Electric Vehicle Charging Infrastructure Trends from the Alternative Fueling Station Locator: Second Quarter 2022

Abby Brown,[1] Jeff Cappellucci,[1] Emily White,[2]
Alexia Heinrich,[2] and Emma Cost[2]

1 National Renewable Energy Laboratory
2 ICF Inc.

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Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

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Technical Report
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Cover Photo by Tam Do: NREL 69320.

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List of Acronyms

AFDC	Alternative Fuels Data Center
AMPUP	AmpUp network
API	application program interface
BN	Blink network
CCS	Combined Charging System
CHARGELAB	ChargeLab network
CPN	ChargePoint network
DC	direct current
E85	ethanol blend containing 51% to 83% ethanol, depending on geography and season
EA	Electrify America network
EV	electric vehicle, including all-electric and plug-in hybrid electric vehicles
EVC	EV Connect network
EVCS	EV Charging Solutions network
EVGATEWAY	evGateway network
EVN	EVgo network
EVSE	electric vehicle supply equipment
EVSP	electric vehicle service provider
FCN	Francis Energy network
FLO	FLO network
FPLEV	FPL EVolution network
GRN	Greenlots network
HD	heavy duty
L1	Level 1
L2	Level 2
LD	light duty
LIVINGSTON	Livingston Energy Group network
MD	medium duty
NEVI	National Electric Vehicle Infrastructure
NON	non-networked
NREL	National Renewable Energy Laboratory
OC	OpConnect network
OCPI	Open Charge Point Interface
POWERFLEX	PowerFlex network
Q1	quarter 1, or first quarter of the calendar year
Q2	quarter 2, or second quarter of the calendar year
Q3	quarter 3, or third quarter of the calendar year
Q4	quarter 4, or fourth quarter of the calendar year
RIVIAN_ADVENTURE	Rivian Adventure Network
RIVIAN_WAYPOINTS	Rivian Waypoints network
SCN	SemaConnect network
SWTCH	SWTCH Energy network
TESLA	Tesla Supercharger network
TESLAD	Tesla Destination network

VLTA	Volta network
WEB	Webasto network
ZEFNET	ZEF Energy network

Executive Summary

Electric vehicle (EV) charging continues to experience rapidly changing technology and growing infrastructure. Using data from the U.S. Department of Energy's Alternative Fueling Station Locator, this report provides a snapshot of the state of EV charging infrastructure in the United States in the second calendar quarter of 2022 (Q2 2022) by charging level, network, and location. Additionally, this report measures the current state of charging infrastructure compared with two different 2030 infrastructure requirement scenarios. This information is intended to help transportation planners, policymakers, researchers, infrastructure developers, and others understand the rapidly changing landscape of EV charging infrastructure. This is the tenth report in a series. Reports from previous quarters can be found in the Alternative Fuels Data Center (AFDC) and National Renewable Energy Laboratory (NREL) publication databases, as well as the AFDC Charging Infrastructure Trends page (https://afdc.energy.gov/fuels/electricity_infrastructure_trends.html).

In Q2 2022, the number of electric vehicle supply equipment (EVSE) ports in the Station Locator grew by 4.6%, or 6,165 ports. Public EVSE ports grew by 5.1%, or 5,875 ports, bringing the total number of public ports in the Station Locator to 121,778 and accounting for the majority of ports in the Station Locator (Figure ES-1). Private EVSE ports increased by 1.5%, or 290 ports. The Mid-Atlantic region had the largest increase in public charging infrastructure in Q2 (6.7%), though California, which has almost one-third of the country's public charging infrastructure, continues to lead the country in the number of public ports.

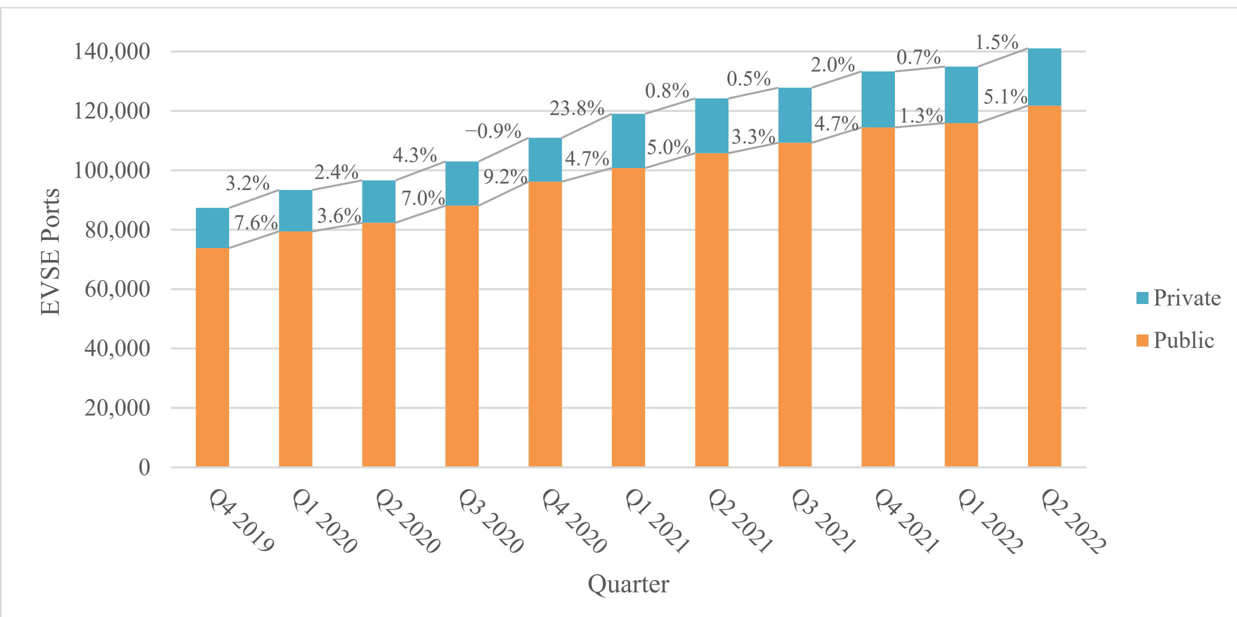

Figure ES-1. Quarterly growth of EVSE ports by access.

Note: The percentages in this figure indicate the percent growth between each quarter.

Direct-current (DC) fast EVSE ports increased by the greatest percentage (6.4%) in Q2 (Figure ES-2). Level 1 EVSE ports decreased by 12.6%. The decrease in Level 1 EVSE ports can be largely attributed to the removal of public Level 1 ports at Kwik Trip locations from the Station

Locator that were determined to not have enough power to charge an EV based on communication with the Station Locator team's Kwik Trip contact.

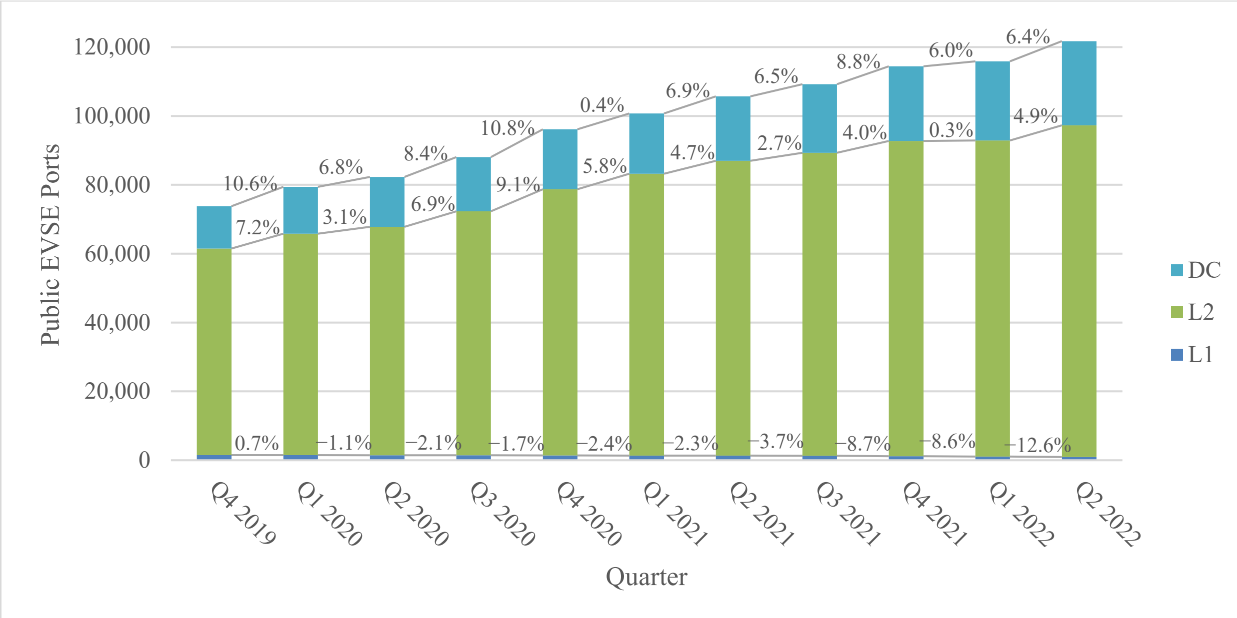

Figure ES-2. Quarterly growth of public EVSE ports by charging level.

Note: Figure excludes legacy EVSE ports that are not classified by charging level and are no longer manufactured. As of Q2, there were 42 public legacy EVSE ports in the Station Locator. Additionally, the percentages in this figure indicate the percent growth between each quarter.

DC fast EVSE ports have the highest power output and therefore provide the most charge in the least amount of time. Building out the country's network of public DC fast chargers is critical to supporting EV adoption in the United States, and it is therefore important to highlight trends in the growth of DC fast EVSE ports in the Station Locator. DC fast EVSE ports have a typical power output of 50 kW, and DC fast chargers with higher levels of power output are increasingly available. Extreme fast charging infrastructure, which has a power output of 350 kW or more, was introduced in 2018. The number of DC fast EVSE ports with these higher power levels remains a minority in the Station Locator, yet is steadily increasing (Figure ES-3).

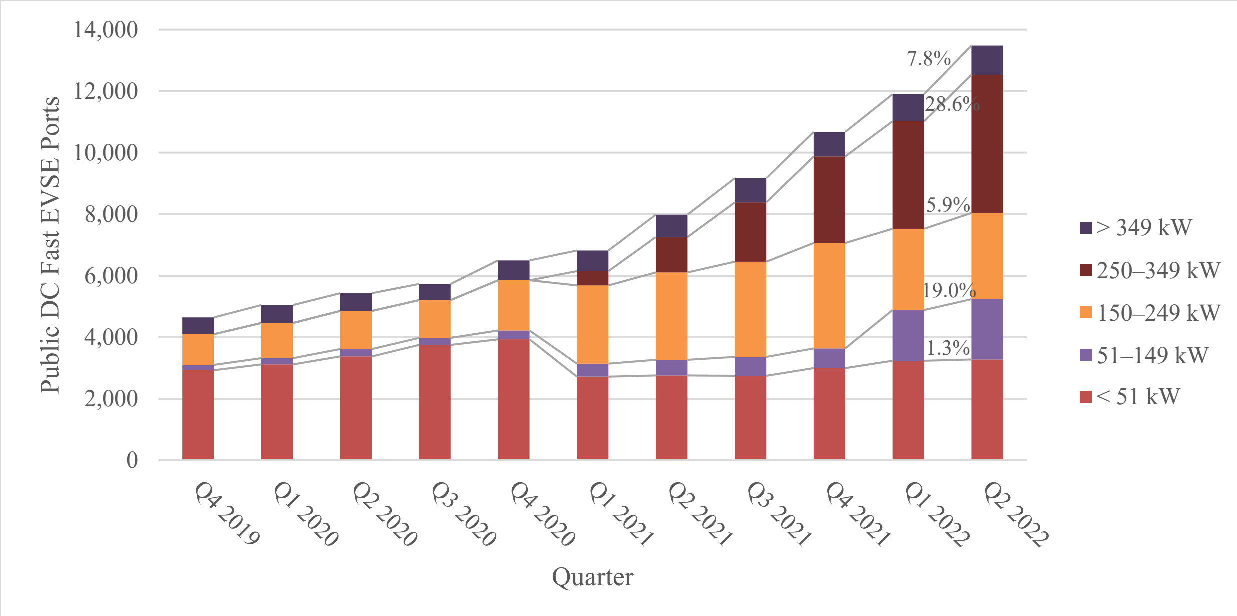

Figure ES-3. Quarterly growth of public DC fast EVSE ports by power output.

Note: The percentages in this figure indicate the percent growth between each quarter. For an explanation of the changes seen in Q1 2021, see the Q1 2021 report (Brown et al. 2021).

When comparing the current rate of deployment of public charging infrastructure with the Biden administration's goal of reaching 500,000 EVSE ports in the United States by 2030, it is clear the pace of installations will need to significantly increase. To meet the administration's goal by 2030, an average of 12,607 public EVSE port installations will be needed each quarter for the next 8 years, equating to an average quarterly growth rate of 4.8%. This is substantially higher than the average of 4,794 public EVSE ports installed each quarter since the start of 2020, when this report series began.

