Electric Vehicle Charging Infrastructure Trends from the Alternative Fueling Station Locator: Fourth 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.

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
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Technical Report
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List of Acronyms

AFDC	Alternative Fuels Data Center
AMPUP	AmpUp network
API	application programming interface
BN	Blink network
CCS	Combined Charging System; a connector type for DC fast charging
CHAdeMO	a connector type for DC fast charging
CHARGELAB	ChargeLab network
CPN	ChargePoint network
DAC	disadvantaged community
DC	direct current
DOE	U.S. Department of Energy
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
EVRANGE	EV Range network
EVSE	electric vehicle supply equipment
EVSP	electric vehicle service provider
FCN	Francis Energy network
FLASH	FLASH network
FLO	FLO network
FPLEV	FPL EVolution network
J1772	the connector type for Level 1 and Level 2 charging
L1	Level 1
L2	Level 2
LIVINGSTON	Livingston Energy Group network
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
RED_E	Red E Charging network
RIVIAN_ADVENTURE	Rivian Adventure Network
RIVIAN_WAYPOINTS	Rivian Waypoints network
SCN	SemaConnect network
SHELL_RECHARGE	Shell Recharge network

SWTCH	SWTCH Energy network
TESLA	Tesla Supercharger network
TESLAD	Tesla Destination network
UNIVERSAL	Universal EV Chargers network
VLTA	Volta network
WEB	Webasto network
ZEFNET	ZEF Energy network

Executive Summary

Electric vehicle (EV) charging infrastructure continues to rapidly change and grow. Using data from the U.S. Department of Energy's (DOE's) Alternative Fueling Station Locator (AFDC 2023b), this report provides a snapshot of the state of EV charging infrastructure in the United States in the fourth calendar quarter of 2022 (Q4 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 twelfth 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 Q4 2022, the number of electric vehicle supply equipment (EVSE) ports in the Station Locator grew by 5.7%, or 8,394 EVSE ports. Public EVSE ports grew by 6.3%, or 8,082 EVSE ports, bringing the total number of public ports in the Station Locator to 136,513 and accounting for the majority of ports in the Station Locator (Figure ES-1). Private EVSE ports increased by 1.6%, or 312 ports. The North Central region had the largest increase in public charging infrastructure in Q4 (8.6%), 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.

