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Vehicle-to-Grid System Integration Focus

February 8th, 2023

Chris Moris

Principal, Grid Innovation

This is our start.

THE VERGE

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GM is working with PG&E to turn electric vehicles into a virtual power grid in California

And possibly the electrical grid

By Andrew J. Hawkins | @andyjayhawk | Mar 8, 2022, 8:30am EST | 4 comments

SHARE

General Motors and utility Pacific Gas and Electric a
can be used to power people's homes during a black
during times of peak demand. The pilot will take place
wildfires are putting strain on the state's energy infrastr

TC

PG&E, Ford to explore electric pickup truck as backup generator for home

Rebecca Bellan @rebeccabellan / 8:27 PM PST • March 10, 2022

Comment

Image Credits: Ford Motor Company

Pacific Gas and Electric Company (PG&E) and Ford Motor Company are
collaborating to explore how Ford
Lightning electric pickup
es in the California utility

General Motors on a
ilities to send elect
an outage. The uti

Green Car Congress

Energy, technologies, issues and policies for sustainable mobility

BMW Group and PG&E launching ChargeForward Phase 3 pilot; V2G testing

23 March 2021

Group and Pacific Gas and Electric Company (PG&E) announced an expanded
rages renewable energy to sustainably power electric
charging program to offer customers
hile optimizing their EV
electric

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DIVE BRIEF

California approves $11.7M vehicle-to-grid pilots in PG&E footprint

Published April 1, 2022 • Updated May 6, 2022

Kavya Balaraman
Senior Reporter

Anthony Devlin via Getty Images

UPDATE: May 6, 2022: The California Public Utilities Commission on Thursday approved three vehicle-grid integration pilots, estimated to cost $11.7 million, for Pacific Gas & Electric Co. The programs will help the utility support electric vehicle deployment and bidirectional charging equipment — technology that regulators say will help provide backup power, build resiliency, and lower the cost of EV ownership

We’re focusing on technology barriers

1

Safety and transition to islanded mode

- Lab testing of CCS and CHAdeMO single-phase DC chargers with OEMs for use in homes
- UL1741 covers only on-grid performance with ***gaps on transition and islanded modes***

Island transition testing

- No load, full load, and overload transitions
- Loss of communication to isolation device
- Mechanical failure or sensor failure in isolation device
- Return to grid

Island power quality

- Resistive and reactive load banks, no load to overload
- Unbalanced single phase loading
- Performance on motor loads and inrush

Fault testing

- Line-to-line fault at panel
- Line-to-neutral fault at panel

We’re focusing on technology barriers

2 CCS1 interoperability and communications

- Engaged multiple vendors and OEMs on modified bi-directional DIN 70121 capability
- Focused on ***single phase*** inverters and retrofitting ***existing light duty vehicles***

DIN 70121 discharge

- At project start no viable ISO 15118-20 solutions existed
- Modified DIN 70121 to signal discharge values
- Successful discharge of mass market LDV over CSS1

J2847-2 V2G update

- Shared our experience with the SAE
- Draft interoperable bi-directional standard update complete
- Estimated adoption Q4/Q1

Standards adoption

- Future workstream…
- Push for adoption of J2847-2 V2G with chargers and vehicles
- Harmonize J2847-2 with ISO 15118-2/20

We’re focusing on technology barriers

3

Interconnection, field pilots, and programs

- Simplifying processes for DC V2H to fast-track interconnection and streamlining for V2G
- First installations on our network to identify any unknowns from lab to production state

Interconnection

- Electric Rule 21 applies to any generator that “parallels” the utility
- Exploring potential for V2H to bypass or fast-track
- Handholding first V2G applications through

Field pilot learnings

- Understanding areas of CX improvement
- Identifying valuable data types for tech dev
- Creating process connections for DR and incentive programs

VGI pilot programs

- Data connections to OEMs for program data
- Explore capabilities of V2H, TOU, and DR
- Learnings lead to development of follow on programs

