



Southeastern Distribution Apparatus School and Conference

August 21st - 24th, 2023

The Hotel at Auburn University
and Dixon Conference Center
Auburn, Alabama

Utility Technology Association is a 501c(6) non-profit organization dedicated to the delivery of high quality, practical and comprehensive training designed to meet the needs and challenges of today's electric utility industry.

Southeastern Distribution Apparatus School & Conference

Module 100	Module 200	Module 300	Module 400	Module 500	Module 600
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Monday

10:00 - 4:00	Registration				
1:00 - 1:30	General Session				
1:30 - 2:30	MicroGrid Projects - Duke Energy				
2:30 - 3:00	Networking Refreshment Break				
3:00 - 4:30	Electrical Fundamentals	Protective Grounding	Winter Storm Elliott - Utility Panel		
4:30 - 6:00	Exhibit Hall / Hospitality				

Tuesday

8:30 - 10:00	Power Theory	Capacitor Installations & Operation	Power System SCADA and Smart Grids	Power Flow Study	Eaton CL-7 Regulator Controls & Regulators	HIPOTRONICS AMSC
10:00 - 10:30	Networking Refreshment Break in Exhibit Hall					
10:30 - 12:00	Distribution Devices & Equipment Overview	Application of Voltage Regulators	Power System SCADA and Smart Grids - Continued	Power Flow Study <i>Continued</i>	Beckwith Electric Regulator & Capacitor Controls	G&W Electric Franklin Electric Grid Solutions
12:00 - 1:00	Lunch					
1:00 - 2:30	Substation Devices & Equipment Overview	Distribution Feeder Protection	Cyber Resiliency - Operational Technology	ROI on DA Investments Beyond Three Phase Automation	Schweitzer Engineering Labs Event Analysis Basics	Hitachi Energy TE Connectivity
2:30 - 3:00	Networking Refreshment Break in Exhibit Hall					
3:00 - 4:00	Substation Breakers	Apparatus Equipment Maintenance & Testing	Non-Traditional SCADA Solutions	DER Interconnection Case Study		Central Service Association
4:00 - 5:30	Exhibit Hall / Hospitality					

Knowledge is Power

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Wednesday

8:30 - 10:00	Voltage Regulators	Applications of 600A Underground Connectors	CyberSecurity for DER & Grid-Edge Systems	Leveraging Asset Sensors Using Data Analytics to Drive Reliability Improvement	ABB Self Powered Single Phase Recloser	Southern States GE Grid Solutions
10:00 - 10:30	Networking Refreshment Break in Exhibit Hall					
10:30 - 12:00	Overvoltage Protection	Underground Switchgear	Intelligent Device Placement for Reliability Securing the Digital Grid	Fast Bus Tripping Scheme Hosting Capacity System Study	S&C Electric TripSaver II Cutout-Mounted Recloser	nVent ERICO Sunwa Technos America
12:00 - 1:00	Lunch					
1:00 - 2:30	Distribution Transformer Connections Infrared Inspections	System Protection	Communication Network Architecture	Advanced Phase Identification Condition Monitoring for Oil-Immersed Assets	Hubbell VersaTech Recloser	Megger
2:30 - 3:00	Networking Refreshment Break					
3:00 - 4:30	Underground Cable & Cable Accessories	Recloser Applications	Fiber Optic Hands-On Applications	Harmonics - Tracking Down the Issues	Siemens CMR & Fusesaver	
5:00 - 6:30	Annual Dinner - Grand Ballroom					
6:00 - 9:00	Casino Royale - Grand Ballroom					

Thursday

8:30 - 10:00	Effective Grounding Solutions to Reduce Power & Telecom Equipment Failure Rates
10:00 - 10:15	Networking Refreshment Break
10:15 - 11:30	Vehicle Grid Integration Systems
11:30	Closing Session

Opening Session

MicroGrid Projects - Duke Energy

Jason Handley, *Duke Energy*

According to the U.S. Department of Energy, a MicroGrid is a group of interconnected loads and distributed energy resources (DER) within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid. A MicroGrid can connect and disconnect from the grid to enable it to operate in either grid-connected or island mode. Additionally, the MicroGrid's operational controls need to be fully coordinated when connected to the main power grid or while islanded, requiring additional equipment, communications and control applications. Duke Energy has been a leader in the implementation and technology advances of MicroGrids. This session will cover the applications, benefits and constraints of a MicroGrid.

