EV and VGI Research

Reports Database

click here for an explanation and introduction

click here to continue to the index

Current curator: Adam Orford, U.C. Berkeley Energy & Resources Group. adam.orford@berkeley.edu.
Please contact with any suggestions or requests. Hosted documents obtained from public sources.
Last update: 2016.05.16
Introduction

This document organizes information about ongoing publicly-funded electric vehicle (EV) and vehicle-grid integration (VGI) research, development, and demonstration projects. It was produced to consolidate information collected via the California Public Utilities Commission’s Electric Vehicle Pilot Survey, and to expand on that dataset by sorting projects into research areas and adding links to the most current available information, including reports (if available), websites, public presentation slide decks, and news references. The purpose is to help researchers and decisionmakers get up to speed on this rapidly-developing field, avoid duplicative research, and identify research gaps, all ultimately toward the goal of leveraging R&D to support transportation electrification goals.

The document is a novel use of Google Slides inspired by HyperCard. To navigate, simply click the links. The Google platform is not perfect (it is not possible to disable advance-on-click, for example), but was chosen because it is an efficient and flexible sharing service that does not rely on public resources or administration to keep running or to update. It can be curated by anyone in the field willing to volunteer.

The most current version of this document is always available at http://tiny.cc/vgireports. To join discussions about this topic, please join the Vehicle-Grid Integration Network on LinkedIn.
## EV-VGI Resource Index

<table>
<thead>
<tr>
<th>Grid Impacts</th>
<th>Residential Charging</th>
<th>Utility Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase Behavior</td>
<td>Workplace Charging</td>
<td>Download the dataset:</td>
</tr>
<tr>
<td>Charging Behavior</td>
<td>Public Charging</td>
<td>EV Pilot Survey Results</td>
</tr>
<tr>
<td>Rate Design</td>
<td>Integrated Renewables/Storage</td>
<td></td>
</tr>
<tr>
<td>VGI Communications</td>
<td>Battery Recycling/Disposal</td>
<td></td>
</tr>
<tr>
<td>V1G Services (DR)</td>
<td>Medium- and Heavy-Duty Vehicles</td>
<td></td>
</tr>
<tr>
<td>V2G Services</td>
<td>School Buses</td>
<td></td>
</tr>
<tr>
<td>Wireless Charging</td>
<td>Public Transportation</td>
<td></td>
</tr>
</tbody>
</table>

[Back to home screen]
Grid Impacts of EV Adoption

Examining the extent to which widespread plug-in electric vehicle charging might impact the electric grid.

Publications:

- California Electric Transportation Coalition, California Transportation Electrification Assessment Phase 2: Grid Impacts (Oct. 2014), Phase 3 Part A: Commercial and Non-Road Grid Impacts (Jan. 2016)
- Electric Power Research Institute, Transportation Electrification: A Technology Overview (July 2011)
Purchase Behavior

Examining consumer decisions to purchase, or not to purchase, an electric vehicle.

Ongoing R&D:

- UCLA (funded by the California Air Resources Board Research Division), *Designing Light-Duty Vehicle Incentives for Low- and Moderate-Income Households* (scope of work) (Feb. 2016)

Publications:

- CA Air Resources Board - UCLA, *Examining Factors that Influence ZEV Sales* (scope of work) (June 2013)
Charging Behavior

Examining where, when, and how people charge their electric vehicles.

Ongoing R&D:

- SCE, *PEV WorkPlace Charging DR Pilot* (plan) (report due Q2 2016)

Publications:

- SDG&E, *Final Evaluation for SDG&E’s PEV TOU Pricing and Technology Study* (Feb. 2014)
Rate Design

Examining issues related to designing special rates for electricity used to charge electric vehicles.

Publications:

- CPUC, California Statewide PEV Submetering Pilot - Phase 1 Report (Apr. 2016)
- NYSERDA, Electricity Pricing Strategies to Reduce Grid Impacts from Plug-in Electric Vehicle Charging in New York State (June 2015)
- SDG&E, Final Evaluation for SDG&E’s PEV TOU Pricing and Technology Study (Feb. 2014), EV Project Addendum (Apr. 2015)
- The Brattle Group, Will Smart Prices Induce Smart Charging of Electric Vehicles? (July 2011)

Current EV rate information (alphabetical by state):

VGI Communications

Developing communications standards, protocols, and software packages that permit secure, reliable, real-time communication between vehicles, charging technologies, and the electric grid.

