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The Future of PEV Infrastructure

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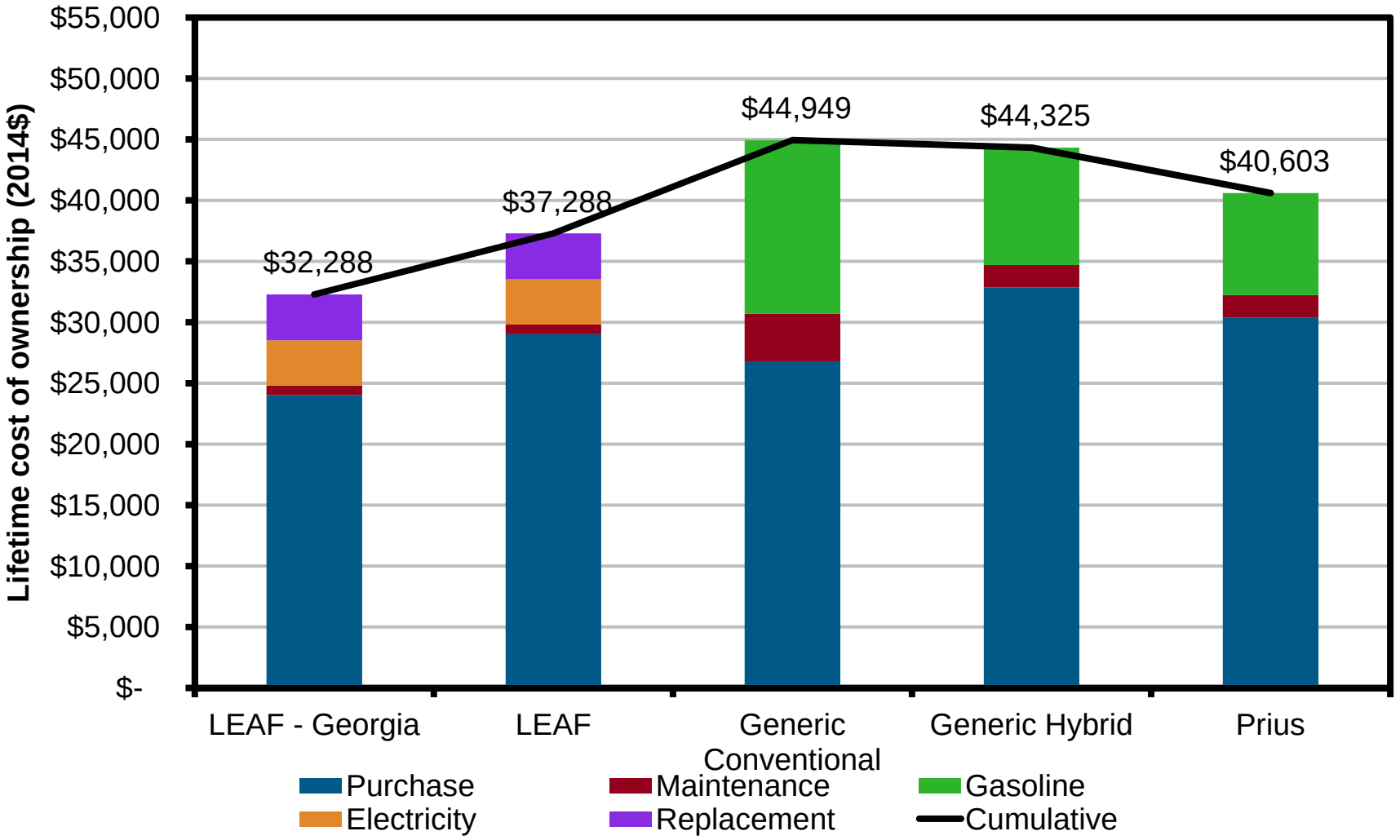
IEPR Transportation Workshop

