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19-TRAN-02 Electric School Bus Infrastructure Workshop

Additional submitted attachment is included below.

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22 September 2022

California Energy Commission

Re: 19-TRAN-02 Electric School Bus Infrastructure Workshop

Motiv is very interested in vehicle-grid interactivity (VGI) which is driven by rational economics and helps solve real problems. Those real problems include grid support (especially during peak grid demand), facility power for emergency response and also increasing the utilization of battery packs on school buses beyond those times when the buses are driven.

However, 60kW DC-based VGI which uses proprietary, closed standards does not solve any of the above problems in an economically-viable way. As such, Motiv requests the CEC team consider making two changes to 19-TRAN-02:

1) **Require the use of ISO 15118-20 for all projects.** This standard is now published and available (https://www.iso.org/standard/77845.html). Two years ago, a requirement of "hardware capable" may have been sufficient, but now such a requirement no longer encourages standards adoption and instead just locks in preferential treatment of certain proprietary technologies that claim "hardware compatibility" but do not actually implement the standard. The solution is easy – require the use of the published standard!

2) **Level the playing field – Require a Total Site Power instead of mandating a bus count and a power-per-vehicle.** Specifying 10+ buses and 60+ kW per bus creates an unfair advantage for technology providers with solutions geared to that configuration and hurts the long-term viability of VGI. 60 kW seems especially arbitrary; this power requirement happens to match the hardware specification of one hardware manufacturer exactly. By setting a total site power requirement and/or setting a requirement for the number of hours a site must run (or deliver the power) using bus energy, the program will level the playing field and create more diverse and comparative case studies to drive adoption rather than appear to support one specific hardware provider. For a specific example of why a lower power-per-vehicle site may be economically advantageous, see appendix below.

Thank you,

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Jim Castelaz and the Motiv team.

Appendix: Lower-power AC VGI:

The total, fully-burdened cost of charging a vehicle or a fleet of vehicles is always lower when the vehicle(s) is(are) charged over a longer dwell time because (a) lower power may be used, (b) the electrical infrastructure providing the power has a higher utilization rate, (c) battery degradation is minimized, (d) there is less total waste heat generated. Some vehicles require high power charging because their route profile and usage preclude them from being connected to a charge station for an extended period of time. These vehicles are poor candidates for VGI because they are not connected to a charge station for an extended period of time. If they were connected to a charge station for an extended period of time, then they would no longer require as high of power for charging.

Given the above fundamentals, the total power required to charge a fleet of buses at a given site should be based on the maximum acceptable charging dwell time (for school buses, typically 12+ hours). The economics of any incremental infrastructure power should provide more incremental benefit than its incremental cost, including incremental costs from (a) – (d) above.

If lower-power, AC-based VGI is used, the incremental costs are nearly zero. Especially in emergency response when a user may desire to power a facility from a fleet of vehicles for many hours (4 to 12 hours for example), then higher power VGI provides little benefit since the buses will run out of energy sooner.

The absence of additional high-cost hardware may deter some private companies from developing low-power AC-based VGI, but it should not deter the CEC from evaluating its potential to make a large impact on the real problems listed at the beginning of this comment.

Numerical example:

A site with 20 buses driving an average of 65 miles per day at an average of 1.3 kWh/mi consume 1690 kWh per day. With a 12 hour charge window, the site power requirement would be 157 kW assuming 90% charge efficiency. The buses will probably require a taper in charge for the final 1-2 hours of charging, so accounting for the charge taper and an operational buffer, the site may elect to move to 200 kW total power. Based on Motiv's commercial experience, this type of site with 20 charge stations and an appropriate step down transformer would likely cost $220,000-$300,000 provided that incremental service is not needed at the site (it rarely is for this power level, within commercial and industrial sites). With AC-based VGI, the incremental vehicle cost could be $5,000 per vehicle. The incremental infrastructure cost would probably be $10,000 for some extra monitoring and maybe an extra islanding switch. For an extra $110,000, the site could be powered at a power level of 180 to 200 kW. Buses in this example could have a range of 100 miles, or 130 usage kWh. Buses would charge to 100% and return from their route at an

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average SOC of 35%, or a total kWh of 910 kWh among all 20 buses. At full charge, all buses would have 2600 kWh of energy. So long as all 20 buses were present when the site lost power, the 200 kW of power could be provided for 4 to almost 12 hours (90% bus-to-site efficiency).

If those same 20 buses each had a 60 kW charger, the total site power would be 1.2 MW. This site could easily cost $2M for infrastructure, and since a facility upgrade would be needed, it would take probably 1 year longer to commission. During an emergency, the site could provide 1.2 MW of power for between 40 minutes and just under 2 hours, or it could provide the same 200 kW as above for the same 4 to 12 hours, despite the huge incremental cost of around $1.6M.