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Session 7: PEV Charging Infrastructure Lessons Learned

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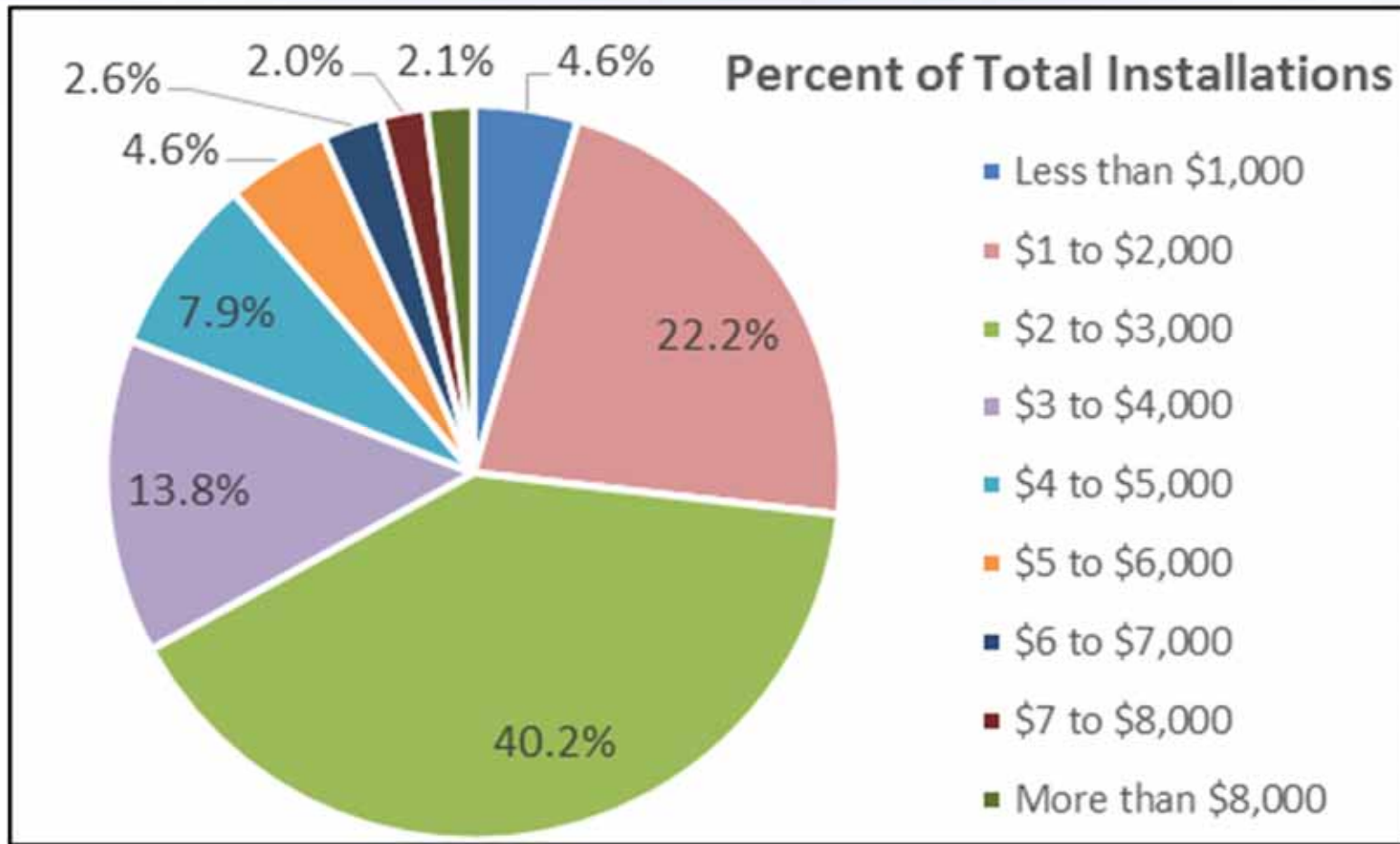
Level 2 EVSE Charging & Installation Costs

Level 2 EVSE Installation Costs

- Installation cost data for analysis is available for 2,479 units
- Average installation cost per EVSE, for publicly accessible Level 2 in EV Project markets, was \$3,108
- The five most expensive geographic markets had per unit installation costs over \$4,000 (\$4,004 to \$4,588)
- The five least expensive geographic markets had per unit installation costs under \$2,600 (\$2,088 to \$2,609)
- Similar to residential EVSE and direct current (DC) fast charger installation costs, AC Level 2 EVSE installed in California were the most expensive installations