NREL's *National Plug-In Electric Vehicle Infrastructure Analysis* estimated the United States would require 27,500 DC fast and 601,000 Level 2 public and workplace EVSE ports to support a scenario of 15 million EVs on the road by 2030 (Wood et al. 2017). Based on this analysis, 89.1% and 17.6% of the required DC fast and Level 2 EVSE ports, respectively, have been installed as of Q2 2022. However, the majority (58.2%) of public DC fast EVSE ports in the Station Locator are on the Tesla network and are therefore only readily accessible to Tesla drivers. When Tesla EVSE ports are removed, this decreases to 37.4% and 15.8%, respectively, of the projected need.

Atlas Public Policy's *U.S. Passenger Vehicle Electrification Infrastructure Assessment* estimated that an additional 252,000 DC fast and 244,000 Level 2 public and workplace EVSE ports would be required by 2030 to support a scenario where 100% of passenger vehicle sales are electric by 2035 (McKenzie and Nigro 2021). Based on this assessment, the number of DC fast and Level 2 EVSE ports is 9.1% and 31.6%, respectively, of the way toward meeting 2030 infrastructure requirements. This decreases to 4.0% and 29.2%, respectively, when Tesla EVSE ports are removed.

If there are additional metrics that readers are interested in seeing, please email suggestions to the authors at TechnicalResponse@icf.com.

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1 Importance of Tracking Electric Vehicle Charging Infrastructure Trends

The U.S. Department of Energy's Alternative Fuels Data Center (AFDC) launched in 1991 in response to the Alternative Motor Fuels Act of 1988 and the Clean Air Act Amendments of 1990 (AFDC 2022a). Originally, it served as a hard copy resource for alternative fuel performance data, and then became an internet resource in 1995. Since then, the AFDC has evolved dramatically into a robust online resource that provides a broad range of information on alternative fuels and advanced transportation technologies, including fueling and charging station data. In 2017, the National Renewable Energy Laboratory (NREL) partnered with National Resources Canada to expand the data set to include the location of alternative fuel stations across Canada as the Electric Charging and Alternative Fueling Stations Locator, or *Localisateur de stations de recharge et de stations de ravitaillement en carburants de remplacement* (Levene et al. 2019). The Station Locator database now includes information on public and private nonresidential alternative fueling stations in the United States and Canada. The database currently tracks ethanol (E85), biodiesel, compressed natural gas, electric vehicle (EV) charging, hydrogen, liquefied natural gas, and propane stations.

Although historical data for all fuel types in the Station Locator are available, it is especially important to take an in-depth look at EV charging due to rapidly changing technology and growing infrastructure. This trend is likely to continue given the Joseph R. Biden administration's goal of building a national EV charging network of up to 500,000 EV chargers by 2030 and the newly available funds from the Bipartisan Infrastructure Law to support this goal. Using Station Locator data, this report explores the growth of both public and private EV charging infrastructure in the United States for the second calendar quarter of 2022 (Q2 2022). This is the tenth report in a series. Reports from previous quarters can be found in the AFDC and NREL publication databases, as well as the AFDC Charging Infrastructure Trends page (https://afdc.energy.gov/fuels/electricity_infrastructure_trends.html).

It is important to state these reports reflect a snapshot of the number of available electric vehicle supply equipment (EVSE) ports in the Station Locator at the end of each quarter. Therefore, notable changes may be attributed to the manual data collection process, as new manually added EVSE ports are counted in the quarter in which they are added to the Station Locator as opposed to when the infrastructure was installed. Additionally, stations that are temporarily out of service are not included in these reports.

1.1 Projecting Future Charging Infrastructure Needs

The Biden administration set an early goal of building a network of up to 500,000 public EVSE ports in the United States by 2030.[1] To put this goal into context, the number of public EVSE ports in the Station Locator has grown by an average of 4,794 EVSE ports per quarter since the start of 2020, when this report series began. In order to reach 500,000 EVSE ports by 2030, an average of 12,607 public EVSE port installations will be required each quarter for the next 8

[1] The goal includes installing 500,000 public charging stations by 2030 but does not specifically outline whether a charging station means a location or an EVSE port, as defined in Section 1.2. For the purposes of this report, it was assumed that charging station refers to a single-port charger, and therefore 500,000 EVSE ports.

years, equating to an average quarterly growth rate of 4.8% and indicating that the pace of installations will need to increase significantly.

The Bipartisan Infrastructure Law (H.R. 3684), which President Biden signed into law on November 15, 2021, formally established the National Electric Vehicle Infrastructure (NEVI) Formula Grant Program and the Discretionary Grant Program for Charging and Fueling Infrastructure (The White House 2022). These programs will provide states with $7.5 billion (collectively) in funds to begin building the network of 500,000 public EVSE ports, though it will not necessarily fund all the infrastructure required to meet the Biden administration's goal. This goal does not differentiate between direct-current (DC) fast and Level 2 (L2) EVSE ports, and these programs do not dictate how many DC fast versus Level 2 EVSE ports will be funded. However, the NEVI Formula Grant Program will initially be focused on building out charging infrastructure along the interstate highway system with DC fast EVSE ports, and the Discretionary Grant Program is expected to fund both DC fast and Level 2 EVSE ports (Federal Highway Administration 2022a).

Two studies with different EV projection scenarios offer insight into how much public and workplace DC fast and Level 2 charging might be required in the United States to support a growing fleet of light-duty EVs. The first study, NREL's 2017 *National Plug-In Electric Vehicle Infrastructure Analysis*, estimates that a total of 27,500 DC fast EVSE ports and 601,000 Level 2 EVSE ports would be required across the United States to support 15 million light-duty EVs by 2030 (Wood et al. 2017). This equates to 1.8 DC fast EVSE ports per 1,000 EVs and 40.1 Level 2 EVSE ports per 1,000 EVs. The second study, Atlas Public Policy's 2021 *U.S. Passenger Vehicle Electrification Infrastructure Assessment*, assumes that 100% of passenger vehicle sales will be electric by 2035, which would result in approximately 57.5 million light-duty EVs by 2030 (McKenzie and Nigro 2021). To support these EVs, this study estimates that an additional 252,000 DC fast EVSE ports and 244,000 Level 2 EVSE ports would be required. Using the number of installations as of Q1 2021 as a baseline, this results in approximately 269,558 DC fast EVSE ports and 335,266 Level 2 EVSE ports by 2030 and equates to 4.7 DC fast EVSE ports per 1,000 EVs and 5.8 Level 2 EVSE ports per 1,000 EVs. For a more detailed discussion of these studies and the different assumptions used to arrive at their respective infrastructure projections, see the Q3 2021 report (Brown et al. 2022).

As of Q2 2022, there were 24,506 public and workplace DC fast EVSE ports and 106,038 public and workplace Level 2 EVSE ports available in the United States (Figure 1). Based on NREL's analysis, the number of DC fast and Level 2 EVSE ports installed is 89.1% and 17.6%, respectively, of the way toward meeting projected 2030 infrastructure requirements to support 15 million EVs (Figure 1). Based on Atlas' assessment, the number of DC fast and Level 2 EVSE ports is 9.1% and 31.6%, respectively, of the way toward meeting projected 2030 infrastructure requirements to support 57.5 million EVs (Figure 1). It is important to note that 58.2% of public DC fast EVSE ports in the Station Locator are on the Tesla Supercharger network and are therefore only readily accessible to Tesla drivers.[2] Additionally, as of June 30, 2022, 47% of EVs on the road were Teslas (Experian Information Solutions 2022a). When public Tesla EVSE ports are excluded, the number of DC fast and Level 2 EVSE ports currently installed decreases

[2] Tesla has suggested in some comments that it may open its network to non-Tesla drivers in exchange for federal funding (Loveday 2022).

to 37.4% and 15.8%, respectively, of the way toward meeting NREL's projected infrastructure requirements, and 4.0% and 29.2%, respectively, toward meeting Atlas' projected infrastructure requirements.

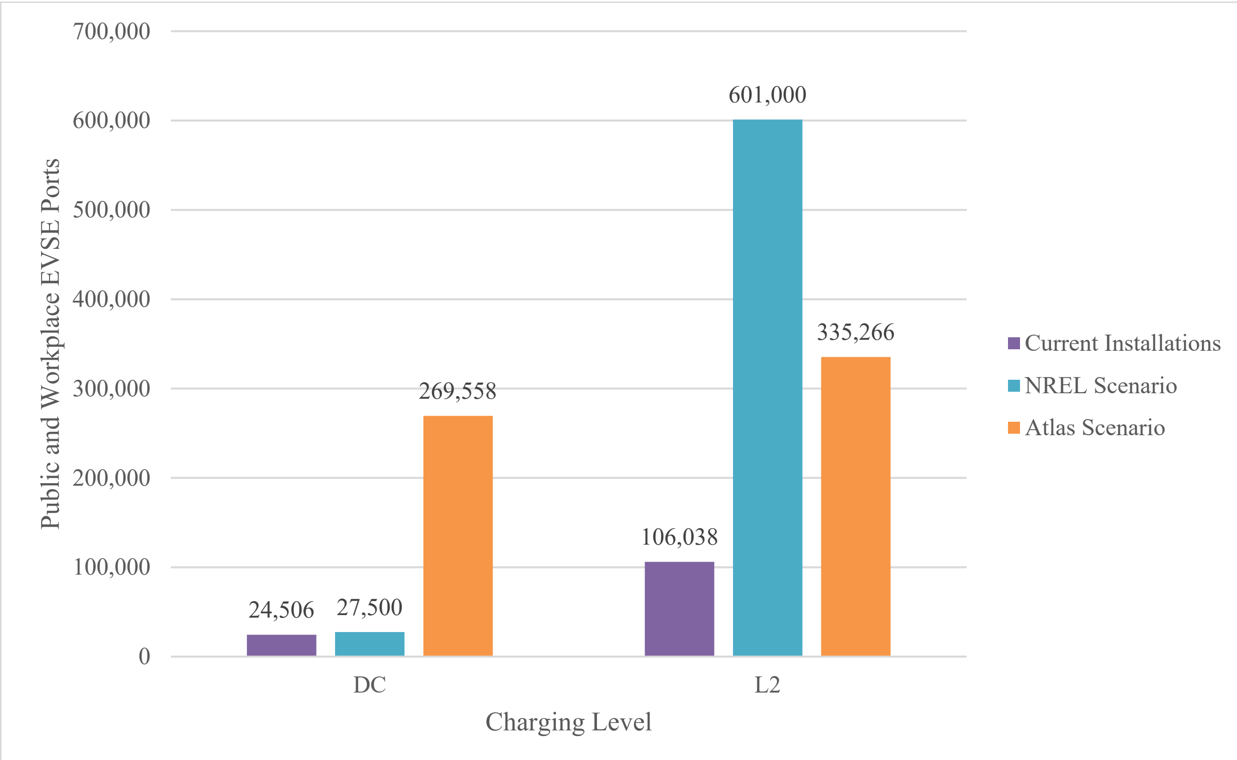

Figure 1. Current availability of public and workplace charging versus two scenarios of 2030 infrastructure requirements in the United States

There were approximately 2.6 million EVs on the road in the United States as of June 30, 2022 (Experian Information Solutions 2022a). The ratios of DC fast and Level 2 public and workplace EVSE ports per 1,000 EVs in Q2 were 9.2 and 40.0, respectively (Table 1). These ratios decrease to 3.9 and 35.7, respectively, when Tesla EVSE ports are excluded (Table 1). Using NREL and Atlas' estimated ratios of the number of DC fast and Level 2 EVSE ports per 1,000 EVs as a proxy for how much infrastructure is sufficient to meet charging needs in 2030, Table 1 suggests that, as of Q2, public and workplace DC fast EVSE ports are keeping up with current charging needs in terms of the total amount of infrastructure currently available. Public and workplace Level 2 EVSE ports, on the other hand, have fallen below NREL's estimated ratio of EVSE ports per 1,000 EVs for the first time. Level 2 EVSE ports have continued to steadily increase each quarter since the start of 2020; however, the number of EV registrations has grown at a faster rate each quarter since the start of 2021, causing the ratio of Level 2 EVSE ports per 1,000 EVs to decrease. For example, the number of registered EVs grew by 9.3% in Q2 while the number of Level 2 EVSE ports grew by 4.9%. Although roughly 18% of the 15 million light-duty EVs in NREL's analysis and roughly 5% of the 57.5 million light-duty EVs in Atlas' assessment were on the road as of Q2, resulting in a relatively high ratio of EVSE ports to EVs,this ratio will continue to decrease unless infrastructure growth is able to keep pace.

Table 1. Current Public and Workplace EVSE per 1,000 EVs Versus Two Scenarios of 2030 Infrastructure Requirements in the United States

Port Level	EVSE per 1,000 EVs in Q2 2022 (including Tesla)	EVSE per 1,000 EVs in Q2 2022 (excluding Tesla)	NREL – EVSE per 1,000 EVs Needed in 2030 To Support 15 Million EVs	Atlas – EVSE per 1,000 EVs Needed in 2030 To Support 57.5 Million EVs
DC Fast	9.2	3.9	1.8	4.7
Level 2	40.0	35.7	40.1	5.8

1.2 EV Charging Data Fields

Current charging infrastructure in the Station Locator is classified into the following categories:

- **Public:** A broad category that includes EV charging located in publicly accessible areas or along highway corridors. Public EV charging infrastructure is generally accessible to any EV driver, though this includes some stations with certain qualifications, such as stations that are made available to the public after business hours or stations that require payment through a specific application. Additionally, stations that are reserved for patrons of a business, such as guests of a hotel, visitors of a museum, or customers of a retail store, are classified as public restricted access.
- **Workplace:** EV charging intended to provide charging to employees during the workday. Workplace charging infrastructure is accessible only to employees of a business and is therefore classified as private in the Station Locator.
- **Commercial/Fleet:** EV charging intended to provide charging for electric fleet vehicles, including municipal/private fleets, car sharing, and transportation network companies. Fleet charging infrastructure is classified as private in the Station Locator.

