

## **Vehicle Electrification –**

## **Cars, Infrastructure Investments, and Consumer Demand**

### **NASEO/ASERTTI 2010 State Energy Policy and Technology Conference**

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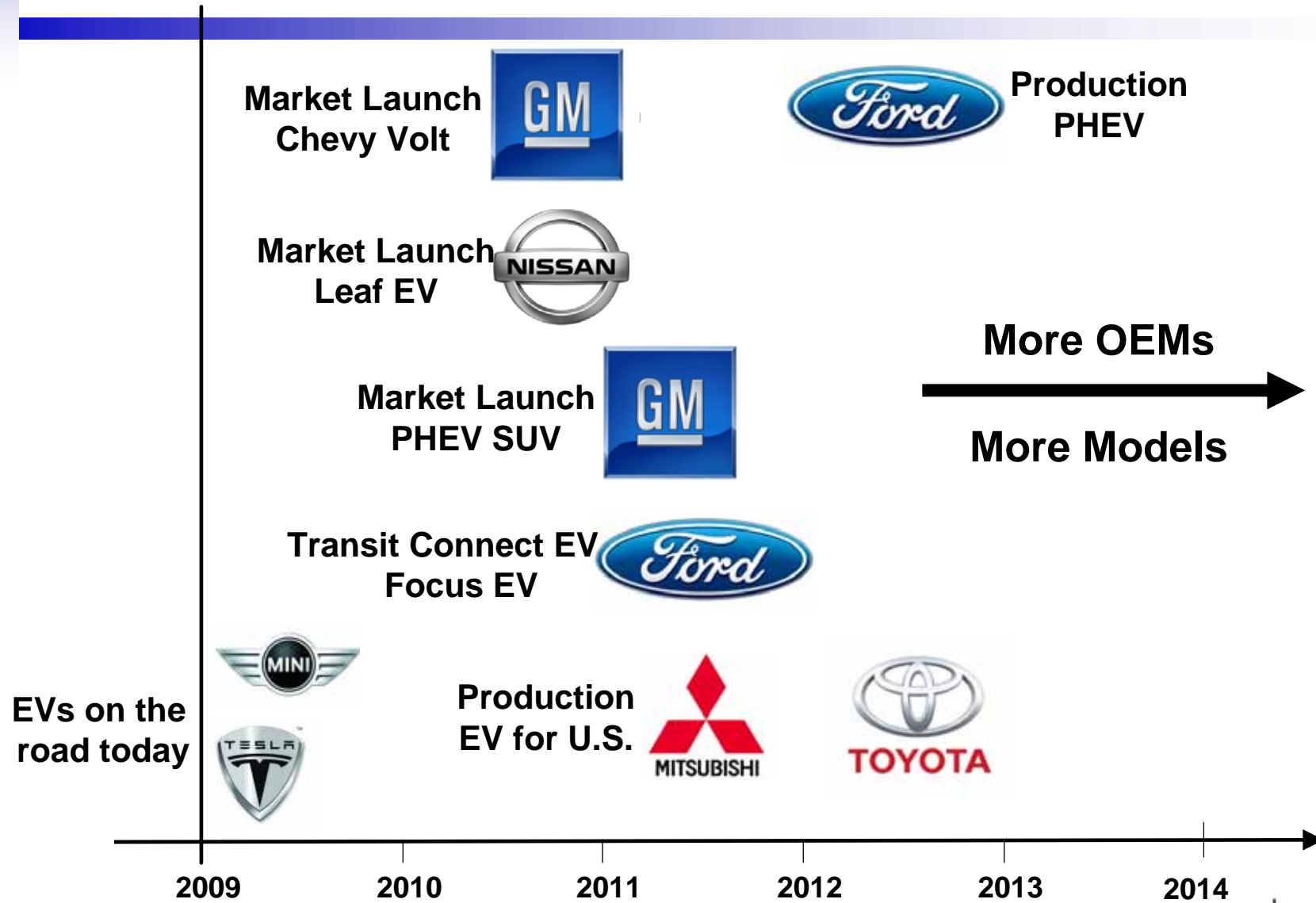
# Overview

- Plug-In Hybrid and Electric Vehicles (PEVs) are almost here
- There are nationwide, comprehensive benefits to electrifying transportation
- Communities and utilities are preparing – there is a lot to do
- Charging infrastructure is a complex issue
- The future is bright – there are many challenges ahead



