events (except when eating and drinking), even if they have been vaccinated. Hand sanitizer stations will be set up in various places. Please refrain from hand shaking & observe social distancing as much as possible. Thank you for your understanding & commitment to safety, a hallmark value of the NC Electric Meter School & Grid Technology Conference for generations.
Steering Committee Mission Statement
To represent the planning committee as a working group with a mission to guide the School, its programs, and its activities in a way deemed appropriate by the planning committee and in the best interest of the North Carolina Electric Meter School and Grid Technology Conference.

Steering Committee
Chairperson: Chad Cooper
Vice Chairperson: Greg Johnson
Secretary/Treasurer: Connie McElroy-Bacon

<table>
<thead>
<tr>
<th>COMMITTEES</th>
<th>CHAIRPERSON</th>
<th>VICE CHAIRPERSON(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Phase</td>
<td>Clare Bargerstock</td>
<td>Rodney Brown</td>
</tr>
<tr>
<td>Polyphase</td>
<td>Chad Cooper</td>
<td>Greg Johnson</td>
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<tr>
<td>Advanced</td>
<td>Rusty Mutschink</td>
<td>Tony Horton</td>
</tr>
<tr>
<td>Management</td>
<td>Kenneth McCraw</td>
<td>Jimmy Green</td>
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<tr>
<td>Substation and Distribution (Basic)</td>
<td>Curtis Craig</td>
<td>Bob Wilcox</td>
</tr>
<tr>
<td>Substation and Distribution (Advanced)</td>
<td>John Maclaga</td>
<td>Bob Wilcox</td>
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<tr>
<td>Emerging Technologies</td>
<td>Jason Parker</td>
<td>Garey Edwards, Angela Hare, Tony Horton</td>
</tr>
<tr>
<td>Hall of Fame</td>
<td>Tony Horton</td>
<td>Jimmy Grubbs</td>
</tr>
<tr>
<td>Mfrs./Hospitality</td>
<td>Craig Shoaf</td>
<td>Jeff Lewis</td>
</tr>
<tr>
<td>Banquet/Entertainment</td>
<td>Connie McElroy-Bacon</td>
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<tr>
<td>Members at Large</td>
<td>Sean Dempsey, Dean Williams, Tim Overbee, Raeann Miller</td>
<td></td>
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</tbody>
</table>
SINGLE PHASE
The single phase track is designed for the entry-level person. Classes are designed to provide a basis for understanding metering principles, power and to complement the participant’s metering skills gained on the job. Sessions offered cover overviews of a power system, basic math, AC and DC theory, meter testing safety and all areas related to single phase meters. The classes are designed to prepare participants for the next level of classes relating to polyphase meters.

POLYPHASE
The polyphase track is designed for the purpose of providing participants with an overview of the basic information needed to understand polyphase metering. This session covers selection, installation, and maintaining polyphase meters. The session provides training on programming polyphase meters. Participants also will receive training in the selection, use, and maintenance of current and voltage transformers.

ADVANCED
The advanced track includes topics on complex metering theory and concepts, high-end metering applications, power quality, remote metering communication methods and other advanced metering applications, tools and equipment. Individuals that have previous metering experience or education should attend this session.

MANAGEMENT
The management track provides information about the newest technologies, current industry trends, day to day operational issues, as well as updates on new technology implementation projects. This track is ideal for professionals and managers who want to learn more about the metering industry, where it is headed and current challenges.

BASIC SUBSTATION & DISTRIBUTION PRINCIPLES
This track is designed to provide entry-level knowledge of substations and distribution systems. It is ideal for substation personnel with less than two years’ experience or meter technicians who work occasionally in substations. Classes cover the fundamentals of substation construction, proper grounding, electrical layout, and the purpose for typical equipment in a substation. Examples include safety, station power transformers, batteries, circuit breakers, capacitors, switches, voltage regulators, basic communications, metering, and other miscellaneous components found in most substations. Classes are also offered to cover distribution system operation and the various types of equipment used.
ADVANCED SUBSTATION & DISTRIBUTION CONCEPTS
This track is geared towards experienced substation and meter technicians as well as supervisors and managers who maintain, repair, and/or oversee the daily operation of substations. Classes cover advanced calibration, maintenance and repair of station equipment as well as troubleshooting techniques of station components. Included are classes on remote communication controls. SCADA, grounding, oil testing, welding, relays, voltage reduction, security protocols, lightning protection, IEEE and OSHA requirements, AMI equipment, infrared, and high frequency testing. Classes are also offered to cover various distribution system operation methods and techniques, and various types of equipment used.