The Station Locator does not maintain data on single-family residential charging and has minimal, yet expanding, data on charging at multifamily buildings. EV charging infrastructure at multifamily buildings is also classified as private in the Station Locator. See Section 2.2.3 for additional details.

In 2019, the Station Locator team transitioned its counting logic to align with the hierarchy defined in the Open Charge Point Interface (OCPI) protocol: station locations, EVSE ports, and connectors (EVRoaming Foundation 2020), as shown in Figure 2 and described below. Therefore, the Station Locator counts the number of EVSE ports at each station location. Additionally, the term "EV charger" is used to refer to a single piece of charging equipment throughout this report. For example, Figure 2 has two pieces of charging equipment, and therefore two EV chargers. However, it should be noted that the Station Locator does not track the number of EV chargers at each station location.

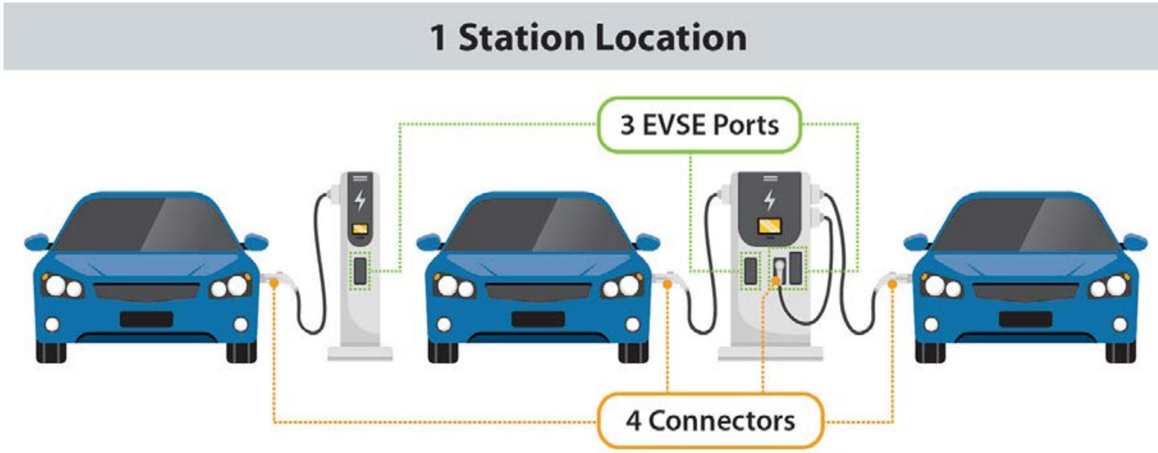

Figure 2. EV charging infrastructure hierarchy.

Source: AFDC (2022d)

The following fuel-specific fields are tracked in the Station Locator for EV charging stations (AFDC 2022c):

- EV charging information:
  - Station location: A site with one or more EVSE ports located at the same address.
  - EVSE port count: The number of outlets or ports available to charge a vehicle (i.e., the number of vehicles that can simultaneously charge at a charging station).
  - EVSE port type:
    - Level 1 (L1): 120 V; 1 hour of charging = 5 miles of range[3]
    - Level 2 (L2): 240 V; 1 hour of charging = 25 miles of range[4]
    - Direct-current (DC) fast: 480+ V; 30 minutes of charging = 100–200+ miles of range[5]
  - Connectors (number and type): What is plugged into a vehicle to charge it. Multiple connectors and connector types can be available on one EVSE port, but only one vehicle will charge at a time.
    - NEMA: for Level 1 charging[6]
    - J1772: for Level 1 and Level 2 charging
    - Combined Charging System (CCS): for DC fast charging for most vehicle models
    - CHAdeMO: for DC fast charging for select vehicle models

[3] This assumes a power output of 1.9 kW. The actual range per hour of charging depends on the power capacity of the EVSE port and the efficiency of the vehicle being charged.
[4] This assumes a power output of 6.6 kW. The actual range per hour of charging depends on the power capacity of the EVSE port and the efficiency of the vehicle being charged.
[5] The power output of DC fast EVSE ports varies greatly. The actual range per hour of charging depends on the power capacity of the EVSE port and the efficiency of the vehicle being charged.
[6] Most, if not all, EVs will come with a Level 1 cordset, so no additional charging equipment is required. On one end of the cord is a standard NEMA connector (for example, a NEMA 5-15, which is a common three-prong household plug), and on the other end is an SAE J1772 standard connector (often referred to simply as J1772). The J1772 connector plugs into the car’s J1772 charge port, and the NEMA connector plugs into a standard NEMA wall outlet.

    – Tesla: for all charging levels for Tesla vehicles
  - Network
  - Manufacturer
  - Power output (kW)
- Open date
- Workplace
- Pricing
- On-site renewable electricity source.

These fields and the associated definitions are used in the analysis that follows.

2 Electric Vehicle Charging Infrastructure Trends

The purpose of this report is to identify EV charging infrastructure trends for Q2 of 2022. In Q2, the number of EVSE ports in the Station Locator grew by 4.6%, or 6,165 EVSE ports. Public EVSE ports grew by 5.1%, or 5,875 ports, and account for the majority of EVSE ports in the Station Locator (Figure 3). Private EVSE ports increased by 1.5%, or 290 EVSE ports. As of Q2, 86.3% of EVSE ports in the Station Locator were public and 13.7% were private, compared with 84.5% public and 15.5% private in Q4 2019.

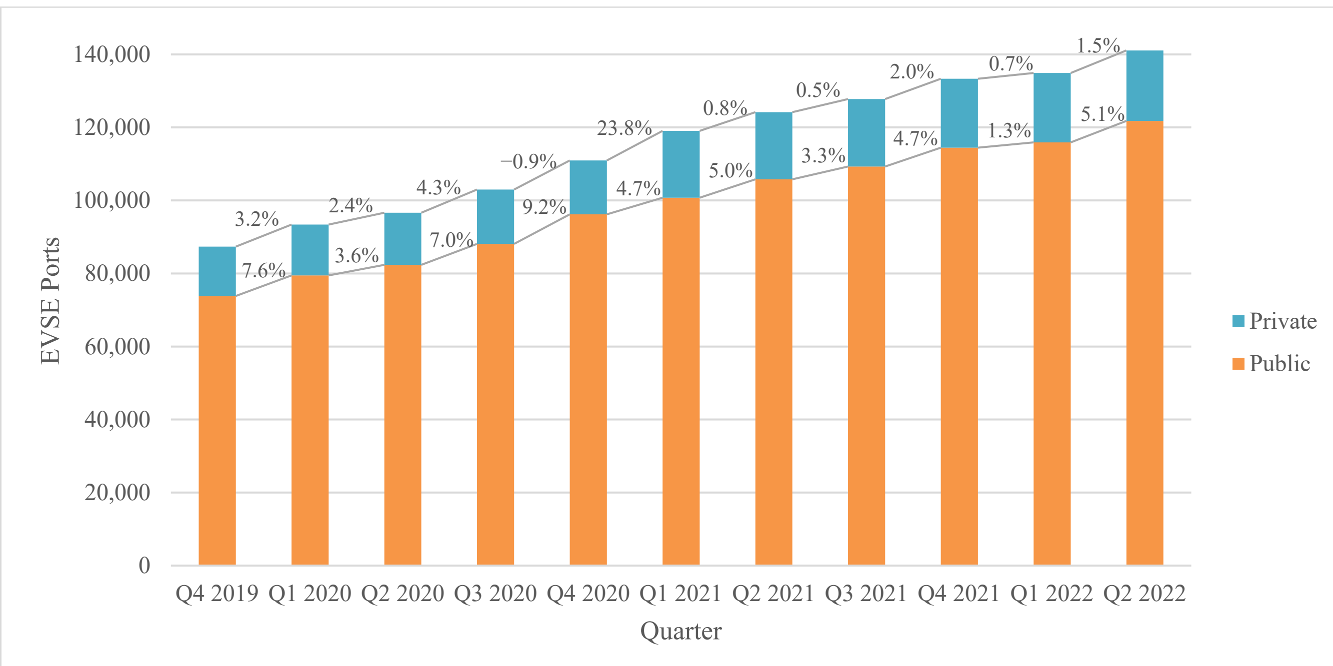

Figure 3. Quarterly growth of EVSE ports by access.

Note: The percentages in this figure indicate the percent growth between each quarter.

The following sections break down the growth of public and private EVSE ports further to highlight what types of EV infrastructure grew in Q2 and where EV infrastructure has grown geographically. Because the number of EVSE ports represents the number of vehicles that can charge simultaneously at an EV charging station, the remainder of this report will focus on EVSE port growth.

2.1 Public Charging Trends

As previously mentioned, public EV charging refers to EV charging stations that are available to all EV drivers and located in publicly accessible locations, such as commercial locations or along highway corridors. In Q2, the number of public EVSE ports in the Station Locator increased by 5,875, bringing the total number of public EVSE ports in the Station Locator to 121,778 and representing a 5.1% increase since Q1 2022. The following sections break down the growth of public EVSE ports by charging level, network, region, and state.

2.1.1 By Charging Level

As shown in Figure 4, the majority of public EVSE ports in the Station Locator are Level 2, followed by DC fast and Level 1. However, similar to the last several quarters, DC fast EVSE ports increased by the greatest percentage (6.4%) in Q2 (Figure 4). DC fast EVSE ports made up 16.7% of public EVSE ports in Q4 2019 and 20.1% of public EVSE ports as of Q2 2022.

Similar to Q1 2022, Level 1 EVSE ports decreased by 12.6% (Figure 4). The decrease in Level 1 EVSE ports can be largely attributed to the removal of public Level 1 EVSE ports at Kwik Trip locations from the Station Locator that were determined to not have enough power to charge an EV based on communication with the Station Locator team's Kwik Trip contact.

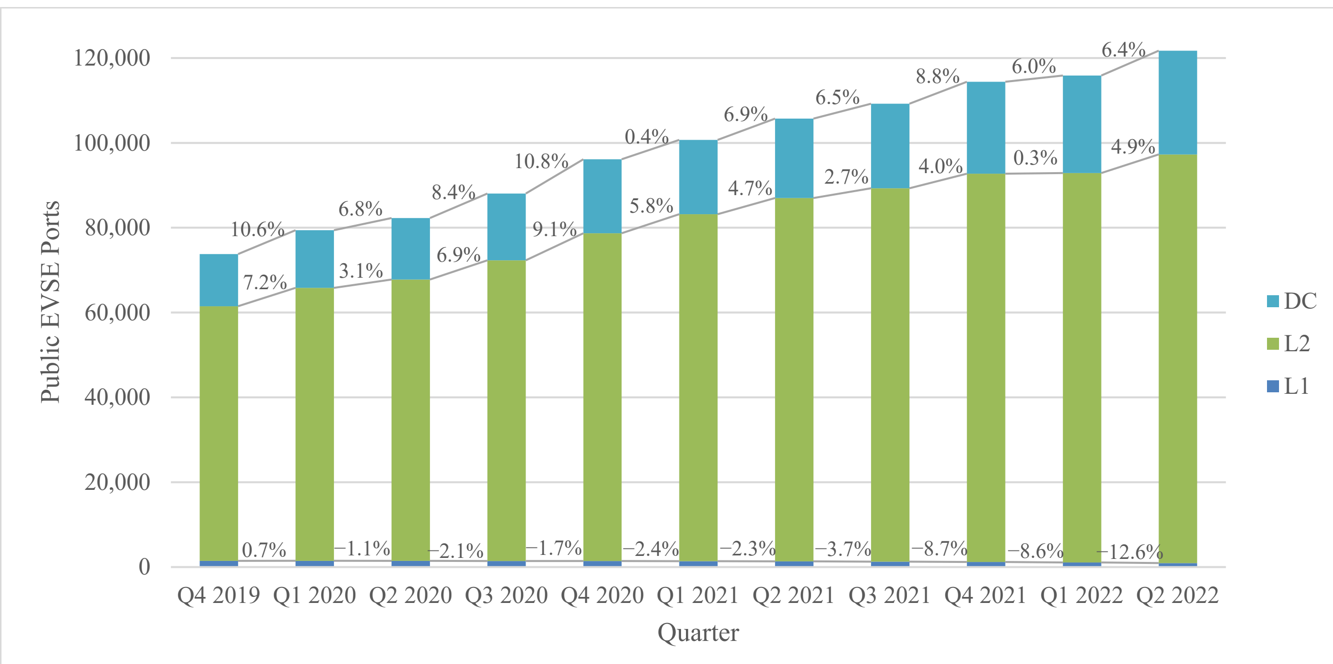

Figure 4. Quarterly growth of public EVSE ports by charging level.

Note: Figure excludes legacy EVSE ports that are not classified by charging level and are no longer manufactured. As of Q2, there were 42 public legacy EVSE ports in the Station Locator. Additionally, the percentages in this figure indicate the percent growth between each quarter.

