

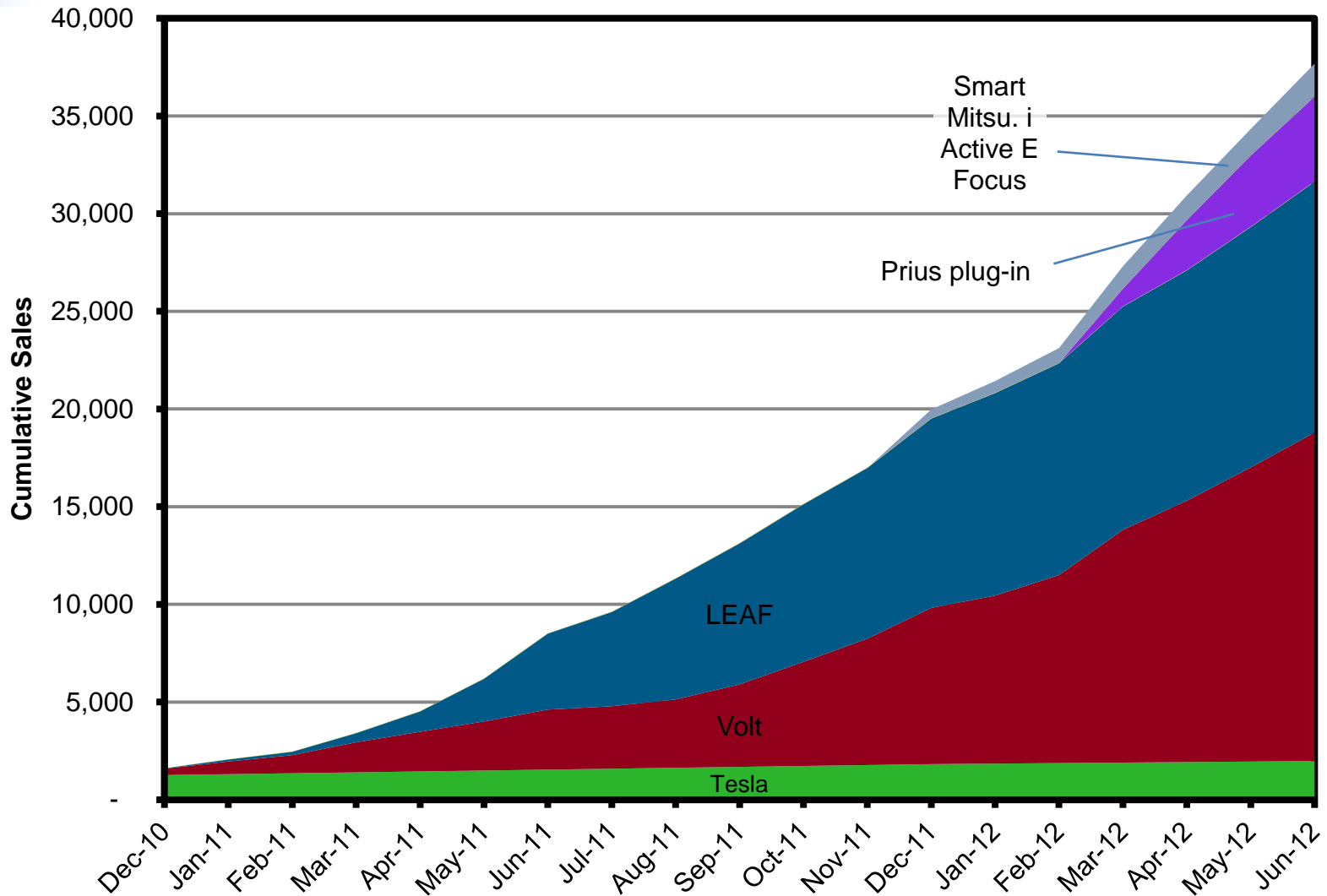


Plug-In Electric Vehicles Cost, Infrastructure, and the Grid

Dan Bowermaster
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