April 10th, 2014

The PEV Landscape in 2025

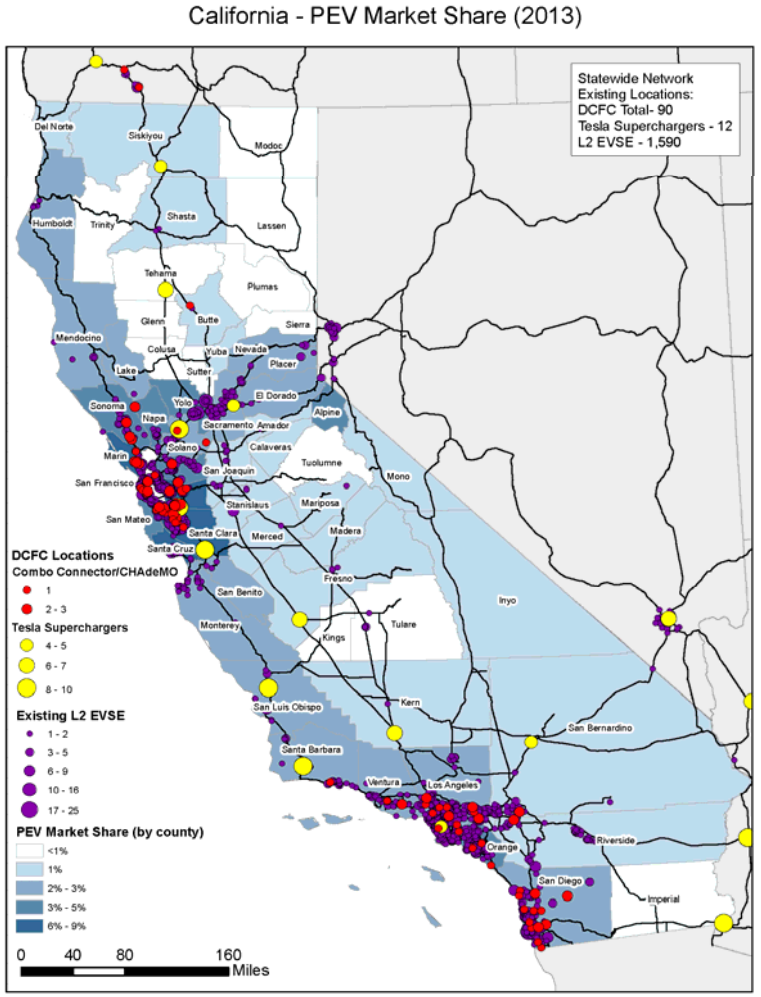
- PEV Adoption in CA that meets or exceeds ZEV Program targets
- Significant increase in fleet adoption (non-road and on-road)
- PEVs in many more (typically larger) vehicle platforms
- Increase in range and electric performance
- Vastly increased capabilities in connectivity and power delivery
- Superior total cost of ownership of PEVs

An Example of BEV Total Cost of Ownerhship
2013 Nissan Leaf



A 2025 To-Do List
Infrastructure Technology and Planning

- Elimination of the residential infrastructure barrier to PEV ownership
- Flexible and scalable public and workplace infrastructure
- Lower costs all around – installation, equipment, O&M
- EVSE that are increasingly connected—at dramatically lower costs
- Integration of PEVs—at scale—into load management programs
- More robust and resilient charging (particularly cord-and-plug connected)