When compared with Level 1 and Level 2 EVSE ports, DC fast EVSE ports have the highest power output and therefore provide the most charge in the least amount of time. Building out the country's network of public DC fast chargers is critical to supporting EV adoption in the United States, and it is therefore important to highlight trends in the growth of DC fast EVSE ports in the Station Locator. Whereas the power output for Level 1 EVSE ports is about 1 kW and Level 2 EVSE ports can operate at up to 19 kW, DC fast EVSE ports have a typical power output of 50 kW, and DC fast chargers with higher levels of power output are increasingly available. Extreme fast charging infrastructure, which has a power output of 350 kW or more, was introduced in 2018. The number of DC fast EVSE ports with these higher power levels remain a minority in the Station Locator, yet are steadily increasing, as seen in Figure 5.

It is important to point out that of the 24,450 public DC fast EVSE ports in the Station Locator, power output data are currently available for 55.1%; Figure 5 is therefore based on power output data for 13,481 DC fast EVSE ports, up from 4,644 in Q4 2019. Additionally, if a DC fast EVSE port has two connectors with different power outputs, only the maximum power output is counted in Figure 5. NREL is in the process of integrating updated OCPI-based application programming interfaces (APIs) to streamline the collection of power output data and create a more complete data set, as well as making power data publicly available for CCS and CHAdeMO connectors.

As shown in Figure 5, the number of EVSE ports with a power output between 250 and 349 kW grew by the largest percentage in Q2 (28.6%). This growth can primarily be attributed to new Tesla Supercharger installations with a power output of 250 kW. The large growth seen in the number of EVSE ports with a power output between 51 and 149 kW can be primarily attributed to new ChargePoint and EVgo installations with a power output of 62 and 100 kW, respectively.

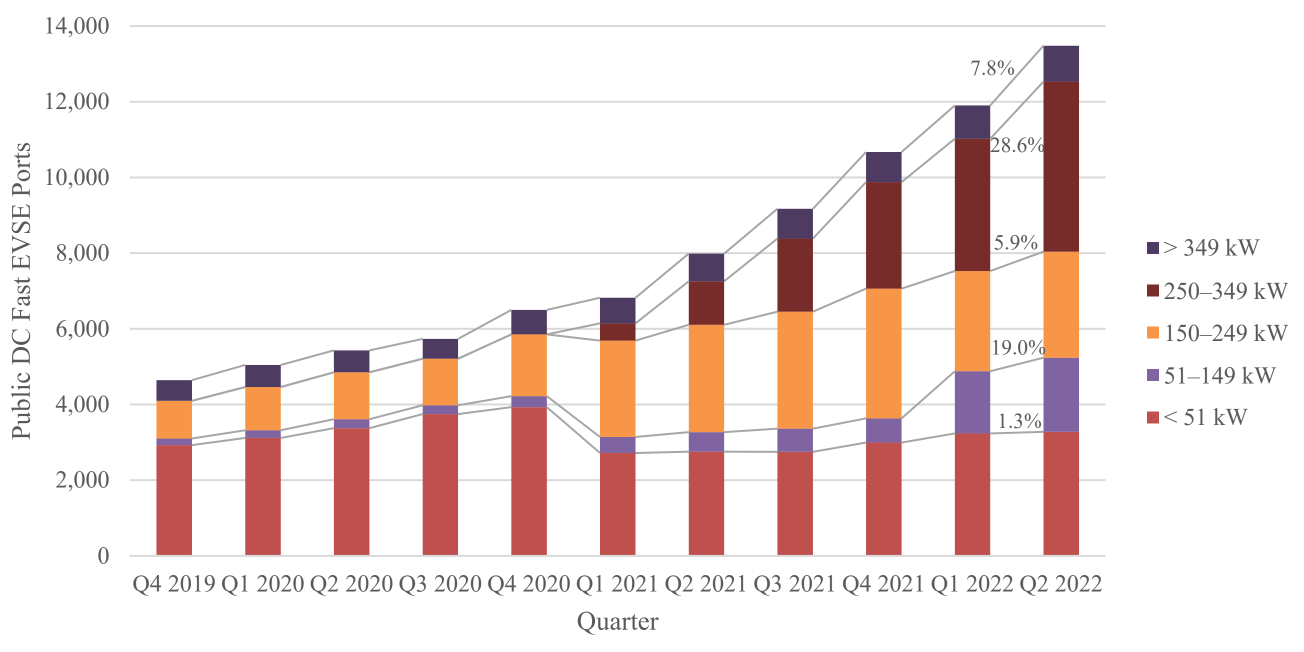

Figure 5. Quarterly growth of public DC fast EVSE ports by power output.

Note: The percentages in this figure indicate the percent growth between each quarter. For an explanation of the changes seen in Q1 2021, see the Q1 2021 report (Brown et al. 2021).

Finally, there are currently three types of connectors available for DC fast chargers: CHAdeMO, CCS, and Tesla. As noted in Section 1.2, not all EVs are compatible with each connector type. Most EV models entering the market today can charge using the CCS connector, while the all-electric Nissan LEAF and Mitsubishi Outlander plug-in hybrid electric vehicles are the only models still being produced in the United States with the CHAdeMO connector standard. Only Tesla vehicles can charge with the Tesla connector. Although Tesla vehicles do not have a CHAdeMO charge port and do not come with a CHAdeMO adapter, Tesla does sell an adapter that allows Tesla vehicles to charge at non-Tesla DC fast chargers with a CHAdeMO connector. Additionally, Tesla is in the process of making a CCS adapter for Tesla vehicles.

As of June 30, 2022, approximately 70% of registered all-electric vehicles in the United States were Teslas and therefore compatible with the Tesla connector, 22% of registered all-electric vehicles were compatible with the CCS connector, and 8% were compatible with the CHAdeMO connector (Experian Information Solutions 2022a).[7] Of the 29,319 DC fast connectors in the Station Locator as of Q2, Tesla connectors grew by the largest percentage (7.3%), followed by CCS connectors (5.5%) (Figure 6). Despite CHAdeMO-compatible vehicles making up the smallest percentage of registered EVs, the number of CHAdeMO connectors in the Station Locator continued to grow (4.5%) in Q2. One possible reason for the continued growth of CHAdeMO connectors is that, historically, some grant and incentive programs have required that public DC fast stations have both CHAdeMO and CCS connectors available to be eligible for funding. However, CHAdeMO connectors continue to make up a smaller share of public DC fast connectors each quarter. In Q4 2019, CHAdeMO connectors made up 22.1% compared with 21.2% in Q2 2022. Similarly, Tesla connectors made up 49.6% of public DC fast connectors in Q4 2019 compared with 48.6% in Q2 2022. The share of CCS connectors, on the other hand, has continued to grow, from 28.3% in Q4 2019 to 30.3% in Q2 2022.

[7] These figures exclude PHEVs since most PHEVs are not compatible with DC fast EVSE ports.

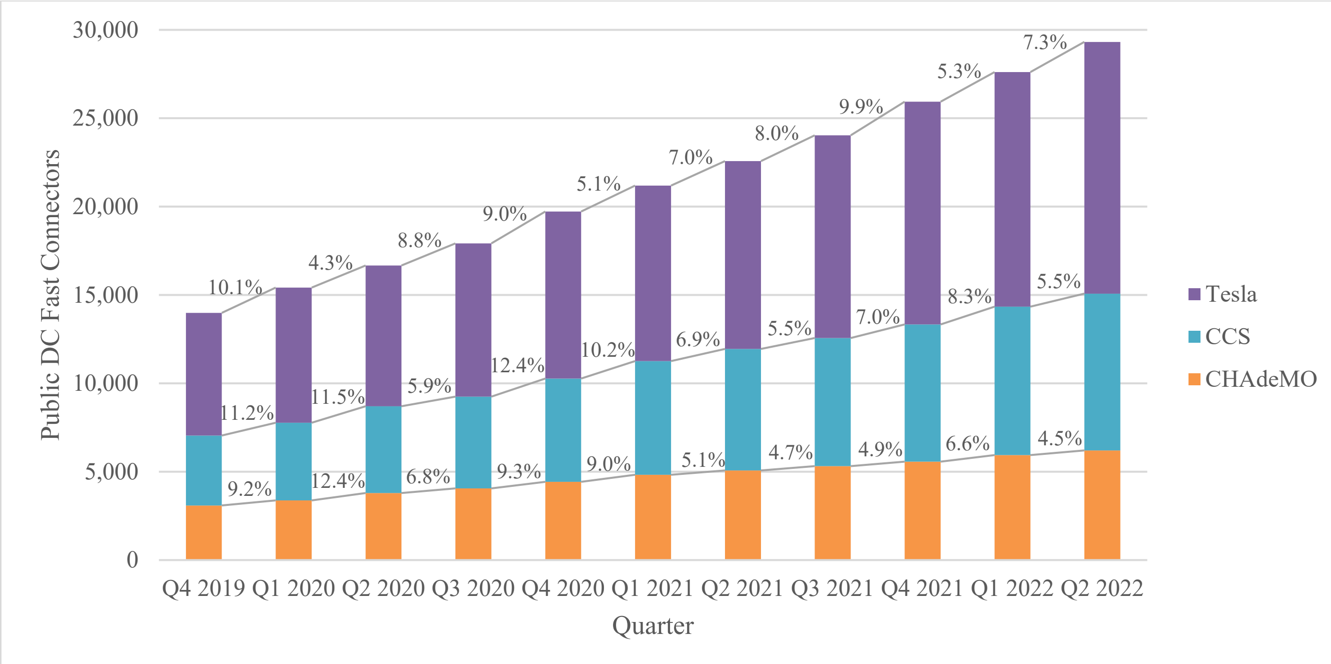

Figure 6. Quarterly growth of public DC fast connectors by type.

Note: The percentages in this figure indicate the percent growth between each quarter.

2.1.2 By Network

As of the end of Q2, the ChargePoint network accounted for the largest number of public EVSE ports (41.3%) in the Station Locator, and Level 2 EVSE ports constituted the majority of ChargePoint's network (Figure 7). This holds true for many of the networks in the Station Locator, except for the Electrify America, EVgo, Francis Energy, FPL EVolution, Rivian Adventure Network, and Tesla Supercharger networks. These networks are predominantly, if not completely, made up of DC fast EVSE ports. Of the networks with DC fast EVSE ports, Tesla Supercharger has the largest share of public DC fast EVSE ports (58.2%), followed by Electrify America (14.1%) and EVgo (8.3%) (Figure 8).

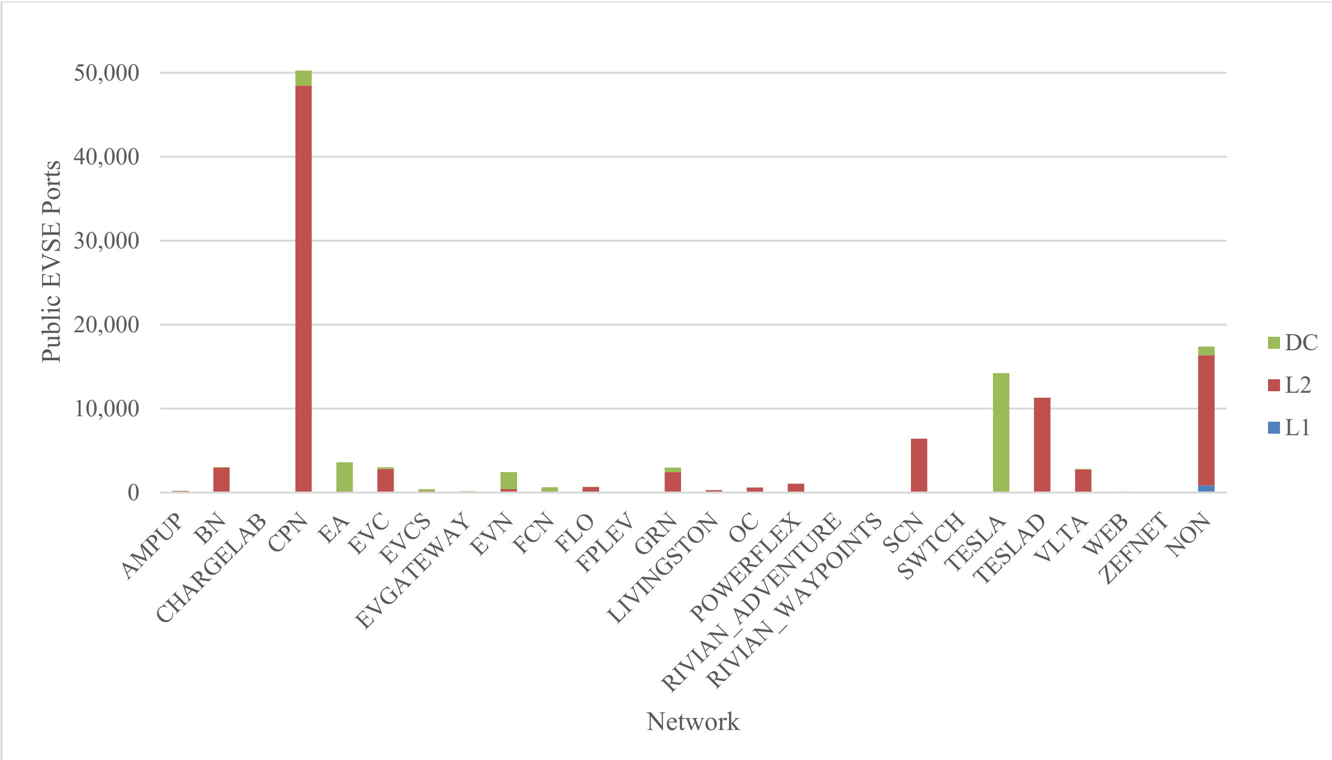

Figure 7. Breakdown of public EVSE ports by network and charging level in Q2 2022