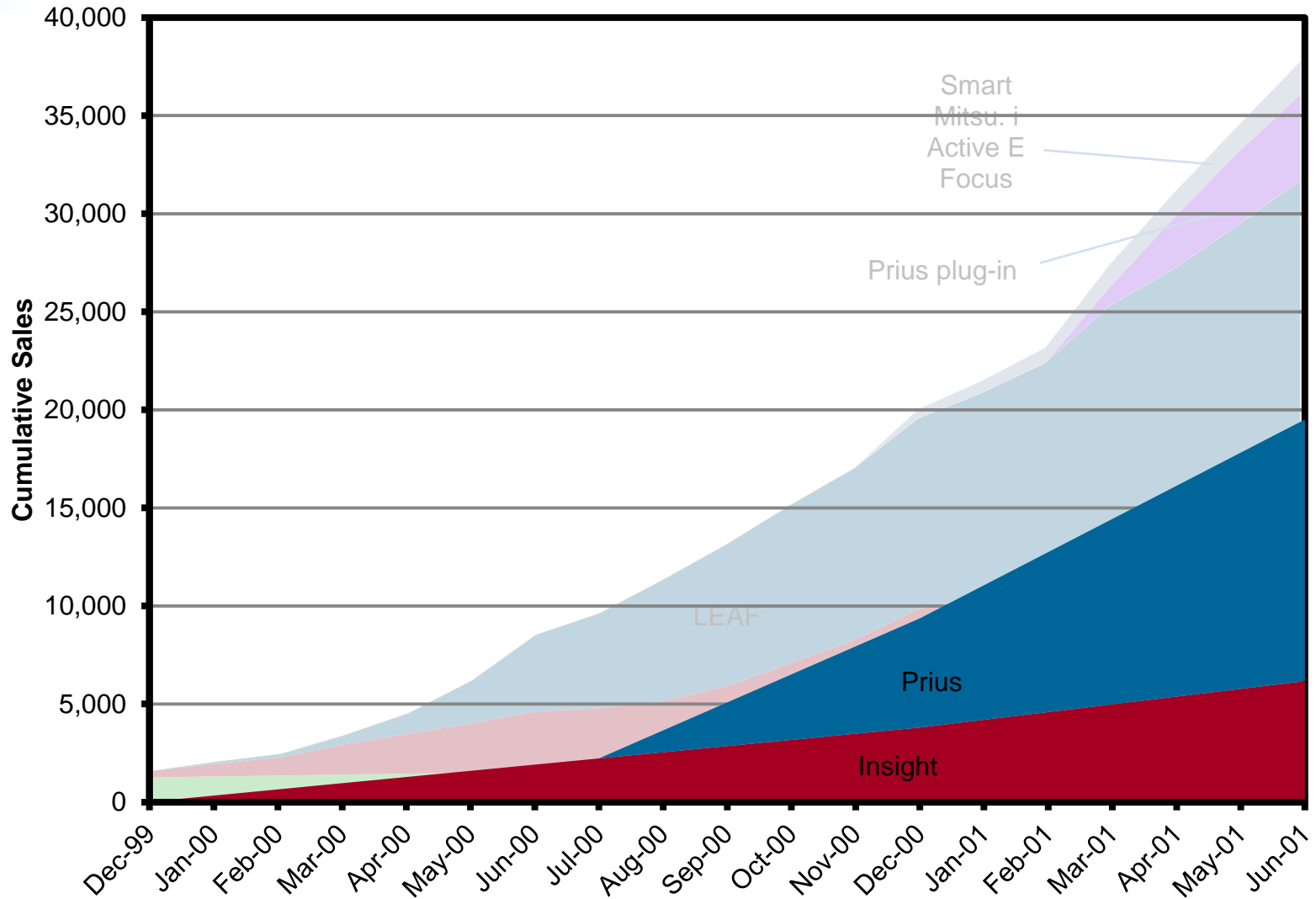
September 11, 2012

Nationwide Plug-In Electric Vehicle Sales (As of June 30, 2012)



