

Use of National Household Travel Survey (NHTS) Data in Assessment of Impacts of PHEVs on Greenhouse Gas (GHG) Emissions and Electricity Demand

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PHEV Has Potential to Reduce U.S. Petroleum Dependence and Possibly Reduce GHG emissions

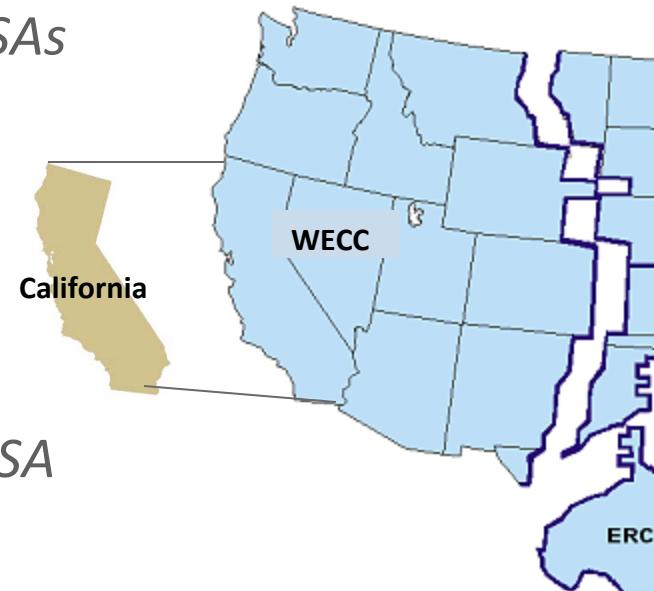


Used NHTS and Other Data Sources to Estimate PHEV Population

- **2009 NHTS data** → determine the pattern of daily vehicle usage
- **EIA's 2010 Annual Energy Outlook (AEO) projections** → estimate future number of vehicles by vehicle type in 2030
- **U.S. Census Bureau's population projections and FHWA's registration data from Highway Statistics** → allocate national vehicle projection to individual states
- **NHTS travel data** → allocate total PHEVs in different geographical areas by 10-, 20-, 30-, and 40-mile all electric ranges (AERs).

Developed Vehicle Usage Patterns in Nine Regions for Further Evaluations

- Nine geographical areas
 - *Western Electric Coordinating Council (Excl CA)– All MSA*
 - *Western Electric Coordinating Council (Excl CA)– Other*
 - *California – Large (> 1 Millions) MSAs*
 - *California – Other*
 - *New England*
 - *Illinois – Chicago MSA*
 - *Illinois – Other*
 - *New York State – New York City MSA*
 - *New York State – Other*
- Four quarters of calendar year were considered



Analyzed 2009 NHTS to Determine the Patterns of Daily Vehicle Usage and the Extent of Travel

- Developed distributions of vehicles by the hour of day when the last vehicle trip ended
 - *Sorted vehicle trips in the day trip file by household identification and vehicle number*
 - *Arranged all trips made by a vehicle according to time sequence and created one record for each vehicle*
 - *Estimated percent of vehicles that ended their last trip at different time of day for each area of interest*
 - *Analyzed the last trip ending patterns by four quarters of the year and travel day type*



Estimated Vehicle Population by Vehicle Type in Each Study Area

- Assumed state level propensity of ownership of each vehicle type per driving-age population (age 16-84) to remain unchanged over time
 - *2008 Highway Statistics provided state level registration information by vehicle type*
 - *U.S. Census Bureau's projections provided population by age group for each state*
 - *Accounted for different vehicle ownership rates per driving-age person by state*



Allocated Total PHEV Stock to Each Study Area

- Assumed PHEVs will be available in cars and SUVs only
- Argonne's VISION model estimated 10% of vehicles on road will be PHEVs in 2030
- Used the state level vehicle stock estimates to produce PHEV stock in each of the nine electric utility service areas of interest
- Estimated share of PHEVs by daily travel distance (10-20, 20-30, 30-40, and 40-50 miles) using 2009 NHTS
 - *Assumed that a PHEV owner will select a range according to daily travel distance*
- Argonne's PSAT Model was used for sizing usable battery kWh for each vehicle and AER combination