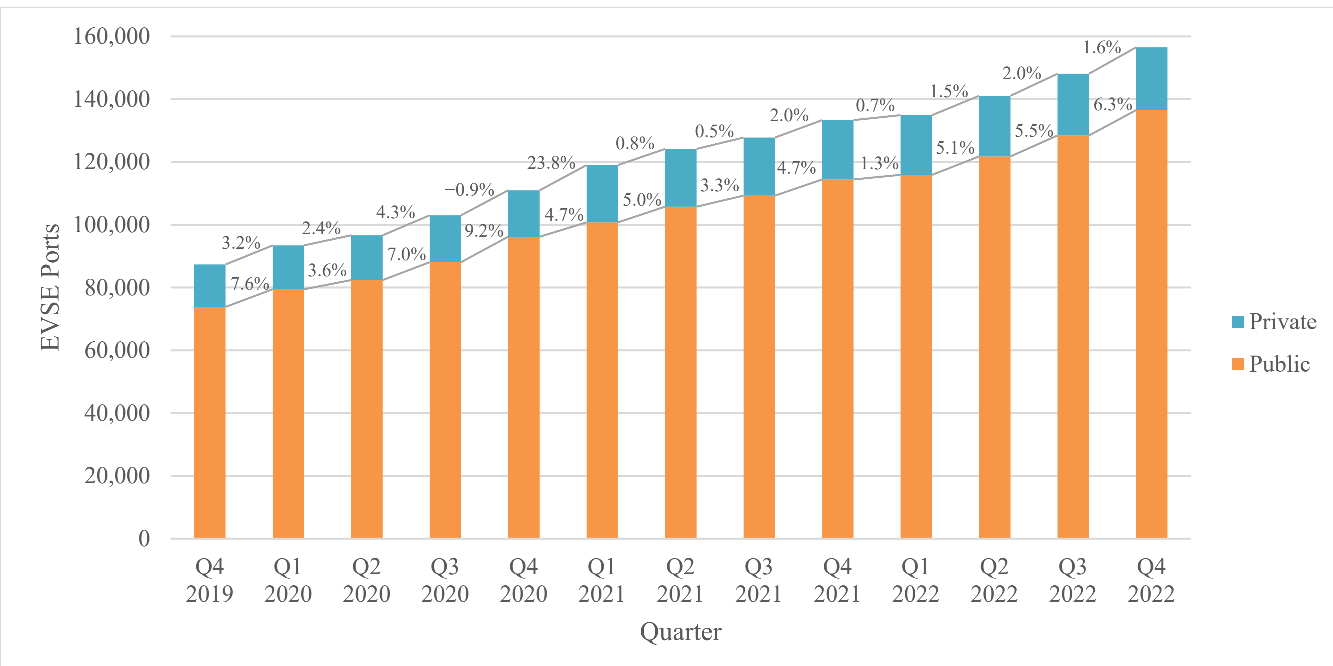

Figure ES-1. Quarterly growth of EVSE ports by access.

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

Of public EVSE ports, direct-current (DC) fast EVSE ports increased by the greatest percentage (8.5%) in Q4 (Figure ES-2).

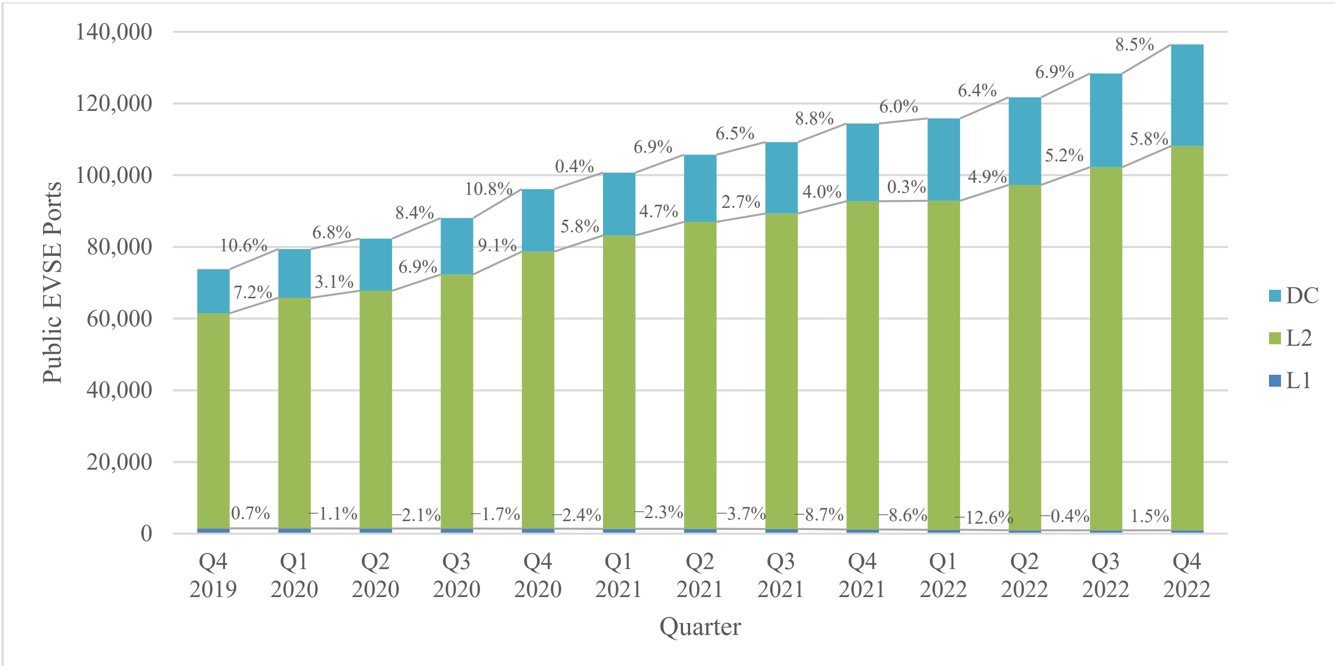

Figure ES-2. Quarterly growth of public EVSE ports by charging level.

Note: Figure excludes legacy EVSE ports that are not classified by charging level and are no longer manufactured. As of Q4, there were 40 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. The power output of DC fast EVSE ports ranges from 24 kW to 350 kW. DC fast EVSE ports with power outputs of 50 kW and 150 kW are common, though the number of DC fast EVSE ports at higher power levels is steadily increasing (Figure ES-3).