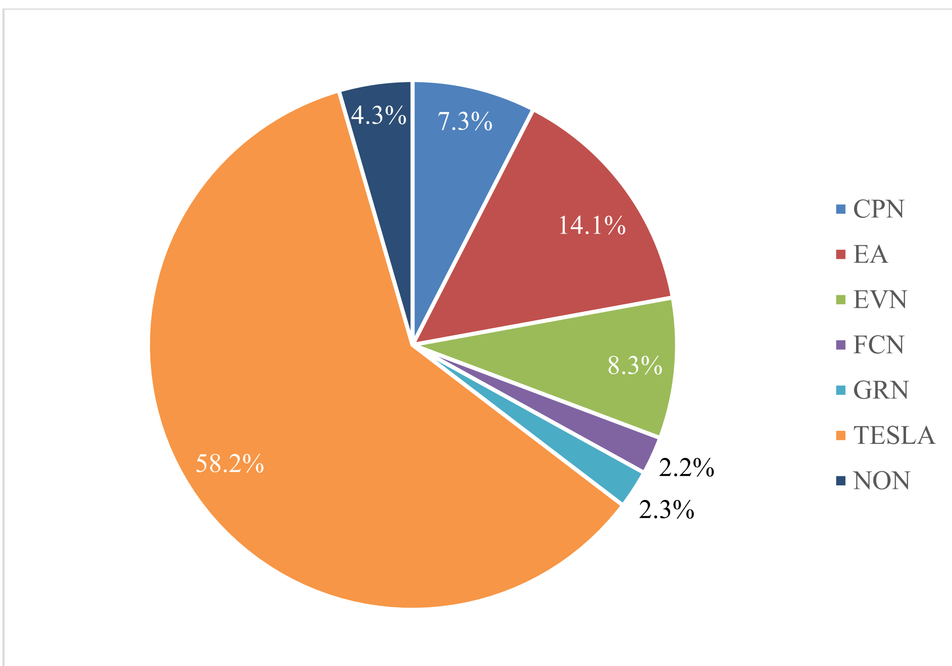

Figure 8. Breakdown of public DC fast EVSE ports by network in Q2 2022.

Note: Figure excludes networks that make up less than 1% of public DC fast EVSE ports.

Figure 9 shows the growth of each network in Q2, and Table 2 includes the percent growth of each network over the last four quarters. The number of public EVSE ports for the majority of networks increased in Q2. The number of EVSE ports on the Rivian Waypoints network increased by the largest percentage (64.3%) in Q2 as a result of the integration of Rivian's API with the Station Locator, which increased the number of EVSE ports from 28 to 46. The Station Locator team expects to see continued growth on the Rivian Waypoints and Adventure networks given their plans to deploy 10,000 Level 2 stations and 3,500 DC fast stations across the United States and Canada (Rivian 2022).

The number of EVSE ports on the FLO network grew by the second-largest percentage (30.2%), increasing the number of EVSE ports from 510 to 664. This increase was primarily driven by new Level 2 installations in Los Angeles, California. In September 2021, FLO was named a recipient of a California Energy Commission BESTFIT grant along with ARUP, Southern California Edison, Los Angeles Cleantech Incubator, and the Electric Power Research Institute (Green 2021). This team is piloting a program to scale the deployment of public curbside EV charging stations throughout the Los Angeles metro area using FLO's charging hardware and networking services. The program's goals are to make charging more accessible and equitable by deploying charging stations in underserved areas, and to develop methods to reduce installation and operational costs by utilizing existing utility assets. Installations for this pilot began coming online in Q2.

Finally, the growth of the AmpUp (10.7%), EV Charging Solutions (23.2%), evGateway (25.2%), Livingston Energy Group (47.9%), and Volta (11.9%) networks were a result of these networks sharing large updates with the Station Locator team in Q2.

The number of public EVSE ports on the Blink, FPL EVolution, and SWTCH Energy networks all decreased in Q2. The reduction in Blink EVSE ports is primarily attributable to older EVSE ports in Arizona, California, and Oregon that came online before 2017 being removed from Blink's data, likely due to these stations being decommissioned. However, Blink installed several new EVSE ports in Q2. The decrease of EVSE ports on the FPL EVolution and SWTCH Energy networks is due to ongoing database maintenance. Specifically for FPL EVolution, the Station Locator team identified duplicate records, resulting in the removal of three station locations and 19 EVSE ports. For SWTCH Energy network, the Station Locator team identified one station location with two EVSE ports that was misclassified as public when it is actually private. The station location therefore remained on the Station Locator but was removed from public counts.

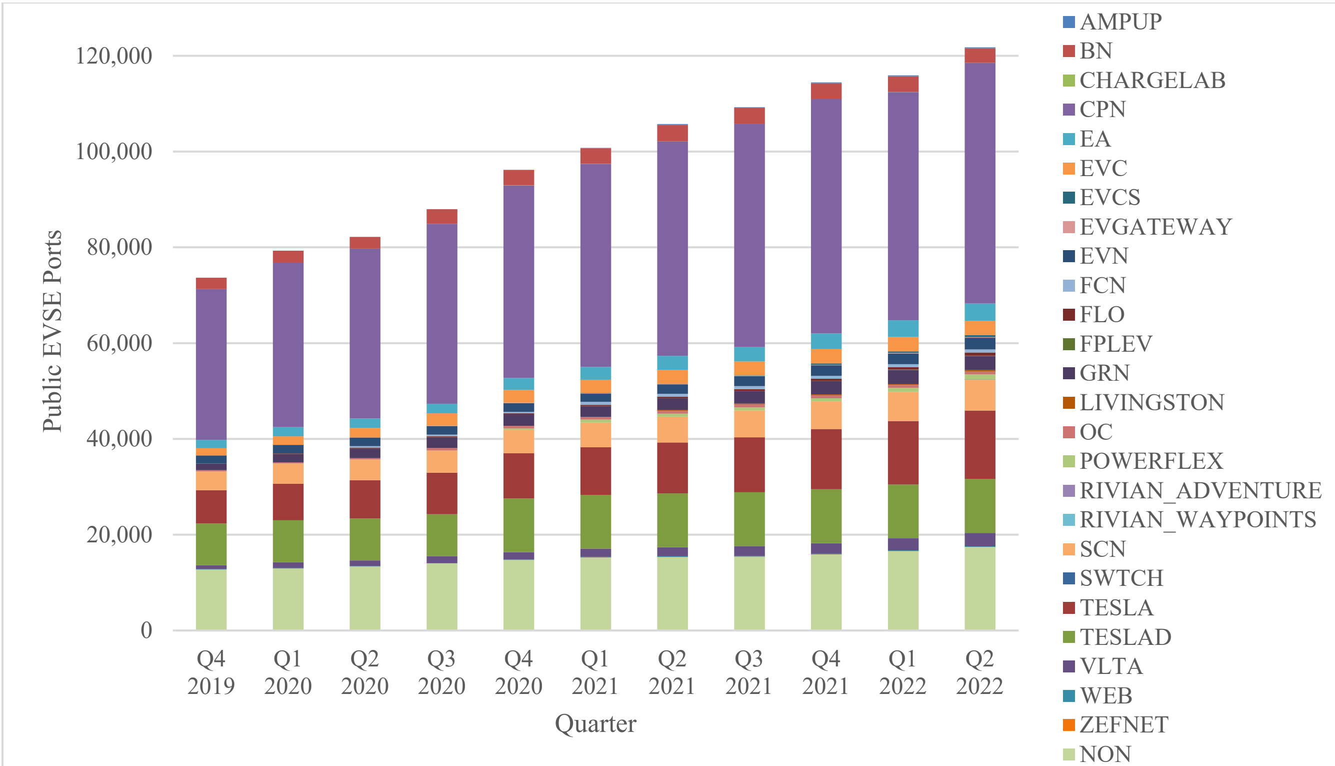

Figure 9. Quarterly growth of public EVSE ports by network

Table 2. Growth of Public EVSE Ports by Network Over the Last Four Quarters

Network	Q3 2021 Growth	Q4 2021 Growth	Q1 2022 Growth	Q2 2022 Growth
AMPUP	0.0%	3.6%	2.3%	10.7%
BN	−2.8%	−1.1%	−0.5%	−8.1%
CHARGELAB	0.0%	0.0%	0.0%	0.0%
CPN	3.9%	5.1%	−2.6%	5.4%
EA	4.0%	8.1%	6.0%	4.0%
EVC	0.9%	1.6%	1.2%	0.3%
EVCS	19.2%	409.7%	3.2%	23.3%
EVGATEWAY	34.2%	12.2%	8.2%	25.2%
EVN	4.6%	5.2%	3.2%	8.5%
FCN	0.0%	0.5%	0.0%	0.0%
FLO	33.8%	20.3%	11.6%	30.2%
FPLEV	0.0%	0.0%	760.0%	−22.1%
GRN	6.0%	5.1%	5.8%	1.2%
LIVINGSTON	0.0%	0.0%	0.0%	47.9%
OC	12.0%	1.5%	−7.0%	6.4%
POWERFLEX	0.0%	0.0%	42.8%	17.8%
RIVIAN_ADVENTURE	N/A	N/A	N/A	N/A
RIVIAN_WAYPOINTS	N/A	N/A	N/A	64.3%
SCN	4.3%	3.2%	3.6%	6.7%
SWTCH	N/A	N/A	N/A	−13.3%
TESLA	7.7%	9.9%	5.3%	7.4%
TESLAD	0.0%	0.0%	0.0%	0.5%
VLTA	9.5%	5.8%	13.4%	11.9%
WEB	0.0%	0.0%	0.0%	0.0%
ZEFNET	0.0%	0.0%	16.7%	0.0%
Non-networked	0.4%	3.1%	4.3%	5.2%
Total	**3.3%**	**4.7%**	**1.3%**	**5.1%**

The Station Locator team works with most major electric vehicle service providers (EVSPs) to collect EV charging infrastructure data for the Station Locator. Currently, the Station Locator includes stations on the 25 networks listed below, 11 of which update on a nightly basis. The Rivian Adventure Network is new to the Station Locator as of Q2. In addition, the Station Locator contains non-networked (NON) station data, which includes stations that were previously networked.

- AmpUp (AMPUP)
- Blink (BN)
- ChargeLab (CHARGELAB)
- ChargePoint (CPN)
- Electrify America (EA)
- EV Connect (EVC)
- EV Charging Solutions (EVCS)
- evGateway (EVGATEWAY)
- EVgo (EVN)
- Francis Energy (FCN)
- FLO (FLO)
- FPL EVolution (FPLEV)
- Greenlots (GRN)
- Livingston Energy Group (LIVINGSTON)
- OpConnect (OC)
- PowerFlex (POWERFLEX)
- Rivian Adventure Network (RIVIAN_ADVENTURE)
- Rivian Waypoints (RIVIAN_WAYPOINTS)
- SemaConnect (SCN)
- SWTCH Energy (SWTCH)
- Tesla Supercharger (TESLA)
- Tesla Destination (TESLAD)
- Volta (VLTA)
- Webasto (WEB)
- ZEF Energy (ZEFNET).

2.1.3 By Region

As shown in Figure 10, the California region continues to have the largest share of the country's public EVSE ports (30.5%). However, similar to the last two quarters, the Mid-Atlantic region grew by the largest percentage in Q2 (6.7%). With the exception of the North Central region, DC fast EVSE ports grew at a faster rate than Level 2 EVSE ports in each region in Q2, with the Southeast region again seeing the largest percentage growth in DC fast EVSE (Table 3).

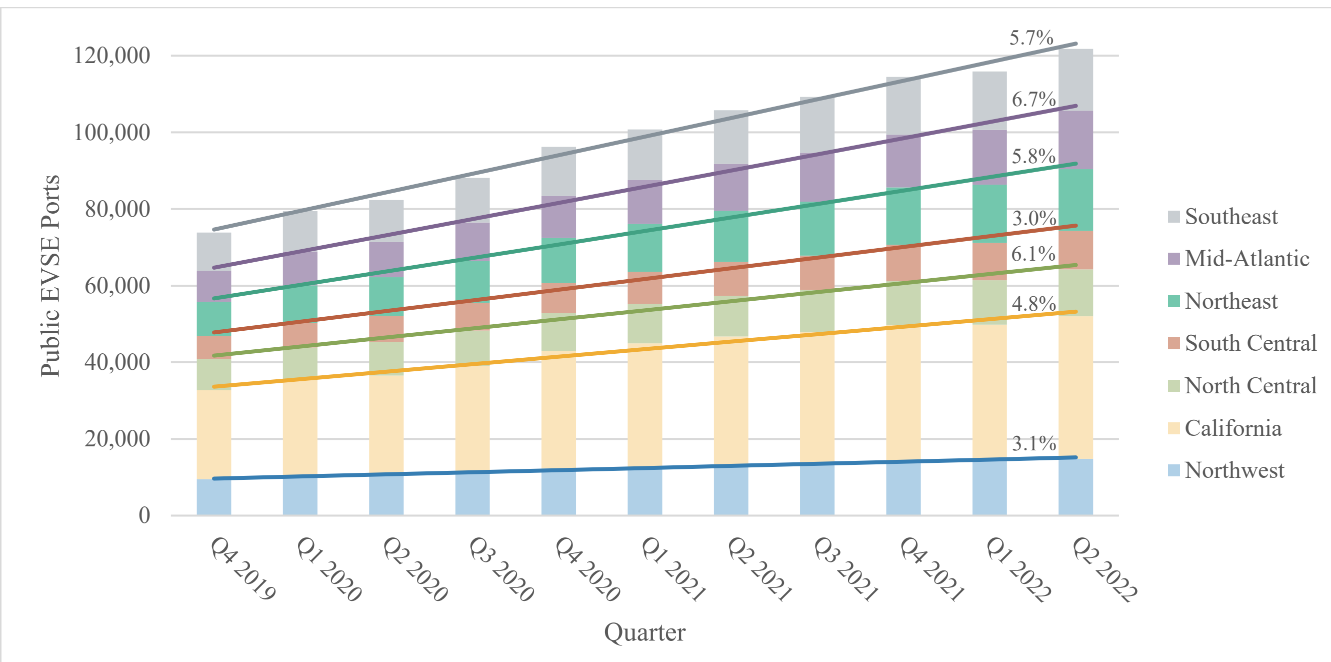

Figure 10. Quarterly growth of public EVSE ports by Clean Cities region.