EMERGING TECHNOLOGIES
The Emerging Technologies Track provides an opportunity to explore how electric metering and the overall electric grid are working together in a variety of ways. New technologies, methods, tools, equipment, and challenges will be discussed. In addition to revenue metering as part of the overall electric grid this session will include a forum for Security, Renewables/Alternative Energy, Communications, IT/Computer/Programmable Devices, and Customer Service issues.
Conference Schedule

Sunday, June 12, 2022

2:00 p.m.  Begin Vendor Set-up – Embassy Suites, Kensington Ballroom
5:00–7:00 p.m.  Registration – Embassy Suites Lobby
6:00–7:00 p.m.  Welcome Reception – Kensington Ballroom

Monday, June 13, 2022

General Session

Presiding:  Chad Cooper, Dominion Energy, SC
9:00 a.m.  Welcome to the School
Chad Cooper, Dominion Energy, SC

Presentation of Colors
Opening Comments
Connie McElroy-Bacon, Conference Manager,
NC State University
9:30 a.m.  Welcome from NC State University Continuing Education
Mark Bernhard, Vice Provost, Continuing Education,
NC State University
9:45 a.m.  Battery/Energy Storage, EV Charging, Demand Side Management
Peter Muhoro, Rappahannock Electric
10:45 a.m.  Break
11:00 a.m.  Overview FREEDM Systems Center at NC State University
Ken Dulaney, NC State University
12:00 p.m.  Lunch
Presiding:  Chad Cooper, Dominion Energy, SC
1:00 p.m.  What can I do now with all of this data?
Scott Mossbrooks, mPower Innovations
2:30 p.m.  Break
2:45 p.m.  Single Phase, Polyphase, Advanced, Basic Substation & Distribution, Advanced Substation & Distribution and Emerging Technologies Sessions Begin
2:45 p.m.  Visit Vendors, Management Track Participants
### Track Sessions Begin

#### SINGLE PHASE
Presiding: Clare Bargerstock, Northern Virginia Electric Coop

2:45 p.m. **Overview of a Power System**  
Clare Bargerstock, Northern Virginia Electric Coop

4:15 p.m. **Adjourn / Networking Social**

#### POLYPHASE / SINGLE PHASE COMBINED SESSION
Presiding: Jimmy Grubbs, SCE&G (Retired)

2:45 p.m. **Polyphase Metering 101**  
Tom Lawton, TESCO – The Eastern Specialty Company

4:15 p.m. **Adjourn / Networking Social**

#### ADVANCED
Presiding: Rusty Mutschink, Central Electric Power Cooperative

2:45 p.m. **Meter Site Testing and Analysis**  
Ryan Roth, Radian Research

4:15 p.m. **Adjourn / Networking Social**

#### MANAGEMENT
2:45 p.m. **Visit Vendors**

4:15 p.m. **Adjourn / Networking Social**

#### SUBSTATION & DISTRIBUTION BASIC
Presiding: Curtis Craig, Shenandoah Valley Electric Cooperative (Retired)

2:45 p.m. **Introduction to Subsations I: Equipment**  
Court H. Weathers, PE, Booth & Associates LLC

4:15 p.m. **Adjourn / Networking Social**

#### SUBSTATION & DISTRIBUTION ADVANCED
Presiding: John Maclaga, City of Statesville

2:45 p.m. **Lightning Round**  
John Maclaga, City of Statesville

4:15 p.m. **Adjourn / Networking Social**

#### EMERGING TECHNOLOGIES
Presiding: Bob Whitmore, Radian Research

2:45 p.m. **Survey of Emerging Technologies**  
Sean Dempsey, WESCO Anixter

4:15 p.m. **Adjourn / Networking Social**
## SINGLE PHASE

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Presenter</th>
<th>Company</th>
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</thead>
<tbody>
<tr>
<td>8:00 a.m.</td>
<td><strong>Math for Electricity Metering</strong></td>
<td>Michael Corbin</td>
<td>Honeywell</td>
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<tr>
<td>9:00 a.m.</td>
<td><strong>Theory of AC and DC Meter Testing</strong></td>
<td>Tom Lawton</td>
<td>TESCO</td>
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<tr>
<td>10:00 a.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>10:15 a.m.</td>
<td><strong>Watthour Meter Principles</strong></td>
<td>Tom Van Valkenburg</td>
<td>Radian Research</td>
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<tr>
<td>12:00 p.m.</td>
<td><strong>Lunch</strong></td>
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<tr>
<td>1:00 p.m.</td>
<td><strong>Understanding Nameplate Basics</strong></td>
<td>Ryan Alkire</td>
<td>GE Instrument</td>
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<td>Transformers</td>
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<td>2:00 p.m.</td>
<td><strong>Watthour Meter Configurations</strong></td>
<td>Chris Prince</td>
<td>Hubbell/Aclara</td>
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<tr>
<td>3:00 p.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>3:15 p.m.</td>
<td><strong>Introduction to Watthour Meter Testing</strong></td>
<td>John Jones</td>
<td>Powermetrix</td>
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<tr>
<td>4:15 p.m.</td>
<td><strong>Adjourn / Networking Social</strong></td>
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## POLYPHASE

