



Smart Charging and Vehicle Grid Integration

First Annual California Multi-Agency Update on Vehicle-Grid Integration Research

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Storyline

Vehicle-Grid Integration and Smart Charging are important

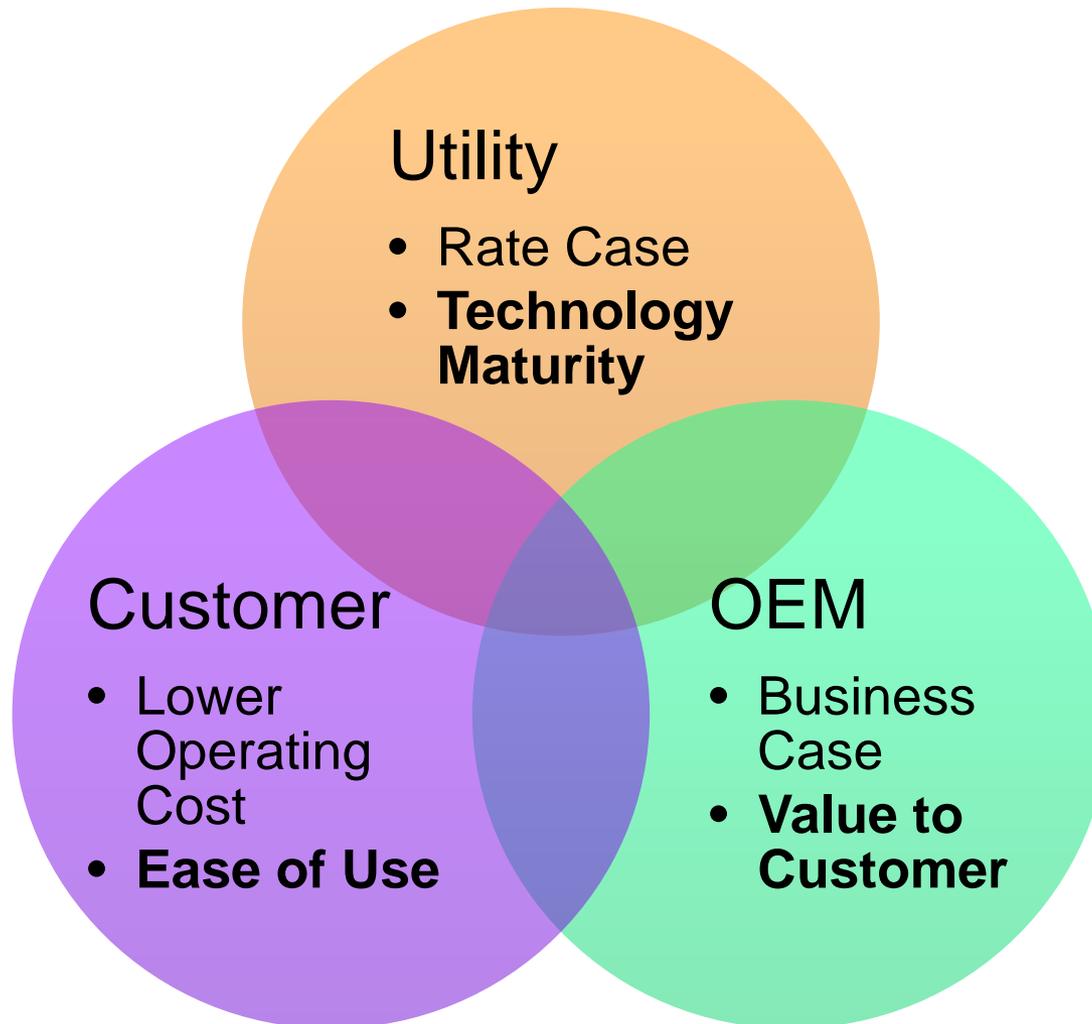
- EPA 2023 and CA 2050 GHG reduction targets → 1.5M PEVs by 2023
- Uncontrolled charging will give rise to two daily peaks around commute hours
- It enables better grid capacity utilization → Save on peak power procurement and T&D capacity deferral
- It enables improvement of PV hosting capacity, alleviating the 'Duck Curve'
- Unidirectional power management → Bidirectional power management

