CHANGING TIRES:

Electric Car Chargers, Car Sharing, And More
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National Telecom Manager
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Founder
EV Charging Pros
Transportation Oriented Development Market Catalysts

• Urban Planning and Smart Cities
• Urban No Parking Trend
• Tenant Demographics and Lifestyle
• Electrification of Transportation Infrastructure
• Automotive Industry Transitions From Ownership To Mobility
• Multifamily Developer Economics
• Multifamily Sustainability Initiatives
• Multifamily Market Differentiation
Seven Steps To EV Charging
7 Steps To An EV Charging Program

1. Current and Future Demand for Charging
2. Existing and Scalable Electrical Infrastructure
3. Charging Levels
4. Driver Use Cases, Recovery of Energy Costs and Vendors
5. Parking Facility Design, including Accessibility/ADA
6. Construction Project Requirements
7. EV Charging Communication and Deployment
Car Sharing Options Abound

280 Cities with Carsharing
     Traditional carsharing services are currently operating in nearly 280 North American cities.

75+ Bikesharing Systems
     Bikesharing systems have launched in more than 75 North American cities.

160+ Cities with TNCs
     Ridesourcing or Transportation Networking Companies (TNCs) are operating in more than 160 cities in North America.

Now 1.3M Car Sharing Members in USA, Up from 100K in 2006

http://sharedusemobilitycenter.org/#
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Cumulative Sales of PEV Vehicles

- National Sales:
  - 2015 Sales: 90,209
  - Cumulative 2011-2015: 377,033
  - October: 9,821

- California Sales:
  - Cumulative 2011-2015: 158,946
  - October: 4,419
Top Cities For EV’s .... 
Because The Cars Are Not Available In All 50 States

Top 10 EV Friendly Regions

1. Bay Area, CA
2. Los Angeles, CA
3. Seattle, WA
4. San Diego, CA
5. Honolulu, HI
6. Austin, TX
7. Detroit, MI
8. Atlanta, GA
9. Denver, CO
10. Portland, OR

*Totals as of Dec. 31, 2014

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2016 Volt

Larger battery pack - 18 kWh
53 miles all-electric range vs 35 miles
$8,000 less than the 2011 Volt, est $34,000
2017 Chevy Bolt – 200 Mile Range, $37,000 Will Be Sold In All 50 States

2016 Leaf With 107 mile Range starts at $35K
2018 Leaf 60 kWh battery pack and 300 mile range

Nissan Expects BEV Inflection in 2019-2021 - 10%+ Of All Cars Sold
Volvo plans on making a PHEV of every model by 2020
Statewide/Bay Area Rebates and Density

Source: http://energycenter.org/clean-vehicle-rebate-project/cvrp-rebate-map
Southern California Rebates and Density

Source: http://energycenter.org/clean-vehicle-rebate-project/cvrp-rebate-map

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# EV’s Per 1,000 - By Population Density

<table>
<thead>
<tr>
<th>County</th>
<th>Population</th>
<th>EV by 1,000</th>
<th>EV Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA</td>
<td>10,017,068</td>
<td>2.38</td>
<td>23,845</td>
</tr>
<tr>
<td>San Diego</td>
<td>3,211,252</td>
<td>2.32</td>
<td>7,445</td>
</tr>
<tr>
<td>Orange</td>
<td>3,114,363</td>
<td>3.41</td>
<td>10,623</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>1,862,041</td>
<td>7.38</td>
<td>13,745</td>
</tr>
<tr>
<td>Alameda</td>
<td>1,578,891</td>
<td>4.63</td>
<td>7,311</td>
</tr>
<tr>
<td>Contra Costa</td>
<td>1,094,205</td>
<td>3.19</td>
<td>3,488</td>
</tr>
<tr>
<td>Ventura</td>
<td>839,620</td>
<td>2.16</td>
<td>1,810</td>
</tr>
<tr>
<td>San Francisco</td>
<td>837,442</td>
<td>2.31</td>
<td>1,923</td>
</tr>
<tr>
<td>San Mateo</td>
<td>747,373</td>
<td>4.87</td>
<td>3,643</td>
</tr>
<tr>
<td>Sonoma</td>
<td>495,025</td>
<td>2.89</td>
<td>1,430</td>
</tr>
<tr>
<td>Solano</td>
<td>424,788</td>
<td>1.24</td>
<td>528</td>
</tr>
<tr>
<td>Santa Cruz</td>
<td>269,419</td>
<td>3.18</td>
<td>858</td>
</tr>
<tr>
<td>Marin</td>
<td>258,365</td>
<td>5.64</td>
<td>1,457</td>
</tr>
<tr>
<td>Napa</td>
<td>140,326</td>
<td>1.81</td>
<td>254</td>
</tr>
</tbody>
</table>

http://insideevs.com/map-shows-electric-car-hot-spots-california/

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Electrical Distribution Infrastructure

- Electric Distribution Service
- Electric Vehicle Supply Equipment (EVSE)

Components:
- Utility Distribution Network
- Utility Pad Mounted Transformer
- Meter
- Panel
- Conductor (Boring/Trenching)
- EV Charger

Connections:
- EV Service Connection
- EV Supply Infrastructure
- EV Charger Equipment

Electric Vehicle
National Electric Code Section 625

• Everything external to the car that is required to charge the vehicle
  – 625.1 – Covers the electrical conductors and equipment external to an EV that connect an EV to a supply of electricity and the installation of equipment and devices related to EV charging.

