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<tr>
<th><strong>Docket Number:</strong></th>
<th>17-EVI-01</th>
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<tr>
<td><strong>Project Title:</strong></td>
<td>Block Grant for Electric Vehicle Charger Incentive Projects</td>
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<tr>
<td><strong>TN #:</strong></td>
<td>233940</td>
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<td><strong>Document Title:</strong></td>
<td>07 Electric Vehicle Infrastructure Training Program</td>
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<tr>
<td><strong>Description:</strong></td>
<td>N/A</td>
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<tr>
<td><strong>Filer:</strong></td>
<td>Spencer Kelley</td>
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<tr>
<td><strong>Organization:</strong></td>
<td>California Energy Commission</td>
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<tr>
<td><strong>Submitter Role:</strong></td>
<td>Commission Staff</td>
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<td><strong>Submission Date:</strong></td>
<td>7/20/2020 9:18:54 AM</td>
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<td>7/20/2020</td>
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What is the Electric Vehicle Infrastructure Training Program (EVITP)?

A non-profit, volunteer, brand neutral, national 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/EVSE ("Charging Station") Manufacturers
- Electrical Energy Storage Device Manufacturers
- State and Local Electrical Inspectors
- Electrical Contractors and Electrical Workers
- First Responders
EVITP 4.0 Curriculum (Updated 2019)
Comprehensive Residential, Commercial, Industrial Charging Infrastructure Training

- Level 1 (120V), Level 2 (220V) Residential Charging
- Commercial / Institutional Level 2 Charging
- Medium Duty (MD) Commercial - Up to 480 Volts AC
- Heavy Duty (MD) Commercial, Industrial & DC Fast Charging - up to 600VAC
- Site assessment and load calculations (Core)
- ADA – accessibility
- Maintenance, Troubleshooting and Repair
- Wireless Conductive Energy Transfer
- Comprehensive Proctored Exam
1. Electric Vehicles (EVs)
   1.1 Introduction to EVs
   1.2 The History of EVs
   1.3 EV Types and Technology
   1.4 Modern EVs
   1.5 Heavy Vehicles - commercial/industrial delivery including transit, delivery, port transport, etc.

2. Electric Vehicle Supply Equipment /EVSE (“Charging Stations”)
   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
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

4. Load Calculations, Based on National Electrical Code (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
5. Site Assessment
   5.1 Customer service / considerations / and facility tour (meet and greet)
   5.2 EVSE market drivers – incentives, LEED
   5.3 Locating
   5.4 Signage
   5.5 ADA – accessibility
   5.6 Installation
   5.7 Shawbell’s Hardware case study

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)
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 Proctored Exam including Residential, Commercial and Industrial applications, the National Electrical Code by category, Site Assessment, Load Calculations, and Troubleshooting Problems
Open to All State Certified Electricians

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.

*EVITP builds on the platform of state certified electrician’s extensive knowledge, skills, and experience.*
Course Information

• Launched in 2012 at the University of Michigan
• 20 hour class with proctored certification exam
• EVITP does not charge for curriculum use
• Classes made available in an on-demand schedule
• Taught primarily in utility training centers, community colleges, and industry training centers
• Training institutions charge little to nothing
• EVITP receives $75 per student for class materials, exam proctoring, record keeping, certification documents and delivery, web site maintenance
• Taught in Canada, too
• EVITP office in Detroit, Michigan area
Inductive Charging
Why EVITP?

- Training and Education
- Safety, Safety, Safety
- Performance
- Reliability
- Risk and Liability Reduction & Safety. Reduces Risk First and Foremost for People and Property, also Governments, Financial Institutions, Insurers, and the EV Industry

- *Is this really a problem?*
Fire, Connecticut, 2011

Fire Started in Garage Wiring, Not Chevy Volt
Fire, North Carolina, 2011

Vehicle: Chevy Volt
Fire, North Carolina, 2011

- Blaze damage estimated at $800,000
- Deputy Fire Marshal: Volt not ignition source
Fire, Florida, 2012

- Estero, FL: Smart Car EV Charging
- Est. damages: $200,000
- Charger was plugged into the Smart Car
- Charger was purchased online and installed by homeowner
Estero, Florida, 2012
Fire, Houston Texas, 2014

- Houston firefighters arrived to find heavy flames
- Garage and Chevy Volt completely destroyed
Fire, Palm City, Florida, 2016