However, barriers do exist around

- Creating proven secure, scalable and extensible **technology** that addresses the entire installed base at lowest incremental cost
- Demonstrating a **business case** for OEMs and cost/benefit analysis for utility rate case
- Maximizing **customer** participation

EPRI, Utilities and 8 major OEMs working for over 24 months to address the barriers through Open VGI Platform Program

Successful Scaled Implementation of VGI Systems must Pass Utility, OEM and Customer 'hurdle tests'



Key Requirements

- Must be able to connect with all of the prevailing **standards** and technologies to make it forward *and* backward compatible, with preferably a global reach
- Must allow **customer overrides** to program participation *where possible*
- Must be able to present non-discriminatory **open** interface to all parties: Utilities and OEMs
- Must be **secure, scalable and extensible**
- Must provide **open data access** to power and energy use related parameters of utility interest
- Must allow **all options** to communicate with the vehicles
 - AMI (Utility Private WAN)
 - Public Broadband (Public WAN)
 - Telematics (Automotive Private WAN)

VGI Platform Development Goal: Accelerate Commercialization of VGI Technology and Ecosystem

Project Overview – Open Vehicle-Grid Integration Platform

Implement a multi-stakeholder, multi-year, phased approach

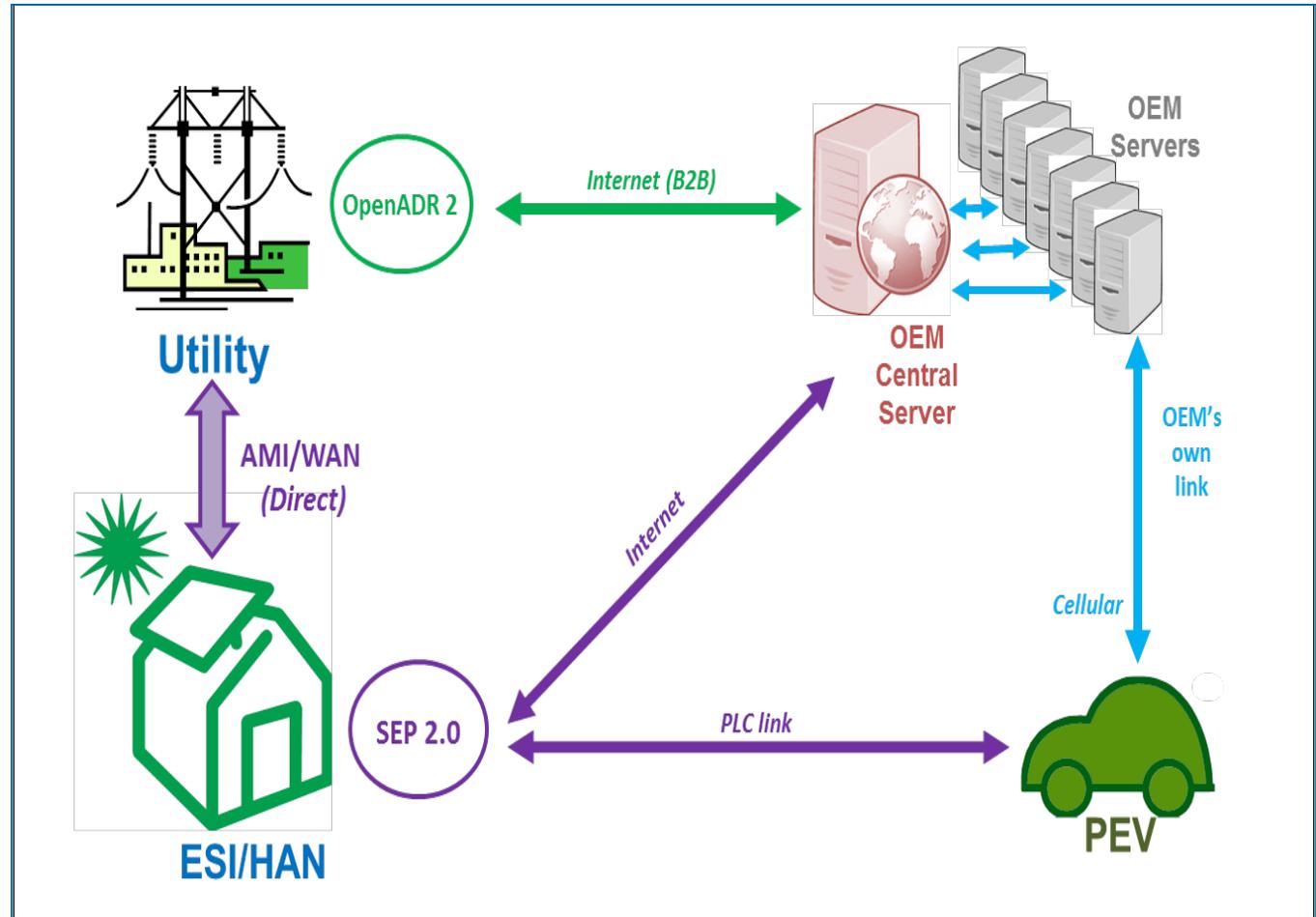
- EPRI, eight OEMs, sixteen utilities, and major IT developer engaged
- 6-year project
 - Phase 1 scheduled to complete Dec 2014 (2012-2014),
 - Phase 2 planning now; runs through December 2016
 - Phase 3 forecast through December 2018