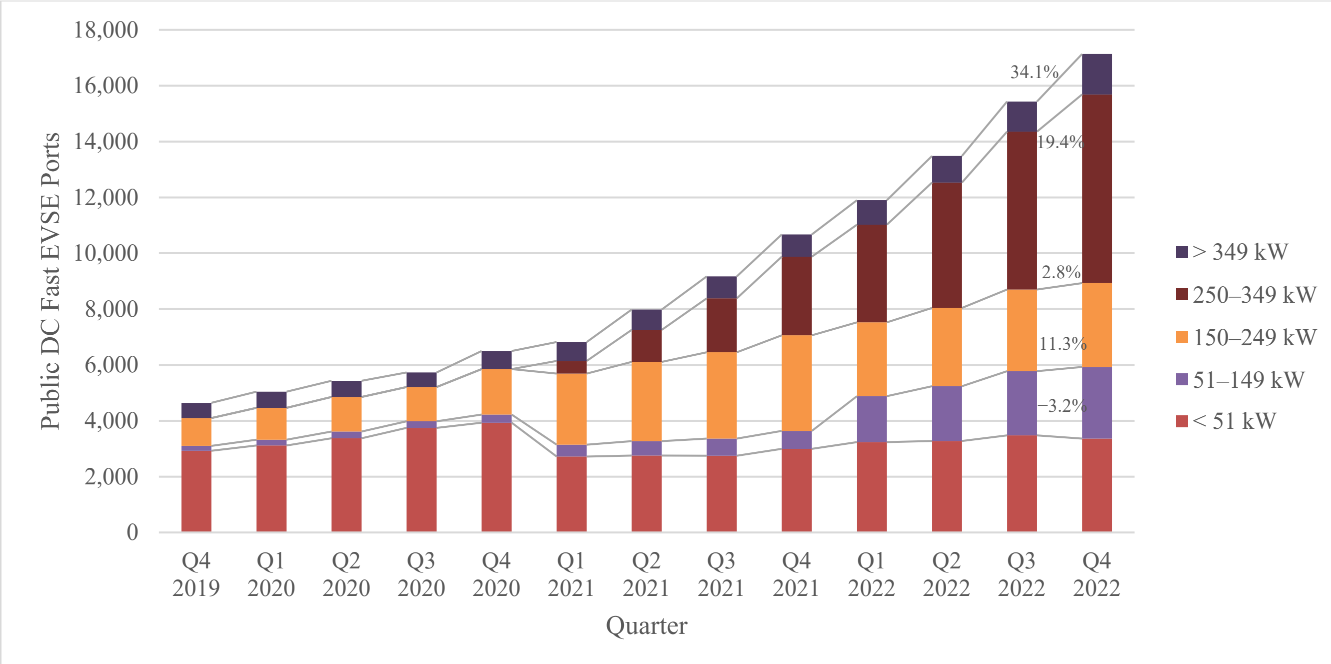

Figure ES-3. Quarterly growth of public DC fast EVSE ports by power output.

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, Schayowitz, and Klotz 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 12,981 public EVSE port installations will be needed each quarter for the next 8 years, equating to an average quarterly growth rate of 4.6%. This is substantially higher than the average of 5,223 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, 103.3% and 19.5% of the required DC fast and Level 2 EVSE ports, respectively, have been installed as of Q4 2022. However, the majority (60.3%) 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 41.1% and 17.6%, respectively, of the projected need.

Atlas Public Policy's *U.S. Passenger Vehicle Electrification Infrastructure Assessment* estimated that an additional 252,000 350 kW 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 0.6% and 34.9%, respectively, of the way toward meeting 2030 infrastructure requirements. This remains the same (0.6%) for DC fast EVSE ports and decreases to 32.6% for Level 2 EVSE ports 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 (DOE'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 2023a). 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 Fuelling 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 charging stations by 2030 and the newly available funds from the Bipartisan Infrastructure Law and Inflation Reduction Act 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 fourth calendar quarter of 2022 (Q4 2022). This is the twelfth 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 and temporarily unavailable (i.e., unavailable for use for an extended period due to maintenance) 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.

1.1 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 housing. EV charging infrastructure at multifamily housing is also classified as private in the Station Locator. See Section 2.2.3 for additional details.

The Station Locator counting logic aligns 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 1 and described below. Therefore, the Station Locator counts the number of EVSE ports at each station location.