• Man rushed to hospital suffering burns
• Inspection determined that neither C-Max, nor charging equipment was cause of fire
Fire, San Antonio, TX, 2019

San Antonio Fire Dept: EV charging overloaded the electrical system, starting the blaze just after 4am.
Fire, Irvine, California, 2013

- Garage fire on the campus of the University of California, Irvine
- $25,000 of damage, though the Tesla Model S sustained only light smoke damage.
- Fire was not caused by any part of the car nor its charging system, reported Reuters
- Issues were with the building's electrical supply, rather than with the vehicle
Fire, Cerritos, California, 2020

Tesla Charging When Fire Breaks Out At Cerritos Garage, Child Suffers Minor Injuries
Tesla Plugged In and Charging


• Voltage: Single phase, 208-250 volt AC supply, 60 hertz
• Conductors: 6 AWG, **Copper Wire Only**
What About Commercial Installations?

- Aug. 2015, Norfolk, VA
- 32 year old NC man electrocuted while working on new Tesla charging station
- Commercial installations are much more powerful and dangerous
- Especially DC fast chargers
### Number of Fires Reported to Local Fire Departments in the United States by Property Use: 2014-2018 Annual Averages

<table>
<thead>
<tr>
<th>Major Property Class (click here to expand)</th>
<th>Fires</th>
<th>Civilian deaths</th>
<th>Civilian injuries</th>
<th>Property loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Assembly</td>
<td>15,984</td>
<td>14</td>
<td>176</td>
<td>$333,380,930</td>
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<tr>
<td>2 - Educational</td>
<td>4,763</td>
<td>1</td>
<td>50</td>
<td>$64,628,767</td>
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<tr>
<td>3 - Health Care, Detention &amp; Correction</td>
<td>6,719</td>
<td>5</td>
<td>156</td>
<td>$56,766,860</td>
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<tr>
<td>4 - Residential</td>
<td>382,399</td>
<td>2,746</td>
<td>11,477</td>
<td>$7,561,851,557</td>
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<tr>
<td>5 - Mercantile or Business</td>
<td>18,972</td>
<td>15</td>
<td>282</td>
<td>$849,120,202</td>
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<tr>
<td>6 - Industrial, Utility, Defense, Agriculture, Mining</td>
<td>2,925</td>
<td>2</td>
<td>36</td>
<td>$230,102,755</td>
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<tr>
<td>7 - Manufacturing, processing</td>
<td>5,270</td>
<td>3</td>
<td>167</td>
<td>$509,513,456</td>
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<tr>
<td>8 - Storage</td>
<td>22,401</td>
<td>32</td>
<td>299</td>
<td>$637,147,702</td>
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<td>9 - Outside or special property</td>
<td>27,418</td>
<td>19</td>
<td>113</td>
<td>$135,960,099</td>
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<tr>
<td>Unclassified or unknown property</td>
<td>6,946</td>
<td>7</td>
<td>56</td>
<td>$80,039,075</td>
</tr>
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</table>
National Fire Protection Assoc. (NFPA)
March 2019 Report Key Takeaways

• Non-residential fires/year: 111,398 (23%)
• Residential fires/year: 382,399
• Fires involving electrical failures or malfunctions = highest share of civilian deaths (18%) and direct property damage (20%)
• 24% of these fires occurred between midnight and 8 a.m., but accounted for 60% of deaths
• Over $10 billion in property loss
NFPA 921 Sections 14-1 and 14-9 through 14-12.2

14-1. Introduction.
The primary emphasis is on buildings with 120/240-volt, single-phase electrical systems. These voltages are typical in residential and commercial buildings.

14-9.6. High-Resistance Faults. High-resistance faults are long-lived events in which the fault current is not high enough to trip the circuit overcurrent protection, at least in the initial stages. A high-resistance fault on a branch circuit may be capable of producing energy sufficient to ignite combustibles in contact with the point of heating.
The leading specific items most often first ignited in residential building electrical fires were electrical wire, cable insulation (31%) and structural member or framing (18%).

**One Electrical fire cause: Wiring.** Outdated wiring often causes electrical fires. If a home is over 20 years old, it may not have the wiring capacity to handle the increased amounts of electrical appliances such as computers, wide-screen televisions, video and gaming players, microwaves and air conditioners. *(Without EV!)*

Breakers should be triggered when circuits get overloaded but outdated breaker boxes often have worn connectors that don’t work, causing the system to overload and start an electrical fire.
EV Mfrs, Conductor Size, Condition

Charge Limit Preference
- Maximum - 12 Amps
- Reduced - 8 Amps

Tesla Model S Software Update 5.8.4 reduces charging current by 25% if input power fluctuations are detected.

