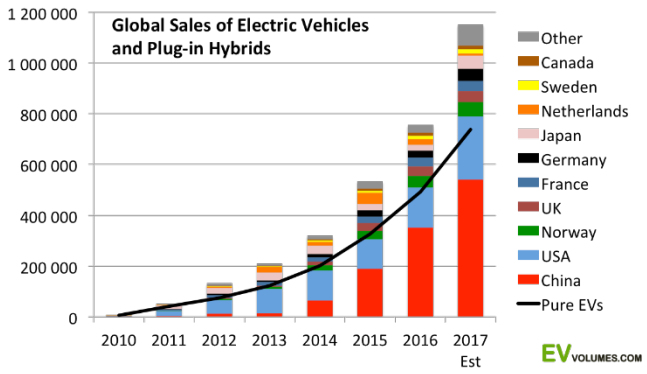
Solution Brief

Rhombus Energy Solutions

ENERGY STORAGE FOR FLEET ELECTRIC VEHICLE (EV) CHARGING SYSTEMS

Background

Vehicle electrification is more than just a trend. In fact, vehicle electrification is exponentially increasing in acceptance, popularity and recognition as one of many global solutions to addressing economic and climate change priorities. Global sales of electric automobiles exceeded one million vehicles in 2017, with electric automobile shipments in the U.S. alone of nearly 200,000 vehicles. By 2050, 65%-75% of new light-duty vehicles sold will be electric.



Charging stations for EVs are not just being built and deployed by EV manufacturers. Businesses, utilities and municipalities are making large investments in charging stations for everything from automobiles to medium-duty and heavy-duty vehicles. More and more of these charging stations are of the "fast-charge" type, with power ratings of up to 250kW for the latest Tesla "supercharger" stations.

Vehicle electrification has also produced a fundamental shift in utility grid peak load times. Because most electric vehicles operate during the day, charging typically occurs overnight. This problem is further exasperated by the increasing use of renewables such as solar that only produce during the daytime. In addition, peak power required by a typical fleet charging location can often exceed the power commonly available from the utility grid. The result is a disconnect between available utility grid power and demand for that power.

Combining Energy Storage with Fleet Charging to Address Utility Grid Issues

Adding more fossil fuel power generation stations to support this growing need is not a viable option for a variety of reasons. These include: lack of desire to make new long-term investments in generation capabilities by utilities; environmental/climate change concerns; regulatory hurdles to building new powerplants; and "not in my backyard" pushback. Moreover, new powerplants do not solve the issue of getting power to the places it is needed without requiring very expensive investments in new cabling. The obvious solution is putting energy storage resources where the demand actually is. For fleet charging stations, the obvious place to add energy storage is in the vehicle charging infrastructure itself.

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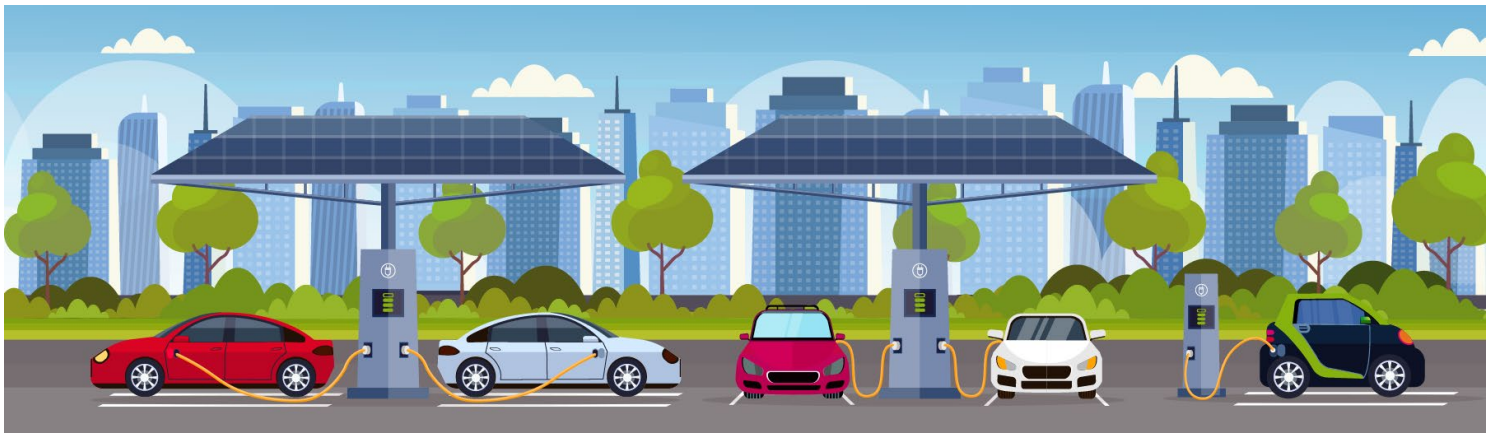
This approach has several advantages over alternative solutions such as utility grid-based energy storage ("microgrids") or auxiliary power generation stations:

- Most large fleet charging locations have the real estate to support solar photovoltaic power generation ("solar farms"), which can supply on-location energy storage with power. Most of these renewables also provide DC power.
- Energy storage solutions are direct current (DC) based as they use batteries to store the power.
- Because they also utilize batteries, EVs are also inherently DC power-based.
- The output stages of EV charging systems (and much of the power conditioning in these systems) are also DC power-based.

The nexus of these four trends is a fleet charging infrastructure where utility grid AC power is but one piece of the overall power supply, storage and charging puzzle. However, it would be overly simplistic to think that charging system providers can just connect up a bunch of shipping containers full of batteries to their charging systems and solve this issue. Rather, charging infrastructure needs to be architected to support these needs in an intelligent manner.



Equipping Fleet Charging Infrastructure to Integrate Energy Storage Solutions

To build the most effective combination of energy storage and fleet charging infrastructure, the solution should embody the following attributes:

- **Intelligence**: The entire purpose of adding energy storage to charging infrastructure is to reduce costs and to ensure power availability. This requires intelligence (i.e., "software") in the system to manage loads and power sources. The software should provide peak load shaving, power usage reporting, systems status and support for power usage forecasting and scheduling/provisioning to avoid brownouts or other issues.
- **Bi-Directional Power Architecture**: The DC portion of the charging infrastructure needs to support managed bi-directional power flow, both to/from the energy storage system and to/from the electric vehicles, which can be used to store energy or to provide unused energy a to other vehicles.

This combination of capabilities can effectively couple AC grid connections, bi-directional DC energy storage resources and renewable energy sources, such as solar, into a robust fleet charging solution that mitigates utility grid-only solutions. Rhombus Energy Solutions is dedicated to creating fleet charging solutions to meet not only today's needs, but also the charging infrastructure needs of tomorrow. Find out more at info@rhombusenergy.com.