• Considered “continuous load” and Automatic Load Management Possible
  – 6254.14 EV charging loads shall be considered to be continuous loads.

• Must provide electrical capacity for 125% of EVSE rating
  – 625.40 Overcurrent protection circuits supplying EVSE shall be sized for continuous duty and shall have a rating of not less than 125 percent of the maximum load of the EVSE.
# Electrical Requirements For Charging

<table>
<thead>
<tr>
<th>Charge Method</th>
<th>Think</th>
<th>Plug Standard</th>
<th>Voltage</th>
<th>Maximum Current</th>
<th>Circuit Breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Level 1</td>
<td></td>
<td>120 V ac, one phase</td>
<td>12A</td>
<td>15A minimum</td>
<td></td>
</tr>
<tr>
<td>AC Level 2</td>
<td></td>
<td>208 to 240 V ac, one phase</td>
<td>32A</td>
<td>40A</td>
<td></td>
</tr>
<tr>
<td>DC Charging</td>
<td></td>
<td>Direct connect</td>
<td>60V dc maximum</td>
<td>400A maximum</td>
<td>As required</td>
</tr>
</tbody>
</table>
Plug in Where You Are Spending Time

L1 Wall Outlets
5 miles per hour

L2 Charging Stations
20 miles per hour

DC Fast Charging
40 miles in 20 minutes

30 mins. to grab a bite
10 miles at L2 or 60 miles at DCFC

1 hr. grocery shopping
20 miles at L2

2 hrs. between meetings
40 miles at L2

3 hrs. at a ballgame
60 miles at L2

8 hrs. overnight
40+ miles at L1
How many Electrified Parking Spots Now..... 3 Years From Now?

- The amount of power for X number of parking spots
- The number of parking spots pre-wired and “EV Ready”
- The number of chargers required at Occupancy

- CA AB 2565 and SB 209 – Tenant can request EV Charging, multifamily owners and HOA’s “cannot reasonably deny” the request

- Title 24 – 3% moving to 5%
- City of San Francisco Proposal for 20%
- City of Palo Alto 100%
Selecting Spots Requires Consideration
Accessibility Is Not Necessarily ADA
New ADA “Standards” Require Space Planning

• Van Accessible
  – 144 inches wide and have an adjacent accessible aisle

• Standard Accessible
  – 108 inches wide and have an adjacent accessible aisle

• Ambulatory Accessible
  – 120 inches wide and not required to have an accessible aisle
Use Cases, Energy Costs and Vendors

• What is the end-to-end customer experience
  – Do you have a driver specific access policy?
  – Is your building in a regulated utility territory or can you recover energy costs?
  – Are you going to use a sub-meter or EVSE metering software?
  – Are you going to incur tiered or demand charges?
  – What is your fee logic and user experience?
  – How do you administrate fees?

• Own/Operate vs. Outsourced

• You can choose an EVSE vendor once you understand the scalable vehicle demand, electrical infrastructure and user/admin scenarios
Energy Fee Recovery Strategies

• Unlimited charging based on “Reserved Parking” Fee

• Submeter the EVSE and bill the tenant at a rate of X. Can use any non-networked charger (less expensive, “home-style” charger)

• Use a “Smart Charging” network system to set the rates per charging session. Driver uses a pre-paid “access card” so you are not in the billing the customer business. However, you will be in the “energy reconciliation” business because you will need to make sure what you are receiving in fees covers the increased use of energy.

• Publically Available Charger Billing Tariff: Charging prices generally should escalate after the first few hours to discourage “charging hogs”
## Charging Station Network Service Models

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Turnkey Owner Operator</th>
<th>Network Service Provider</th>
<th>Subscription Services</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What</strong></td>
<td>The company owns and operates the EVSE for a variety of clients/sites</td>
<td>The company offers integrated EVSE and network for clients and companies to operate</td>
<td>The company offers tiers of services from company controlled EVSE to PEV Owners</td>
</tr>
<tr>
<td><strong>Who</strong></td>
<td>Car Charging, NRG</td>
<td>ChargePoint, GE, Eaton, Schneider</td>
<td>NRG, CarCharging, Evercharge, Powertree, ChargePoint</td>
</tr>
<tr>
<td><strong>Fees</strong></td>
<td>Fees to drivers, minimal revenue to site hosts</td>
<td>Yearly software fees($0-$260 Vendor Service Fee = % of transaction)</td>
<td>Driver pays for charger like a cable box, Driver pays additional charges for energy</td>
</tr>
<tr>
<td><strong>Site Host Responsibilities</strong></td>
<td>Nothing except turn over spaces, revenue covers energy</td>
<td>Sets policy, pricing, manages stations, administrates site software</td>
<td>Does nothing except turn over spaces, revenue covers energy plus small %</td>
</tr>
</tbody>
</table>
Resources to Consider

- Your Planning Department
- Local EV Readiness Plans
- PEV Collaborative
- Multifamily EV Working Group
- EV Charging Pros
Operational Discussion and Insights

- Scaling Electrical Capacity
- Metering and Electricity Rates
- Where Do We Put The Chargers
- Driver Expectations and Considerations
- Business Models – Yours and the Vendors
- Development Team Collaboration