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Electric Vehicle Sales and the Charging Infrastructure Required Through 2030

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Prepared for:

Edison Electric Institute

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EXECUTIVE SUMMARY

Since the Edison Electric Institute's (EEI's) last electric vehicle (EV) forecast in 2018, the EV market has accelerated rapidly. The first major milestone of one million cumulative EV sales was achieved in 2018, more than eight years after the introduction of the first mass market EVs in late 2010. Fewer than three years later, the next milestone of two million in cumulative sales was achieved in mid-2021.

Customers continue to purchase EVs in record numbers, and electric companies are working with stakeholders to make the transition to EVs a seamless one for all drivers. Automakers are continuing to respond to customer demand by developing more EV models, including both plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs), that are increasingly cost-competitive with their internal combustion engine (ICE) counterparts.

The Infrastructure Investment and Jobs Act (IIJA) is critical to the continued acceleration of EVs. IIJA is the largest investment in infrastructure since the New Deal, and it contains several provisions for electric transportation including up to \$7.5 billion in funding for EV charging infrastructure, \$5 billion for electric school buses, and \$5.6 billion for electric transit buses. The lack of charging infrastructure often is cited as a primary barrier to increased adoption of EVs and the funding from IIJA will represent unprecedented EV charging investment in many areas of the country, which is fundamental to the growth of the market.

Unlike conventional vehicles, which typically refuel only at gas stations, EVs may charge at many different locations, such as while parked at home, at work, or in public spaces, using various types of charging equipment, which often is referred to as a charging station or a charging port.

For the purposes of this paper, a charging station refers to either a wall-mounted or free-standing charging cabinet and a charging port is a plug on that station that sends electricity into a vehicle battery. A charging station may have more than one port, and charging equipment comes in a variety of types and configurations, but generally is categorized by power level.

The data provided in this paper is forecasted through 2030 and details new insights into the coming wave of EV sales and the infrastructure needed to support the projected EV growth.

This consensus forecast is based on four independent forecasts and concludes that:

- The **stock of EVs** (i.e., the number of EVs on U.S. roads) is projected to reach **26.4 million in 2030**, up from 2.4 million at the end of 2021 (see Figure 1). This is more than 10 percent of the 259 million vehicles (cars and light trucks) expected to be on U.S. roads in 2030.
- It took eight years to sell one million EVs and fewer than three years to sell the next million. We project **the next one million EVs** will be sold in roughly one year, before the end of 2022.
- **Annual sales of EVs will be nearly 5.6 million in 2030**, reaching nearly 32 percent of annual light-duty vehicle sales in 2030 (see Figure 2). Compared to our 2018 forecast, this is an increase of more than 1.8 million in annual sales in 2030.

The availability of EV charging infrastructure also is fundamental to the growth of EVs.

Based on the EEI forecast, we estimate that:

- **12.9 million charge ports will be needed** to support the projected 26.4 million EVs that will be on U.S. roads in 2030.

- Approximately **140,000 DC fast charging (DCFC) ports will be needed** to support the level of EVs we expect to be on the road in 2030.

DCFC stations are key to enabling long distance EV travel, reducing range anxiety, and to providing fast, convenient charging for individuals who lack access to dedicated parking. America’s electric companies are making significant investments to expand access to EV charging, including investing more than \$3.4 billion dedicated to charging infrastructure and other EV programs.

Additionally, in late 2021, EEI announced the launch of the National Electric Highway Coalition (NEHC), a collaboration among electric companies that share the common goal of deploying EV fast charging infrastructure along major U.S. travel corridors. Members of the NEHC are working together to efficiently and expediently deploy fast charging infrastructure that supports the growing number of EVs and that helps ensure that the transition to EVs is seamless for drivers. Members of the NEHC are committed to supporting more than 4,500 DCFC ports.