Note: The percentages in this figure indicate the percent growth between each quarter.

Table 3. Growth of Public Level 2 and DC Fast EVSE Ports by Clean Cities Region in Q2 2022

Clean Cities Region	Level 2 EVSE Port Growth	DC Fast EVSE Port Growth
California	4.7%	5.5%
Mid-Atlantic	6.6%	7.5%
North Central	7.4%	7.1%
Northeast	5.7%	6.5%
Northwest	3.1%	3.6%
Southeast	4.5%	11.1%
South Central	2.7%	4.1%

The growth of public EV charging infrastructure across the country was analyzed by dividing the country into the same seven regions used by the Clean Cities Coalition Network (Figure 11) (Clean Cities Coalition Network 2022a). See the Q1 2020 report for more information about the Clean Cities Coalition Network (Brown et al. 2020).

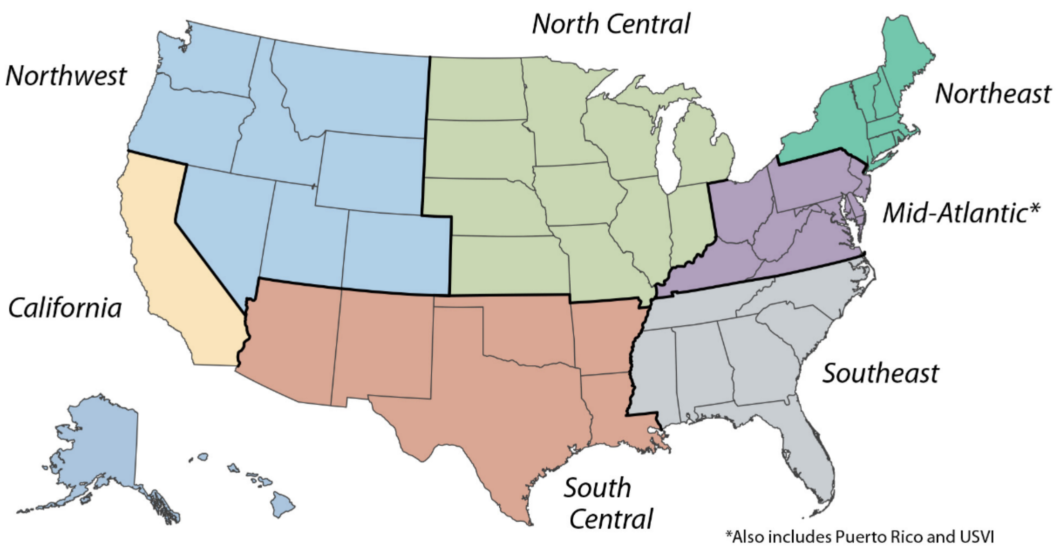

Figure 11. Clean Cities regions.

Source: Clean Cities Coalition Network (2022b)

2.1.4 By State

In Q2, the five states that had the largest percent growth of EVSE ports per 100 EVs were Michigan, Maine, Alabama, North Dakota, and South Carolina, all five of which outpaced the growth in the United States as a whole (Table 4). The growth in Michigan and Maine is primarily driven by installations of new non-networked Level 2 EVSE ports. In Q2, Michigan Governor Gretchen Whitmer and Lieutenant Governor Garlin Gilchrist II announced a flurry of initiatives to expand EV charging infrastructure throughout the state, including partnerships with Rivian and the National Park Service to install charging stations in state and national parks and $577,000 in funding through Michigan's Mobility Funding Platform to launch services to expand EV charging infrastructure and increase access to EVs (Pohl 2022).

Some of Maine's installations can be attributed to Efficiency Maine, a quasi-state agency that administers energy efficiency and greenhouse gas reduction programs in the state. Efficiency Maine is working to improve access to local and destination charging through five rounds of competitive grants for public Level 2 charging using funds from the Volkswagen Settlement, the Maine Public Utilities Commission, and the New England Clean Energy Connect settlement (Efficiency Maine 2022). Efficiency Maine is also expanding the state's DC fast charging network along travel corridors through a partnership with ChargePoint, with new DC fast EVSE ports expected along Interstate 95 by the end of 2022.

Table 4. Top Five States With the Largest Growth of EVSE Ports per 100 EVs in Q2 2022 [8]

State	EVSE Ports per 100 EVs in Q1 2022	EVSE Ports per 100 EVs in Q2 2022	Growth of EVSE Ports per 100 EVs in Q2 2022
Michigan	5.0	6.4	27.4%
Maine	9.0	10.6	17.2%
Alabama	6.6	7.6	15.7%
North Dakota	18.2	20.5	12.9%
South Carolina	6.7	7.4	9.7%

To track the growth of EVSE ports by state, the Station Locator team calculated the number of public EVSE ports per 100 light-duty EV registrations in each state. The team chose this metric to compare charging infrastructure development across states on a basis that accounts for differing EV deployments by state. Washington, D.C., is considered a state for the purpose of this analysis, and the vehicle registration data are based on Experian's registration information as of December 31, 2021 (Experian Information Solutions 2022b).

2.1.5 By Housing Density

To better understand where EV charging infrastructure is being deployed, the Station Locator team analyzed the growth of EVSE ports in urban, suburban, and rural areas across the United States. As shown in Figure 12, public EVSE ports are predominantly located in suburban tracts, followed by urban and rural tracts. When looking at just Level 2 EVSE ports, these ports grew by the largest percentage (6.3%) in rural tracts in Q2, and when looking at just DC fast EVSE ports, these ports grew by the largest percentage (6.7%) in suburban tracts. However, across charging levels, DC fast EVSE ports grew by the largest percentage overall in all neighborhood types in Q2. See Section 2.1.1 for an explanation of the decrease in Level 2 EVSE ports. Future reports will provide additional insight into this growth, including whether this growth is attributable to DC fast infrastructure development along highway corridors.

[8] See Appendix A for the growth of EVSE ports per 100 EVs in all states in Q2.

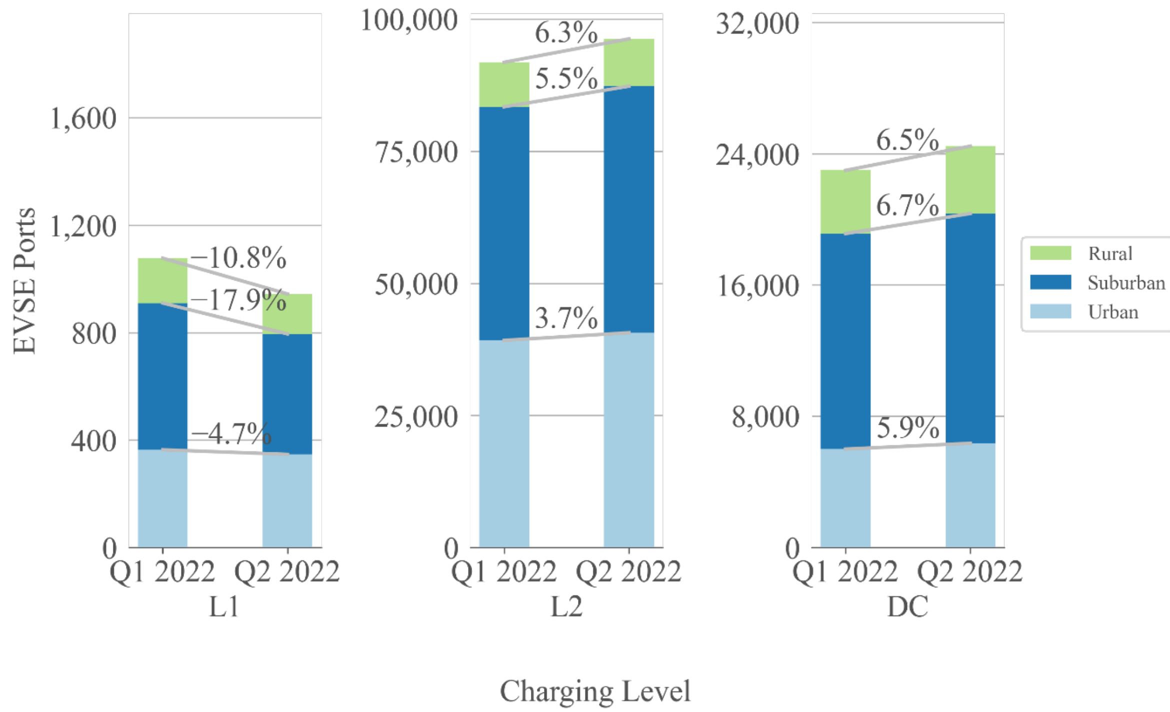

Figure 12. Q2 2022 growth of public EVSE ports by neighborhood type and charging level.

Note: These graphs are not to scale.

The Station Locator team used the U.S. Department of Housing and Urban Development's Urbanization Perceptions Small Area Index for this analysis. The index classifies census tracts as urban, suburban, or rural based on how American Housing Survey respondents described their neighborhood (U.S. Department of Housing and Urban Development Office of Policy Development and Research 2022). Based on the survey, approximately 27% of census tracts are urban, 52% are suburban, and 21% are rural. However, urban census tracts take up only approximately 1.3% of the United States' land area, whereas suburban and rural tracts take up 6.2% and 92.6%, respectively.

2.2 Private Charging Trends

In Q2, the number of private EVSE ports in the Station Locator increased by 290, bringing the total number to 19,309 and representing a 1.5% increase since Q1 2022. The following sections break down the growth of private EVSE ports by level, as well as by three specific types: workplace, multifamily building, and fleet charging.

Private EV charging refers to EV charging stations that are available only to certain drivers for specific purposes, such as charging for transit fleets or employee-only charging at workplaces. Although the Station Locator team proactively seeks out new station openings to include, the opening of private workplace charging stations may not necessarily be shared publicly. The Station Locator team therefore relies on Clean Cities coalitions, industry partners, and Station Locator users to share this information. Due to the challenge in collecting these data, private, nonresidential charging stations are likely underrepresented in the Station Locator; however, the Station Locator team is continually working to improve the data collection in these areas.

2.2.1 By Charging Level

As shown in Figure 13, the majority of private EVSE ports in the Station Locator are Level 2. In Q2, private Level 2 EVSE ports also grew by the largest percentage (1.7%), representing the addition of 283 EVSE ports (Figure 13). However, the share of Level 2 EVSE ports in the Station Locator has been decreasing since Q4 2019: Level 2 EVSE ports made up 90.2% of private EVSE ports in Q4 2019 compared with 87.0% in Q2 2022. The share of Level 1 and DC fast EVSE ports has continued to increase: in Q4 2019, Level 1 and DC fast EVSE ports made up 9.1% and 0.8%, respectively, of private EVSE ports compared with 11.4% and 1.5%, respectively, in Q2 2022.

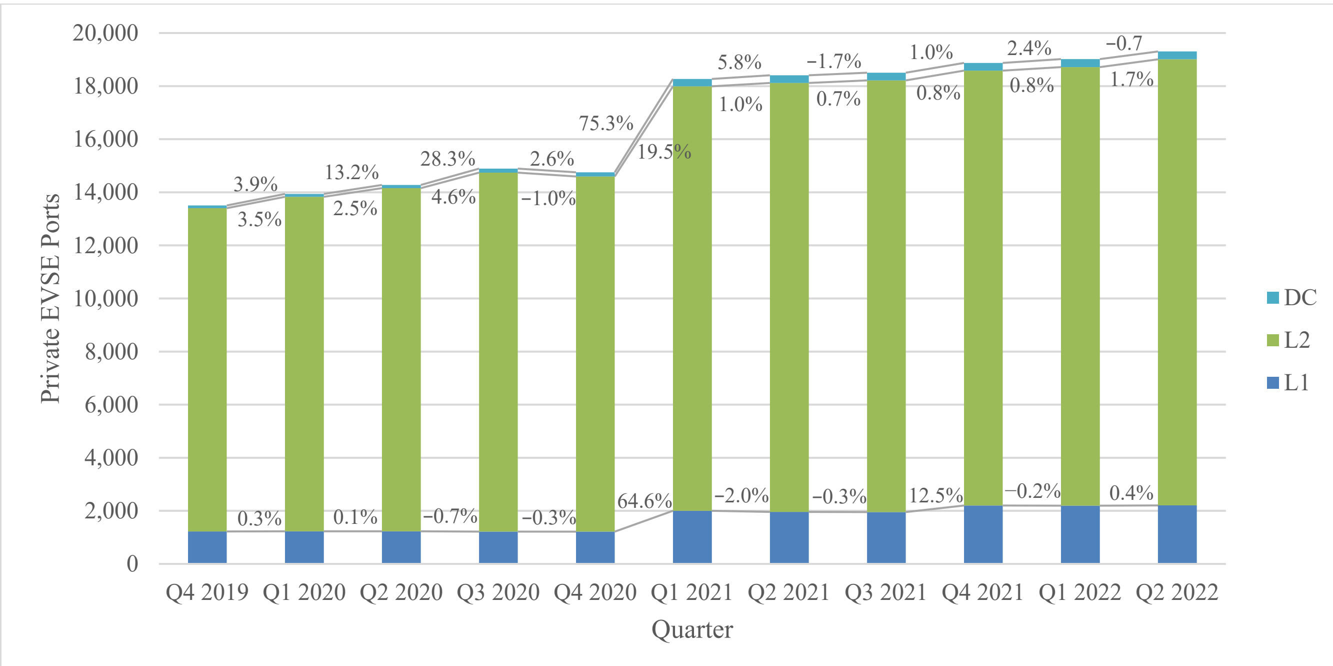

Figure 13. Quarterly growth of private EVSE ports by charging level.

