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What are the Public Health and Environmental Implications of Drayage Truck Electrification Targets in California?

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Issue

Like other heavy-duty trucks, drayage trucks (trucks with a gross vehicle weight of 33,000 lb. or more hauling containers and bulk to and from ports and intermodal railyards) contribute disproportionately to fine particulate matter (PM2.5), the common air pollutant of most concern for health, nitrogen oxides (NOx), and greenhouse gas (GHG) emissions. Disadvantaged communities are disproportionately exposed to air pollution from heavy-duty trucks.

Unlike long-haul trucks, however, drayage trucks mostly operate in populated areas, which is the case for drayage trucks serving the San Pedro Bay Ports of Los Angeles and Long Beach, the largest port complex in the nation. The Clean Air Action Plan (jointly adopted by the two ports in 2006) phased out pre-2007 drayage trucks serving the ports by 2012. An update to the Plan in 2017, further required any new truck in the Port Drayage Truck Registry (registration is a necessary condition to serve the ports) be model year 2014 or later starting October 1, 2018.

At the state-level, the Road Repair and Accountability Act of 2017 (Senate Bill 1) "prohibits new regulatory requirements to replace, retire, repower, or retrofit heavy-duty trucks before they have reached the earlier of either 800,000 vehicle miles traveled or 18 years from the engine model year." In turn, the Governor's Executive Order N-79-20 (issued September 2020) sets a goal of ending sales of new drayage trucks with internal combustion engines by 2035.

To better understand the implications of transitioning drayage trucks to zero-emission, we analyzed the health impacts and GHG freeway emissions from diesel-powered drayage trucks and the benefits of replacing them with zero-emission trucks, accounting for current and expected air quality regulations. Our study area stretched between the San Pedro Bay and the Inland Empire, home to large warehouse complexes. We focused on two years: 2012 (when pre-2007 drayage trucks were phased out in the Clean Air Action Plan), and 2035 (the deadline in Executive Order N-79-20). Our analyses incorporated projections of the size and composition of the vehicle fleets from data collected by the California Air Resources Board (CARB), estimates of future emission factors from the U.S. Environmental Protection Agency that account for projected technology improvements, and projected increases in cargo demand at the ports in 2035 compared to 2012.

Key Research Findings

With current and foreseeable regulations, emissions are expected to drop significantly between 2012 and 2035 for all vehicles on the roadway. Due to more stringent emission standards and increased adoption of zero-emission vehicles, emissions in the study area are expected

to drop by 94.6 percent for PM2.5 and by 90.6 percent for NOx, for all vehicles, between 2012 and 2035. The decline in emissions is slightly lower for drayage trucks (92.1% for PM2.5 and 76.5% for NOx), due to the projected 145 percent growth in cargo handled by the port complex in 2035 compared to 2012.

The number of projected PM2.5 related premature deaths in 2035 is substantial. In 2035, despite technological advances, the projected number of premature mortality cases in 2035 is still substantial (106 versus 483 in 2012) partly because of the population increase in the study area but mostly because of the sharp (+145%) projected increase in drayage operations in 2035 compared to 2012. The cost of these premature deaths would be about $1.3 billion annually by 2035, compared to around $5.6 billion in 2012 (in 2022 $).

Disadvantaged communities will still be disproportionately affected by drayage truck emissions in 2035. Disadvantaged communities (as identified by the California Environmental Protection Agency) would bear over two-thirds (68%) of the health costs resulting from PM2.5 emissions from drayage trucks in 2035 ($888.5 million in 2022$). They are also estimated to bear 78 percent (1,671 out of 2,142) of annual asthma exacerbation cases in 2035 among 6 to18 year-olds in our study area.

Carbon dioxide (CO2) emissions from non-electric drayage trucks will increase by 11.9 percent between 2012 and 2035 due to projected cargo growth. CO2 emissions from non-electric drayage trucks are expected to increase from 2.5 million tons annually in 2012 to 2.9 million tons in 2035. The annual social cost of these emissions would be between $220 million and $316 million in 2035 (in 2022$).

Policy Considerations

Based on insights from this study, the state may want to revisit or repeal the limits on replacing heavy-duty trucks as outlined in Senate Bill 1 in order to speed up the transition to zero-emission drayage trucks and avoid irreparable damages to public health and the environment. The total cost of ownership of battery-electric trucks used for short-range service (<500 mi) is projected to dip below that of comparable diesel trucks by 2025 if diesel prices stay sufficiently high (> $3/gal, which has been the case in California since 2016). Drayage trucks serving the ports are prime candidates to be replaced with battery electric trucks because they drive under 300 miles per day, and return to a home base at night, which is ideal for overnight charging.

More Information

This policy brief is based on the paper "Health and Equity Impacts from Electrifying Drayage Trucks," by Monica Ramirez-Ibarra and Jean-Daniel Saphores of the University of California, Irvine, published in Transportation Research, Part D, in 2023.[1] For more information about the findings presented in this brief, please contact Jean-Daniel Saphores at saphores@uci.edu.

[1]Ramirez-Ibarra, M., and Saphores, J. D. (2023). Health and equity impacts from electrifying drayage trucks. Transportation Research Part D: Transport and Environment, 116, 103616. https://doi.org/10.1016/j.trd.2023.103616

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