NEW ANALYSIS: ACCELERATING THE ELECTRIC TRUCK TRANSITION WILL REQUIRE $100B+ IN CHARGING INFRASTRUCTURE COMMITMENTS THIS DECADE

THE UNITED STATES will need to commit between $100 and $166 billion in charging infrastructure investments in the next nine years to support a pathway to 100% electric medium- and heavy-duty truck sales by 2040, according to a new analysis by DC-based policy and tech firm Atlas Public Policy.

Almost 30 percent of ground transportation greenhouse gas emissions come from medium- and heavy-duty trucks.[1] These vehicles are responsible for substantial air pollutant emissions, which are linked to asthma, cancer, cardiovascular disease, and premature death.[2] These impacts disproportionately affect the predominantly low-income communities and communities of color located close to freight corridors, ports, warehouses and depots. Heavy-duty (class 7-8) tractor-trailers are particularly high polluters due to their low fuel economy and use in long-haul applications, representing only 13 percent of on-road medium- and heavy-duty vehicles but generating approximately 60% of their greenhouse gas emissions and fuel consumption.[3]

Atlas found that to meet 100% electric new medium- and heavy-duty truck sales by the end of 2040 (in line with government and corporate targets), a rapid ramp-up of charging infrastructure will be needed for all truck segments.[4] Infrastructure needs include at-home charging for pickups; depot charging for fleets; and a variety of on-road charging options, including ultra-high powered stations for long-haul trucks.

TAKEAWAYS FOR POLICY-MAKERS

- **Reaching 100% electric sales by 2040 will require rapid ramp-up of charging for all truck types**
- **Targeting high-traffic corridors first and serving multiple vehicle types at each site can increase utilization of on-road charging and significantly reduce needed investments**
- **Policies & incentives that encourage right-sized depot equipment can reduce needed investments**
- **A mix of high-powered and ultra-high-powered charging ports will be needed to support long-haul trucks**
- **Investment commitments will likely be needed by 2030 to support a ramp in electric long-haul trucks through 2035 due to long project and utility lead times for high-powered sites**

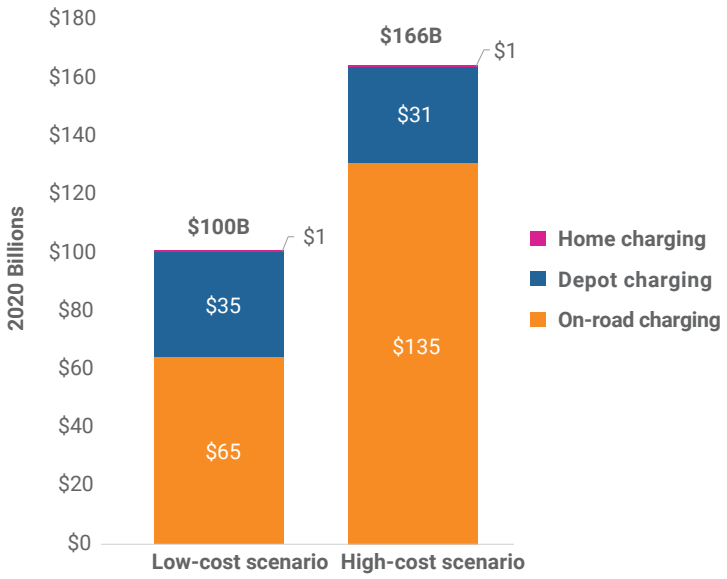
The significant price tag differential reflects uncertainty in charger utilization rates and the required amount of on-road charging—the most expensive to build. Policies to support right-sized depot charging and the build out of high-traffic travel corridors first can help keep overall costs down.

Atlas's study estimates needed upfront investments in charging infrastructure that are not expected to be covered by electric utilities. This analysis does not estimate the climate, financial, noise, air pollution, or health benefits of electrification, though these have been shown elsewhere to be substantial. Work by the International Council on Clean Transportation, the National Renewable Energy Lab, Argonne National Lab, and the Luskin Center for Innovation suggests that depot-charging electric trucks will be cost-competitive with diesel in the near future.[5]

METHODOLOGY

Atlas Public Policy modeled charging infrastructure needed to support 100% electric sales of medium- and heavy-duty trucks by 2040 and a full transition by 2060--an estimated 17M electric trucks. The analysis assumes that battery electric truck technologies continue to improve, enabling an expansion beyond the many use cases that can already be served by electric models to all truck applications. Using fuel economy forecasts from Argonne National Laboratory and average travel distances reported by CALSTART, Atlas calculated the daily energy needs of each truck type and assigned it a right-sized charging power level. The analysis used state-level vehicle counts from IHS Markit, s-curve electric truck sales levels, and industry cost estimates to calculate needed infrastructure investment under two scenarios with different levels of charger utilization, charging location mix, and utility cost share of needed upgrades.

