Status: Plug-in Electric Vehicle and Infrastructure Analysis Report

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Task

- **PEMP Deliverable: Issue a report that summarizes DOE's national light duty plug-in electric vehicle (PEV) and infrastructure programs that documents the results and lessons learned from plug-in electric vehicles and charging infrastructure projects. (PEMP: INL's Performance Evaluation and Measurement Plan)**

- **PEMP Description: This report will summarize the background and key findings of two large-scale PEV charging infrastructure demonstrations and three PEV demonstrations that were conducted by INL and partners between January 2011 and July 2015**

- **Also a deliverable for**
  - **DOE-HQ**
  - **NETL (National Energy Technology Laboratory – managed the FOA contracts)**

Task Significance

- **DOE's Vehicle Technologies Office tasked INL to expand INL's PEV and charging infrastructure data analysis capabilities (i.e., the systems required to collect data, ensure data quality, perform analysis, and generate appropriate reports for the 5 projects)**
- **The EV Project alone is the largest demonstration of PEVs and charging infrastructure in the world**
  - **INL combined data from 4 data streams to benchmark use patterns for 20,600 PEVs and charging units**
- **Combined breath of these projects:**
  - **8 data streams, 25,600 PEVs and charging units**
  - **129 million miles, 48,200 MWh of clean transportation**
- **The *Plug-in Electric Vehicle and Infrastructure Analysis* Report documented the deployments, use patterns results, and lessons learned**
- **Lessons learned is the most significant report section**

Background

- The American Recovery and Reinvestment Act funded 5 charging infrastructure and light-duty plug-in electric vehicle (PEV) projects
- Barriers:
  - INL's 8 partners in the 5 projects all stated they had never shared raw data before
  - Significant marketing of INL capabilities was required by INL staff
  - INL signed NDA's with all the partners (and their lawyers)
  - Secure data transfer methods were developed
- Total funding for the 5 projects was $462 million

- INL staff have been using vehicle-based data loggers and databases to benchmark PEV and charging infrastructure use for 20+ years
- Data collection for all 5 projects is complete
- Analysis and reporting continues by INL

Individual Projects

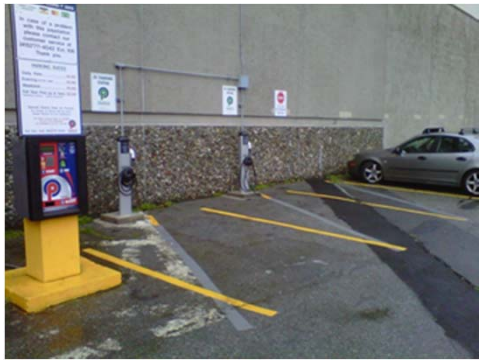
- **EV Project - $230 million**
  - **Goal: build the world's largest charging infrastructure laboratory to provide lessons learned for guiding future EVSE deployments**
  - **INL received data streams from project partners:**
    - **Blink - 12,400 electric vehicle supply equipment (EVSE) and DC Fast Chargers**
    - **Nissan - 5,789 Leaf Electric Vehicles (EVs)**
    - **OnStar/GM - 2,023 Volt Extended Range Electric Vehicles (EREVs)**
    - **Car2Go – 416 Smart EVs**
  - **124 million miles, and 4.2 million charge events benchmarked**

Individual Projects – cont'd

- **Chevrolet Volt EREV Development - $61 million**
  - **Goal: support the development of EREV technology and document the use and petroleum reduction potential**
  - **INL received data from project partner OnStar/GM : 150 Volts, 3.8 million test miles**
- **Chrysler Ram Pickup Plug-in Electric Vehicle (PHEV) Development - $96 million**
  - **Goal: support the development of PHEV technology and document the use and petroleum reduction potential**
  - **INL received data from project partner Chrysler : 111 Rams, 1.3 million test miles**

Individual Projects – cont'd

- **ChargePoint America Charging Infrastructure Deployment - $30 million**
  - **Goal: support the development of EVSE and document PEV drivers use patterns to guide future deployments**
  - **INL received data from project partner ChargePoint: 4,647 EVSE, 1.8 million charge events**
- **Via Motors PHEV Development - $45 million**
  - **Project was delayed getting CARB certification. Impacted deployment**
  - **INL has received 69,000 miles of data for 145 PHEV pickups and vans. End was June 30, 2015**