Much of tomorrow's infrastructure has not yet been invented today

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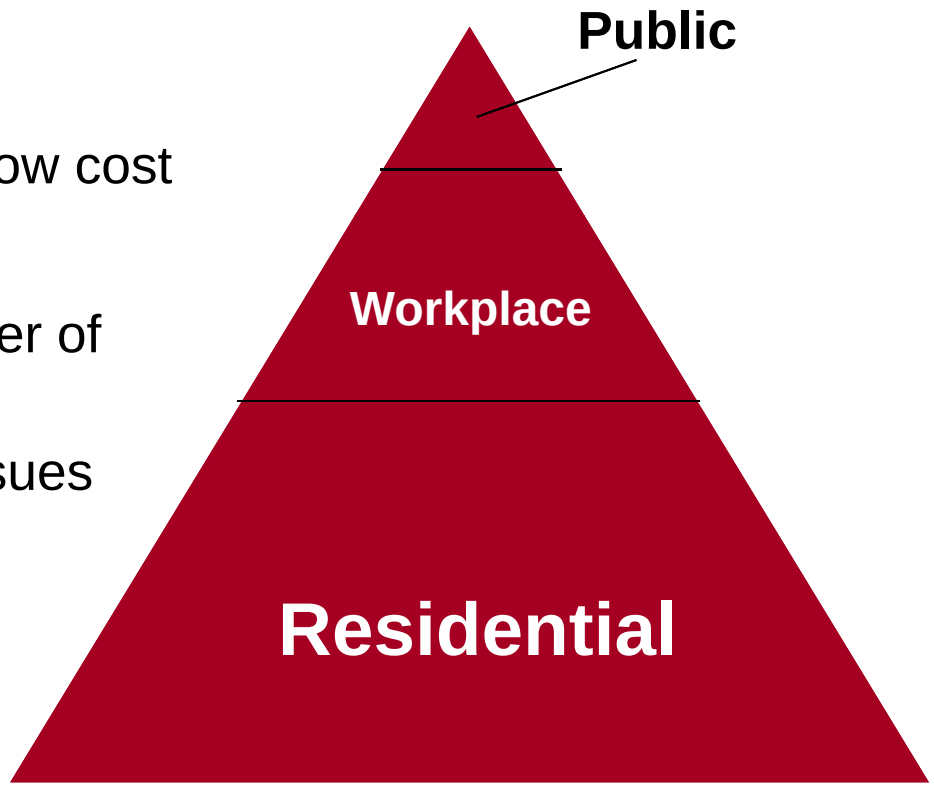
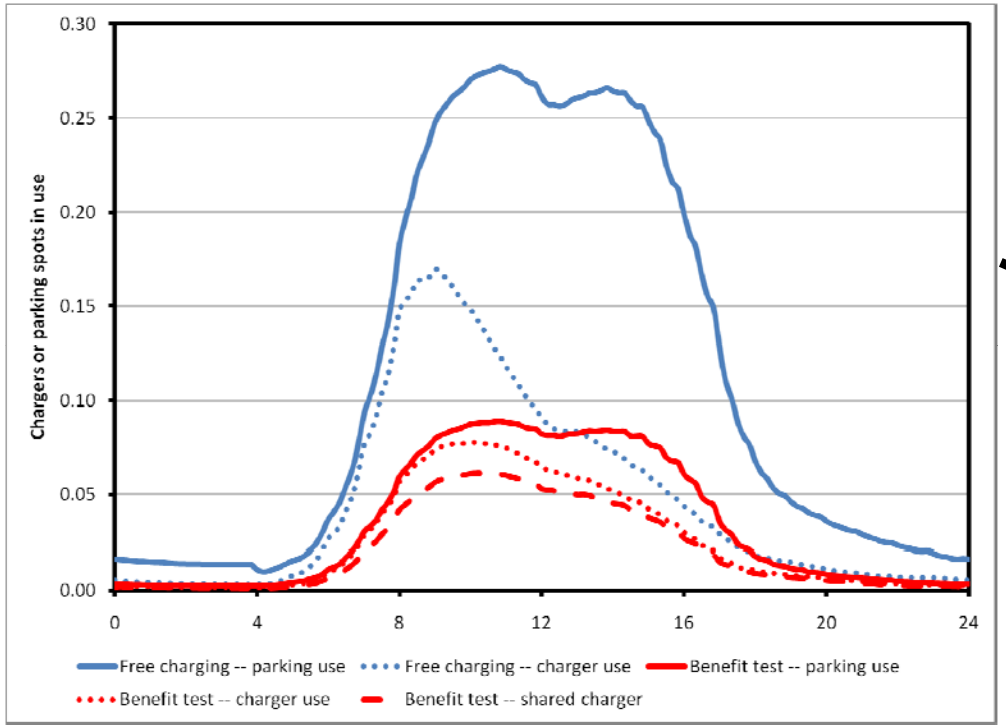
What Have We Learned to Date?

- Residential issues
  - Multi-unit and tenant dwellings
  - Relatively high initial costs
  - High adoption of Level 1 at very low cost
- Workplace
  - Potential has grown—see as driver of adoption
  - High installation costs, scaling issues
- Public Charging
  - Clustering – need to build out networks
  - Long-term sustainability of infrastructure
  - Underestimated difficulties of locating infrastructure

