



Driving EV Fleet Resiliency: PG&E



Figure 1. PG&E's electric vehicles parked by charging stations.

Commitment to EV fleet resiliency

Pacific Gas and Electric Company (PG&E) is transitioning its fleet to electric vehicles (EVs). This transition supports California's climate goals and helps reduce emissions. PG&E is making this transition while providing reliable service across Northern and Central California. PG&E plans to electrify approximately 10,000 vehicles by 2045. The company is focusing on light-duty and medium-duty vehicles.

For PG&E, EV fleet resiliency means keeping critical vehicles operating during power outages that affect essential work. PG&E's resiliency strategy focuses on critical-service EVs that need to remain operational during an outage. These vehicles support electric crews repairing downed power lines and gas crews responding to damaged pipelines.

PG&E prepares for planned outages such as Public Safety Power Shutoffs and scheduled maintenance. The company also plans for unexpected events including wildfires, storms, and earthquakes. A more resilient EV fleet helps PG&E maintain and restore service to customers and protect public safety during outage events.

Charging infrastructure deployment

PG&E utilizes telematics software to capture vehicle data. This includes vehicle miles traveled (VMT), routes, and diagnostics. PG&E reviewed data from light and medium-duty EVs. The data shows these vehicles can complete their daily work on a single overnight charge. The data also shows vehicles return to the charging stations with about 70 percent state of charge. A typical workday uses only about 30 percent of a vehicle's battery. Under normal conditions, they can continue for about three days before needing to charge. This built-in resiliency may enable a more affordable resiliency solution. For example, a site may be able to use mobile backup power instead of permanent on-site equipment.

The utility designed its charging infrastructure with one charging port for every vehicle. The company also installed an additional set of DC fast chargers (DCFCs). The number of additional chargers equals 10 percent of the total vehicle count. These chargers are available 24 hours a day, seven days a week. Level 2 AC and 25–30 kW DC chargers support routine off-peak charging. The spare DCFCs are available for urgent daytime needs, such as when overnight chargers fail or when a driver needs a quick charge during the day. During emergencies, PG&E prioritizes power to these DCFCs. This setup works like a gas fill-up station, helping critical vehicles charge quickly and return to service.

Charging equipment includes:

- **Level 2 AC Chargers** (delivering up to 19.2 kW)
- **Level 3 DC Chargers** (25-30 kW per port)
- **Level 3 DC Fast Chargers** (200-400 kW per port)

PG&E installed cam lock connectors in site switchgear to allow mobile generators to provide backup power to the entire depot. These connectors allow crews to quickly and safely connect mobile generators during an outage.

PG&E uses [Wevo](#), a charging management system (CMS), to direct generator power to DC fast chargers during outages. Fast chargers can quickly charge critical vehicles before the next vehicles are brought in to charge. Mobile generators are sized to support the fast-charging stations rather than every charger on site. This allows most PG&E sites to rely on mobile generation during outages.

Develop resiliency planning

Start with a data-driven approach

PG&E uses a data-driven framework to determine if its EV fleet needs a resiliency solution. The process follows these steps:



Step 1. Collect daily mileage data

PG&E uses fleet management telematics software to track daily vehicle miles traveled. This data shows how far the vehicles drive during operations. The utility focuses on data from historically long outage events. This helps the company make sure its resiliency analysis accounts for the highest demand during an outage event.



Step 2. Calculate energy needs and battery charge

PG&E converts daily vehicle miles traveled into energy use. Energy use is measured in kilowatt-hours (kWh). The company uses the fuel efficiency of expected vehicle types, measured in miles per kWh, to estimate how much battery energy is used each day. PG&E then compares daily energy use with total battery capacity. This helps estimate the expected state of charge (the percentage of battery charge remaining) when vehicles return to the depot.



Step 3. Compare results with outage risk

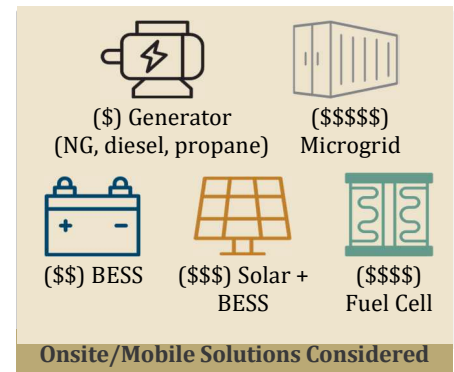
PG&E compares expected state of charge from past higher-mileage emergency events with historical outage data. The analysis focuses on outages that can interrupt overnight charging and affect whether vehicles can continue operating the next day. Because PG&E has a low tolerance for service disruptions, sites that may not have enough energy to keep vehicles operating during an outage require a permanent on-site solution. Other sites may be able to rely on mobile backup power. In these cases, vehicles can continue operating until a mobile energy resource arrives.

Evaluate and prioritize solutions

PG&E evaluated several backup power technologies. The review considered safety, cost and performance. It also considered technology maturity and deployment speed. PG&E evaluated site space requirements and emissions. The company also reviewed compatibility with EV charging infrastructure.

