SEDAC
SMART ENERGY DESIGN ASSISTANCE CENTER

Electric Vehicle Charging Stations

February 2022

To address the challenges of rising gas prices, climate change, and dwindling fossil fuel resources, policymakers point to electrification as a potential solution. The transportation sector in particular exhibits great promise to reduce negative externalities and change the way people live and work.

Electric Vehicles (EVs) show increased energy efficiency compared to traditional internal combustion engine vehicles. **They produce nearly 75% fewer carbon emissions and other pollutants hazardous to human health, and they can save owners money**, whether as personal or work-related means of transportation. According to a 2020 Consumer Report, EVs save car owners $800-$1,000 annually due to their high energy efficiency and lower operating costs compared to conventional fuel-consuming cars.

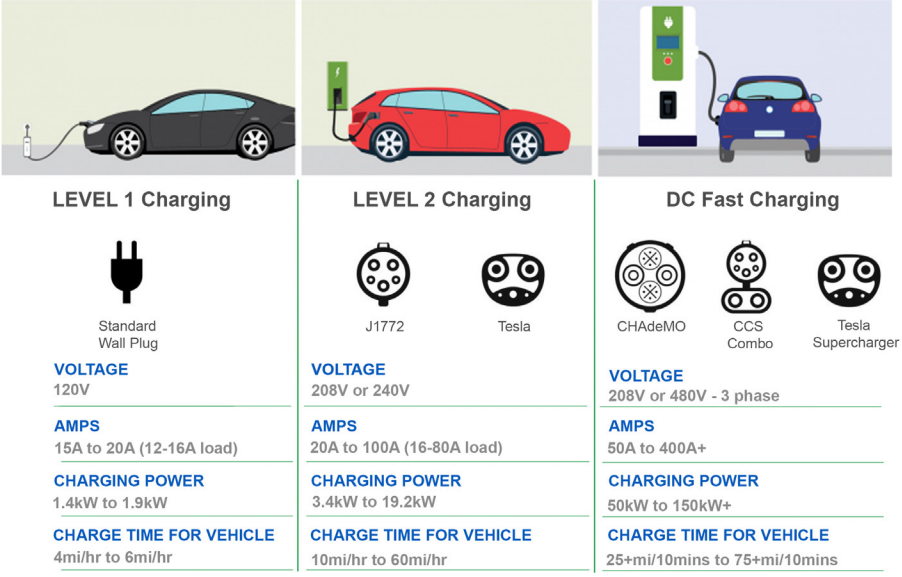
However, many people appear reluctant to purchase an EV due to concerns about driving range and charger availability. How can EVs rival the convenience of gas stations and mileage over long trips? EV charging stations play a vital role by recharging EV batteries whose relative size and capacity can limit driving range. With charging stations made widely available across the country, EVs can drive long distances even when they cannot be recharged at home overnight.

Types of EV Chargers

There are many different kinds of chargers—over 300 charging companies exist worldwide (Reuters 2022)—but they each make use of one of three different types of charging: Alternating Current (AC) Level 1, AC Level 2, or Direct Current (DC) Level 3 (also known as DC Fast Charging or DCFC). The higher the level, the faster the charging that occurs.

Level 1 charging utilizes standard wall plugs and most often occurs overnight in residential dwellings, when EVs aren't in use for long periods.

Level 2 charging uses J1772 plugs—except for Tesla—and suits office and commuter settings, where owners can leave their cars to charge for a few hours at a time.



Typical charging times and outlets for Level 1, Level 2, and Level 3 Fast Charging EV chargers

Level 3 Fast Charging is the nearest equivalent to pumping gas for a conventional combustion engine vehicle. Fast chargers yield full batteries the quickest, but technology and installation costs can be quite expensive. There are several different kinds of outlets for Level 3 Fast Charging. The CCS Combo is the most common outlet, as it is tied to the J1772 standard.

EV Charger Installation

Beyond charging levels, EV Supply Equipment (EVSE) comprises many different options, including:

- **Mounting** - simple roadside charging posts, wall chargers for use on buildings or in parking garages, and fully automated charging stations integrated with power distribution equipment;
- **Communications capabilities** - how "smart" chargers are (i.e., sending and receiving data and whether they are networked with other chargers);
- **Access control** - who gets to use the chargers; and
- **Point-of-sale functionality** - integration with electronic payment methods.

More advanced chargers can even monitor energy usage and demand response, as well as diagnose and automatically fix some issues. In general, the more features and connectivity a charger has, the more costly it will be. To date, a comprehensive 2015 Department of Energy (DOE) report provides the most robust data on technology and installation costs of EVSE. Its estimates remain accurate compared to more recent sources:

- Level 1 units cost between $300 - $1,500;
- Level 2 units cost between $400 - $6,500;
- Level 3 units cost between $10,000 - $40,000.