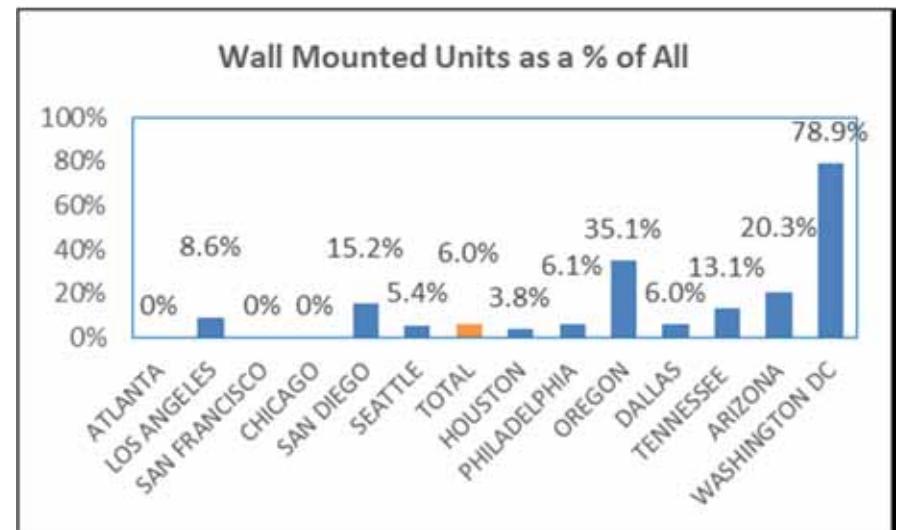
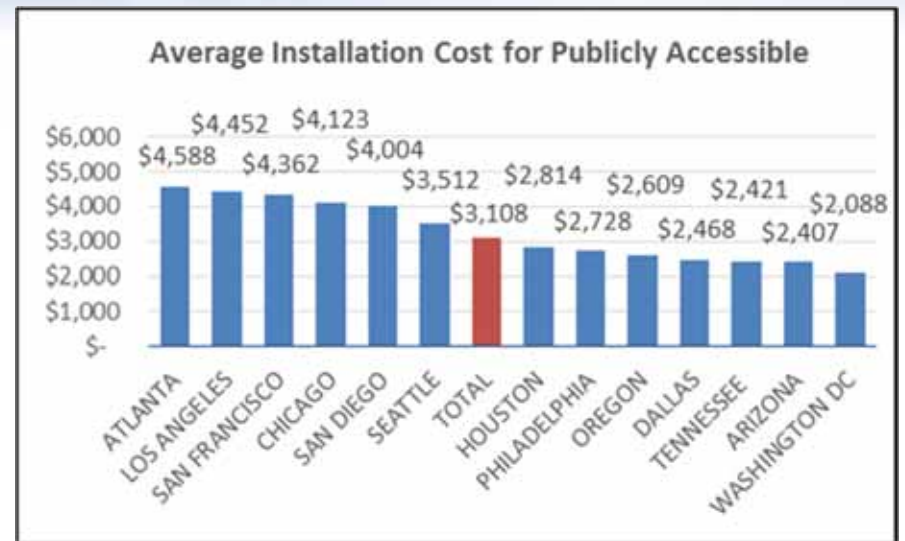