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>8:00 a.m.</td>
<td><strong>AC Theory</strong></td>
<td>Phil Fischbach</td>
<td>Powermetrix</td>
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<tr>
<td>9:00 a.m.</td>
<td><strong>Polyphase Electric Meter Applications</strong></td>
<td>Michael Corbin</td>
<td>Honeywell</td>
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<tr>
<td>10:00 a.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>10:15 a.m.</td>
<td><strong>Instrument Transformer Basics</strong></td>
<td>Jon S. Rennie</td>
<td>Peak Demand, Inc.</td>
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<tr>
<td>11:00 a.m.</td>
<td><strong>CT Test Principles</strong></td>
<td>Ryan Roth</td>
<td>Radian Research</td>
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<tr>
<td>12:00 p.m.</td>
<td><strong>Lunch</strong></td>
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<tr>
<td>1:00 p.m.</td>
<td><strong>Visit Vendors</strong></td>
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<tr>
<td>2:15 p.m.</td>
<td><strong>Site Inspections - Looking for Dangerous Installations and Incorrect Billing</strong></td>
<td>Tom Lawton</td>
<td>TESCO</td>
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<tr>
<td>3:00 p.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>3:30 p.m.</td>
<td><strong>Metering Terms</strong></td>
<td>Joe Ostrowsky</td>
<td>AMETEK</td>
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<td>3:45 p.m.</td>
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<tr>
<td>4:15 p.m.</td>
<td><strong>Adjourn / Networking Social</strong></td>
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## ADVANCED

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 a.m.</td>
<td><strong>Ratio, Burden, Admittance Testing</strong></td>
<td>John Williams, TESCO</td>
</tr>
<tr>
<td>8:45 a.m.</td>
<td><strong>Advanced Functional Meter Testing</strong></td>
<td>Chad Marcum, Radian Research</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td><strong>Using Vector Diagrams with Site Testing</strong></td>
<td>Steve Hudson, Powermetrix</td>
</tr>
<tr>
<td>10:15 a.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>10:30 a.m.</td>
<td><strong>Theory of AC and DC Meter Testing</strong></td>
<td>Tom Lawton, TESCO</td>
</tr>
<tr>
<td>11:15 a.m.</td>
<td><strong>Instrumentation Data - the Meter as a Sensor and Data Logger</strong></td>
<td>Bryan Seal, Itron</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td><strong>Lunch</strong></td>
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<tr>
<td>1:00 p.m.</td>
<td><strong>How to Use Vector Data to Identify Issues</strong></td>
<td>Mark Hubbard, Dominion Energy</td>
</tr>
<tr>
<td>1:45 p.m.</td>
<td><strong>Waveshape Analysis</strong></td>
<td>Dan Sabin, Schneider Electric</td>
</tr>
<tr>
<td>2:30 p.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>2:45 p.m.</td>
<td><strong>Accuracy Testing of Form 5 Meters</strong></td>
<td>Victor Love, Schweitzer</td>
</tr>
<tr>
<td>3:30 p.m.</td>
<td><strong>Visit Vendors</strong></td>
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</tr>
<tr>
<td>4:15 p.m.</td>
<td><strong>Adjourn / Networking Social</strong></td>
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## MANAGEMENT

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<thead>
<tr>
<th>Time</th>
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</tr>
</thead>
<tbody>
<tr>
<td>8:00 a.m.</td>
<td><strong>Leveraging AMI System for Municipal Services - From Electric to Sanitary Sewer Overflow</strong></td>
<td>Bryan Seal, Itron</td>
</tr>
<tr>
<td>8:45 a.m.</td>
<td><strong>Consideration of Adding AMI to Distribution Transformers</strong></td>
<td>John Kretschmar, SAMSCO</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td><strong>New Challenges in KYZ Pulse Metering with AMI Meters</strong></td>
<td>Bill Brayden, Brayden Automation</td>
</tr>
<tr>
<td>10:15 a.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>10:30 a.m.</td>
<td><strong>Benefits of LoRa Communications</strong></td>
<td>Randy Austin, Vision Metering, LLC</td>
</tr>
<tr>
<td>11:15 a.m.</td>
<td><strong>Cellular Communications for Utilities</strong></td>
<td>Jon Scott, Nighthawk</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td><strong>Lunch</strong></td>
<td></td>
</tr>
<tr>
<td>1:00 p.m.</td>
<td><strong>Monitoring to Reduce Maintenance Costs and Reduce/Prevent Outages</strong></td>
<td>Deborah McLeod, Emlogix</td>
</tr>
<tr>
<td>1:45 p.m.</td>
<td><strong>Resources and Strategies for Protecting Revenue, People and Physical Assets - Mitigating Risk and Losses at the Meter and Beyond</strong></td>
<td>Steve Diebold, American Casting &amp; Mfg Corp.</td>
</tr>
</tbody>
</table>
1:45 p.m.  Power Outage! - Zones of Protection  
Paul Smith, GE

2:30 p.m.  Break

2:45 p.m.  Introduction to Differential Protection  
Luke Booth, Schweitzer Engineering Laboratories

3:30 p.m.  Key Elements of Distribution Design (NESC)  
Bill Jordan, Booth & Associates

