



Smart Electric
Power Alliance

The State of Bidirectional Charging in 2023

Executive Summary

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In Partnership with

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 **Fermata Energy**



Virtual Peaker 

Executive Summary

The Opportunity for Bidirectional Charging

Bidirectional charging has significant potential in transforming how consumers view and use their electric vehicles (EVs). Bidirectional charging allows EVs to become a flexible resource for power systems that act as both a flexible load and an energy resource. The ability to act as both a load and an energy resource creates new revenue and grid services value streams for customers and utilities alike.

Grid-tied, bidirectional-capable EVs can support peak shaving, store renewable generation, provide ancillary services (such as voltage support, ramping support, and distribution congestion), and act as resilience assets. The scale at which bidirectional-capable EVs can participate in these grid services is a significant benefit for grid operators. With a sales-weighted average battery size of 60 kilowatt-hours (kWh) for light-duty EVs,¹ the United States' (U.S.) 2.1 million battery electric vehicles (BEVs) represent approximately 126 Gigawatt-hours (GWh) in storage capacity.² This amount of battery storage represents

five times the amount of stationary battery storage currently on the grid (25 GWh in 2023).³ While few of these vehicles have bidirectional charging capabilities today, this amount of storage provides a largely untapped resource for power systems.

The bidirectional charging industry is in the early stages of transitioning to a commercial product ready for mass-market adoption. At this time, challenges and barriers to implementing bidirectional charging at scale remain. The Smart Electric Power Alliance's (SEPA) report "[The State of Bidirectional Charging in 2023](#)," includes an overview of the bidirectional charging industry, highlights perspectives from industry stakeholders, explores existing bidirectional charging deployments, and explains the opportunities and barriers that exist to wide-scale adoption of bidirectional charging technologies. These barriers present new opportunities for utilities and industry partners to engage with one another and to redefine their relationship with consumers.

Recommendations for Utilities

- **Utilize existing interconnection processes and learnings to streamline interconnection of bidirectional charging systems.** Utilities and regulators can use existing interconnection guidelines from other distributed energy resources (such as solar, battery storage, and backup generation) to allow interconnection of bidirectional charging systems. Streamlined interconnection processes help customers and installers to more easily implement bidirectional charging systems.
- **Develop bidirectional charging programs that allow for customers to energize bidirectional systems more expeditiously.** Bidirectional-capable chargers are first and foremost chargers for the vehicle. Consider bidirectional charging programs that allow and/or accommodate for customers more expeditiously deploying their system in charging only mode while they wait for additional interconnection studies

or applications to be processed. Additionally, some vehicle-to-everything (V2X) applications fall entirely under energization (such as backup vehicle-to-home (V2H)/ vehicle-to-building (V2B) and vehicle-to-microgrid (V2M) configurations) and will not need to undergo a full interconnection process.

- **Develop bidirectional charging programs.** Bidirectional charging has great potential to provide flexible grid services to utilities and provide customers with additional value streams. To access this value, utilities will need to develop bidirectional charging programs so they can use customer assets and provide customers incentives to participate in those programs.

1 IEA. (2023). [Global EV Outlook 2023: Catching up with Climate Ambitions](#).

2 IEA. (2023). [Global EV Data Explorer](#).

3 American Clean Power. (Q4 2022). [Clean Power Quarterly Market Report: Q4 2022](#).

- **Utilize existing managed charging programs to engage with and educate customers on bidirectional charging.** As utilities offer Time-of-Use (TOU), demand response (DR), and other managed charging programs, they can use those programs to

educate customers on bidirectional charging. Customer education will be a critical component to increasing customers' understanding of bidirectional charging and willingness to participate in utility programs.

Recommendations for Manufacturers

- **Engage with and educate customers on bidirectional charging.** Original equipment manufacturers (OEMs) and retailers are expected to be a significant source of education for customers. Engaging with customers at the point-of-purchase can promote customer adoption of bidirectional charging systems and promote customer participation in utility programs.
- **Be clear on warranties and battery degradation.** Customers are often concerned about voided warranties and increased battery degradation after using bidirectional charging functionalities. OEMs need to be clear about which V2X applications a customer can use without impacting the warranty and need to educate customers about the impacts of bidirectional charging on batteries. Customers need

to understand how some applications have minimal (or even beneficial) impacts on the battery while others applications will have more significant battery degradation.

- **Bring more products to market.** Bringing more bidirectional-capable vehicles and electric vehicle supply equipment (EVSE) to market improves wide scale adoption. Many utilities are waiting for more offerings to enter the market before they promote a bidirectional charging program.
- **Decrease hardware and installation costs.** Bidirectional charging systems have a price premium over their unidirectional counterparts. Decreasing the price premium will allow more customers to adopt bidirectional charging systems.