Ongoing R&D:

- ChargePoint ($1.5 million funded by California Energy Commission EPIC program), Next-Gen Grid Communications for Residential PEVs (scope of work) (30-home pilot running through Feb. 2018)
- Center for Sustainable Energy ($1.5 million funded by California Energy Commission EPIC program), ISO/IEC 15118 Demand Clearing House (scope of work)
- University of California, Berkeley ($1.5 million funded by California Energy Commission EPIC Program), Open Source Platform For Plug-in Electric Vehicle Smart Charging in California (scope of work)
Examining the potential to utilize VGI communications to effect unidirectional demand response at peak demand periods.

Ongoing R&D:

- PG&E-BMW, *iChargeForward program* ([website](http://ichargeforward.com))
- eMotorWerks, DRAM commitments: ([news](http://www.emotorwerks.com)) For further information on California's DRAM program, see: [CPUC Rulemaking 13-09-011](http://www.cpuc.state.ca.us/pubs/rul1309011.htm) [CAISO demand response](https://www.caiso.com/sustainability/ets/ets-demand-response) pages, [PG&E](http://www.pge.com), [SDG&E](http://www.sdge.com), and [SCE](http://www.sce.com) DRAM pages.
- SCE, *Augmenting AMI with Broadband: A Smart Charging Pilot Demonstration* ([plan](http://www.sce.com/pdf/54808.pdf)) (demonstrated charge throttling with variety of communications protocols) (report expected release Q2 2016)

Completed demonstration:

V2G Services

Examining potential to utilize VGI communications and bidirectional charging technologies to provide demand response and ancillary services.

Ongoing R&D:

- Electric Power Research Institute ($1.5 million funded by California Energy Commission EPIC program), *Distribution System Aware Vehicle to Grid (V2G) Services for Improved Grid Stability and Reliability* ([scope of work](#)) ([presentation](#)) (4-vehicle testing through June 2018)
- University of California Los Angeles ($2 million funded by California Energy Commission EPIC program), *Demonstration of PEV Smart Charging and Storage Supporting Grid Objectives* ([scope of work](#))
- Andromeda Power LLC ($700,000 funded by California Energy Commission EPIC program), *InCISIVE - Grid Communication Interface for Smart Electric Vehicle Services* ([scope of work](#)) (Feb. 2016)
- NRG EVgo, *Storage Accelerator* ([presentation](#)) ([settlement annual report](#))
- U.S. Dept. of Defense, China Lake Naval Air Weapons Station V2G demonstration ([rate schedule](#))
- U.S. Dept. of Defense, 63rd Regional Support Command (Moffett Field) demonstration ([presentation](#) Nov. 2014 (after LAAFB))
- U.S. Dept. of Defense, Fort Carson pilot ([assessment report](#)) ([presentation](#))
- University of Delaware

Publications:

Wireless Charging

Examining potential to utilize wireless charging technologies.

[COMING SOON - WORK IN PROGRESS]

Publications:

- NREL, Dynamic Wireless Power Transfer Grid Impacts Analysis (Nov. 2015)
Residential Charging

[COMING SOON - IN PROGRESS]

Examining special problems related to installation and operation of electric vehicle charging equipment in residences.

- Alternative and Renewables Fueled Vehicle Technology Program, Charging Grants: Residential Deployment (presentation)
Workplace Charging

Examining special problems related to installation and operation of electric vehicle charging equipment in workplaces.

Ongoing R&D:

- California Dept. of General Services, Electric Vehicle Charging Infrastructure program (presentation)

Publications:

- PEVC, Plugging in at Work: How to Effectively Install, Share and Manage Electric Vehicle Charging Stations (Nov. 2015) (earlier presentation)
- U.S. Dept. of Energy, Costs Associated with Non-Residential Electric Vehicle Supply Equipment (Nov. 2015)
Public Charging

Examining special problems related to installation and operation of electric vehicle charging equipment in publicly accessible locations.

Ongoing R&D:

- PG&E, DCFC Siting project (report due 4/15/2016)
- Alternative & Renewable Fueled Vehicle Technology Program, Public Charging Grants: CEC overview (presentation), Redwood Coast (presentation), SMUD DCFC (presentation), Adopt-a-Charger (presentation), ChargePoint public-private (presentation)

Publications:

- NREL, California Statewide Plug-in Electric Vehicle Infrastructure Assessment (May 2014)
Integrated Renewables/Storage

Projects demonstrating integration of renewable energy generation or energy storage technologies with electric vehicle charging technologies.