# Major Automaker Production Plans

## Current Status



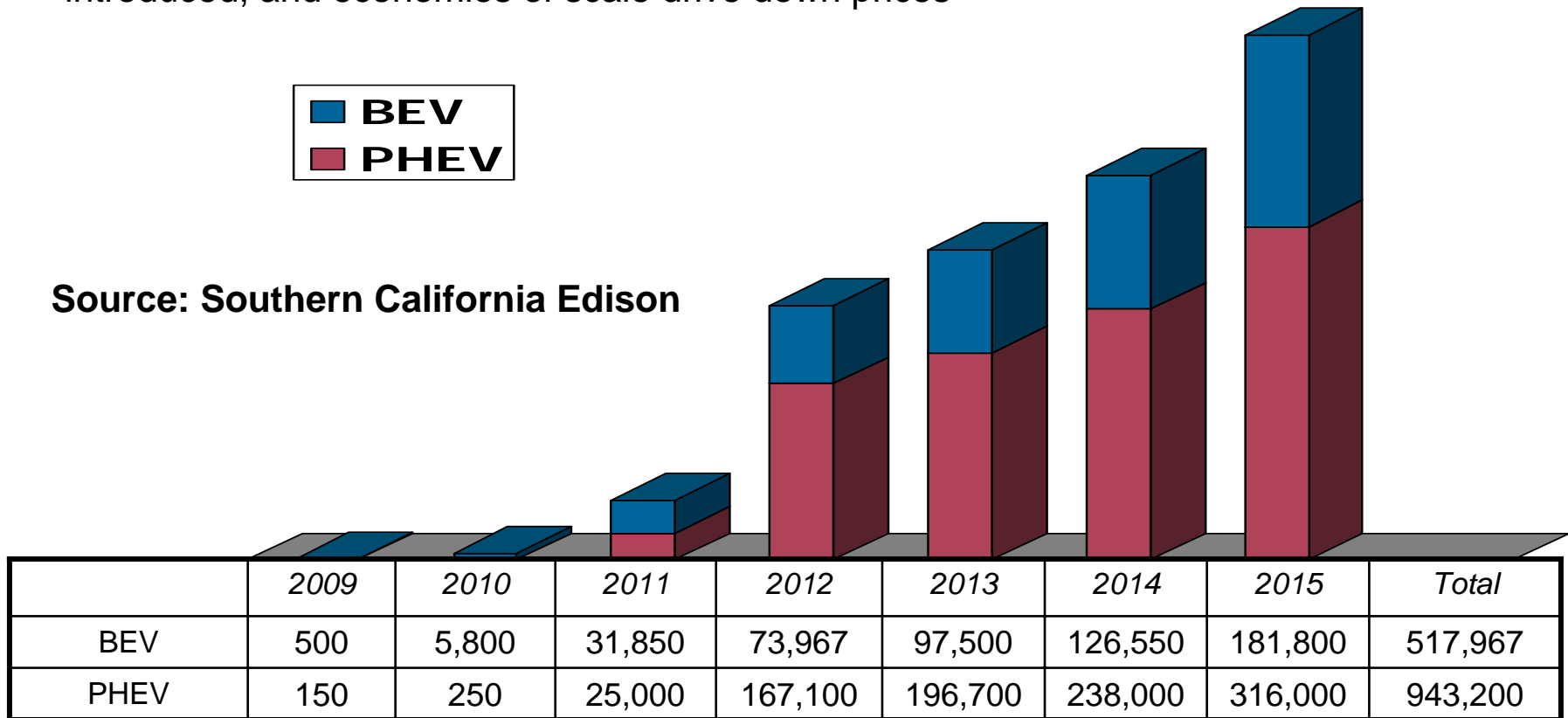
# Plug-In Vehicles Enter Market in Late 2010

## What is the Near-Term Achievable Market Penetration?

Market penetration grows as vehicle production numbers increase, new models are introduced, and economies of scale drive down prices



Source: Southern California Edison



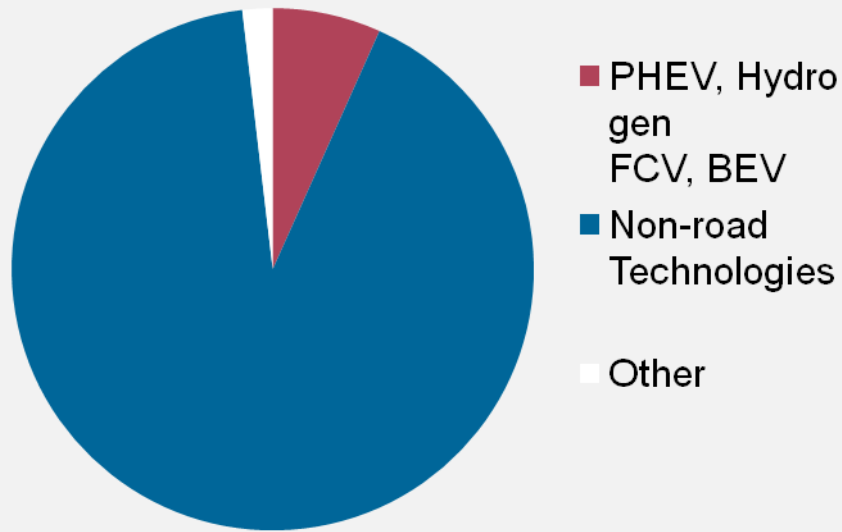
# Benefits of Electric Transportation

- **Air Quality**
  - **Greenhouse Gas Emissions**
  - **Petroleum Reduction**
  - **Economic Output**
- 
- Realizing these benefits also requires minimizing the cost of widespread adoption
  - Community readiness is a key driver of both adoption and benefits