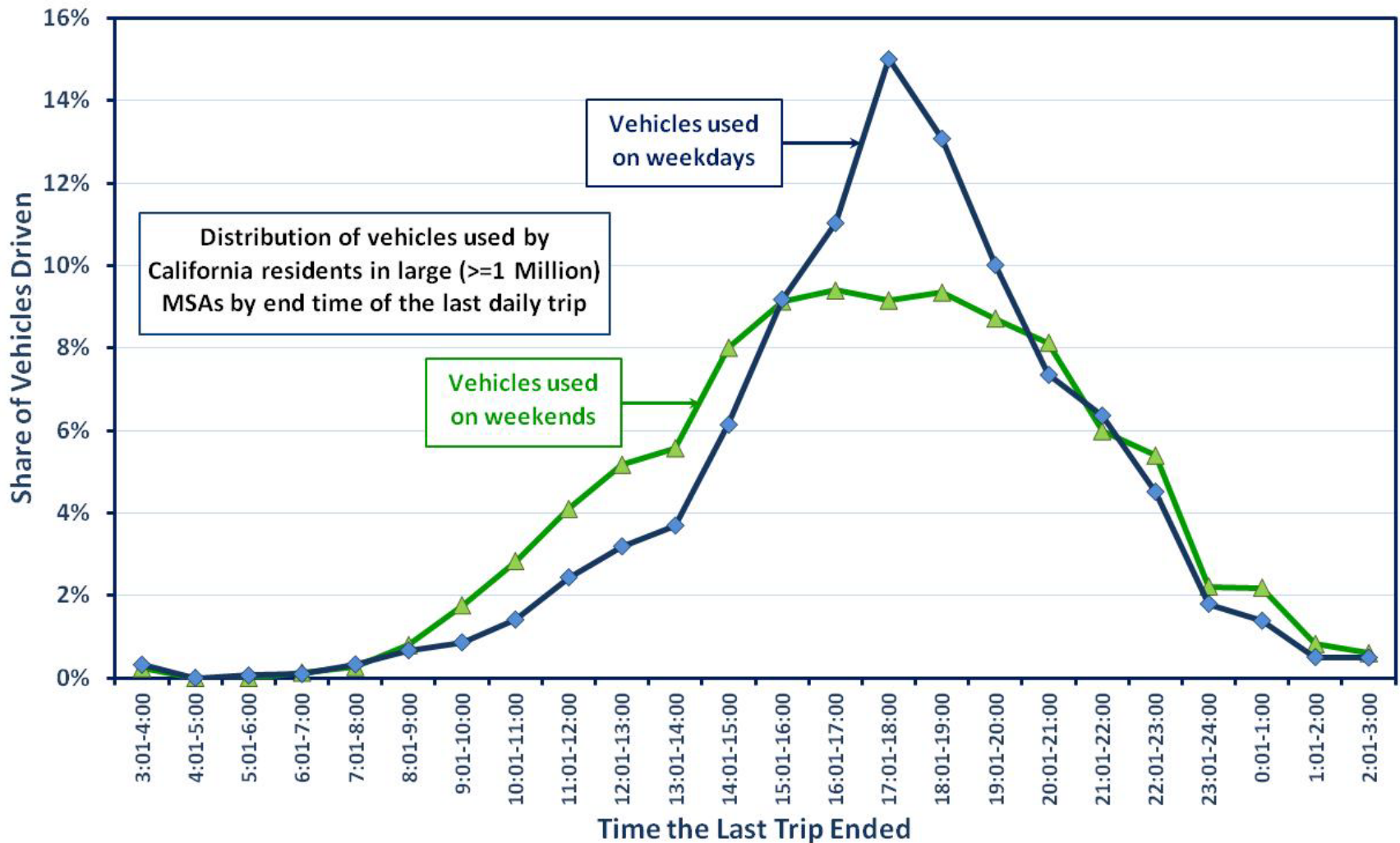


Assessed the Impacts of PHEVs on Electricity Demand and GHG Emissions

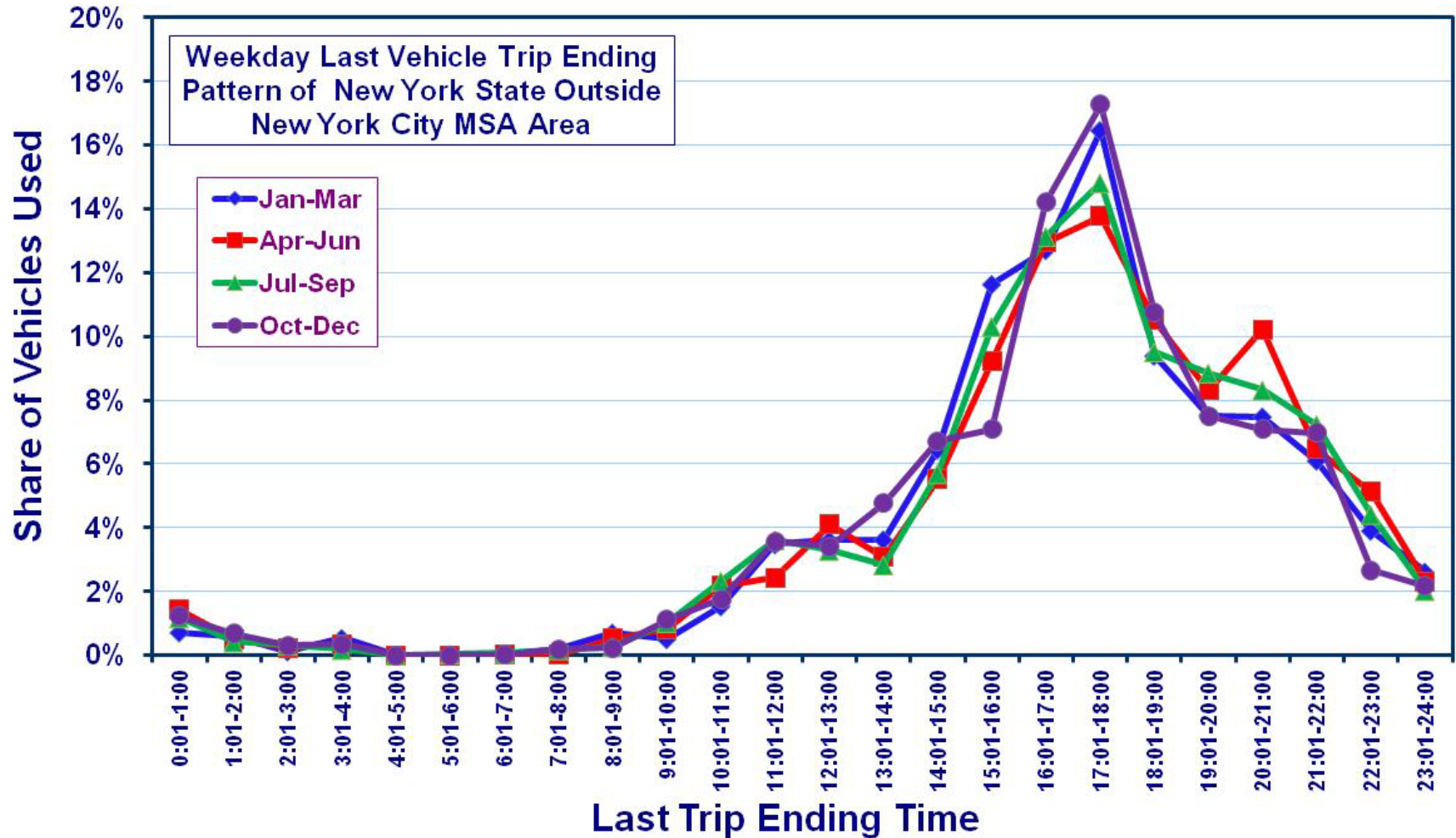
- Estimated hourly power draw from wall plug by PHEV type (by AER and vehicle type)
- Electric utility modelers have simulated two PHEV charging scenarios:
 - *Charge at the end of daily travel*
 - *Charge during periods of low electricity demand (smart charging)*



