

# GRIDED

The Center for Grid Engineering Education

## **Electric Transportation Fundamentals (10.5 PDH)**

### Course Description

The electrification of transportation, including light duty passenger vehicles, heavy duty vehicles, and people and goods movement, is occurring at an increasing rate. The US alone has over 1.3 million light duty plug-in electric passenger vehicles on the road today and has seen electrification of port equipment, goods movement, and delivery vehicles. Several major heavy-duty truck manufacturers have announced plans to develop and sell battery electric heavy-duty vehicles, dozens of pilots of battery electric buses are underway and electric forklifts are becoming common place.

Beginning with an overview of the electric transportation space, this course will cover the basics of transportation electrification opportunities, vehicle technologies, charging technologies, and the benefits of electrified transportation technologies. Students will learn about integration of goods movement technologies and electric vehicles with the grid, reverse energy flow from electric vehicles and pertinent standards relative to the electric vehicle space. The course will introduce participants to methods being used to manage electric vehicle charging and to mitigate high power loads that have very low duty factors. Laboratory testing and field demonstration results will be presented to highlight the impact of transportation electrification. Students will be introduced to relevant standards and recommended practices, including the latest developments in the National Electric Code, Society of Automotive Engineers documents, and other standards impacting the electrified transportation space

### Who Should Attend

Utility engineers interested in learning about transportation electrification opportunities, individuals involved in deployment of transportation technologies, fleet managers, and grid planners that will be required to deal with these new electrification activities would benefit from course attendance.

### Registration Information

PDH Available: 10.5 hours

Course Length: 1.5 days

Registration Fee:

- \$1,200 per person
  - 20% discount for organizations with three or more attendees
  - 25% discount for government employees (non-utility)
  - 25% discount for university professors\*
  - 75% discount for graduate students\*
- \*University IDs required to qualify for professor or graduate student discounts.

*Students need to bring: laptops or tablets to access online resources and to follow class notes. Wi-Fi access is provided. Lecture slides will be provided electronically in PDF format.*

### For More Information

Amy Feser, [afeser@epri.com](mailto:afeser@epri.com), (865) 218-5909

### Course Instructors

Instructor: John Halliwell, [jhalliwell@epri.com](mailto:jhalliwell@epri.com)



## Meet the Instructor

**John Halliwell** is a Technical Executive in the Electric Transportation Group of EPRI where his focus is infrastructure development and smart charging for plug-in electric vehicles. He joined EPRI in 2007 and has been active in the electric transportation space since 2008. John has managed dozens of electric transportation projects in his tenure at EPRI including vehicle demonstrations, infrastructure installations and lab testing of electric vehicle supply equipment.

John is the current chair of the Society of Automotive Engineers J1772 “Electric Vehicle Conductive Charge Coupler Task Force”. His former employers include EG&G, Oak Ridge National Lab and Vacuum Technology, Inc. He has broad experience in design and application of electronic circuits and electronic systems. His favorite pastimes are hiking, building and repairing tube guitar amplifiers and amateur radio. Halliwell received Bachelor of Science and Master of Science Degrees in electrical engineering from the University of Tennessee, Knoxville.

## Course Outline

### Day 1 (Full Day)

- **Transportation Electrification Overview**
  - Light Duty Vehicles
  - Heavy Duty Vehicles
  - People and Goods Movement
  - Benefits of Electrifying Transportation
- **Technologies Used in Electrification of Transportation**
  - Power and Energy
  - Batteries
  - Drive System Technologies
  - Vehicle Types
  - People and Goods Movement Technologies
- **Charging Technology**
  - AC Charging
  - DC Charging
  - Wireless Charging
  - Catenary and Other Forms of Charging
  - Communications
  - Networking of Charging
- **Vehicle/Grid Integration**
  - Grid impacts
  - Intelligent charging

### Day 2

- **Reverse Energy Flow - Vehicle to --**
  - Load
  - Home
  - Grid
- **Goods Movement Technology Overview**
  - Forklifts
  - Planes, Trains and Cranes
  - Other technologies
- **Electric Transportation Standards Overview**
  - Society of Automotive Engineers
  - IEEE
  - Underwriters Labs
  - National Fire Protection Association
  - NIST, NEMA, and others
  - International

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