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**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**

Order Instituting Rulemaking to Regarding
Transportation Electrification Policy and
Infrastructure.

Rulemaking 23-12-008

**PACIFIC GAS AND ELECTRIC COMPANY'S (U 39 E)
CORRECTED VEHICLE-GRID INTEGRATION STRATEGIES
SEMI-ANNUAL REPORT FOR SEPTEMBER 2024**

(PUBLIC VERSION)

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Dated: March 17, 2025

Attorneys for
PACIFIC GAS AND ELECTRIC COMPANY

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(PUBLIC VERSION)

On September 13, 2024, Pacific Gas and Electric Company (PG&E) filed the *Pacific Gas and Electric Company (U 39 E) Vehicle-Grid Integration Strategies Semi-Annual Report for September 2024*. PG&E filed this Semi-Annual Report for September 2024 (Report) pursuant to the California Public Utilities Commission’s (Commission) Decision (D.) 21-12-029, Ordering Paragraph (OP) 1.

While preparing the Vehicle-Grid Integration Strategies Annual Report for 2024, filed concurrently, PG&E identified a discrepancy between the Q3-Q4 2023 Fleet Peak Load profile and the Q1-Q2 2024 Fleet Peak Load profile. The error was due to an inadvertent formulaic mistake that was reported and rectified upon discovery. This corrected filing addresses those identified discrepancies, and the correct data can now be found on page 23, section 40:

“Aggregate Peak Load of EV TOU Rates within Program (kW).”

The corrected Report is attached to this pleading as Attachment A.

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Respectfully submitted,

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Pacific Gas and Electric Company
Corrected Vehicle-Grid Integration Strategies Semi-Annual
Report For September 2024
Submitted on March 17, 2025

(Public)

Pacific Gas & Electric
Mid-Term
Vehicle-Grid Integration Strategies
Report
Submitted on September 13, 2024
Revised Report Submitted
March 17, 2025

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Pacific Gas and Electric's Annual Report on Vehicle-Grid Integration Strategies, Programs and Pilots Metrics

September 13, 2024

Executive Summary

On December 21, 2020, the California Public Utilities Commission (CPUC or Commission) issued Decision (D.) 20-12-029, *Decision Concerning Implementation of Senate Bill 676 and Vehicle-Grid Integration Strategies* (the Decision), which among other things, orders the utilities to file annual and mid-term reports on metrics pertaining to pilots and programs related to Vehicle-Grid Integration (VGI).

Ordering Paragraph (OP) 1 directs utilities to file mid-term and annual VGI Reports on its Vehicle Grid Integration (VGI) activities.¹ Additionally, in accordance with the Decision,² this report uses the VGI reporting template that was developed in consultation with Energy Division staff and upon which stakeholders commented during the Joint Utilities' VGI Pilots and Reporting Template Workshop on March 16, 2021.³ The data collection template is provided as a separate excel document.

This report covers the period from January 1 through June 30, 2024, and includes any pilots, programs or activities that were active at any point during that time period.

VGI Definitions

Senate Bill 676 originally defined VGI and gave authority to the Commission to revise the definition. In D. 20-12-029, the Commission revised VGI's definition to the following:

"Electric vehicle grid integration" means any method of altering the time, charging level, or location at which grid-connected light-duty electric vehicles, medium-duty electric vehicles, heavy-duty electric vehicles, off-road electric vehicles, or off-road electric equipment charge or discharge, in a manner that optimizes plug-in electric vehicle or equipment interaction with the electrical grid and provides net benefits to ratepayers by doing any of the following:

- Increasing electrical grid asset utilization and operational flexibility.
- Avoiding otherwise necessary distribution infrastructure upgrades and supporting resiliency.
- Integrating renewable energy resources.
- Reducing the cost of electricity supply.

¹ D.20-12-029, OP 1.

² D.20-12-029, p. 61.

³ SCE, San Diego Gas & Electric Company (SDG&E), and Pacific Gas and Electric Company (PG&E) are collectively referred to as the Joint Utilities.

- Offering reliability services consistent with the resource adequacy requirements established by Section 380 or the Independent System Operator tariff.⁴

Based on this definition, VGI activities and programs can take many forms, broadly categorized as follows:

- V1G: Vehicle charging is managed to respond to grid requirements to improve reliability and reduce costs. Southern California Edison (SCE) in their definition further breaks this down into direct and indirect forms:
 - Indirect V1G uses price signals and/or other mechanisms to optimize charging, including Time of Use (TOU) rates and demand response
 - Direct V1G features the utility taking an active role in controlling timing and amount of vehicle charging, for example throttling charging load during peak periods
- Vehicle-to-building (V2B)/Vehicle-to-home (V2H): V2B or V2H integration, under which an EV may provide power directly to a home or building. In the United States, auto Original Equipment Manufacturers (OEMs) are using this term to refer to backup solutions in which the home or building is disconnected (islanded) from the grid.
- Vehicle-to-Grid (V2G): V2G bidirectional charging and discharging, under which EVs may discharge onto the grid in addition to characteristics offered by V1G.

VGI Reporting Template Structure

The Decision determines that “[r]obust VGI metrics and reporting are essential” for statutory compliance as well as determining progress toward goals and providing information to various parties and to help evaluate the VGI programs.⁵ Additionally, the Decision adopts the VGI staff paper proposal to establish 3 categories, with numerous corresponding metrics:

- (1) activity – track adoption of VGI policy actions
- (2) program – track the success of program implementation against program goals
- (3) outcome – track aggregate progress toward end goals across all programs and activities.⁶

For reporting purposes, the Decision directed the large electrical corporations to consult with the Commission’s Energy Division staff to create a VGI reporting template that incorporated the required metrics.⁷ The utilities collaborated with Energy Division staff and also served a

⁴ D.20-12-029, p. 12-13.

⁵ Decision, p. 52.

⁶ Id.

⁷ Decision, p. 60.

draft copy of the VGI reporting template to the service list and other stakeholders on February 28, 2021 in order to allow time for review prior to the Joint Utilities' workshop on March 16, 2021, in which stakeholders had an opportunity to provide feedback.

