



EXECUTIVE INSIGHTS

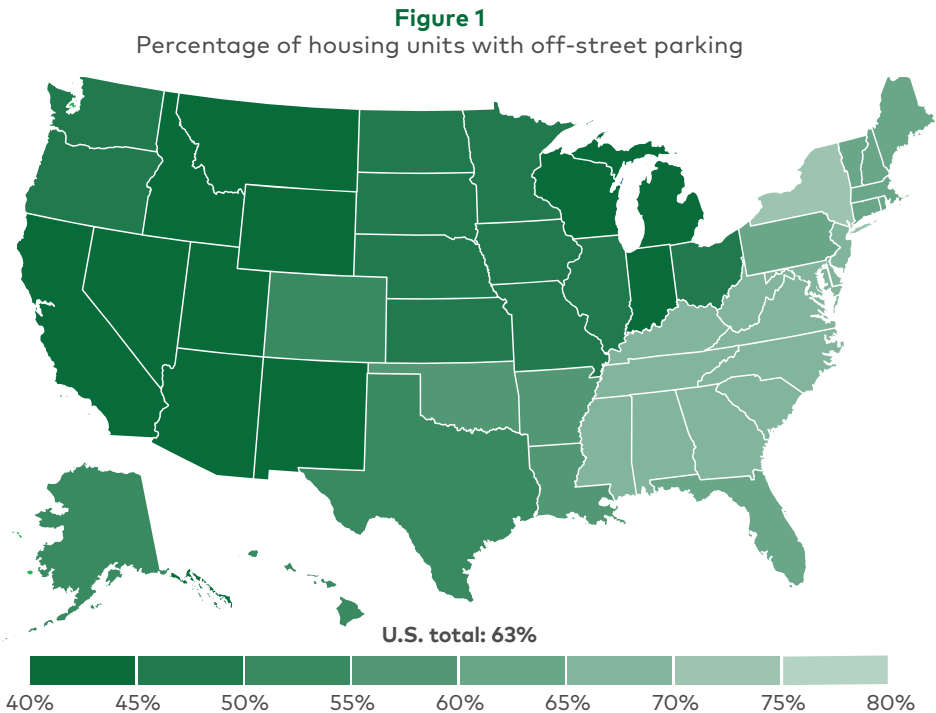
Winning on the Road to Building America's Electric Vehicle Charging Infrastructure

The value proposition of a battery electric vehicle (BEV) — including lack of tailpipe emissions, lower ownership cost and quiet operation — is attractive enough that by 2019, 63% of prospective car buyers expressed interest in owning one.¹ Still, BEV penetration remains limited, hitting roughly 1.7% of annual U.S. new light vehicle sales, excluding hybrid vehicles.

The higher price tag is one reason for limited penetration. Another is the lack of model availability. There's also range anxiety, or the fear of running out of battery power far from the nearest charging station, which persists even though BEVs can now run several hundred miles on a single charge. Despite these speed bumps, we estimate that BEVs will account for 25%-35% of annual light vehicle sales in the U.S. market by 2030.

