Fleet Electrification Services

Benefits of EV Adoption

Plug-in electric vehicles (EVs), including all-electric and plug-in hybrid models offer many benefits for fleet vehicle operators. While upfront costs can be higher, EVs generally offer lower operating costs and significant environmental benefits compared to internal combustion engine vehicles. More information on cost of ownership, environmental performance and common fleet electrification question are covered below.

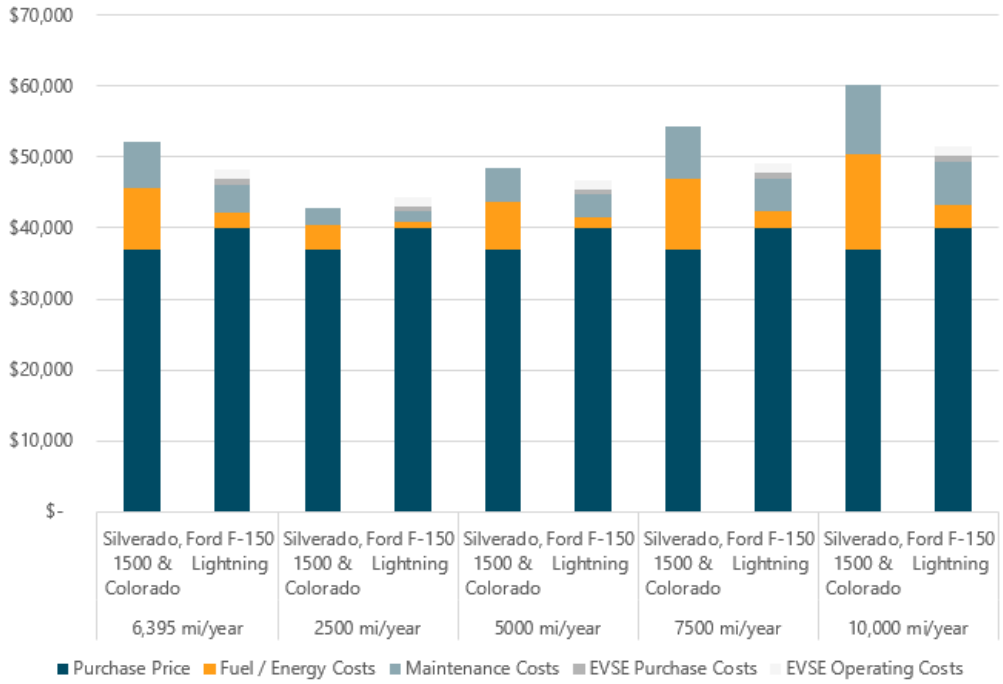
Total Cost of Ownership

According to the U.S. Department of Energy (DOE), "in addition to federal, state, or local incentives that can lower their purchase price, EVs offer high fuel economy, which translates to lower operating cost. EVs achieve their best fuel economy during stop-and-go driving conditions typical of many fleet applications. Electricity prices are also less volatile than those of gasoline/diesel, making it easier to predict fuel costs over time. Finally, lower off-peak electric rates may be available for charging, which further reduces EVs fuel costs."[1] These factors may result in a lower total cost of ownership for EVs compared to gas-powered vehicle options.

Total cost of ownership refers to the purchase price of a particular asset, plus operating costs, over the asset's lifespan.[2] This metric can be calculated on a per mile and per vehicle basis. An example of fleet electrification total ownership analysis cost per vehicle is shown in Figure 1 below. Champlain Water District (CWD) worked with VEIC on a fleet electrification study in 2022 that focused on total cost of ownership between a Ford F-150 Lightning (EV light-duty pickup truck) and a Chevrolet Silverado 1500 / Chevrolet Colorado gasoline-powered trucks. As shown in Figure 1, based on the average annual miles traveled (6,395 mi), the Ford F-150 Lightning is most cost effective for CWD's light-duty pickup trucks with a net savings of $4,674 over the lifetime of each vehicle – due to lower fuel/energy costs and maintenance costs. Figure 1 also shows how lifetime savings for the F-150 Lightning increase as annual mileage increases up to 10,000 miles.