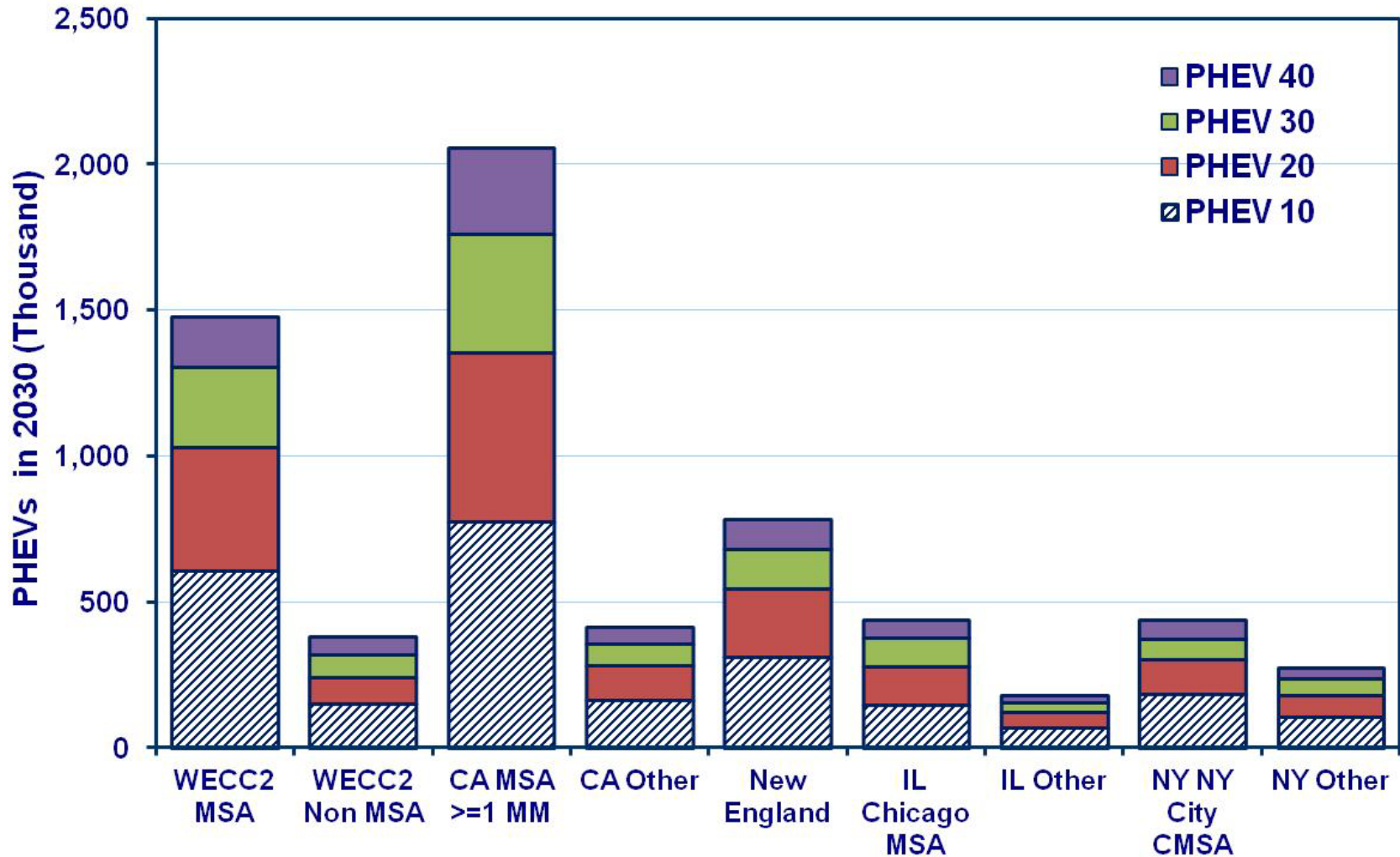
Last Trip Ending Time for Large MSAs in California Peaks around 5 - 6 PM on Weekdays



