EPRI ELECTRIC POWER RESEARCH INSTITUTE

# Transportation Electrification

## September 2, 2015

**Mark Duvall**
**Director, Energy Utilization**

**Together…Shaping the Future of Electricity**

© 2015 Electric Power Research Institute, Inc. All rights reserved.

# Automakers Investing $ Billions In New PEVs
# 15+ Models Arriving and On The Way

| Make | Model | Type | Body Style | Launch |
|---|---|---|---|---|
| Cadillac | ELR | PHEV | Luxury couple | Q4 2013 |
| Porsche | Panamera | PHEV | Luxury sedan | Q1 2014 |
| BMW | i3 | BEV; REx | 5 door hatchback | Q2 2014 |
| KIA | Soul | BEV | 5 door hatchback | Q3 2014 |
| Mercedes | B-Class | BEV | 5 door hatchback | Q3 2014 |
| BMW | i8 | PHEV | Sports car | Q3 2014 |
| VW | eGolf | BEV | 5 door hatchback | Q4 2014 |
| Tesla | Model X | BEV | SUV/Crossover | 2015 |
| Mitsubishi | Outlander | PHEV | SUV/Crossover | 2015 |
| Audi | A3 Etron | PHEV | Wagon | 2015 |
| BMW | X5 | PHEV | SUV | 2015 |
| Mercedes | S-Class | PHEV | Luxury sedan | 2015 |
| Volvo | XC90 | PHEV | SUV | 2015 |
| Chrysler | Town & Country | PHEV | Minivan | 2016 |
| Volvo | V60 | PHEV | Wagon | 2016 |

# Almost Anything Can Be Electrified – To Some Degree

**Industrial 'Non-Road' Transportation Electrification Results in Greatest Air Quality Improvements**



© 2015 Electric Power Research Institute, Inc. All rights reserved.

# Plug-In Electric Vehicle Charging Technology

**120V – Level 1** (1.4kW)

Portable cordset
Use any 120V outlet

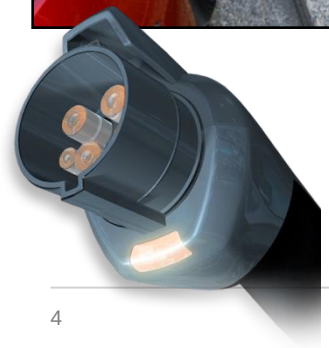
~ 6 km per hour of charging

**DC Fast Charging**

50 kW and greater

Fast, expensive

3 – 8 km per **minute** of charging



**240V – Level 2** (3.3 – 19.2 kW)

Permanent charge station (EVSE)