[1] Alternative Fuels Data Center: Electric Vehicles for Fleets (energy.gov)
[2] Total Cost of Ownership: How It's Calculated With Example (investopedia.com)

Figure 1. Lifetime total cost of ownership for Ford F-150 Lightning compared to a Chevy gasoline-powered full-size pickup truck. Graph courtesy of Champlain Water District EV Fleet Study Report.



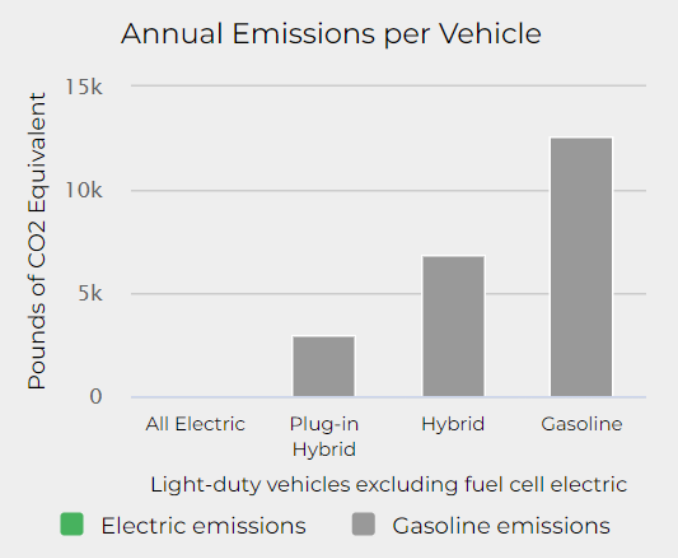
Emissions Reductions

According to the DOE, all-electric vehicles have zero tailpipe greenhouse gas (GHG) emissions, but electricity production, such as power plants, may generate "upstream" emissions.[3] In regions with relatively low-polluting energy sources for electricity generation, EVs typically have a larger life cycle emissions advantage over vehicles that run on gasoline or diesel. In areas with higher-emissions electricity, EVs may not demonstrate as strong a life cycle emissions benefit.[4]

Vermont uses relatively low-polluting sources to generate electricity. According to the Energy Information Administration (EIA), "Vermont generated almost 100% of its electricity from renewable resources, a larger share than any other state" in 2021.[5] Figure 2, below, shows averages for emissions reductions per vehicle type in Vermont. All-electric light-duty vehicles emit nearly 13,000 pounds of CO2 less per vehicle compared with gasoline light-duty vehicles.[6]

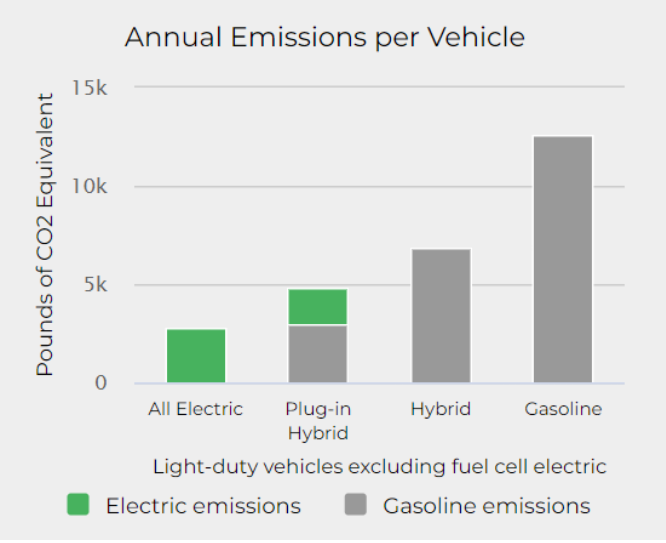
[3] Alternative Fuels Data Center: Emissions from Electric Vehicles (energy.gov)
[4] Alternative Fuels Data Center: Electric Vehicles for Fleets (energy.gov)
[5] https://www.eia.gov/state/?sid=VT#:~:text=In%202021%2C%20Vermont%20generated%20almost,came%20from%20conventional%20hydroelectric%20power.
[6] Alternative Fuels Data Center: Vehicle Cost Calculator (energy.gov)

Figure 2. Vermont annual emissions per vehicle based on 2021 EIA data.



It should be noted that Vermont imports a portion of the State's electric generation, which may not be considered in Figure 2, above. It is interesting to compare the Vermont emissions data in Figure 2 with national emissions data shown in Figure 3 below, because going all electric in Vermont is even cleaner than the national grid.