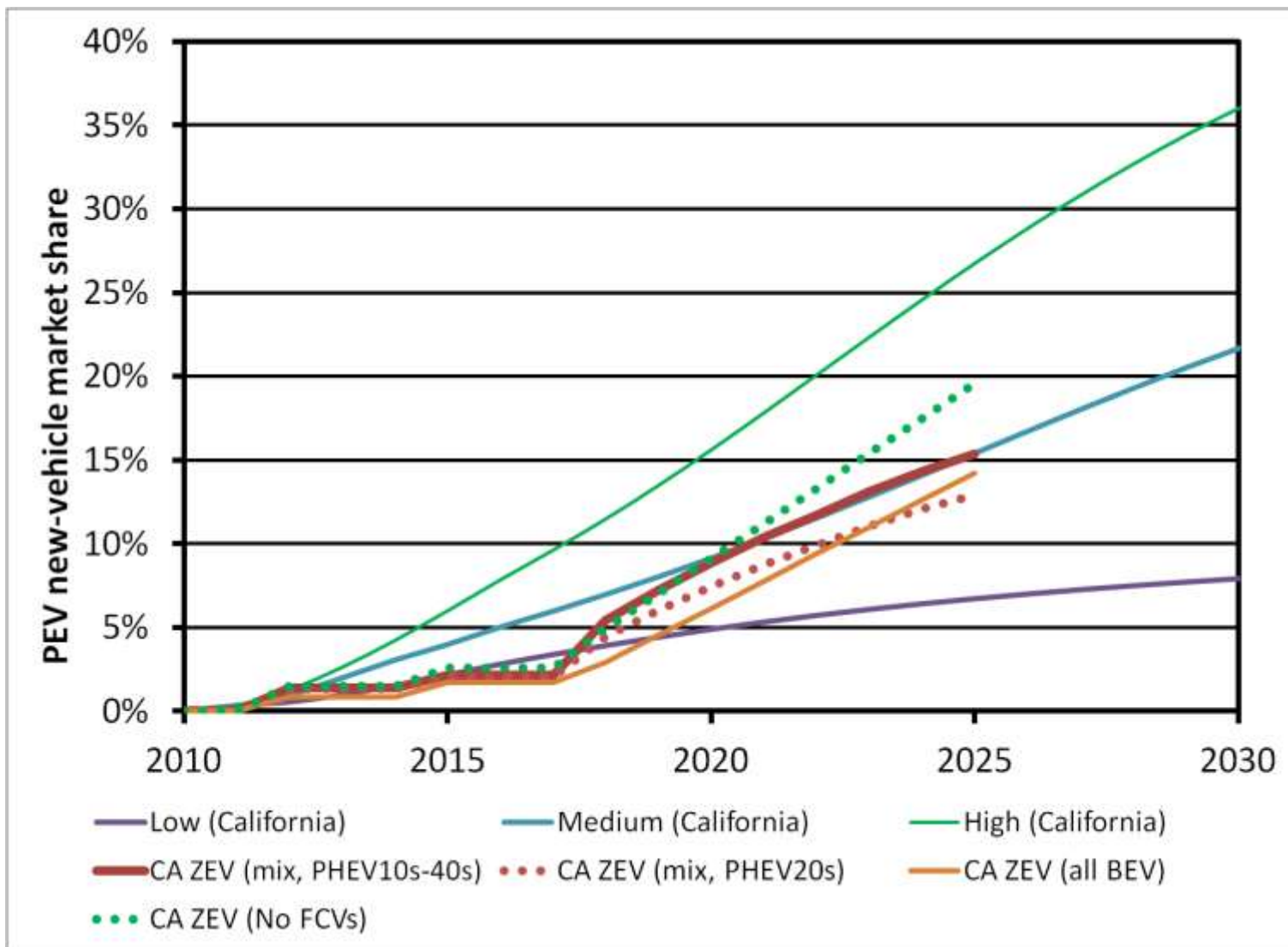
Sources: Automotive News, hybridcars.com

The Introduction of PEVs is Outpacing the Intro of HEVs (More models, greater sales numbers)



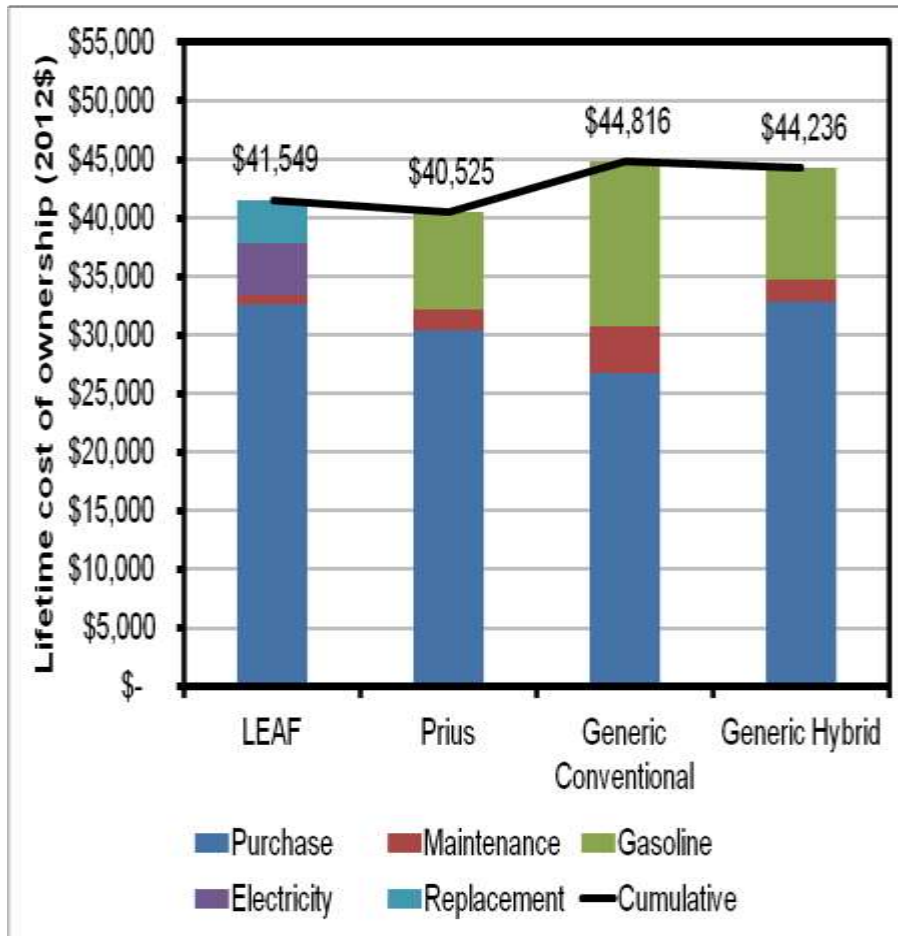
Source: US Department of Energy

The California Zero Emission Vehicle Program will Drive PEV Adoption in all States

