Online Courses | DISTRIBUTED ENERGY RESOURCES

enerdynamics
The Energy Education Experts

Course length: 4.5 hours **Cost:** $295-$350
Subscription: 2-12 months
Prerequisites: A general knowledge of the electric system and industry including the basics of generation, transmission, distribution, customers, and regulation.

An in-depth exploration of Distributed Energy Resources (DERs) and how they impact the grid and energy markets.

Many regions are seeing rapid growth of DERs, including energy efficiency, demand response, distributed generation, and distributed storage. Growth of these resources will have significant impacts on planning, design, and operation of transmission and distribution systems. Full utilization of these resources will require restructuring of wholesale markets and creation of new distributed markets. This learning path explains the different DER technologies and their characteristics, explores how they will challenge and benefit the bulk electric system and distribution systems, and how markets must evolve to integrate DERs. .




WHO WILL BENEFIT FROM THIS COURSE?

- Senior managers needing an understanding of the impacts of DERs
- Regulators and policymakers considering changes associated with DERs
- Engineers, IT professionals, field force managers, and other technical experts working in system operations, transmission or distribution sectors
- Energy industry business professionals needing to evaluate strategies associated with DERs
- Finance, legal, accounting, public relations, and regulatory affairs professionals
- DER technology marketing professionals planning strategies to monetize DER assets

WHAT PARTICIPANTS WILL LEARN

Upon completing Distributed Energy Resources, you will be able to:

- Define DERs and categorize the different types
- Describe the operational and economic characteristics of each key DER technology
- Evaluate the factors that will impact the rate of growth of DERs in any specific region
- Analyze different methods of aggregating DERs including virtual power plants and microgrids
- Identify appropriate interconnection standards and technologies including smart inverters
- Evaluate challenges and benefits associated with integrating DERs into transmission and distribution systems
- Describe key strategies to successfully integrate DERs into electric grids
- Determine market services that a specific DER technology has the potential to provide and identify necessary market evolutions to integrate DERs into wholesale and distributed markets

This knowledge will empower you to actively participate in discussions and consideration of how the current electric industry must evolve to integrate large penetrations of DERs.

COURSE AGENDA

Introduction to Distributed Energy Resources

- The definition of DERs
- Categories of DERs (demand side management, distributed generation, distributed storage) and a list of the key technologies in each category
- How DERs can be aggregated into larger pools (virtual power plants, microgrids, community solar, and distributed energy resource management systems)
- DERs as a load modifier vs. as a supply resource
- Overview of key impacts DERs may have on distribution and bulk electric systems
- Overview of how distribution and bulk electric systems will benefit from DERs
- How DERs may participate in electric markets (customer bill management, retail markets, wholesale markets)
- Potential growth of DERs
- Stages in the DER adoption curve and how distribution and bulk electric systems adapt to integrate DERs in each stage

Distributed Energy Resource Technologies

- Key characteristics of DER technologies
  - Defining technical characteristics (dispatchability, variability, predictability, ramp rates)
  - Defining costs (fixed, variable, levelized)
  - Defining value (capacity, energy, ancillary services, non-wires alternatives)
- Demand side management (DSM)
  - Energy efficiency (EE)
  - Demand response (DR)
    - DR technologies (including EV charging)
    - DR programs
    - Use of DR (shape, shift, shed, shimmy)

- Distributed generation (DG)
  - Combined heat and power (CHP)
  - Photovoltaic solar (PV)
  - Smart inverters combined with PV
  - Reciprocating engines
  - Microturbines
  - Fuel cells
  - Wind
  - Use of DG
- Distributed storage (DS)
  - Batteries
  - Batteries combined with power control systems (PCS)
  - Thermal storage
  - Flywheels
  - Use of storage
- Integrated DSM (end users maximizing use of two or more DERs)
- Aggregation of DERs
  - Virtual power plants/third-party aggregation
  - Community solar/storage
  - Microgrids
  - Distributed energy resource management systems (DERMs)

Integrating Distributed Energy Resources into the Bulk Electric System

- Introduction
  - Definition of DERs
  - Definition of the BES
  - Why DERs have different impacts than centralized generation
  - Definition of reliability
  - Key factors for reliable operation of the BES
- Impacts of DERs on frequency
  - Principles of managing frequency
  - Tools for frequency management
  - DERs' impact on frequency
  - Challenges and how they are addressed (loss of visibility, supply variability, lack of inertia, and need for ride-through)
  - Potential benefits of DERs
- Impacts of DERs on voltage
  - Principles of managing voltage
  - Tools for voltage management
  - DERs' impact on voltage
  - Challenges and how they are addressed (lack of reactive power control, fluctuation in reactive flows, lack of visibility, and need for ride-through)
  - Potential benefits of DERs
- Impacts of DERs on protection
  - Principles of fault currents and protection
  - How DERs impact protection
  - Challenges and how they are addressed (unexpected fault currents, reverse flow)
  - Impacts of DERs on resource adequacy
  - Principles of resource adequacy
  - Flexible resource adequacy
  - Challenges and how they are addressed (lack of visibility, net load curve changes, flexible capacity needs, fast growth rates)
  - Potential benefits of DERs
- Impacts of DERs on power flow
  - Principles of power flow analysis
  - Network models
  - Challenges and how they are addressed (inadequate data, insufficient modeling, unexpected power flows)

Integrating Distributed Energy Resources into the Distribution System

- Introduction
  - Definition of DERs
  - Types of DERs and aggregation into useful blocks
  - Potential growth of DERs
  - Value for consumers and the grid from DERs
- Impacts of DERs on distribution
  - Distribution basics
  - Substations
  - Line components
  - Service components
  - Voltage
  - Power quality
  - Component sizing
  - Protection
  - Safety
  - Potential benefits from DERs
- Interconnection of DERs
  - Interconnection components
  - Inverters and the importance of Smart Inverters
  - Remote control and monitoring
  - Interconnection rules and standards
  - Interconnection processes and screening
- Grid Modernization to Integrate DERs
  - What grid modernization is
  - The four key modernization technologies
  - Examples
  - Communication
  - IT systems
  - Grid evolution and stages of DERs penetrations

- Distribution planning with DERs
  - The concept of distribution resource planning
  - Forecasting
  - Power flow
  - Hosting capacity analysis
  - Locational value analysis
  - Non-wires alternatives
  - Service enhancements
  - Resources of distribution resource planning

Distributed Energy Resources in Electric Markets

- Introduction
- DERs in wholesale markets
  - Organized wholesale markets
  - Services DERs can provide to wholesale markets
  - How DERs participate in markets (direct, aggregation)
  - Current market participation in ISOs
  - FERC decisions concerning DERs in markets
  - Key issues for market participation
  - Impacts of DERs
  - Potential benefits of DERs
- DERs in retail markets
  - Services DERs can provide to distribution systems
  - Why consumers invest in DERs
  - The three phases of retail DER markets
  - Utility tariffs and retail marketer services
  - Bill management with DERs
  - Net energy metering
  - Prosumer revenues
  - Aggregation
  - FERC versus state jurisdiction
- Transactive energy markets
  - What transactive energy markets are
  - Smart homes and buildings
  - Characteristics of transactive markets with examples
  - Pricing
  - Future market structures