Figure 3. National emissions per vehicle based on 2021 EIA data.



Tools to Evaluate TCO and Emissions Reductions

The AFLEET tool developed by the Argonne National Laboratory can be used to estimate petroleum use, greenhouse gas (GHG) emissions, air pollutant emissions, and cost of ownership of light-duty and heavy-duty vehicles.

Additionally, the U.S. Alternative Fuels Data Center (AFDC) developed a Vehicle Cost Calculator that uses basic information about driving habits to calculate total cost of ownership and emissions for makes and models of most vehicles.

Finally, the Electrification Coalition developed a Dashboard for Rapid Vehicle Electrification (DRVE) tool with Atlas Public Policy that allows users to upload simple fleet data into an Excel-based tool. Users can analyze and assess the best fit for EV deployment, reducing time spent on traditional fleet analysis work.

Recommended Vehicle Use Types

Light-duty electric vehicles have been around since the end of the 19th century, but they've become especially valuable to fleets in the past few years.[7] These vehicles range from plug-in hybrid to all-electric vehicles, and most major car manufacturers now offer EVs.[8]

Electric vehicles are more abundant than ever before across different use cases. For example, medium and heavy-duty vehicles are rolling out for customers ranging from utilities to school districts. In the not-so-distant future, electric options are also expected to become more widely available in "off-road" transportation sectors, such as electric farm tractors, snowmobiles, and boats.

Common Fleet Electrification Q&A

In terms of performance and range, what should I expect from an electric vehicle in the winter?

Drive Electric Vermont has a deep dive on light-duty electric vehicles in winter here. As this blog post states, "Cold weather reduces efficiency of all vehicle types, not just EVs. According to FuelEconomy.gov, conventional gasoline vehicles typically have a 20% reduction in fuel economy at 20° F. However, it is often more noticeable with an EV and is especially concerning for all-electric vehicle drivers who may see up to 50% less range in the coldest Vermont conditions." This is due in large part to the need to keep the vehicle warm, draining the battery and reducing vehicle range. For this reason, it is recommended to keep your vehicle plugged in

[7] Timeline: History of the Electric Car | Department of Energy
[8] Automakers Are Adding Electric Vehicles to Lineups - Consumer Reports

and charged whenever possible. Medium and heavy-duty electric vehicles using current technology are expected to be impacted in similar ways under cold weather conditions.

For more information on specific EVs that perform well in winter conditions, news sources such as US News and Consumer Reports regularly test and make recommendations on the best vehicles for winter conditions. The U.S. Department of Energy offers other recommendations to improve fuel economy in cold weather conditions, such as minimizing idling and whenever possible, parking in warm places such as car garages.

What are common operational issues to consider when thinking about EVs?

In addition to the operational concerns related to winter driving outlined above, other common issues are related to charging and charging infrastructure, battery life, service and maintenance, and staff training. In terms of fuel economy, electric drive components are highly efficient and considerably reduce fuel costs. According to the DOE, "...fuel economy of medium- and heavy-duty all-electric vehicles and [plug-in hybrid electric vehicles] is highly dependent on the load carried and the duty cycle, but in the right applications, all-electric vehicles maintain a strong fuel-to-cost advantage over their conventional counterparts." In terms of charging infrastructure, it is important to determine on-site charging and enroute charging needs, which are discussed in more detail below. In terms of battery life, manufacturers typically warranty light duty EV batteries for at least 8 years / 100,000 miles (whichever comes first) and predictive modeling by the National Renewable Energy Laboratory indicates that "today's batteries may last 12 to 15 years in moderate climates (8 to 12 years in extreme climates)."[9] It is important to note that EV batteries are at risk of catching fire, however, a recent study indicates that EVs have a lower fire risk compared to gasoline and traditional hybrid vehicles.

Service and maintenance can be hard to compare between conventional vehicles and EVs. However, a recent U.S. Department of Energy Office of Scientific and Technical Information study found battery electric vehicles (BEV) have scheduled maintenance cost of $6.01 cents/mile compared to internal combustion engine (ICE) vehicles $10.1 cents/mile.[10] Much of this is driven by a *lack* of mechanical components that EVs have to maintain – such as engine oil, timing belts, oxygen sensors and spark plugs. Despite these benefits, it is important that fleet service technicians understand how to repair EVs and have a positive relationship with EV dealers. Finally, in terms of staff training, it is recommended that fleet drivers receive initial training on EV use and charging. This can help assuage driver concerns around EV range, charging access and operations, or other common questions.

