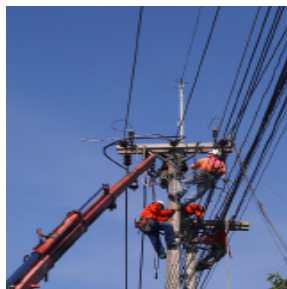
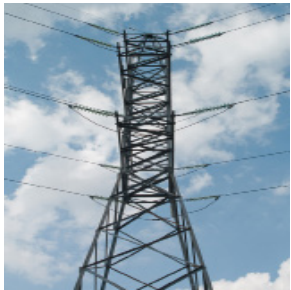




Course length: 4.5 hours **Cost:** \$295-\$350*
Prerequisites: None **Subscription:** 2-12 months
CPE credits: 6 (see website for more details)

An in-depth look at electricity's journey from source to end-use consumer

This course focuses on the physical electrical system and takes learners on a tour from generator to customer meter. Topics covered include common industry jargon and the basic physical laws of electricity, how generators work, which generation types are commonly used and why, how a system of generators is used to serve a customer load curve, the components that make up transmission and distribution systems, how transmission and distribution systems are designed and operated, the different types of service configurations and when they are used, and how electricity is metered.



WHO WILL BENEFIT FROM THIS COURSE?

- New engineers without a power background
- New hires in the generation, transmission or distribution sectors
- Professionals needing to interact with employees from the technical side of the business
- Employees with customer account management, customer services, sales or marketing responsibilities
- Employees moving from business functions to electric operations
- ISO employees needing to understand the physical system
- Finance, legal, public relations, or regulatory professionals who need to understand the physical principles of the electrical system

WHAT PARTICIPANTS WILL LEARN

- The basic characteristics of electricity and electric circuits
- The numerous qualitative and quantitative terms used to describe electricity
- The various energy sources and technologies used in electricity production, the physical and environmental characteristics and costs of each type of generation currently in use, and how the various generation types are used to serve customer loads
- The components of the transmission system and the way in which the system is designed and operated in both regulated and competitive markets
- The components of the distribution system and the way in which the system is designed and delivers power to end-use customers
- The components of the final service connection that links the distribution system to the customer's internal electrical wiring and various options for configuring services
- The types of meters installed throughout the electrical system and how each is used to collect usage data

COURSE AGENDA

Basic Concepts of Electricity

- What is electricity?
- Direct current (DC)
- Alternating current (AC)
- Conductors
- Insulators
- Electrical terms and units (voltage, current/amps, resistance/ohms, frequency/hertz, real power/watts, apparent power/volt-amps, reactive power/volt-amps reactive, power factor)
- Resistive, inductive and capacitive loads
- Energy (kWh, MWh) and Demand (kW, MW)
- Watt's Law
- Ohm's Law
- Circuits and circuit components (source, path, load, control devices, and protective devices)
- Overview of the electric delivery system

Generating Electricity

- Key quantities used in discussing generation (rated capacity, output, capacity factor, voltage, and frequency)
- Methods for creating electricity (electromagnetic induction, electrochemistry, photoelectric effect)
- Key generation technologies (photovoltaic cells, fuel cells, batteries, turbines, reciprocating engines)
- Key generation fuels (renewables, nuclear, coal, natural gas, oil, hydro)
- Centralized vs. distributed generation
- How generators work (steam turbine, combustion turbine, combined-cycle turbine, coal gasification (IGCC) turbine, water turbine, wind turbine, photovoltaic cells, reciprocating genset, fuel cells and batteries)
- Combined heat and power (CHP)
- Overview of physical, financial and environmental characteristics of each generation type

* Please contact us for bulk discounts and site license pricing.





- Generation costs (capital, fixed and variable)
- The generation dispatch stack and how dispatch decisions are made

The Electric Transmission System

- The role of transmission
- Overview of the transmission system layout
- What transformers do and how they work
- Station transformers
- Switchyards (switches, breakers, transformers, busbar)
- Transmission lines
- Transmission substations
- Monitoring and metering equipment
- Protective equipment (circuit breakers, fuses, switches)
- How a transmission system is configured
- North American power grids
- How the North American Electric Reliability Corporation (NERC) sets standards for reliable operation
- The role of FERC in overseeing reliability
- The role of the transmission owner (TO) and entities that are TOs
- The role of the system operator and entities that are system operators
- Which regions of North America operate under ISOs/RTOs

The Electric Distribution System

- The role of distribution
- Overview of the distribution system layout
- Distribution substations
- Distribution lines (overhead and underground, single phase and three phase, wye and delta)
- Advantage and disadvantages of each distribution line option
- Other distribution components (lightning arrestors, voltage regulators, line and service fuses, reclosers,

capacitor banks)

- System design (how primary and secondary feeds are used and laid out)
- Types of secondary feeds (radial, dual feed, loop and network)
- How systems are designed to balance cost and reliability objectives
- Service transformers

Electrical Services

- The role of services
- Overview of how a service is laid out
- Overhead and underground services
- Single phase and three phase services
- Wye and delta services
- Service voltages (transmission, primary and secondary)
- Service components (service conductors, meter loop, meter, ground wire/rod, main disconnect, breaker/fuse box)
- Circuits (feeder and branch)
- Designing services to adequately match a specific customer load

Electric Meters and Metering

- The role of metering
- Categories of meters
- Single phase vs. three phase meters
- Operating technologies (induction, solid state, hybrid)
- Data communication (manual vs. remote)
- Automated meter reading (AMR)
- Smart meters
- Registers (energy, time-of-use, demand, solid state)
- Net meters
- Transmission, primary and secondary meters
- Installation types (self contained vs. transformer rated)

- Master and sub-meters
- Current transformers (CTs) and potential transformers (PTs)
- Meter operations and management
- Regulatory requirements
- Accuracy and testing
- Diversion and tampering