Four Infrastructure Costs to Consider When Electrifying Medium and Heavy-Duty Fleets

Drive Electric MINNESOTA

Electrifying medium- and heavy-duty (MHD) vehicles present fleets with an opportunity to lower vehicle operating costs and emissions. Purchasing an electric vehicle (EV) is one of the many steps fleets take on the journey to electrification. Successfully integrating MHD EVs into fleets requires fleet managers to understand the fueling process and make the required investments for these vehicles. This fact sheet highlights the unique infrastructure costs of integrating MHD EVs in fleets.

In this fact sheet, we use the following classifications to differentiate each category:

Category	Classes	Weight Range	Examples
Medium-duty EVs	3 to 6	10,001 to 26,000 lbs	Heavy-duty pickup trucks, large panel vans, medium school buses, medium straight trucks
Heavy-duty EVs	7 & 8	Over 26,000 lbs	18-wheelers, class 7 school buses, transit buses, dump trucks, coach buses, refuse trucks

COST 1: UPFRONT COSTS

Before adding MHD EVs to a fleet, it's important to understand the types of chargers they can use and their associated costs.

- **Level 2 (L2) chargers:** L2 chargers are most commonly installed at depots or other places where fleet vehicles are parked for several hours. These chargers are appropriate for light- and medium-duty EVs that return to base every day and can complete their daily shift without additional charging. On average, L2 chargers cost between $2,700 and $24,000 per charger.[1]
- **Direct current fast chargers (DCFC):** DCFCs are versatile chargers that can support a variety of use cases. DCFCs can support overnight depot charging for MHD EVs with big battery packs that may require many hours to fuel fully, even with fast charging. These chargers can also be installed as opportunity chargers. Opportunity charging refers to the strategic placement of high-powered chargers to charge MHD EVs along their routes (e.g., an electric transit bus can recharge using DCFCs at bus stops).

  DCFCs can vary in power levels, ranging from 50 kilowatts (kW) up to 350 kW. Depending on the power level, the units can range between $28,000 and $150,000 per charger, and installation costs can range between $17,692 and $138,200 per charger. Other factors, like trenching and electricity upgrades, also impact installation costs.[2]

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[1] "Electric Vehicle Charging Infrastructure Costs," ICF, last modified January 1, 2023, https://www.icf.com/insights/transportation/electric-vehicle-charging-infrastructure-costs.

[2] "Electric Vehicle Charging Infrastructure Costs," ICF, last modified January 1, 2023, https://www.icf.com/insights/transportation/electric-vehicle-charging-infrastructure-costs.

- **Megawatt chargers:** Megawatt chargers are very high-powered charging systems designed for heavy-duty EVs like trucks and buses. They deliver up to 3.75 megawatts (MW) of power—over 10 times faster than DCFC chargers—to rapidly recharge large batteries. These chargers are still being developed, and commercial options do not exist. Once the technology improves, they can be installed at depots or used as opportunity chargers. Primary uses include enabling long-haul electric trucking, reducing downtime for commercial fleets, and supporting public transit electrification by allowing buses to charge during short stops.

Electricity upgrades

Adding chargers will likely require electricity upgrades, which may increase costs and significantly prolong the installation. Without proper planning, the concentrated demand from a large fleet of EVs being charged simultaneously with high-powered chargers can overload distribution transformers, substations, and power lines.

- **Customer investments:** Include required electrical panel upgrades, trenching, conduits, and wiring modifications to handle high-power EV charging loads.
- **Utility investments:** Include upgrading transformers and distribution lines and making other substation-level upgrades to handle increased demand from charging stations.

According to the California Electric Transportation Coalition, a 5 MW DCFC site, enough to support more than 50 MHD EVs, is highly likely to trigger a secondary distribution upgrade worth $150,000 and may additionally require a primary distribution upgrade costing $6 million or a substation upgrade costing $1–9 million.[3]

Working with utilities early and often ensures that adequate upgrades are made before the vehicles are put into operation. Utilities will often share some upgrade costs with fleets.