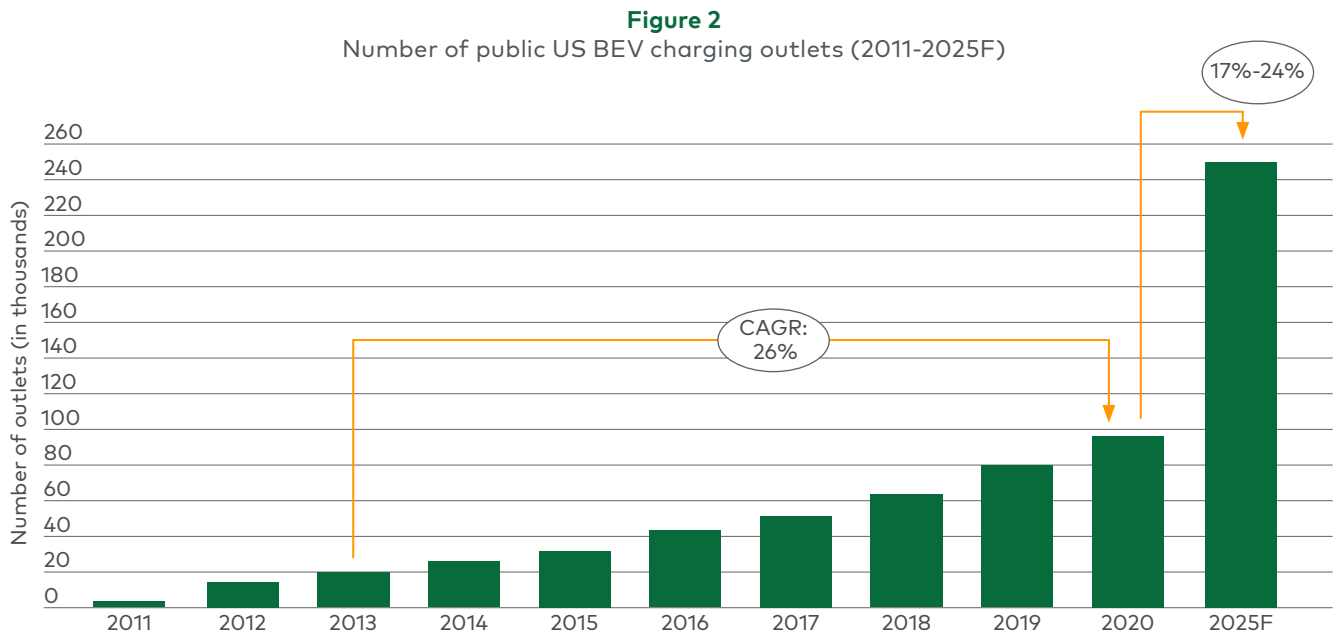
Getting past the starting line

But there are a few asterisks on that forecast, one of which is the availability offered by a convenient charging infrastructure. While today's BEV owners typically charge at home, roughly 37% of U.S. households don't have off-street parking (see Figure 1). Many new multifamily developments offer charging points, but these aren't nearly enough for BEVs to reach a meaningful level of penetration. Neither do they address the need to recharge on the road. To get a sense of the challenge, consider that every year in the U.S., people take 10 billion trips of 50 miles or longer. Some of these trips will require a stop to recharge.



Source: National Household Travel Survey; L.E.K. analysis of American Housing Survey; data based on census region, except for CA, CO, FL, IL, MA, MD, NY, OH, PA, TX and VA, which are broken out separately

There has been some progress in expanding capacity. The number of charging stations in the U.S. saw an annual growth rate of 26% over the seven years ending in 2020. We expect growth to continue at 17%-24% per year through 2025 (see Figure 2), with continued growth through 2030. That reflects the Biden administration's goal to get the overall number of public charging stations to 500,000.²



Source: ICCT, Whitehouse.gov, L.E.K. analysis of U.S. Department of Energy Alternative Fuels Data Center

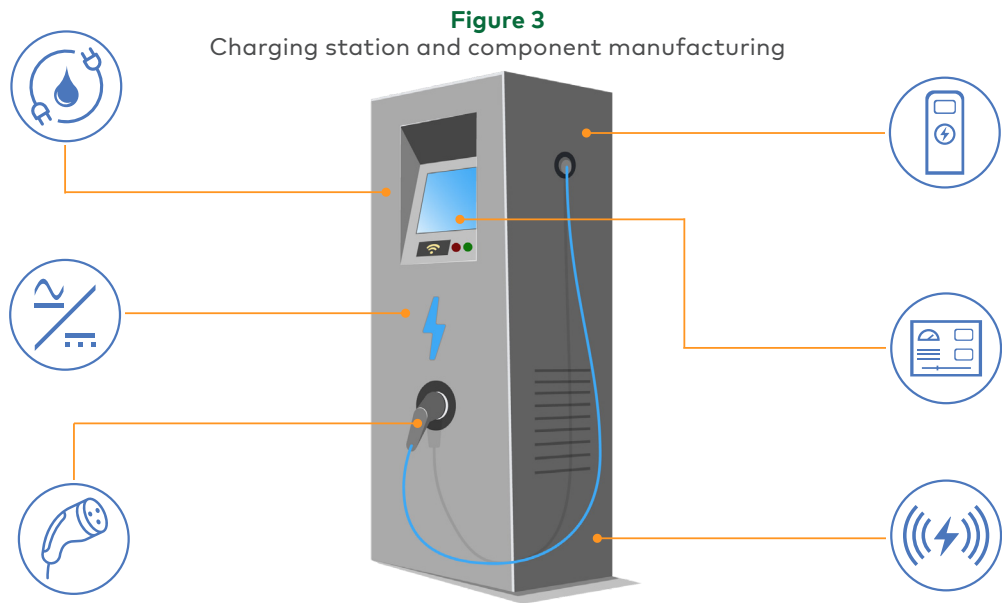
Places to plug in

Public charging stations are popping up at a variety of locations across the country, including:

- **Retail stores.** For retailers, charging stations are a way to attract customers and encourage them to spend time in the store. Walmart, for example, has committed to supplying 1,000 fast chargers in the U.S. so that customers can charge their electric vehicles as they shop. And Target has announced plans to expand its BEV charging points by 600 in 2021 through collaboration with Tesla, ChargePoint and Electrify America.
- **Offices, multifamily residences and parking garages.** Charging stations near offices may be part of an employer's benefits package or corporate sustainability initiative. Similarly, multifamily dwellings with parking may also offer charging stations to residents as an amenity.
- **Gas stations.** Traditional filling stations, taking advantage of their existing infrastructure and location along transport routes, can operate charging stations for an additional revenue stream. Shell is a case in point. The oil and gas giant currently operates 60,000 charging locations and aims to boost that number to 500,000 by 2025.³
- **Schools and universities.** Academic institutions may offer BEV charging services to faculty and students as part of a focus on sustainability. ChargePoint, for instance, has installed BEV charging points at the University of California San Diego, Northwestern University and the University of Florida, among others.
- **Hotels.** Increasingly, hotels are offering BEV charging for a fee. More than 350 Hilton properties have charging stations, while Marriott has installed more than 3,000 charging stations at its properties around the world.
- **On-street parking.** In some U.S. cities, a lack of off-street parking has prompted municipal governments to experiment with curbside BEV charging. Seattle piloted a curbside charging program in 2019. In June 2021, New York introduced the first of what will eventually become 50 curbside charging stations located throughout the city.⁴

