

Virtual Training

Constructing, Operating and Maintaining Underground Distribution Systems

Virtual Training

Delivered through four Zoom sessions

Oct. 20, 21, 22, 27

8:30 a.m. – 12:30 p.m. Pacific

COURSE OVERVIEW

Learn all about the effective design, construction, operation and maintenance of underground electric distribution systems. Review critical factors involved in the conversion of overhead systems to underground and discuss real-life examples. Discuss operations, safety and regulatory requirements, and hear from an industry cable application engineer about underground cable reliability, failure modes, and testing methods.

COURSE TOPICS

Session 1: Oct. 20

Introduction

- Course Objectives & Subject Matter Outline
- History of Underground Systems
- Advantages & Disadvantages of Underground Systems

Policy and Service Guidelines

- Cost Recovery Methods
- Easements/Point of Ownership
- Overhead to Underground Conversion
- Harmonics
- Policy Development Discussion Example

Planning & Design

- Load Characteristics
- Planning Criteria
- Load Estimating & Diversity
- Subdivision System Design Criteria & Techniques
- Reliability Considerations

- Commercial Service Considerations
- Sectionalizing/Fault Interruption Options
- Planning, Design & Layout Discussion
- Residential/Commercial Subdivision
- Industrial Subdivision

Session 2: Oct. 21

Planning & Design (*continued*)

- Transformer Design Considerations – Loss Evaluation
- Equipment Installation Locations

Cable Design, Application & Failure Modes

- Cable Theory & Cable Construction
- Conductor/Insulation Types
- Mechanical/Electrical Properties
- Cable Replacement/Life Extension
- Cable Pulling Example

Session 3: Oct. 22

Cable Design, Application & Failure Modes

- Cable failure modes (*Ben Lanz, Director, Applications Engineering, IMCORP*)

Terminations & Splice Design & Operation – 200A & 600A

- Voltage Stress Relief
- Terminations
- Splices
- Loadbreak Connections – 200A
- Deadbreak Connections – 600A

Inspection/Preventive Maintenance

Session 4: Oct. 27

Inspection/Preventive Maintenance (*continued*)

Over Current Fuse Application

- Types of Fuses
- Fuse Application & Operation
- Time-Current Curves
- Transformer & Lateral Protection

- Fuse Coordination – field application discussion
- Other Fuse Related Topics

Cable Fault Location

- Fault Cable Indicators
- Fault Location Techniques

Ferroresonance

Discussion & Wrap Up

COURSE LEVEL

Basic/Intermediate. No prerequisites; no advance preparation.

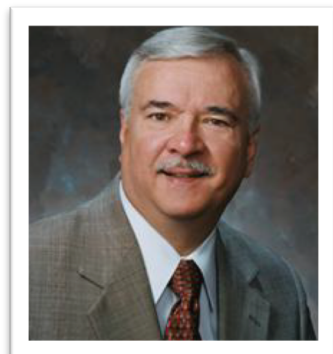
This course provides a good foundation for those new to the industry and a helpful refresh and update for those with experience on underground distribution principles, practices, components and equipment.

RECOMMENDED FOR

Public power professionals and skilled personnel including: engineers, designers, technicians and field personnel, as well as for all those involved in the management, construction, safety and operational aspects of transmission and distribution systems.

INSTRUCTORS

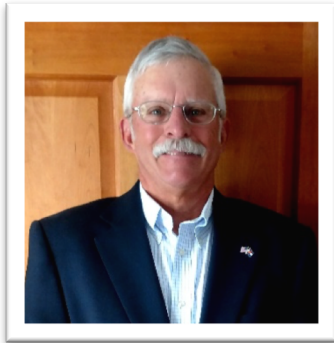
Larry Koshire, P.E., President, Koshire Consulting, LLC, Rochester, Minnesota



Larry has held various positions in the electric industry for private and public power utilities and has extensive experience in electric transmission and distribution design, construction, and operation. He served as the general manager of Rochester Public Utilities, in Minnesota, for 17 years and is also the former general manager of Muscatine Power and Water in Iowa. Larry has been active in state and national boards, committees and professional organizations. He holds an electrical engineering degree from the University of Minnesota Institute of Technology, is a Registered Professional Engineer, a senior member of the Institute of Electrical and Electronic Engineers and has taught APPA's Underground

Distribution course since 1988.

Mark Swan, P.E., Principal, MDS Engineering Consulting, LLC, Colorado Springs, Colorado



Mark is a consulting engineer with over 31 years of experience in the utility industry, serving as the general manager of the operations department of Colorado Springs Utilities. He managed the operation of power plants, water, and wastewater plants, and field operations for electric, gas, water, and wastewater services. Since 1988, Mark has taught APPA's Underground Distribution course. He is a member of the National Society of Professional Engineers and the Institute of Electrical and Electronics Engineers. He holds bachelor's and master's degrees in electrical engineering from the University of Colorado.

Guest Speaker: Ben Lanz, Director, Applications Engineering, IMCORP

As Director of Applications Engineering at IMCORP, Ben has the technical oversight of power cable diagnostics and life cycle consulting. He is a senior member of the IEEE PES and ICC, and voting member of DEIS, IAS, EPRA, AWEA and CIGRE. He served as Chair IEEE technical committees responsible for power system testing, reliability and protection. He holds an Electrical Engineering degree from the University of Connecticut where he studied under Dr. Mashikian, an early pioneer of cable diagnostics and director of Electrical Insulation Research Center at the Institute of Material Science. He has published dozens of papers and technical conference contributions on the subjects of power system reliability, asset management, and diagnostics and is a regular guest speaker at numerous conferences and seminars.

ACCREDITATION

The following continuing education credits will be provided, after successfully completing all four sections.

