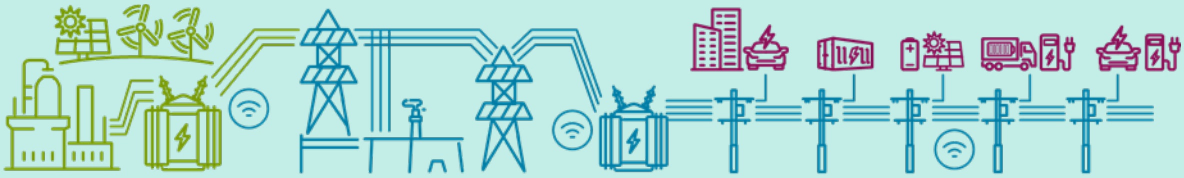
Decarbonized | Reliable | Resilient | Cost-effective



EVGrid Assist Webinar Highlights

U.S. DEPARTMENT OF ENERGY EVGrid Assist ACCELERATING THE TRANSITION

Grid Aware Site Selection

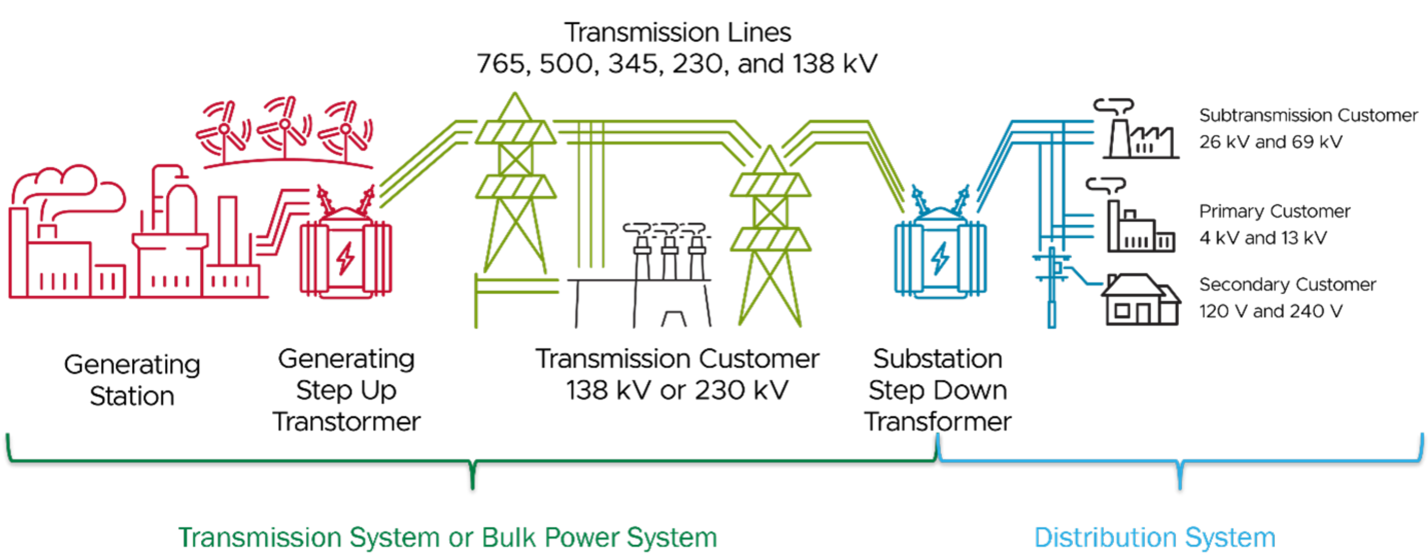
Powering the coming wave of electric vehicles (EVs) in the United States will demand thousands of new chargers from coast to coast. The National Electric Vehicle Infrastructure (NEVI) program allocates $5 billion to states to create a nationwide, interconnected network of direct current fast chargers (DCFC) along alternative fuel highway corridors.

There is more to installing a charger than digging a hole and plugging it in, however. Many other factors must be considered. The physical limitations of and impacts to electrical transmission and distribution systems, the capacity for feeders to serve the EVs in a given area, policies relating to line extensions or distributed energy resources (DERs), and even energy equity can all play roles in siting for a new charging station.

Transmission and Distribution

When siting a charging station, one must consider electrical capacity at the transmission or distribution level, depending on the power requirements needed for the charging station. Capacity availability can depend on both physical limitations (e.g., Is enough power being generated to supply EV charging and other loads and can the wires carry it?) and operational considerations (e.g., Can it be operated safely and reliably to deliver that power to where needed?). Even when adequate power is available, EV charging load can have impacts on the dynamics of the system, which could require operational measures or grid equipment upgrades.