Module 100: Fundamentals of Distribution System Apparatus

Electrical Fundamentals

Instructor: Mike Chirico, *Covington Electric Cooperative*

Session on AC and DC circuit theory including ohms law and associated math, circuit components, and current and voltage laws. Included are discussion of the relationship between current, voltage, resistance, impedance, power and energy.

Power Theory

Instructor: Mike Chirico, *Covington Electric Cooperative*

An expansion of the basic electricity review class – with an elaboration on volts, amps, power factor, etc. Definition and applications of KW, KVA, the power triangle, and calculating power factor.

Distribution Devices & Equipment Overview

Instructor: Keith Hardt, *Pungo Engineering Services*

This session will cover generation, transmission, distribution and utilization of an electric grid. Topics include the equipment on the distribution system with discussion on design and function.

Substation Devices & Equipment Overview

Instructor: Keith Hardt, *Pungo Engineering Services*

This session will cover generation, transmission, distribution and utilization of an electric grid. Topics include the equipment used in the substation with discussion on design and function.

Substation Breakers

Instructor: Chad Cassity, *Georgia Power*

Session will include common functions, types, how breakers work and why the equipment is

used. Learn about protection schemes, protective relays and how to bypass breakers. Learn about the different interruption mediums such as oil, SF6 or vacuum. Discusses testing, inspection & sampling practices. Students will learn about the components of dissolved gas analysis testing.

Voltage Regulators

Instructor: Jimmy Smith, *Howard Industries*

Session will center on how a regulator works and the internal components. Covers how they are used in distribution systems along with basic operation & functions. Covers safety issues such as by-passing & deenergizing regulators. Basic inspection procedures.

Overvoltage Protection

Instructor: Joe Hall, *CREASTA*

Covers how arresters work and their use in the distribution system. It introduces the student to how lightning and other causes create overvoltage on the system. We also introduce the student to the concepts of BIL (Basic Insulation Level) ratings of equipment / hardware. We discuss the importance of properly grounding the system to make arresters operate properly.

Distribution Transformer Connections

Instructor: Jason Waters, *Georgia Power*

Discussion in this class will include components and internal workings of a transformer. Covers how a transformer works and how it is used on the distribution system. Learn the meaning of transformer polarity and how to easily hook up transformer banks using the Arrow System.

Infrared Inspections

Instructor: Reid Buckner, *Alabama Power*

Infrared inspection is a proactive approach to identifying issues in electrical systems before they cause a serious or costly outage. This session will cover the tools used and various findings from inspections.

Underground Cable & Cable Accessories

Instructor: Oscar Dominguez, *Hubbell Power Systems*

Session will begin with a discussion on the differences between underground and overhead cables with an emphasis on the types of underground cable. Topics included in this class will be 200A accessories, cable stress, terminations and underground arresters.

Module 200: Principles & Applications of Distribution System Apparatus

Protective Grounding

Instructor: Keith Hardt, *Pungo Engineering Services*

Session gives a comprehensive understanding of the theory and practice of safe electrical grounding

principles as it relates to the individual. There will be discussion on the OSHA requirements, understanding ground potential rise, touch and step potential, and vehicle safety along with applications, principles and procedures related to grounding.

Capacitor Installation & Operations

Instructor: Miguel Bengla, *Beckwith Electric*

Discussion on why capacitors are used in the distribution system and how they work. Defines terms such as working power, non-working power and power factor.

Application of Voltage Regulators

Instructor: Roger Munay, *Eaton*

Explanation of why voltage regulators are needed and how they work. Topics include the placement of regulators, settings, and effects on the distribution system. Class will cover safety considerations of voltage regulators.

Fundamentals of Distribution Feeder Protection

Instructor: Craig Wester, *GE Grid Solutions*

Session provides a basic understanding of the principles of relaying and protection of the electric distribution feeder. Topics included in this class are why relays are used, how relays protect the feeder, applications of various types of relays, and relay coordination.