Recommended CEUs 1.6/PDHs 14/CPEs 16.8

Field of Study: Specialized Knowledge

Requirements:

- Attendees are required to attend and participate in all four learning events and complete an online evaluation at the end of each session
- Partial credit cannot be given
- Attendance is monitored by an Association staff member
- Certificates will be emailed out on November 3

- Sessions are recorded (in case you miss the live version), though credits can only be given for attending live events

TECHNOLOGY REQUIREMENTS

The course will be presented on the Zoom Meeting platform. In order to join the webinar, you will need the following:

- An Internet connection
- Speakers: we recommend using your computer's audio and microphone
- Webcam (optional): there will be designated times that you can turn on a webcam (during introductions and Q&A times) to promote networking

LOG-IN INFORMATION/COURSE MATERIALS

You'll receive a logistics email from the APPA Academy (APPAAcademy@PublicPower.org) on **October 14**. You'll receive a separate email with your Zoom log-in link (no-reply@zoom.us) – one link will work for all sessions. Please reach out to the APPA Education Department (EducationInfo@PublicPower.org) with technical questions or if you do not receive those emails. Attendees will automatically receive recordings of the course sessions.

VIRTUAL COURSE PREP

- Consult with your IT team to ensure you can access Zoom and test computer audio
- Fill out a pre-course survey, in advance of the first session (included in the email you'll receive on Oct. 14)
- Plan to log in 15 minutes early for each session

Advanced Topics in Underground Distribution Systems

Virtual Training

Delivered through two Zoom sessions

Oct. 28 – 29

8:30 a.m. – 12:30 p.m. Pacific

COURSE OVERVIEW

Underground distribution continues to be the installation method of choice in many applications on public power systems. Although the initial installation cost of underground distribution is almost always greater than equivalent overhead distribution, it offers a wide range of advantages including greater operating reliability, lower operating and maintenance costs, better public safety and, of course, reduced visibility and greater public acceptance.

Learn how to improve your utility's policies, standards, and practices for planning, designing, constructing, operating, and maintaining underground distribution and hear about current and emerging industry trends.

COURSE TOPICS

Session 1: Oct. 28

Introduction

- Course objectives, schedule, manual, and format
- Course participants' sharing of questions and topics of interest

Underground Distribution Practices, Costs, and Benefits

- Underground distribution practices
- Public expectations for undergrounding
- Underground distribution costs and benefits

Long-Life Cable Installations

- Cable features and specifications
- Cable applications
- Cable Installation in underground structures
- Overvoltage Protection for cable life extension
- In-service cable testing

Section 2: Oct. 29

Professional Practice in Utility Underground line Design

- Risk exposures and management strategies
- Legal and regulatory environment for utilities and engineers
- Underground line design criteria
- The underground line design process

Distribution System Improvement

- System improvement goals
- System planning
- Standards and specifications
- Testing & analysis
- Key drivers for performance improvement
- Prioritizing capital investments
- Selected hot topics
- Closing Remarks, Recap and Q&A

COURSE LEVEL

Intermediate. No prerequisites; no advance preparation. The content builds on what is learned in the **Constructing, Operating & Maintaining Underground Distribution Systems** virtual class (October 20-27).

RECOMMENDED FOR

Public power professionals and skilled personnel including: engineers, designers, technicians and field personnel, as well as for all those involved in the management, construction, safety and operational aspects of transmission and distribution systems.

This is a logical follow-up to the Underground Distribution Systems (Oct. 20-27) course. Even if your knowledge of underground distribution is limited or recent, this course will help prepare you to improve your utility's policies, standards, and practices for planning, designing, constructing, operating, and maintaining underground distribution.

ADDITIONAL REQUIREMENTS

Participants are required to have a copy of the [2017 National Electric Safety Code®](#) (ANSI C2-2017) on hand to review during the course. Hard copies and electronic version can be purchased from IEEE (www.ieee.org; 800/701-4333).

INSTRUCTORS



**M. Thomas Black, P.E., Management Consultant,
Collaborative Learning, Inc.**

Tom is a management consultant with Collaborative Learning, Inc. His experience includes both municipal (Colorado Springs and City of Fountain, CO) and investor owned (Progress Energy) utilities. His range of experience in the utility industry covers 30 years and includes planning and engineering, standards, Construction and Maintenance Manager, Energy Delivery General Manager and Chief Energy Officer responsible for all aspects of energy supply, electric transmission and distribution and gas distribution. Tom has extensive executive level experience in managing electric and gas utility systems and significant utility experience in the development of tracking and reporting electric and gas system performance metrics. Tom has served on the boards of RMEL and the Colorado Association of Municipal Utilities CAMU and is a member of the Institute of Electrical and Electronic Engineers.



**John Miner, P.E.
President and Principal Consultant,
Collaborative Learning Inc., Austin, Texas**

John is an accomplished executive manager and educator with over 45 years of experience in the electric utility industry. He is president of Collaborative Learning, Inc., of Austin and San Antonio, Texas and has been an APPA instructor for more than 30 years and an instructor for the University of Wisconsin for 20 years. Before forming his own company, he worked for the Austin, Texas, Electric Utility Department, Rochester Public Utilities in Minnesota, and as an assistant professor for the University of Houston. John earned a Bachelor of Science degree in electrical engineering (with honors), and a Master of Science degree in engineering science, both from the University of Toledo. John is a Senior Life Member of the IEEE and is a registered Professional Engineer in the states of Texas and Minnesota.

Guest speaker: Tara Parker, Applications Engineer, Prysmian

ACCREDITATION

The following continuing education credits will be provided, after successfully completing all four sections.

Recommended CEUs .8/PDHs 7/CPEs 8.4

Field of Study: Specialized Knowledge

Requirements:

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