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INSIGHT

Class 8 Truck Zero-Emission Routes

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Trucking accounts for nearly a quarter of the total greenhouse gases emitted by the transportation sector in the United States. As Congress takes up reauthorization of federal surface transportation programs, interest in mitigating climate change is drawing attention to two provisions of law, the Designation of Alternative Fuel Corridors provision (P.L. 114-94, §1413) and the Congestion Mitigation and Air Quality Improvement Program (CMAQ; P.L. 114-94, §1114). Both could be used to further encourage trucking companies to invest in zero-emission heavy-duty trucks.

Commonly called "18-wheelers," Class 8 trucks present formidable challenges to converting to zero-emission engines. Unlike lighter delivery trucks, many of which run on battery-electric power, Class 8 trucks engaged in long-haul transport do not return each night to a truck depot at which they can recharge or refuel. While trucks powered by natural gas or diesel blended with biofuels are already in use, these fuels result in greenhouse-gas emissions. Making zero-emission Class 8 trucks feasible would require a nationwide network of alternative fuel or recharging stations. The preferable refueling range for intercity Class 8 trucks in long-haul service is around 500 to 600 miles, because this is the distance a driver can cover in a typical day within federal limits on hours of driving.

Engine Technologies Being Tested

Batteries and hydrogen fuel cells are the leading engine technologies now being tested in zero-emission prototype Class 8 trucks. Each has advantages and disadvantages.

Equipping Class 8 trucks with battery-electric engines using current technology is expected to reduce engine maintenance and repair costs considerably, but the range of the battery is often under 500 miles. The batteries can take hours to fully recharge, and because of their size and weight, they significantly reduce the amount of cargo that can be carried. Faster charging or charging a fleet of trucks simultaneously likely requires significant investment in additional electric transmission capacity at a charging station. Given the extensive research and development under way for passenger car battery technology, trucks may eventually benefit as smaller batteries with a longer range emerge. It is unclear if swappable battery packs might be a solution to reduce charging time for Class 8 trucks.

Conversely, hydrogen fuel cell truck prototypes typically have a range over 500 miles. Hydrogen trucks can be fueled in a matter of minutes and present only a small space penalty for the motor and fuel tank in terms of cargo displacement. Hydrogen may be less energy-efficient than electric drive, however: more energy may be required to produce it, to compress or liquefy it for storage and transportation, and to

deliver it to fueling locations. Hydrogen fuel, particularly "green hydrogen" produced by electrolysis powered by solar or wind power, is expected to be significantly costlier than diesel, although research efforts are under way to reduce hydrogen costs. A cost disadvantage might be mitigated if hydrogen provides more price stability than diesel.

In addition to batteries and hydrogen, researchers are testing trolley-like overhead electric catenary lines. Trucks using this technology have apparatus above their cabs that transfer energy from the overhead lines to electric motors in the truck. While this system has some advantages, a disadvantage is the large public investment required to install and maintain the catenary along highways.

Drayage Truckers May Be Early Adopters

While significant hurdles remain in achieving zero emissions in the Class 8 truck sector, a subset of this sector that typically engages in shorter-haul transport might provide a market opening: drayage carriers. Drayage is the carriage of shipping containers to and from seaports and rail yards. Often these are intracity trips with the truck driver making two or three trips per day. Since the trucks are typically parked at the same depot every night and make trips to the same port or rail yard each day, they would require a local rather than a national network of fueling stations and, in the case of hydrogen, fuel could be produced on-site. Overhead catenary might also be possible on a specific route—for instance, a roadway used to shuttle containers between a seaport and a nearby railyard with dedicated trucks. The Ports of Los Angeles and Long Beach have been testing zero-emission drayage trucks using battery-electric, hydrogen fuel, and overhead catenary technology. To help owners finance the replacement of their diesel-powered drayage trucks with zero-emission trucks, the ports are contemplating charging a $20 fee on each shipping container.

Financing commercial adoption of zero-emission trucks in the Class 8 market is likely to be a significant challenge. Very small firms carry a sizable portion of U.S. freight, including many owner-operators, who effectively operate as one-truck firms. With limited finances, small firms typically purchase secondhand trucks. This is particularly the case in drayage trucking, which often involves moving in stop-and-go traffic on urban freeways and idling in long lines at seaport gates. Some drayage truckers may not have a business case for purchasing costly zero-emission trucks.

Federal Planning

Reauthorization of surface transportation programs is an opportunity for Congress to encourage further planning for any necessary fueling infrastructure. It might encourage states and local officials to consider nominating "intermodal connectors" as designated alternative fuel corridors as outlined in Section 1413 of P.L. 114-94. This provision is intended to identify the near- and long-term needs for, and location of, alternative fuel stations at strategic locations and to identify any standardization needs among fuel suppliers and users (23 U.S.C. §151). Intermodal connectors are roads heavily used by drayage trucks, as they connect seaports and intermodal rail yards with the Interstate Highway System. The Department of Transportation has inventoried these roads and periodically reports on their condition. The National Association of Truck Stop Operators or other entities could assist in identifying strategic locations for fuel stations along these corridors.

Congress might also consider adding hydrogen truck fueling stations as eligible and a priority for CMAQ funding. Under existing law (49 U.S.C. §149(c)(2)), CMAQ funds may be used to construct electric charging and natural gas fueling stations, but not hydrogen fueling facilities, for trucks.

Author Information

John Frittelli
Specialist in Transportation Policy

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