Figure 1. EEI Forecast of EV Stock: 26.4 Million EVs on U.S. Roads in 2030

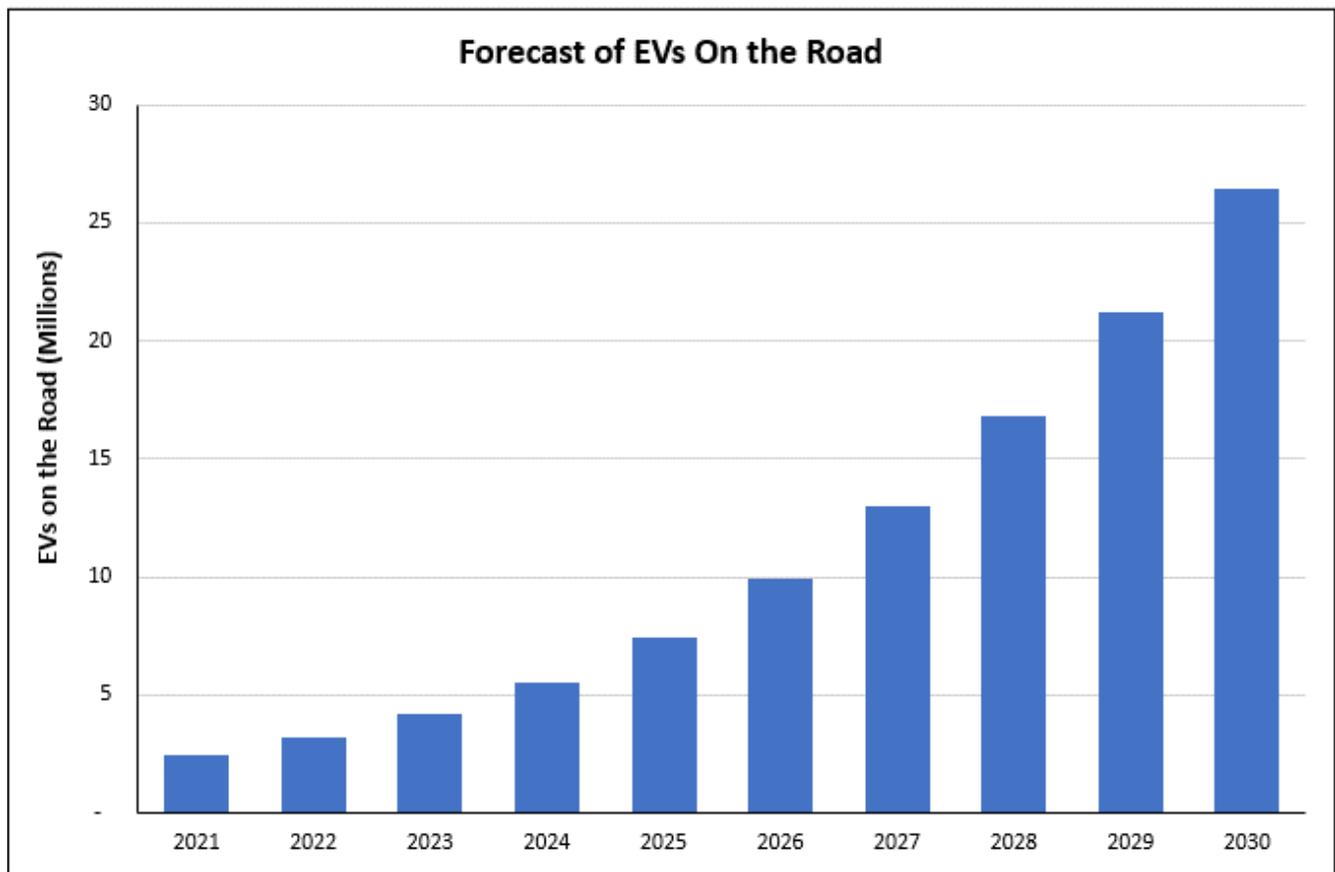
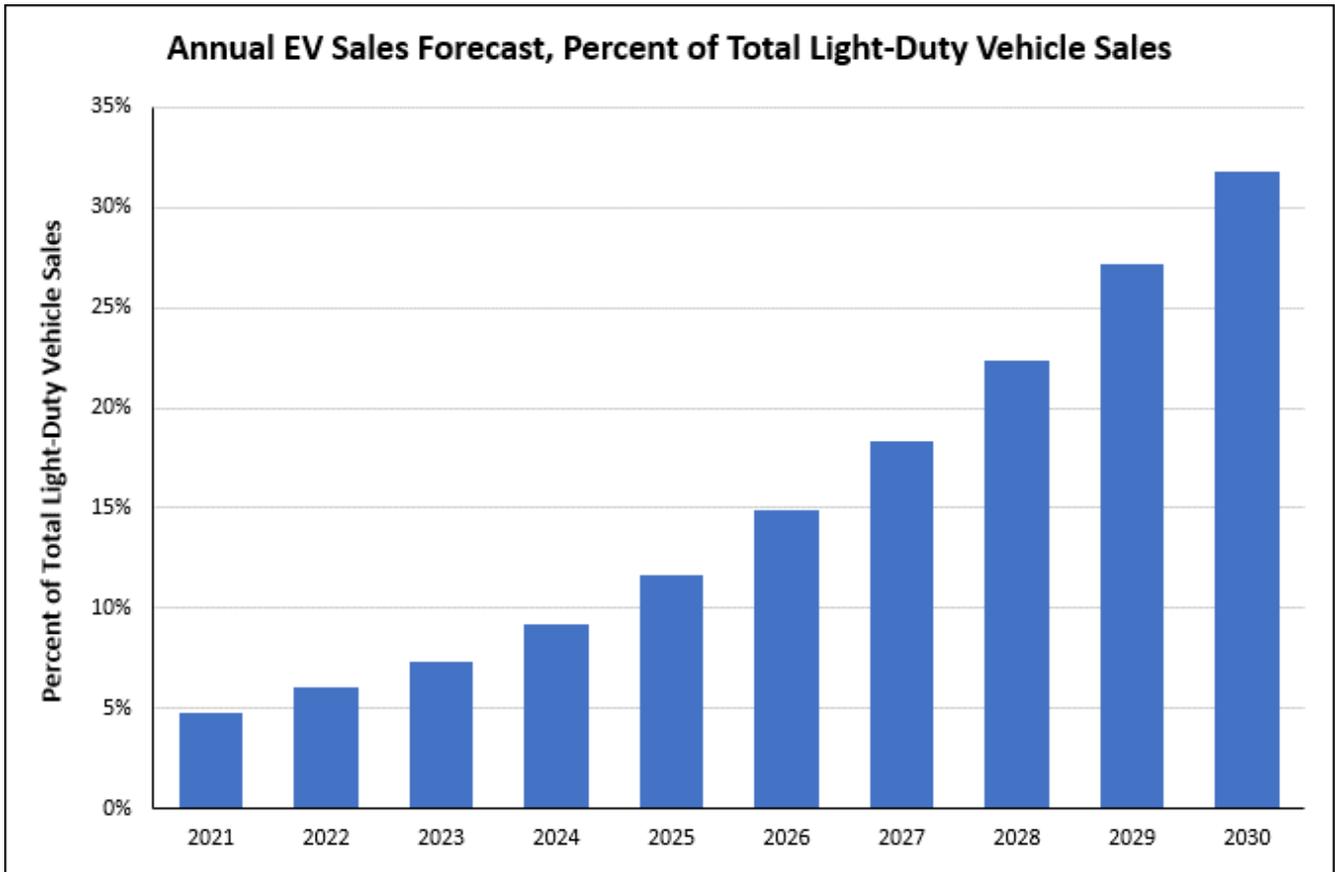


Figure 2. EEI Annual EV Sales Forecast: Nearly 32 Percent of Total Light-Duty Vehicle Sales in 2030



Electric Vehicle Forecast

Approach

EEI developed a consensus forecast of EV sales projections from 2021 to 2030 based on four independent forecasts:

- Guidehouse – Guidehouse Insights: PEV Sales by Region, World Markets (Q4 2021).¹
- Boston Consulting Group (BCG) – Electric Cars Are Finding Their Next Gear (June 2022).²
- Deloitte – Electric Vehicles: Setting a Course for 2030 (July 2020).³
- Wood Mackenzie – Electric Vehicle Outlook to 2040 (2020).⁴

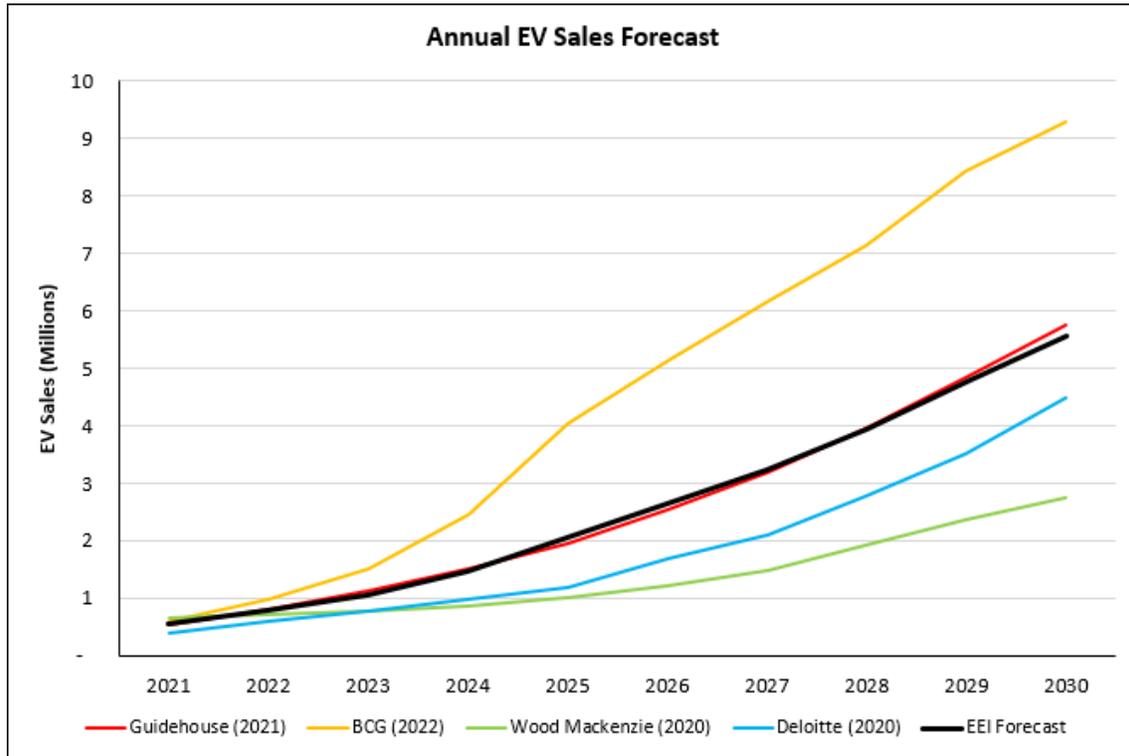
These forecasts were selected because they include three key factors: customer preference models that determine interest in EVs; declining battery costs that influence EV cost competitiveness with ICE vehicles and manufacturer profitability; and fuel efficiency standards and environmental regulations. In cases where forecasts reported EV sales in terms of percent of total U.S. auto sales, EEI applied that percentage to estimated total auto sales for that year to determine an EV sales figure. The 2022 forecast from BCG did not report sales figures for all years and missing data was estimated based on the relative increase in sales from previous BCG forecasts.

