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Electric Vehicle
EVITP
Infrastructure Training Program

EVITP 4.0

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 Partner Advisors

PG&E
SDGE connected
A Sempra Energy utility
BMW
GM
TOYOTA
SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company
KCP&L energizing life
DTE Energy
EATON
Powering Business Worldwide
Duke Energy
NFPA
NECA
NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
SOUTHEASTERN MICHIGAN CHAPTER
AV
aerovironment
GE
HUBBELL POWER SYSTEMS
INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS
UC DAVIS
UNIVERSITY OF CALIFORNIA
ecotality
Consumers Energy
Count on Us
BOSCH
OUC
The Reliable One
IAEI
FOUNDATION for CALIFORNIA COMMUNITY COLLEGES
AEP OHIO
A unit of American Electric Power
legrand
LEVITON
ComEd
An Exelon Company
Schneider Electric
Ameren
MISSOURI
Exergonix
INCORPORATED
MILBANK
SMITH
PEP stations
CHARGING ACTIVATED.
CLIPPERCREEK
THE Electric Vehicle Charging Station

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**

EVITP 4.0 - Syllabus

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

Electric Vehicle EVITP Infrastructure Training Program

EVITP 4.0 - Syllabus

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

Electric Vehicle EVITP Infrastructure Training Program

EVITP 4.0 - Syllabus

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)

Electric Vehicle EVITP Infrastructure Training Program

EVITP 4.0 - Syllabus

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

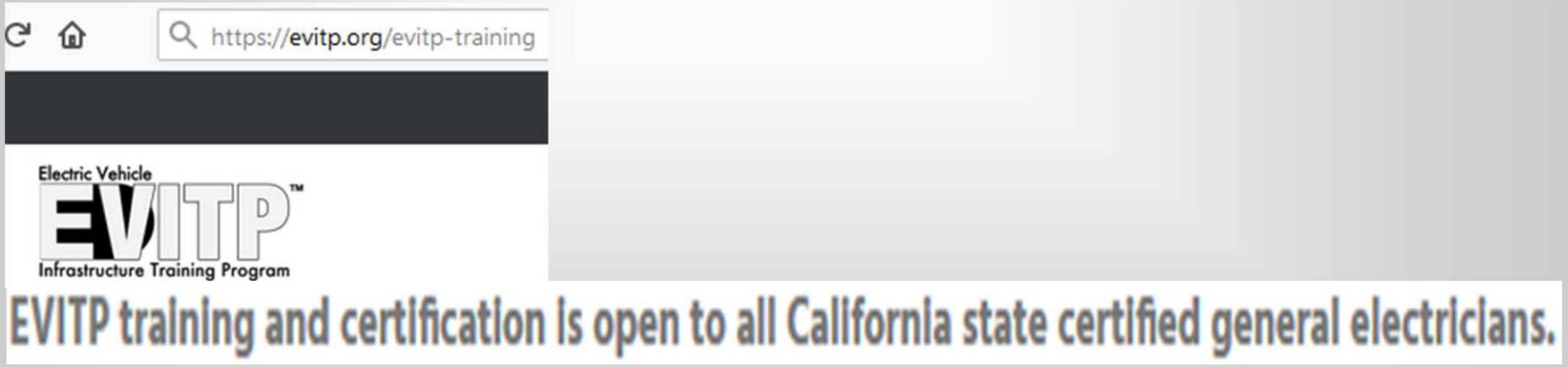
Comprehensive Proctored Exam including Residential, Commercial and Industrial applications, the National Electrical Code by category, Site Assessment, Load Calculations, and Troubleshooting Problems

