



The Road to Transportation Decarbonization:

Understanding Grid Impacts of Electric Fleets

Fleet electrification is a major opportunity

The transportation sector is the largest source of greenhouse gas emissions in the United States. The transition to electric vehicles will be an essential element of our path forward to meet climate goals. While much attention has focused on passenger vehicles, the electrification of fleet vehicles such as trucks, delivery vans, and buses presents a huge opportunity to reduce emissions. These medium- and heavy-duty vehicles (MHDVs) can emit up to 30 times the amount of carbon dioxide as a typical passenger vehicle, and as much as 150 times as much harmful particulate matter pollution in nearby communities. Electrifying fleets will reduce air and noise pollution in these impacted neighborhoods, particularly those near industrial or high-traffic areas, often classified as environmental justice communities.

Communities aren't the only ones who will benefit: when factoring in the lower cost of maintenance and fuel, the total cost of ownership of EVs (including many fleet vehicles) is on par with or better than that of internal combustion engine vehicles. That cost profile is only expected to improve over time. Fleet electrification will likely be a growing area of focus for policymakers and utilities. Not only does the business case for electric MHDVs make sense—fleet electrification will also help states meet climate goals and provide access to clean public transportation through electric city and school buses.

The fleet electrification challenge – and what's needed to meet it

What will large-scale fleet electrification mean for the electric grid? Large bus, trucking, or delivery fleets could demand a lot of power all at once and in specific locations. A piecemeal approach to electrifying fleets could strain distribution and transmission grids, cost more than a more proactive approach, and slow fleet electrification if the right infrastructure isn't put in place and at the right time.

National Grid and Hitachi Energy conducted an analysis to determine the grid impacts of electrifying fleet vehicles, focusing on a Top 100 metro region in the United States. The resulting study seeks to provide an understanding of how differences in fleet locations, usage patterns, fleet sizes, vehicle types, and/or charging patterns impact specific portions of distribution or transmission systems. The study identified more than 50 fleets currently operating in the metro area, analyzed their potential charging behavior and power needs if they fully electrified their vehicles, and mapped those fleets to a specific portion of National Grid's distribution system. This study offers an early look at how large-scale, fully electric fleets might impact an actual part of our electric grid.

Findings: Fleet electrification requires strong collaboration and proactive planning

Impacts will vary substantially at different parts of the electric grid. That's because fleets are often "clustered" in specific geographic areas. For instance, the analysis identified two distribution feeders (the electric circuit to commercial or residential customers) which might eventually need to support more than 400 fleet vehicles.

Where fleets are "clustered", new load from electric MHDVs could eventually exceed the electric grid's current capabilities, meaning upgrades will be needed to enable fleet electrification. At one substation (which is where the higher voltage and lower voltage electric systems meet), fully electric fleets could increase peak load by over 60 percent.

These potential impacts suggest that there is an immediate opportunity to proactively plan for and invest in infrastructure upgrades or other solutions to serve this new electric load.

Planning for these changes requires collaboration between utilities and fleet operators, since every fleet will have different needs. For instance, school buses and freight trucks will likely use different chargers and charge on different schedules. The study demonstrates how different charging strategies can reduce impacts from fleet charging, suggesting that managed charging programs can support EV adoption.

This study does not identify specific solutions, upgrades, costs, or timelines, but instead provides a "bottom-up" view of the potential impacts of future fleet electrification – and a foundation for future analysis and collaboration among stakeholders.

We can work together to make electric fleets a reality

What needs to happen to deliver a rapid, well-coordinated, and least-cost transition to electric fleets?

- Utilities, system operators, and policymakers can work together to forecast and plan for the medium- and long-term impacts of fleet electrification, and to develop and implement solutions.

Opportunity: Develop processes and plans for the needs of multiple fleets and proactive, comprehensive solutions that benefit multiple parties over the long term.

- Meeting fleet needs will require an "end-to-end" approach: solutions should include transmission, distribution, distributed energy resources like storage, and charging programs.

Opportunity: Conduct detailed analyses of system needs and evaluation of solutions, with a view to minimizing long-term cost and increasing near-term electrification.

- Fleet electrification must be considered in tandem with other needs (such as asset condition) to increase efficiency and reduce costs.

Opportunity: Develop comprehensive views of grid impacts, needs, benefits, and costs when assessing system needs and solutions

- Implementing these solutions will require collaboration across multiple stakeholders, including utilities, regulators and policymakers, fleet operators, suppliers, and communities.

Opportunity: Form partnerships to better share data (e.g., vehicle operating data and electrification schedules) to understand timing and magnitude of impacts.

Electrifying medium- and heavy-duty vehicles is a major opportunity to act on climate and reduce local pollution in affected communities. The time to act is now.

Want to learn more? Read the full study at ngrid.com/fleet-electrification-study.

Electric fleets: a win for climate, communities, and businesses

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Why is the electrification of fleet vehicles important?

Electrifying trucks, vans, and buses will help decarbonize transportation and reduce pollution in affected communities

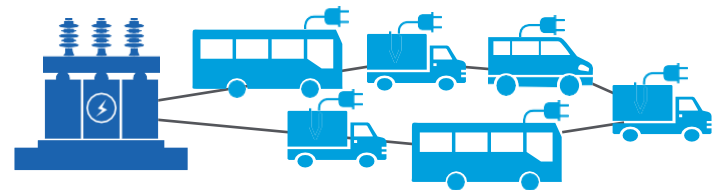
Over **25%** of on-road emissions come from medium- and heavy-duty vehicles (MHDV)

A fleet vehicle emits up to **150X** as much PM2.5 pollution as a passenger car



How might fully electric fleets impact the electric grid?

Fleets often “cluster” in certain geographic areas. Impacts will vary, but some distribution feeders may eventually need to support the charging needs of hundreds of fully electric fleet vehicles.



On areas of the grid where fleets are “clustered,” long-term impacts could be substantial — in some areas, peak load could increase by

60%



How can we prepare the grid for electric fleets?



Start planning now for long-term impacts of electric fleets
Addressing fleet needs will require proactive, collaborative planning



Evaluate multiple solutions
Including transmission and distribution investments that meet the needs of multiple fleets



Work together to accelerate the electric fleet transition
We're here to help — email us at EVGridStudy@nationalgrid.com