Recommendations for the Industry

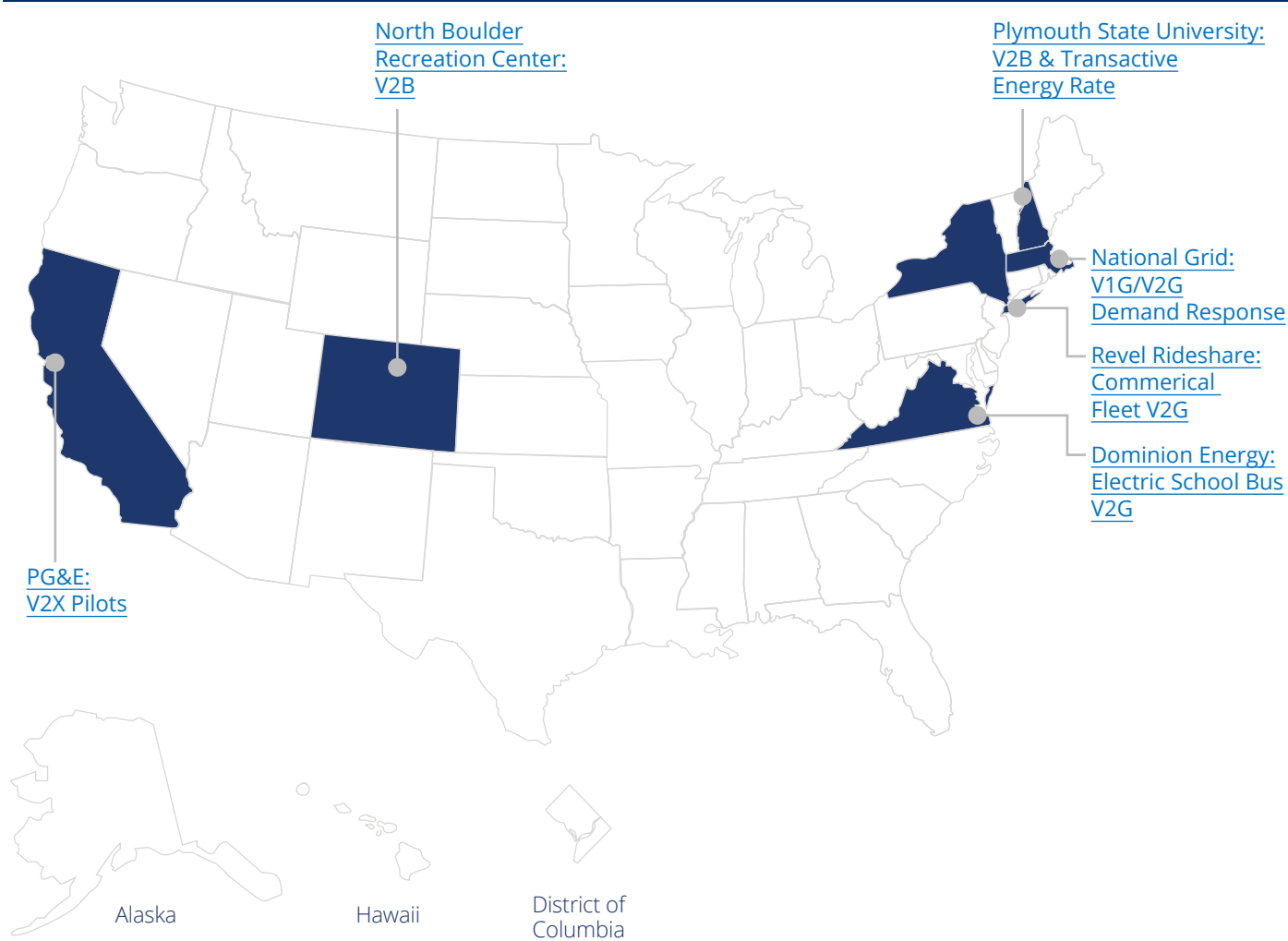
- **Establish clear and fair compensation mechanisms for V2X services and market them to customers.** It is difficult for customers to make a purchase decision if they do not know what the payback will be on their investment, and it is hard for utilities to justify implementing a new program if there is no clear customer benefit.
- **Promote standardization and interoperability.** Bidirectional charging relies on many different types of hardware and software technology, and effective interoperability allows for easier implementation and scalability for bidirectional charging. Product standardization would also help customers de-risk their investments in the case where proprietary hardware/software vendors exit the market.
- **Engage with regulators and legislators to educate them on bidirectional charging.** The industry can utilize its knowledge to educate regulators and legislators about this technology. OEMs, utilities, and other stakeholders can engage in rulemaking proceedings to ensure regulators and legislators understand the potential for bidirectional charging.

- **Engage in cross-stakeholder partnerships and coalitions.** Wide scale adoption of bidirectional charging relies on a variety of stakeholders and benefits from cross-stakeholder collaboration. Industry stakeholders should participate in regular gatherings to promote interoperability, to progress policy, and to further develop the technology.

The bidirectional charging industry will continue to see many changes as this product matures and is adopted by consumers. As the industry develops, bidirectional charging will continue to expand and evolve beyond current predictions ([Figure 1](#)).

The State of Bidirectional Charging in 2023

Figure 1. Geographical Locations of the Bidirectional Charging Case Studies Referenced in This Report



Source: SEPA. (2023). Note: This is not a comprehensive map of all bidirectional charging projects/programs in the U.S.

Case Studies

As a companion document to the “[State of Bidirectional Charging in 2023](#)” report, the [Case Study Booklet](#) contains

six case studies that feature currently active bidirectional charging projects and programs ([Table 1](#)).

Table 1. Bidirectional Charging Projects and Programs

Customer Projects

Customer & Location	Type of Bidirectional Charging Project & Incentive Type
North Boulder Recreation Center (Colorado)	Commercial V2B with Peak Demand Savings
Plymouth State University (New Hampshire)	Commercial V2B with a Transactive Energy Rate
Revel Rideshare (New York)	Commercial Fleet V2G with Demand Response Rate

Utility Programs

Utility & Location	Type of Bidirectional Charging Program
Dominion Energy (Virginia)	Electric School Bus Fleet V2G
National Grid (Massachusetts)	V1G/V2G Demand Response
Pacific Gas & Electric (California)	V2X Pilots

Source: SEPA. (2023).

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**Smart Electric
Power Alliance**

1800 M STREET, NW FRONT 1
#33159
WASHINGTON, DC 20036
202-857-0898

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