Public Level 2 EVSE Installation Costs



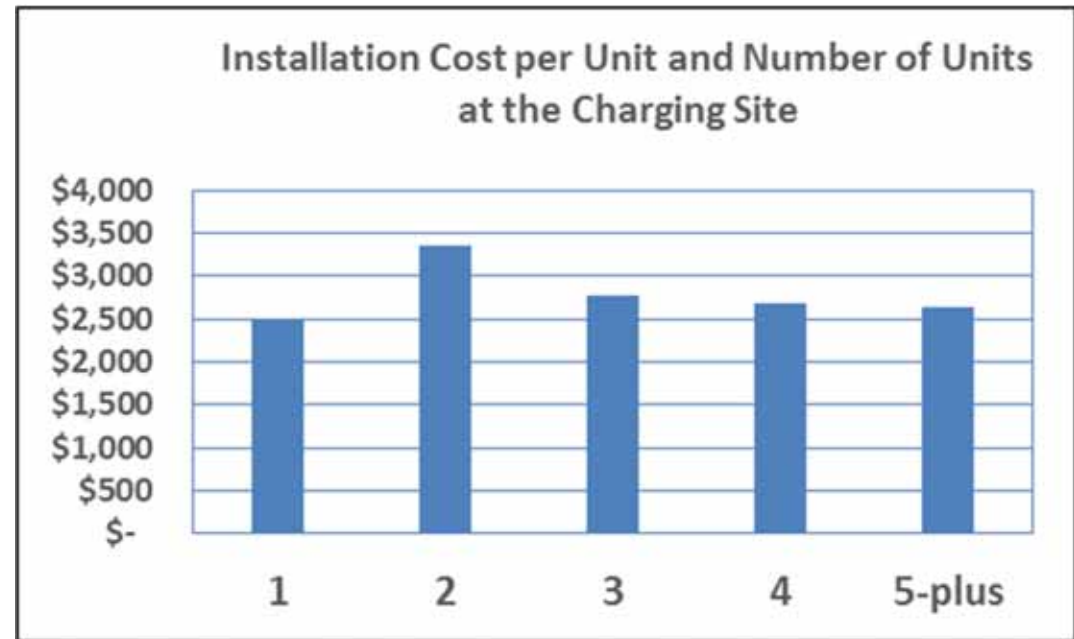
Level 2 EVSE Installation Costs

- **The largest installation site conditions cost drivers were:**
 - **Distance between EVSE and power distribution panel**
 - **The nature of the surface needing restoration as a result of the EVSE installation**
- **Labor cost is primary geographic differentiator of EVSE installation cost**
 - **Labor costs can be mitigated by wall mount versus pedestal installation**



Level 2 EVSE Installation Costs

- The distance and surface condition variations had more impact on installation cost than the number of units installed per site



Level 2 EVSE Installation Cost Drivers



Pedestal EVSE installed on **decorative paving**; **removal and replacement** required for underground conduit



Pedestal EVSE installed on concrete pad, with **underground boring** for conduit



Pedestal EVSE installed on asphalt, with **trenching and repaving** for underground conduit

Level 2 EVSE Installation Cost Savings



Wall-mounted EVSE installed in parking garage with overhead surface-mounted conduit



Wall-mounted EVSE installed on block divider wall with surface mounted conduit



Wall-mount EVSE installed on building pillar with backing plate and overhead surface mounting for conduit

Utility Demand Charges on AC Level 2 EVSE

- **Some electric utilities impose demand charges on the highest power delivered to a customer in a month**
- **Simultaneously charging plug-in electric vehicles via multiple AC Level 2 EVSE can create significant increases in power demand**
 - **4 EVSE x 6.6 kW = 26.4 kW**
- **Many utilities start demand charges at 20 kW**
- **Demand charge can exceed \$1,000 per month**
- **The increased charging rate allowed by many newer plug-in-electric vehicles (PEVs) will exacerbate this impact**



DCFC Charging & Installation Costs



DC Fast Charger Installation Costs for 111 Units

- **By the end of 2013, the EV Project had installed 111 DCFCs**
 - Installation costs varied widely from \$8,500 to over \$50,000
 - Declined \$75,000 installation estimate
- **The median cost to install the Blink dual-port DCFC in the EV Project was \$22,626. Does NOT include DCFC unit cost**
- **The addition of new electrical service at the site was the single largest differentiator of installation costs**
- **The surface on or under which the wiring and conduit were installed was second largest cost driver**
- **Cooperation from the electric utility and/or the local permitting authority is key to minimizing installation costs (both money and time) for DCFCs**
- **Presenter aware of:**
 - **British Columbia installation costs of \$100,000+ per site**
 - **New York City \$350,000 estimate for one installation**
 - **Required approval from 29 departments/commissions**

Characteristics of Most Expensive DCFC Installations

- **Primary characteristic of the more expensive installations can be simply identified as those that had a new electric service installed to accommodate the DCFC**
- **In some cases, the increased cost for new service was compounded by long underground conduits and surface conditions that were expensive to restore (e.g., concrete or asphalt)**
- **Another consideration for the DCFC site hosts is installation time:**
 - **Contractors installing equipment**
 - **Contractors waiting to start**
 - **Contractors waiting to finish**
- **When things went smoothly the installation took from 30 to 60 days from the agreement to proceed**
- **When there were delays in administration and materials the duration of the installation from start to finish often exceeded 90 days**

