



## Electric Vehicle Infrastructure Training Program (EVITP) 4.0

Bernie Kotler, EVITP Co-Chair

California Public Utilities Commission  
San Francisco, May 23, 2018

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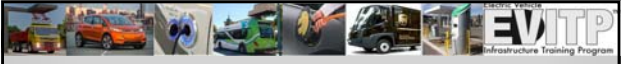
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## What/Who is EVITP?

**A not-profit, volunteer, EV industry collaborative** training program that addresses the technical requirements, safety imperatives, and performance integrity of industry partners and stakeholders including:

- Automobile Manufacturers
- Investor-Owned and Municipal Utilities
- Electric Vehicle Supply Equipment Manufacturers
- Electrical Energy Storage Device Manufacturers
- State and Local Electrical Inspectors
- Electrical Contractors
- Electrical Workers
- First Responders

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### EVITP Partner Advisors




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**Agenda Question One a)**

**What classes of projects require EVITP training?**

- **All CA Investor Owned Utility EV charging infrastructure projects require EVITP**
- EVITP is Comprehensive
- Residential
- Commercial
- Institutional, and
- Industrial Charging Infrastructure Training ...

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**EVITP Curriculum**

**Comprehensive Residential, Commercial, Charging Infrastructure Training**

- Level 1 and Level 2 Residential Charging
- Commercial / Institutional Level 2 Charging
- DC Fast Charging
- Medium Duty (MD) Commercial / Institutional
- Heavy Duty (MD) Commercial & Industrial
- Site assessment and load calculations
- Maintenance, Troubleshooting and Repair
- Wireless Conductive Energy Transfer

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**More Technical**

- **Single & Multi-family Dwellings:** 120/240VAC systems meeting SAE J1772 (CC2)
- **Non-dwelling buildings in the private and public sectors:** 480VAC systems meeting SAE J1772 (Plug-In DC) and SAE J2954 (Wireless Power Transfer)
- **Public transportation infrastructure:** Up to 600VAC meeting SAE J3068 (High Power Plug-In AC), SAE J3105 (Overhead high power), and SAE J2954/2 (Wireless high power)

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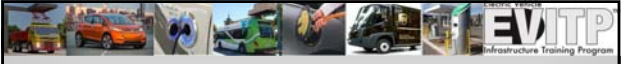
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**Agenda Question One b)**

**Should additional sector-specific training programs be developed by utilities?**

- EVITP is comprehensive
- Addresses all major EV infrastructure categories
- Need not evident
- New technologies and categories will develop
- EVITP updates regularly
- All three CA IOUs are EVITP partner advisors
- No need to duplicate training

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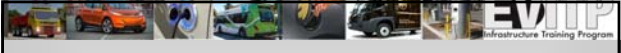
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**EVITP 4.0 Content Summary**

**Lesson #1 Electric Vehicles (EVs)**

- 1.1 The History of EVs
- 1.2 Modern EVs
- 1.3 EV types and drivetrains including: passenger vehicles, light-duty trucks, and heavy-duty vehicles (Busses, truck, etc.)

**Lesson #2 EVSE**

- 2.1 What is EVSE & types
- 2.2 AC EVSE – level 1, 2, and High Power
- 2.3 DC Charging – High Power and Overhead
- 2.4 Wireless charging
- 2.5 EVSE Communications and Networks

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**EVITP 4.0 (Continued)**

**Lesson #3: 2017 National Electrical Code (NEC)**

- 3.1 NEC Art. 90
- 3.2 NEC Chapter #1
- 3.3 NEC Chapter #2
- 3.4 NEC Chapter #3
- 3.5 NEC Art. 625 + add notes on 702 and 705
- 3.6 NECA 413-2012 Standards for EVSE Installation

**Lesson #4 Load Calculations, based on the 2017 NEC**

- 4.1 Planning and Installing EVSE (introductory materials)
- 4.2 Load considerations
- 4.3 Ampacity considerations including conductors, temperature ratings, and OCPD.
- 4.4 BC, Feeder, and Service Calculations
- 4.5 Voltage Drop
- 4.6 Examples

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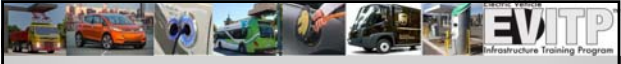
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**EVITP 4.0 (Continued)**

