Advanced Plug-in Electric Vehicle Travel and Charging Behavior

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Project Overview

• Provide most in-depth study of PEV usage and charging dynamics. Inform policy on battery size/vehicle architecture/consumer behavior interaction

• Monitor **all** vehicles in PEV households. PEVs: Leaf, Volt, Prius Plug-in, (C-Max?)

• 108 households

• Monitor OBD driving and charging parameters along with location

• Determine PEV household travel dynamics. How is the PEV used compared to other cars? EVMT impacts?

• Determine charging frequency and location. L1, L2, QC location.
Project Objectives

• Show eVMT as a percentage of household miles across all available vehicles, not only the one being studied. Find out where the “other” gasoline miles go.

• Explain the “why” in the distribution of eVMT between different households who own the same PEV and among different PEVs.

• Provide the building blocks to construct eVMT with multiple formulas with differing consumer interaction

• Measure dependence on public charging infrastructure as a function of vehicle model

• Determine which other metrics are important to explain variation in VMT and eVMT
Two main Data Collection Efforts: Survey And On-Road Data Collection

• Survey will be sent to 30,000 PEV households of most makes and models
  
  Sent invitation by mail  
  Fill out survey  
  Want to participate/Release Data  
  DAQ households chosen

• 1 Year data collection of 108+ households with Plug-in Prius, Volt, and Leaf vehicles. Collect data from all household vehicles
Survey Informs On-Road Data Collection

- Household demographics, income
- Household vehicles
- Vehicles per driver
- Commute location
- Travel behavior/needs, Important destinations, HOV usage
- Home and work charging infrastructure
- Electricity prices
- Purchase motivation
- Risk taking
On-Road Data Collection

- Travel patterns, distribution
  - PEV
  - Other vehicles
- Charging behavior
  - Location
  - Time
  - Frequency
  - Power
  - Level
  - Efficiency

- Gasoline operation
  - MPG
  - Cold Starts
- Electric operation
  - MPKWH
  - eVMT (engine off and blended)
- Comfort/climate control
On-Road Data Informs Survey

• Back-casting – how well does the survey data about travel and charging behavior predict actual behavior?

• What factors explain variation in eVMT per household?
  • Behavior
  • Vehicle architecture
  • battery size
  • charger availability
  • Others?

• What is the distribution of these households?
• What are the implications for policy?
# Timeline

### Recruitment/Surveys (Task 1)
- IRB Human Subjects Approval (Task 1.1)
- Entry and Exit Survey design (Task 1.2)
- Entry and Exit Survey Deployment (Task 1.3)
- Survey Analysis & Sampling Frmwrk (Task 1.4)
- Recruitment Email (Task 1.5)
- Interviews (Optional Task 1.6)

### Logger testing (Task 2)
- Vendor Selection (Task 2.1)
- Logger Procurement/Fabrication (Task 2.2)
- Vehicle Rent and Install (Task 2.3)
- Pilot Test Data Collection (Task 2.4)
- Pilot Test Analysis Tools (Task 2.5)
- Local Tester Recruiting (10HH) (Task 2.6)

### Data collection management (Task 3)
- Mail In/Out Installation (Task 3.1)
- Data Collection (Task 3.2)

### Data Analysis (Task 4)

### Report Writing (Task 5)
- Progress Meetings/Report (Task 5.1)
- Interim Report (Task 5.2)
- Presentations (Task 5.3)
- Draft Final Report (Task 5.4)
- Final Report (Task 5.5)

## Data Collection Schedule
- 1st deployment (soft launch)
  - 10
- 2nd deployment
  - 44
- 3rd deployment
  - 54

## Total HH
- 0
- 0
- 10
- 10
- 10
- 10
- 10
- 10
- 10
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- 10
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- 0
- 54
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### Significant Milestones
- k = kick off meeting
- p = progress meeting
- i = interim report due
- d = draft final report due
- f = final final report due
- fp = final public presentation to ARB
Extending the analysis

• Add more models first
  • C-Max
  • BEVx
  • Tesla

• Add volume
  • Perhaps shorter time periods?
  • Only PEVs?
  • Connect results to OEM Data

• Analysis beyond ARB deliverables
  • Grid impacts
  • Emissions impacts
Questions?