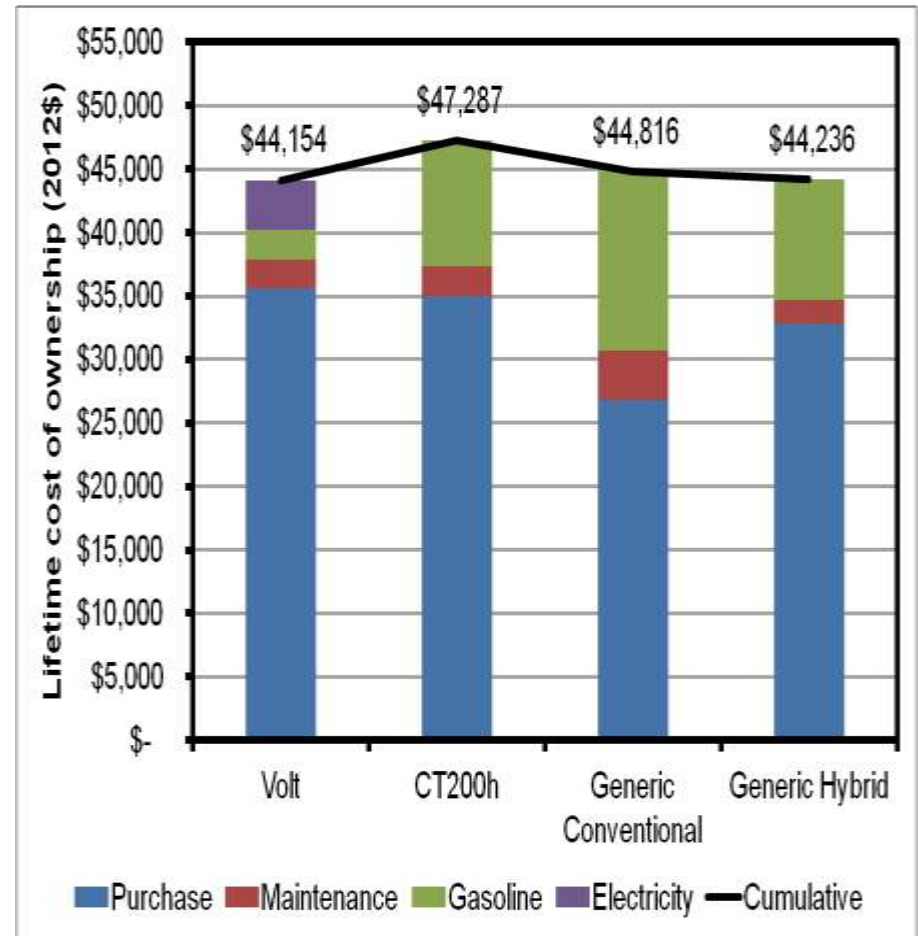


PEVs Cost Effective for Many Drivers – Today

Nissan Leaf

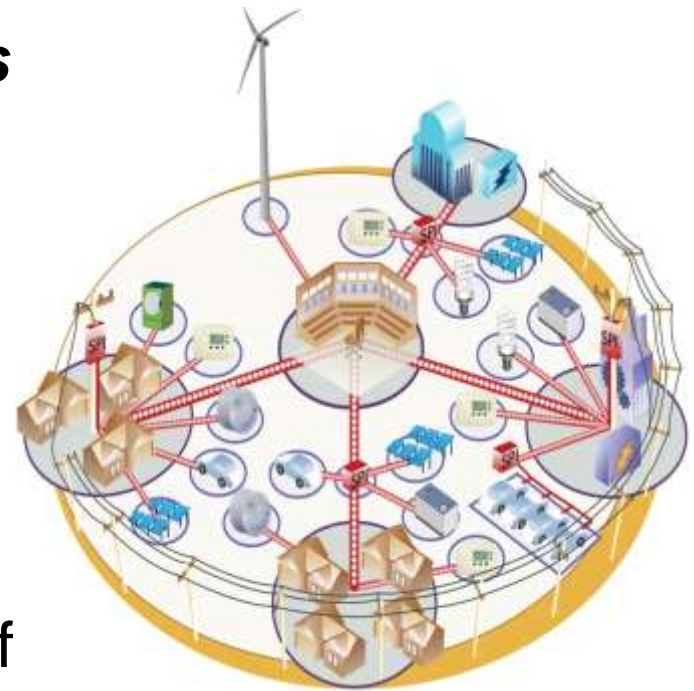


Chevrolet Volt



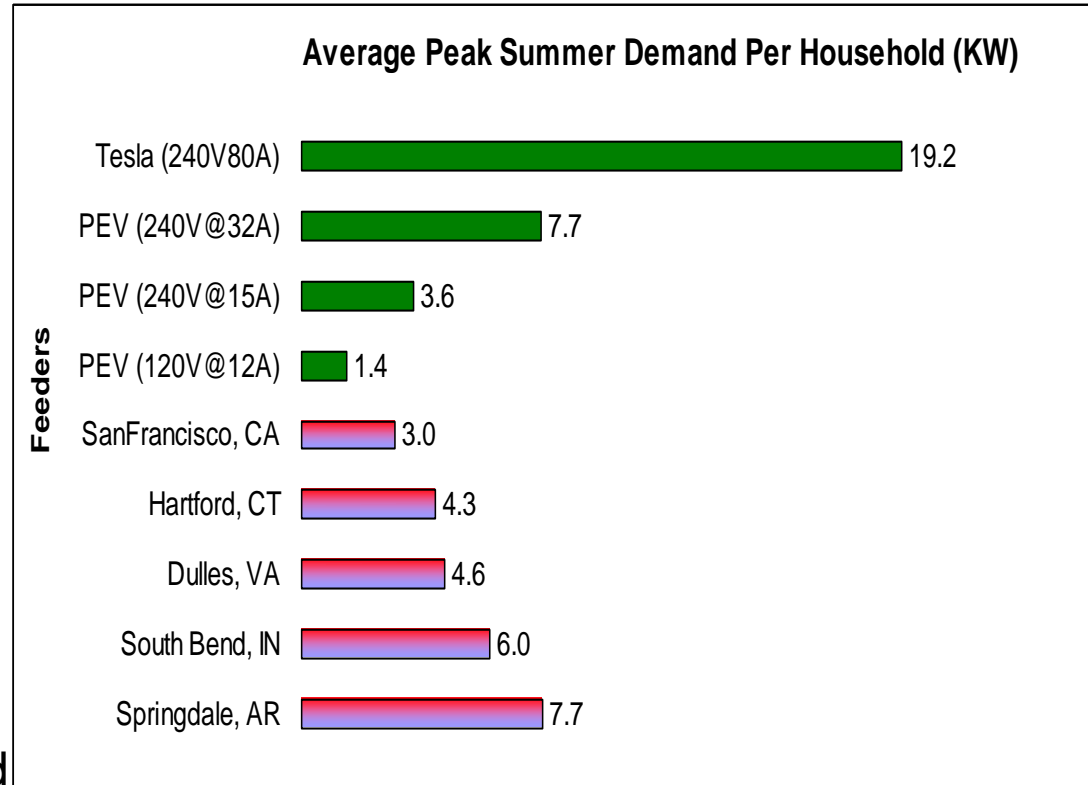
Grid Impacts of PEVs and Smart Charging

- ***PEV owners should almost always charge as fast as they need to***
- Value of PEVs to the public will be highest if PEVs are complementary to the grid
 - Cost to ratepayers dictated by charge power and time of day
- Utility requirements will drive value of smart charging
 - Smart charging is a voluntary agreement between utility and vehicle owner
 - Technology enables the easy implementation of this agreement



