GMA | TRUCKING

A program of the Center for Green Market Activation

Benefits of Zero-Emission Vehicles

Introduction

Zero-emission heavy-duty vehicles, such as battery electric vehicles (BEV) and fuel cell electric vehicles (FCEV), offer a convergence of benefits that extend beyond climate, presenting an opportunity to make meaningful impact. Accelerating their adoption will reduce greenhouse gas emissions, improve public health in freight-burdened communities, lower operational costs over time, and reduce the noise pollution that degrades quality of life in urban corridors.

The Benefits of Zero-Emission Vehicles

Emissions Mitigation

The transportation sector is one of the largest sources of greenhouse gas (GHG) emissions, with heavy-duty vehicles accounting for more than 1.2Gt of CO_2e emissions globally. As zero-emission[1] alternatives to traditional internal combustion engines (ICE), transitioning to BEVs and FCEVs can offer an effective way to reduce on-road emissions.

Both BEVs and FCEVs produce zero tailpipe emissions, meaning they produce no exhaust or pollutants (such as CO2 or other particulate matter) as they run. As both vehicle types rely on alternative forms of power, how that power is generated offers other opportunities to decarbonize. BEVs that pull electricity from the grid are reliant on the composition of renewables and fossil fuels, and may not reach the highest potential reduction. However, as the grid becomes increasingly reliant on renewable energy sources, more emissions reductions will be realized. For BEVs fully backed by renewable electricity – either directly, through Power Purchase Agreements (PPAs), or with unbundled renewable energy certificates (RECs) – a near-complete 100% reduction in tailpipe emissions as compared to diesel trucks is attainable. Similarly, the type of hydrogen used in FCEVs offers different rates of emissions reductions, with FCEVs that use hydrogen produced using renewable electricity achieving the greatest reduction.

Improved Public Health

Transitioning to zero-emission trucks delivers significant public health benefits, particularly in communities located near ports, warehouses, and freight corridors that bear the heaviest

[1] "Zero-emission" refers to tailpipe emissions only, not inclusive of upstream manufacturing emissions.

burden of on-road pollution. Although they only account for 10% of all vehicles on roads in the U.S., heavy-duty trucks are responsible for 57% of particulate matter and 45% of smog-forming nitrogen oxide pollution.[2] These pollutants have serious health impacts, with exposure leading to issues such as heart and lung damage, asthma, cardiovascular disease, and premature death.[3]

Even relatively modest adoption rates can yield measurable improvements. Research indicates that nitrogen dioxide (NO2) concentrations decrease by approximately 1.1% for every 200 ZEVs deployed in a given area.[4,5] As fleets scale, this effect compounds, offering communities near freight hubs a genuine path to cleaner air. With four out of ten Americans currently living in areas affected by unhealthy levels of air pollution[6], and with low-income communities and communities of color bearing a disproportionate share of that burden due to proximity to major freight routes and industrial facilities, the need to transition to zero-emission vehicles is urgent.

Energy Security

By diversifying transportation energy sources, lowering reliance on imported petroleum, and lessening vulnerability to disruptions in the global oil supply, battery-electric and fuel cell electric vehicles both greatly improve energy security. The transition also boosts other domestic sectors, driving the use of local electricity and enabling the use of native resources for hydrogen production. Shippers, fleet owners and drivers of these zero-emission vehicles also benefit from reduced cost variability as compared to diesel.

In 2021, 67.2% of total petroleum consumption in the United States was used by the transportation sector.[7] Of this, 43% of the oil was imported[8]. While domestic production and increased fuel efficiency both play parts in reducing dependence on foreign oil, the transition to zero-emission vehicles is one of the most impactful ways to enhance energy security while also reaping numerous other benefits related to human health and the environment.

[2] https://www.jec.senate.gov/public/index.cfm/democrats/2024/4/electrifying-heavy-duty-vehicles-will-benefit-the-u-s-economy-environment-and-public-health
[3] https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm
[4] This figure reflects changes measured within ZIP Code Tabulation Areas (ZCTAs), the Census Bureau's geographic approximations of ZIP code boundaries. An increase of 200 ZEV registrations within a ZCTA was associated with a decrease in annual average NO_2
[5] https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(25)00257-8/fulltext
[6] https://www.lung.org/research/sota/key-findings
[7] https://www.ebsco.com/research-starters/power-and-energy/hybrid-vehicles-and-energy-security
[8] Id.

Reduced Noise Pollution

The health consequences of noise pollution are frequently underappreciated, yet the scientific evidence is robust: excessive noise pollution has been linked to adverse health problems, including heart disease and reductions in overall quality of life.[9] Approximately 70% of total urban noise originates from vehicle traffic[10], and heavy-duty vehicles are among the loudest contributors.

Electric drivetrains are dramatically quieter than their internal combustion counterparts, particularly at lower speeds where much of the noise burden in urban environments is concentrated.[11] Deploying zero-emission trucks on freight routes through urban areas can produce measurable reductions in ambient noise levels, with projected benefits for residential neighborhoods, schools, and healthcare facilities located near major truck corridors

Higher Driver Satisfaction

While more research on this topic will be needed given the nascency of the heavy-duty zero-emission trucking market, early reports indicate that drivers of these vehicles have higher satisfaction than those driving diesel incumbents. BEVs boast a smoother driving experience, as drivers don't need to shift as they would with a typical 13-speed transition leading to less fatigue.[12] Drivers also report loving the clean, quiet operation of zero-emission vehicles. The lack of environmental and noise pollution are also seen as major benefits.[13]

[9] https://www.health.harvard.edu/heart-health/how-noise-pollution-may-harm-the-heart
[10]https://www.sciencedirect.com/science/article/abs/pii/S2468584425000327#:~:text=There%20is%20consensus%20that%20EVs,contribute%20significantly%20to%20noise%20reduction.
[11] Arenas, J. P. (2025). On the impact of electric vehicle transition on urban noise pollution. *Current Opinion in Environmental Science & Health*, *45*, 100623. https://doi.org/10.1016/j.coesh.2025.100623
[12] https://chargedevs.com/newswire/another-reason-to-buy-electric-trucks-driver-recruitment-and-retention-because-they-love-them/
[13] https://www.c2es.org/wp-content/uploads/2020/02/Insights-On-Electric-Trucks-For-Retailers-And-Trucking-Companies.pdf