4:15 p.m.  Adjourn / Networking Social

SUBSTATION & DISTRIBUTION
BASIC
Presiding:  Frank Lopez, GE

8:00 a.m.  Introduction to Substation II: Protection  
Court Weathers, Booth & Associates, LLC

9:30 a.m.  Introduction to Distribution Reclosing  
Anthony Rahiminejad, Schweitzer Engineering Laboratories

10:15 a.m.  Break

10:30 a.m.  BCT – What I Should Know?  
Ryan Alkire, GE Instrument Transformers

11:15 a.m.  Substation Mathematics  
Brett Cockerham, Schweitzer Engineering Laboratories

12:00 p.m.  Lunch
Presiding:  Mike Gaston, WESCO

1:00 p.m.  Metering in Distribution Applications  
Anthony Rahiminejad, Schweitzer Engineering Laboratories

1:45 p.m.  Power Outage! - Zones of Protection  
Paul Smith, GE

2:30 p.m.  Break

2:45 p.m.  Introduction to Differential Protection  
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4:15 p.m.  Adjourn / Networking Social

SUBSTATION & DISTRIBUTION
ADVANCED
Presiding:  Rodney Brown, Dominion

8:00 a.m.  Reduce Fault Energy Using Selective Instantaneous Overcurrent Element  
Daniel Gillen, City of Wilson, NC - Wilson Energy

8:45 a.m.  Real World Experiences with Real Time Equipment Monitoring  
Joel Valley, PWC of Fayetteville

9:30 a.m.  G&W FLISR  
Eric Brandstaedter, G&W

10:15 a.m.  Break

10:30 a.m.  Application of Retrofit External Bushing CT’s for Metering & Relaying in Substation Applications  
Lee Bingham, Instrument Transformer Equipment Corp.

11:15 a.m.  Using High Accuracy, Extended Range CT’s for Solar & Wind Projects - When They Should & Should Not be Used  
David Ward, Instrument Transformer Equipment Corp.
Tuesday (continued)

12:00 p.m.  Lunch
Presiding: Rick Anderson, Fayetteville PWC, (Retired)

1:00 p.m.  Advanced Regulator Controls with Distributed Energy Resources
Roger Munay, Eaton

1:45 p.m.  Advanced Recloser Applications
Roger Munay, Eaton

2:30 p.m.  Break

2:45 p.m.  Substation Asset Management
Nand Singh, MinMax

3:30 p.m.  More than the Basics of Faulted Circuit Indicators
William Narshall and Rick Anderson, Smart Grid Solutions

4:15 p.m.  Adjourn / Networking Social

9:30 a.m.  Distributed Intelligence - An Update on Using Local Processing at the Meter
Bryan Seal, Itron

10:15 a.m.  Break

10:30 a.m.  Electric Vehicle Impacts - Is the Grid Ready?
Jimmy Woods, Border States Electric

11:15 a.m.  Asset Insights Through Analytics
Paul Fratellone, TESCO

12:00 p.m.  Lunch
Presiding: Blake Zorn, L&G

1:00 p.m.  Certifying DC Electric Vehicle Fast Chargers and AC Level Two Chargers
Iosif Grigoryev or Tom Lawton, TESCO

1:45 p.m.  Advancing Business Process Automation in Field Service Management
Paul Fratellone, TESCO

2:30 p.m.  Break

2:45 p.m.  Solutions for Protecting Distribution Systems with Solar Farm Installations
Brett Cockerham, Schweitzer Engineering Laboratories

3:30 p.m.  Distributed Energy Resources (DER)- Trends in the DER Space
John Steinberger, Itron

4:15 p.m.  Adjourn / Networking Social

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**EMERGING TECHNOLOGIES**

Presiding: Chris Rigsbee, WESCO Anixter

8:00 a.m.  Some New Things to Chew On Ya’il: IPMeter, Cellular DR, FTTH, EV Energy, Management Circuit Breaker/EV Charging
Michele Brown, Eaton

8:45 a.m.  The Impact of Grid Modernization on the Performance of Metering Current Transformers
Jon Rennie, Peak Demand, Inc.
Wednesday, June 15, 2022

**SINGLE PHASE**

Presiding: Preston Fry, Chapman Co.

8:00 a.m. **Meter Mounting Devices**  
Nick Chandler, The Durham Company

9:00 a.m. **Meter Testing 101**  
Tom Lawton, TESCO

10:00 a.m. **Break**

10:15 a.m. **Visit Vendors**

11:00 a.m. **Programming Workshop for Single Phase Meters**  
Will Elliott, Hubbell/Aclara

12:00 p.m. **Lunch**

Presiding: Paul Keadle, NTS

1:00 p.m. **Programming Workshop for Single Phase Meters (continued)**  
Ken Hause, Itron

2:00 p.m. **Break**

2:15 p.m. **Programming Workshop for Single Phase Meters (continued)**  
Scott Finley, NTS

3:15 p.m. **Programming Workshop for Single Phase Meters (continued)**  
Dan Riddle, Honeywell