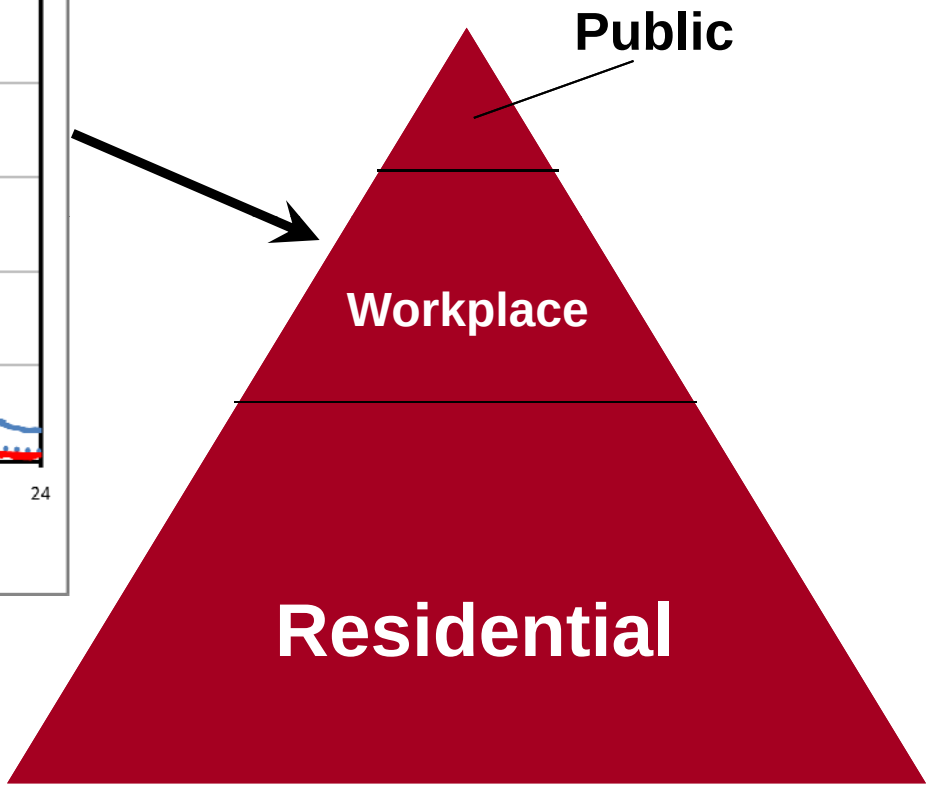


What Does Sufficient Infrastructure Look Like? Quantity, Location, Technology



Local workplace EVSE requirements

