Electricity Cost for Electric Vehicle Fast Charging

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Issue Statement

Chicken & Egg

Recharging infrastructure, including DC fast charging (DCFC), is needed to support plug-in electric vehicle adoption but low utilization is likely in the early phase.

Previous studies have shown that **DCFC can be more expensive** compared to residential or workplace charging, mainly for low-utilization stations.

Scope

- Review electricity cost for DCFC in the U.S.
- Explore technology solutions that can help make DCFC more affordable for EV drivers:
  - Co-locating DCFC with a commercial building
  - Solar PV and/or energy storage (batteries).

Methods

NREL's **REopt model** is used to optimize the integration and operation of behind-the-meter assets and determine the optimal combination, size, and dispatch strategy of PV, lithium-ion batteries, and grid-purchased electricity to minimize the lifetime cost of electricity consumption for a given DCFC station load, utility tariff, and solar resource.

Cost of electricity: based on thousands of existing commercial electricity rates from the Utility Rate Database.

Solar resource: NREL's PVWatts solar electricity production across the entire U.S.

Charging loads: two DCFC load scenarios based on insights from a convening of experts and current station design and use:

A. One 50 kW plug: 1–2 recharges per day, 8.8 kWh per charge, load factor: ~1%

B. Four 150 kW plugs: ~50 recharges per day, 38 kWh per charge, load factor: ~25%

REopt

Utility Rate DATABASE

Conclusions

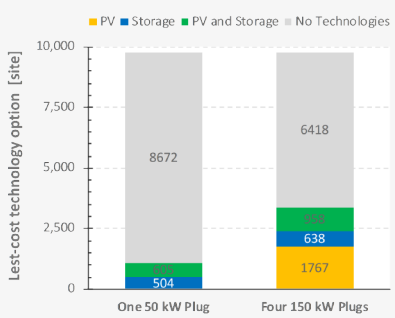
Demand Solution & Impact of Utilization

Based on over 7,000 commercial electricity rates currently available, electricity cost for DCFC varies greatly. In particular, at low electricity use, rates with demand charges show high average costs of electricity that decrease rapidly as utilization increases.

Engineering Solutions & Station Design

For many locations, these high costs can be mitigated by using technologies:

- ✓ Co-location with a commercial building load can help reduce electricity costs, but as the DCFC load increases the relative savings decrease.
- ✓ PV and energy storage (batteries) can provide cost-effective technology solutions to reduce electricity costs that could be passed on to consumers at locations with high costs for DCFC.



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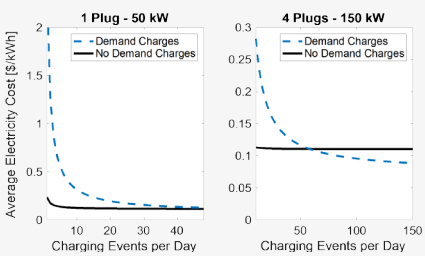
Results

Electricity Cost for DCFC

Based on data reported by major service providers in the United States, namely AeroVironment, Blink, EVgo, and Tesla, charging price for DCFC in the United States varies between less than $0.10/kWh to more than $1/kW, with an average of $0.35/kWh. This variation is due to different capital and O&M cost for different DCFC stations as well as different cost of electricity.

The cost of electricity varies significantly depending on location as well as usage levels:

- ➢ For rates with no demand charges, the station use minimally influences the electricity cost.
- ➢ For rates with demand charges, low electricity use (few charging events per day) leads to high costs of electricity that decrease very rapidly as utilization increases.

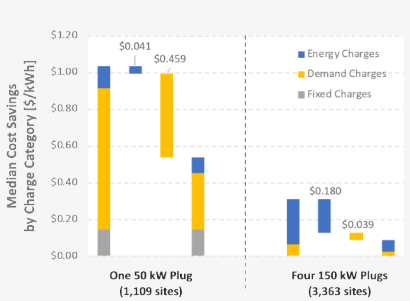


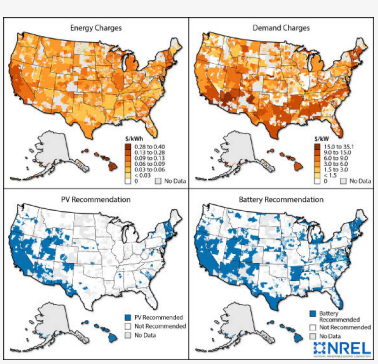
Technology Solutions to Mitigate Electricity Costs

- ➢ Co-location with a commercial building (DCFC behind the same meter) is often economically preferable, but relative savings diminish as the load increases.
- ➢ For over 7,500 electricity rates considered and different levels of solar resource, 11% to 35% of sites can significantly reduce lifetime electricity cost by installing PV and/or batteries, including capital cost of technologies.

Technology recommendations vary geographically mainly as a result of different electricity energy ($/kWh) and demand ($/kW) charges:

- ➢ Energy storage (battery) is effective at mitigating high demand charges due to its ability to shave peaks in demand.
- ➢ Photovoltaic (PV) can reduce electricity cost, even in areas with lower solar resource (e.g., Vermont), whenever PV-produced electricity is cheaper than grid purchases due to high electricity energy charges.





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