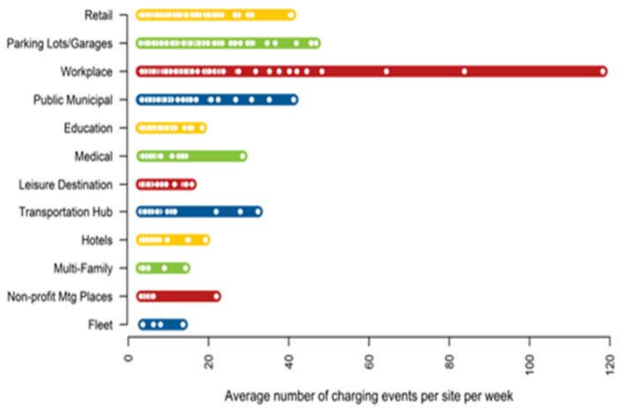


Source – Via Motors

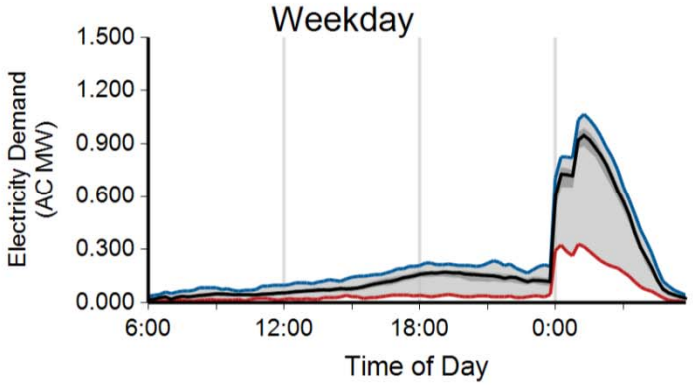
Report Significance

- **Vehicle Technologies Office (VTO) is required to produce a report that documents the five projects, including, but not limited to:**
  - **Rollouts and data accumulation**
  - **Fees and Time-of-Use rate impacts on charging**
  - **EVSE utilization rates by venues**
  - **Petroleum reduction potentials**
  - **Lessons Learned = provide unbiased data to decision makers**
  - **How $238.5 million of tax payer funds were used**
- **VTO requested INL produce this major DOE deliverable**

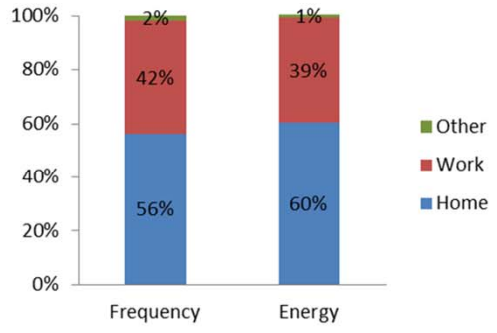
Charging Venue Use Rates



TOU Rate Impacts



Value of Workplace EVSE



Summary Report Topics For Each Section

- Scope and Objectives (includes timeline)
- Equipment Types (description of technologies involved)
- Deployment and Data Collection Rate (equipment deployment rate and resulting data collection rate)
- Reporting (types of reports and subjects reported on, including parameters reported on, e.g.,)
- Results
  - Energy used, miles driven, number of trips, connection times
  - TOU influences, fee impacts, clustering impacts on the grid
  - Charging start times, results by PHEV operating mode, etc.
  - Vehicle and EVSE data depends on the project
- Summaries

Summary Report Sections

- How to read this report
- Acknowledgements
- Executive summary
  - Featured Highlight: How Americans Charge Their Plug-In Electric Vehicles
- Summary of key lessons learned findings
  - EV Project Lessons Learned
  - Lessons Learned from Combined Projects
  - Miscellaneous Observations
- ChargePoint America project
- U.S. Department of Energy/General Motors Chevrolet Volt extended range electric vehicle demonstration
- Chrysler Ram plug-in hybrid electric vehicle demonstration

Summary Report Sections

- The EV Project
- SCAQMD/EPRI/Via Motors plug-in hybrid electric vehicle conversion demonstration
- EV Project lessons learned (full write-ups, number of white papers per section)
  - EV Project Direct Current Fast Chargers, 4
  - EV Project Residential Electric Vehicle Supply Equipment, 8
  - EV Project Public Electric Vehicle Supply Equipment, 8
  - The EV Project Plug-In Electric Vehicle Gasoline and CO2 Savings, Carbon Credits, and Greenhouse Gases, 3
  - EV Project Participants, 4
  - EV Project Vehicle Use, 4
  - EV Project Workplace Charging, 6

Summary Report Sections – cont'd

- **Combined projects lessons learned**
  - **Categorizing Electric Vehicle Supply Equipment Venues: Describing Publicly Accessible Charging Station Locations**
  - **Analyzing Public Charging Venues: Where are Publicly Accessible Charging Stations Located and How Have They Been Used?**
  - **Workplace Charging Case Study: Charging Station Utilization at a Work Site with Alternating Current Level 1, Alternating Current Level 2, and Direct Current Fast Charging Units**
  - **Direct Current Fast Charger Usage in the Pacific Northwest**

Summary Report Sections – cont'd

- **Miscellaneous observations**
  - **Top 10 Electric Vehicle Cities and American Recovery and Reinvestment Act of 2009 Charging Infrastructure Deployments**
  - **Comparing Driver Influence on Plug-In Electric Vehicle Petroleum Reduction Benefits**
  - **Comparing EV Project Chevrolet Volt Use and Nissan Leaf Use**
  - **ChargePoint America Project and The EV Project Comparative Results**
  - **Who Has Used This Information and How Have These Results Helped Progress the Plug-In Electric Vehicle Market?**
- **INL Data Systems Used For The American Recovery and Reinvestment Act of 2009 benchmarked projects**

Final Products

- **Full Report**
  - **527 pages**
- **Executive Summary**
  - **Select highlights from the full report**
  - **24 pages**
- **Highlights Summary**
  - **Combined very high level summary of joint EV Project and ChargePoint results**
  - **2 pages**
- **All posted on http://avt.inel.gov/summaryreport.shtml**