Taking infrastructure opportunities for a spin







Despite anticipated challenges, the race is on to keep charging infrastructure ahead of vehicle demand. It will take time to build out the infrastructure, but there may be interesting ways to invest in the rollout and create significant opportunities for incumbent and emerging stakeholders. For instance, charging stations use multiple components whose manufacturers can offer solid investment opportunities (see Figure 3).



Note: Table 1 explains these charging-station components in detail
Source: L.E.K. research and analysis

One way to participate in the charging infrastructure market is through investments in charging station component manufacturing (see Table 1).

Table 1
Components in a charging station

	Liquid-cooled cables are lightweight, thinner-gauge cables that are less prone to overheating, making them well suited for rapid charging.		Interactive digital displays allow customers to interact with the charging station to recharge their vehicles. In addition to being durable and waterproof, these displays may also enable ancillary revenue for charging stations (e.g., advertising, surveys).
	Enclosures house internal components in a durable case and are precision engineered to offer tight tolerances resulting in their higher value. Today, enclosures are manufactured mostly out of metals, but many companies are exploring the use of other materials. Polycarbonate resins and other polycarbonate blends, for example, are lightweight and more resistant to weathering, and have higher impact and flame resistance.		Connectors for Level 1 and 2 chargers are mostly J-plugs (SAE J-1772 standard), which different BEV models can use. For Level 3 charging stations, however, there are multiple charger connector technologies (e.g., the SAE combined charging system, Tesla's Supercharger, CHAdeMO). As the space matures, there is room for further development of connector technology as well as potential homogenization through regulation, providing another investment opportunity.
	AC/DC and DC/DC converters help convert power from the grid to a stable DC voltage of around 800 volts. These components are highly engineered to prevent damage to EV batteries and battery management systems. They also allow bidirectional connections to the grid to enable smart grids, which adds to their value.		Control pilots and control units moderate current inputs from a charging station and communicate with metering to facilitate payment. Highly engineered solutions for multiple outlet chargers are of higher value.

In addition to the specific components listed above, at-home and commercial charging station assembly also provides a significant opportunity for investment. Separately, the anticipated increase in alternative power sources (e.g., solar panels and hydrogen fuel cells as a power source for BEV chargers) would offer another avenue for investment.

Emerging charging companies

Charging companies that provide and install charging stations may also provide opportunities for investment.

Public charging infrastructure is an expensive proposition. The all-in cost of a commercially viable Level 2 charger is about \$8,000 to \$12,000. For a Level 3 charger, the cost starts at around \$25,000 and can be double that amount for a high-end version. There are various revenue models to pay for it all, including free-to-charge, ad-based and pay-to-charge options. But investors are leaning toward a pay-to-charge model, in which emerging charging companies like FreeWire Technologies, EVgo and EVBox (as well as more established charging station providers) can provide significant opportunities.

Additionally, both at-home and public charging infrastructure will require maintenance services, presenting another investment route.

Ancillary products and services

Despite the threat from BEVs, gas stations can play in the BEV charging space because their locations near retail outlets and along truck routes are a natural fit for public charging points. Recognizing this, gas stations have begun to invest in charging stations. The time it takes to charge a BEV (versus filling a gas tank) may create an issue with space, but it also provides an opportunity for ancillary revenue from advertising, shopping, entertainment and more.

En route to critical mass

Although BEV penetration is low today, the market is expected to rev up over the coming years. That means BEV charging infrastructure, from the number and location of charging stations to charging technologies and service models, will also need to grow significantly to keep up with demand. Smart investors will keep their instruments trained on these developments and will be ready to take action once the appropriate time for investment arrives.

For more information, please contact strategy@lek.com.

Endnotes

¹Consumer Reports and the Union of Concerned Scientists, "New survey shows strong support for electric vehicles across economic spectrum." https://advocacyconsumerreports.org/press_release/evsurvey2019/

²The White House, "FACT SHEET: Biden Administration Advances Electric Vehicle Charging Infrastructure." <https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-biden-administration-advances-electric-vehicle-charging-infrastructure/>

³TechCrunch, "EV charging stations, biofuels, the hydrogen transition and chemicals are pillars of Shell's climate plan." <https://techcrunch.com/2021/02/11/ev-charging-stations-biofuels-the-hydrogen-transition-and-chemicals-are-pillars-of-shells-climate-plan>

⁴Advanced Clean Tech News, "Curbside Electric Vehicle Charging Now Available in New York City." <https://www.act-news.com/news/curbside-electric-vehicle-charging-now-available-in-new-york-city/>

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