Electric Vehicle EVITP Infrastructure Training Program

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

Electric Vehicle
EVITP™
Infrastructure Training Program

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

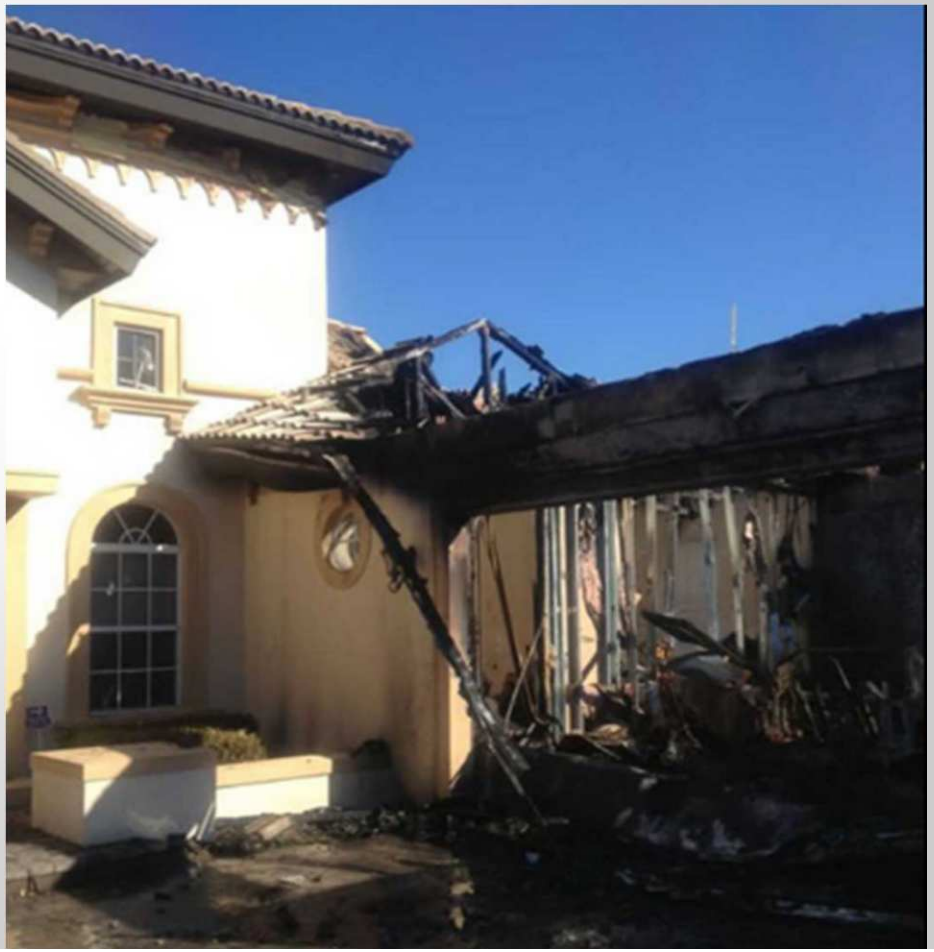
Vehicle: Chevy Volt

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

2,076 views • Feb 12, 2020 28 3 SHARE SAVE

Tesla Plugged In and Charging

Cerritos subdivision built with aluminum wiring. Tesla Specs: https://www.tesla.com/sites/default/files/downloads/US/universalmobileco

- Voltage: Single phase, 208-250 volt AC supply, 60 hertz
- Conductors: 6 AWG, **Copper Wire Only**

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

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

NFPA

RESEARCH

Select a Type of Fire

- ○ Outside or Unclassified Fire
- ◉ Structure Fire
- ○ Vehicle Fire

Number of Fires Reported to Local Fire Departments in the United States by Property Use: 2014-2018 Annual Averages

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

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: Electrical Faults and Combustion

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.**

U.S. Fire Administration

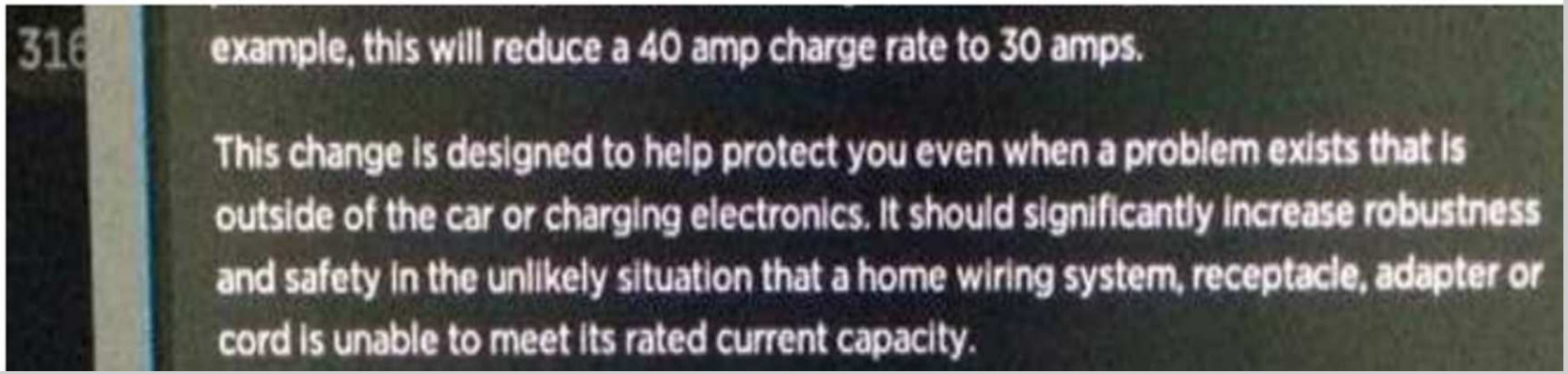
The leading specific items most often first ignited in residential building electrical fires were electrical wire, cable insulation (31%) and structural member or framing (18%).