4:15 p.m. **Adjourn**

6:00 p.m. **Networking Social**

7:00 p.m. **Banquet**

**POLYPHASE**

Presiding: Greg Johnson, Alabama Power

8:00 a.m. **Options to mitigate VT/PT issue with System Ferro-resonance and VFTOV(Very Fast Transient Over-voltage)**  
Roger Lapay, ABB

9:00 a.m. **Instrument Transformer Theory & Testing**  
Phil Fischbach, PowerMetrix

9:45 a.m. **Break**

10:00 a.m. **Programming Polyphase Meters-Session 1**  
Vendor Rooms — Itron, Aclara, Honeywell  
Dale Prashad

11:00 a.m. **Programming Polyphase Meters-Session 2**  
Vendor Rooms — Itron, Aclara, Honeywell, Landis + Gyr  
Diego Barquero

12:00 p.m. **Lunch**

Presiding: Jimmy Grubbs, (Retired)

1:00 p.m. **ANSI Meter Forms**  
Tom Lawton, TESCO

2:00 p.m. **Instrument Transformers – Understanding Nameplate Basics**  
Ryan Alkire, GE Instrument Transformers

3:00 p.m. **Break**

3:15 p.m. **Bill Estimating After Meter Issues**  
Mark Hubbard, Dominion Energy

4:15 p.m. **Adjourn**

6:00 p.m. **Networking Social**

7:00 p.m. **Banquet**
Wednesday (continued)

**ADVANCED**

**Presiding:** Jeanne Kretzschmar, SAMSCO

**8:00 a.m.**  
**CT Testing: Theory and Practice**  
Tom Lawton, TESCO

**8:45 a.m.**  
**Sizing Instrument Transformers for Most Accurate Metering Performance**  
Ryan Alkire, GE Instrument Transformers

**9:30 a.m.**  
**The Benefit of High Accuracy, Extended Range Current Transformers**  
Jon Rennie, Peak Demand Inc.

**2:30 p.m.**  
**Break**

**2:45 p.m.**  
**KYZ Pulse Metering**  
Bill Brayden, Brayden Automation/Solid State Instruments

**3:30 p.m.**  
**Next Generation Cellular: Navigating Obsolescence and Emerging Technologies**  
Michael Coddington, Duke Energy

**4:15 p.m.**  
**Adjourn**

**6:00 p.m.**  
**Networking Social**

**6:30 p.m.**  
**Banquet**

**MANAGEMENT**

**Presiding:** Phil Dudley, Texas Meter Device

**8:00 a.m.**  
**Safety in Field Metering Equipment**  
Steve Hudson, Powermetrix

**8:45 a.m.**  
**Personal Protective Equipment & Regulatory Compliance Attainment**  
Paul Fratellone, TESCO

**9:30 a.m.**  
**Meter Asset Management 101**  
Chad Marcum, Radian Research

**10:15 a.m.**  
**Break**

**10:30 a.m.**  
**21st Century Power Measurements**  
Tom Lawton and Bill Hardy, TESCO

**11:15 a.m.**  
**Billing vs. Metering Accuracy**  
John Jones, Powermetrix

**12:00 p.m.**  
**Lunch**
### MANAGEMENT (continued)

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>1:00 p.m.</td>
<td><strong>Renewable Energy and BESS</strong></td>
<td>Edward Kobeszka, Power Engineers</td>
</tr>
<tr>
<td>1:45 p.m.</td>
<td><strong>Considerations for a Cryptocurrency Operation</strong></td>
<td>Garey Edwards, City of High Point</td>
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<tr>
<td>2:30 p.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>2:45 p.m.</td>
<td><strong>Panel Discussion - Impacts on Operations as a Result of the Pandemic, Supply Chain and Different Technologies</strong></td>
<td>Kenneth McGraw, Duke Energy; Clare Bargerstock, NOVEC; Garey Edwards, City of High Point; Sean Dempsey, WESCO; Jeff Lewis, PowerTech, LLC; Tina Pampanelli, Itron</td>
</tr>
<tr>
<td>4:15 p.m.</td>
<td><strong>Adjourn</strong></td>
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### SUBSTATION & DISTRIBUTION BASIC

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>8:00 a.m.</td>
<td><strong>Event Analysis Basics Part 1</strong></td>
<td>Anthony Rahiminejad, Schweitzer Engineering Laboratories</td>
</tr>
<tr>
<td>8:45 a.m.</td>
<td><strong>Event Analysis Basics Part 2</strong></td>
<td>Anthony Rahiminejad, Schweitzer Engineering Laboratories</td>
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**Wednesday**