PHEV40 – Level 1 Charging



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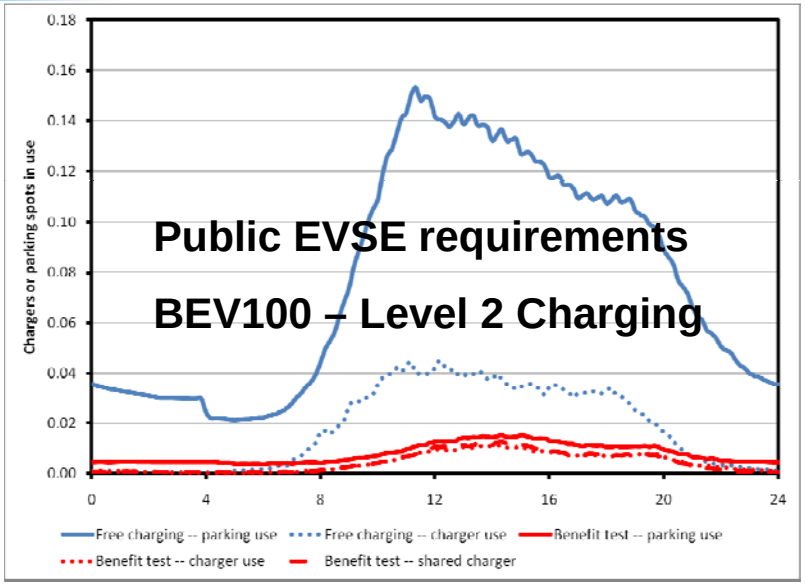