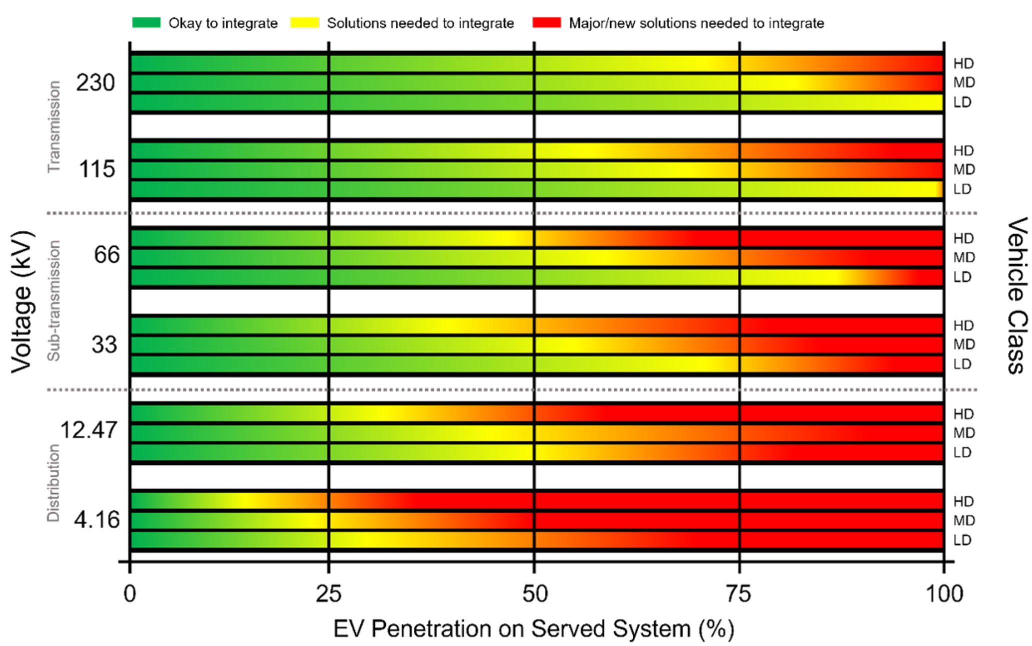
Transmission vs. Distribution: What's the difference?



The power system can be divided into two parts: transmission and distribution. The transmission system consists of the larger sources where energy is generated – nuclear plants, solar farms, hydroelectric plants, etc. – and the transmission lines that move the electricity from remote generation facilities to population centers and other places where it is needed. Those high-power lines feed into substations that step the voltage down and feed into the distribution system. Distribution lines are smaller and have lower voltages than those in the bulk power system. They cover the last few miles of electricity's journey, running into feeders that deliver the energy to homes, businesses, and other end use devices, including EV chargers.

In many areas, seasonal factors will determine load availability. For example, a system that has ample capacity in winter may be limited in summer due to air conditioner usage. Similarly, adding a significant load to a portion of the grid can disrupt stability limitations that could lead to poor power quality, outages, or damage to infrastructure.

Whether on the transmission or distribution system, available capacity can be affected by a number of factors but will show up sooner on the distribution system. As illustrated below, the lower the voltage of the line carrying the electricity, the lower the EV penetration levels that will have an impact that will need to be addressed through upgrades and other measures.



It is important to identify resources that are already available at or near a site under consideration. Determining the capabilities already in place and diagnosing needed upgrades will lead to other questions about capital expenses, permitting contacts, lead times for work to be completed, environmental factors, and more. Answers to these will help determine the best options for a DCFC site.

Furthermore, one should be diligent in researching technologies that promise to solve distribution-side problems. Grid-edge devices and DERs like solar panels and on-site energy storage can certainly help offset demand and reduce energy costs, but only when used properly, and even then, they're effectiveness has limitations. It's important to have realistic expectations of technology, including understanding operational considerations or constraints the local utility may have on such technologies.

Know the Utility Design Parameters
Integrating on-site energy storage at a charging site can offset demand spikes from vehicle charging that may impact the grid and, therefore, the cost of operation. Not all utilities will assess the use of battery storage in the same manner, however. In some areas, the energy storage capacity of the battery might be considered an additional load (in addition to the charger load) rather than a tool to reduce the site demand. This can lead to additional costs and could impact interconnection approval.

Hosting Capacity

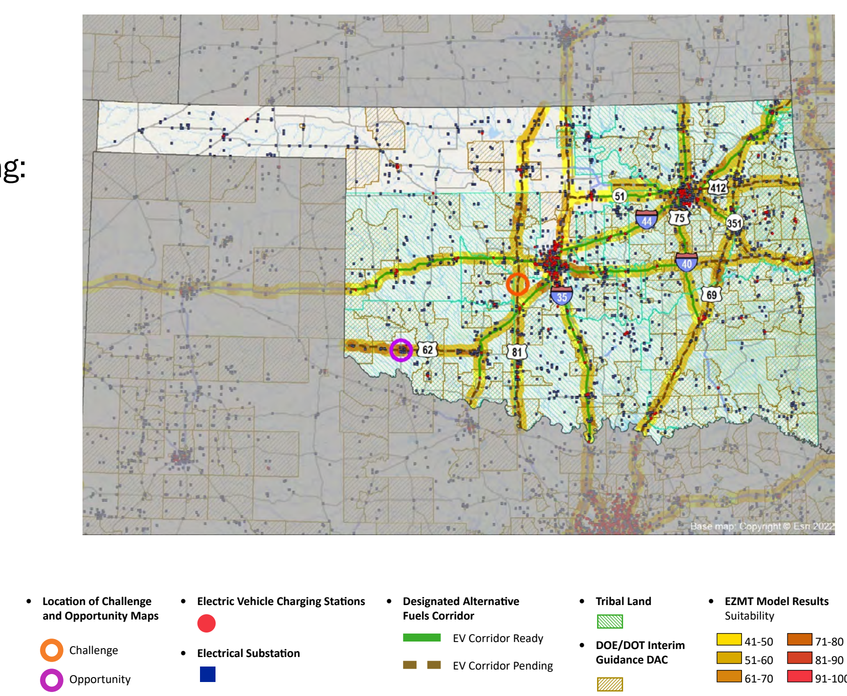
Hosting capacity was developed in assessing photovoltaic (PV) installations as a mechanism to help with interconnection studies to determine how much solar PV could be added to a distribution feeder. Hosting capacity analysis determines the amount of capacity that can be accommodated without adversely impacting voltage, protection, and power quality or requiring upgrades or modifications. For electric vehicles, the concept is similar, but shifts slightly because instead of adding new generation, load is being added to the system.