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!)***

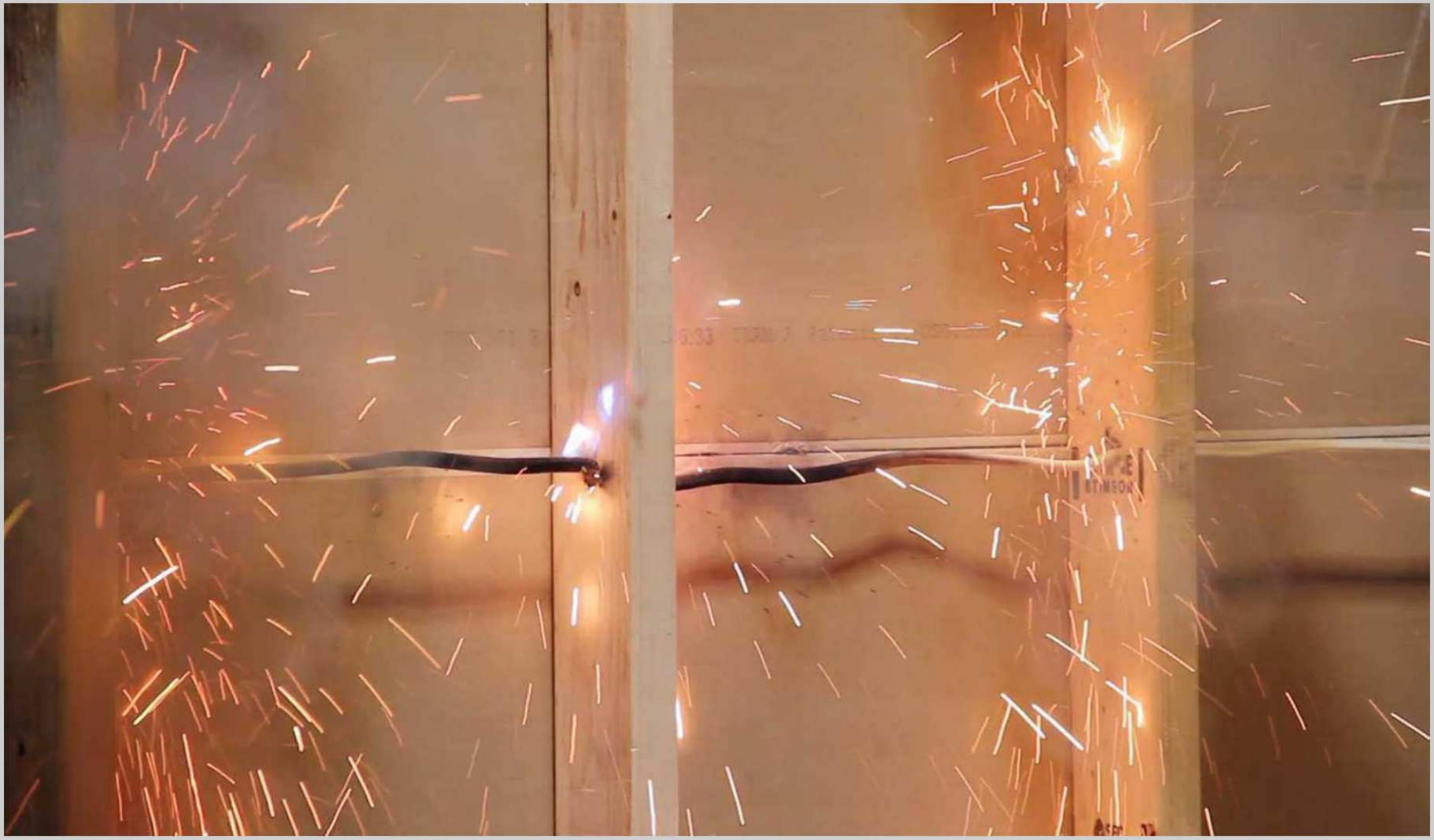
Breakers should be triggered when circuits get overloaded but outdated breaker boxes often have worn connectors that don't work, causing the system to overload and start an electrical fire.