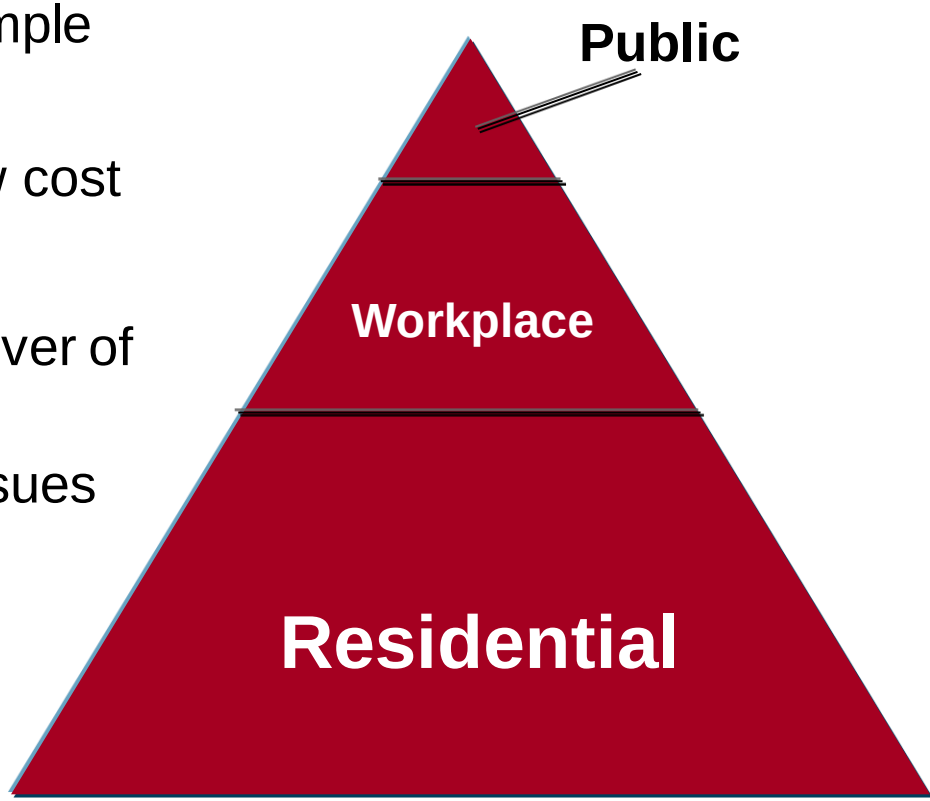
15 – 90 km per hour of charging



© 2015 Electric Power Research Institute, Inc. All rights reserved.

# Where to Locate Infrastructure?

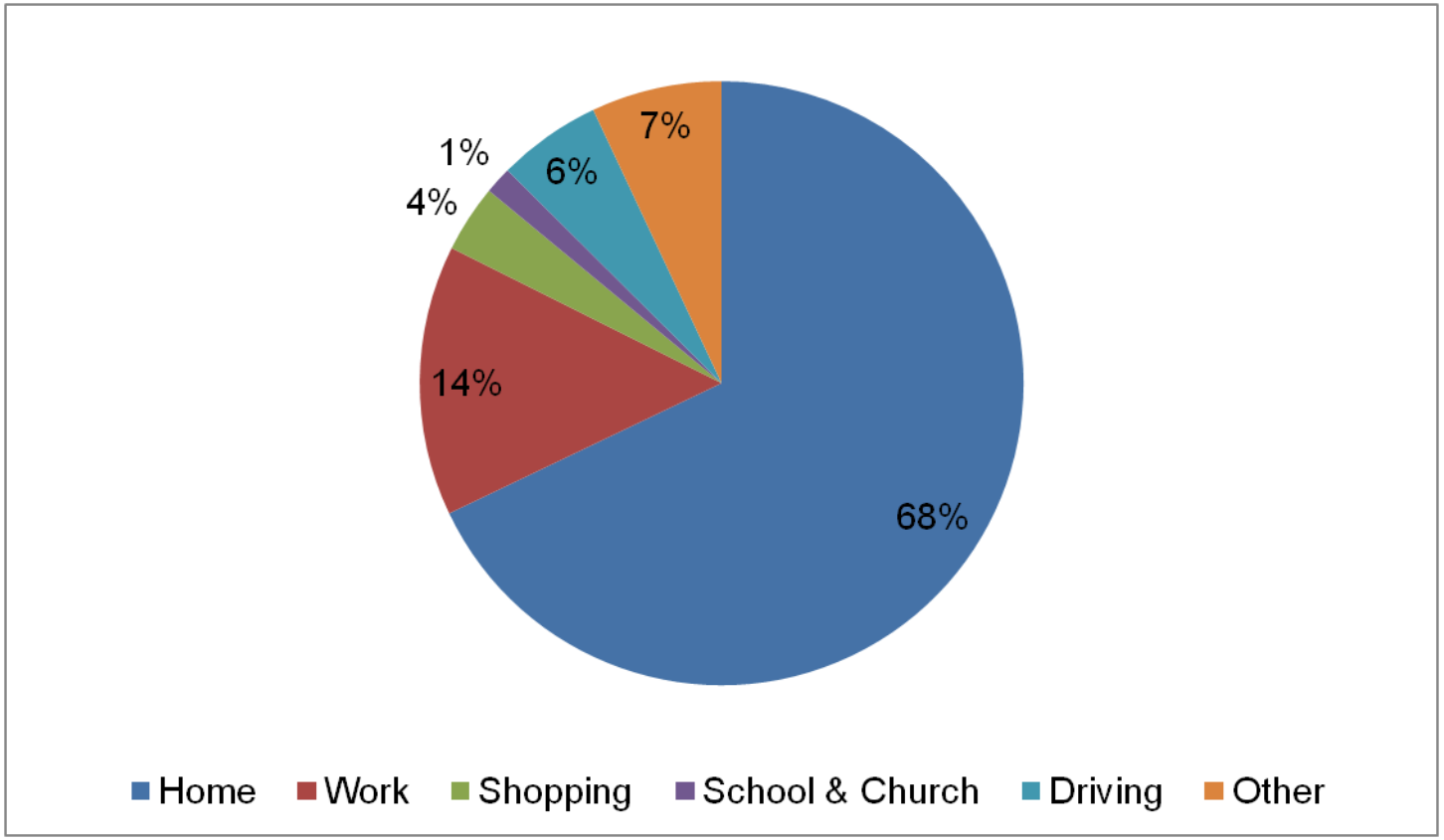
- Residential
  - Single-family homes relatively simple
  - Multi-unit and tenant dwellings
  - Use of existing outlets at very low cost
- Workplace
  - Potential has grown—seen as driver of adoption
  - High installation costs, scaling issues
- Public Charging
  - Clustering – need to build out networks
  - Long-term sustainability of infrastructure
  - Can be difficult to find suitable host sites