Charging posts for suitable placement roadside and in parking lots

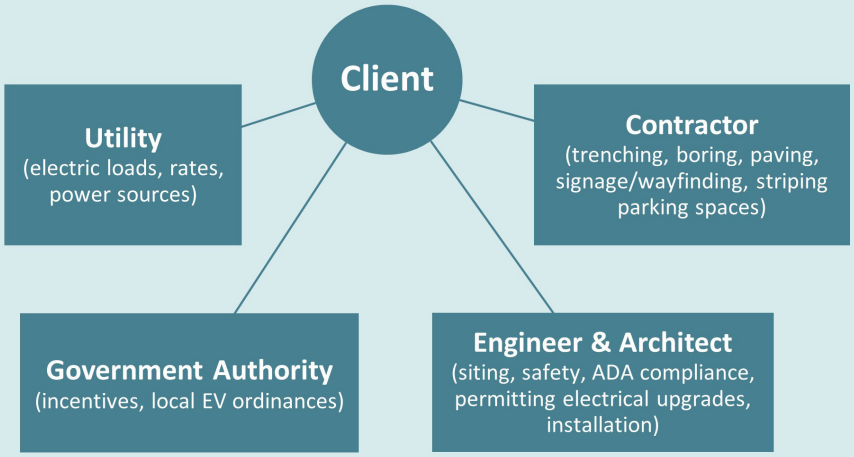
Installation costs are substantial compared to the charger itself. These costs vary widely depending on location, existing versus desired utility/electrical infrastructure, construction and labor, permitting, taxes, and availability of incentives. Trenching and boring for underground cable placement and installation of dedicated charger circuits—all but required for EVSE—immensely inflate pricing, so charger placement should take into account existing and future needs to avoid repeating expensive underground cable work and cost overruns due to lengthy cable connections, especially when digging into asphalt and concrete that may require resurfacing. Early planning with utility providers can ensure optimal designs that factor in usage and load capacity. Planning pays future dividends: most of the cost is in the supportive infrastructure. Plan for that, and it will likely support any number of future charger model upgrades with little extra cost. All told, the referenced 2015 DOE report estimates:

- Level 1 installation costs from $0 - $3,000;
- Level 2 installation costs from $600 - $12,700;
- Level 3 installation costs from $4,000 - $51,000.

Parking lot with EV charging stations

EVSE Planning Considerations

What are your needs? What kind of charger and how many? Do you plan to site for electrical capacity and future upgrades? Are you self-installing or hiring a firm?
Reach out to these entities early in your process:



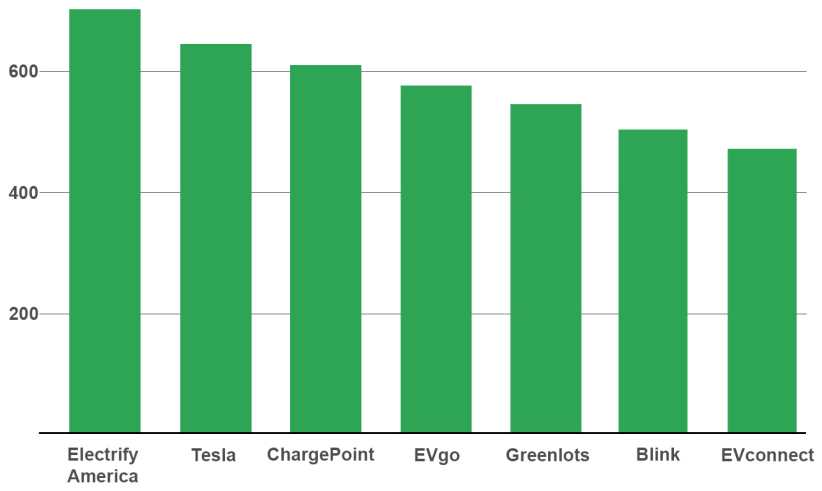
Funding EV Chargers

Fortunately, federal and state policymakers understand the need for expanding EVSE across the country, and many utilities provide incentives. The Biden Administration recently announced approximately **$18.6 billion in support of EVSE installation across the country. This historic investment includes $148.6 million in direct funding to Illinois**. Further, as part of the new Climate and Equitable Jobs Act (CEJA) passed in the Illinois General Assembly, the state plans to award **tax credits of up to 80% of the cost of EVSE to qualifying applicants**. Expect also new notices of funding opportunities from the Illinois Environmental Protection Agency (IEPA) as they look to invest $70,000,000 of their Driving a Cleaner Illinois Program funds on EV infrastructure projects.

Anyone interested in installing EVSE can find appropriate returns on their investment and help encourage the electrification of transportation. Granted, there are many variables to consider: available incentives; type of EVSE installed; chosen user fee structures (fee per hour, fee per kWh, or none at all); flexibility of fee payment (proprietary payment versus credit cards or e-payments); peak demand or time-of-use (TOU) costs charged by utilities; remote fault notification; and charges associated with network maintenance from the charging developers or operators. The key to finding this balance is research, proper planning, open and early communication with local utilities, and thorough siting to limit costs and enable future upgrades.

U.S. EV Charging Network Performance

Ranking of U.S. EV Charging providers on reliability, charging location and app performance on a maximum score of 1,000



Note: Test of randomly selected EV chargers in MI, OH, MD, NJ, NY, CT, and PA; tests did not consider vehicle performance
Source: umlaut USA Charging Infrastructure 2021

Illinois Colleges with EVSE

In a recent SEDAC survey of community colleges, respondents reported the following:

- 7 of 9 have EV chargers
- 7 of 9 cite funding as a main barrier

Of the 7 respondents with EV chargers:

- All reported use by students, staff, faculty, and community members
- 6 have at least two charging stations; the maximum is six
- 5 view siting and installation as challenges
- 5 do not charge fees for use; 1 charges a fee after the first three hours of use
- 3 employ ChargePoint stations

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The Smart Energy Design Assistance Center assists buildings and communities in achieving energy efficiency, saving money, improving indoor air quality, and becoming more sustainable. SEDAC is an applied research program at the University of Illinois at Urbana-Champaign. SEDAC services to save energy and money include:

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