Some of these forecasts were published prior to several major federal and state policy announcements including the passage of the Infrastructure Investment and Jobs Act (IIJA) and may not reflect the current policy landscape. The potential impact of policy on the EV market is discussed further below.

EEI forecasts 5.6 million annual EV sales in 2030 which results in more than 26 million total EVs on the road in the United States in 2030 (see Figure 3 for annual EV sales).

-
1. Guidehouse. Market Data: EV Geographic Forecast – North America. <https://guidehouseinsights.com/reports/market-data-ev-geographic-forecast-north-america>.
 2. Boston Consulting Group. Electric Cars are Finding Their Next Gear. <https://www.bcg.com/publications/2022/electric-cars-finding-next-gear>
 3. Deloitte. Electric Vehicles: Setting a Course for 2030. <https://www2.deloitte.com/us/en/insights/focus/future-of-mobility/electric-vehicle-trends-2030.html>.
 4. Wood Mackenzie. Electric Vehicle Outlook to 2040. <https://www.woodmac.com/our-expertise/capabilities/electric-vehicles/>.

Figure 3. EEI Annual EV Sales Forecast Compared to Selected Forecasts: 5.6 Million in Annual Sales in 2030



Comparison to Automaker Announcements

Comparing the forecasted EV sales to automaker announcements is a useful reality check. Following the Executive Order from the Biden Administration setting a goal for half of all vehicle sales to be zero emission in 2030, many major automakers announced ambitious goals for zero emission vehicle sales.⁵ Based on these announcements, potential EV sales in 2030 could be more than 8.3 million, well exceeding the consensus forecast of 5.6 million.⁶

Table 1 shows an estimate of total light-duty vehicle sales by automaker in 2030, the percent of EV sales expected in 2030 based on automaker announcements, and the likely number of EV sales in 2030 based on those announcements. Figure 4 shows the automaker estimate in relation to EEI's consensus forecast. EEI estimated overall vehicle sales to be 17.5 million in 2030 based on an approximately 17 percent growth over 2021 sales. This figure accounts for a gradual recovery in auto sales from the COVID pandemic while also attributing an approximate two percent annual increase in sales from the pre-pandemic period, consistent with similar increases seen in total average auto sales over the prior decade. The market share of each automaker was kept constant based on 2021 sales, except for Tesla whose market share was increased from two to five percent to account for the introduction of new models in different market segments while other market shares were reduced proportionately. The fraction of EV sales is based on public automaker announcements, which then were applied to overall sales numbers from 2030. This estimate does not account or the emergence of new market entrants such as Rivian and Lucid, though those automakers are not expected to account for significant portion of auto sales in the near future.

5. Executive Order on Strengthening American Leadership in Clean Cars and Trucks, <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/>.

6. Individual automaker data was gathered from automaker websites, trade press articles, and public announcements.

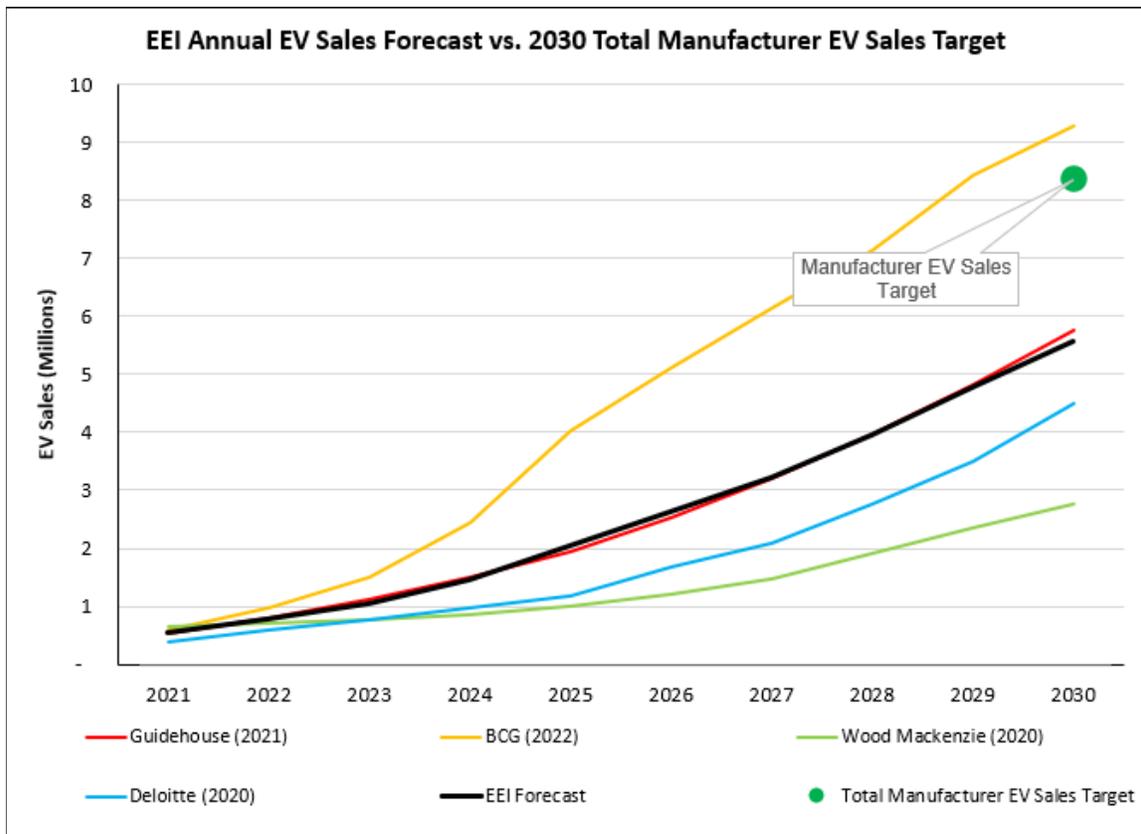
Table 1. EEI Analysis of Projected EV Sales in 2030 by Vehicle Manufacturer

Manufacturer	EEI estimated light-duty vehicle sales in U.S. in 2030	Manufacturer announced EV sales targets in 2030*	Estimated EV sales in 2030
BMW	420,000	50%	210,000
Ford	2,150,000	40%	860,000
General Motors	2,580,000	50%	1,290,000
Honda	1,660,000	40%	664,000
Hyundai-Kia	1,650,000	50%	825,000
Jaguar Land Rover	120,000	100%	120,000
Mazda	370,000	25%	92,500
Mercedes	370,000	100%	370,000
Nissan	1,230,000	40%	492,000
Stellantis	2,010,000	50%	1,005,000
Subaru	680,000	40%	272,000
Tesla	880,000	100%	880,000
Toyota	2,540,000	30%**	762,000
Volkswagen	720,000	55%	396,000
Volvo	140,000	100%	140,000
Total	17,520,000	48%	8,378,500

*Percentages are based on most recently announced sales targets for EVs.

