

Electricity Planning for Fleet Electrification

Hundreds of billions of dollars are now being invested in electric, connected, and autonomous vehicles. To fully support these vehicles, the nation's existing transportation infrastructure will need to evolve to incorporate electric infrastructure needed to power these vehicles and the communications infrastructure needed to support their connected and autonomous functionality. In short, we need to integrate our existing transportation, communications and electric infrastructure.

Meeting this challenge will require significant upgrades to the electric distribution and the bulk power grid. Siting new electric transmission in existing highway rights-of-way not only brings electricity to where it's needed, new high-voltage transmission capacity can significantly increase the amount of clean energy available to power electric fleet vehicles.

Key takeaways

Ambitious fleet electrification goals require an extraordinary shift as transportation moves away from a system built around the availability of gasoline to a system that relies on the availability of electricity, a very different commodity.

The most cost-effective approach to making a shift of this magnitude is to adapt the current infrastructure to changing demands. In addition, joining electric infrastructure with the transportation infrastructure reduces the need for land acquisition, already in tight supply, and could enable access to clean energy resources in remote locations.

Background

Fleet electrification is happening now. The Biden Administration has issued an Executive Order that sets the government-owned fleet on a path to zero-emission vehicles (ZEVs),

aiming for [100% Zero-Emission Vehicle Acquisitions by 2035, including 100% light-duty acquisitions by 2027](#).

- The U.S. Postal Service, for example, received \$3 billion in [Inflation Reduction Act](#) to buy zero-emissions delivery vehicles and install necessary charging infrastructure at post offices and central mail facilities. The nation's school buses are going electric thanks to a federal rebate program.
- Private companies are pursuing similar goals. The e-commerce giant Amazon has plans for 100,000 custom electric delivery vehicles from electric vehicle maker Rivian. The move to electrify the company's fleet is part of Amazon's Climate Pledge, aiming to reach zero net carbon by 2040.

Meeting clean energy goals will require adding and expanding high-voltage transmission lines. If we co-locate that new transmission in the highway right-of-way, we can increase efficiencies for both transportation and the electric system while, at the same time, lessening the impact of new transmission development on private landowners.

Reimagining the grid

Southern California Edison (SCE), examining how the electric system will need to change in order to supply the needs of transportation corridors carrying an electrified fleet, has called for "re-imagining the grid." In the utility's vision, increasing the use of high-voltage direct current (HVDC) power may be part of the solution.

Among the bolder concepts considered is a DC-based architecture in the long term, once EV penetration starts reaching a point beyond what incremental distribution upgrades and existing transmission capacity can address locally in specific areas. The core concept is that given the higher voltages and increased power required to provide fast charging for a growing number of heavy-duty EV fleets, switching to a medium/high-voltage, DC-based system could be less costly than adding a traditional solution, including the transmission, sub-transmission and distribution level cable and transformer equipment required.

The SCE vision includes two technology components that could be enabled by HVDC transmission: 1) direct high-voltage EV charging at distribution direct current substations (230kV+), and 2) power inverters and direct current converters to connect the transportation corridors with new renewable sources.

Looking ahead still further, deploying HVDC lines could open up new economic opportunities, such as the creation of economic development zones where converter stations can serve as clean energy supply hubs.

The strategic creation of such economic development zones will also deliver societal value in urban areas. A combination of loads, including depot-based fleet charging in dense warehouse districts, and a large value for grid reliability and resilience (from the large population and commercial activity) could cover the cost of the converter stations in urban areas.

The electrification of the nation's transportation system is a feat of significant complexity and also tremendous opportunity. While the separate components – generation, transmission, charging – are all well-understood, reconfiguring the system as a whole is daunting. Co-locating the electric transmission infrastructure with the transportation infrastructure could reduce that complexity.

Sources

- [The Future of Mobility is at Our Doorstep](#) McKinsey and Company
- [Our Transportation Future: Industries Collide](#) Morgan Putnam, *The Fuse*
- [Reimagining the Grid](#), white paper by Southern California Edison

About NextGen Highways

The NextGen Highways is a collaborative initiative promoting the use of highways and other existing rights-of-way as infrastructure corridors where electric and communications infrastructure are strategically and safely co-located in existing highway right-of-way. Learn more at <http://www.NextGenHighways.org>