The VGI reporting template consists of two components: (1) a narrative section, which includes general utility and PG&E specific questions, to provide an overview of the utility's VGI efforts and qualitative information and (2) a spreadsheet for reporting quantifiable data, such as pilot/program participation, costs, and other data. PG&E's spreadsheet is provided as Attachment A.

Narrative Questions

The metrics reported below correspond to the row number in the VGI Reporting Template excel file, Narrative tab (starts with Row 3).

3. Customer program or pilot and incentives related to VGI -

Demand Response Emerging Tech Pilot – Technology Demonstration (Complete)

PG&E completed a study to understand the potential to incorporate EVs into Demand Response programs:

EV study for Automated Demand Response (ADR) incentive – This study evaluated if PG&E's ADR program should develop an ADR incentive for residential EV charging stations, and the following are the results of the study:

- a. Vehicle telematics and EV charger controls are both effective strategies for curtailing EV charging during DR events with minimal impact on participants.
- b. EV ADR charging controls technology holds promise for mitigating overnight peaks
- c. The maximum resource potential for EV ADR control technologies is 9 MW to 13 MW during the peak period from 4:00 p.m. to 9:00 p.m.
- d. The clustering analysis results reveal that 28% of EV owners are “overnight chargers,” who could be targeted to mitigate distribution system impacts in areas with high EV adoption
- e. An additional 20% of EV owners are “peak period chargers” and would be good targets DR efforts designed to curtail consumption during the peak period 4:00 p.m. to 9:00 p.m. window

DRP DIDF and Partnership Pilot Aggregated Distribution Service (Ongoing)

The existing Distribution Investment Deferral Framework (DIDF) currently provides opportunities for Distributed Energy Resources (DERs), including EVs, to defer distribution investments. Efforts include exploration of alternative sourcing methods to procure aggregated Behind-The-Meter (BTM) DERs to defer distribution investments. The program was amended in 2023 with recommended reforms with details published at: [509105421.PDF \(ca.gov\)](#).

Vehicle-to-Everything (V2X) Microgrid pilot – Infrastructure (Ongoing)

The V2X Microgrid Pilot was approved in Resolution E-5192. The Pilot will provide upfront and performance-based incentives to customers located in either a multi-customer microgrid or a single-customer microgrid supporting critical infrastructure that has eligible EVs and Electric Vehicle Service Equipment (EVSEs). The microgrid pilot is focused on enabling bidirectional electric vehicles to charge/discharge in a microgrid to support community resiliency during an outage with the goal of operational integration with multi-customer and critical infrastructure microgrids.

- Phase 1 Testing Cohort – bidirectional chargers at selected microgrid site (Launched 2023, expected to be operational Q1 2025)
- Phase 2 Incentive Cohort – expand pilot to up to 200 participants (Expected Launch Q4 2024)

Residential V2X pilot – Infrastructure (Ongoing)

The V2X Residential Pilot was approved in Resolution E-5192. The Pilot will provide upfront and participation-based incentives to residential customers that have eligible EVs and EVSEs. The pilot is intended to study 1) the technical capability of achieving vehicle-to-home (V2H) resiliency during grid outages and 2) customer behavior and preferences for V2H and V2G participation. The following services will be enabled:

- EV backup power (2024)
- EV load shift (2024)
- EV export (2024)

Commercial V2X pilot – Infrastructure (Ongoing)

The V2X Commercial Pilot was approved in Resolution E-5192. The Pilot will provide upfront and participation-based incentives to commercial customers that have eligible EVs and EVSEs. The pilot is intended to study 1) the technical capability of achieving vehicle-to-building (V2B) resiliency during grid outages and 2) customer behavior and preferences for V2B and vehicle-to-grid V2G participation. The following services will be enabled:

- EV backup power (2024)
- EV load shift (2024)
- EV export (2024)

EV Submetering Protocol (Active)

The CPUC approved the EV Submetering Protocol in 2022 to enable EV owners to measure an EV's energy use independently from the owner's main utility meter through submetering. The Investor Owned Utility (IOU) implementation plans were approved in June 2023 and PG&E opened up submetering to customer enrollment in August 2023. Submetering will enable more customers to enroll their EVs on specific EV rates, incentivizing off-peak charging.

Customers can currently enroll in submetering through a Meter Data Management Agent (MDMA) who has registered with PG&E. As of the end of June 2024, there are no registered MDMA's and therefore no customers enrolled on submetering. PG&E is currently reviewing registration requests from prospective candidates.

V2G EVSE AC Pathway (Active)

The objective of this project is to develop a temporary interconnection pathway for pilots seeking V2G AC interconnection that will ensure the necessary safety precautions until a permanent interconnection process for V2G AC systems is approved.

The Joint Investor Owned Utilities requested to extend the V2G AC Pilot for an additional two years via Advice Letter 7125-E and received CPUC approval via Resolution E-5315 on August 22, 2024. In addition to extending the pilot timeline, the Resolution directs the IOUs to participate in industry-led efforts to develop and implement an alternative certification process for interconnection of AC V2G pilot projects and file Advice Letters proposing any changes.

BMW ChargeForward Pilot (Active)

The BMW ChargeForward Pilot⁸ is a smart charging program in partnership with PG&E. It has been running for more than eight years and is currently in its third phase. BMW and PG&E were the first to offer customers cash incentives for maximizing clean energy by optimizing their EV charging times to periods of high renewable energy. It is available to all BMW battery and plug-in EV drivers in Northern and Central California who are also PG&E residential electric customers.

In March 2023, PG&E and BMW of North America expanded their collaboration through March 2026. They will be testing V2X technology that will improve grid reliability and help EV customers lower their electric bills. BMW and PG&E will test vehicle-to-grid applications in a field trial at a BMW facility in Mountain View, California, and V2X applications at PG&E's Applied Technology Services (ATS) Lab in San Ramon.