© 2015 Electric Power Research Institute, Inc. All rights reserved.

# Where Do Vehicles Spend Their Time When Driven?




Vehicles spend large amounts of time both parked and just sitting at home and work.



© 2015 Electric Power Research Institute, Inc. All rights reserved.

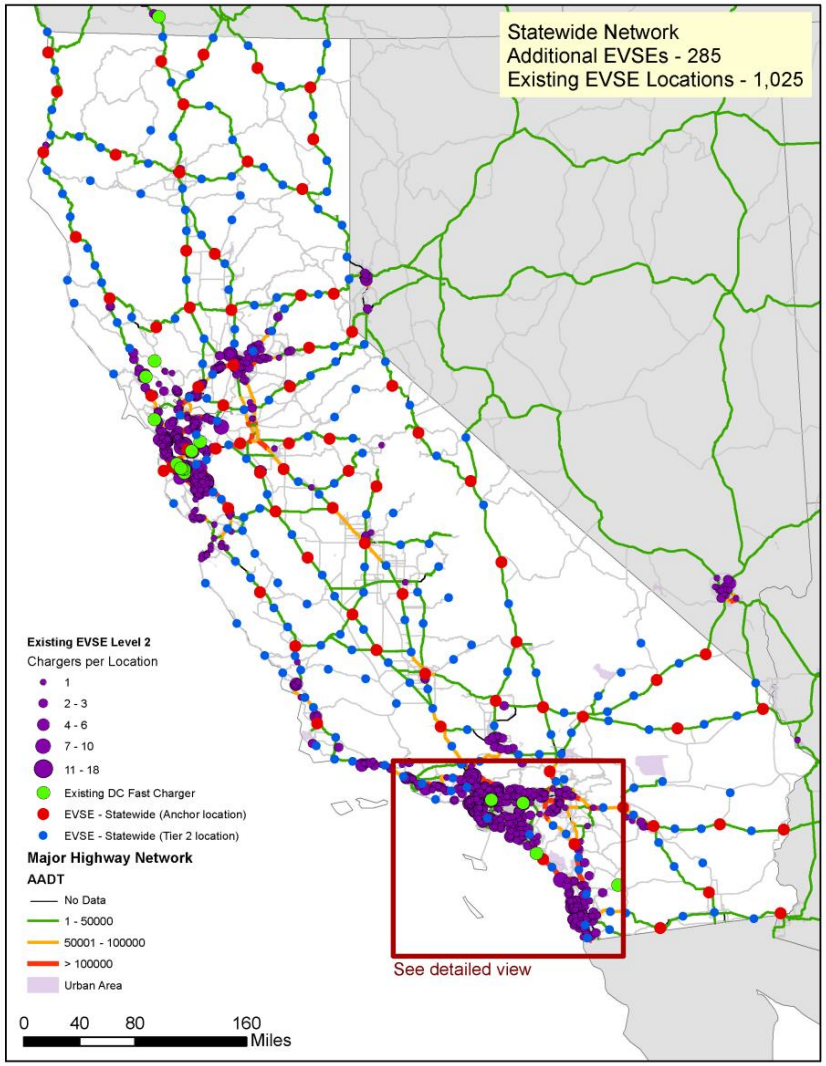
# A Few Points about PEV Infrastructure

- Its expensive and must be carefully planned
- **Paradigm shift – weekly refueling versus daily recharging**
- There are few, if any, proven experts at planning EV infrastructure—no one has the magic formula
- No one knows your community better than you do
  - **All of the needed PEV readiness expertise is available from your local stakeholders**
- It is likely necessary to leverage all the possible infrastructure investment, incentive, and ownership models (public, private, utility, etc)

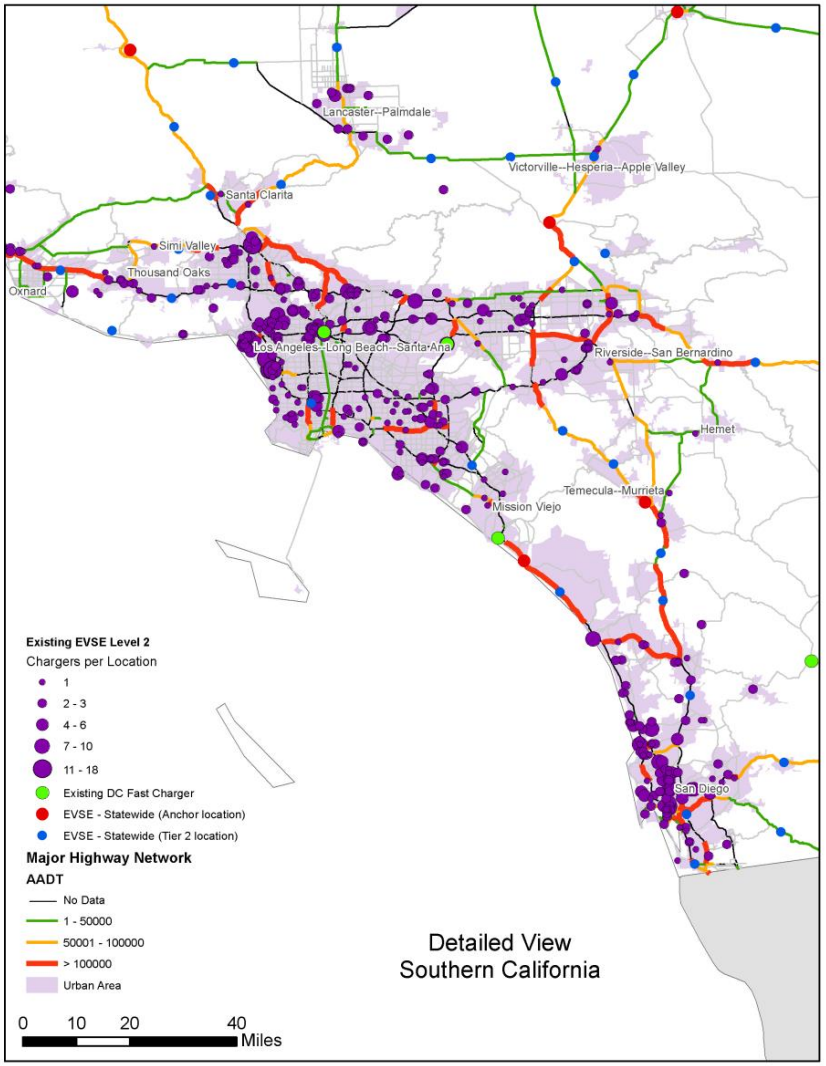

© 2015 Electric Power Research Institute, Inc. All rights reserved.