For about 80 percent of sites, PG&E selected a mobile-first approach. These sites can use mobile natural gas and diesel generators during an outage. Mobile solutions are a good fit for sites with lower risk of extended outages, where vehicles keep enough charge to operate until a mobile unit arrives. Vehicle data shows vehicles can still reach a full state of charge even with outages under six hours.

PG&E is evaluating permanent on-site solutions for remaining sites. These sites are often remote or have limited space. Historical data shows they may experience longer outages or longer generator response times.



PG&E milestones

1 Fleet and outage analysis

PG&E converted vehicle miles traveled into energy use and expected state of charge. PG&E compared these results to historical outage data. The process helped identify where power solutions may be needed.

2 Mobile vs. permanent strategy

PG&E analyzed vehicle and outage data. The results showed that mobile solutions are enough for most sites. Some sites require permanent on site backup power. These decisions are based on risk tolerance and site specific conditions.

3 Technology evaluation and selection

PG&E evaluated backup power technologies available in the market. The company also reviewed accessible internal resources. Based on the evaluation, PG&E selected in house mobile natural gas generators as its primary solution and selected Emergency Operations Center diesel generator contracts as a secondary option.

4 Mobile generator testing

PG&E tested mobile natural gas and diesel generators with its existing charging infrastructure. The results confirmed that mobile generators can be quickly deployed and connected to support charging during an outage.

5 Solar and battery storage evaluation partnership

PG&E partnered with The National Laboratory of the Rockies to evaluate solar and battery storage system at a remote site. The study compares battery energy storage systems with diesel generators for permanent on site backup power.

Deploy site-specific solutions

Categorize sites

PG&E analyzed 10 years of outage data from more than a hundred service yards. The company also reviewed vehicle telematics data. The analysis showed that vehicles can continue operating during outages that last less than six hours.

To determine the right solution for each site, PG&E evaluates site size, daily vehicle miles traveled, outage frequency, and outage duration. These factors help determine whether a mobile solution is enough or a permanent on-site solution is needed.

Select the right backup generators

Generator selection depends on a site's charging demand. It also depends on how much power the site's infrastructure can support. Infrastructure can include transformers, switchgear and charging stations. PG&E selects generators based on the power needs of DC fast chargers. Some sites require 450 kilowatts of power. If a site requires 450 kilowatts of power or less, a single 450-kilowatt natural gas generator can support those sites. Many PG&E sites require more power to support larger vehicle fleets. These sites typically need about 650 kilowatts of power. PG&E plans to connect two generators together at these locations. This approach provides a combined 650 kilowatts of power because single 650-kilowatt generators are not widely available or easy to transport.

Mobile generator deployment

During an outage, PG&E can deploy mobile generator trailers to service yards and charging depots. Fuel can be delivered as needed to keep the generators operating. PG&E owns natural gas generators and contracts diesel generators. Crews connect the generators and uses a transfer switch. The switch transfers power from the electric grid to the generator. This allows DC fast chargers to continue operating during an outage. It also avoids the need for additional grid upgrades. If natural gas generators are unavailable, PG&E's Emergency Operations Center can deploy contracted diesel generators. These generators can help restore charging.

PG&E tested a natural gas generator during a simulated outage event. The generator was delivered, installed and connected to DC fast chargers within one to two hours. The test demonstrated the potential for rapid deployment of mobile backup power.

Key takeaways

1 Understand your risk tolerance

Resiliency is an investment in infrastructure, equipment and operational planning. Organizations should determine how much risk they are willing to accept during an outage. PG&E has a low tolerance for service disruptions. As a result, the company uses a conservative approach when planning resiliency solutions.

2 Assess your energy demand

Determine how much energy your EV fleet needs during an outage. At PG&E, vehicle miles traveled data was converted into energy use and then used to estimate state of charge. The company compared these state of charge estimates with outage duration data. This process helped identify sites that need resiliency solutions.

3 Set your priorities

Establish internal priorities that support your backup power strategy. These priorities may include electrification goals, sustainability targets, cost, and deployment speed. PG&E adopted a mobile first approach. The company adds permanent solutions when site conditions require them. This approach supports business goals.

4 Evaluate each site individually

Review conditions at each site. Consider outage frequency, outage duration, weather conditions impacting vehicle fuel efficiency, regulatory requirements, access to public charging, and available site space. PG&E serves a large and diverse territory. Each site requires its own evaluation. This helps match the right resiliency solution to each site's operating conditions.

5 Test and implement your strategy

Test resiliency solutions, emergency response protocols and crew communications. PG&E conducted outage drills with mobile generators to confirm deployment and operational readiness. If your strategy includes mobile generators, consider incorporating a switchgear with cam lock connectors. Consider working with vendors that can provide generators, fuel and reliable transportation.

Prepare your electric vehicle (EV) fleet for power outages with support from PG&E's EV Advisory Services. Contact [PG&E EV Advisory Services](#).



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