EVs are more of a variable than PV when forecasting. When the sun shines on a region, it tends to do so uniformly on all solar panels, which are bolted in place. EVs, however, are used differently depending on the drivers, miles covered in a day, and charging profiles, plus they may plug in any number of different places depending on where they are when the battery gets low. EV hosting capabilities vary by location on the feeder and on the feeder type; therefore, understanding the hosting capacity of feeders can provide insights as to where and what type of charging the feeder can accommodate in its current state, as well as forecasting when and what upgrades may be needed in the future.

Energy Zones Mapping Tool

The Energy Zones Mapping Tool (EZMT) is a free, online, self-service analysis tool. It has a large database of mapping layers and modeling capability to screen and identify areas meeting user-selected criteria, including:

- Federal Highway Administration designated EV Corridors
- Existing EV Charging Station Locations
- Transmission Substations and Lines
- Average Annual Daily Vehicle Traffic (some states)
- Public Transit Stop Density
- DOE/DOT Interim Guidance Disadvantaged Communities (DACs)
- Household Transportation Energy Burden
- Transit Desert Index
- Housing and Urban Development Opportunity Zones



It can be accessed at https://ezmt.anl.gov

Despite this challenge, forecasting is still important to develop an understanding of a feeder that can help utilities to make timely decisions to ensure that distribution grids continue to operate reliably. Considering vehicle telematics data, vehicle registration information, and other factors can help flesh out those forecasts.

Line Extension Policies

If capacity is not available, a site owner may request the utility extend service to a new site. Policies for how costs are covered for extending service (or extending a line) will vary by site location and utility. Policies vary from utility to utility and can range from utilities recovering all upgrade costs through rates, sharing costs between utilities and site owner, or the site owner bearing all grid upgrade costs.

Many factors will be used to determine the utility's ability to fund a line extension to a new area, upgrade equipment, and obligate costs to the broader customer base. Factors include engineering impact studies, cost of design, cost of equipment, and potential future revenue resulting from electricity sales. Therefore, it is important to engage with local utilities one-on-one as early as possible.

The National Renewable Energy Laboratory's (NREL) Distribution System Upgrade Cost Database provides examples of equipment and costs associated with distribution upgrades, but it is not a replacement for direct consultation with a host utility.

The decisions around cost sharing for infrastructure upgrades and infrastructure impacts are complex, and transportation electrification may require a reexamination of these policies.

Line Understanding the Social Dimensions

Equity is another important component to consider when siting a charging station. In fact, an executive order signed in 2021 established the Justice40 Initiative, which requires 40% of all benefits from federally funded programs be accrued to disadvantaged communities (DAC), including charging stations funded under the National Electric Vehicle Infrastructure (NEVI) Formula Program.
A tool to help identify opportunities that serve this goal is the EV Charging Justice40 Mapping Tool. It combines Department of Transportation and Department of Energy definitions of disadvantage, and uses publicly available datasets that capture:

- Vulnerable populations
- Health
- Transportation access and burden
- Energy burden
- Fossil fuel dependence
- Resilience
- Environmental and climate hazards

These considerations, along with those of transmission and distribution, hosting capacity, and line extension policies, are all essential elements to factor into the determination of any charging site.

Equity Guiding Principles for Siting and Engagement

1. Determine targeted underserved communities
2. Incorporate community education, outreach, and engagement
3. Empower communities to co-create the process
4. Identify goals and metrics
5. Actively avoid causing disbenefits
6. Identify synergistic funding sources for comprehensive solutions
7. Measure equity metrics and track progress towards equity goals

ANL Report: https://www.osti.gov/biblio/1870157/

Data and Resources for Equity-Based Siting Decisions

EV Charging Justice40 Mapping Tool: https://anl.maps.arcgis.com/apps/webappviewer/index.html?id=33f3e1fc30bf476099923224a1c1b3ee

Low-Income Energy Affordability Data (LEAD) Tool: https://www.energy.gov/eere/slsc/maps/lead-tool

EPA's EJScreen: https://www.epa.gov/ejscreen