ELECTRIC SCHOOL BUS VEHICLE-TO-GRID (V2G) DEMONSTRATION PROJECT

PORTLAND, OR

Key Findings for Nova Scotia

- Strong communication and collaboration between all actors and technology providers is critical to success.
- It is important to test combinations of electric school buses (ESBs), chargers, and software to ensure alignment in protocols.
- Automated calling of discharge events (through distributed energy resources management systems, or DERMS) can help minimize human error.

PROJECT AT-A-GLANCE

West Linn, Oregon

2022-2024

1 Blue Bird Type C Bus
(not used for school operations)

Grid services provided: avoiding charging during regular peak hours and discharging during scheduled events (27 events in summer 2024)

PARTNERS

Portland General Electric (PGE) Project lead
BlueBird ESB manufacturer
First Student School bus transportation contractor
Nuvve Corporation V2G technology provider

PROJECT MOTIVATION

GOAL

Demonstrate that ESBs can reliably discharge to the grid during peak events without negatively impacting school bus operations; use the gathered data to inform a potential future V2G customer incentive program. PGE is receiving signals from customers that a commercial fleet V2G incentive is expected and desired.

POLICY/PROGRAM CONTEXT

V2G demonstration funded through the State's Clean Fuels Program.

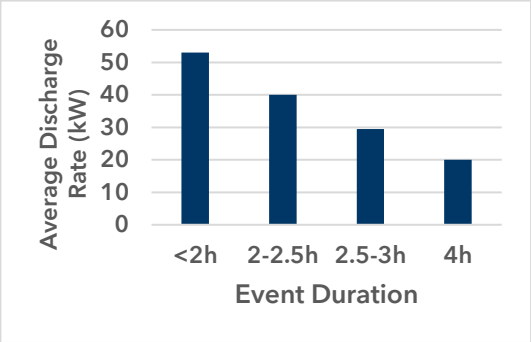
KEY PERFORMANCE INDICATORS (KPIs)

- **Event execution accuracy**: charger responds to event type and adheres to start/stop times.
- **Discharge & export capacity:** ability to deliver requested power during peak events.
- **Peak charging avoidance:** DC charger does not charge ESB during peak periods.
- **Managed charging compliance:** managed charging occurs during an event.
- **Minimum state of charge (SOC) compliance:** ESB maintains operator-set minimum SOC for operational readiness and battery health.

VEHICLE TO GRID (V2G) FINDINGS

SELECT TECHNICAL RESULTS

- **Insights into discharge capacity.** The demonstration successfully showed discharge capacity for different event durations.



Source: PGE, 2024

- **Lower than target reliability for called events.** 70% of the called events led to battery discharge. Missed events were caused by technical and integration difficulties.
- **Managed charging during peak periods was inconsistent.** There were some issues starting discharge on time, avoiding charging during peak hours, and aligning protocols around the minimum state of charge.

CONCLUSIONS

- **Summer peak opportunity.** ESBs are very available in the summer, when they can be used like stationary energy storage.
- **Integration is paramount.** The quality of the integration between the bus and charger platforms has a large impact on the reliability of V2G participation. It is important to have alignment in V2G standards and protocols for smoother operations.
- **Strong collaboration between equipment and software providers builds success.** It is important to have all actors available to troubleshoot and build ongoing working relationships.
- **Automation will help avoid human error.** Events were called by email for this demonstration, but automated processes across event notifications, discharge scheduling, and event operations could reduce human error and improve reliability and scalability. This finding highlights the importance of utilities integrating V2G into scalable systems like a Distributed Energy Resources Management System (DERMS) and using established communications protocols and standards.

OTHER LESSONS LEARNED

- **Proof of concept.** PGE was able to demonstrate the potential for V2G with ESBs and felt that the results justify continued testing. Future pilots could explore applications during winter peaks and other extreme weather, and use buses actively involved in operations.
- **Need for clearer interconnection processes.** The pilot highlighted the need for the utility to set a clear process for V2G interconnections like those in place for net metering.

ABOUT THIS PROJECT

This case study is part of a series commissioned by the Ecology Action Centre exploring the potential for electric school buses (ESBs) to provide grid services by supplying electricity back to the local building or grid when they are not in use, otherwise known as to as "vehicle-grid integration (VGI)." VGI can help make ESBs more financially viable and boost community resilience, but grid services are just one of many important benefits offered by ESBs, alongside cleaner air for children and drivers, quieter operation, and fuel cost savings.

The Council of Atlantic Ministers of Education and Training commissioned a study for ESBs that showed a feasible pathway to electrifying Nova Scotia's school bus fleet by 2036. These case studies explore how learnings elsewhere could inform future programs in Nova Scotia.

References: PGE, 2024. "Emerging Technologies". pg. 23. Clean Fuels Program 2024 Annual Report; PGE, 2023. "Emerging Technologies". pg.18. Clean Fuels Program 2023 Annual Report; Interview with PGE staff, Nov. 2025.

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