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<tr>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>9:30 a.m.</td>
<td>Microprocessor Based Relay Testing Principles</td>
<td>Luke Booth, Schweitzer Engineering Laboratories</td>
</tr>
<tr>
<td>10:15 a.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>10:30 a.m.</td>
<td>Power Transformer Protection</td>
<td>Paul J. Smith, GE Grid Solutions</td>
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<tr>
<td>11:15 a.m.</td>
<td>Distribution Feeder Protection</td>
<td>Paul J. Smith, GE Grid Solutions</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td>Lunch</td>
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<tr>
<td>1:00 p.m.</td>
<td><strong>Troubleshooting Meter Connections in Distribution Applications</strong></td>
<td>Brett Cockerham, Schweitzer Engineering Laboratories</td>
</tr>
<tr>
<td>1:45 p.m.</td>
<td>Overcurrent Protection Principles</td>
<td>Luke Booth, Schweitzer Engineering Laboratories</td>
</tr>
<tr>
<td>2:30 p.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>2:45 p.m.</td>
<td>Control and Automation of Distribution Capacitor Banks</td>
<td>Brett Cockerham, Schweitzer Engineering Laboratories</td>
</tr>
<tr>
<td>3:30 p.m.</td>
<td>Distribution Generation Impacts and Common Mitigation Solutions</td>
<td>Bill Jordan, Booth &amp; Associates, LLC</td>
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<tr>
<td>4:15 p.m.</td>
<td><strong>Adjourn</strong></td>
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<tr>
<td>6:00 p.m.</td>
<td>Networking Social</td>
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<tr>
<td>7:00 p.m.</td>
<td>Banquet</td>
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**Wednesday (continued)**

### SUBSTATION & DISTRIBUTION ADVANCED

**Presiding:** Joel Valley, PWC of Fayetteville

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>8:00 a.m.</td>
<td>Distribution Substation Optimized Protection &amp; Control Architecture</td>
<td>Craig Wester, GE Grid Automation</td>
</tr>
<tr>
<td>8:45 a.m.</td>
<td>Transformer Condition Assessment</td>
<td>Bastian Auerbach, Reinhausen Manufacturing Inc.</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>CCVT Design and Application for Use in Relaying and Revenue Metering</td>
<td>Chris Zaphiris, Ritz Instrument Transformers</td>
</tr>
<tr>
<td>10:15 a.m.</td>
<td>Break</td>
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<tr>
<td>10:30 a.m.</td>
<td>How to Leverage Cellular Communication for DTT and POTT Schemes</td>
<td>Andre Smit, Siemens Industry Inc.</td>
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<tr>
<td>11:15 a.m.</td>
<td>Unlicensed Radio Applications</td>
<td>Andy Gould, Schweitzer Engineering Laboratories</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td>Lunch</td>
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<tr>
<td>1:00 p.m.</td>
<td>Distribution Capacitors &amp; Controls Advanced</td>
<td>Roger Munay, Eaton</td>
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<tr>
<td>1:45 p.m.</td>
<td>Tap Changer Application</td>
<td>Carlos Bittner, Reinhausen Manufacturing Inc.</td>
</tr>
<tr>
<td>2:30 p.m.</td>
<td>Break</td>
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</tbody>
</table>

**2:45 p.m.** Reactor Tap Changer Maintenance RMV-II  
Carlos Bittner, Reinhausen Manufacturing Inc.

**3:30 p.m.** Digital Transformer Monitoring  
Markus Stank, Reinhausen Manufacturing Inc.

**4:15 p.m.** Adjourn

**6:00 p.m.** Networking Social

**7:00 p.m.** Banquet

### EMERGING TECHNOLOGIES

**Presiding:** Raeann Miller, Radian Research

<table>
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<th>Time</th>
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<tr>
<td>8:00 a.m.</td>
<td>The Future of Edge Computing</td>
<td>Steve Kenny, Landis + Gyr</td>
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<tr>
<td>8:45 a.m.</td>
<td>Microgrid Power Conversion</td>
<td>Kyle Farmer or Alan McDonnell, Switchgear Power Systems</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>Infrastructure Required for Mounting 5G and Other Services on Telephone Poles</td>
<td>John Williams, TESCO</td>
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<tr>
<td>10:15 a.m.</td>
<td>Break</td>
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<tr>
<td>10:30 a.m.</td>
<td>Distribution FLISR Solutions</td>
<td>Luke Booth, Schweitzer Engineering Laboratories</td>
</tr>
<tr>
<td>11:15 a.m.</td>
<td>Shedding a Light on Streetlight Meter Testing</td>
<td>John Williams, TESCO</td>
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</tbody>
</table>
Wednesday (continued)

**EMERGING TECHNOLOGIES (continued)**

12:00 p.m.  
**Lunch**

Presiding:  
Chris Graves, WR Daniel

1:00 p.m.  
**Voltage Regulated Distribution Transformers (VRDTs): Smart Grid Applications for Conservation, Voltage Reduction, Increase Hosting Capacity for Distributed Generation and Other Low Carbon Technologies**

Tu Anh Tran, Reinhausen Manufacturing Inc.

