



+ E-BOOK

Bidirectional Charging for Electric School Buses

Deploy Your Bus Batteries as Valuable Energy Assets

6-MINUTE READ

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Why Bidirectional Charging?

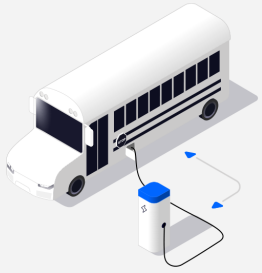
Bidirectional chargers enable electric school buses to behave like energy storage systems, providing a source of power in times of elevated energy prices or grid disruption.

In a Vehicle-to-Building (V2B) scenario, the bus discharges to serve loads behind the meter. That can mean offsetting building demand day to day or replacing a diesel generator as a clean and silent source of backup power during an outage. Alternatively, the bus can generate bill savings and revenue for the school district by sending power to the utility grid, referred to as Vehicle-to-Grid (V2G).

Bidirectional chargers are capable of both charging and discharging, making them costlier than their unidirectional counterparts. That’s why it’s essential for fleet and facilities operators to match electric vehicle service equipment (EVSE) to their use case and model the value streams before purchasing.

Bidirectional charging infrastructure should be paired with a strategy to generate value. This value generally falls into three categories: **Backup Power**, **Bill Management**, and **Utility Programs**.

Value Stream	Backup Power	Bill Management	Utility Programs
Unidirectional Charging		 Time-of-Use, Demand Charge Management	 Demand Response, Dynamic Rate
Bidirectional Charging	 Onsite Resilience via V2B	 Building Load Offset via V2B	 Demand Response and/or Dynamic Rate with Export via V2G



What is vehicle-grid integration (VGI)?

Vehicle-grid integration (VGI) is any adjustment to EV charging time, duration, rate, or location that **reduces grid impact or creates value**. Think of it as the umbrella: V2B and V2G are its bidirectional forms.

Not every VGI use case needs bidirectional hardware. Shifting a depot's charging to off-peak hours or curtailing during a demand response event are unidirectional examples.

Backup Power

Electric school buses can replace diesel generators as a source of resilient backup power for school buildings and facilities during periods of grid instability. This is only possible with bidirectional chargers capable of islanding, which requires a grid-forming inverter and the switchgear to isolate the building from the grid safely.

Bill Management

Smart chargers and a compatible charge management system (CMS) can ensure electric school buses charge at the most cost-efficient time. Bidirectional chargers can provide additional value through V2B, supplying power to offset electricity demand from building loads such as HVAC, lighting, or even other EVs on the same meter. Intelligent energy management and discharging at the right times can create significant electric bill savings.

Utility Programs

Many electric utilities have created programs for large energy users such as electric school bus fleets to incentivize grid-friendly charging schedules. Some programs allow for V2G discharge with bidirectional charging to increase the value of participation.

School bus fleets are uniquely suited to participate in these types of utility programs. They have large batteries, they park in depots, and they have long dwell times — especially in the summer. This means that from a grid perspective,

an electric school bus depot with bidirectional chargers is a bank of batteries that can provide considerable value if incentivized and managed appropriately.

Some utilities are actively designing school bus V2G pilots and are looking for interested customer sites. [Talk to an expert at PowerFlex](#) to see if your utility is participating.

How to Evaluate Bidirectional Chargers

AC Input Voltage

It's important to make sure the voltage of the chargers matches that of the distribution panel to which it will be connected. Bidirectional DC chargers for fleet depots are typically rated 480 VAC three-phase, a common input voltage for commercial and industrial buildings.

Some commercial buildings use 208 VAC single-phase, and most residential homes in the United States and Canada use 240 VAC split-phase.

Interoperability

Although most buses are interoperable with almost any DC Fast Charger, not all buses can discharge energy through every bidirectional charger. Each electric vehicle model must be compatible with the charger's DC output voltage, communication systems, and more.

Even within a vehicle manufacturer's product line, there may be variations in compatibilities based on powertrain, model year, or trim. It's important to get clear confirmation from all technology and integration vendors early in the design process to ensure all hardware and vehicles are interoperable.

AC Input



Interoperability



Certifications and Standards



Certifications and Standards

There are several standards relevant to bidirectional charging.