What are important charging and facility considerations?

[9] Alternative Fuels Data Center: Electric Vehicle Benefits and Considerations (energy.gov)
[10] Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains (Technical Report) | OSTI.GOV

Gasoline powered conventional vehicles require gas stations for refueling. Electric vehicles have the flexibility to charge wherever electricity is available. To safely deliver energy to a vehicle's battery, a charging station, formally referred to as electric vehicle supply equipment (EVSE), is needed. Drivers can charge on site, usually overnight, or enroute during regular operations. Charging usually occurs at three "levels": level 1, level 2, and DC Fast Charging (DCFC, sometimes referred to as level 3). Each level relates to the speed of charging; level 1 charges at approximately 5 miles of range per 1 hour of charging whereas DCFC offers approximately 100 to 200+ miles of range in 30 minutes. It is worth noting DCFC charging is usually up to 80% state of charge before slowing significantly.[11] The DOE offers more information on charger types, plugs and infrastructure at this website.

Every charging and facility operation is different, and planning depends on a range of factors from vehicle siting to electrical needs to parking availability. For an overview of the process and benefits of fleet electrification, including additional tools and resources, DEV recommends reviewing this blueprint from the DOE on Electric Vehicles and Fleet Electrification.

One area of increased focus is charger reliability. Reliability relates to how often chargers are functioning properly and "in service." As EV usage expands, it is critical to have reliable charging for drivers. When working with EVSE installers, fleets should consider holding vendors to certain service level agreements (SLAs) such as minimal charger downtime and agreed upon service times. Furthermore, fleets may want to install additional charging infrastructure to serve as a backup, especially for essential vehicles. Finally, fleets should be aware of local public charging options in case of facility power outages or other emergency situations.

How can fleets maintain resilient operations with EVs?

Developing resilient operations in the face of an emergency, such as a multi-day electrical grid power outage, starts with planning and adopting multiple strategies. Adding EVs to your fleet is no different, and fleet managers should develop solutions to fit their resiliency needs. A few examples might be (a) multiple connections to the grid across the major charging hubs of a region to provide redundancy; (b) right-sized backup generators (e.g. diesel, bio/renewable diesel, compressed natural gas); (c) battery storage with or without a microgrid associated with renewable generation; and/or (d) maintaining a portion of the fleet as gas/diesel powered that could cover basic operations under extended power outage. VEIC recommends large fleet managers consult their electric utility and other relevant stakeholders while developing resiliency strategies and before finalizing operational plans.

What are end of life considerations for EVs?

[11] Lithium-ion battery fast charging: A review - ScienceDirect

Many of the end-of-life considerations for EVs are the same as conventional vehicles. Fleet managers may consider vehicle performance, resale value, and operational needs. One key area of difference for EVs is batteries. As previously noted, one study found that today's batteries may last 12 to 15 years in moderate climates. However, EV batteries degrade over time and fleet managers may need to determine whether a battery should be replaced, sold, or recycled. Fortunately, the market for second-life batteries is growing, and EV battery technology and recycling is still improving. To learn more about old electric batteries and end of life vehicle opportunities, check out this Efficiency Vermont blog post.

What are the most affordable (and available) EV makes and models?

The most affordable and available EVs can shift over time depending on fleet needs and a range of factors from available incentives to market demand and supply. For new EVs, check out the Drive Electric Vermont website and fact sheet to compare models. For new and used EVs, Vermont dealerships can provide the most up to date information.

What are the most affordable (and available) EV chargers?

Just as with EV makes and models, EV charger availability and affordability depends on a range of factors. Level 2 chargers can charge vehicles between 12 to 80 miles each hour and tend to fit most light-duty fleet use cases. Independent research and consulting car or EVSE manufacturer websites are always recommended when determining what is the best EV charger for your vehicle and operational needs.[12]

How do I get in touch with Drive Electric Vermont if I want to learn more about EVs or transitioning my fleet?

Please take this survey to set up a time to speak with a at Drive Electric Vermont fleet or facility electrification specialist.

[12] Best Home EV Chargers for 2023, Tested - Car and Driver