Factors influencing upfront costs

The scale and complexity of investment in charging infrastructure can vary greatly depending on several factors, including the following:

- **Fleet size:** As the number of vehicles in the fleet increases, so will the energy demand. Fleets may have to add more chargers, increase the power levels for existing chargers, or share the chargers between vehicles.
- **Type of MHD EV:** Smaller MHD EVs, like electric pickup trucks and delivery vans, can use lower-powered chargers (e.g., L2), like passenger EVs, to reach full charge. Larger MHD EVs, like tractor-trailers, will often require DCFCs to reach full charge within a reasonable timeframe.
- **Duty cycle:** Factors such as daily mileage, route types, and parking times determine the energy needs and charging duration. Vehicles with long idle periods can use slower, less expensive chargers, while those with back-to-back shifts may require high-powered, more expensive chargers to minimize downtime.
    - **Charger location:** The duty cycle for the vehicle determines whether a vehicle can be charged at the depot or if it will need high-powered opportunity chargers along its route. Opportunity charging can be expensive and complex because it involves purchasing multiple high-powered chargers and coordinating with utilities, site hosts, and partners to develop multiple charging sites.

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[3] "The Infrastructure Needs and Costs for 5 Million Light-Duty Electric Vehicles in California by 2030," CalETC, June 2020, https://caletc.com/wp-content/uploads/2024/03/EV-infrastructure-study-white-paper-FINAL.pdf.

- **Charging method:** There are several EV charging technologies available for fleets today. Costs can vary significantly, even when delivering the same amount of energy, depending on the technology used to provide the charging session.
    - **Wired chargers:** Wired chargers are the most common, reliable, and cheap form of charging available for EVs. However, they can only be used by one vehicle at a time, and the vehicle must be stationary.
    - **Pantograph chargers:** These chargers use overhead wires to supply electricity to vehicles, such as electric trucks or buses, that are equipped with a pantograph that contacts the wires to draw power. This system is often used for vehicles on fixed routes, like public transit. The system can be expensive to set up, but it allows electric fleets to operate cheaper vehicles with smaller batteries since they can charge more frequently along their routes.
    - **Wireless chargers:** Also known as inductive charging, this method uses electromagnetic fields to transfer energy between a pad on the ground and a receiver on the vehicle. These chargers offer seamless charging for vehicles driven or parked on surfaces supporting wireless charging. Wireless charging can also be more expensive upfront, as portions of the road surface may have to be repaved, and additional electricity service may have to be redirected to the routes where wireless charging is installed.

      A pilot program in Michigan has embedded these chargers in the pavement and is currently testing the EV charging roadways in real-world conditions.[4] A team of researchers in Indiana is also working on a Dynamic Wireless Power Transfer (DWPT) project, which will allow electric vehicles to receive power of up to 200 kW directly from the roadway while in motion.[5]

Lowering upfront costs

Many utilities provide incentives for fleets to purchase and install smart L2 chargers. Additionally, the IRS offers the Alternative Fuel Vehicle Refueling Property Tax Credit for fleets that install EV charging equipment in eligible low-income community census tracts. Fleets can receive a rebate of up to $100,000 for each qualified item of property.[6]

Refer to our Electric Vehicle Incentives Database for information about current incentives available in Minnesota.[7]

COST 2: MAINTENANCE AND NETWORKING COSTS

As with all technology, charging stations require regular maintenance to perform in optimum condition. Most charging providers offer warranties or maintenance packages for chargers. Maintenance packages usually include annual inspections, preventative maintenance, repairs and replacement, and technical support for troubleshooting. They also usually include a commitment to response time, time for a given repair, and an overall uptime requirement. Fleet owners may also contract third party companies for maintenance and repair work. According to the Alternative Fuels Data Center, the annual cost for

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4 "MDOT, City of Detroit, and Electreon Unveil the Nation's First Public EV Charging Roadway at MI Central," Michigan Department of Transportation, last modified November 29, 2023, https://www.michigan.gov/mdot/news-outreach/pressreleases/2023/11/29/mdot-city-of-detroit-and-electreon-unveil-the-nations-first-public-ev-charging-roadway-at-mi-central.

5 "Purdue University Researchers Win IEEE Award for Highway Charging Technology," Elmore Family School of Electrical and Computer Engineering, May 29, 2025, https://engineering.purdue.edu/ECE/News/2025/purdue-researchers-win-ieee-award-for-highway-charging-technology.