⁸ <https://www.bmwchargeforward.com/>

evPulse for PG&E (LCFS Resilient Charging Pilot) (Completed)

evPulse for PG&E is a Low Carbon Fuel Standard (LCFS) funded pilot designed to provide resiliency for EV drivers in the face of increasing Public Safety Power Shutoffs (PSPS) due to wildfire risk. It was a two-phased pilot, with the following goals:

Phase One

- 1) Identify EV drivers in High Fire Threat Districts (HFTDs) and areas that have been affected by PSPS events.

Phase Two

- 2) Develop a baseline for EV driver charging behavior before a PSPS event.
- 3) Test customer experience and valuation of a third-party platform that provides proactive communication and managed charging of EVs as a resiliency service.

PG&E has concluded implementation of evPulse as of December of 2023. There was a total of 4,831 EVs participating in the pilot. A final evaluation report has been submitted to the CPUC and a public version of the report can be viewed [here](#).

Emergency Load Reduction Program (ELRP)

The ELRP was created by the CPUC in 2021 to pilot a new Demand Response approach to help avoid rotating outages during peak summer electricity usage periods. Driven by the July 30, 2021 Emergency Proclamation from Governor Newsom “urging all state energy agencies to ensure there is adequate electricity to meet the needs of Californians in 2022,”⁹ the CPUC adopted changes to ELRP, “expand[ing] on electric vehicle potential by allowing aggregation of vehicle to grid managed charging and discharge to support the grid at net peak.”¹⁰ In 2023, the CPUC extended the pilot’s operating period through 2027 for most subgroups, including subgroup A.5 Vehicle-Grid Integration.

Third-party aggregators managing a VGI aggregation consisting of any combination of EVs and charging stations, including V1G and V2G, are eligible to participation in ELRP provided the following criteria is met:

- The VGI aggregation or any customer site within the aggregation is not simultaneously enrolled in a market-integrated, supply-side DR program.
- All enrolled sites within the aggregation are located within PG&E’s service territory.
- All enrolled sites within the aggregation have operational EVSE.
- All enrolled sites within the aggregation meet required UL 1741 certification requirements.
- The aggregation can contribute 25 kW or greater for a minimum of one hour during an ELRP event.

9 D.21-12-015, page 2

10 D. 21-12-015, page 3

ELRP events can occur between May and October and are triggered in response to Energy Emergency Alert notices issued by California Independent System Operator (CAISO). ELRP A.5 VGI events are limited to 3 hours in duration with a maximum annual dispatch limit of 60 hours. A.5 VGI events may also be dispatched at PG&E's discretion to meet the 30 minimum dispatch hours per season guaranteed by the program, which is intended to encourage participation by providing a level of certainty on the level of compensation. The ELRP A.5 VGI incentive rate is \$2 per kilowatt-hour (\$2/kWh) for incremental load reduction, calculated using a day-matching baseline.

In 2023, PG&E had one non-residential aggregator with three sites participating in ELRP A.5. PG&E does not have visibility into the number of EVs participating at each site.

PG&E-Ford Vehicle-to-Home Pilot (Active)

In the pilot, PG&E and Ford tested Ford's F-150 Lightning EV and bidirectional charging system in a field demonstration at two customers' homes beginning in Q2 2023. Sunrun performed the installations. PG&E will monitor system performance at the two participants' homes for 12 months.

4. Adoption of rates that encourage VGI and adoption of mechanism to provide credit for export

EV2-A – EV2-A is a time-of-use rate for customers with either an electric vehicle (EV), battery storage, or an electric heat pump. It combines home and EV loads on the same rate and off-peak hours extend from 12 midnight to 3 p.m., every day, including weekends and holidays. PG&E had approximately 127,882 customers enrolled on EV2-A at the end of June 2024.

EV-B – EV-B is a time-of-use rate that requires the installation of a separate meter. Off-peak hours extend from 11 p.m. to 7 a.m. when energy demand is lowest. Peak periods are from 2 - 9 p.m. and partial-peak periods are from 7 a.m. - 2 p.m. and 9 - 11 p.m. PG&E had approximately 420 customers enrolled on EV-B at the end of June 2024.

E-ELEC - E-ELEC is a time-of-use rate that is ideal for customers who have begun to electrify their home with either an EV, battery storage, or electric heat pump for water heating or climate control (space heating or cooling). It includes a Base Services Charge that lowers the price per unit of energy (kWh), on average, compared to other rate plans. Peak periods on E-ELEC extend from 4 - 9 p.m. and while off-peak periods extend from 12 a.m. – 3 p.m. PG&E had approximately 15,302 customers enrolled at the end of June 2024 with EVs.

BEV1 - Business Low Use EV Rate - For EV charging installations up to and including 100 kilowatts (kW). Best suited for smaller workplaces and multi-unit dwellings. This rate plan allows selection of a subscription level in 10 kW blocks, up to 100 kW with a price of \$12.41 per 10 kW block. The electricity is the most expensive during peak hours (4 - 9 p.m.), less expensive during off-peak hours (2 - 4 p.m. and 9 p.m. – 9 a.m.), and the least expensive during super off-peak hours (9 a.m. – 2 p.m.). BEV-2 TOU structure is year-round with no seasonality. There were 281 customer sites enrolled in BEV1 rate at the end of June 2024.

BEV2 - Business High Use EV Rate - For EV charging installations of 100 kilowatts (kW) and above. Best suited for sites with fleets and fast-charging stations. This rate plan allows selection of a subscription level in 50 kW blocks, starting at 100 kW (and over). For BEV2 (Secondary) customers, the price of each 50 kW block is \$95.56. For BEV2 (Primary) customers, the price of each 50 kW block is \$85.98. The electricity is the most expensive during peak hours (4 - 9 p.m.), less expensive during off-peak hours (2 - 4 p.m. and 9 p.m. – 9 a.m.), and the least expensive during super off-peak hours (9 a.m. – 2 p.m.). BEV-2 TOU structure is year-round with no seasonality. There were 545 customer sites enrolled in BEV2 rate at the end of June 2024.