EV Mfrs, Conductor Size, Condition

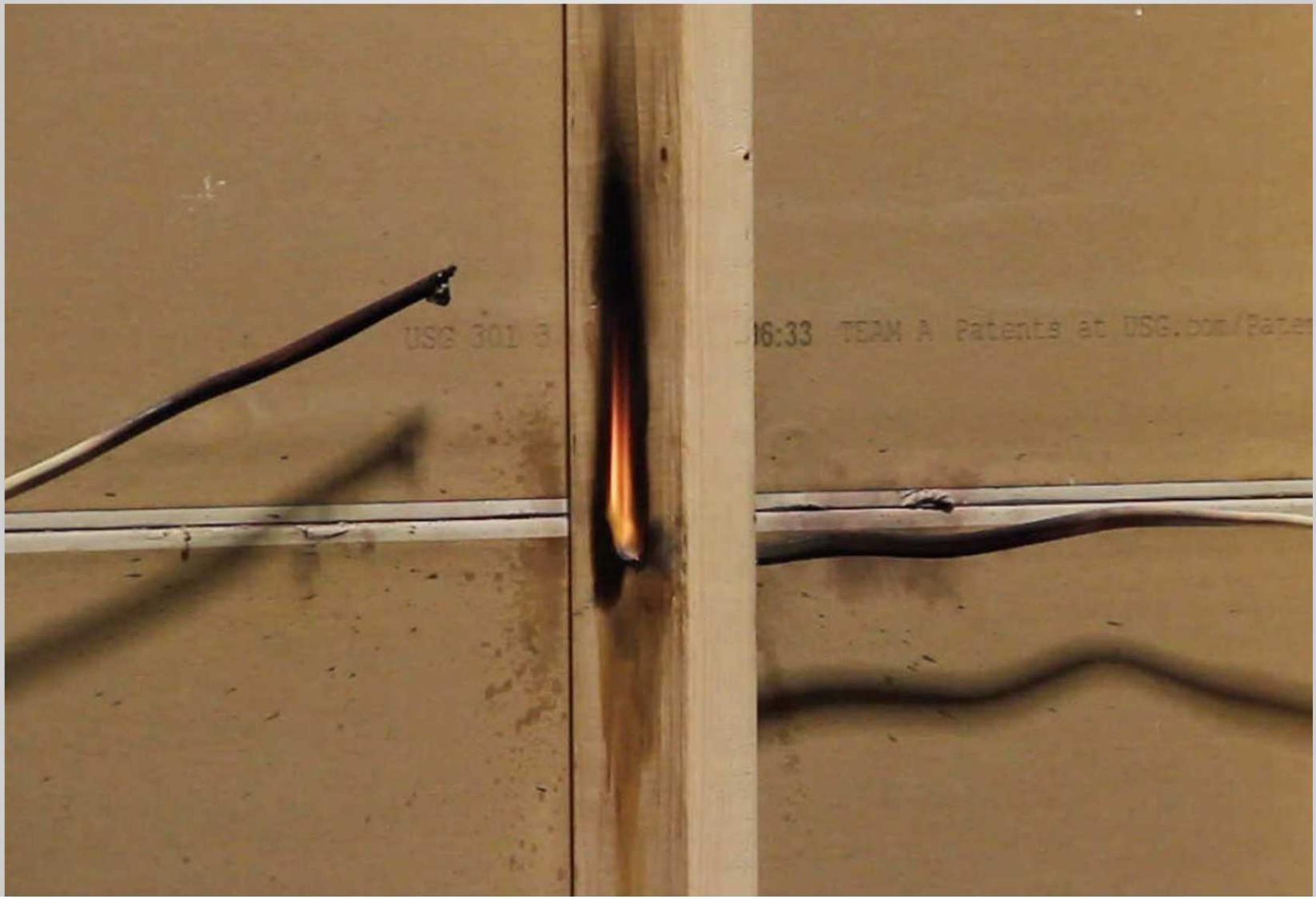
Tesla Model S Software Update 5.8.4 Reduces Charging Current by 25% If Input Power Fluctuations Are Detected