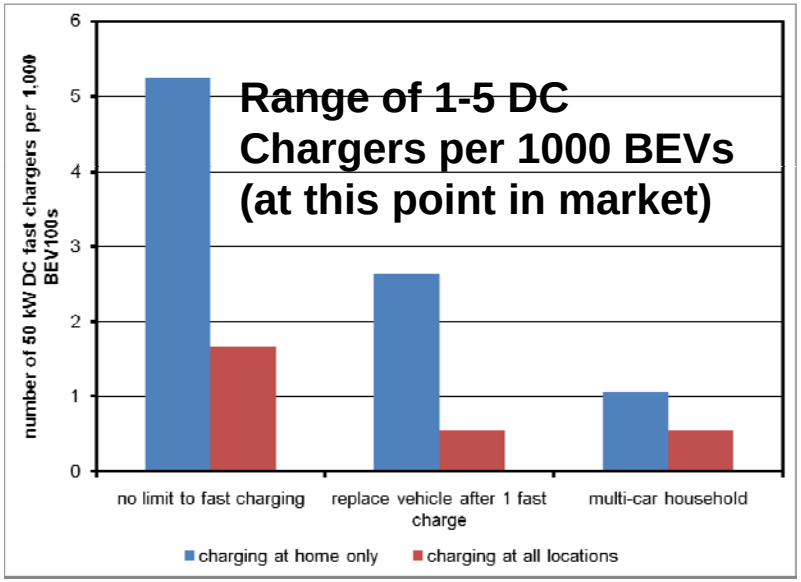
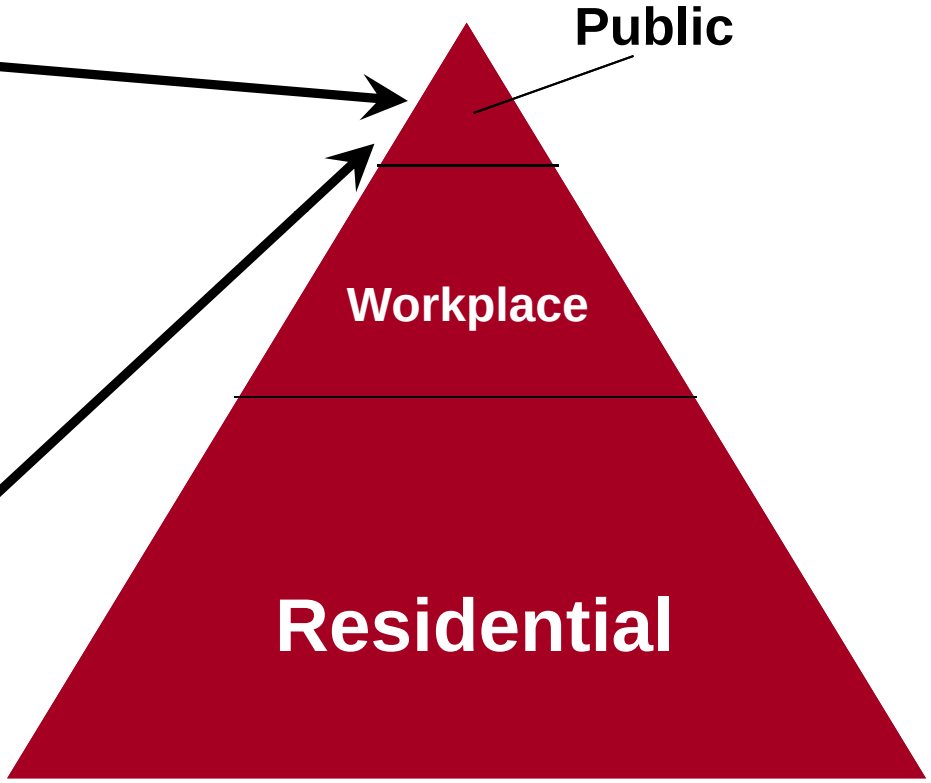
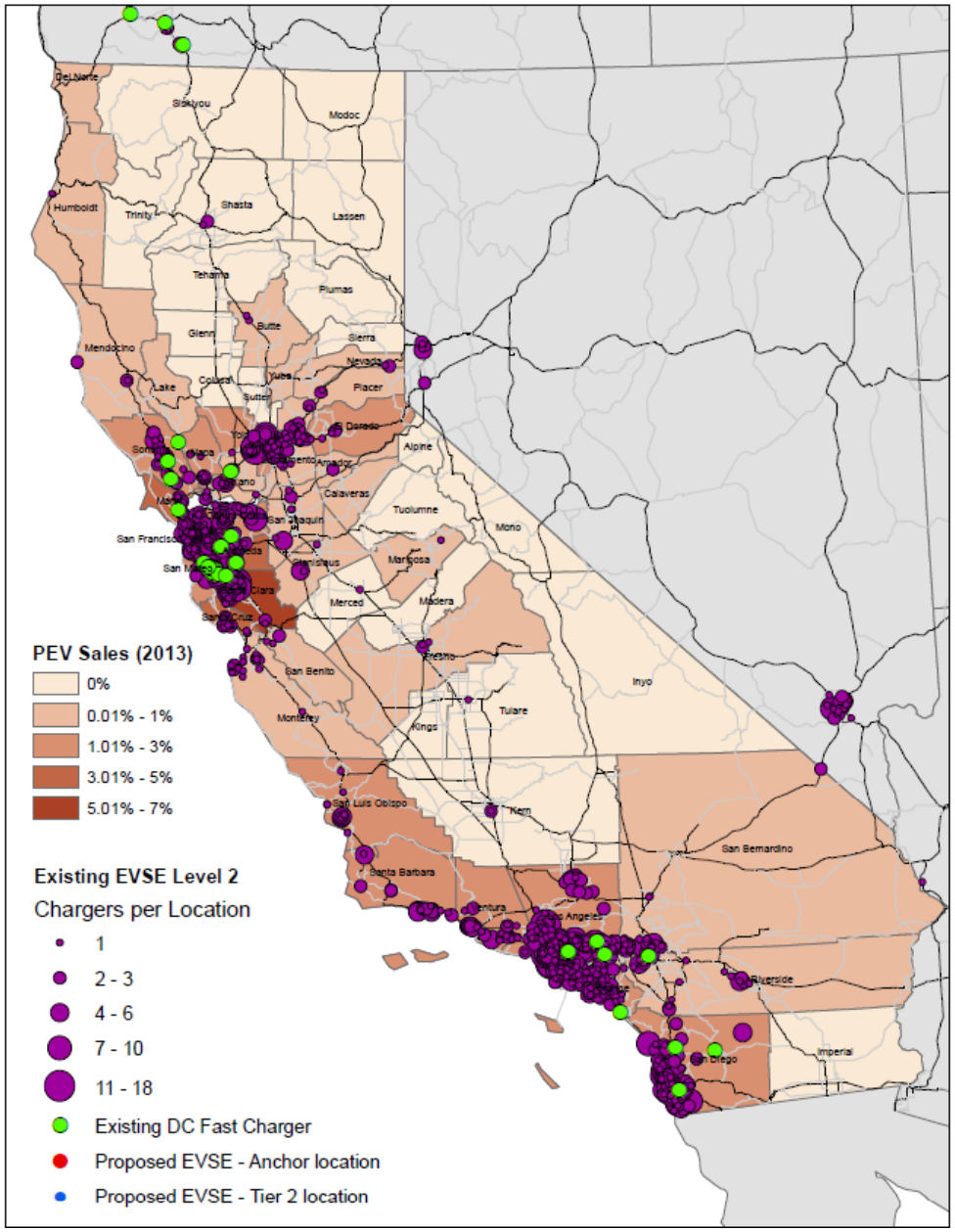
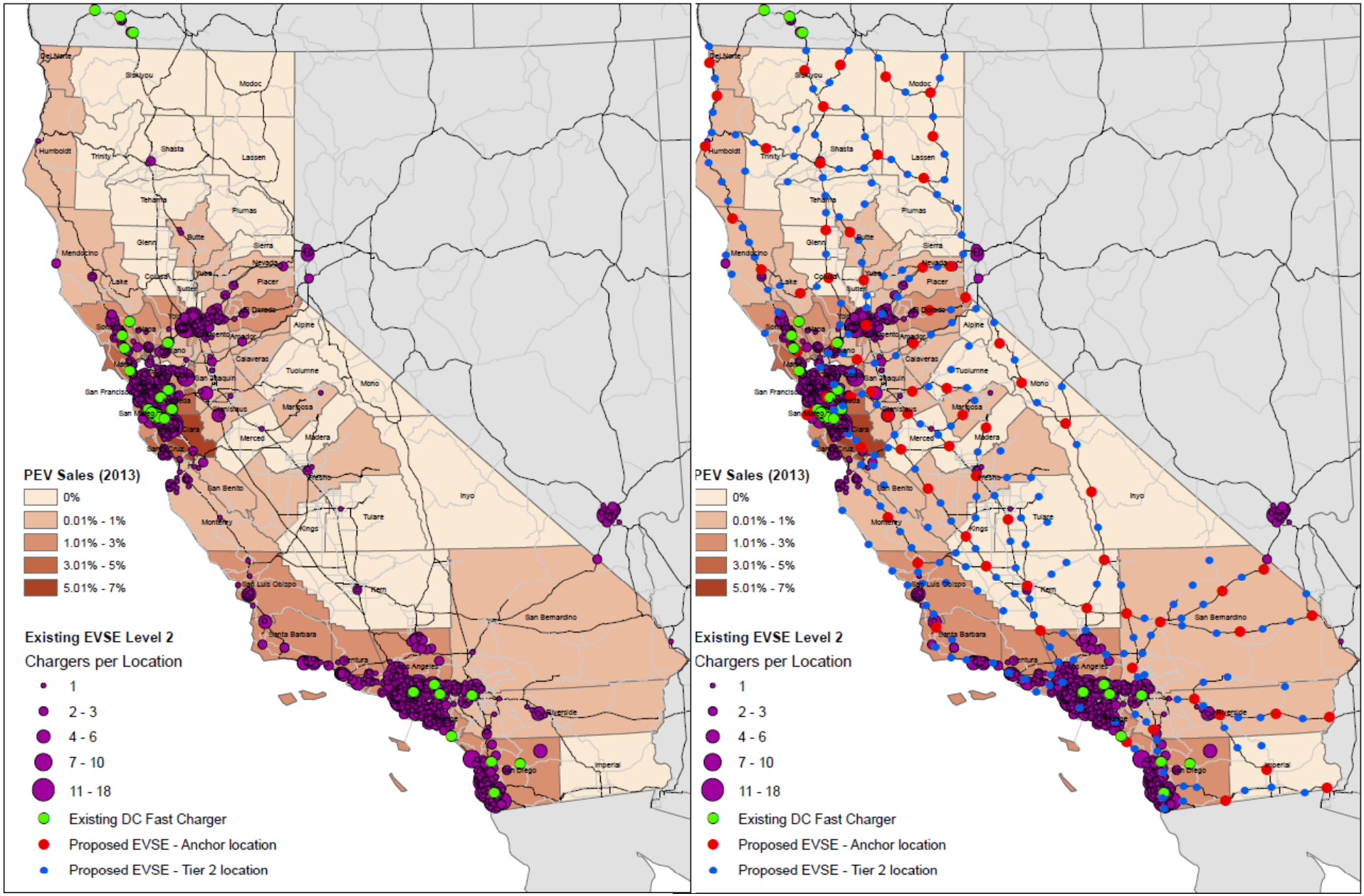