**Estimated based on announced global EV sales target of 3.5 million in 2030.

Figure 4. EEI EV Sales Forecast Compared to 2030 Auto Manufacturer Sales Target



Policy and Technology Factors to Consider

Two of the key considerations for the development of the EV market is the evolving policy landscape in the United States and continued technological advancement. Since EEI's forecast in 2018, there have been significant new developments in both federal and state policy aimed at advancing transportation electrification. In terms of technological advancement, the development of more energy dense and less expensive batteries has continued on a similar trajectory seen over the prior decade, while new investments in emerging technologies such as solid state batteries suggest continued progress.

Federal Policy Issues

Policy developments at the federal level that could impact the U.S. EV market between now and 2030 include:

- **Vehicle Fuel Economy Standards:** In April 2022, the U.S. Department of Transportation (DOT) announced new Corporate Average Fuel Economy (CAFE) standards for light-duty vehicles for model years 2024-2026 that require an industry-wide fleet average of 49 miles per gallon in model year 2026.⁷ Previously, the standards had been frozen for model years 2021-2026 at model year 2020 levels of 37 miles per gallon, rather than increasing in stringency through 2025.
- **Greenhouse Gas Standards:** The U.S. Environmental Protection Agency (EPA) finalized its companion greenhouse gas regulation in December 2021. These standards contain flexibilities that encourage automakers to increase production of EVs. Additionally, in March 2022, EPA reinstated California's waiver under the Clean Air Act to set its own vehicle standards, including the Zero Emission Vehicle (ZEV) program that requires an increasing number of ZEV sales—primarily EVs—through 2025.
- **Qualified Plug-In Electric Drive Motor Vehicle Credit (Internal Revenue Code 30D):** This credit, enacted in 2008, reduces the effective purchase price of EVs. The credit is structured to phase out for an individual automaker when it sells 200,000 qualifying vehicles. Tesla and General Motors have exceeded the cap, and Toyota is expected to cross the threshold in the first quarter of 2022. The proposed Build Back Better Act included an expansion and extension of the 30D tax credit from \$7,500 to as much as \$12,500, as well as an additional tax credit of up to \$4,000 for the purchase of pre-owned EVs. The outcome of legislation to expand the EV tax credit has not been determined as of this writing.
- **Infrastructure Investment and Jobs Act:** Passed in November 2021, the IIJA is the largest investment in infrastructure since the New Deal. The package contains several provisions for electric transportation including up to \$7.5 billion in funding for EV charging infrastructure, \$5 billion for electric school buses, and \$5.6 billion for electric transit buses. The lack of charging infrastructure often is cited as a primary barrier to increased adoption of EVs and the funding from IIJA will represent unprecedented EV charging investment in many areas of the country.
- **Federal Fleet Electrification:** The Federal government fleet is the largest in the United States, comprised of more than 650,000 vehicles. The Biden Administration announced, via executive order, a goal to make all light-duty vehicles purchased for the federal fleet electric by 2027 with all vehicle purchases electric by 2035.⁸

7. See <https://www.nhtsa.gov/press-releases/usdot-announces-new-vehicle-fuel-economy-standards-model-year-2024-2026>.

8. See <https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/08/fact-sheet-president-biden-signs-executive-order-catalyzing-americas-clean-energy-economy-through-federal-sustainability/>.

The EEI forecast is not driven exclusively by these policies. Customer demand and other market conditions that are driving EV sales will be present even if these policies are weakened, however, the policies stated above will have a positive impact on the EV market.

Battery Costs Trending Down

Declining battery costs and growing customer demand for EVs act as an accelerant to EV sales. Cost reductions in battery packs enable longer-range EVs, increase cost-competitiveness with ICE vehicles, and result in automobile manufacturers producing a wider variety of EVs across more vehicle segments to better meet customer demand.

- Between 2010 and 2021, battery pack costs declined by nearly 90 percent in real terms. Bloomberg New Energy Finance estimated average battery pack costs in 2021 at \$132 per kilowatt-hour (kWh).⁹

Recent supply chain issues potentially have reversed the downward trend in battery prices in the near term, but the long-term projections of continued decreases in battery cost have not changed.

Battery Technology Advancements

In addition to continued refinements in existing battery technology, which have driven down costs dramatically over the previous decade, several new companies have emerged recently that are demonstrating entirely new battery technologies capable of significant increases in energy density and reduced cost. In particular, solid state battery technology could result in EV batteries that are more stable, lighter, longer lasting, and capable of faster charging compared to current EV batteries.¹⁰

- Volkswagen,¹¹ Ford,¹² GM,¹³ and Nissan¹⁴ all have announced significant investments or partnerships with solid state battery companies, with Nissan planning on launching its first solid-state battery EVs by 2028.

9. See <https://about.bnef.com/blog/battery-pack-prices-fall-to-an-average-of-132-kwh-but-rising-commodity-prices-start-to-bite/>.

10. See <https://www.asme.org/topics-resources/content/solid-state-batteries-drive-the-future-of-the-ev-market>.

11. See <https://www.autoevolution.com/news/quantumscape-will-now-sell-its-solid-state-batteries-to-a-fourth-carmaker-182980.html>.

12. See <https://media.ford.com/content/fordmedia/fna/us/en/news/2021/05/03/ford-boosts-investment-in-solid-power.html>.

13. See <https://techcrunch.com/2021/03/11/gm-partners-with-startup-solidenergy-systems-to-pack-more-energy-in-its-batteries/>.

14. See <https://www.engadget.com/nissan-solid-state-battery-ev-release-date-182025167.html>.

Charging Infrastructure Needed to Support EV Market

The availability of EV charging infrastructure also is fundamental to the growth of EVs. Unlike conventional vehicles, which typically refuel only at gas stations, EVs may charge at many different locations, such as while parked at home, at work, or in public spaces.

Charging equipment is needed to deliver electricity from the energy grid to an EV and comes in a variety of types and configurations, and generally is categorized by power level:

- **Level 1:** 120-volt, alternating current (AC) power. Level 1 charging refers to charging stations and conventional electric outlets that a driver may plug into via a charging cord set that typically is included with an EV. Level 1 charging adds approximately 3 to 4 miles of electric range per hour of charging.

For this analysis, we assume that half of all EVs with access to home charging – including both single-family homes and multi-family dwellings (MFDs) – will use Level 1 charging, while the other half will use Level 2. Level 1 charging also may be available at workplaces and public locations, but that is not considered in this analysis.