Overloaded Wiring



Fire Starting



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Electric Vehicle EVITP Infrastructure Training Program

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Electric Vehicle EVITP Infrastructure Training Program

Conductor 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

(1 of 6 Pages of EVITP Load Calc. Formulas)

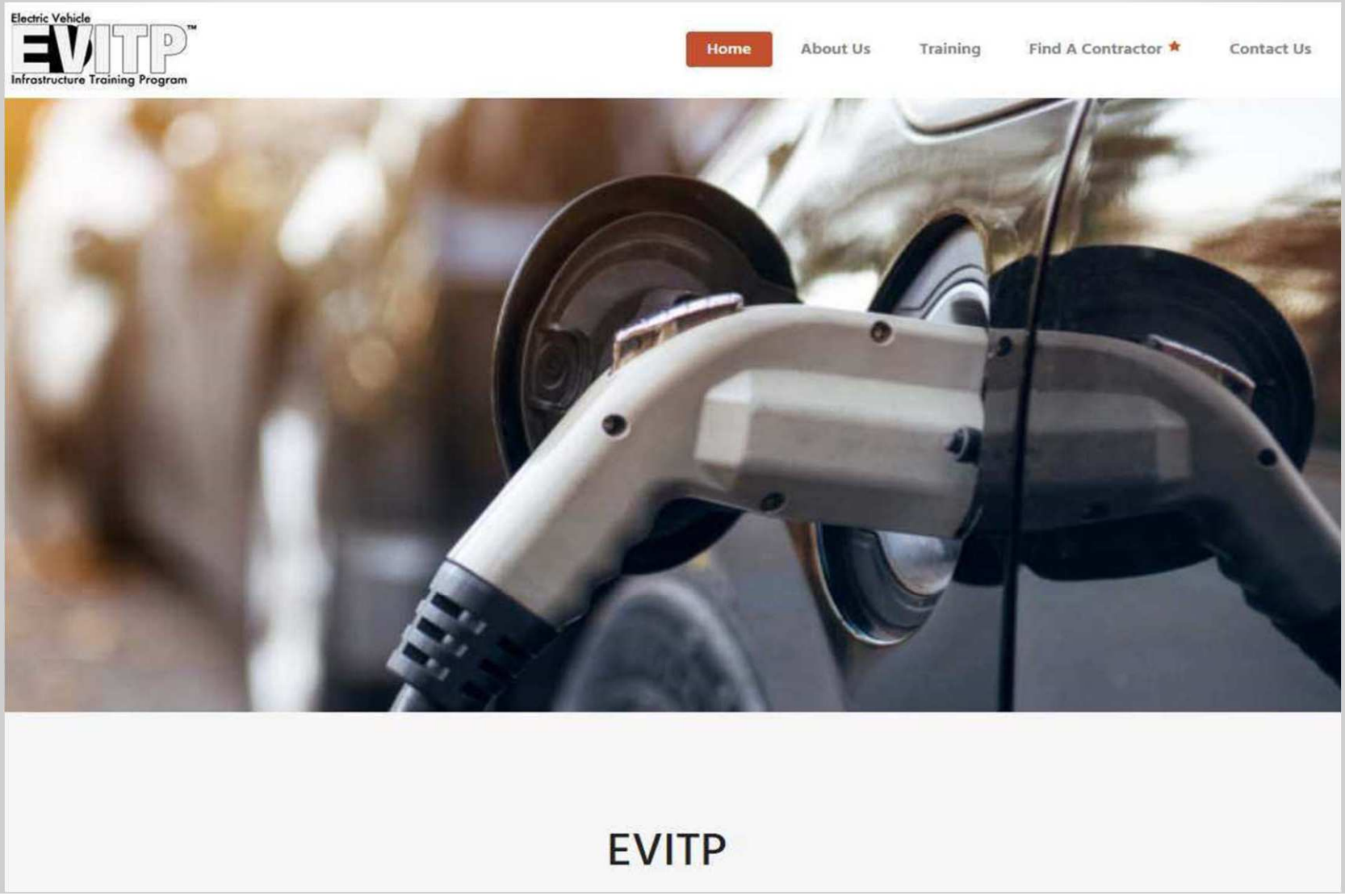
EVITP Requirements/Precedents

- CA Public Utilities Commission (CPUC) Safety Language Requirements, December 2016
  - SDG&E, So. Cal. Edison, PG&E
- 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."*