Day Ahead Hourly Real Time Pricing Business Electric Vehicle (DAHRTP-BEV) Rate – Due to the dependency on a billing system modernization upgrade which has been delayed, PG&E has delayed the launch of the DAHRTP-BEV Rate and Export Compensation Pilot and is working on a solution to offer real-time pricing rates to BEV customer class as soon as possible. In February 2024, PG&E received an extension for implementation of the DAHRTP-CEV rate to February 2025. To ensure BEV customers have an option to participate in the dynamic pricing sooner than 2025, PG&E expanded the eligibility in the V2X Pilots for the Phase 2 to include unidirectional BEV customers. Advice Letter 7234-E-A with this change was approved by the CPUC on May 3, 2024.

VGI Dynamic Rate – This rate will be tested in Phase 2 of both the residential and commercial V2X pilots that PG&E launched in April 2023 and will send price signals to incentivize EV load shifting and export. Phase 2 of the V2X pilots is targeted for the Q4 2024.

For further information on the electric vehicle rates, please refer to the following reports filed annually. EV Cost and Load Report examines EV customer charging behavior and service and distribution system upgrade costs related to EV load and contains the impact EV rates have on driver charging behavior, among other relevant information.¹¹ BEV Performance Report contains information on the BEV rate class.¹²

5. Efforts to collaborate with CAISO to design wholesale market rules and access that support VGI

PG&E proposed a pilot in Advice Letter (AL) 6259-E that was intended to investigate the potential for V2G participation in the CAISO wholesale market. The proposal was rejected because the CPUC determined that it was not sufficiently explicit in how it would achieve those goals, and instead, instructed PG&E to implement a VGI Dynamic Rate as described in a in the prior section. Thusly, PG&E is working with CPUC to use Real Time Pricing (RTP) rates in lieu of direct CAISO participation in the V2X pilots and is also incorporating day-ahead CAISO pricing into the DAHRTP-BEV rate and the DAHRTP BEV Export Compensation pilot as mentioned above.

¹¹ Annual reports are filed on April 1 and available <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/transportation-electrification/resources-and-reporting>

¹² 2023 BEV Performance Report available at https://www.pge.com/tariffs/assets/pdf/adviceletter/ELEC_7232-E.pdf.

6. Leveraging or supplementing EPIC and/or other sources of funding for VGI technology demonstration projects

PG&E is currently coordinating with EPIC 3 Pilot 3.11.B in phase 1 of the V2X Microgrid Pilot. The V2X Microgrid Pilot expands upon the existing EPIC 3.11B program (which is validating BTM real time resiliency controls for solar and storage) to include EVs. Phase 1 of the pilot is working with EVSE suppliers to demonstrate the capability for EVs to participate in multi-customer microgrid generation and load balancing support utilizing the EPIC 3.11B control scheme.

PG&E hosted its first Innovation Summit in July 2023 which brought together stakeholders from around the world both in person and virtually. The focus of the summit was increased collaboration between PG&E and innovators to meet key challenges to meeting the following goals, as identified by PG&E subject-matter experts:

- Connecting our customers to the grid (timely and cost-efficiently)
 - Residential (Single and Multifamily)
 - Commercial & Fleet
- Leveraging these connected assets to serve the grid
- Helping decarbonize the grid by achieving the following by 2030:
 - Customer adoption of 3 million EVs across our system
 - 2 million of those vehicles participate in VGI (managed charging and/or vehicle to grid)
 - A result of a reduction of 58+ Million Metric Tons (MMT) of carbon emissions

Following the summit, PG&E hosted a “pitchfest” in which companies proposed solutions to meet these challenges. EPIC funds will be used to help realize the solutions that are identified and prioritized. PG&E is currently going through the pilot development and set up process for EPIC pilots that will launch beginning in fall 2024. PG&E has three VGI related EPIC pilots that are currently being developed and are described briefly below:

EPIC 4.02 – Smart Meter Connect Pilot

Pilot will deploy grid edge computing platform and enable residential EV customers to avoid panel and service upgrades by coordinating with their EVSE directly to “next generation” smart meters. Pilot will launch in first half of 2025.

EPIC 4.04 – EV Managed Charging for Distribution Assets (EV Charge Manager):

Pilot to test the value of using EV managed charging to extend the life of distribution and service assets, in particular service transformers. It also aims to understand how to best incentivize customers to participate in managed charging. The pilot is planned to launch Fall 2024 and run through 2025.

EPIC 4.12 – AC V2G Pilot

Pilot is currently designed to have two phases – Phase 1 will accelerate a pathway to scale interconnection of AC V2G in support of the V2G AC pilot that was just extended by the Commission and Phase 2 will demonstrate an at-scale virtual power plant with AC V2G vehicles to lay the framework for future scaling. Pilot will launch in early Q1 2025.

7. Efforts to accelerate the use of VGI for Resiliency

All three of the PG&E V2X pilots specified in approved AL 6259-E include efforts to support resiliency by incentivizing the installation of V2X technology capable of backup power and then testing that capability in the pilots. Given delays in equipment availability, there has been limited participation as of now. Participation is expected to increase in 2024 and subsequent years as the market evolves.

The evPulse for PG&E Pilot, funded by the Low Carbon Fuel Standard revenue, was designed to provide managed charging services to ensure customers' vehicles are charged prior to a potential public safety power shutoff (PSPS) event. This pilot concluded in December 2023.

8. Progress to reform interconnection rules to advance VGI

PG&E AL 6209-E (SCE AL 4510-E and SDG&E AL 3774-E) was approved with modifications in Resolution E-5165, reforming the interconnection rules to advance VGI.

In recognition of the importance of interconnection to scaling VGI, PG&E is providing hands on assistance to the first residential and commercial customers through the interconnection process. Learnings will support efforts to reform interconnection rules in the future.