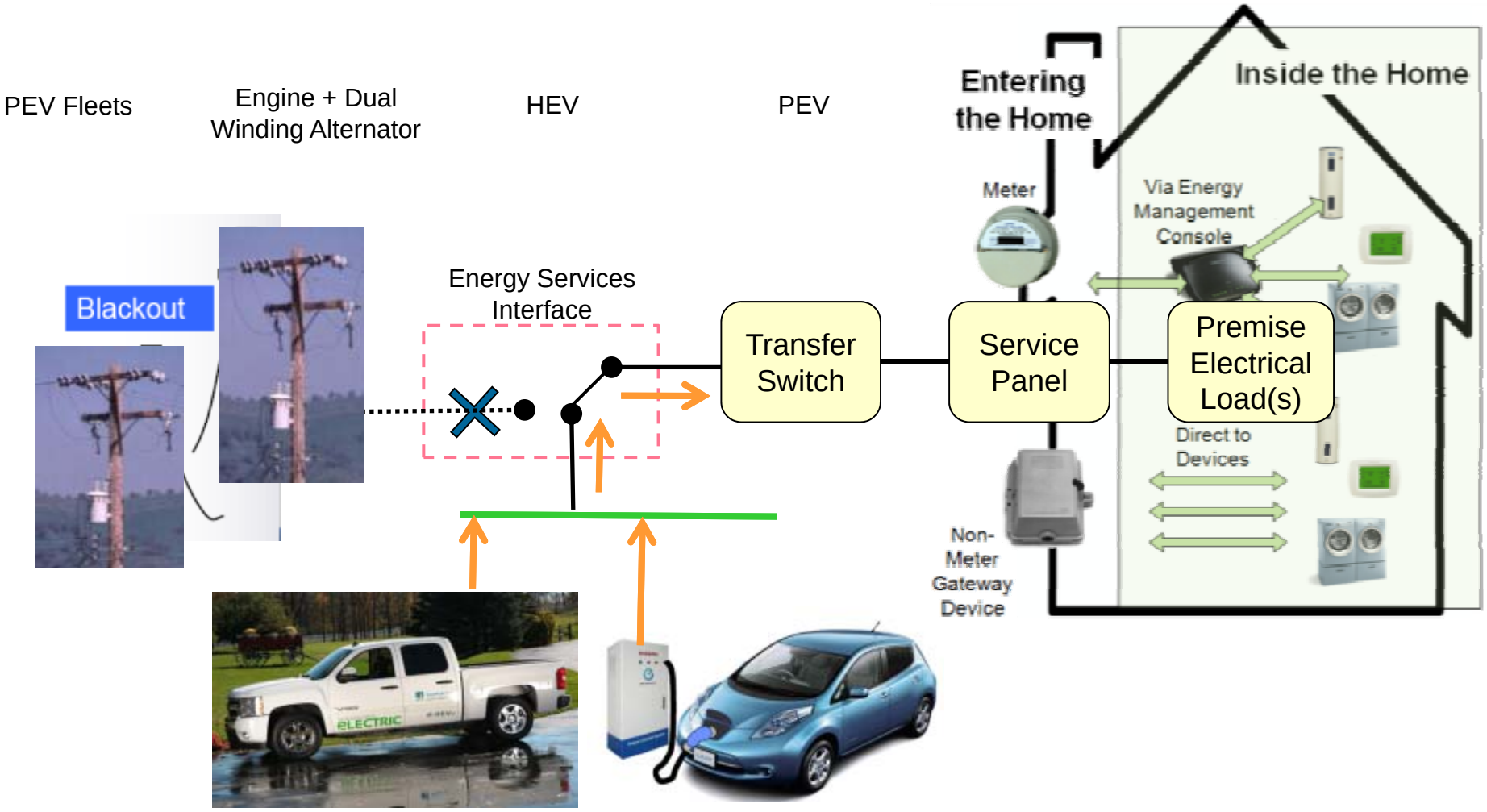






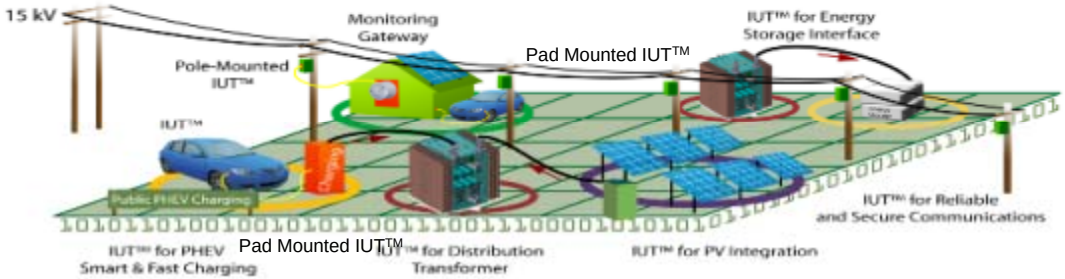


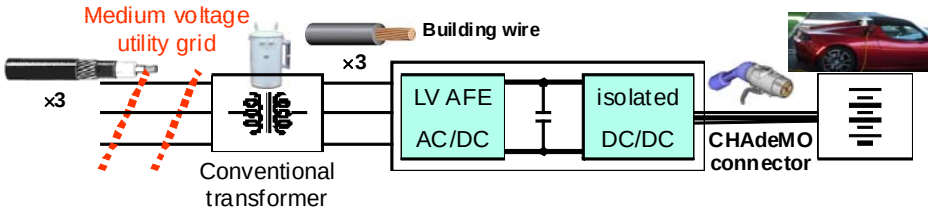
‘Vehicle-to-Grid’ is Here Today – How Will It Be Used?



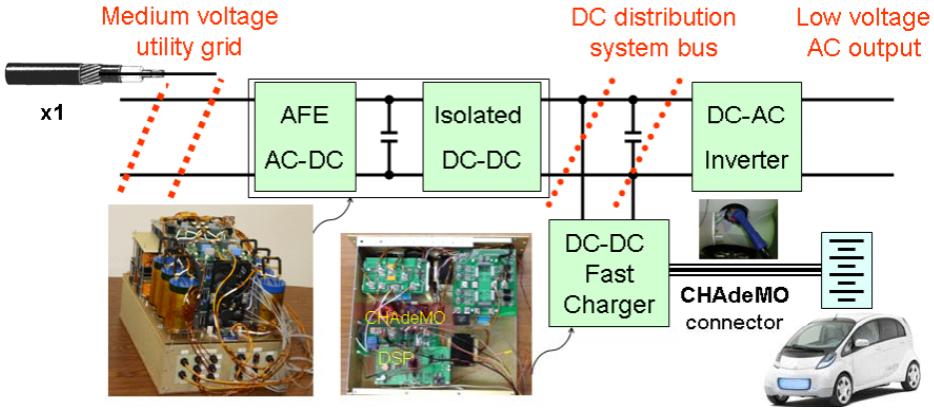
On-board Bi-directional Systems ***Off-board Bi-directional Systems***

Technology for an Integrated Grid Will Improve the PEV Charging Experience





(a) Conventional DC fast charger with low-voltage power electronics



(b) EPRI DC fast charger with medium-voltage IUT

- Improving options for feeding PEV infrastructure networks (public, work, MUDs) will lower costs
- Solid state transformers can integrate DC devices (PV, storage, DC charging) and mitigate demand impacts

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