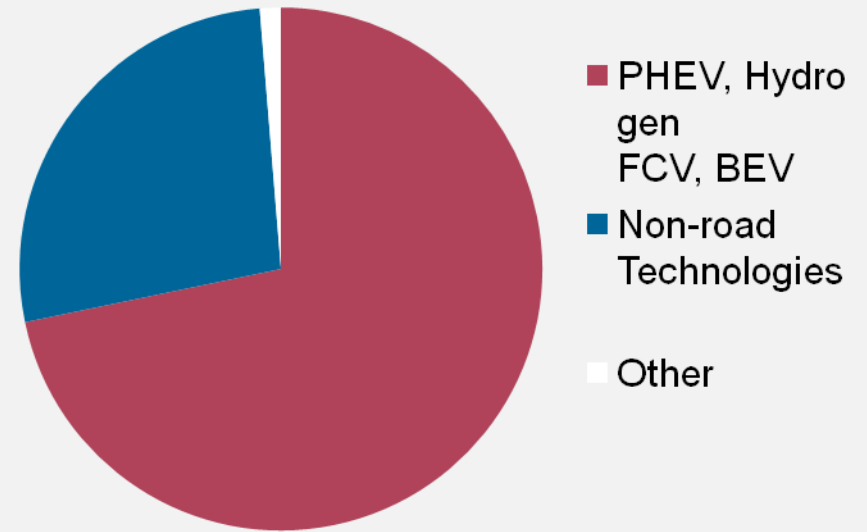


# Estimated Reductions in Electric Drive Transportation for CA

## Criteria in Million tons/day



## GHG in Million tons CO2e/year

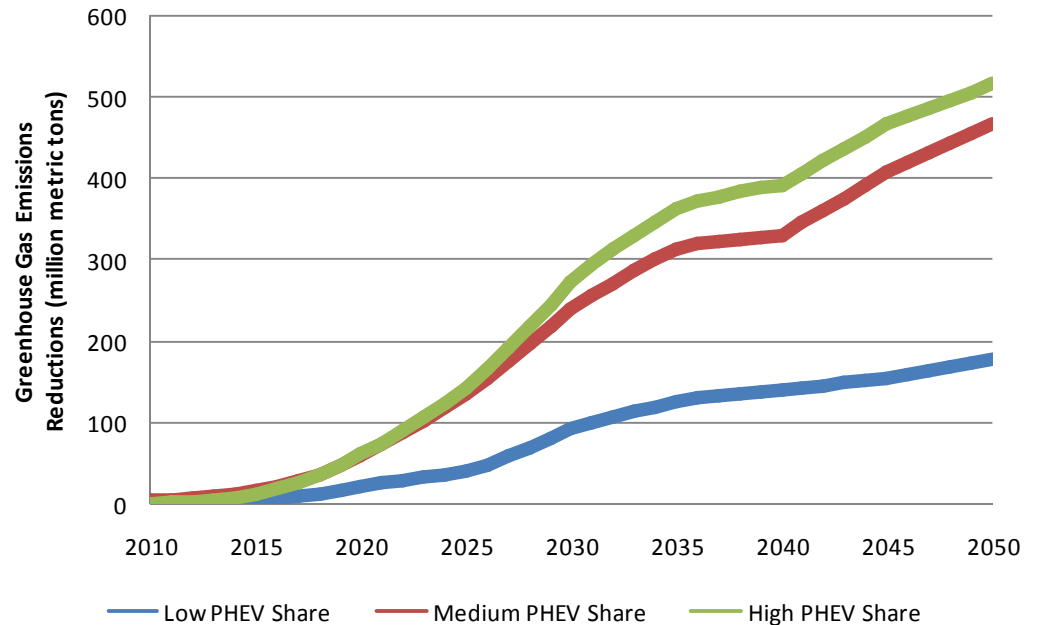


Data: TIAX estimates these achievable reductions in greenhouse gas and criteria emissions from electric drive transportation