Example, this will reduce a 40 amp charge rate to 30 amps.

This change is designed to help protect you even when a problem exists that is outside of the car or charging electronics. It should significantly increase robustness and safety in the unlikely situation that a home wiring system, receptacle, adapter or cord is unable to meet its rated current capacity.
Overloaded Wiring
Fire Starting
3. 2017 National Electrical Code (NEC)
   3.1 NEC Art. 90
   3.2 NEC Chapter #1
   3.3 NEC Chapter #2
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EVITP 4.0 - Syllabus

5. Site Assessment
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Conductor Calculation Formulas

\[ V_d = \frac{2 \times K \times I \times L}{cm \ a} \]

\[ cm \ a = \frac{2 \times K \times I \times L}{V_d} \]

\[ V_d = \frac{1.732 \times K \times I \times L}{cm \ a} \]

\[ cm \ a = \frac{1.732 \times K \times I \times L}{V_d} \]

\[ V_d\% = \frac{V_d}{V_{source}} \times 100 \]

- \( cm \ a = \) conductor size from Chapter 9, T8
- \( K = 12.9 \) for Cu, \( K = 21.2 \) for Al
- \( L = \) length from supply to load

(1 of 6 Pages of EVITP Load Calc. Formulas)
EVITP Requirements/Precedents

- Port of Long Beach Grant, CA Energy Commission
- Nevada Utility: NV Energy, Electric Highway
- National Smart Cities Award: Columbus, OH
- City of Carson, CA
- City of Pico Rivera, CA
- City of Long Beach, CA
Are There Enough EVITP Certified Electricians?

“1400 EVITP electricians, 1,182 non-EVITP electricians, and 2,582 electrical apprentices would install, conservatively, 521,424 charging stations in three years. That’s a total of 5,164 electrical workers, out of a grand total of 38,408, or 13.4%. Therefore, the current electrical workforce and training exceeds California’s projected EV infrastructure needs in all three categories.”
https://evitp.org/
Find a contractor in your area that utilizes EVITP certified installers for your next Residential, Commercial, Public or Fleet project.
1,600+ Electricians in CA

75 California Electrical Contractors/Employers
U.S. DoE Clean Cities for Contractors
EVITP is the Only Training Featured

EVSE Training for Electrical Contractors

Establishing a well-trained, nationally distributed group of electrical contractors able to install PEV infrastructure is essential to the widespread deployment of PEVs. To meet this need, a number of organizations offer PEV infrastructure training for electrical contractors. One such organization is the Electric Vehicle Infrastructure Training Program (EVITP).

EVITP is a non-profit partnership of PEV stakeholders, including automakers, utilities, EVSE manufacturers, energy storage device manufacturers, electrical inspectors, electrical contractors, electrical workers, and first responders. It was established to provide a structured platform to facilitate training and certification for EVSE installation in the residential, commercial, and public markets. The EVITP training program addresses the technical, safety, and performance requirements of its stakeholders. Its goal is to create a nationally recognized training standard for EVSE installation, commissioning, maintenance, and customer service.

EVITP’s training is offered at community colleges and electrical training centers nationwide and taught by experienced instructors. To learn more, contact EVITP at Info@EVITP.org.

EVITP Phase One Class List of Topics

- Overview of Electric Vehicles
- Types of Electric Vehicles – Present and Future
- Electric Vehicle Manufacturers
- EVSE Manufacturers
- Electrical Vehicle Charging Stations and Charging Load Requirements
- Electrical Vehicle Charging Site Assessment
- Electric Vehicle Rules and Regulations
- Code Officials and Inspection
- First Responders
- Utility Policy and Integration
- Renewable Energy and Electric Vehicles
- Customer Code of Excellence/Contractor’s Role, Electrician’s Role
- Electrical Codes, Electrical Safety Requirements, Other Regulations, and Standards
- Electric Vehicle Charging Installations
- Field Installation Practicum (Lab)
- Electric Vehicle Certification, Phase One
U.S. DoE Clean Cities for Public Hosts
EVITP is the Only Training Featured
Thank You

Electric Vehicle Infrastructure Training Program (EVITP) 4.0