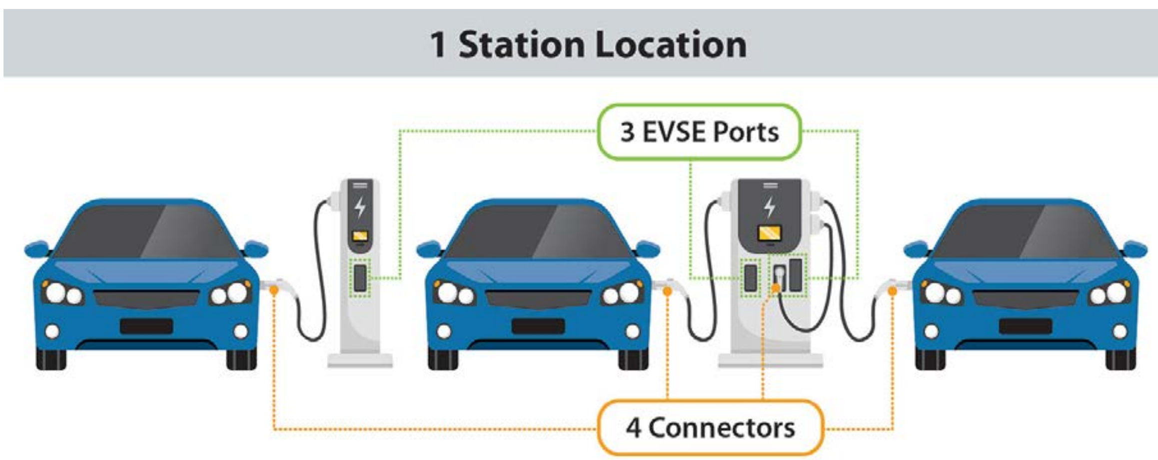

Figure 1. EV charging infrastructure hierarchy.

Source: AFDC (2023d)

The following fuel-specific fields are tracked in the Station Locator for EV charging stations (AFDC 2023c):

- 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[1]
    - Level 2 (L2): 240 V; 1 hour of charging = 25 miles of range[2]
    - Direct-current (DC) fast: 480+ V; 30 minutes of charging = 100–200+ miles of range.[3]
  - 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[4]
    - J1772: for Level 1 and Level 2 charging
    - Combined Charging System (CCS): for DC fast charging for most vehicle models[5]
    - CHAdeMO: for DC fast charging for select vehicle models
    - 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.

1.2 Projecting Future Charging Infrastructure Needs

The United States set an early goal of building a network of up to 500,000 public EVSE ports by 2030. To put this goal into context, the number of public EVSE ports in the Station Locator has grown by an average of 5,223 EVSE ports per quarter since the start of 2020, when this report series began. To reach 500,000 EVSE ports by 2030, an average of 12,982 public EVSE port installations will be required each quarter for the next 8 years, equating to an average quarterly growth rate of 4.6%, 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

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[1] 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.
[2] 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.
[3] 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.
[4] 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.
[5] The CCS connector is a standard developed by SAE, similar to the J1772 standard.

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 United States' aggressive infrastructure goal. Additionally, this goal does not differentiate between DC fast and Level 2 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, so the Station Locator team expects a significant increase in public DC fast EVSE ports as a result of these programs (Federal Highway Administration 2022).

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 252,000 350 kW DC fast EVSE ports and 244,000 Level 2 EVSE ports would be required.[6] Using the number of EVSE ports in the Station Locator as of Q1 2021 as a baseline, this results in approximately 252,675 350 kW DC fast EVSE ports and 335,266 Level 2 EVSE ports by 2030 and equates to 4.4 350 kW DC fast EVSE ports per 1,000 EVs and 5.8 Level 2 EVSE ports per 1,000 EVs.[7] 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, Schayowitz, and Klotz 2022).

As of Q4 2022, there were 28,397 public and workplace DC fast EVSE ports, of which 1,448 had a power output of 350 kW, and 116,994 public and workplace Level 2 EVSE ports available in the United States (Figure 2). Based on NREL's analysis, the number of DC fast EVSE ports installed has surpassed projected 2030 infrastructure requirements to support 15 million EVs, while the number of Level 2 EVSE ports installed is 19.5% of the way toward meeting those requirements (Figure 2). However, it is important to note that 60.3% of public DC fast EVSE ports in the Station Locator are on the Tesla Supercharger network and are therefore only readily accessible to Tesla vehicles, which make up approximately 47% of EVs on the road as of December 31, 2022 (Experian Information Solutions 2023).[8] When public Tesla EVSE ports are excluded, the number of DC fast and Level 2 EVSE ports currently installed decreases to 41.1%

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[6] Atlas' analysis assumes that all DC fast EVSE ports have a power output of 350 kW. Therefore, only 350 kW DC fast EVSE ports are considered when comparing current installations against Atlas' analysis.