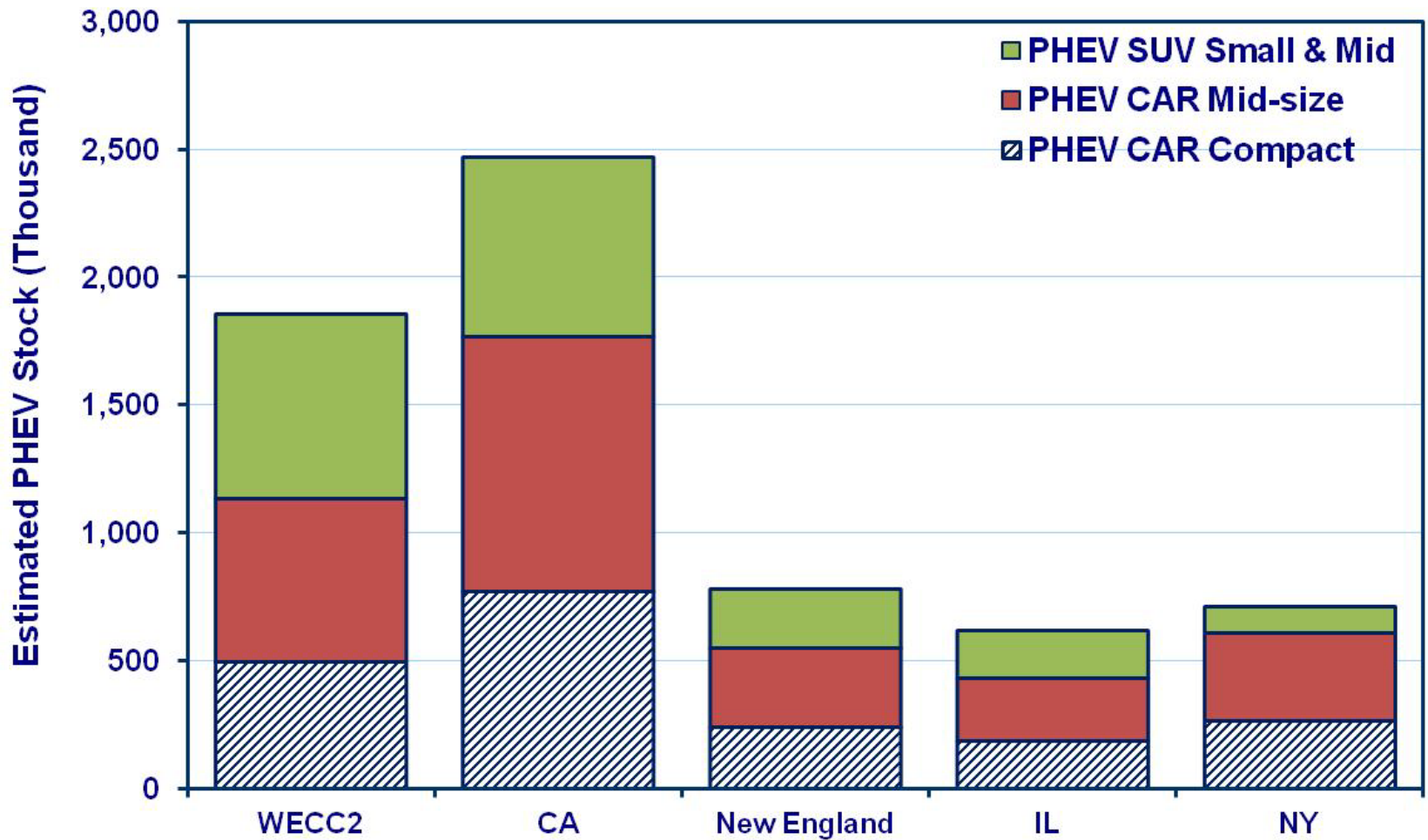
Seasonal Variations Are Observed More in Areas With Cold Weather



PHEV 10 Is Expected to be the Most Popular Option



Most of PHEVs Will be Mid-size Cars



Conclusions

- **NHTS data combined with other data sources helped in providing regional vehicle ownership and usage**
 - A peak is observed at 5-6 PM for the last vehicle trip ending time during weekdays.
 - Some seasonal variations are observed in all regions, more distinct in areas with cold weather
 - If PHEV buyers select all-electric range (AER) based on daily driving pattern in NHTS, 10-mile AER PHEV would be the most popular option
- **Study results can be used by electric utility demand modelers to assess impacts on generating capacity mix and by lifecycle analysts to assess GHG emissions**

Thanks!

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