9. Support and adoption of non-interconnection technical standards to advance VGI -

ISO 15118-20	Has been finalized by the International Standards Organization (ISO) and we are now waiting for additional standards including the standards for testing the implementation to be published.
IEEE 2030.5	While not yet supported by many parties, it will be a supported protocol for the VGI Pilots and for PG&E's Distributed Energy Resource Management System (DERMS) in the future.
OpenADR 2.0.b	Currently being used for the ChargeForward pilot program and will be supported in phase 2 of the V2X Pilots.
OpenADR 3.0	Currently being considered as an option for interaction with the dynamic pricing engine that will be used by the PG&E VGI Pilots. OpenADR 3.0 offers functionality that provides additional flexibility in working with DERs that will provide benefits for VGI programs. This functionality includes the ability to subscribe to dynamic prices and the ability to directly control customer equipment.
Vehicle telematics (4G/5G)	Currently being used by the BMW ChargeForward pilot and was used for evPulse.

network rules)	
UL 9741	The Underwriter's Laboratory (UL) Standard 9741 covers both unidirectional and bidirectional equipment that is connected to an electric vehicle. Unidirectional equipment exports power from the vehicle to off board loads including an electric power system such as the electric utility grid. Bidirectional equipment serves the same function but additionally provides power to the electric vehicle for recharging of the on-board electric vehicle battery.
SAE J3072	The Society of Automotive Engineers (SAE) J3072 Standard establishes requirements for a grid support inverter system function which is integrated into a plug-in electric vehicle (PEV) which connects in parallel with an electric power system (EPS) by way of conductively coupled, electric vehicle supply equipment (EVSE). This standard also defines the communication between the PEV and the EVSE required for the PEV onboard inverter function to be configured and authorized by the EVSE for discharging at a site. Of particular interest is its role in enabling AC V2G

10. Summary on efforts to fund and launch VGI customer education

PG&E offers several resources on our website to educate customers around VGI. This includes the EV Savings calculator, which helps customers browse EVs, discover incentives, locate charging stations, and compare rate plans. The EV Rate Comparison Tool helps customers, including those with solar, understand the impact of different EV rates in charging their EV at home. PG&E also provides online information to educate customers as part of pilot efforts. PG&E will launch a new site as part of the new EPIC managed charging pilot later this year. A site also exists with resources and education to support the V2X Pilots at www.pge.com/vgi.

PG&E plans to include information on VGI as part of the Technical Assistance (TA) Program of the Transportation Electrification Framework as directed by the CPUC and in the Transportation Electrification Advisory Services Near Term Priority pilot proposal approved by CPUC in April 2024. The minimum TA Service requirements (from D.22-11-040) include:

- Basic technical assistance
- Planning load management and other VGI considerations
- Help with choosing rates
- Support with walking through the IOU energization and interconnection process
- Support and advisory services during planning, installation, and post-deployment
- Operations post-deployment, like route optimization, load management, and future fleet electrification
- Available Automated Load Management (ALM) & Distributed Energy Resource (DER) options to lower deployment costs

The general education efforts will include a self-service webpage, links to tools and resources, and webinar and workshop materials, along with tailored information from a dedicated Transportation Electrification (TE) Advisor.

11. Summary on efforts to develop and support complementary policies needed to support Automated Load Management (ALM) technology

PG&E understands the definition of ALM to be the use of software or other BTM technologies to strategically share charging capacity across multiple charging ports at the same charging site, helping to safely connect multiple charging ports whose total nameplate load would otherwise exceed the rated capacity of the customer connection.

The technology for ALM exists today and PG&E customers have deployed it in a few of its EV Programs such as Electric Vehicle Charge Network (EVCN) and EV Fleet. PG&E is also considering additional ways to educate customers about ALM both before and after energization to help customers maximize the benefit of EV charging as noted above via its various technical assistance programs.

12. ALM deployment in the utility territory in the context of both existing and future transportation electrification programs, rules, and tariffs to the extent practical; including estimates on the number of ALM

PG&E launched the Flexible Service Connection pilot program which enables customers who trigger an upstream grid capacity upgrade to connect sooner in a limited state, before the capacity upgrade is completed. The PG&E grid management system will forecast circuit constraints every day and send out a 24-hour day ahead schedule to the energy management system. The energy management system will react and adjust charger output limits dynamically to maintain site charging power below the constraint. In so doing, the customer can connect some charging sooner as a bridge solution while PG&E builds out their preferred full capacity. Engagement with ten sites has been initially targeted in 2024. PG&E is aiming to offer this capability as a more standardized solution to a broader audience in the years ahead.

PG&E is also considering ways to provide additional education on ALM to customers participating in the various EV programs.

13. ALM systems Installed for passenger vehicles and any medium and heavy-duty vehicle segment(s) under currently approved transportation electrification programs as well as estimates on the potentially expected avoided distribution and customer-side cost savings attributable to such ALM installations

Within the EVCN program, over 1,300 ports were deployed with ALM. The benefits of using ALM include cost savings, space savings, and enables a project to overcome physical constraints on the

site. In the EVCN program, ALM produced cost savings ranging from \$30,000 to \$200,000 per project.

PG&E also uses ALM for a few customers in the EV Fleet program where the site has capacity restrictions. PG&E does not currently have data on avoided distribution costs or customer cost savings and may do that analysis upon the conclusion of the program.

14. Customer VGI participation in utility demand response programs, including customer retention and efforts to reduce churn and data requested from 3rd party providers as needed

PG&E had one non-residential aggregator participating with three sites in the Emergency Load Reduction Program A.5 VGI subgroup at the end of the 2023 season. This aggregator was dispatched for 30 event hours across nine event days, providing incremental load reduction of up to 12 kW.

15. Implementation of VGI pilots, lessons learned and potential future efforts

Enrollment in PG&E's V2X pilots launched in April of 2023. Learnings to date have been limited by the lack of available compatible equipment. Additionally, the lack of fully implemented open standards has necessitated the inclusion of a requirement that vehicle and EVSE OEMs must agree that their equipment is interoperable prior to being eligible to participate in the pilot. As of the end of 2023, the only solution that is approved for installation for the residential V2X pilot is the Ford F-150 Lightning with the Ford/Sunrun Pro charger and home integration system. A few of these have been installed in PG&E service territory. As of Q2 of 2024, two customers have enrolled in the V2X pilot using the Ford F-150 Lightning. Other OEM products should follow soon once UL testing and certification is completed.