Modeled investment needed by end of 2030, by charging location



Vehicle Category	Model Charging Type
Class 3 trucks	Home Level 2 (11.5kW) Depot Level 2 (10kW)
Class 4 – 6 trucks	Depot Level 2: 10kW & 16.6kW (based on need) Depot 50kW On-road 150kW or 350kW
Class 7 – 8 trucks, excl. long-haul	Depot 50kW Depot 150kW On-road 350kW
Long-haul trucks	On-road 350kW truck parking or 2MW
Motorhomes	On-road 350kW

Modeled vehicle and charging types

RAPID RAMP-UP OF DIVERSE CHARGING INFRASTRUCTURE REQUIRED TO MEET NEEDS

The United States will need to make major investment commitments by 2030 in several types of charging infrastructure to facilitate rapid electrification of medium- and heavy-duty trucks:

DEPOT CHARGING FOR FLEET VEHICLES $31B-$35B

The largest number of charging ports will be needed at depots, where fleet vehicles can charge for longer periods, usually overnight. An estimated 470-560K depot-charging ports with power levels ranging from 10 kilowatts (kW) to 150kW will be required.

ON-ROAD CHARGING FOR LONG-HAUL TRUCKS $62B-$124B

Long-haul trucks' charging needs can be met cost effectively through a mix of 350kW electrified parking spaces that can refuel trucks during drivers' mandated 10-hour breaks; and 1-2 megawatt (MW) ultra-high powered charging stations for faster en-route charging (forecasted to take 50 minutes to fill daily energy needs at 2MW). Though vehicles able to support long-haul routes are still in development, these charging sites will need early investment commitments because of long project and utility lead times. Atlas's estimates represent commitments required by 2030 to facilitate project siting, planning, permitting, and utility upgrades to support long-haul vehicle adoption through 2035.

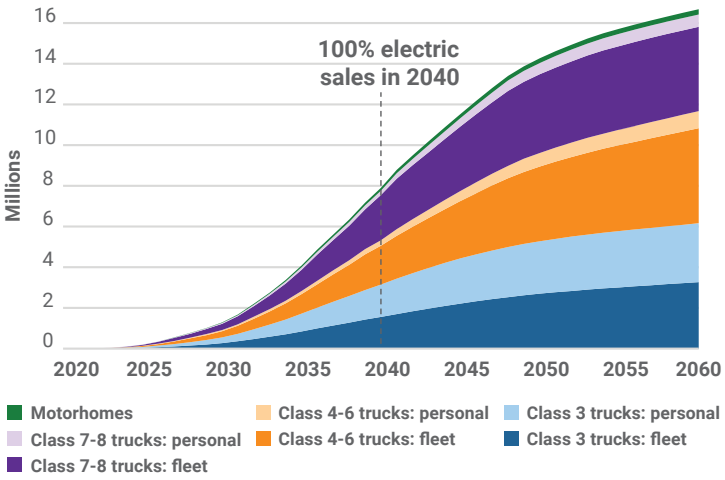
ON-ROAD CHARGING FOR OTHER TRUCKS $3B-$10B

Personally-owned trucks too large to be parked at home will likely require on-road charging, and some en-route charging support for fleet vehicles is also expected. Costs for on-road charging for these trucks will depend on the percentage of fleet truck charging that happens en-route versus at depots, the mix of 150kW and 350kW charging ports, and most significantly the utilization rate of charging ports.

AT-HOME CHARGING FOR CLASS 3 TRUCKS $600M

As with car and light-truck electrification, some investment in home charging will be needed to support adoption of individually-owned class 3 trucks, mostly large pick-ups.

Cumulative modeled electric trucks through 2060



FOCUSED INVESTMENTANDTARGETED POLICIES CAN KEEP COSTS DOWN

The two scenarios included in the analysis reveal different levers to keep costs down.

Increasing utilization of charging ports can substantially reduce investment needs. Utilization at depots can be increased using chargers or software that enable sequenced or simultaneous charging, or by physically moving vehicles to share charging ports. Utilization of on-road chargers can be increased by first targeting charging to high-traffic routes, and by using technology to allow long-haul drivers to reserve electrified parking spaces. Planning for charging stations that can accommodate several vehicle types will also be key -- for example, serving larger (class 3) pickups and motorhomes at the same sites as light-duty vehicles, and serving multiple medium- and heavy-duty vehicle types at the same site.

Policies and incentives that encourage right-sizing of depot equipment can also reduce needed investments.

Additional detail on findings and methodology is available online at: **https://atlaspolicy.com/u-s-medium-and-heavy-duty-truck-electrification-infrastructure-assessment**

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ATLAS PUBLIC POLICY

1 https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions; International Council on Clean Transportation (ICCT), 2021, "Infrastructure to support a 100% zero-emission tractor-trailer fleet in the United States by 2040"

2 https://www.lung.org/clean-air/outdoors/who-is-at-risk/highways

3 U.S. Environmental Protection Agency, "Final Rule: Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles–Phase 2." Federal Register / Vol. 81, No. 206, October 25, 2016. https://www.gpo.gov/fdsys/pkg/FR-2016-10-25/pdf/2016-21203.pdf.

4 The analysis assumes that zero-emission vehicle goals will be met by battery electric vehicles, and does not model potential hydrogen vehicle alternatives. It also assumes that battery electric truck technologies continue to improve, enabling an expansion of electrification to include all truck types.

5 See a) ICCT, 2019, "Estimating the infrastructure needs and costs for the launch of zero-emission trucks", b) NREL 2021 "Spatial and Temporal Analysis of the TCO for Class 8 Tractors and Class 4 Parcel Delivery Trucks", c) Argonne National Lab 2021,"Electric Truck Economic Feasibility Analysis." d) Luskin Center for Innovation 2019, "Zero Emission Drayage Trucks: Challenges and Opportunities at the San Pedro Bay Ports".