6 "Alternative Fuel Vehicle Refueling Property Credit," Internal Revenue Service, last modified January 1, 2023, https://www.irs.gov/credits-deductions/alternative-fuel-vehicle-refueling-property-credit#who.

7 DEMN Electric Vehicle Incentives Database, Drive Electric Minnesota, Charging Incentive, accessed January 3, 2024, https://driveelectricmn.org/incentives/.

maintenance packages is up to $400 for L2 chargers and over $800 for DCFC.[8]

Networking costs are often included in warranties and maintenance plans. EV charger networking connects charging stations to software platforms for access control and performance monitoring.

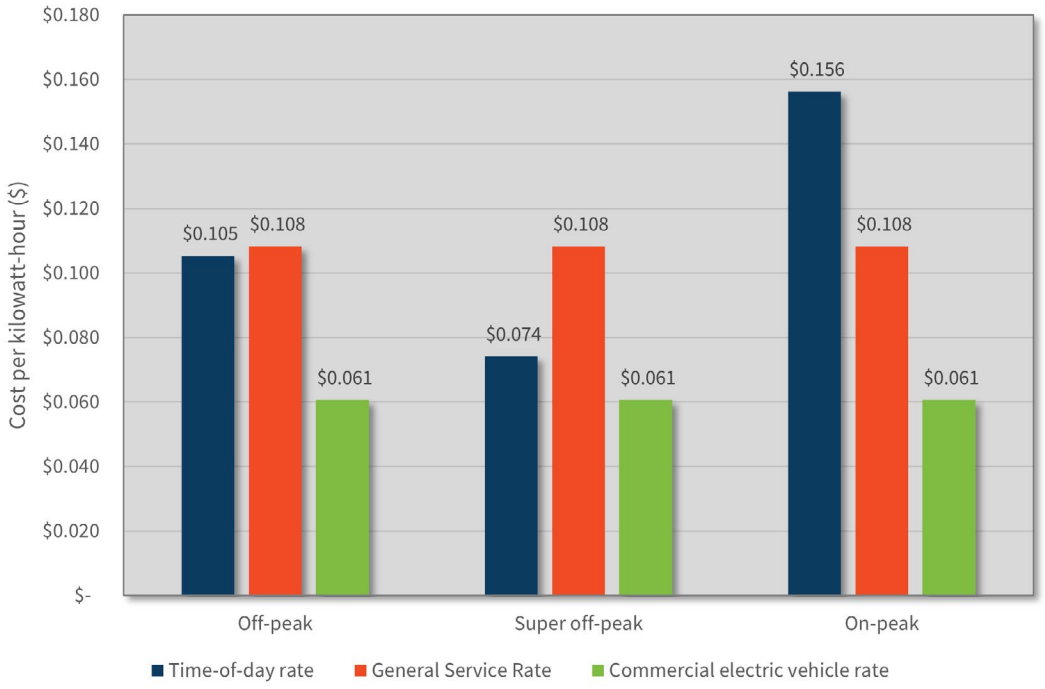
COST 3: ENERGY CHARGES

The energy cost used to charge MHD EVs varies by region, utility, and even the time of day. Most utilities offer time of use, off-peak, or EV-specific rates to incentivize customers to use electricity when there is less demand on the electric grid. With these rates, utilities provide electricity at lower rates during off-peak hours when demand is low (e.g., overnight) or there is more supply (e.g., through solar panels during the day) and higher rates for electricity sold during peak hours when the demand may exceed the electricity supply and constrain the grid. This incentivizes users to shift their electricity consumption to off-peak hours.

Most utilities also offer commercial rates for commercial customers. These rates offer cheaper energy rates to qualified commercial customers.

Fleets can take advantage of commercial rates and time of use programs to save on fuel costs. EVs and smart chargers can be programmed to charge vehicles when utilities offer the lowest rates. As an example, figure 1 shows the pricing structure for Minnesota Power's commercial rates.