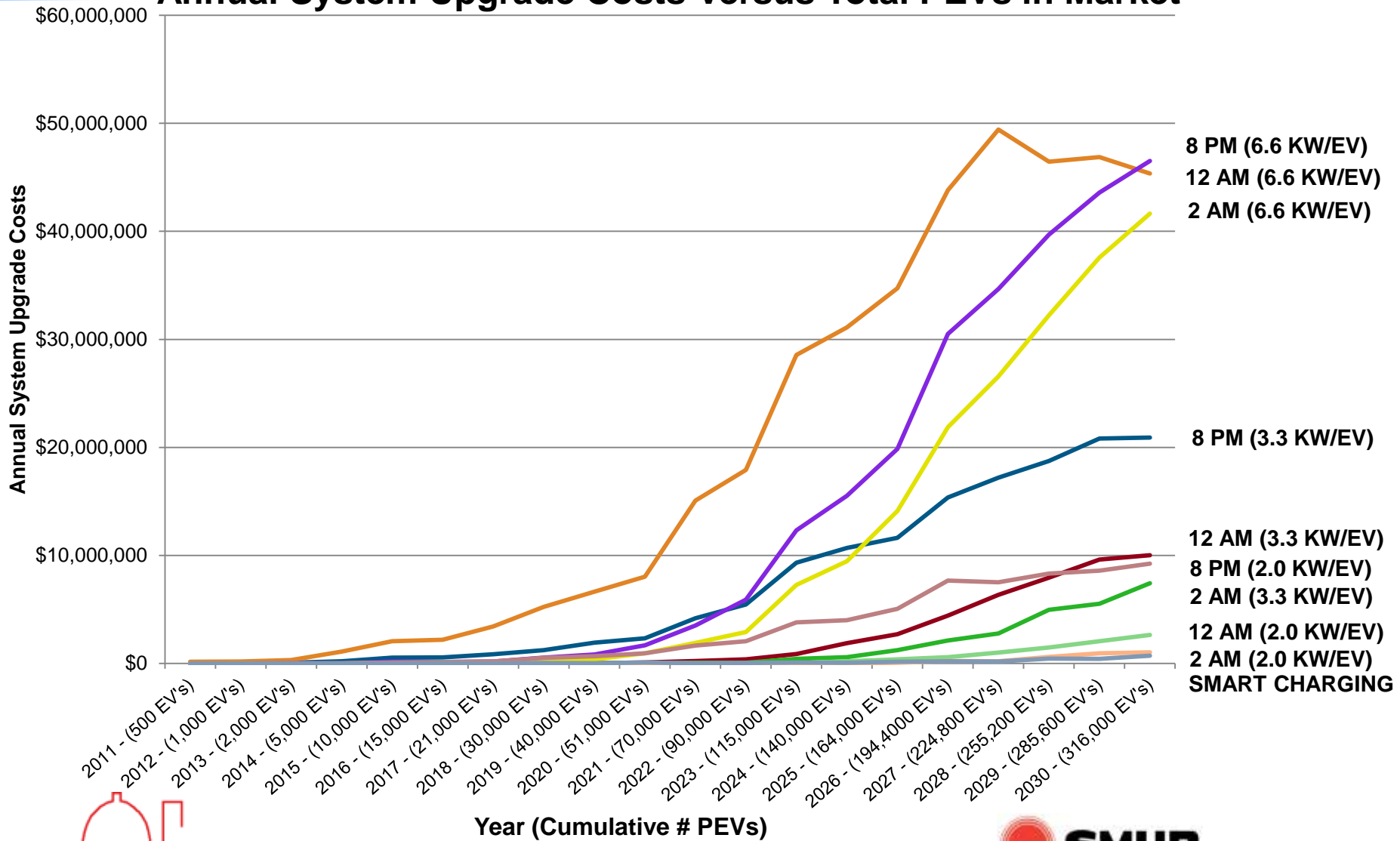
Distribution Impacts of PEV Charging

- Local distribution transformers are among the first equipment impacted
- Charge power is the likely dominant factor determining impact, not time-of-day
- Charge power is increasing—automotive OEMs trend to about a four-hour charge time
 - 19.2 kW is the maximum for residential AC charging
- TOU rates and other off-peak charging programs mitigate upstream impacts but offer limited help to local transformers
 - Especially true with clustering