Existing demonstrations:

- Greencharge Networks (presentation), Solar Tree (presentation)
- SDG&E San Diego Zoo (presentation)

Publications:

- Simpson (NREL), Plug-in Electric Vehicle Fast Charge Station Operational Analysis with Integrated Renewables (May 2012) (presentation)
Battery Recycling/Disposal

Examining recycling and disposal of electric vehicle batteries at the end of useful operating life.

Ongoing R&D:

Lawrence Berkeley National Lab (PIER funded), *Strategies for Sustainable and Cost-effective Scale-up of Second-Life, Recycling, and Disposal Pathways for PEV Battery Packs* (expected June 2015)

Publications:

- Electricore, [Market Impact of Standardized Design in PEV Battery Pack Purchase and Disposal](#) (March 2015)
- Farasis, [Direct Recycling Technology for CA’s PEV Li-ion Battery Packs](#) (March 2015)
- NREL, [Identifying and Overcoming Critical Barriers to Widespread Second Use of PEV Batteries](#) (Feb. 2015).
Medium- and Heavy-Duty Vehicles

Ongoing R&D:

- NREL, Miami-Dade hydraulic hybrid refuse vehicles evaluation (fact sheet)

Publications:

- NREL, Medium-Duty Plug-in Electric Delivery Truck Fleet Evaluation (June 2016)
- EPRI, Plug-in Hybrid Medium-Duty Truck Demonstration and Evaluation (2015)
- NREL, Characterization of In-Use Medium Duty Electric Vehicle Driving and Charging Behavior (Dec. 2014)
School Buses

[COMING SOON - WORK IN PROGRESS]

Clinton Global Initiative V2G School Buses (presentation) (website)

Mass. Dept. of Energy, Electric School Bus Project (presentation requested)
Public Transportation

Electrified transit bus demonstrations, renewable energy for electric trains.

Publications:

- NREL, Fast Charge Battery Electric Transit Bus In-Use Fleet Evaluation (June 2016) (fact sheet)
- NREL, Foothill Transit Battery Electric Bus Demonstration Results (Jan. 2016)
- Bruzzone & Ferry, Making BART Run with the Warm California Sun (Nov. 2015) (presentation)

Transit agency electric bus pages:

San Joaquin RTD, Stanford Marguerite Shuttle, Mountain View Community Shuttle, Antelope Valley Transportation Authority, Santa Barbara MTD, Los Angeles DOT, Los Angeles County MTA, Long Beach Transit, Gardena Municipal Bus Lines, Foothill Transit, Washington State DOT, RTC Southern Nevada, TriMet (Portland), King County Metro (WA), Link Transit (Wenatchee WA), Ben Franklin Transit (WA Tri-Cities), Utah Transit Authority, VIA Metro Transit (San Antonio TX), Metro Transit (Houston TX), Chicago Transit Authority, IndyGo (Indianapolis IN), TARC (Louisville KY), CARTA (Chattanooga TN), Nashville MTA, StarMetro (Tallahassee FL)
Utility Regulation


Western States

Oregon

Washington
Utility Regulation: Oregon

**EO 08-24.** Created AFV Infrastructure Working Group ([Final Report](#)).


Freeway Corridor Pilot: PGE [AL 12-05](#) (Mar. 2012) (approved); PGE [AL 13-21](#) (Oct. 2013) (approved); PGE [Schedule 344](#).

[SB 1547](#) §§ 20, 21, 29. OPUC [Docket 599](#) (opened Apr. 2016) [Staff Proposal](#) on application requirements, plus proposed schedule. Proposed rule coming soon.
Utility Regulation: Washington
EV Pilot Survey Results

The Electric Vehicle Pilot Survey is designed to collect baseline information on EV and VGI research, development, and demonstration projects in California and beyond. See [http://tiny.cc/evpilotsurvey](http://tiny.cc/evpilotsurvey) for further information.

Information from the survey is curated and compiled into a single spreadsheet, for reference. The most recent version is:

2016.05.16 EVPS Response Master
Change Log


2016.05.20 migrated to dedicated account

2016.06.30 began compiling State Commission Proceedings