Enrollment in the commercial pilot is expected to begin in Q3 of 2024 as agreements are signed.

16. Integration of VGI across the utility relevant business activities

PG&E has integrated VGI options into the Emergency Load Response Program. PG&E has also integrated V2X adoption forecasts into its electric load forecasting process which informs multiple utility planning processes such as the Integrated Energy Policy Report, the Integrated Resources Plan, and internal capacity and distribution planning.

Looking forwards, PG&E is committed to using VGI to decarbonize society at the lowest societal cost with flexible use of EVs. Using a combination of managed charging (V1G) and vehicle to grid (V2G) energy can be

stored into vehicles during times of peak renewable generation and made available to supply energy during period of peak demand. This can lower our reliance on fossil fuels which are burned in Peaker Plants and used to supply energy during peak demands at the cost of lower efficiency and greater greenhouse gas emissions.

17. Pilots underway with a discussion on the results and next steps including cost, lessons learned

Pilot	Description	Budget	Learnings
Residential V2X pilot – Infrastructure (active)	Give residential customers access to V2X technology, determine pathways to scale and enable the following services: - EV backup power (2024) - EV load shift (2024) - EV export (2024)	\$7.5M	Enrollment in the pilot was launched in April 2023, and participation has been delayed due to lack of capable vehicles and EVSE. PG&E is currently working with OEMs to establish agreements around participation and has added one equipment option - the Ford F-150 Lightning with the Ford/Sunrun Pro charger and home integration system - to the approved list by the end of 2023, allowing customers to begin to enroll. There are currently 2 customers enrolled in the pilot.
Commercial V2X pilot – Infrastructure (active)	Give commercial customers access to V2X technology, determine pathways to scale and enable the following services: - EV backup power (2023) - EV load shift (2024) - EV export (2024)	\$2.7M	Enrollment in the pilot was launched in April 2023, and participation has been delayed due to lack of capable vehicles and EVSE. As of the end of June 2024, BYD Ride school buses paired with Tellus Power Green bidirectional chargers are able to enroll in the commercial pilot with the first commercial customer expected to enroll in the V2X pilot by end of Q3 2024. PG&E is continuing to work with OEMs to establish agreements around participation and expects to have additional equipment added to the approved list before the end of 2024.
Microgrid pilot – Infrastructure (active)	Pilot will provide incentives to customers located in a multi-customer microgrid that has eligible EVs and EVSEs. The microgrid pilot is focused on enabling bidirectional electric vehicles to charge/discharge in a microgrid to support community resiliency during PSPS and other power outage events with the goal of operational integration with multi-customer and critical infrastructure microgrids (i.e., front of the meter (FTM) microgrids with behind the meter (BTM) support)	\$1.5M	A location has been selected as the primary site for Phase 1 of the Microgrid Pilot. Significant progress has been made in the testing and design of the testing cohort which will consist of multiple bidirectional chargers supporting a multi-customer microgrid. Testing is being performed to determine capability of frequency controls to regulate charging/discharging in a microgrid Over the past two years there has been a significant decrease in the number of Public Safety Power System (PSPS) shutoffs that have been required due to upgrades to the PG&E grid that automatically shut off circuits to avoid dangerous situations. As a result, options to broaden the scope of the pilot and expand customer eligibility are being explored. This will allow for additional participation in Phase 2 of the Microgrid Pilot which is expected to launch in line with Phase 2 of the Residential and Commercial Pilots

18. Metrics on interconnection reform (in conjunction with item 7)

PG&E does not currently track metrics related to interconnection reform.

19. Effectiveness of credit-for-export availability, lessons learned and potential next steps to increase availability

This will be tested as part of phase 2 of the V2X pilots which will allow credit for export based on the VGI Dynamic Rate and is anticipated to launch in late 2024.

20. Participants in credit for export and discussion to increase participation –

This will be determined when phase 2 of the V2X pilot projects is open to customer enrollment which, as described above, is anticipated in late 2024.

21. Annual energy exported (kWh) and report out on potential efforts to increase participation

PG&E customers did not export energy from EVs through the end of June 2024. PG&E anticipates this will increase as availability of V2G technology and export compensation materialize.

22. Overall barriers removed in V2B

PG&E is actively engaged in an effort to remove barriers to V2H as part of the V2X Residential Pilot and the AC V2G EPIC Pilot planned for early 2025. PG&E will extend this to commercial V2B as part of the V2X commercial pilot. For V2H we have established an option to bypass interconnection for solutions that are configured to not allow operation parallel to the grid as in the example of solutions that only support islanded backup.

Customers can also receive incentives as part of the V2X pilots for installation V2H and V2B capable infrastructure to help lower the total cost of adoption.

23. Number of EVs enrolled in DR programs

In 2023, PG&E has one non-residential aggregator participating in the Emergency Load Reduction Program A.5 Vehicle-Grid Integration subgroup. PG&E does not currently have the ability to track the number of EVs participating in other subgroups contributing to load reduction.

It is also possible that customers with EVs are participating in other aggregator programs that PG&E does not have visibility into.

24. Rate of change of EV DR enrollment and potential steps to increase enrollment

Before the start of each ELRP season, workshops are held to educate and inform prospective aggregators about the program and participation options.

25. EV DR enrollment capacity (MW)

In 2023, PG&E had one aggregator participating in the ELRP A.5 Vehicle-Grid Integration subgroup that provided up to 0.012 MW of load reduction during events.

26. EV DR enrollment load shift (MWh)

In 2023, PG&E had one aggregator participating in the ELRP A.5 Vehicle-Grid Integration subgroup that provided up to 0.079 MWh of load reduction across the 9 events called. ELRP was not called in the first half of 2024.

27. Estimated aggregated GHG reduction attributable to VGI

This is not currently tracked within PG&E.

