What Does it Take to Electrify the Last Mile?

Bernie Kotlier, Executive Director, Labor Management Cooperation Committee, CA & NV
National Co-chair, Electric Vehicle Infrastructure Training Program
What Does it Take to Electrify the Last Mile?

- Best Forecast of the Scope of Solutions and Applications
- Good Vision and Good Luck
- Power Transformation (Gas & Diesel to Electricity)
- Long Range Utility Infrastructure Planning, Construction and Maintenance
- Coordinated Efforts by State, Counties, Cities, and Towns
- Adequately Skilled and Experienced Workforce
- Education and Training
- (And More)
Scope of Possible Solutions & Applications

- Tiered Fleets
- Electric Small Trucks
- Electric Mini Vans
- Electric Micro Vans
- Ride Share >>> Delivery Share Cars
- Delivery Share Micro Vans
- Autonomous Versions of Above
- Pedal and Pedal Electric Vehicles
- Drones
- Local Lockers
- Why So Much Electricity?
Decarbonization = Electrification?

Infrastructure, Infrastructure, Infrastructure:
• After all the years of development, all the money, and PR
  Only 33 public hydrogen fuel cell filling stations in Calif.
• CA only state w/retail hydrogen vehicle refueling infrastructure
  (4 non-retail on East Coast)

Hydrogen from?
• Sandia National Lab: When fuel cells use hydrogen from natural
gas (methane), some emissions are the same or worse than diesel
powered engines
• “The GHG emissions are worse.”
• Recent study: In S. F. Bay area, renewable hydrogen cost 1.5 - 2 times
  more than hydrogen from natural gas
Hydrogen vs. Electric Efficiency

Renewable AC electricity

Hydrogen

AC-DC conversion (95%) 95 kWh

Electrolysis (75%) 71 kWh

Compression (90%) 64 kWh

Transport/transfer 90% 51 kWh

Fuel cell 50% 26 kWh

Fuel cell vehicle 90% 23 kWh

Electricity

AC via grid transmission (90%) 90 kWh

AC-DC conversion and battery charging (85%) 77 kWh

Electric vehicle with regenerative braking (90%) 69 kWh

23% 19% 50-69%
What Does it Take to Electrify the Last Mile?

• Best Forecast of the Scope of Solutions and Applications
Tiered Fleet (U.K.): City-City; Neighborhood-Neighborhood; Street-Street
Amazon To Buy 100,000 Electric Vans From Rivian

By RYAN DENHAM  SEP 19, 2019
Renault EZ-FLEX (With Driver)
Arcimoto (With Driver)

Eugene, Oregon
Boxbot Launches Last-Mile Self-Driving Parcel Delivery

Oakland, CA
NURO Autonomous

Mt. View, CA
Ride Share To Delivery Share

The Detroit Bureau

Walmart Partnering with Uber, Lyft to Deliver Groceries
“Walmart Groceries Delivered at Uber Speed”
UPS Pedal Electric

UPS driver Jake Jewett rides the new cargo e-bike, which can carry 400 pounds of cargo and go as fast as 20 mph. UPS is launching the service on a... (Steve Ringman / The Seattle Times) More

The pilot project, an attempt to make downtown deliveries more efficient, will start in the Pike Place Market neighborhood and, if successful, could expand around Seattle and the nation.
Autonomous E-Van + Drone
Testing Now
(Not Now)
Volkswagen Pedal / Electric
(Not Electric)
Batteries Not included
What Do Most Have in Common?

Electric Power
Where Will These Vehicles Charge?
Wireless Charging
(May Also be Overhead)
What Does it Take to Electrify the Last Mile?

- Long Range Planning, Construction, and Maintenance of Utility Infrastructure
Utilities Must Adapt to ...

Technology dynamics and disruptive change in the utilities sector

The current large scale shift from centralised to distributed generation based on renewables and other technologies can be disruptive for many electric utilities.

Corporate direct purchase of renewable energy
Companies are now signing direct power purchase agreements with large scale off-site renewable developers.

Renewable energy
Projections for investment in renewables, newly installed capacity and grid parity in various countries suggest a growing share of renewables in the energy mix.

Energy storage
Progress in energy storage technology is anticipated to further reduce costs and to reduce intermittency-of-supply problems commonly associated with renewables.

Grid integration
Utilities have improved demand forecasting tools to deal with fluctuating supply of renewables and as a result grid operators can now accept up to 20% renewable capacity.

Energy efficiency
Supply-side energy savings measures are very cost efficient. Various solutions such as the use of LED technology and energy efficient home appliances may change consumer energy use.

Carbon Capture & Storage
There are few projects in the world aiming to improve the viability and reduce costs, so CCS technology is not yet deployed at scale to have significant impact on emissions reduction.

Electric vehicles
New solutions and decreasing battery costs are rapidly changing the economics of this technology. Demand for electric vehicles from individual consumers is expected to rise rapidly.

Historically, power generation has focused on large centralised power plants through the combustion of fossil fuels such as coal and gas, supplemented by nuclear and hydro power.

Distrib. Gen, DER, EE, Microgrids, 2 Way Power, & EVs ...
Utility Challenges

• Oncor, the largest utility in Texas says growth of large EVs — like electric delivery vans and semi trucks — could necessitate "major investments" to its distribution grid.

• For just one logistics company, Oncor calculated that charging its 325 fleet vehicles would add 40 MW to the customer's power demand — a huge increase over the 0.5 MW load the utility typically sees from a commercial ratepayer. (80 x’s!)

• "What do you see when you fly into Dallas? A sea of warehouses as far as you can see," he said. "Every one of them has a fleet."