Figure 1. Minnesota Power's commercial electric vehicle rate compared to its time of day rates



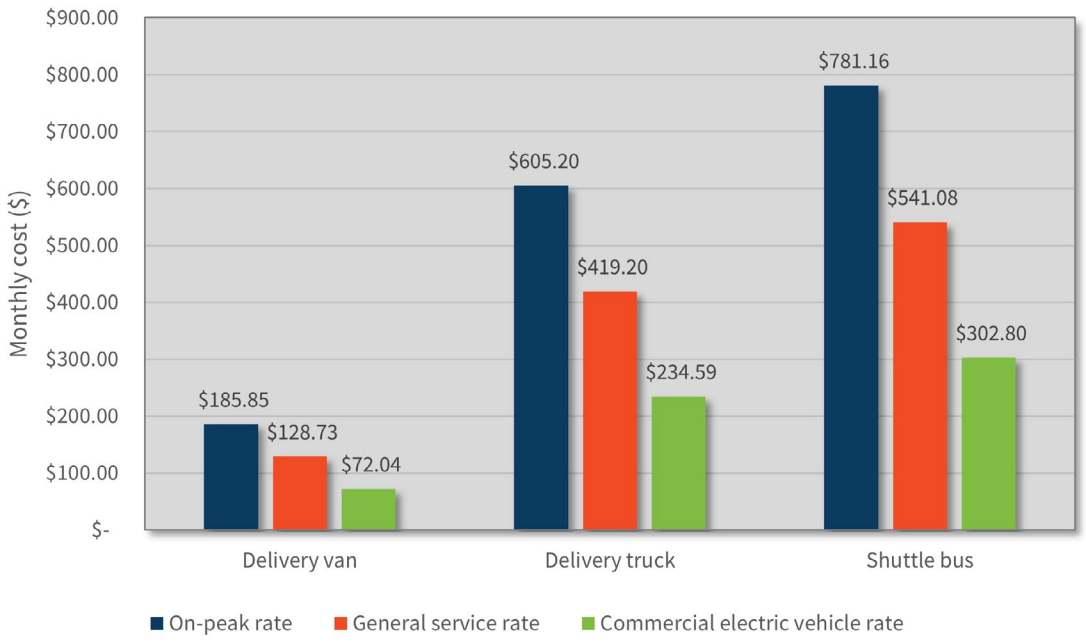
Source: Data from Minnesota Power.

Figure 2 shows the costs associated with charging fleet vehicles in Minnesota Power's service territory according to the various programs and rates offered by the utility. The figure shows that by choosing the appropriate program, fleet managers can cut their energy charges by more than half.

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[8] "Electricity Infrastructure Maintenance and Operation," U.S. Department of Energy, last modified January 1, 2023, https://afdc.energy.gov/fuels/electricity-infrastructure-maintenance-and-operation.

Figure 2. Estimated monthly cost to charge on a commercial electric vehicle rate versus an on-peak rate



Note: The costs are based on applying Minnesota Power's rates to the annual miles and powertrain efficiency data for each medium- and heavy-duty vehicle as stated in the Environmental Defense Fund report *Medium- & Heavy-Duty Vehicles: Market structure, Environmental Impact, and EV Readiness.*

Sources: Electricity rate data from Minnesota Power; Environmental Defense Fund, *Medium- and Heavy-Duty Vehicles: Market structure, Environmental Impact, and EV Readiness*, July 22, 2021, https://www.edf.org/sites/default/files/documents/EDFMHDVEVFeasibilityReport22jul21.pdf.

COST 4: DEMAND CHARGES

Demand charges are fees imposed by electric utilities based on the highest level of power, measured in kW, and a customer draws from the grid during a specific interval. Unlike standard energy charges that are based on total electricity consumed, usually measured in kW-hours, demand charges reflect the peak rate of electricity use, regardless of how long that peak lasts. The demand charge can vary by utility but is usually above $10 per kW. Demand charges help utilities recover the costs of maintaining and upgrading infrastructure to meet customers' maximum power needs, not just their average usage.



Demand charges can be a large part of a fleet's electric bill without taking measures to control them. For example, let's say that a utility's demand limit is 500 kW, and the demand charge rate is $20 per kW. If a fleet plugs in two vehicles to charge at 300 kW each, the combined demand of 600 kW will exceed the demand limit by 100 kW, incurring a demand charge of $2,000, as shown in the example in Figure 3 below.