# Environmental Benefits of Plug-In Vehicles

## Key Challenges

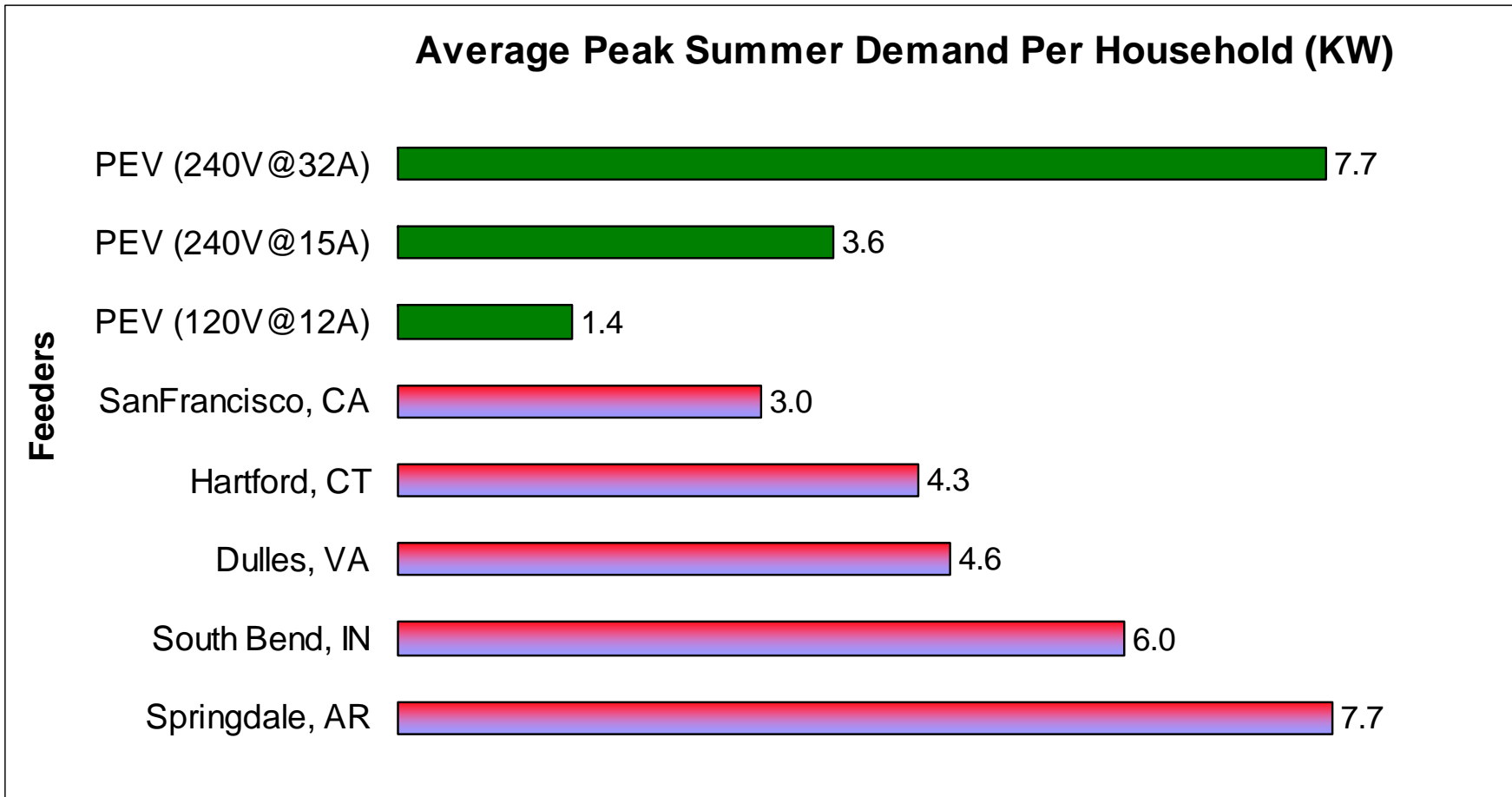
- Electricity is a low-carbon fuel
  - Potential 400-500 mton reduction
  - 3-4 million barrels/day petroleum reduction
- Ownership of CO<sub>2</sub> reductions
- Quantify societal value
- Competing perceptions – similar to energy efficiency studies



**Annual Reduction in GHG Emissions  
due to PHEV Adoption**  
Source – 2007 EPRI-NRDC Study

# Peak Demand

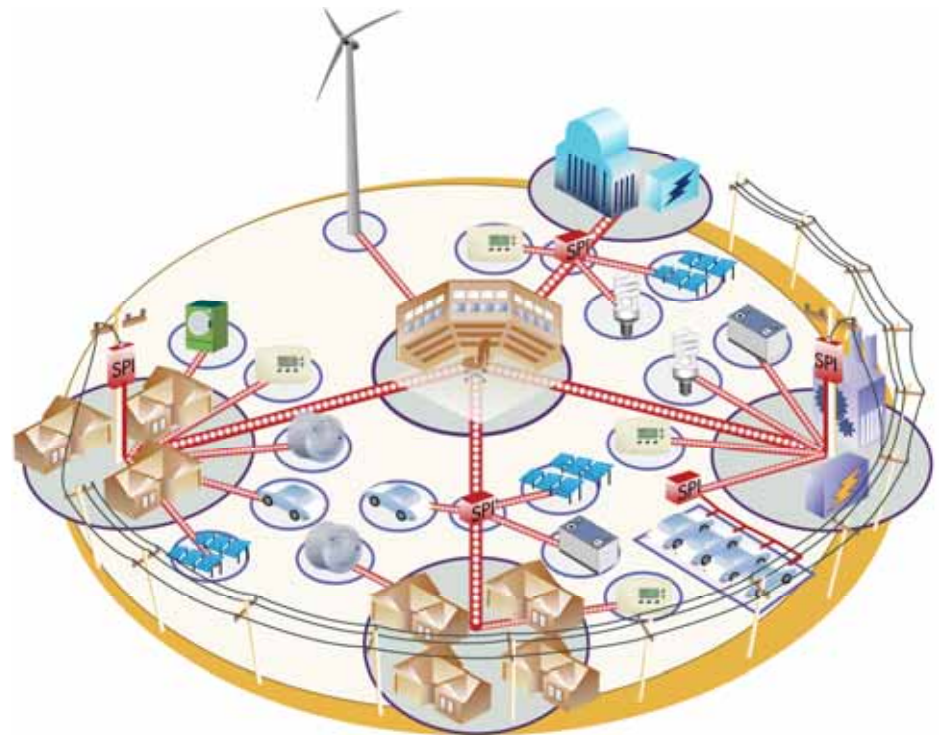
Average Peak Summer Demand Per Household (KW)