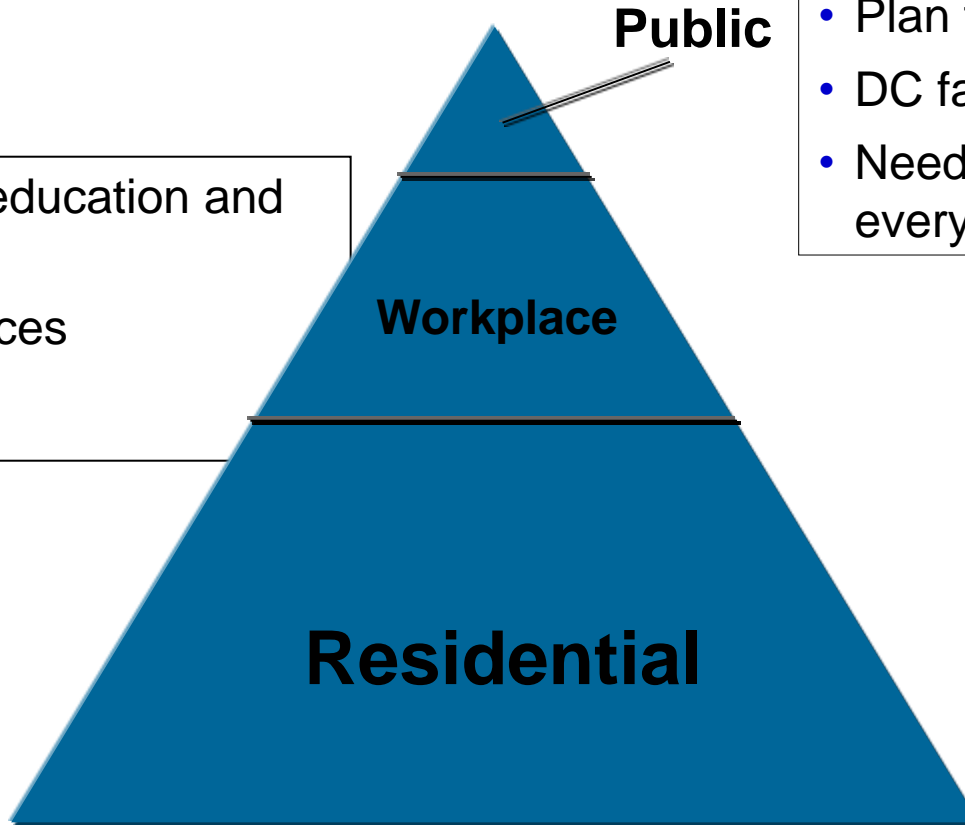


PEV Charging Rate Matters More Than Time

Annual System Upgrade Costs Versus Total PEVs in Market



Planning and Implementing Infrastructure

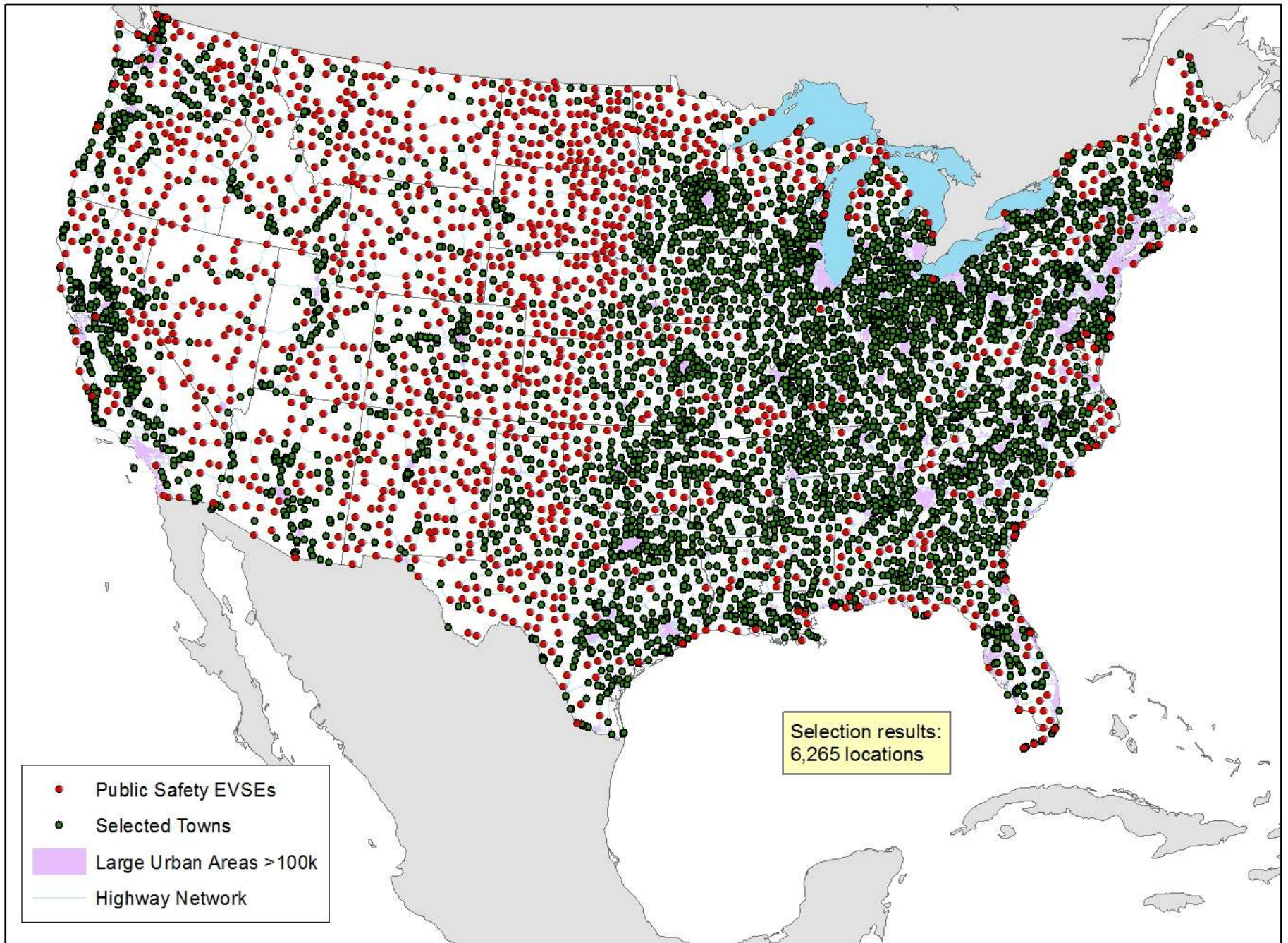


- Understand workable models
- Public vs. private ownership
- Plan for scale of PEV adoption
- DC fast charging
- Need (some) infrastructure everywhere (BEVs vs. PHEVs)