For the Utility: In order to have a DC bidirectional charging station approved for interconnection to the grid, it needs the UL 1741 certification. In a few U.S. states, a more complex certification, UL 1741-SB, is required.

For the CMS: Open Charge Point Protocol 2.1 is the latest version of the OCPP protocol, built to add bidirectional functionality to the communication between chargers and CMS software. Any bidirectional charger operating on the earlier standard, OCPP 1.6J, relies on proprietary extensions to add bidirectional functionality.

ChargePilot® by PowerFlex is the only CMS operating bidirectional chargers with an OCPP 2.1 integration as of Q1 2026. This allows the platform to operate bidirectional charging with multiple models and brands of EVSE, without needing a proprietary integration for each one.

For the EV: There are several standards between the vehicle and charging stations. The most important standards for bidirectional functionality for commercial vehicles are ISO 15118-2 and 15118-20. There are technical differences between these two standards, with the industry moving toward ISO 15118-20, which has native bidirectional support.

Generating Revenue With V2G

Value Streams

V2G revenue is generated through mechanisms such as demand response payments for discharging when the utility calls an event and dynamic or time-varying rates that reward exporting during high-price hours.

Every utility in North America is in a different stage of implementing V2G. Some utilities may have multiple programs which may or may not be stackable. In some states, it's important to note that sites with solar net metering may not be eligible to receive compensation for V2G export.

Work with your local utility early in the project design phase to learn about available programs and calculate potential revenue opportunities.

Interconnection

You will need to submit an interconnection application to your electric utility before connecting any bidirectional charging system.

It's important to review interconnection rules with your utility and factor interconnection into your project costs and timeline. This timeline can vary widely depending on the utility and the size of the interconnection, sometimes taking up to several months.

Warranty Considerations

Battery warranties on electric school buses can vary significantly by OEM and powertrain. Some electric vehicle battery warranties also have limitations based on gross energy throughput and vehicle age. Confirm throughput and warranty terms with your OEM before committing to a V2G program.

Electrify, Optimize, and Maximize With ChargePilot by PowerFlex

PowerFlex is the industry leader in charge management and VGI for electric fleets in North America, supporting pioneering electric school bus fleets deploying V2G and V2B infrastructure in California, New York, Massachusetts, Oregon, and Colorado.

PowerFlex can serve school bus operators electrifying their fleets, from planning to long-term operation. The company's charging simulations can help estimate the cost to charge at a given site, estimate V2G revenue potential for your fleet, and assist in recommending the best charger mix to meet the fleet's needs.

Charge Management for High-Demand Bus Fleets

School bus fleet operators rely on ChargePilot® by PowerFlex to manage charging with the highest degree of reliability and lowest possible cost of energy.

OCPP certified and SOC 2 audited, the platform uses local optimizations to manage infrastructure with intelligent load management, adjusting charging to adapt to building loads in real time and avoid demand charges and other peak rates.

For customers participating in utility VGI programs such as demand response, ChargePilot® by PowerFlex can accept and accommodate grid signals while still meeting bus charging needs, creating a win-win for fleets and utilities.

Talk to a PowerFlex expert
today to get started with
bidirectional charging.



About PowerFlex

PowerFlex is a clean technology solutions company making the transformation to carbon-free electrification and transportation possible. Our intelligent energy management platform PowerFlex X™ monitors, controls, and co-optimizes onsite assets like EV chargers, solar, energy storage, and microgrids — reducing overall energy costs through patented algorithms that maximize distributed energy resources.

PowerFlex is the largest installer of commercial solar in the United States, with over 500 megawatts (MW) of total solar capacity plus 50+ megawatt-hours (MWh) of battery energy storage. PowerFlex also manages more than 70,000 EV chargers nationwide, making it the largest hardware-agnostic EV charging provider in the U.S.

Through intelligent charging management and bidirectional vehicle-grid integration technology, PowerFlex enables electric vehicles to serve as flexible energy resources for transit agencies, school districts, and fleet operators.

PowerFlex is backed by EDF power solutions North America, Manulife Investments, and The Mobility House.

Visit powerflex.com for more information and connect with us on [LinkedIn](#) and [YouTube](#).

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