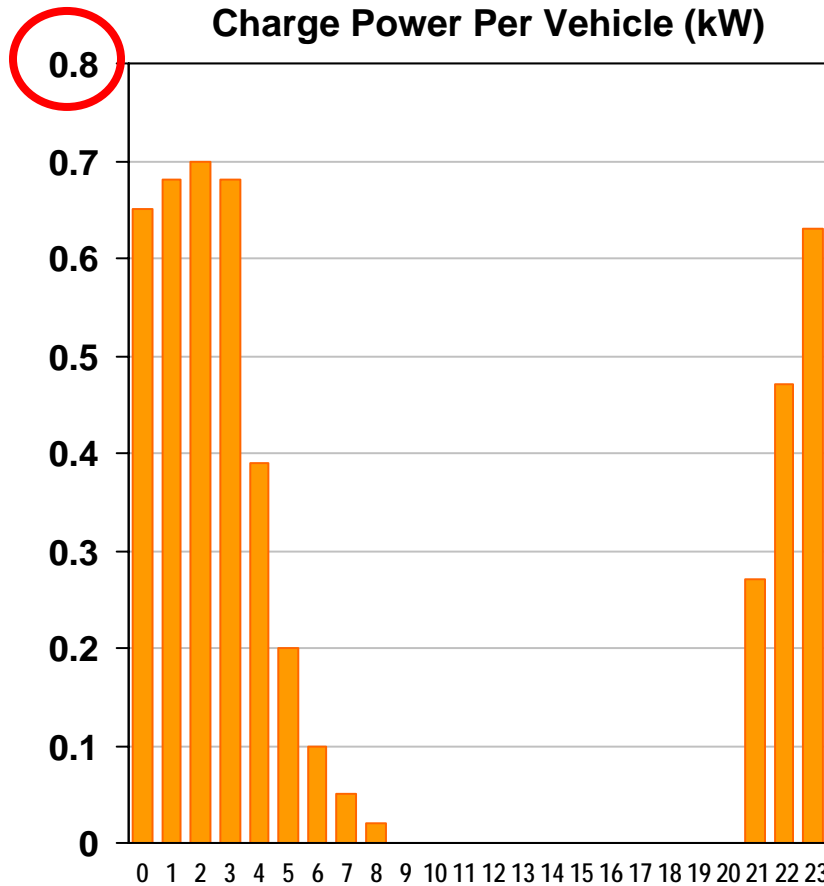
**PEV Peak Demand Depends on Charging Capacity (Voltage/Amperage)**

# Smart Charging is the Key to Reducing Grid Impacts

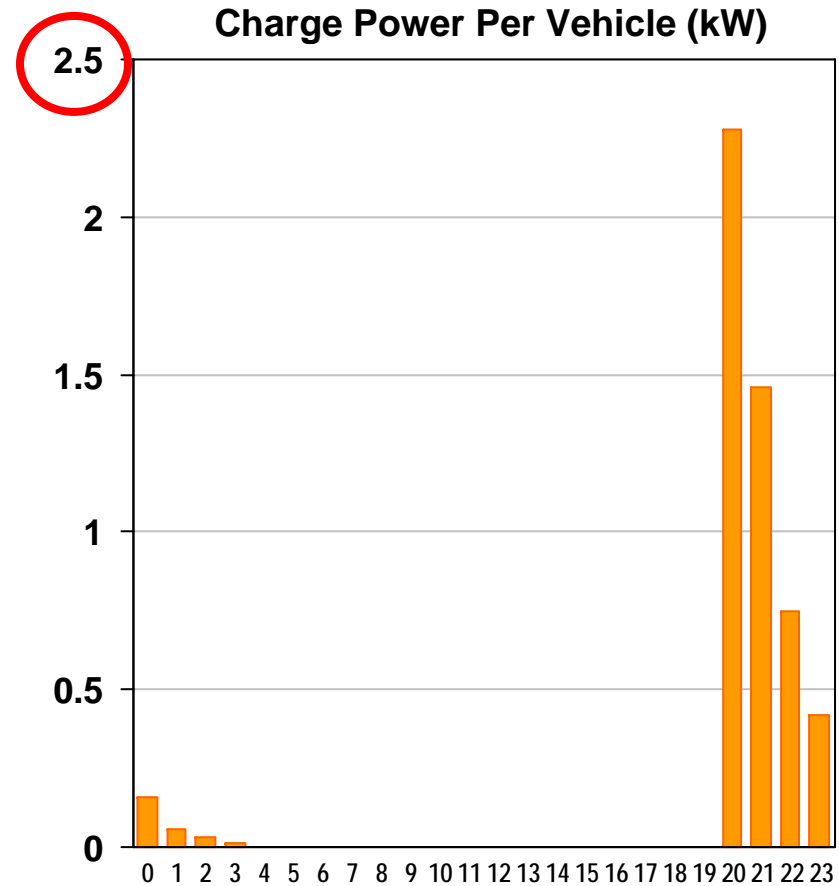
- Varying time-of-day and charging power level can greatly reduce system impacts, consumer costs – However:
- Standards still under development
- All EVSEs about to become ‘smart’
  - Multiple suppliers
  - Multiple discrete networks
- Badly controlled charging worse than uncontrolled
  - 2-3 time higher peak demand
- Rapid migration to the next hot concept



