



## EV Charging & Power Grid – Standards & Modes for Plug-in Vehicles

This course is an introduction to electric vehicle charging technologies and standards for AC normal charging and DC fast charging. A quick introduction to three-phase alternating current theory is included for the audience with no prior experience in electrical engineering. All modes and types of vehicle charging are explained and visualized. On-board and off-board charging technology is analysed all the way from power electronic components and circuit diagrams, to a system level, power grid perspective. Vehicle-to-grid communication protocols are also discussed. Alternative modes of charging, such as wireless/inductive charging and electric roads are also included. The course is based on lectures and hands-on laboratories.

The lecturer is a specialist with long experience in system design of electric vehicles.

Course length: 16 hours, mixed between lectures and labs

Course overview:

- High-level overview
  - Basic theory
  - System overview
  - Power perspective
  - Charging modes
  - Charging types
  - Charging infrastructure
  - Business model
  - Battery charging behavior
- Component and system design
  - Power electronic components
  - Switching technologies
  - Galvanic isolation
  - Efficiency & cooling
- Laboratories in small groups
  - Circuit design and analysis of 1-phase charger
  - Design and construction of a small-scale wireless charger
- Standards
- Safety

Course target group:

Automotive engineers who need understanding of plug-in vehicles and charging standards.

Course outcomes:

- Better understanding of technical solutions for plug-in vehicle charging
- Knowledge of the key functionality of an on-board-charger and the communication standards used for EV charging