- **Level 2:** 240-volt, AC power. Level 2 charging stations typically are mounted on a wall or on a pedestal. Level 2 charging at home typically requires the installation of a 240-volt circuit, the same as would be used for a household clothes dryer. Level 2 charging adds approximately 10 to 20 miles of electric range per hour of charging.

For this analysis, we assume that all workplace and public locations use Level 2 charging.

- **DC Fast Charging:** Converts AC electricity to direct current (DC) and delivers charge to the vehicle at high power, typically anywhere from 50 to 350 kilowatts (kW). DCFC is intended to add a substantial charge to an EV in a short amount of time (e.g., charge a battery to 80 percent capacity in 15-45 minutes, depending on battery size and charger power level).

For this analysis, we assume DCFC is used only at public DCFC locations at power levels of 50 to 150 kW and is only available for use by BEVs.

An important additional distinction for charging infrastructure is how it is tabulated. In general, there are three ways in which locations that provide EV charging are referred to in this report:

- **Charging Site:** A charging site is a location that hosts charging equipment for use by the public. A charging site is similar to a gas station in that it refers to the piece of land or business where charging equipment is located. Charging sites often have multiple charging stations available for use.
- **Charging Station:** For the purposes of this report, a charging station is either a wall-mounted or free-standing charging cabinet which has the capability to charge one or more EVs.
- **Charging Port:** A charging port is a plug on a charging station that sends electricity into a vehicle battery. A charging station may have more than one port.

Table 2 summarizes the EV charging infrastructure locations, charging equipment type, and available charging time considered in this analysis. This analysis limits consideration to these major categories for simplicity.

Table 2. EV Charging Equipment by Location

Location	Charging Type Considered	Time Available to Charge
Home (single-family homes and multi-family dwellings)	Level 1, Level 2	Overnight (approx. 12 hours)
Workplaces	Level 2	Work day (approx. 8 hours)
Public Level 2	Level 2	Approx. 2+ hours
Public DC Fast Charging	DCFC	Approx. 15-45 minutes

Home EV charging generally is the most convenient for those who have access to a dedicated parking space with proximity to power. However, having charging infrastructure at workplaces or in public settings allows EV owners to drive more miles on electric, enables longer trips, and increases driver confidence. In addition, public charging infrastructure is important for EV owners who do not have dedicated home charging, such as in multi-family dwellings (e.g., apartment buildings) or those with street parking.

Modeling the Charging Infrastructure Needed to Support EV Growth

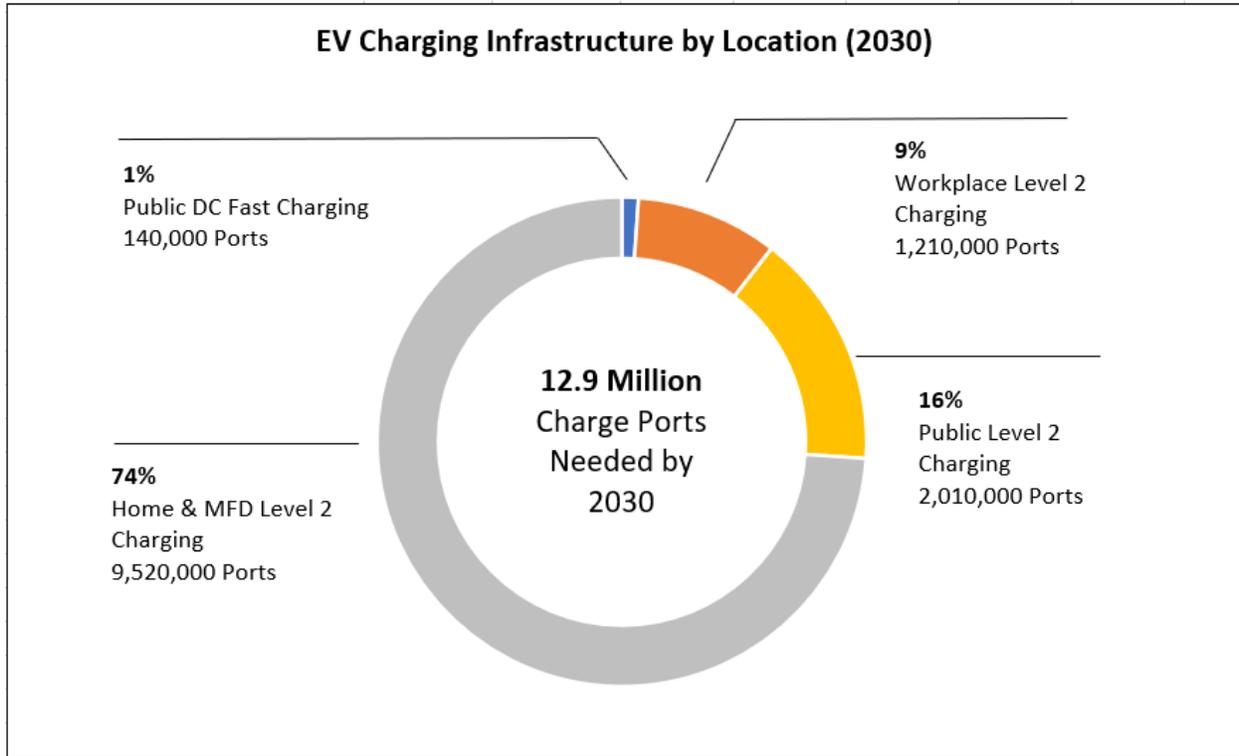
EEI estimated the EV charging infrastructure needed to support the more than 26 million EVs projected to be on U.S. roads in 2030 using the Department of Energy’s Electric Vehicle Infrastructure Projection (EVI-Pro) Lite tool as well as a charging infrastructure assessment from the California Energy Commission (CEC).^{15,16} The EVI-Pro Lite tool is a simplified, publicly accessible version of a model developed by the National Renewable Energy Lab (NREL) to estimate the demand for EV charging infrastructure. The tool estimates the number of charging ports needed within a city or state to support a given EV population based on vehicle travel patterns as well as EV and charging station characteristics. The tool allows users to adjust key assumptions, such as the mix of BEVs versus PHEVs and the amount of charging done at home.

Based on the EEI forecast, we estimate that approximately 12.9 million charge ports will be needed to support the 26.4 million EVs projected to be on U.S. roads in 2030. The mix of charge ports by location is shown in Figure 5.

15. See <https://www.afdc.energy.gov/evi-pro-lite> (accessed May 2022).

16. See Commission Report Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment: Analyzing Charging Needs to Support Zero-Emission Vehicles in 2030. Available at <https://www.energy.ca.gov/programs-and-topics/programs/electric-vehicle-charging-infrastructure-assessment-ab-2127>.

Figure 5. EV Charging Infrastructure in 2030 Based on EEI Forecast



The basis for the analysis in this report comes from two sources, the EVI-Pro Lite tool and the CEC report “Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment: Analyzing Charging Needs to Support Zero-Emission Vehicles in 2030.” The CEC report relies on EVI-Pro 2 for its analysis, an updated version of EVI-Pro Lite that is unreleased as of the publication of this report. To take advantage of the updated analysis from the CEC, EEI determined a scaling factor for EVI-Pro 2 by recreating the conditions of the CEC analysis in EVI-Pro Lite and comparing the output between the two tools. This scaling factor was then applied to the EVI-Pro Lite results from each state to arrive at the updated EV charging infrastructure forecast in this report.