Note: Figure excludes legacy EVSE ports that are not classified by charging level and are no longer manufactured. As of Q2, there were four private legacy EVSE ports in the Station Locator. Additionally, the percentages in this figure indicate the percent growth between each quarter.

2.2.2 Workplace Charging

Workplace EV charging infrastructure includes charging stations that are private and designated for employee use only. The majority of private workplace EVSE ports in the Station Locator are Level 2 (Figure 14), which is to be expected because employees use workplace chargers while they are parked at work for an extended period and therefore do not necessarily need rapid charging.

By the end of Q2, there were 10,145 workplace EVSE ports in the Station Locator, representing 52.5% of private EVSE ports. The number of workplace EVSE ports decreased by 20 ports. As discussed in Appendix B, stations that the Station Locator team are unable to contact are removed from the database as part of the annual unreachable station cleanup process. The decrease in workplace charging EVSE is attributable to this process and explains the slight decrease (0.3%) in Level 2 EVSE ports seen in Q2 (Figure 14).

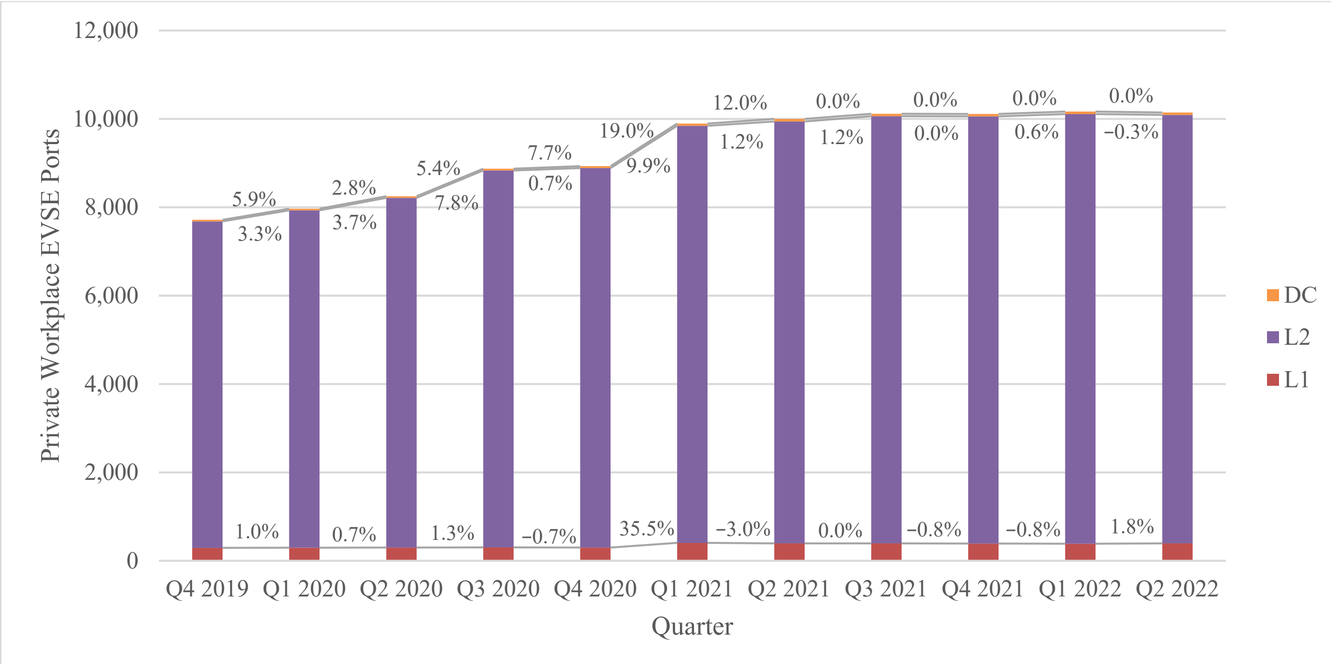

Figure 14. Quarterly growth of private workplace EVSE ports by charging level.

Note: The percentages in this figure indicate the percent growth between each quarter.

2.2.3 Multifamily Housing Charging

The Station Locator team continues to focus efforts on capturing private charging infrastructure installed at multifamily housing that is available for resident use only. In Q2, there was an increase of 7.7% in EVSE ports at multifamily housing, bringing the total number of EVSE ports to 1,092 compared with 1,014 in Q1 2022 (Figure 15). The EVSE ports added in Q2 were primarily non-networked Level 2 EVSE in California and Michigan. As shown in Figure 15, multifamily housing EVSE ports in the Station Locator are either Level 1 or Level 2. Overall, EVSE ports at multifamily housing represent 5.7% of private EVSE ports in the Station Locator.

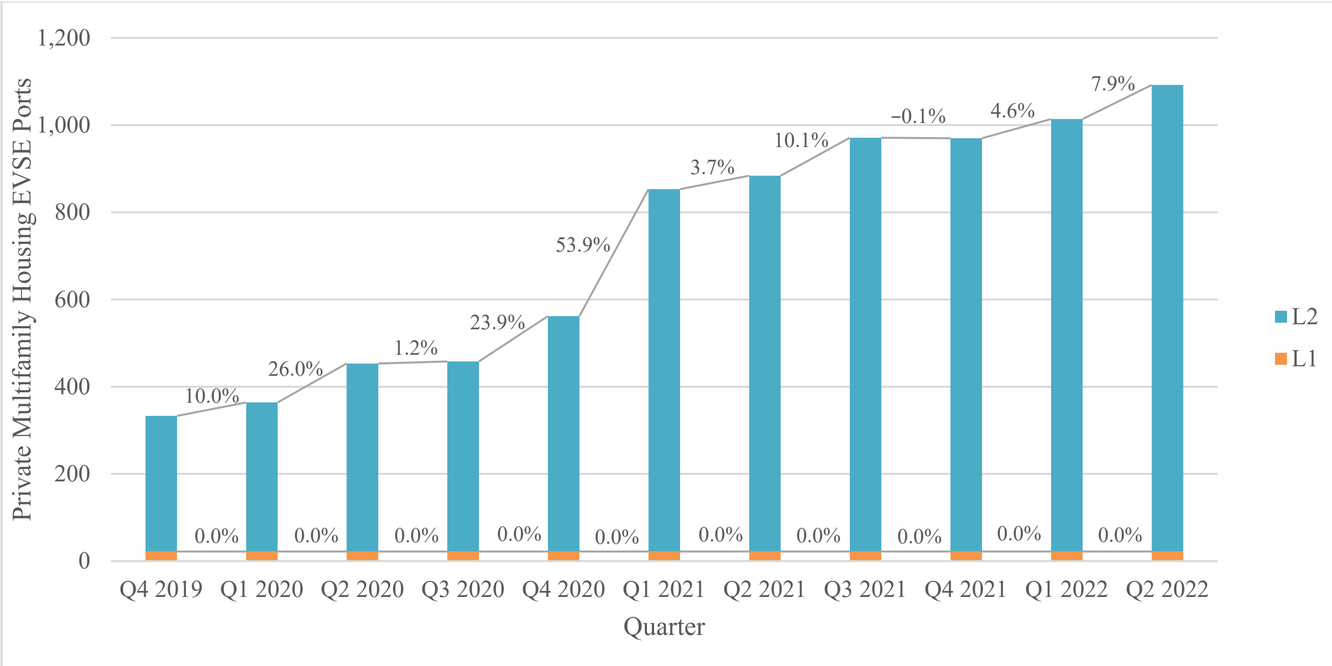

Figure 15. Quarterly growth of private multifamily housing EVSE ports by charging level

2.2.4 Fleet Charging

The Station Locator team collects data on whether stations are dedicated fleet charging stations, and if so, what types of vehicles charge at the station based on the Federal Highway Administration weight class (i.e., light-duty [LD], medium-duty [MD], or heavy-duty [HD] vehicles). As of Q2, the team has collected this information for 88.0% of private EVSE ports in the Station Locator, of which 45.3% are being used for fleet charging purposes. Note that some fleet EVSE ports are also used by employees and are therefore counted as workplace EVSE ports in Section 2.2.2 as well.

Figure 16 shows the breakdown of these EVSE ports by fleet type and charging level. The fleet type indicates the largest vehicle type that uses the station as of Q2 based on the types of vehicles in the fleet, though smaller vehicle types may charge at the station as well. The majority of EVs on the road are LD vehicles such as sedans, SUVs, and pickup trucks; unsurprisingly, the majority of fleet charging EVSE ports are used to charge LD vehicles (Figure 16). Additionally, the majority of fleet charging EVSE ports are Level 2 (Figure 16).

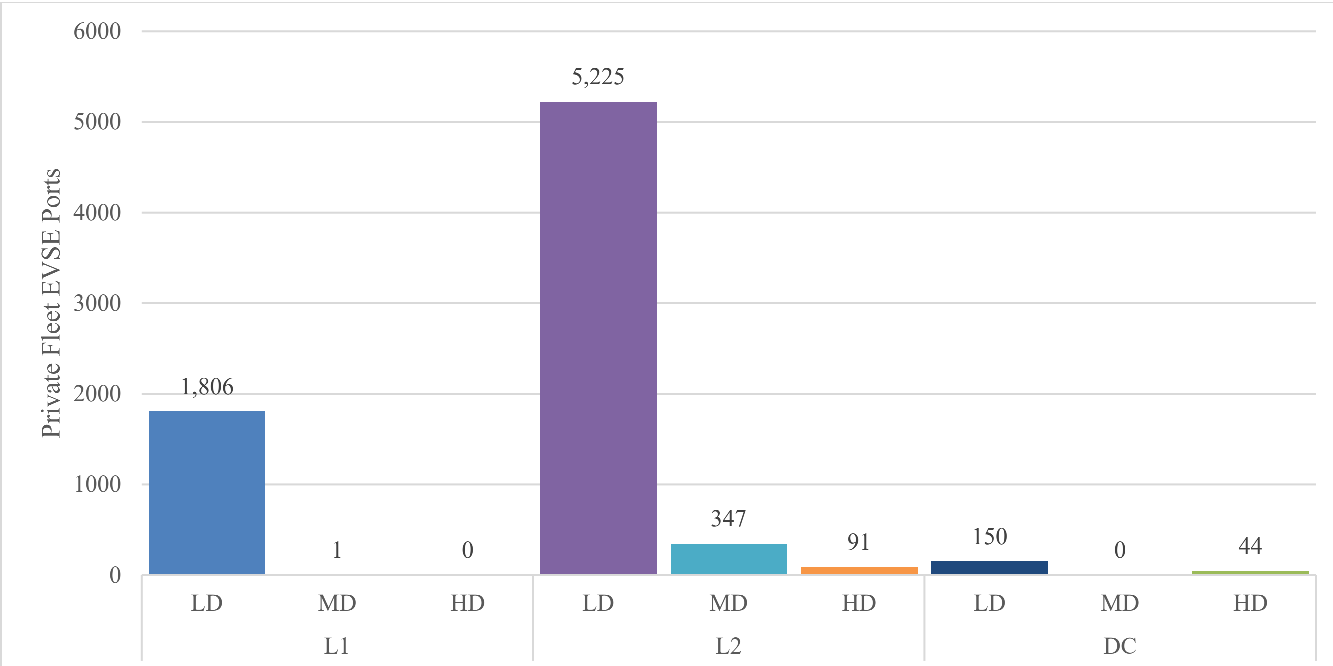

Figure 16. Breakdown of private fleet EVSE ports by charging level and fleet type in Q2 2022

The Station Locator team continues to expand its private fleet data collection efforts, especially for fleets that are installing charging infrastructure for MD and HD vehicles such as school bus fleets and public transit fleets. Additionally, the Station Locator team is tracking the development of MD and HD charging infrastructure and will collect additional data, such as new connector types, as the technology evolves and is deployed.

3 Developments That Could Impact Future Quarters

The momentum continued for EV charging station deployment across the country during Q2. In June, the Federal Highway Administration published the 180-day minimum standards and requirements of proposed rules for the NEVI Formula Grant Program. The proposed rules would establish the foundation for states to build out a national EV charging network and ensure drivers will be able to charge uniformly between charging station locations (Federal Highway Administration 2022b). States have made significant progress in developing their NEVI plans. To date, the majority of states have published NEVI websites to share updates, resources, and stakeholder engagement efforts, and several states have published draft plans. Each state was required to develop and submit a plan by August 1, 2022.