[7] As discussed further in section 2.1.1, power data is available for 60.5% of public DC fast EVSE ports in the Station Locator. Therefore, the Q1 2021 baseline, as well as the current counts, of 350 kW DC fast EVSE may be underrepresented.

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

and 17.6%, respectively, of the way toward meeting NREL's projected infrastructure requirements.

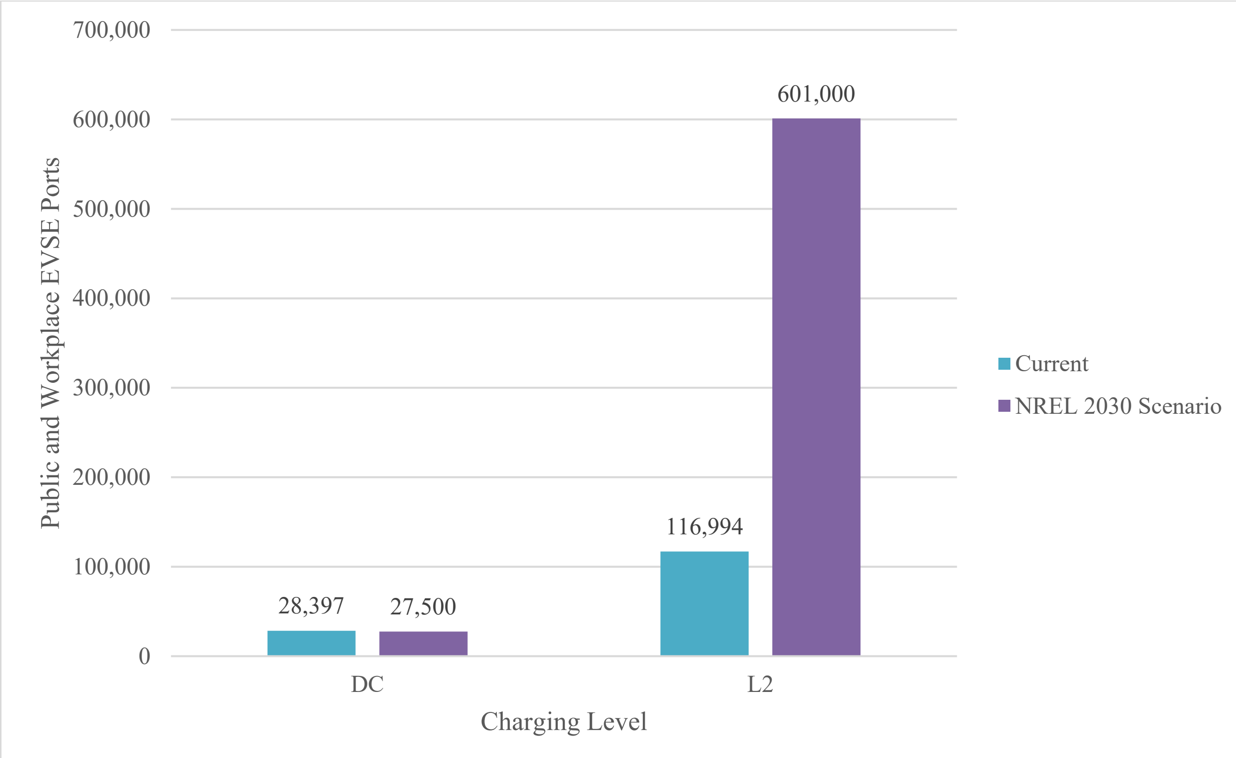

Figure 2. Current availability of public and workplace charging versus NREL's scenario of 2030 infrastructure requirements in the United States

Based on Atlas' assessment, the number of 350 kW DC fast and Level 2 EVSE ports is 0.6% and 34.9%, respectively, of the way toward meeting projected 2030 infrastructure requirements to support 57.5 million EVs (Figure 3). When public Tesla EVSE ports are excluded, the number of Level 2 EVSE ports currently installed decreases to 32.6% toward meeting Atlas' projected infrastructure requirements. Excluding Tesla ports does not impact DC fast EVSE ports, as the maximum power output of Tesla Superchargers ports is 250 kW.