Verify alignment with the California VGI Roadmap and CEC / PUC objectives

- Addresses Track 1 (Determine VGI Value) and Track 3 (Enabling Technology Development)
- Responds to the V1G Attributes and Use Cases for Individual and Aggregated Scenarios
- Follows development sequence starting with least complex (V1G)

Enables Direct and Aggregated Program Paths for VGI with Implementation Flexibility on OEM side

- OEMs Evaluating Direct Path
 - Chrysler
 - Mercedes
 - Toyota
- OEMs Evaluating B2B Path
 - BMW
 - GM
 - Ford
 - Honda
 - Toyota



Goal: Evaluate system-level cost and performance trade-offs among various information paths while enabling all approaches

Execution Plan

Phase 1 Proof of Concept

- Server / Server connectivity
- OEM Central Server with interfaces to
 - Utilities: OpenADR 2.0b / SEP2.0 and IEC/ISO 15118
 - OEM Servers: Proprietary API
- Limited demo, self-funded
- EPRI to lead with a leading technology vendor as developer

Phase 2 Program-Oriented Technology

- Integrated Direct and Indirect B2C and B2B scenarios
- OpenADR 2.0b, SEP2.0/IEC/ISO 15118 and OEM Server interfaces
- Larger-scale demo – externally funded
- Developer / lead and participating utilities - TBD

Geographically diverse number of utility participants for Phase 1; Launching Phase 2 now

Phase 1: Proof Of Concept “The Big Demo”, Sacramento

- Status: **completed** 10/16/2014 at SMUD
- Action: sent single signal to stop and start charging of seven PEVs

Result: **success!**



Phase 2: Open VGI Platform Program Objectives

Four Primary Use Cases

- Residential Demand Response
- Workplace/Fleet Charging
- Distribution Demand Response
- Real-time Pricing

Quantify Value

- Rationale for OEMs to integrate communications into PEVs
- Rationale for customers to participate

Develop Enabling Technology

- Provide standard interface architecture that enables interoperability
- Integrates standard and non-standard protocols

Maximize Customer Acceptance

- Simplicity, convenience, cost savings, choices

Summary

- *All-inclusive*: key stakeholders and vehicle connectivity approaches
- *Open* access to the V1G and V2G ecosystem for grid services: For utilities *and* for grid services providers
- *V1G now, V2G next*: Prioritizes near-term features to address highest value V1G applications
- *Built-in scalability*: Focuses on integration and accelerated deployment at scale
- *Low-Risk*: built on a robust IT foundation, leverages tried and tested components (Telematics, broadband etc).
- Brings *Technology, valuation and customer engagement* together for Phase 2