Apparatus Equipment Maintenance & Testing

Instructor: Curtis Boyer, *Emerald Transformer*

Keeping transformers and other electrical equipment running smoothly is essential to the success of every utility. This session will cover maintenance and repair procedures along with associated testing requirements.

Applications of 600A Underground Connectors: Junctions, Switchgear, and Transformer

Instructor: David Swafford, *Southcon*

Learn about the design, installation, and application of 600A dead front separable connectors for UG distribution systems.

Underground Switchgear

Instructor: Robert Reepe, *Georgia Power*

Pad mounted switchgear provides simplicity and complexity to distribution systems in today's environment. This switchgear discussion covers the design and application of load serving devices in the distribution system. Simple switching systems, simple protection with fuses to complex communication enabled switching and vacuum interruption will be covered as well as design considerations and applications for each category of device. The future of implementing advanced technologies will be included. We will limit the coverage to Medium Voltage Utility Grade outdoor switchgear.

System Protection

Instructor: Bill Baker, *Georgia Power*

Study of power system faults and application of relays for power system protection. Covered in this class will be station protection, feeder protection

and some distribution automation schemes. Also the coordination between devices with isolation and restoration techniques.

Recloser Applications

Instructor: Brad Schafer, *GRESKO Utility Supply*

Covered in this session will be single and three phase reclosers. We will cover how reclosers operate, how they are applied on the distribution system, and how they interact with other devices such as station relays and fuses. We will cover the key differences between electronic reclosers and hydraulic reclosers, and the pros and cons of both options.

Module 300: SCADA, Communications & Cybersecurity

Power System SCADA and Smart Grids

Instructor: John McDonald, *GE Grid Solutions*

Session begins with a brief history of electrical power utility SCADA as well as its use in other industries. All the basic system building blocks are then presented starting with intelligent electronic devices (IEDs), data concentrators, communication links, and master stations. The class includes considerations when building a SCADA system such as budgeting, cost justification, user expectations, staffing, test and commissioning, training, and maintainability. Diving deeper into the system, the fundamentals of SCADA communication will be discussed including protocols, channel types, and cloud services. System design aspects will be described including alarm management, HMI design, integration with our smart grid applications, and time synchronization. Finally, the class will touch on important security considerations. Throughout the talk, the presenter will interject industry best practices and examples from project implementations. Questions and sharing of past experiences are highly encouraged by all attendees.

Cyber Resiliency - Operational Technology

Instructor: Michael Thesing, *Demos Andreou Patterson & Dewar Engineers*

The business benefits of digital transformation in electric grid operations are tremendous, but this progress also expands the cyber risk to the operations technology (OT) environment. While there are some methodologies that can be borrowed from the business information technology (IT) environment, the OT landscape has different purposes, type of computer and communication systems, threats, and impacts. This session will discuss the practice of cybersecurity in utility infrastructure and introduce concepts of cyber resiliency from the OT perspective. Topics to be addressed include the identification of network boundaries and access points, the goals and characteristics of zero trust architecture, hardening, securing legacy control systems, and testing.

Non-Traditional SCADA Solutions

Instructor: Eric Stranz, *NovaTech Automation*

Traditional use of utility SCADA relies heavily on large software packages, client licenses, server computers and extensive engineering and design. For many utilities to incorporate such a solution requires long term budgetary planning and approvals pushing the benefits of such a solution out to the distant future. Manufacturers of in station Remote Terminal Units (RTU's) have developed graphics packages, served by the RTU's, that display measured signals from substation devices in one line and detail screens very similar to the SCADA graphics view at a fraction of the price. Further developments of this technology have allowed certain RTU's to take the place of traditional SCADA in the control room. This presentation will discuss a utility example that addressed SCADA and substation integration in this manner.

CyberSecurity for DER and Grid-Edge Systems

Instructor: Xavier Francia, *EPRI*

Utilities have traditionally held cybersecurity responsibility across generation, transmission and distribution systems. Today with high penetration of Distributed Energy Resources (DER), such as solar, EVs, MicroGrids and other Grid-Edge systems privately owned and operated by third parties, the cybersecurity responsibilities to protect the electric system is now shared by many participants. DERs present several opportunities for improved grid reliability and efficiency. Cybersecurity threats can hinder the realization for these benefits. Learn about new standards, technologies and strategies being developed to ensure safe and secure integration of these new generation resources.