**Lesson #5 Site Assessment**

- 5.1 Customer service / considerations / facility tour
- 5.2 EVSE market drivers – incentives, LEED
- 5.3 Locating
- 5.4 signage
- 5.5 ADA – accessibility
- 5.6 Installation      5.7 Retail store case study

**Lesson #6 Commissioning**

- 6.1 Why commission?
- 6.2 Documentation
- 6.3 Municipality and Utility considerations
- 6.4 Equipment and cord management
- 6.5 EVSE communications and networking, customer interface, setting up network interface (cards and RFID)

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**EVITP 4.0 (Continued)**

**Lesson #7 Troubleshooting**

- 7.1 Common EVSE failure point
- 7.2 troubleshooting examples
- 7.3 EVITP troubleshooting flow chart
- 7.4 troubleshooting tips
- 7.5 EV simulators

**Comprehensive Exam** including

- Residential, Commercial and Industrial applications
- National Electrical Code by category
- Site Assessment
- Load Calculations
- Troubleshooting Problems

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**Eligibility: State Certified Electricians**

Minimum Requirement for EVITP Certification:  
**California State Certified General Electricians** who have completed 8,000 hours of on-the-job training and pass the state exam.

*A key to EVITP success is that the training builds on the platform of state certified electrician's extensive knowledge, skills, and experience.*

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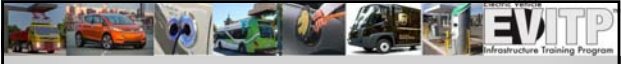
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**Agenda Question Two**

**Is EVITP appropriate for PG&E & SCE MD/HD charging infrastructure applications?**

- EVITP curriculum addresses these electric vehicle types and the equipment used in charging them. (Typical voltage levels of equipment)
- **Light-duty and medium-duty Passenger Vehicles** (120/208/240VAC)
- **Light, medium, and heavy Light-duty Trucks** (120/208/240/480VAC)
- **Heavy Duty vehicles** (480VAC, up to 600VAC)

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**Inductive Charging**




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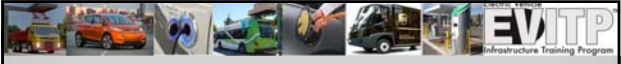
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### Agenda Question Three

**Is EVITP needed for single-family, Level 2 (L2) charging installations?**

EVITP 4.0 curriculum includes or requires (as pre-reqs) all the required safety standards, building codes, and best practices for the safe and proper installation of EVSE in single and multi-family dwellings including:

- 2018 NFPA 70E Stds, Electrical Safety in the Workplace
- OSHA Subpart 1926 Safety and Health Regulations for the Construction Industry
- 2017 National Electrical Code
- NEIS 413-2012 Standard for Installing, Maintaining EVSE
- **SITE ASSESSMENT & LOAD CALCULATIONS**

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### Safety is not an accident




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**Load Calculation Formulas**

$$V_d = \frac{2 * K * I * L}{cm \ a}$$

$$cm \ a = \frac{2 * K * I * L}{V_d}$$

$$V_d = \frac{1.732 * K * I * L}{cm \ a}$$

$$cm \ a = \frac{1.732 * K * I * L}{V_d}$$

$$V_d \% = \frac{V_d}{V_{source}} * 100$$

- cma = conductor size from Chapter 9, T8
- K = 12.9 for Cu, K = 21.2 for Al
- L = length from supply to load

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**Agenda Question Four**

**Is EVITP needed for DC fast-charging installations?**

- DC Fast Charging equipment is connected to higher voltage (**up to 600VAC**) and amperage (**up to 200A**) circuits that require proper safety and installation training.
- The EVITP curriculum and pre-requisite requirements (*verify/certify*) that all EVITP certified electricians have been trained on the **code**, and to **work safely** and effectively on this type of **higher voltage and higher amperage** equipment.




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**Agenda Question Five**

**Is EVITP needed for installation of Level 2 charging equipment at workplaces and destination centers?**

- The SAE J1772 Level 2 Standard for AC coupled charging allows connection to a 240VAC 80A circuit. This size of a **continuous load** in a building requires an understanding of **building power capacity and load calculations**.
- Workplace and public charging requires proper site-survey and building codes understanding. These include the requirements of **2018 NEC** article 625 and special requirements for **ADA compliance**.

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*Thank You*

**Questions?**

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