# Smart Charging Helps – If Done Right



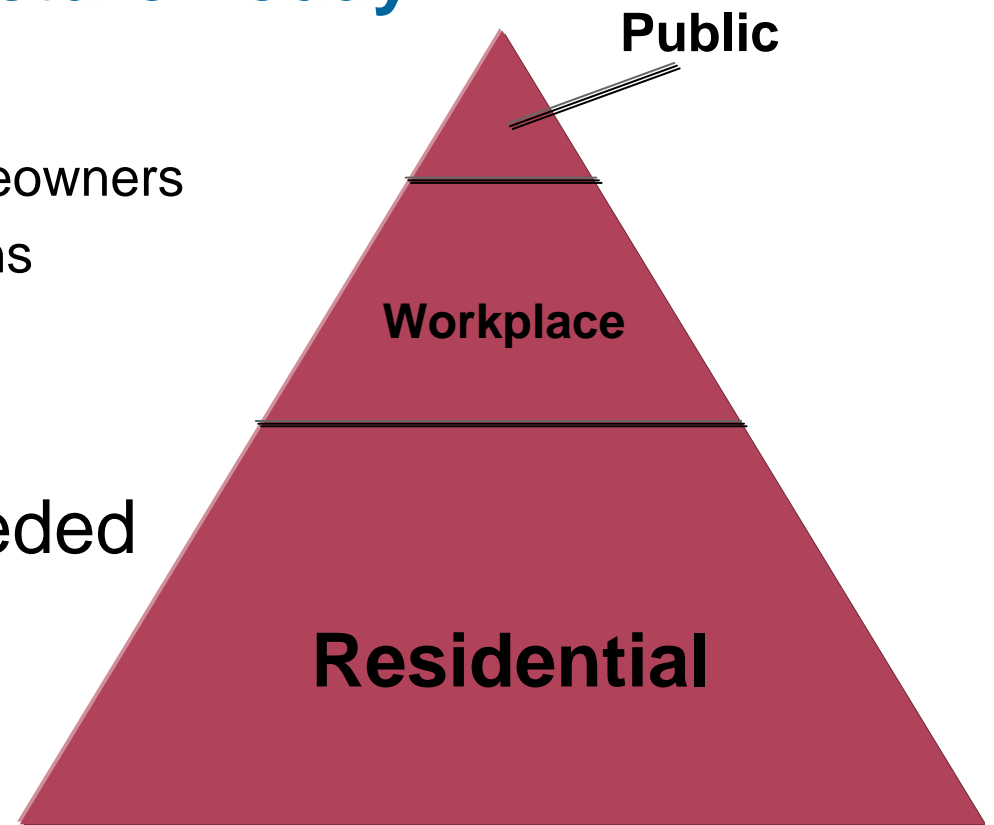
**Shifts the charge load to nighttime, but spreads it out relatively evenly over 6 hours**



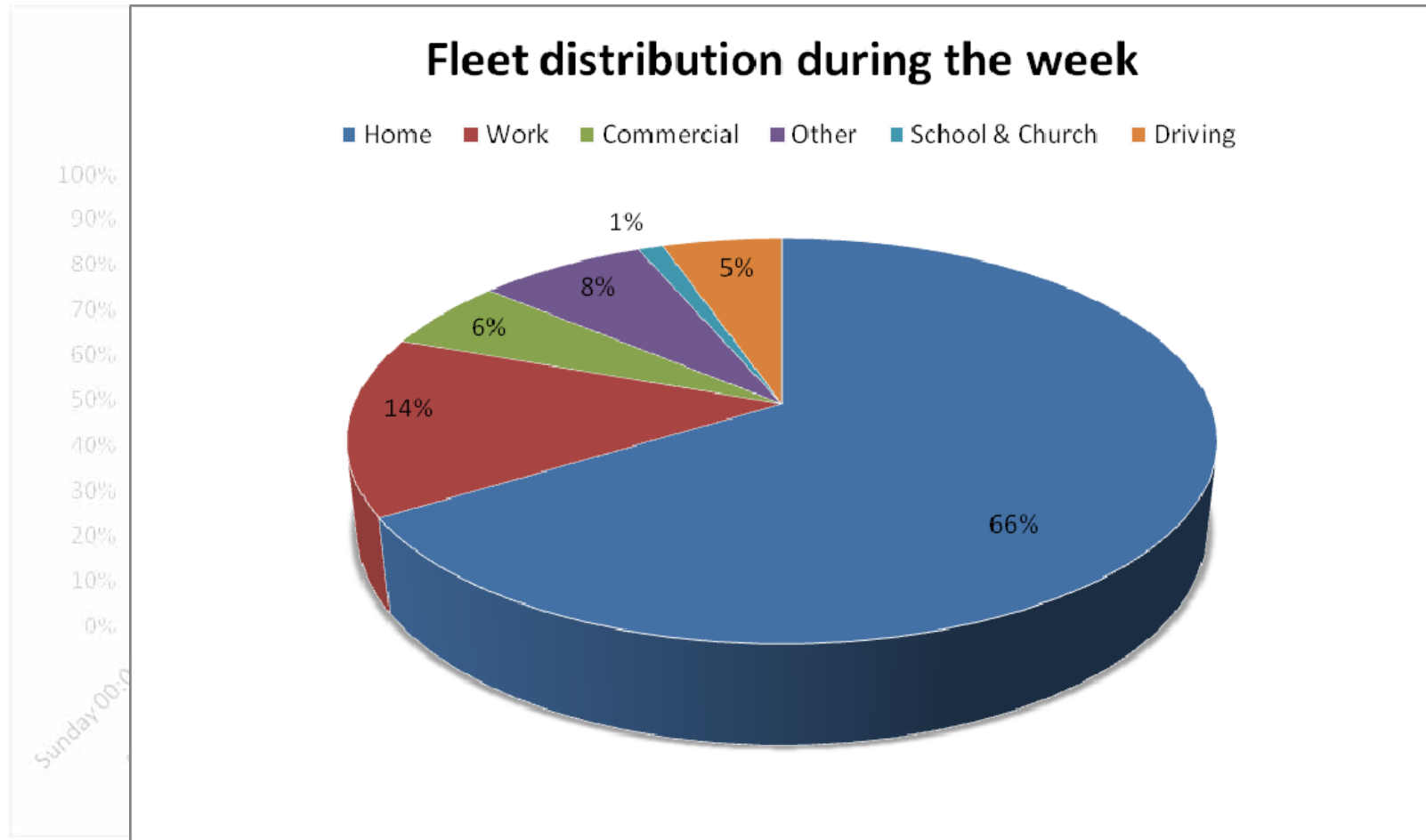
**Only shifting the time without evening out the profile can make the situation worse**