Intelligent Device Placement for Reliability

Instructor: Patrick Jordan, *NRTC*

This session will present information on the selection and placement of intelligent protective devices in the field to mitigate and respond to risks to the distribution network. Intelligent controls along with centralized management platforms enabled by accurate system data, and reliable high-speed communications are the key to improvements in system reliability and outage response.

Securing the Digital Grid

Instructor: Chris Blauvelt, *Fortinet*

As electric utilities modernize their critical infrastructure, they are integrating their OT and IT networks to encourage operational efficiency. The rise in cyberattacks against energy critical infrastructure impacts consumers, government agencies, and institutions. During this session, there will be discussion on the three principles for engineering resiliency into operational networks: Segmentation, Detection, Automation

Communication Network Architecture

Instructor: Daniel Phillips, *Georgia Transmission*

With the growing trend toward optimizing energy efficiency and delivery, distribution automation is rapidly becoming the latest requirement for utility-grade communications and smart grid technology.

Communication is a vital component of a reliable interaction to equipment and customers of a utility. Learn the needs of communication along with a technology overview of today's network. Detail discussion on terminology, serial connectivity and Internet connectivity. In depth review of communication components and basic networking with example architecture.

Fiber Optics Communication Hands-On Applications

Instructor: Randy Gritters, *Connected Fibers*

This class will provide instruction on the proper techniques and tools used while allowing the students hands on experience in splicing and terminating fiber optics. Learn how to splice and terminate fiber optic connections.

Module 400: Smart Grid, Engineering & Emerging Technology

Winter Storm Elliott - Utility Panel

Instructors: Justin Lee, *Cullman EC*; Wes Scott, *Fort Payne Improvement Authority*; Mike Counts, *Huntsville Utilities*; Keith Thomason, *Middle Tennessee Electric*; Paul Rudd, *North GA EMC*; Josh Shultz, *TVA*

Dangerous winter weather conditions swept over the majority of the Central and Eastern U.S., bringing the coldest recorded Christmas in decades to major cities. According to the National Weather Service, Winter Storm Elliott was a once-in-a-generation storm that brought record-breaking frigid temperatures and high winds to the region. The storm also challenged neighboring utilities, limiting power availability, resulting in energy demand exceeding supply being generated and purchased. For the first time in TVA's 90-year history, TVA was forced to implement emergency procedures directing local power companies to reduce power demand that resulted in localized interruptions to keep the overall system stable. The execution of the Emergency Load Curtailment Program worked well. TVA's Transmission and Operations center executed the program as designed and local power companies responded quickly when called upon, supporting grid stability and reliability. TVA and the local power companies will share their experience during the process and the next steps to be taken by the utilities.

Power Flow Study

Instructor: Kevin Mara, *Hi-Line Engineering*

The power flow study is a numerical analysis of the flow of electric power in an interconnected system. Power flow analysis is very important in planning stages of new networks or addition to existing ones like adding new generator sites, meeting increase load demand, and locating new transmission sites. The purpose of power flow studies are to plan ahead and account for various hypothetical situations. This session will work through the process.

How Alabama Power Calculated ROI from DA Investments

Instructors: Shane Powell, *Alabama Power*; Jeremy Nelson, *S&C Electric*

Alabama Power will share the reliability improvements and O&M savings through the selective deployments of distribution automation technology on their system.

Beyond Three Phase Automation

Instructor: Jarrod Kilgore, *Carroll EMC*

This topic would talk through Carroll EMC's venture into using distribution automation at the single phase level. The presentation would include the history leading into single phase automation including cost justification and reliability.

DER Interconnection Case Study

Instructor: Rankin Rouse, *Alabama Power*

With distributed energy resource (DER) penetration growing increasingly in certain regions of the United States, utilities need to incorporate special considerations and solutions that encompass all aspects of the interconnection procedure. The interconnection of any energy resource to the electrical grid requires careful attention to its impact on the surrounding system and consumers. This is true whether the source is landfill gas to energy generation, peaking power plants, community PV, battery storage, or any other type of DER. Different strategies are used by utilities depending on the local characteristics of the distribution system. Learn more about the implementation and requirements of DER interconnections.