# It is Important to Plan Infrastructure Deployment Local & Regional Requirements

California Existing EVSEs and Estimated Statewide Network




California Existing EVSEs and Estimate Statewide Network

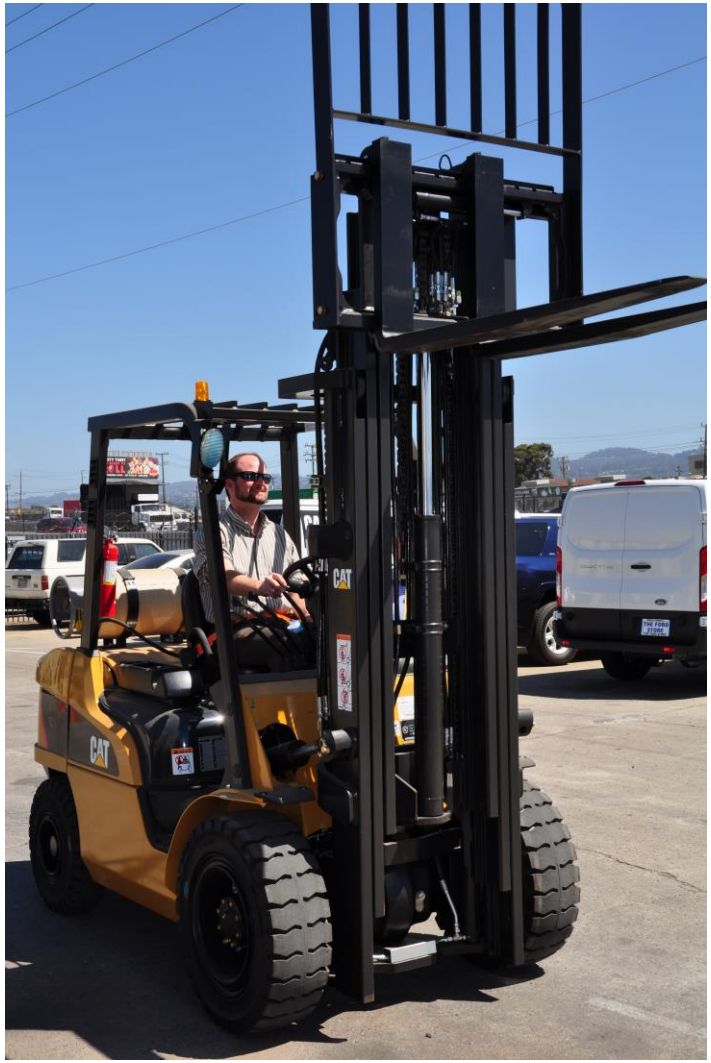





© 2015 Electric Power Research Institute, Inc. All rights reserved.