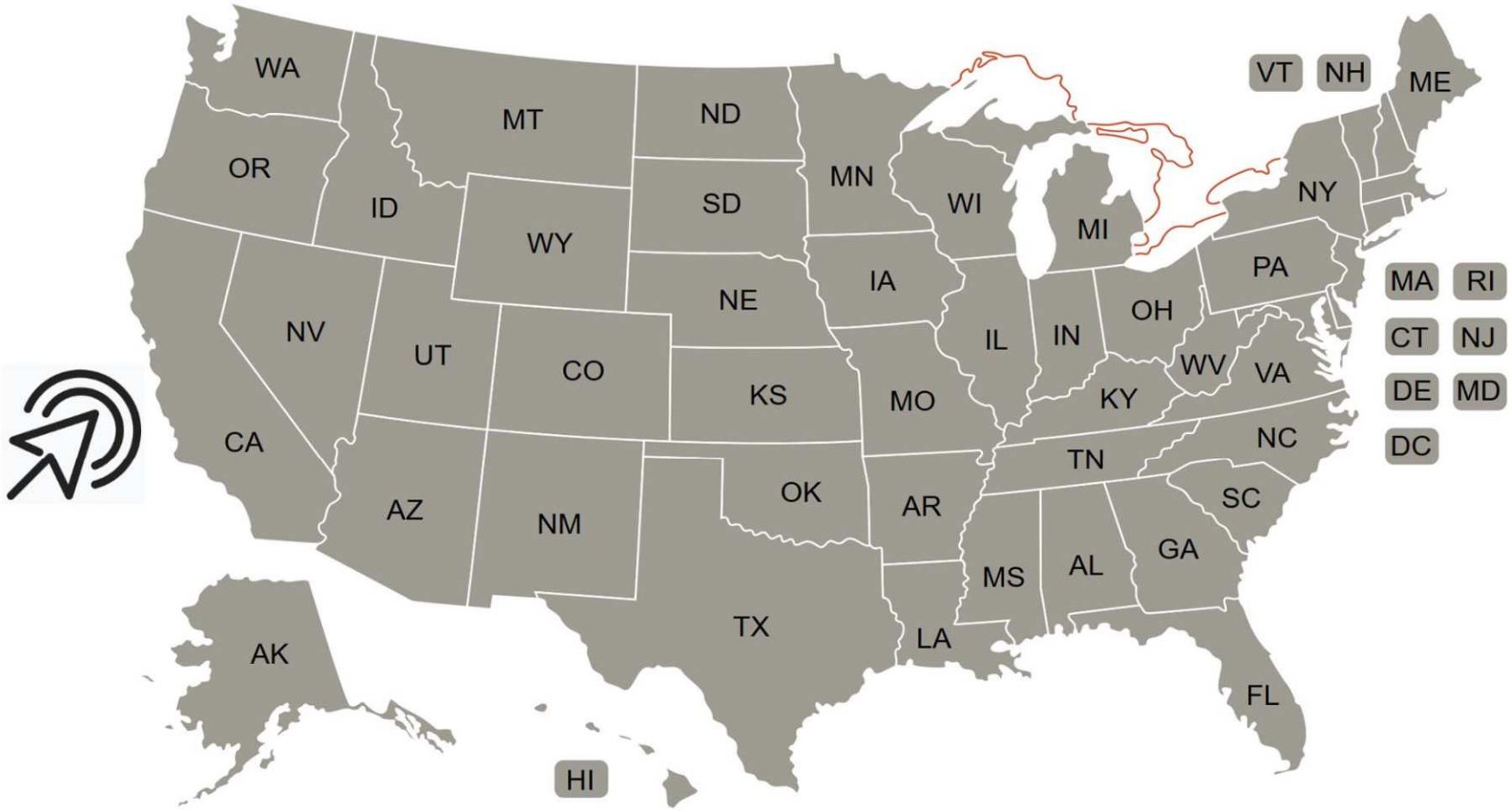
https://evitp.org/



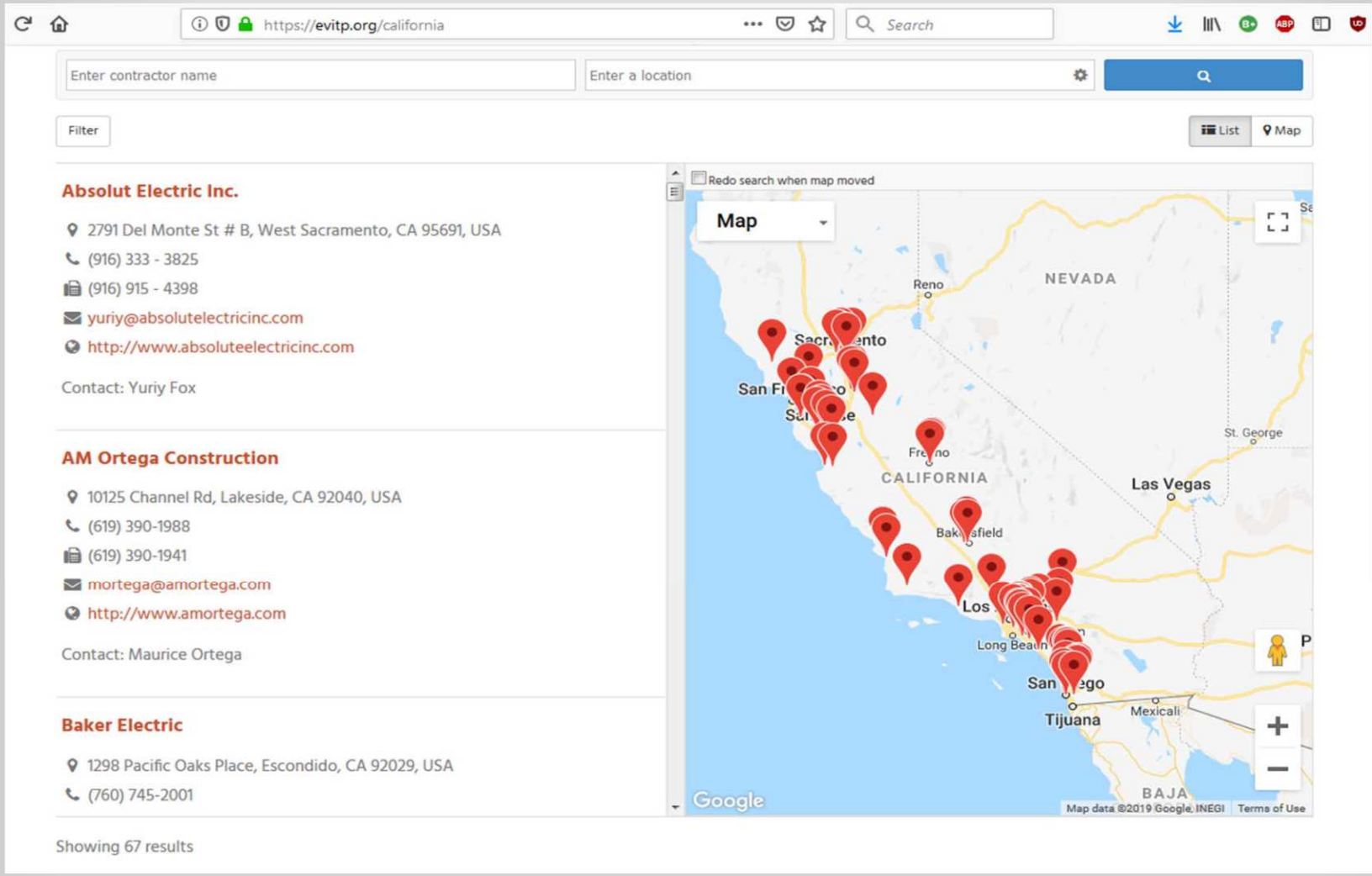
https://evitp.org/find-a-contractor/

Find A Contractor

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

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Plug-In Electric Vehicle Handbook

for Electrical Contractors

Clean Cities
U.S. Department of Energy

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).