Key challenge #1: Interoperability

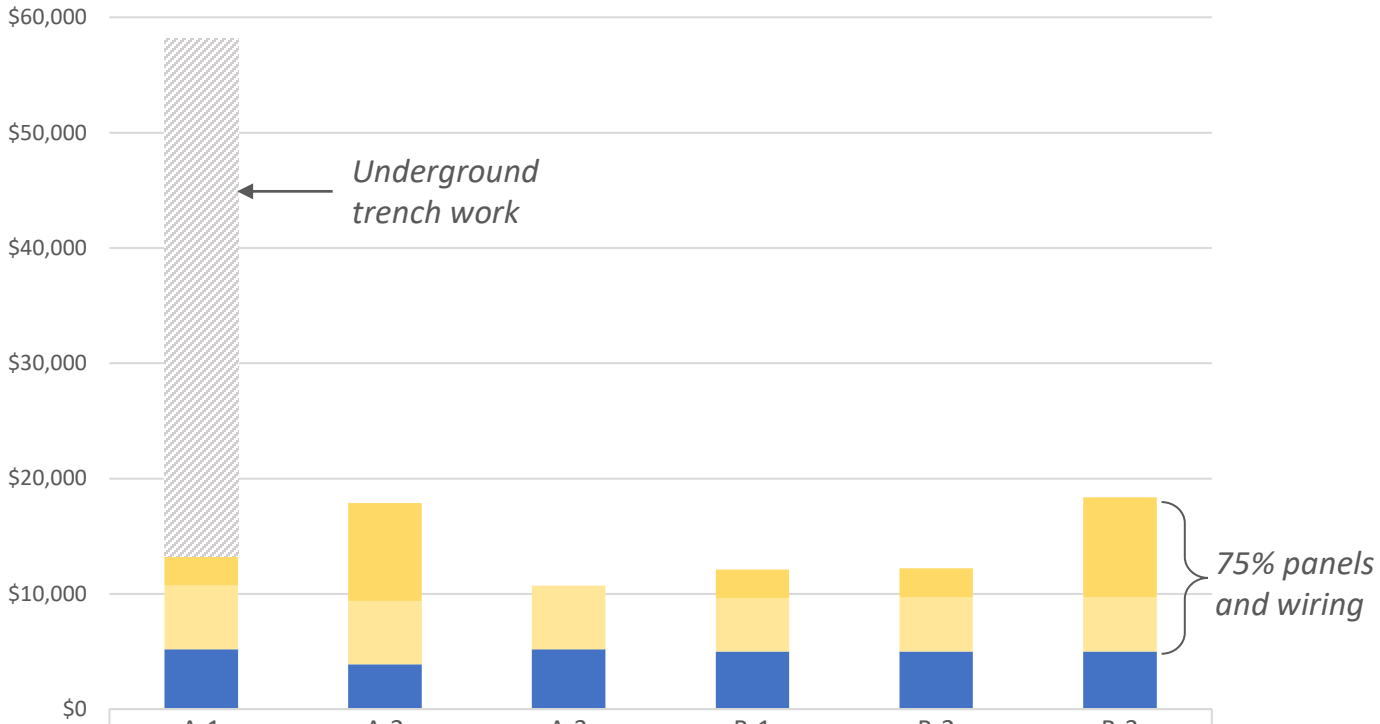
Challenges

- Most ***solutions are proprietary*** or CHAdeMO based
- ISO 15118-20 and SAE J2847-2 ***protocols nascent*** and "some what" unproven
- ***No requirements to support V2G*** for OEMs or EVSEs
- Testing of ***island transition safety*** is still a "one-off" process

Proposed solutions

1. **Lab space for V2X testing**
   - Collaborative approach
   - Multiple OEMs and EVSE vendors test interoperability
   - Island transition testing
2. **CEC maintained inverter list**
   - Similar to existing solar/storage
   - Potential interoperability DB
3. **Interoperability requirements for V2G incentives**
4. **Explore pathways for V2G capability enabled by default**

Key challenge #2: Cost to install



	A-1	A-2	A-3	B-1	B-2	B-3
Service Upgrade	$45,000	$0	$0	$0	$0	$0
Panel Work Adders	$2,500	$8,475	$0	$2,495	$2,495	$8,657
Electrical Labor	$5,505	$5,505	$5,505	$4,615	$4,720	$4,720
Charger Hardware	$5,205	$3,895	$5,205	$5,000	$5,000	$5,000
Total Install Cost	$58,210	$17,875	$10,710	$12,110	$12,215	$18,377

Above: Observed costs for 6 pilot customers across two different V2H vehicle/charger solutions

Initial takeaways

1. V2G installed costs can be substantial
   - 2-3x variability depending on site conditions
   - Larger service and panel incidence vs. solar/storage
2. Charging technology only represents 20% to 30% of the total cost on average
3. Charging vendors, OEMs, and utilities will need to collaborate to bring end-to-end cost down

Thank You!

Chris Moris

Christopher.moris@pge.com