# Points to Consider

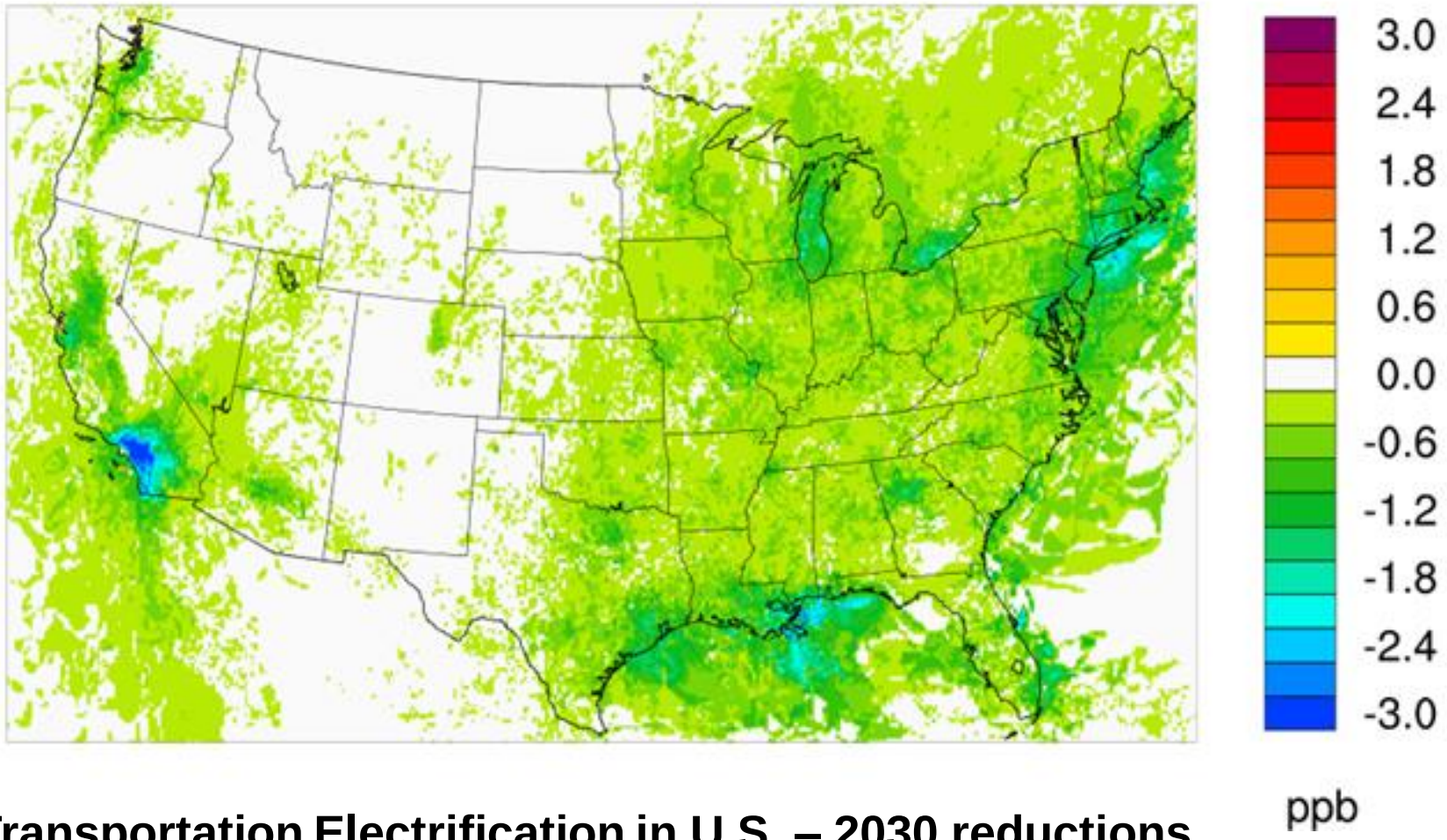
- Stakeholder working groups are critical – inclusive and with strong leadership
- Recommend an economic benefits study
- Develop comprehensive infrastructure and deployment plans
- Long-term goal is 2050 – but go for early victories.
- Most EV deployment in three categories
  1. **Economics work today—go and deploy!**
  2. **Economics not quite there—consider additional benefits or incentives. Consider limited pilots.**
  3. **More development or R&D needed**





© 2015 Electric Power Research Institute, Inc. All rights reserved.

# Thank you




**Transportation Electrification in U.S. – 2030 reductions in ground level ozone**



© 2015 Electric Power Research Institute, Inc. All rights reserved.