The CEC report is the only public report which utilizes EVI-Pro 2 as of the publication of this forecast. To make use of the updated methodology in EVI-Pro 2, EEI adopted several of the assumptions of that report to maintain consistency across forecasts. The assumptions in the CEC report are determined primarily for the market in California and may not be reflective of other states. These assumptions include:

- **EV Population:** The EVI-Pro Lite tool does not provide a national calculation option, so the results shown are the sum of the outputs for individual analyses of all 50 states and the District of Columbia. The 26.4 million EVs were allocated by applying a uniform sales growth rate to each state. Since the tool limits the EV population to no more than 10 percent of all registered vehicles, states that exceeded this market share were capped at 10 percent and the excess vehicles were allocated to the remaining states based on their EV market share. This effectively shifts the EV distribution among the states closer to that of the conventional vehicle population, which is reasonable as EVs become more mainstream.
- **Vehicle Mix:** The EVI-Pro Lite tool simplifies EV models to four types – PHEVs with electric ranges of 20 and 50 miles and BEVs with electric ranges of 100 and 250 miles. Following the CEC

report and consistent with total EV sales figures, this analysis assumed a split of 30 percent 50-mile PHEVs and 70 percent 250-mile BEVs.

- **Support for PHEVs:** The EVI-Pro Lite tool allows users to select “partial” or “full” support for PHEV drivers. The full support option adds Level 2 chargers at workplaces and public locations, such that most PHEV trips can be completed on the electric range only, while the partial support option assumes more PHEV trips will be completed using the gasoline range once the electric range is depleted. This analysis chose the partial support option, consistent with research on the number of electric miles driven by PHEVs.¹⁷ This assumption effectively decreases the number of Level 2 ports compared to the “full support” option.
- **Home Charging:** The EVI-Pro Lite tool allows users to set the percentage of EV drivers who have access to overnight charging at home and begin each day with a full charge. To maintain consistency with the CEC report, this figure was set at 72 percent. While studies suggest this figure may be higher with changes in parking behavior, customer education, and increased investment in electrical access, the 72 percent figure is reflective of the market in California.¹⁸ Increased access to home charging would decrease the number of charging ports needed in other locations. Additionally, this analysis assigned a home Level 2 charging station to half of these EVs with home charging (36 percent of the forecasted EV population), with the assumption that Level 1 charging at home will be available and sufficient for the remaining EVs with home charging.

Approaches to Deploying EV Charging Infrastructure

The EV market is driven by a myriad of dynamics, including customer awareness and acceptance, the types of EVs available and their affordability, and the availability of charging infrastructure. It is well established that the lack of EV charging infrastructure is a primary barrier to EV adoption.¹⁹ The analysis using the EVI-Pro Lite tool in this report estimates the charging infrastructure needed to support a certain level of EVs. In this section, we discuss approaches for deploying EV charging infrastructure.

Today, approximately 95,000 public Level 2 charging ports and 24,000 DCFC ports are available in the United States, including those dedicated to Tesla vehicles.²⁰ The precise number of workplace Level 2 charging ports is unknown. Based on the EVI-Pro Lite tool results, as shown in Figure 5, more than 2.6 million charge ports in workplaces and public locations will be needed by 2030. The significant difference between the current availability of charging infrastructure and the expected charging infrastructure needed suggests a growing “infrastructure gap” that must be addressed.

One of the impediments to widespread charging infrastructure availability is the cost. The costs associated with EV charging infrastructure include the equipment itself, ongoing operation and maintenance costs, and the installation costs needed to get power to the charging station site. These costs can vary widely, from a few hundred dollars to install a Level 2 charger at home to tens or hundreds of thousands of dollars to install

17. Plotz, Patrick, et al., *Real World Usage of Plug-In Hybrid Electric Vehicles*, ICCT, <https://theicct.org/wp-content/uploads/2021/06/PHEV-white-paper-sept2020-0.pdf>.

18. Ge, Yanbo, et al., *There’s No Place Like Home: Residential Parking, Electrical Access, and Implications for the Future of Electric Vehicle Charging Infrastructure*, <https://www.nrel.gov/docs/fy22osti/81065.pdf>.

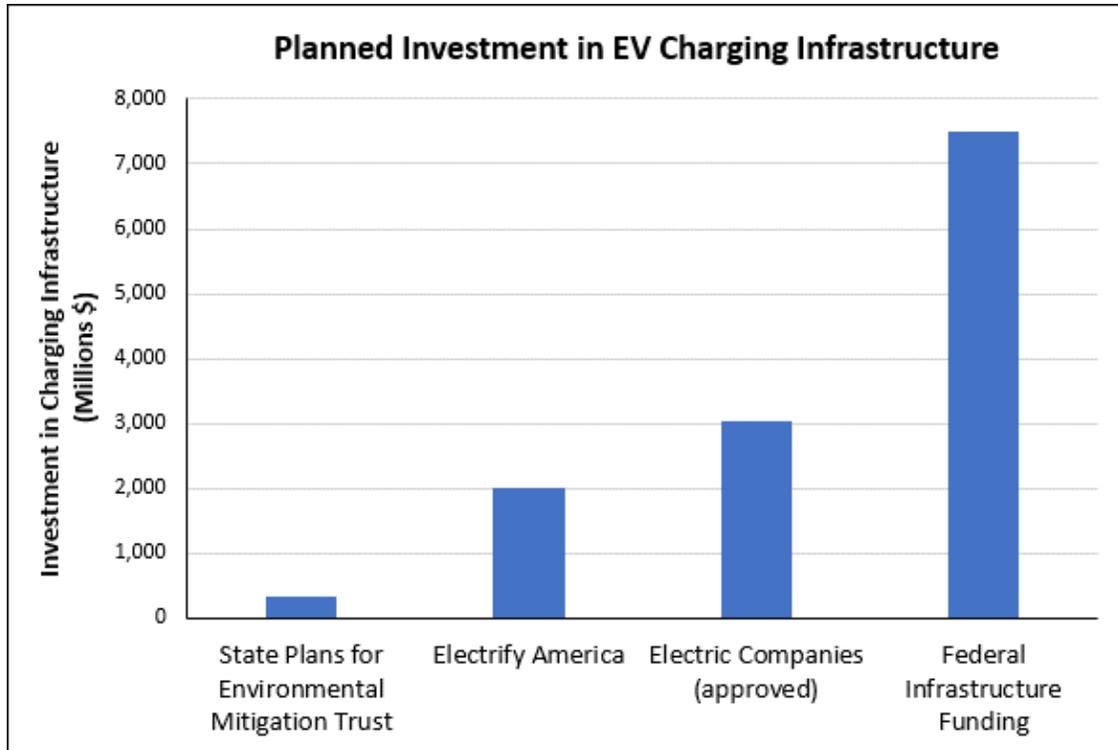
19. NREL, *Consumer Convenience and the Availability of Retail Stations as a Market Barrier for Alternative Fuel Vehicles*, <https://www.afdc.energy.gov/uploads/publication/56898.pdf>.