1:45 p.m.  
**Efficiency Benefits of Centralized Asset Management**

Andy Gould, Schweitzer Engineering Laboratories

2:00 p.m.  
**Voluntary Agreement Drafts**

2:30 p.m.  
**Break**

2:45 p.m.  
**System Reliability through Wildlife Mitigation & How Robotic Installations are Changing the Game**

Jason Jones, Power Line Sentry

3:30 p.m.  
**Wireless Broadband**

Andy Schechter, Trilliant Networks

4:15 p.m.  
**Adjourn**

6:00 p.m.  
**Networking Social**

7:00 p.m.  
**Banquet**
Thursday, June 16, 2022

**SINGLE PHASE**

Presiding: Steve Wright, Itron

8:00 a.m. **Meter Safety**
John Kretzschmar, SAMSCO

9:00 a.m. **Instrument Transformer Basics**
Roger Lapay, ABB

10:00 a.m. **Meter Testing Residential Sites**
Ryan Roth, Radian Research

10:45 a.m. **Break**

11:15 a.m. **All Sessions Combine into General Session**

**POLYPHASE**

Presiding: Tina Pampanelli, Itron

8:00 a.m. **Loss Compensation Application and Verification**
Nathaniel Dunn, Schneider Electric

9:00 a.m. **Introduction to Vector Diagrams**
Phil Fischbach, Powermetrix

10:00 a.m. **Break**

10:15 a.m. **Theory of AC and DC Meter Testing**
Tom Lawton, TESCO

11:15 a.m. **All Sessions Combine into General Session**

**ADVANCED/MANAGEMENT/EMERGING TECHNOLOGIES COMBINED SESSION**

Presiding: Dee Byrd, WR Daniel

8:00 a.m. **Metering, Operations and Utilities: 2022 and Beyond**
Tom Lawton, TESCO

8:45 a.m. **Anatomy of a Cyberattack and Ways to Prevent It**
Steve Lindsay, X Tec, Inc.

9:30 a.m. **Power Distribution for EV Charging**
Jack Hackathorn, Milbank Manufacturing

10:15 a.m. **EV Charging Range of Installations and Rate Structures**
Bill Jordan & Stephanie Beauguay, Booth & Associates, LLC

11:00 a.m. **Break**

11:15 a.m. **All Sessions Combine into General Session**
<table>
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<tr>
<td>10:15 a.m.</td>
<td>Introduction to DNP3</td>
<td>Andy Gould, Schweitzer Engineering Laboratories</td>
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<tr>
<td>8:00 a.m.</td>
<td>Triple Single Line Device Training</td>
<td>Kevin Clark, Blue Ridge Energy</td>
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<tr>
<td>8:45 a.m.</td>
<td>Fault Circuit Indicator Applications</td>
<td>Anthony Rahiminejad, Schweitzer Engineering Laboratories</td>
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<tr>
<td>9:30 a.m.</td>
<td>Environmental Permitting</td>
<td>Briana Eddy, Booth &amp; Associates, LLC</td>
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<tr>
<td>10:15 a.m.</td>
<td>Substation Grounding Design</td>
<td>Byron Johnson, Booth &amp; Associates, LLC</td>
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<tr>
<td>8:45 a.m.</td>
<td>Properly Sizing Distribution Transformers</td>
<td>Bill Jordan, Booth &amp; Associates, LLC</td>
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<tr>
<td>9:30 a.m.</td>
<td>DER Protection &amp; Control Challenges</td>
<td>Derrick Wood, Booth &amp; Associates, LLC</td>
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<tr>
<td>10:15 a.m.</td>
<td>SCADA and Outage Management Systems (OMS) Integration</td>
<td>Jim Baehr, QEI</td>
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<tr>
<td>11:00 a.m.</td>
<td>Break</td>
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<td>11:15 a.m.</td>
<td>All Sessions Combine into General Session</td>
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**General Session**

Presiding: Chad Cooper, Dominion Energy

11:15 a.m. **FR and Arc Flash Protection**
Shawn Norolk, MCR Safety

12:00 p.m. **Participant Feedback on the School**
Closing Comments/Door Prizes
Adjourn
# Conference Schedule

## Manufacturer Programming Sessions

### TUESDAY, JUNE 14

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>8:00 a.m.</td>
<td>Radian/WECO: Calibration Check</td>
<td>Winchester</td>
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<td></td>
<td>Lunch</td>
<td>Pembroke</td>
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<td>1:00 p.m.</td>
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<td></td>
<td>Radian/WECO: Calibration Check</td>
<td>Winchester</td>
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### WEDNESDAY, JUNE 15