Leveraging Asset Sensors for Situational Awareness and Risk Mitigation

Instructor: Tim Barat, *Gridware*

Today sensors, edge computing, communications networks and machine learning is transforming the way many utilities monitor assets, and apply sophisticated algorithms, use correlation and produce dashboards that enable intelligence to minimize risk, reduce labor costs and improve performance. While this is the objective of many field elements, most of these tools require physical connection to the line for monitoring. There is a significant amount of knowledge that can be obtained by monitoring and interpreting physical parameters, such as sound, vibration, induced EMF, acceleration, tilt, and weather conditions. This session will review a self-contained and self-powered multi-sensor edge device that attaches directly to poles, without the need to connect to any conductors.

Using Data Analytics to Drive Reliability Improvements

Instructors: David Boyd, David Huffstutler, *Alabama Power*

Generating significant reliability improvements can be categorized into three major components: identifying areas of concern, developing / prioritizing potential solutions, and tracking the overall effectiveness of the chosen solution. Alabama Power is using data analytics to prioritize and deploy capital investments. This data-driven

approach fuels reliability improvements for both customers and stakeholders. In this session, explore how to utilize data to propel reliability efforts and the results have observed in recent years.

Fast Bus Tripping Scheme

Instructors: Kiran Ravikumar, *SEL*; Wes Allsbrook, *Broad River Electric Cooperative*

This session describes the implementation of a fast bus-tripping scheme with operating times comparable to bus differential schemes, by incorporating wireless protection sensors. The use of wireless sensors opens up the possibility of using this scheme on substations equipped with electromechanical feeder protection relays or relays without communication capabilities by eliminating the need for communication between the main and the feeder relay.

Hosting Capacity System Study

Instructor: Tom Davino, *1898 & Co.*

A hosting capacity study evaluates the following infrastructure to determine the available capacity for solar penetration: Transmission, Sub Transmission, and Distribution. The analysis is useful to understand every part of the system to help answer inquiries from landowners, developers, and the utility itself. Utilities receive steady calls from landowners looking for land uses and developers looking to build projects asking about various sites. The HCA study can be used as an easy, quick, and accurate screening of the area and identifies the best sites for large scale PV solar.

Advanced Phase Identification

Instructor: Aaron Coolidge, *PSI*; Curtis Massey, *Alabama Power*

An introduction to Advanced Live Line Phase Identification with a recap describing some of the ways Phase Identification has assisted a major utility in day to day troubleshooting, equipment installation, and system maintenance.

Economical Condition Monitoring for Oil-Immersed Power Delivery Assets

Instructor: Greg Franklin, *PSS Tech*

Condition monitoring in the form of dissolved gas analysis (DGA) has been employed for many years on large oil-immersed power transformers where transformer cost and lead time for repair could justify the relatively high cost of the monitoring equipment. There are numerous other oil-immersed power delivery apparatus such as smaller transformers, switch gear, voltage regulators, etc for which condition monitoring would also be beneficial to the asset owner. This session discusses an economically viable option for condition monitoring of these other assets based on hydrogen and/or moisture measurements.

Harmonics - Tracking Down the Issues

Instructor: Doug Houseman, *1898 & Co.*

Harmonic currents can have a significant impact on electrical distribution systems. It is important to consider the impact when planning additions or changes to a system. Identifying the size and location of non-linear loads should be an important part of any maintenance, troubleshooting and repair

program. Most systems can accommodate a certain level of harmonic currents but will experience problems when harmonics become a significant component of the overall load. Learn about harmonics studies and investigations.

Module 500: Control Training Lab

These sessions will be demonstrations of apparatus equipment internal and external controls. Learn about programming and functionality of regulator, recloser and capacitor controls from the manufacturer.