20. U.S. Department of Energy, Alternative Fuels Data Center. http://www.afdc.energy.gov/fuels/stations_counts.html (Accessed June 2022).

a DCFC depending on power level.²¹ Much of the EV charging infrastructure to date has been paid for by the customer or entity that hosts the charging equipment (the “site host”), whether that is a homeowner, a commercial property owner, or a public entity.

The EV charging marketplace is evolving, and different approaches to providing the charging infrastructure for the EV market are being deployed. Some of the entities that are investing in charging infrastructure are listed below and are summarized in Figure 6.

Figure 6. Planned Investment in EV Charging Infrastructure



- **State Governments:** Twenty-four states have some type of incentive (e.g., grant or tax credit) to support the deployment of EV charging stations.²² The Environmental Mitigation Trust, established in October 2017 under the Volkswagen diesel emissions settlement, provides states and Native American tribes with \$2.925 billion to mitigate emissions of nitrogen oxides (NOx). States may use up to 15 percent of their funds to deploy EV charging infrastructure. So far, 46 states have allocated at least some of their funds to EV charging infrastructure, representing more than \$319 million in potential investment.²³
- **Federal Government:** In November 2021, the IIJA was signed into law and includes significant funding for transportation electrification. The most significant portion of the bill related to charging infrastructure is the National Electric Vehicle Infrastructure (NEVI) formula program which

21. U.S. Department of Energy, *Costs Associated With Non-Residential Electric Vehicle Supply Equipment*, https://www.afdc.energy.gov/uploads/publication/evse_cost_report_2015.pdf.

22. U.S. Department of Energy Alternative Fuels Data Center, *State Laws and Incentives*, <https://afdc.energy.gov/laws/state>.

23. Atlas EV Hub, <https://www.atlasevhub.com/materials/vw-environmental-mitigation-fund-tracking/state-tracking-dashboard/>.

designates \$5 billion for EV charging infrastructure along designated alternative fuel corridors.²⁴ EEI estimates the NEVI program will support approximately 20,000 DCFC ports at 5,000 sites, assuming a cost of \$1 million per site and four DCFC ports per site.²⁵ The bill also includes up to \$2.5 billion in funding for the deployment of charging infrastructure in communities and corridors. The United States Department of Transportation will distribute these funds to states and local governments with federal oversight and advisory input from the newly formed Joint Office of Energy and Transportation.

- **Automakers:** Tesla has built a “Supercharger” network of approximately 14,000 DCFC ports at 1,400 locations in the United States dedicated to its vehicles.²⁶ Other automakers including BMW, Nissan, and Volkswagen also have invested in public charging stations in targeted locations, with partners such as ChargePoint and EVgo managing the stations.²⁷ General Motors and EVgo announced in November 2021 a plan to build 3,250 DC fast charging ports across the U.S.²⁸ Electrify America, a subsidiary of Volkswagen established as part of the diesel emissions settlement, is required to spend \$2 billion over 10 years (2017-2027) to deploy charging infrastructure and related activities to support the EV market.²⁹ In July 2021, Electrify America announced plans to significantly expand, more than doubling the size of its EV charging network to 10,000 DC fast charging ports and investing additional funds beyond the required \$2 billion.³⁰
- **Electric Companies:** Electric companies across the country increasingly are gaining state regulatory approval to invest in electric transportation. These investments are primarily in EV charging infrastructure deployment, which may include charging infrastructure for other applications (such as medium- and heavy-duty trucks and buses), as well as other market support activities such as customer education and outreach. As of June 2022, approved investments totaled more than \$3.4 billion including more than \$3 billion dedicated to charging infrastructure.
- **National Electric Highway Coalition:** In December 2021, EEI announced the formation of the NEHC, a collaboration among electric companies that share the common goal of deploying EV fast charging infrastructure along major U.S. travel corridors. Members of the NEHC are working together to efficiently and expediently deploy fast charging infrastructure that supports the growing number of EVs and helps ensure that the transition to EVs is seamless for drivers. Members of the NEHC are committed to supporting more than 4,500 DC fast charging ports through a variety of mechanisms, as discussed in the Electric Company Role below.

24. U.S. Department of Transportation, Federal Highway Administration, *National Electric Vehicle Infrastructure Formula Program*, https://www.fhwa.dot.gov/bipartisan-infrastructure-law/nevi_formula_program.cfm.

25. Estimate based upon conversations with state DOT officials and electric company representatives

26. U.S. Department of Energy Alternative Fuels Data Center, *Alternative Fueling Station Locator*, <http://www.AFDC.energy.gov/stations>.

27. See <http://www.autonews.com/article/20180723/MOBILITY/180729957/ev-charging-network-us>.

28. See <https://investors.evgo.com/news/news-details/2021/General-Motors-and-EVgo-Boost-Build-Plan-for-High-Power-Fast-Chargers-Across-the-US/default.aspx>.

29. See <https://www.electrifyamerica.com/our-plan>.

30. See <https://media.electrifyamerica.com/en-us/releases/149>.

DC Fast Charging Infrastructure Gap

Investment in all kinds of charging infrastructure, from home charging to high-powered DCFC stations, is necessary to support the number of EVs projected to be on the road in 2030. While DCFC ports make up only approximately one percent of the EV charging infrastructure needed to support the projected number of EVs on U.S. roads in 2030, DCFC infrastructure is of particular focus for policy makers, third-party charging providers, and electric companies. These charging stations are critical parts of the electric transportation ecosystem that allow vehicles to recharge rapidly, reaching 80 percent capacity in as few as 15 minutes depending on the power level of charging station and size of the EV battery. However, these stations also are significantly more expensive than lower-powered Level 2 stations, often costing hundreds of thousands of dollars per station.

DCFC stations are key to enabling long distance EV travel, to increasing driver confidence, and to providing fast, convenient charging for individuals who lack access to dedicated parking. To adequately serve the coming wave of EVs, there will need to be substantial and sustained investment in the buildout of DCFC infrastructure. Despite the significant investments detailed in the section above, EEI projects a shortfall of nearly 70 percent in the number of DCFC ports needed in 2030 given currently announced levels of funding.

Figure 7 details the number of DCFC ports supported by the planned investment sources listed above. The number of DCFC ports needed in 2030 to meet demand is more than double the planned DCFC ports.