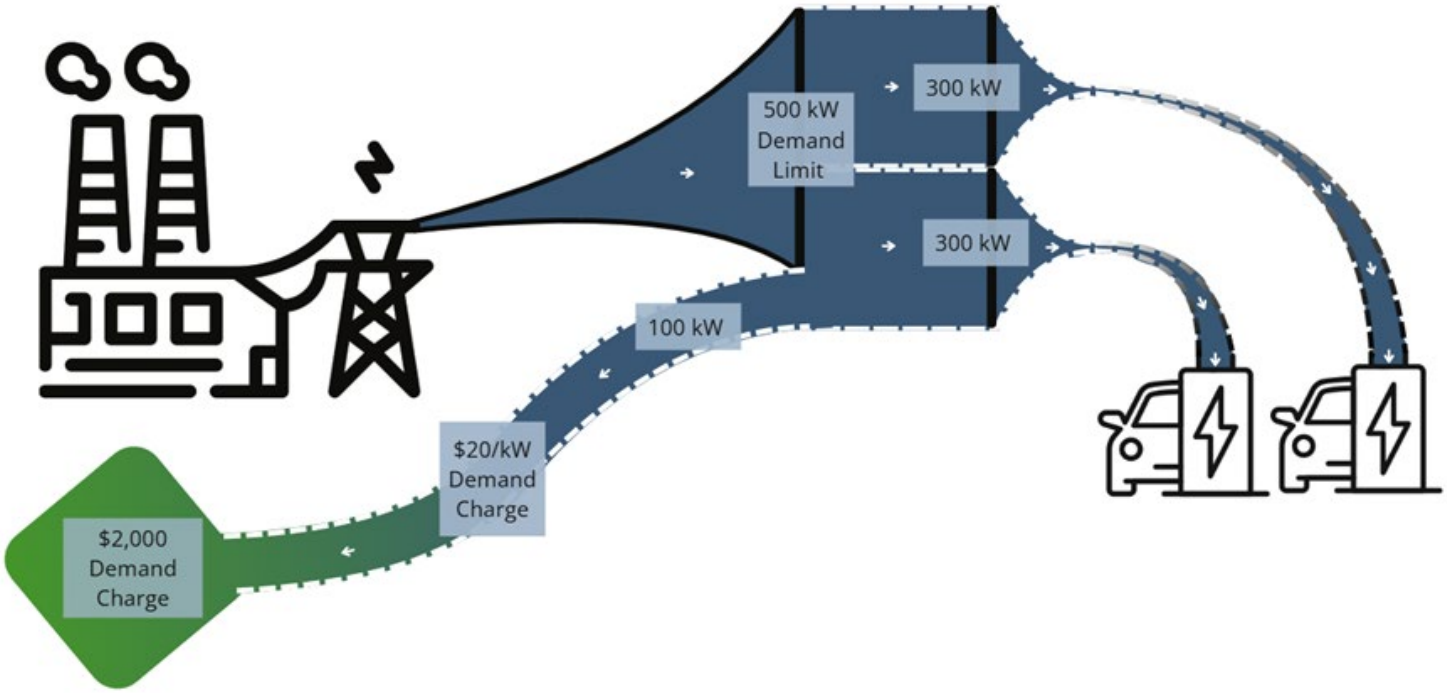


Figure 3. Estimated demand charges for a fleet with a demand of 600 kW when the utility's demand limit is 500kW.

Fleets and site hosts can avoid or reduce demand charges with the following:

- **Time of day demand charges:** Programs like Minnesota Power's Commercial Electric Vehicle rate offer price breaks for customers who shift their energy usage from high-demand, or on-peak hours, to lower-demand, or off-peak hours. The price break essentially removes the utility's demand limit during off-peak hours.
- **Energy management systems:** Smart chargers used in conjunction with EV fleet management software and vehicle telematics tracking can help fleets monitor and control energy usage and can help reduce peak demand.
- **On-site power generation:** Solar or wind generators can help reduce the energy drawn from the grid, shave peak demand from chargers, and mitigate demand charges.
- **Battery storage:** Using batteries on-site to store energy during off-peak times and discharge during peak times can mitigate demand charges.