VTO Vehicle to Building Integration Pathway

Multi-Lab Team: ANL (Keith Hardy & Jason Harper), INL (John Smart & Rob Hosvapian), LBNL (Samveg Saxena & Doug Black), NREL (Tony Markel & Andrew Meintz), and PNNL (Rick Pratt(rmpratt@pnnl.gov) and Ethan Farquhar)

PNNL-SA-117077

Pacific Northwest NATIONAL LABORATORY

Proudly Operated by Battelle *Since 1965*

OBJECTIVE

Develop and demonstrate pre-normative methods needed to develop a standardized and interoperable communication pathway and control system architecture between Plug-in Electric Vehicles (PEVs), Electric Vehicle Support Equipment (EVSE) and Building/Campus Energy Management Systems (BEMSs) to enable the integration of clean variable renewable sources with workplace PEV charging infrastructure..

FY16 Overview:

Budget:

Project funding: $1.4M divided among 5 labs

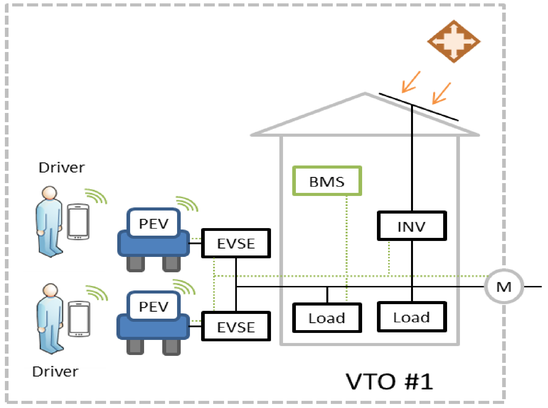
Barriers and Targets:

- PEV / Building communications & control
- Grid-connected PEV economic benefits
- Demand charge mitigation on commercial buildings

Partners: ANL, INL, LBNL, NREL & PNNL

Milestone Name/Description	End Date
Finalize development of vehicle charging demonstration use cases, communication requirements, control requirements, communication architecture and testing processes needed to demonstrate coordinated PEV charging under time varying commercial building load conditions that minimize demand charges.	10/1/2016
Demonstrate one standards-compliant, multi-vehicle, workplace charging use case (e.g., demand response) with PEV charging control and communications coordinated by a supervisory controller and scheduled charge control variations (charge power, load shedding, timing, etc.).	4/1/2017
Demonstrate workplace PEV charging control system performance with building loads, variable renewable resources generation signals, and using selected use cases that require dynamic PEV charging to mitigate peak demand charges.	10/1/2017
Develop and demonstrate emulated PEV charging of many PEVs integrated with physical workplace PEVs and evaluate charging control system performance with building loads, variable renewable resources generation signals, and using selected use cases that require dynamic PEV charging to mitigate peak demand charges.	4/1/2018
Transactive Controls System demonstration	10/1/2018

Value / Motivation



The Vehicle to Building Integration project will develop the technology to enable integrated control of vehicles, building systems and renewables. The VTO #1 platform will enable **behind the building meter** resources to respond to internal signals (e.g., load balancing to avoid peaks) and external signals (e.g., electricity price or demand response).

Workplace charging impacts:

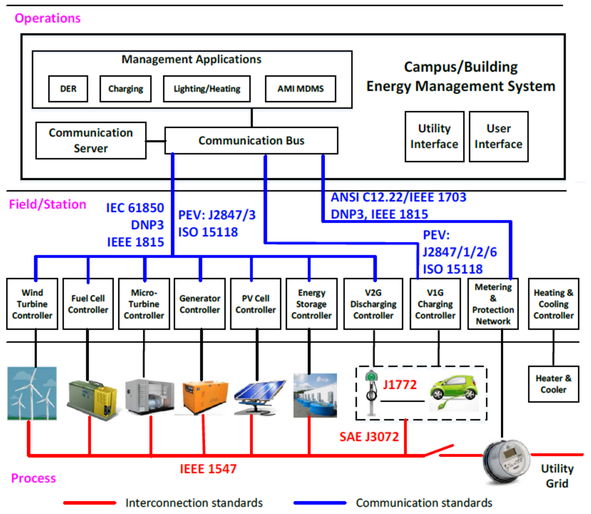
- PEV charging using solar generated renewables
- **More than doubles PEV range without increasing battery size**
- **Minimize demand charges**

2016 Green House Gas Effects

- 450K PEVs & BEVs sold. 40% of PEV & BEV sales are in California (Feb. 2016)
- Estimated annual PEV / BEV energy consumption (500K vehicles): **1,356GWh**
- Transportation gasoline not used: **4.0 million barrels annually @ 25mpg & 0.32 kWh/mile**
- Annual GHG averted: **1,229,000,000 kg**

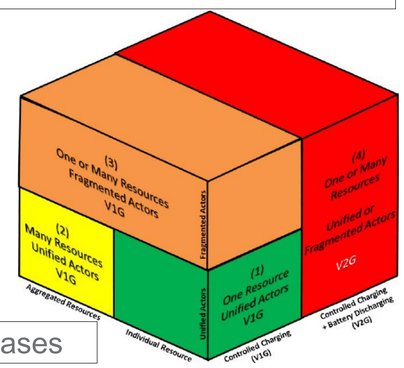
Interoperability Standards

Unified standards needed for the interconnection, communication, and information exchange among components in PEV / Building /Grid systems



Use Cases

Use cases define possible combinations of VGI functions, understand their benefits and costs, and identify regulatory barriers. Several utilities and EVSE manufacturers have committed to review and evaluate proposed use cases.



CPUC use cases

Requirements

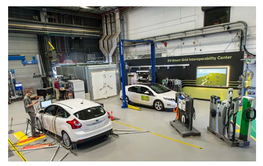
Develop requirements to implement use cases for planned demonstrations. Leverage reference studies including:

- Solutions to barriers for a low-cost and scalable EVSE/Building /Grid solution using "Multi-Lab EV Smart Grid Integration Requirements Study", NREL/TP-5400-63963, May 2015.
- Transactive energy market: "Challenges and Opportunities for Transactive Control of Electric Vehicle Supply Equipment Reference Guide," NREL/TP-5500-64007, July 2015.

The use cases and requirements will be shared by two other Vehicle System's projects: Systems Research Supporting Standards and Interoperability (GM0085) and Modeling and Control Software Tools to Support V2G Integration (GM0086) .

Demonstrations

Multi-Lab demonstrations with differing PEVs and buildings enable use case and requirements validation, identify standards gaps and promote technology development

FY16 Focus

- Develop use cases and requirements for PEV / Building demonstrations
- Demonstrate high value use case