Eaton - CL7-Regulator Controls & Regulator

Instructor: David Swafford, *Southcon*
New power system components and distributed resources often introduce unforeseen compatibility and power quality issues. Utilities need modern solutions using equipment that is readily at hand. Eaton has leveraged its long-standing experience with step-regulators and digital controls to address these voltage concerns. Eaton will address the top benefits it provides:

1. Increased Reliability using vacuum tap changers
2. Improve savings by reducing the number of DER operations using priority algorithms.
3. Enhanced Flexibility - The CL-7 family of controls can be single phase or be ganged for operation. Providing the user with one flexible control platform.
4. Simplified Maintenance - The CL-7 can monitor the regulator's electrical and physical systems and thus recommend on-time maintenance.
5. Robust Cybersecurity - the CL-7 meets the latest standards.

Beckwith - Regulator & Capacitor Controls

Instructor: Miguel Bengla, *Beckwith Electric*

This session will cover regulator and capacitor control basic functions and programming, the presentation of more advanced applications to manage Distributed Automation and Distributed Energy Resources along with how to set up on the controls.

SEL - Event Analysis Basics

Instructors: Jai Subbarayan, Kiran Ravikumar, *Schweitzer Engineering Lab*

Analyzing relay event data is a challenge for most engineers. In this session, participants will use powerful SEL-5601-2 SYNCHROWAVE Event Software to analyze real-world events and learn how to quickly identify the source of power system problems. Topics will include the following:
Event report triggers
Types of event reports
Event report retrieval
Overview of SYNCHROWAVE Event Analysis of real-world events

ABB - Eagle Self Powered Single Phase Recloser

Instructor: Andrew Peterson, ABB

This session will provide an overview of the Eagle recloser including features, functionality, and benefits it can offer your utility. Learn ways the Eagle can improve reliability metrics and lower operational costs.

S&C Electric - TripSaver II Cut-Out Mounted Recloser

Instructors: Ryan McAndrews, Jeremy Nelson, S&C Electric

This session will cover the programming of an S&C TripSaver II for several common lateral recloser deployments. There will be explanations of the specific settings and programming necessary for each application. Also includes a demonstration of the TripSaver II to show the behavior changes behind a settings change.

Hubbell - VersaTech Recloser - Getting the Most Out of Recloser Programming, Data & Communications

Instructor: Javier Bonilla, Hubbell Utility Solutions

Troubleshooting is a critical step in achieving reliable delivery of electricity to end users on a distribution network. Having information is essential to understanding a situation and eventually reaching a solution. This session will help users interpret data logging in the VersaTech reclosers to identify various scenarios that may impact system reliability, provide tips on how to maximize the VersaTech recloser capabilities when combining it with different protective assets on the network, and guide users in understanding the virtues and challenges of wireless communications with various VersaTech recloser models.

Module 600: Products & Solutions

A variety of manufactures will be providing information about their products and solutions for the utility in a classroom.

HIPOTRONICS

AMSC

G&W Electric

Franklin Electric Grid Solutions

Hitachi Energy

TE Connectivity

Central Service Association

Southern States

GE Grid Solutions

nVent ERICO

Sunwa Technos America

Megger

Closing Session

Effective Grounding Solutions to Reduce Power and Telecom Equipment Failure Rates

Instructor: Kris Cox, SAE

Session will review common mistakes with effective lightning protection design/installation at communications towers & control buildings. While there are many construction companies that have “materialized” to meet this demand very few have any experience with mitigation designs. Grounding Kits and solutions for rock, sand and corrosive soils will also be discussed.

Given the current supply chain crisis for replacement of OH & UH equipment. This session will discuss several products & approaches being employed across the USA. A discussion on how to use current wood pole inspection programs to measure and improve existing grounding (where required) at equipment locations for minimal costs to utilities. The net benefit of this approach will reduce equipment failure rates and supply chain pressure.

Vehicle Grid Integration System

Instructors: Shardul Modi, Thomas Canada, Southern Company

Vehicle-grid integration (VGI) is the facilitation of flexible charging (and discharging) of an increasing number of EVs in a way that benefits rather than negatively impacts the transmission, generation, and distribution systems. The increase in higher-power electric vehicle supply equipment (EVSE) can potentially disrupt the grid. However, the effects can be mitigated through grid planning strategies. This session will discuss what is VGI, the Ford V2H project and what the future will look like with VGI.