• Calif. Utility: Two EVs, or one long range EV can double a typical household load – overnight!
Utility Tracking & Power Management

Utility Notification

EV charging can negatively impact the grid if not properly tracked and managed:
- Clustering in certain areas
- Want to avoid transformer overload/failure

Local government and the utility will benefit from collaboration.

Local governments can help:
- Incorporate checkbox into application to give permission to share data with the utility
- Provide utility contact information so applicant can follow up
  - Special rate programs may be available
What Does it Take to Electrify the Last Mile?

• Coordinated Efforts by State, Counties, Cities, and Towns
Coordinated Efforts

"It Takes a Village" to Become PEV Ready: Stakeholders and Roles

PEV Drivers
Encourage PEV Ready communities

Electric Utilities
Offer special rates for PEVs. Advice on best rate options. Grid reliability

Automakers
Roll out and market PEVs

Employers
Encourage employees to drive PEVs. Offer workplace charging

State Government
Regulations, policies, guidance, incentives to spur PEV market. Resources to local governments

Electric Vehicle Supply Equipment (EVSE) Manufacturers
Offer charging solutions

Residential Property Managers
Respond promptly and positively to PEV charging requests. Develop strategy to include PEV charging in Multi-unit Dwellings

Local & Regional Governments
Lead by example. Adopt a PEV Readiness Plan

Fleets
Purchase PEVs. Support PEV car sharing, rentals, loans

Environmental Advocates
Advocate for PEVs. Scientific studies on health impacts of air pollution
SAN FRANCISCO

- Comprehensive plan to upgrade, and expand, hundreds of public charging sites.
- Innovative solutions for curbside charging and charging at Multi-unit Dwellings.
- Battery switching demonstration program with PEV taxicab fleet.
- City Department Workshops to encourage city-wide PEV adoption.

LOS ANGELES

- Goal: 7-day permitting, inspection and approval process for home PEV charging installations. Moved permitting online.
- Incentives of up to $2,000 per household for charging installation.
- Free PEV parking at Los Angeles International Airport.
- Building code amendments to require PEV charging in new construction.

SAN DIEGO

- U.S. D.O.E. EV Project award – ECOtality, Nissan, and SDG&E partnership will place hundreds of public access stations, including some DC Fast Charging.
- First all-electric car sharing program in North America.
- Smart City San Diego consortium will foster greater PEV public charging.
- SDG&E leadership in Multi-unit Dwelling charging outreach, options.
Building Permit Process

A CUSTOMER’S GUIDE TO THE BUILDING PERMIT PROCESS

- Permit Application
  - Permits can be downloaded online at: http://ci.guadalupe.ca.us/residents-mainmenu-34/document-center/doc_download/715-building-permit-application
  - Completed applications must be submitted with three (3) sets of plans

- Permit Review/Plan Check
  - All additions must be reviewed by the Planning Department
  - All additions over 500 Sq. Ft. require school fees to be paid

- Permit Issued/Payment
  - Parties will be notified when permit has been issued and is ready for pick up
  - Payment must be paid in the Finance Department
  - Note: The City does not accept credit cards. Permit fees must be paid in cash or check

- Inspection
  - All permitted projects must undergo onsite inspections to ensure the work is being done safely and to code
  - Yellow inspection cards must be posted onsite
  - To schedule an inspection, call 356-3903

- Final Inspection/Project Completion
  - When the project is complete, the Building Inspector must conduct a final inspection. If the final inspection passes, the project is complete

Frequently Asked Questions:

- What type of projects require a permit?
  Any building or interior that is being erected, constructed, enlarged, altered, repaired, moved, improved, removed, converted or demolished requires a permit.

- Why do I need a permit?
  Permit fees cover the cost of inspections, which are required to ensure projects are done safely and according to code.

Contact Information

City of Guadalupe
Building & Fire Safety Dept.
918 Obispo Street
Guadalupe, CA 93434

Alice Saucedo
Permit Technician

(Guadalupe, CA)
What Does it Take to Electrify the Last Mile?

• Adequately Skilled and Experienced Workforce
• Education and Training
This
Not This
What/Who is EVITP?

A not-profit, volunteer, brand neutral, 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
EVITP Partner Advisors
EVITP 4.0 Curriculum (2019)
Comprehensive Residential, Commercial, Industrial 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
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. 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
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 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
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, 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 Exam including Residential, Commercial and Industrial applications, the National Electrical Code by category, Site Assessment, Load Calculations, and Troubleshooting Problems
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.
Utility MD/HD Charging Infrastructure

- 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)
Inductive Charging
Why EVITP?

EV Infrastructure

- Training
- Education
- Safety, Safety, Safety
- Performance
- Reliability
- Risk and Liability Reduction based on Safety
EVITP Requirements/Precedents

- CA Public Utilities Commission (CPUC) Safety Language Requirements
  - SDG& E, So. Cal. Edison, PG&E
- California Energy Commission: Port of Long Beach
- 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
- Seven More Under consideration
Safety is not an accident
Conductor Calculation Formulas

\[ V_d = \frac{2KIL}{cm\ a} \]

\[ cm\ a = \frac{2KIL}{V_d} \]

\[ V_d = \frac{1.732KIL}{cm\ a} \]

\[ cm\ a = \frac{1.732KIL}{V_d} \]

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

- cma = conductor size from Chapter 9, T8
- K = 12.9 for Cu, K = 21.2 for Al
- L = length from supply to load
https://evitp.org/
Find a contractor in your area that utilizes EVITP certified installers for your next Residential, Commercial, Public or Fleet project.

https://evitp.org/find-a-contractor/
In CA: 1,200+ Electricians

67 Electrical Contractors
U.S. DoE Clean Cities
The Electric Vehicle Infrastructure Training Program is one of the organizations that trains electrical contractors in EVSE installation. Photo from Electric Vehicle Infrastructure Training Program.
Thank You
Questions?