The private sector also continued to work toward expanding EV charging infrastructure in Q2. First, two major charging company acquisitions took place. Schneider Electric, an energy management and automation company and EV charging hardware manufacturer, acquired EV Connect to accelerate EV charging station growth and build a robust networked EV charging platform (EV Connect 2022). Additionally, Blink acquired SemaConnect to further expand its network of EV charging stations and manufacturing capabilities (Blink Charging 2022). The acquisition now affords Blink greater control over its supply chain and will allow Blink to comply with the Biden administration's Buy American mandates via SemaConnect's manufacturing facility in Maryland.

Second, vehicle manufacturers continued efforts to expand access to EV charging across the United States. General Motors announced a partnership with Pilot Company to build out a coast-to-coast network of DC fast charging stations powered by EVgo (General Motors 2022). Through this partnership, 2,000 charging stations, including those capable of delivering up to 350 kW, will be installed at up to 500 Pilot and Flying J centers. EVgo has also partnered with Chase Bank to pilot the deployment of DC fast chargers at 50 branch locations across the United States by summer 2023 (EVgo 2022). On a smaller scale, Volvo Trucks North America is constructing a charging corridor for medium- and heavy-duty EVs (Volvo Group 2022). The project will develop five EV charging stations across California by the end of 2023 that connects several of the largest metropolitan areas in the state.

Finally, the Station Locator data collection and management processes will continue to impact future EVSE port counts as well. As noted in Section 1.2, the Station Locator team transitioned its counting logic in 2019 to align with the hierarchy defined in the OCPI protocol: station locations, EVSE ports, and connectors (EVRoaming Foundation 2020). The Station Locator therefore counts the number of EVSE ports at each station location. As of Q2, all manually collected data, as well as EVSE ports on the ChargePoint, Electrify America, EVgo, Greenlots, OpConnect, and Rivian networks, are counted according to the OCPI logic. Additionally, NREL is continuously working with EVSPs to add new APIs to the Station Locator and is currently working with EV Connect and Volta to integrate their APIs. Finally, the Station Locator team is making a concerted effort to collect power data for all DC fast EVSE ports to support the sixth round of Alternative Fuel Corridors nominations and may add new fields to the Station Locator to support other funding initiatives in the Bipartisan Infrastructure Law. This new information will continue to make the Station Locator as useful as possible to stakeholders and allow for additional analysis for these reports.

4 Conclusion

This report examines the growth of EV infrastructure in the Station Locator, including the growth of public EV charging by charging level, network, region, and state, and the growth of private EV charging by charging level and use type (i.e., workplace, multifamily building, and fleet) in Q2 2022. With such rapid growth and change in EV charging infrastructure, the information presented in this report is intended to help readers understand how and where the infrastructure is developing, where there may be areas of opportunity, and whether development is keeping pace with projected charging demand and national targets.

As of the end of Q2, Level 2 EVSE ports accounted for the majority of both public and private EVSE ports in the Station Locator (79.1% and 87.0%, respectively). Overall, there was a 4.6% increase in the number of EVSE ports in the Station Locator in Q2. Although public Level 2 EVSE ports grew by the largest number in Q2, public DC fast EVSE ports grew at the fastest rate (6.4%). California continues to lead the country in terms of the total number of public EVSE ports available (37,172), though public charging infrastructure grew by the largest percentage in the Mid-Atlantic region in Q2 (6.7%).

Based on NREL's 2017 analysis that estimated the number of public and workplace EVSE ports required to support a scenario in which there are 15 million EVs on the road by 2030, the number of DC fast and Level 2 EVSE ports as of Q2 are 89.1% and 17.6%, respectively, of the projected 2030 needs. However, the majority (58.2%) of public DC fast EVSE ports in the Station Locator are on the Tesla network and are therefore only readily accessible to Tesla drivers. When Tesla EVSE ports are removed, this decreases to 37.4% and 15.8%, respectively, of the projected need. Based on Atlas' 2021 assessment that estimated the number of public and workplace EVSE ports required in a scenario in which 100% of passenger vehicle sales are electric by 2035, the number of DC fast and Level 2 EVSE ports as of Q2 is 9.1% and 31.6%, respectively, of the projected 2030 needs. This decreases to 4.0% and 29.2%, respectively, when Tesla EVSE ports are removed.

When comparing the current rate of deployment of public charging infrastructure with the Biden administration's goal of reaching 500,000 EVSE ports in the United States by 2030, it is clear that the pace of installations will need to significantly increase in order to meet the administration's goal. Since the start of 2020, an average of 4,794 public EVSE ports have been installed each quarter. To meet the Biden administration's goal by 2030, an average of 12,607 public EVSE port installations will be required each quarter for the next 8 years, equating to an average quarterly growth rate of 4.8%.

If there are additional metrics that readers are interested in seeing, please email suggestions to the authors at TechnicalResponse@icf.com.

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Appendix A. EVSE Ports Growth by State

Table A-1. Q2 2022 Growth of Public EVSE Ports per 100 EVs by State

State	EVSE Ports per 100 EVs in Q1 2022	EVSE Ports per 100 EVs in Q2 2022	Growth of EVSE Ports per 100 EVs in Q2 2022
AK	5.1	5.3	4.3%
AL	6.6	7.6	15.7%
AR	10.8	11.4	5.9%
AZ	4.1	4.0	−1.8%
CA	4.0	4.2	4.2%
CO	6.7	6.9	3.3%
CT	5.5	5.7	3.6%
DC	11.4	11.9	4.8%
DE	6.3	6.3	1.3%
FL	4.7	5.0	6.4%
GA	7.9	7.7	−2.4%
HI	4.0	4.2	5.1%
IA	8.1	8.4	4.2%
ID	4.4	4.5	3.4%
IL	4.4	4.6	4.5%
IN	5.0	5.2	4.7%
KS	12.1	12.2	1.0%
KY	7.4	7.3	−0.4%
LA	6.7	7.2	7.9%
MA	8.9	9.3	5.5%
MD	7.3	7.7	6.1%
ME	9.0	10.6	17.2%
MI	5.0	6.4	27.4%
MN	5.4	5.3	−1.9%
MO	12.2	12.3	0.4%
MS	12.0	12.0	0.0%
MT	8.1	8.7	6.8%
NC	6.3	6.7	6.0%
ND	18.2	20.5	12.9%
NE	8.1	8.5	4.8%
NH	4.7	4.9	3.1%
NJ	2.6	2.8	9.5%

State	EVSE Ports per 100 EVs in Q1 2022	EVSE Ports per 100 EVs in Q2 2022	Growth of EVSE Ports per 100 EVs in Q2 2022
NM	6.3	6.5	4.3%
NV	6.1	6.3	3.3%
NY	7.1	7.5	5.0%
OH	6.3	6.7	7.5%
OK	7.2	7.4	2.5%
OR	4.6	4.5	−0.4%
PA	5.9	6.3	6.3%
RI	11.5	12.0	4.6%
SC	6.7	7.4	9.7%
SD	12.1	11.9	−1.8%
TN	7.5	7.6	1.3%
TX	4.7	4.8	3.9%
UT	7.9	7.8	−1.2%
VA	6.1	6.4	3.9%
VT	13.2	12.3	−6.4%
WA	4.2	4.3	1.6%
WI	5.5	5.5	−0.6%
WV	13.7	14.2	3.6%
WY	18.6	19.2	2.9%

Appendix B. EV Charging Data Sources

As previously mentioned, the Station Locator has been collecting data on alternative fueling stations since the 1990s and therefore has historical electric vehicle (EV) charging station data for several years that can serve as a baseline for more analysis. See the first report in this series for the growth of electric vehicle supply equipment (EVSE) ports and EV charging stations in the Station Locator from January 2010 through January 2020 (Brown et al. 2020).

The National Renewable Energy Laboratory (NREL) and its data collection contractor and collaborator, ICF, use a variety of methods to gather and verify EV charging data in the Station Locator. Electric vehicle service providers (EVSPs), responsible for managing a network of EV charging stations (Figure B-1), share data directly with the Station Locator team and are the largest data source for EV charging in the Station Locator. In addition, data are collected through industry outreach efforts, contributions from Clean Cities directors, and other manual methods.

Non-Networked Stations

Non-networked EV charging stations are not connected to the internet and provide basic charging functionality without advanced communications capabilities. Because of this, non-networked charging is generally free or offered as an amenity for those who pay for parking or to access a business.

Networked Stations

Networked EV charging stations are connected to the internet via a cable or wireless technology and can communicate with the back-end computer system of an EVSP. Being connected to a network lets station owners or site hosts manage who can access stations and control how much it costs drivers to charge their vehicle. An EVSP typically manages a group of networked EV charging stations, otherwise known as a network, and may use its communication capabilities to communicate directly with drivers, other EVSPs, or utilities; monitor and share real-time station status; broadcast location information; collect and store usage data; control access; or facilitate payment. For a group of networked EV charging stations to be considered a network, it cannot be considered part of another network and it must have a dedictaed platform that allows users to locate EV charging stations as well as initiate and pay for charging events.

Figure B-1. Non-networked vs. networked EV charging stations

B.1 Data From Charging Network Application Program Interfaces (APIs)

Prior to 2014, NREL manually collected all EV charging data, including EV charging stations managed by EVSPs. In 2014, to keep up with the rapid growth of charging infrastructure, NREL began incorporating daily updates on networked charging station data directly from EVSPs, when available. NREL does this by accessing the network's API and importing each network's API data into the database. Using APIs ensures the efficiency, accuracy, and completeness of the data are maintained.

Figure B-2 shows a timeline of the integration of the network APIs into the Station Locator data management process. In Q2, the Rivian Waypoints and Rivian Adventure Network APIs were integrated into the Station Locator. Open Charge Point Interface (OCPI)-based APIs that have been integrated into the Station Locator are also shown in Figure B-2. See Section 1.2 for more information on the OCPI protocol.

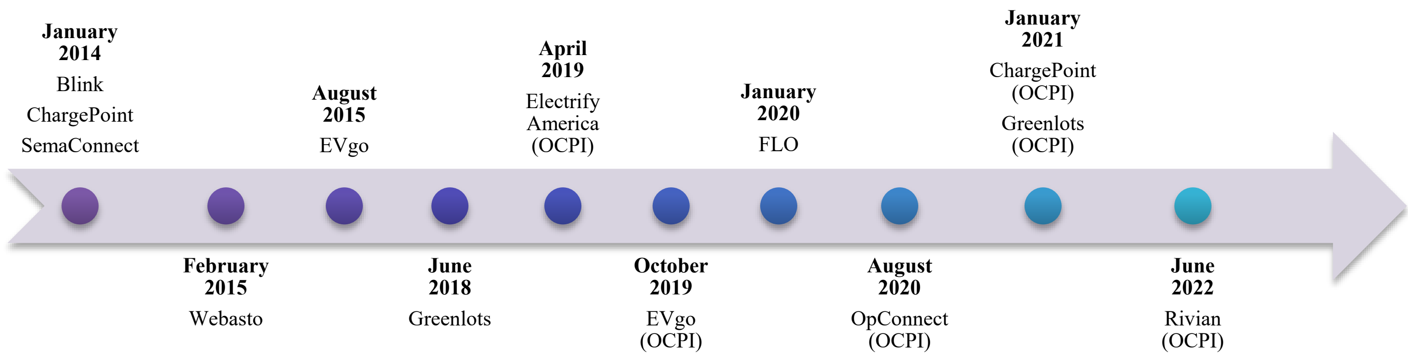

Figure B-2. Timeline of API integrations in the Station Locator

As of the end of June 2022, there were 52,342 public and private charging stations in the database available on the Station Locator or accessible via API or data download (AFDC 2022b). Of those, approximately 76% are automatically updated daily via EVSP-provided APIs, whereas the rest are managed and updated manually.

The Station Locator team is working with additional EVSPs to access and integrate existing APIs or provide them with best practices on developing an API if they have not yet automated their data sharing. This will help ensure station data are as current and accurate as possible, while also increasing the efficiency of the EV charging data update process.

B.2 Manually Collected Data

For non-networked (i.e., not connected to the internet) EV charging stations, data sources include trade media, Clean Cities directors, a "Submit New Station" form on the Station Locator website, EV charging station manufacturers, electric utilities, original equipment manufacturers, state and municipal governments, private companies, and others. The Station Locator team regularly monitors news outlets for press releases on new EV charging station openings and seeks out more information, as appropriate, to confirm and add the EV charging data to the Station Locator.

The Station Locator team also receives semiregular data in the form of spreadsheets from EVSPs that have networked stations but do not currently have an API available. These EVSPs include, but are not limited to, EV Connect, Tesla, and Volta. In Q2, the Station Locator team received an updated list of stations from AmpUp, Livingston Energy Group, and Volta. Additionally, the team receives regular updates from Chargeway that include stations on all networks. The team is greatly appreciative of our partners' continued collaboration and willingness to share regular data updates.

Finally, Clean Cities coalitions (see Section 2.1.3) proactively provide information on station updates and additions throughout the year. Coalitions also serve as a valuable on-the-ground resource for stations that ICF is not able to confirm through normal station confirmation processes. Unconfirmed stations are sent to coalitions throughout the year for confirmation; if the coalition is not able to provide any additional information, the station is subsequently removed from the Station Locator.