28. Site Participation in rate-to-driver and discussion on how to increase participation –

PG&E does not have rate-to-driver programs.

29. Sites participating in DR, lesson learned and next steps to increase participation –

In 2023, one aggregator participated in ELRP A.5 VGI across three sites. PG&E will continue to hold workshops to educate prospective aggregators on their options to participate in ELRP.

30. Barriers to data collection and potential solutions

Barriers include not having previously tracked the data and in certain cases, PG&E doesn't have direct access to that data and would only be able to collect it through a customer survey process which would require additional funding to conduct. This is particularly true for EVs participating in

ELRP outside of the A.5 subgroup since they do not have to report on the type of DER they are participating with.

31. Load shift for EV rate customers

Data on the customer load impacts on TOU rates, including residential EV rates, were included in PG&E's 2023 Load Impact Evaluation of Residential TOU Rates Report filed to CPUC and posted publicly on PG&E's site:

<https://pgera.azurewebsites.net/Regulation/ValidateDocAccess?docID=788326>

A separate report on EV Infrastructure Cost and Load can be found on the CPUC website at: [Microsoft Word - R.23-12-008 PGE Attachment to EV Cost Report PUBLIC.docx \(ca.gov\)](#)

32. Rate-to-driver enrollment by sites

PG&E does not have rate-to-driver programs

33. Dynamic rate load shift (MWh)

PG&E does not currently have any EVs on a dynamic rate. This will be evaluated based on the data collected during Phase 2 of the V2X Pilots targeted to launch in late 2024.

34. Aggregate unmanaged load profiles within programs (kWh)

PG&E does not have a way to identify EV users that are on unmanaged load profiles.

Data on battery electric vehicle (BEV) rate performance can be found in PG&E's 2023 BEV Rate Performance SB 350 SRP Annual Report filed to the CPUC and posted publicly on PG&E's site: [ELEC 7232-E.pdf \(pge.com\)](#)

35. Aggregate unmanaged load profiles within programs (kW)

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36. Aggregate unmanaged load profiles outside of programs (kWh, Misc.)

Data on the customer load impacts on TOU rates, including residential EV rates, were included in PG&E's 2023 Load Impact Evaluation of Residential TOU Rates Report filed to CPUC and posted publicly on PG&E's site:

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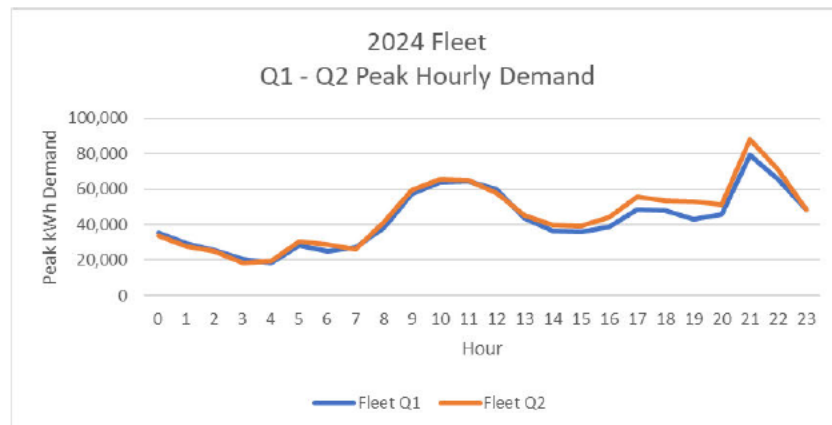
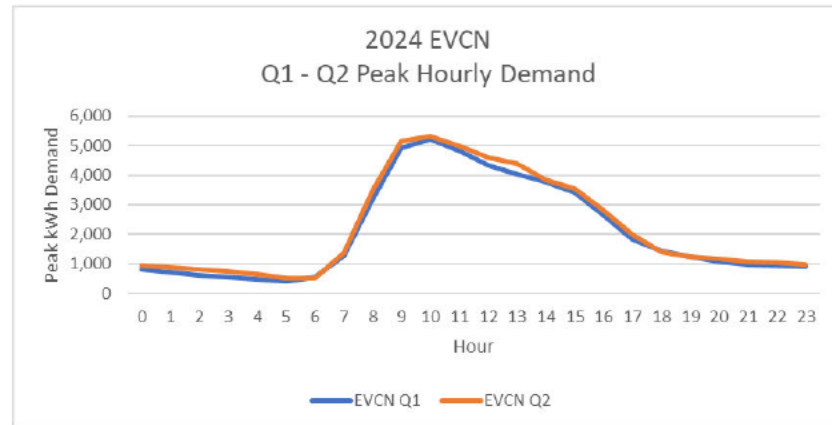
A separate report on EV Infrastructure Cost and Load can be found on the CPUC website at:
[Microsoft Word - R.23-12-008 PGE Attachment to EV Cost Report PUBLIC.docx \(ca.gov\)](#)

38. Net Avoided Costs from Avoided Upgrades

PG&E does not track net avoided costs from avoided upgrades at this time.