Characteristics of Least Expensive DCFC Installations

- The very lowest cost installations (Sears) had **sufficient power and a simple installation with either short underground conduit runs (i.e., hand-shoveled) or surface-mounted conduit**
- Of the three installations that cost less than \$9,000, the sites had sufficient existing power at the site and they used **surface-mounted electrical conduit**



Workplace EVSE Installation Cost Drivers

- **Wall-Mounted Installations**

- Greater freedom as to the installation location at a site led to more wall-mounted installations
- Wall-mounted EVSE were typically less expensive to install, because they did not require underground conduit to supply power, which is typical for a pedestal unit
- **The average cost to install a wall-mount AC Level 2 EVSE was \$2,035**
- **The average cost to install a pedestal AC Level 2 was \$3,209**



Installation Cost Drivers



Installation Cost Savings



Signage and To Bollard or Not?



Installation Considerations - Level 2 vs. DCFC

- Installing Level 2 EVSE cost on average 1/7th the cost of DCFC
- **Level 2 hardware costs from ~\$1,500 to ~\$7,000**
- DCFC hardware costs from \$20,000 to \$45,000 (quoted to INL)
 - INL quote for dual DCFC technologies in one box, 2 ports
- For both DCFC and Level 2
 - Data collection intended?
 - Annual back office and maintenance fee costs
 - Level 2 EVSE from \$0 to \$1,000 annually
 - DCFC about \$5,000 (assumes \$250 / month demand charge)



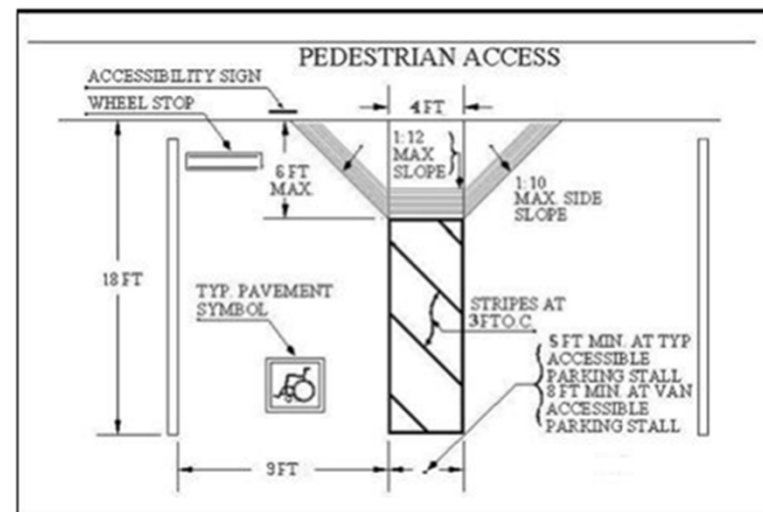
General Installation Considerations

- **Establishing EV charging infrastructure has unique challenges in that drivers are not used to seeing electric vehicle supply equipment (EVSE) and may be unfamiliar with its purpose and use**
- **Without specific signage to the contrary, internal combustion engine (ICE) vehicle drivers may park in spaces equipped with an EVSE because they are convenient and vacant**
- **When a plug-in electric vehicle (PEV) arrives, the driver finds the space occupied and is unable to recharge**



ADA Cost Driver Installation Costs

- Another factor that affected installation costs in different markets was implementation of Americans with Disability Act (ADA) requirements as understood by the local permitting authority having jurisdiction
 - In general, for every 25 parking spaces, one parking space should be accessible. For every six parking spaces that are accessible, one parking space should be van accessible



Workplace Cost Savings

- **Flexibility of workplace installations gives the ability to install EVSE with fewer accessibility requirements:**
 - **Typically there were few, if any, parking signage or striping requirements**
 - **ADA accessibility, including an accessible pathway to the workplace building, was only necessary if an employee was a PEV driver and required this accessibility**
 - **Units did not need to be in conspicuous locations**



Recommendations

- **Fleet Charging**
 - Support the installation of Level 2 EVSE while mitigating potential demand charges
- **DC Fast Chargers**
 - Minimize installation costs via site selection
 - Install limited numbers of DC fast chargers in locations with high PEV population densities to support DCFC charge events
 - If possible, choose high PEV density areas with travel corridor access
- **Data collection to understand infrastructure use patterns and vehicle missions**
 - Requires minimally smart EVSE and DCFC
- **Site selection is critical to control installation costs**
- **Plan EVSE and DCFC for next generation of PEVs with larger batteries**

Questions?