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<tr>
<td>Alkire, Ryan</td>
<td>GE Instrument Transformers</td>
<td>Tampa, FL</td>
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<tr>
<td>Anderson, Rick</td>
<td>Fayetteville PWC</td>
<td>Fayetteville, NC</td>
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<td>Bargerstock, Clare</td>
<td>Northern Virginia Electric Cooperative</td>
<td>Manassas, VA</td>
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<td>Booth, Luke</td>
<td>Schweitzer Engineering Laboratories</td>
<td>Charlotte, NC</td>
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<td>Brown, Rodney</td>
<td>Dominion Energy</td>
<td>Richmond, VA</td>
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<td>Byrd, Dee</td>
<td>WR Daniel &amp; Associates</td>
<td>Mooresville, NC</td>
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<td>Cooper, Chad</td>
<td>Dominion Energy</td>
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<td>Corbin, Michael</td>
<td>Honeywell</td>
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<td>Craig, Curtis</td>
<td>Shenandoah Valley Electric Coop, (Retired)</td>
<td>Mt. Crawford, VA</td>
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<td>Dempsey, Sean</td>
<td>Wesco Distribution</td>
<td>Raleigh, NC</td>
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<td>Dudley, Phil</td>
<td>Texas Meter</td>
<td>Oak Island, NC</td>
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<td>Edwards, Garey</td>
<td>City of High Point</td>
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<td>Finley, Scott</td>
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<td>Powermetrix</td>
<td>Knoxville, TN</td>
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<td>Fry, Preston</td>
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<td>SCE&amp;G (Retired), Gilbert</td>
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<td>Hardy, Bill</td>
<td>TESCO</td>
<td>Bristol, PA</td>
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<td>Hause, Ken</td>
<td>Border States Electric</td>
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<td>Wesco Distributing</td>
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<td>Wendell, NC</td>
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<td>Hudson, Steve</td>
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<td>Fredericksburg, VA</td>
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<td>West Union, SC</td>
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The Hall of Fame award is given for outstanding contributions and dedicated services, which ensure the continued success of the North Carolina Meter School.

1981
Ed Ruggles, NC State University (Deceased)
Bert W. Blake, CP&L (Deceased)
Edwin W. Winkler, NC State University, (Deceased)
William A. Keller, Duncan Electric (Deceased)
George B. Hoadley, NC State University (Deceased)

1982
William J. Perry, CP&L (Deceased)
Donald Eggleston, Duke Power (Deceased)

1983
Herbert B. Adams, VEPCO (Deceased)
Walter Hodde, Sangamo Weston (Retired)
Norman R. Bell, NC State University (Deceased)

1984
Brian C. Fetner, SCE&G (Deceased)
D.K. Woodard, General Electric (Deceased)

1985
Vernon E. Bobo, Duke Power (Retired)
Edward Kennedy, Santee Cooper (Retired)
C.L. McKenzie, CP&L (Retired)

1986
No Inductees

1987
Rick Anderson, P.E., Fayetteville Public Works (Retired)
David B. Stansel, NC State University (Deceased)

1988
Richard P. Dorton, VEPCO (Retired)
Lee Monroe, Duke Power (Retired)

1989
Robert W. Cox, General Electric (Deceased)
Lloyd Jordan, General Electric (Deceased)

1990
Bob Kelly, R.W. Chapman (Deceased)
Ed Manning, NC State University (Deceased)

1991
Earl Garthright, VA/NC Power (Deceased)
J.J. Perry, Jr., J.J. Perry Company (Deceased)
Connie McElroy-Bacon, NC State University

1992
No Inductees

1993
John Sutton, P.E., NC State University (Retired)
Ralph West, Duke Power (Retired)

1994
Jack Tanner, Tanner & Tanner, Inc. (Deceased)

1995
No Inductees

1996
Luther Herman, NC State University (Deceased)
Donald Stanley, City of Wilson (Deceased)

1997
David A. Springs, P.E., Central Electric Power Cooperative (Retired)
Joyce Tanner, Tanner & Tanner, Inc. (Retired)

1998
No Inductees

1999
Jimmy Grubbs, SCE&G (Retired)
Gene Schickedanz, Durham Co. (Retired)

2000
Randy Riley, Landis+Gyr (Retired)
Larry Waters, General Electric (Retired)

2001
John Carr, UTEC (Retired)
Dean Williams, Duke Energy (Retired)

2002
Clare Bargerstock, Northern Virginia Electric Cooperative
Del Weers, ITEC (Retired)

2003
Tony Horton, Duke Energy (Retired)

2004
Brooks Kirby, City of Morganton

2005
Cindy S. Allen, NC State University (Retired)

2006
Tom Van Valkenburgh, Watthour Engineering

2007
Jeff Lewis, PowerTech LLC
Bob Wilcox, Rappahannock Electric Cooperative (Retired)

2008
Craig Shoaf, National Transformer Sales

2009
Greg Tyre, The Durham Company (Retired)

2010
Scott Moss brooks, N-Dimension Solutions

2011
Brian Giusani, Audio Visual Services Coastal
Kenneth McCraw, Duke Energy

2012
John Cochran, ITEC (Retired)
James Green, Brunswick EMC

2013
No Inductees

2014
No Inductees

2015
Mike Byrd, ElectriCities of NC (Retired)
Bill Hardy, TESCO – The Eastern Specialty Company
Chuck Robertson, SCE&G (Retired)

2016
Curtis Craig, Shenandoah Valley Electric Cooperative (Retired)

2017
Rusty Mutschink, Central Electric Power Cooperative
Tim Overbee, Duke Energy

2018
Vernon White, TESCO – The Eastern Specialty Company

2019
Sean Dempsey, WESCO Distribution

2020
Canceled due to COVID-19

2021
No Inductees