# To Electrify Transportation, You Must Get Electricity to the Vehicles

- **Build Today's Infrastructure Today**
- **Focus on Residential**
  - Seamless installations for homeowners
  - Permits, electricians, inspections
  - Rates and customer programs
- **Workplace**
- **Public Charging – as needed**
  - Retail, private, public spaces
  - Open access
- **Know what drivers need**
- **Know where cars are parked**

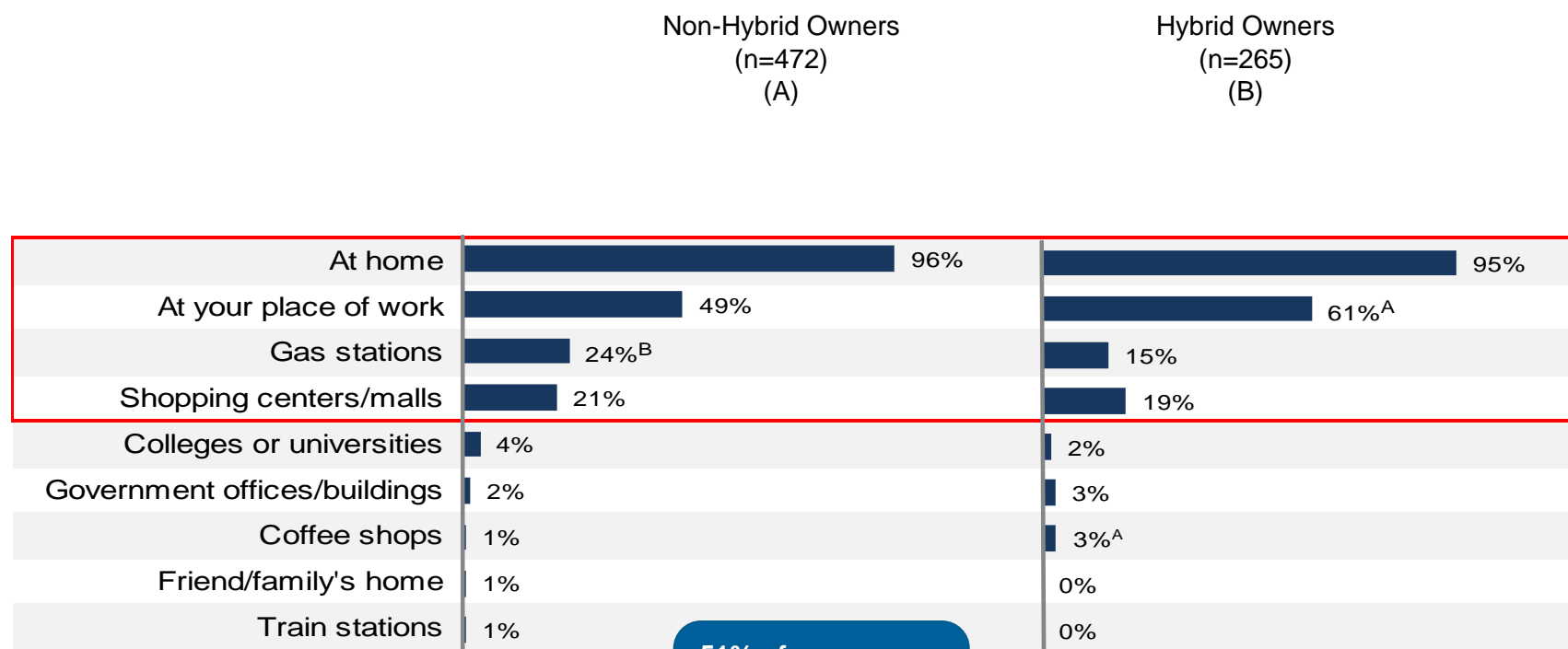


# Deliver Electricity, Charging Infrastructure to the Vehicle's Location



# Charging Location Preferences

## Most Preferred Public Charging Stations

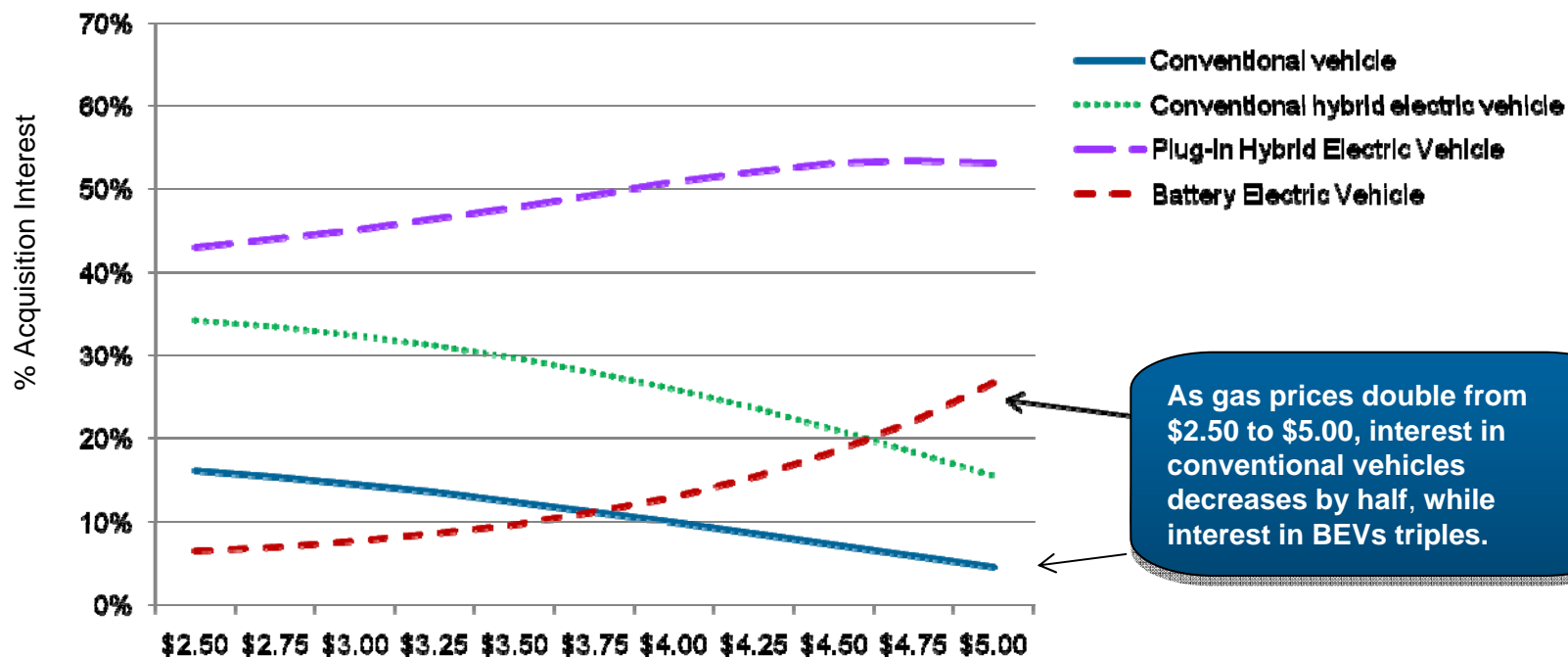


51% of consumers expect a full charge to take 4-8 hours

NOTE: Capital letters represent statistical differences at a 95% confidence level.  
 Q. 19 If you owned a plug-in hybrid electric vehicle, which locations do you think you would use the most to charge the vehicle? SELECT 2 LOCATIONS  
 Q. 21 How much time do you expect it to take to fully recharge a plug-in hybrid electric vehicle, assuming that the battery was low?

# Gas Price Impact of PHEV Purchase Intent

## Non-Hybrid Owners Vehicle Acquisition Interest



As gas prices double from \$2.50 to \$5.00, interest in conventional vehicles decreases by half, while interest in BEVs triples.

\* There may be some PHEV bias as the respondent was educated on this vehicle more than other vehicles and PHEVs were the focus of the survey.  
 Q. 41a/b/c/d Given the above information, which one of these vehicles would you purchase or lease if the price of gas is [INSERT PRICE] a gallon? SELECT ONE RESPONSE

# What Does Community Readiness Mean?

- Organized and effective stakeholders
- Understanding the drivers of PEV adoption
- Education and outreach
- A comprehensive plan to address the challenges of charging infrastructure
  - Addressing residential charging first
    - Looking at all aspects of streamlining the process
    - Incentives, permitting, installation, costs
  - A sensible plan for public infrastructure

Together...Shaping the Future of Electricity



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Image from *NASA Visible Earth*