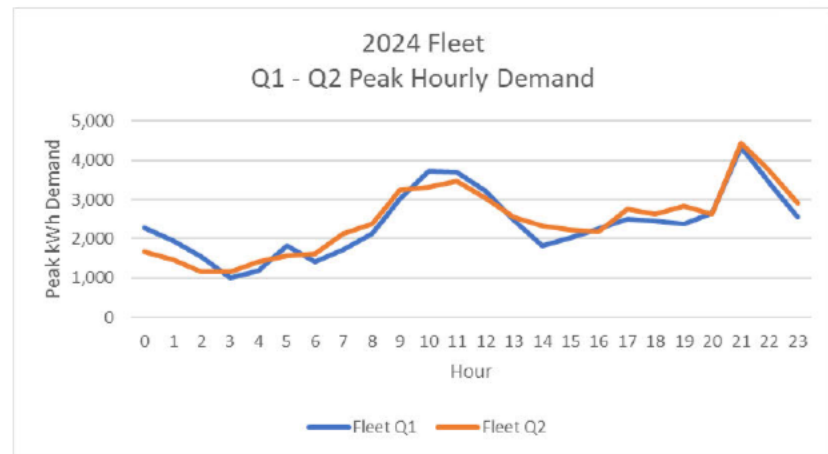
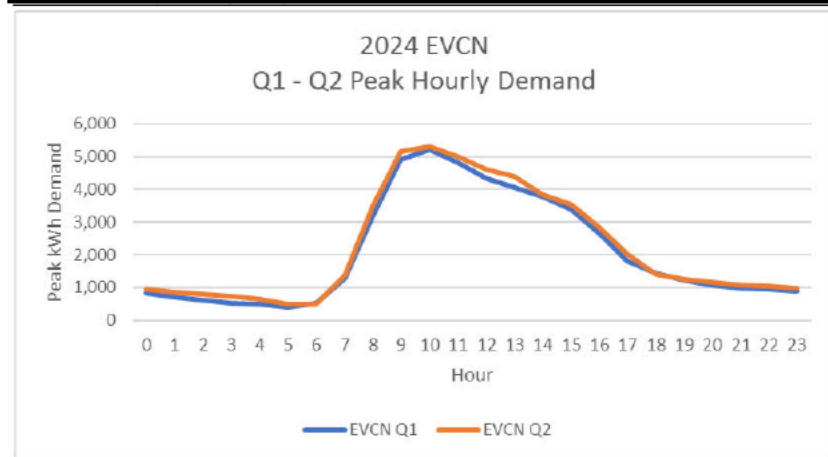
39. Aggregate Load Profiles for EV TOU Rates Within Programs (kWh)

Metric			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Aggregate hourly demand	EVCN	Q1	51,002	43,684	35,917	29,354	23,668	20,889	29,568	66,825	162,400	266,241	291,045	278,062	251,912	235,637	216,509	187,675	149,425	106,866	88,298	78,363	70,936	67,056	62,084	56,270
Aggregate hourly demand	EVCN	Q2	61,176	52,954	44,041	35,353	27,959	22,265	33,350	76,332	176,458	275,675	299,383	285,761	259,808	245,111	226,659	198,578	160,907	117,824	97,731	87,554	79,388	75,605	73,645	67,166
Aggregate hourly demand	Fleet	Q1	99,202	81,483	70,185	56,218	53,830	83,008	74,047	78,522	110,361	157,895	186,848	189,258	170,169	125,575	105,342	98,468	105,736	131,211	130,874	125,813	131,171	231,626	191,752	140,179
Aggregate hourly demand	Fleet	Q2	63,449	50,621	46,545	35,215	36,740	57,551	51,205	51,548	79,625	110,958	122,235	123,185	113,020	89,316	73,786	70,337	82,816	101,979	102,715	101,192	96,694	171,666	135,702	94,643



40. Aggregate Peak Load of EV TOU Rates within Programs (kW)

Metric			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Peak hourly demand	EVCN	Q1	819	711	626	531	479	405	534	1,275	3,198	4,915	5,224	4,816	4,341	4,042	3,773	3,398	2,658	1,814	1,434	1,223	1,072	965	945	898
Peak hourly demand	EVCN	Q2	957	867	802	733	643	505	502	1,370	3,499	5,161	5,309	4,995	4,594	4,405	3,850	3,532	2,831	2,002	1,409	1,244	1,157	1,080	1,047	975
Peak hourly demand	Fleet	Q1	2,273	1,936	1,534	997	1,185	1,811	1,419	1,730	2,130	3,018	3,724	3,688	3,227	2,476	1,823	2,024	2,259	2,499	2,459	2,377	2,650	4,323	3,448	2,566
Peak hourly demand	Fleet	Q2	1,658	1,461	1,171	1,159	1,421	1,560	1,613	2,118	2,370	3,249	3,317	3,480	3,026	2,545	2,336	2,223	2,169	2,762	2,630	2,824	2,630	4,426	3,745	2,900



41. Rate-to-host

PG&E does not have a rate-to-host program.

42. Rate-to-driver

PG&E does not have a rate-to-driver program nor is PG&E aware of what drivers are charged by third parties. Collecting this data would require a separately funded survey process.

43. Aggregate load profiles for EV TOU rates outside of programs (kWh)

PG&E only computes these profiles for annual reporting.

44. Aggregate peak load of EV TOU rates outside of programs (kW)

PG&E only computes these profiles for annual reporting.

Appendix A - VGI Reporting Template

Totals:	1364	20	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	\$388.70	\$193.30
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Program/Pilot	Market Segment - Residential or Commercial	Market Segment - Subcategory	ESJ subcategory	Implementation Status	Number of ports participating in ALM	Number of sites participating in ALM	Number of sites participating in dynamic rates	Number of EV drivers participating in dynamic rates	Total number of V2G EVSE customers	Distribution-side cost savings	Customer-side cost savings (related to panel and similar equipment)	Upgrade avoided by ALM	Savings of Upgrades avoided by ALM	Authorized Budget (Millions)	Budget expended (Millions)
EVCN (Program)	Commercial	Workplace	DAC	Active	50	1	1	N/A	N/A	N/A	N/A	N/A	N/A	130	117
EVCN (Program)	Commercial	Workplace	Non DAC	Active	468	10	10	N/A	N/A	N/A	N/A	N/A	N/A		
EVCN (Program)	Commercial	Multi-Unit Dwelling	DAC	Active	713	5	5	N/A	N/A	N/A	N/A	N/A	N/A		
EVCN (Program)	Commercial	Multi-Unit Dwelling	Non DAC	Active	133	4	4	N/A	N/A	N/A	N/A	N/A	N/A		
Fleet Ready Program	Commercial	All	All	Active	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	236.3	59.1
Fast Charge Program	Commercial	All	All	Active	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	22.4	17.2
Schools Program	Commercial	Workplace	All	Active	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.7	4.3
Parks Program	Commercial	All	All	Active	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.5	0.5