Zero-Emission School Bus Interoperability 101

What Is Interoperability?

Interoperability refers to the ability of different systems and technologies to work together seamlessly through open communication and data exchange, without requiring custom integration each time. This resource defines interoperability within the zero-emission (ZE) school bus ecosystem, the importance of open standards, and several key concepts that school districts should understand.

Interoperability refers to how ZE school buses, chargers, and software platforms can function together reliably and efficiently. For ZE school bus deployment, this means:

- ZE school buses from different original equipment manufacturers (OEMs) can charge on the same charging infrastructure.
- Chargers can connect to different charge management systems.
- Data can be exchanged between ZE school buses, chargers, and charge management systems.
- Equipment can operate together using shared technical standards.

What Is the Role of Open Standards in Interoperability?

Open standards play a central role in enabling interoperability across ZE school bus charging systems. Standards define how vehicles, chargers, and software platforms communicate, connect, and exchange data, helping ensure that components from different manufacturers can function within the same ecosystem.

By relying on shared standards such as Open Charge Point Protocol (OCPP), Combined Charging System (CCS), and International Organization for Standardization (ISO) 15118, districts can help ensure that charging infrastructure remains compatible as fleets grow, technologies evolve, and vendors change over time. Industry-wide open standards support interoperability by improving system safety, scalability, and savings.

Why Does Interoperability Matter?

Procurement with interoperability in mind can create a more streamlined deployment experience by ensuring that ZE school buses, chargers, network solutions, and energy management systems can "speak" the same digital language.

If a school district were to procure charging infrastructure that is only interoperable with select ZE school bus OEMs, it could limit future procurement options, complicate system expansion, and result in additional accrued costs or delays in the deployment process.

> "There are many different pieces of the charging experience that need to communicate effectively for [a] successful charge."
>
> *Joint Office of Energy and Transportation*

When systems are interoperable, districts can:

- Add buses from different manufacturers without replacing existing chargers;
- Expand charging infrastructure in phases using multiple vendors;
- Integrate charging data with fleet, facility, or utility systems;
- Maintain operational flexibility if software providers or service contracts change; and
- Support reliable operations and smoother fleet scaling over time.

In ZE school bus deployments, interoperability is relevant for:

- Vehicle–charger interoperability: Compatibility between buses and charging infrastructure across different OEMs.
- Charger–firmware/software interoperability: Compatibility between chargers and different software management systems.
- Utility and energy system interoperability: Ability to exchange data beyond the fleet and share charging data with utilities.

As the ZE school bus industry continues to evolve, interoperability will remain an important and integral part of the industry. By understanding how systems communicate, relying on open standards, and confirming compatibility early in project development, districts can help ensure their charging infrastructure supports both current needs and future fleet growth.

Key Interoperability Terms for School Districts

- **Handshake:** Automated communication process that occurs when a vehicle is plugged into a charger. During the “handshake,” systems verify compatibility, power capability, and other data critical to initiating charging.

- **OCPP:** Open communication protocol developed by Open Charge Alliance that supports interoperability between systems, regardless of the manufacturer or type of charging station. Some incentive programs also require OCPP compliance from districts in procurement specifications.

- **ISO 15118:** Standard developed by ISO that supports more-advanced interoperability features and specifies a universal communication interface between electric vehicles and electric vehicle supply equipment. It is increasingly referenced in long-term infrastructure planning.

- **CCS:** Dominant DC fast-charging connector standard used for heavy-duty electric vehicles in North America. CCS compatibility helps ensure buses from different manufacturers can charge on shared infrastructure.

Cal Fleet Advisor Zero Emission School Bus Forum

An interactive series of meetings that connects fellow school districts and helps them stay up-to-date on the latest in zero-emission school bus adoption.

Register now:

Recommended Procurement Considerations

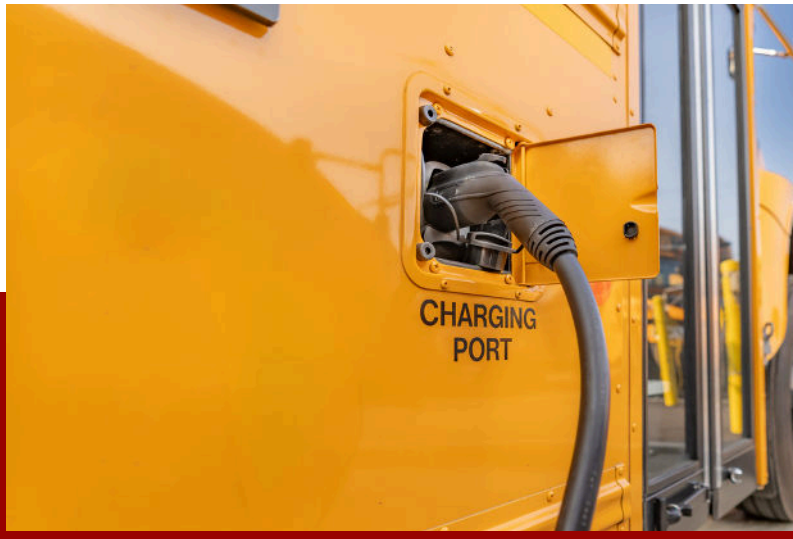
School districts can take several steps to help ensure interoperability is incorporated into ZE school bus deployments.

1. **Require open standards compliance:** Specify in the requests for proposals and contracts that charging equipment must support widely adopted standards such as OCPP. Confirm the version of OCPP supported and whether it aligns with district or incentive program requirements.

2. **Request compatibility documentation:** Request documentation of interoperability or compatibility testing where available. Ask charging equipment manufacturers to identify which bus models, chargers, and charge management systems their products have been tested with.

3. **Avoid proprietary lock-in:** Clarify whether charging hardware is tied to a single software platform or service contract. Confirm whether the district can change software providers in the future without replacing hardware.

4. **Plan for fleet expansion:** Ensure charging infrastructure is selected with future fleet growth in mind, including the potential addition of buses from different manufacturers.



FIND OUT MORE

Visit our website to learn more about Cal Fleet Advisor, get access to free planning tools, and sign up for no-cost technical assistance!
www.CalFleetAdvisor.org

CONTACT US

schoolbusteam@calstart.org

CALSTART

CALIFORNIA AIR RESOURCES BOARD

CAL FLEET ADVISOR