Figure 7. Planned Ports and EEI Projection of DC Fast Charging Port Shortfall by 2030

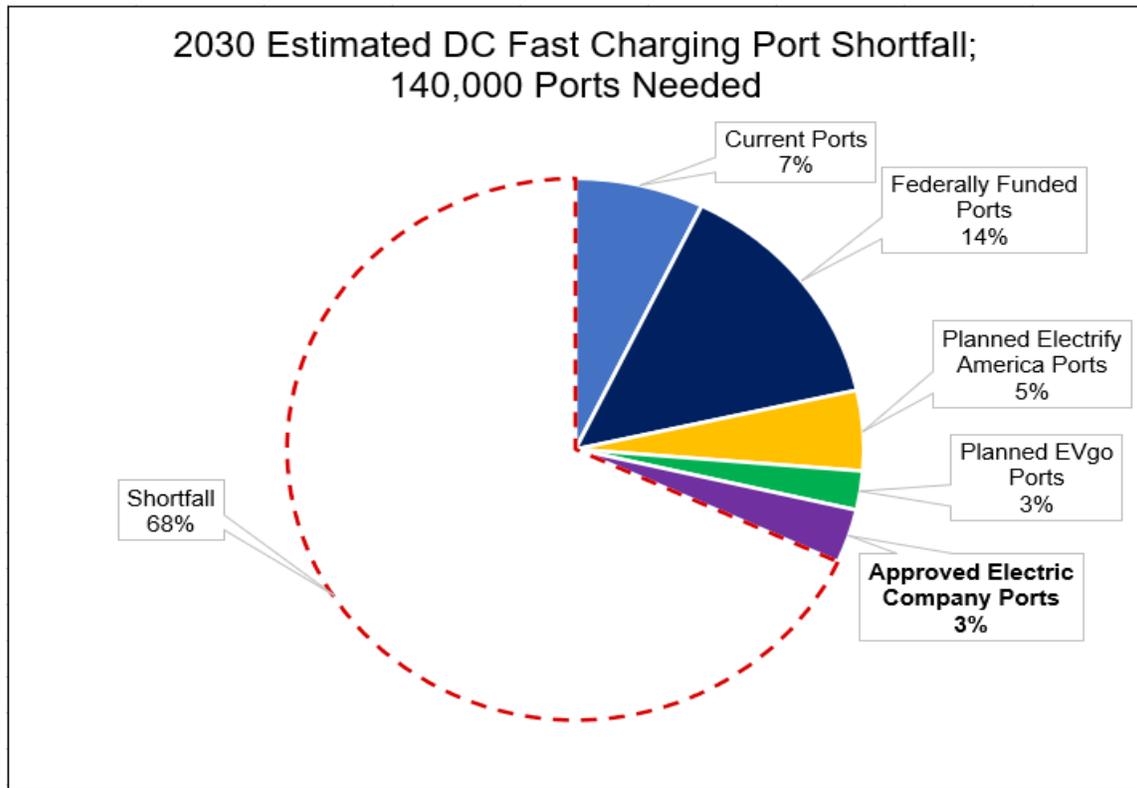


Figure 7 includes 10,100 current publicly available non-Tesla charging ports, 20,000 federally funded ports, 6,700 Electrify America ports, 3,250 EVgo ports, and 4,500 electric company supported ports.

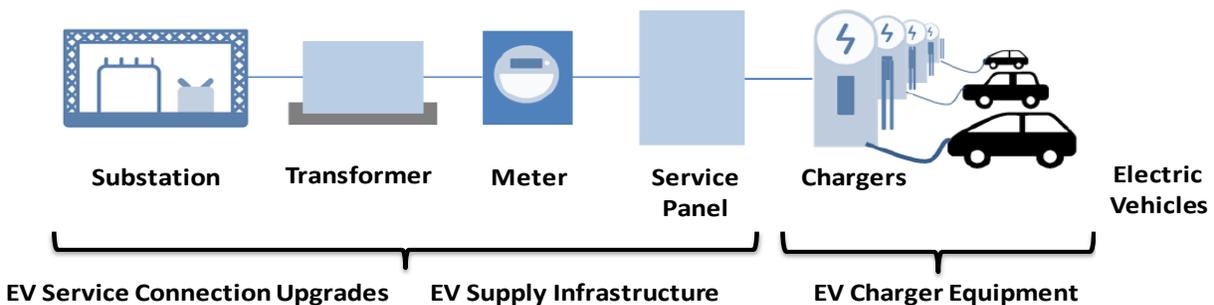
Electric Company Role

Electric companies are well-positioned to deploy EV charging infrastructure. Electric company investment in charging infrastructure may take many different forms, including:

- Developing “make-ready” infrastructure, which includes service connection upgrades and new supply infrastructure to bring power to the charging equipment (see Figure 7); the site host is responsible for procuring the charging equipment.
- Installing and owning all infrastructure up to, and including, the charging equipment itself; either the electric company, the site host, or a third-party may operate and maintain charging equipment.
- Offering incentives, typically in the form of rebates, to defray some or all of the cost of the charging equipment and/or the installation costs.

Members of the NEHC are utilizing each of these forms and others to support more than 4,500 DCFC ports.

Figure 8. Illustration of EV Charging Infrastructure



In addition, electric company investments can support the smart integration of EV charging load into the distribution system in different ways, including:

- Offering electric rates that encourage EV charging at specific times of the day (e.g., at off-peak times).
- Requiring charging equipment associated with these programs to be ready for managed charging, such as being capable of receiving demand response signals.
- Helping to educate EV drivers and site hosts to choose the appropriate rates and connect them with charging equipment providers.

Increased adoption of EVs, when efficiently added to the energy grid, can provide benefits to all customers. The additional electricity demand from EVs added to the energy grid in a way that more fully utilizes existing infrastructure puts downward pressure on rates for all customers, providing benefits to drivers and non-drivers alike.³¹

31. See Synapse Energy, “Electric Vehicles Are Driving Electric Rates Down: June 2019 Update,” <https://www.synapse-energy.com/sites/default/files/EV-Impacts-June-2019-18-122.pdf> ; See also Energy and Environmental Economics, “Cost-Benefit Analysis of Plug-in Electric Vehicle Adoption in the AEP Ohio Service Territory,” https://www.ethree.com/wp-content/uploads/2017/10/E3-AEP-EV-Final-Report-4_28.pdf.

Conclusion

With more than 26 million EVs anticipated to be on U.S. roads in 2030, the future of transportation increasingly looks to be electric. Customer demand for EVs has continued to outpace the expectations from industry analysts, causing nearly every forecast to be revised upwards. Commitments from policymakers and the largest automakers signal a much higher ceiling for transportation electrification this decade than was expected only a few short years ago.

The continued expansion of the U.S. EV market will make coordinated collaboration among all EV charging stakeholders, including policymakers, charging service providers, automakers, and electric companies, critical for ensuring a rapid, efficient buildout of necessary charging infrastructure. In particular, the gap in fast charging must be addressed with announced public and private investment accounting for less than 35 percent of the projected need.

Electric company participation in the development of EV charging infrastructure supports state-level clean energy and transportation goals, expands customer choice, and helps to ensure that EV owners will be able to charge their cars at home, on the street, at the office, at shopping locations, or along major travel corridors.

Electric transportation is a win-win-win that not only meets customer needs, but also provides economic and environmental benefits for all Americans.

The **Edison Electric Institute** (EEI) is the association that represents all U.S. investor-owned electric companies. Our members provide electricity for 235 million Americans, and operate in all 50 states and the District of Columbia. As a whole, the electric power industry supports more than 7 million jobs in communities across the United States. In addition to our U.S. members, EEI has more than 65 international electric companies with operations in more than 90 countries, as International Members, and hundreds of industry suppliers and related organizations as Associate Members.

Organized in 1933, EEI provides public policy leadership, strategic business intelligence, and essential conferences and forums.

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