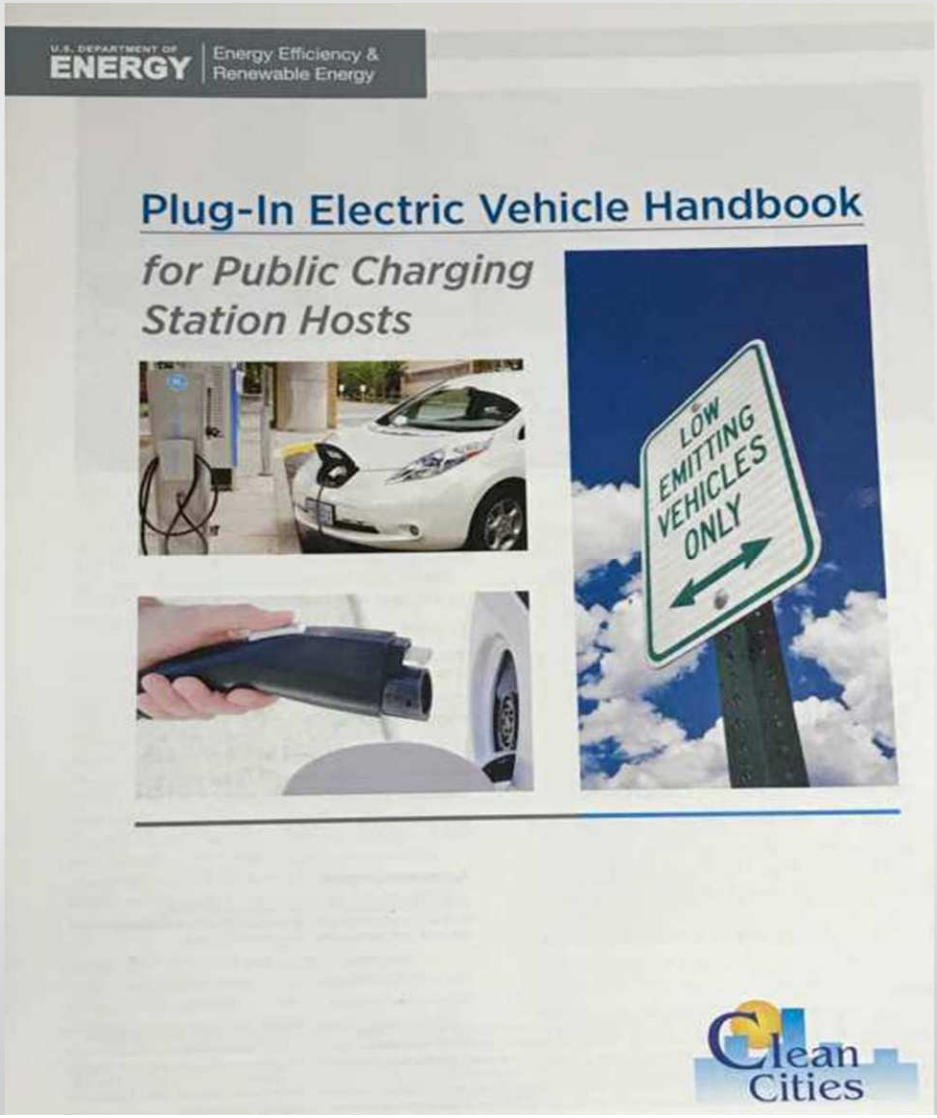
EVITP is a non-profit partnership of PEV stakeholders, including automakers, utilities, EVSE manufacturers, energy storage device manufacturers, electrical inspectors, electrical contractors, electrical workers, and first responders. It was established to provide a structured platform to facilitate training 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

Plug-In Electric Vehicle Handbook *for Public Charging Station Hosts*

Installing and Maintaining Charging St

The Electric Vehicle Infrastructure Training Program is one of the organizations that trains electrical contractors in EVSE installation. *Photo from Electric Vehicle Infrastructure*

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Thank You

Electric Vehicle Infrastructure Training Program (EVITP) 4.0