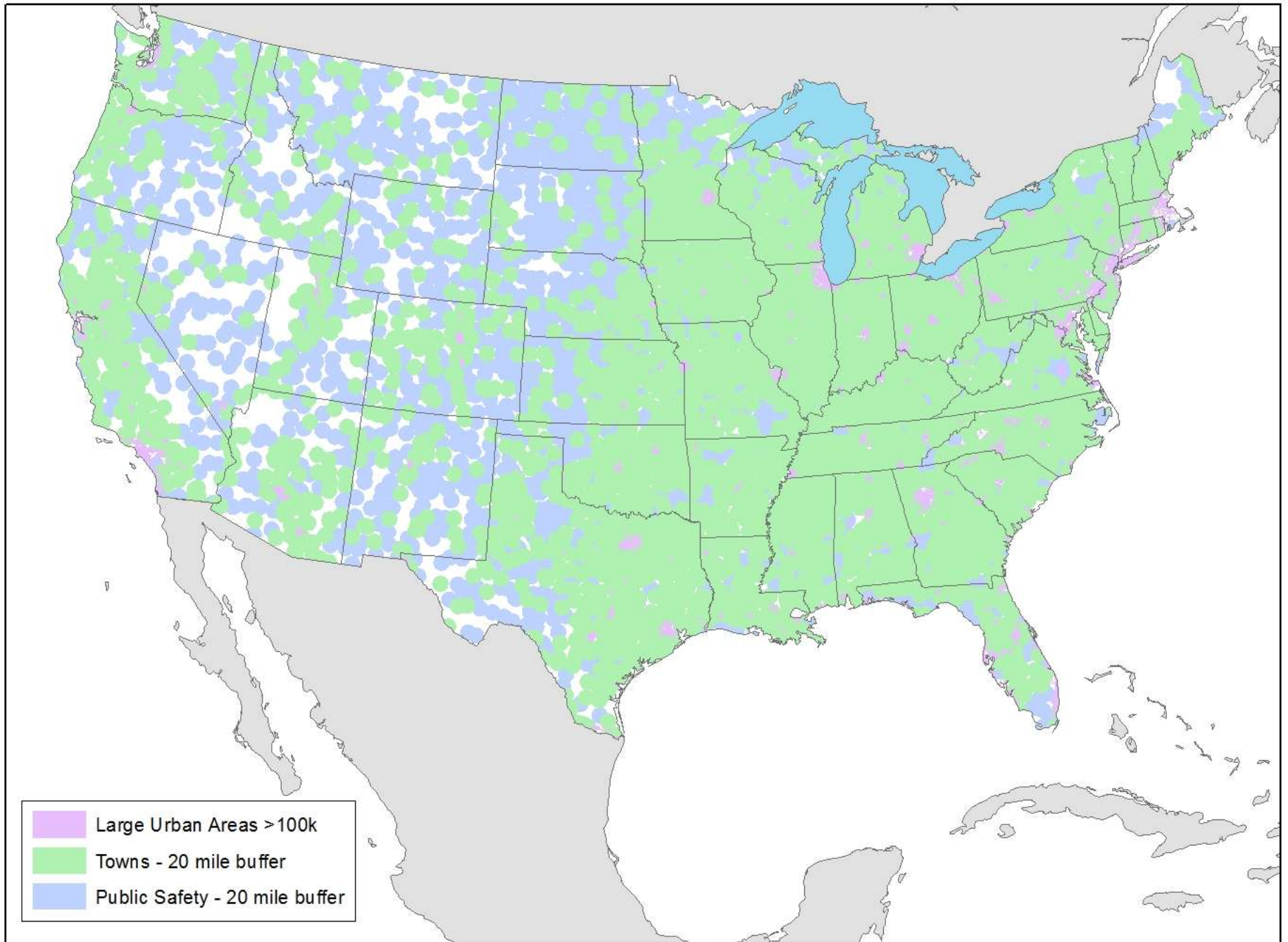
- Employer education and outreach
- Best practices
- Level 1!

- Voluntary pre-notification
- Building codes for pre-wiring – 240V/30A receptacles
- Cost, cost, cost, & cost
- Level 1!
- Make smart charging easy for everyone

National PEV Charging Network: Towns + Public Safety



National PEV Charging Network: Towns + Public Safety (Coverage)



Thank you

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