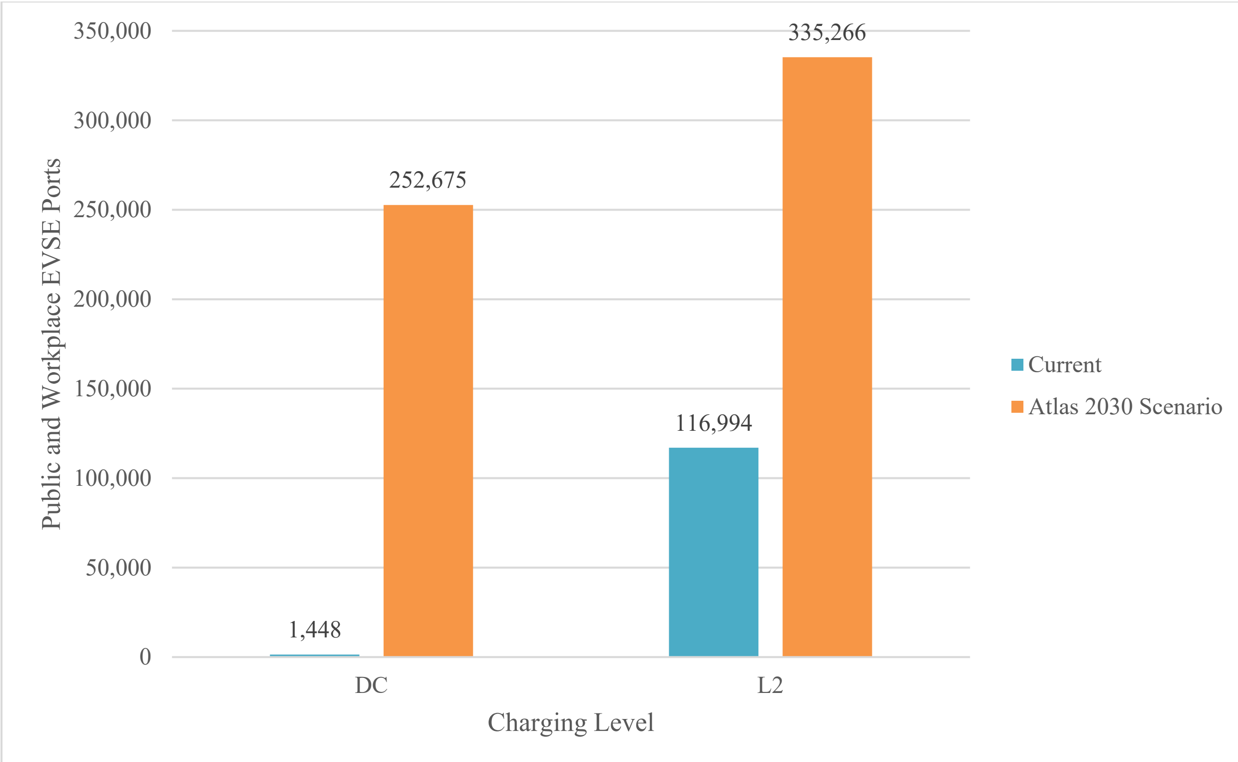

Figure 3. Current availability of public and workplace charging versus Atlas' scenario of 2030 infrastructure requirements in the United States

Note: The current DC fast EVSE port count only includes DC fast EVSE ports with a power output of 350 kW.

There were approximately 3.1 million EVs on the road in the United States as of December 31, 2022 (Experian Information Solutions 2023). The ratios of DC fast and Level 2 public and workplace EVSE ports per 1,000 EVs in Q4 were 9.0 and 37.1, respectively (Table 1). These ratios decrease to 3.6 and 33.6, respectively, when Tesla EVSE ports are excluded (Table 1). Using NREL's estimated ratios of the number of DC fast and Level 2 EVSE ports per 1,000 EVs as a proxy for how much infrastructure (excluding Tesla) is sufficient to meet charging needs in 2030, Table 1 suggests that, as of Q4, public and workplace DC fast EVSE ports have surpassed 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 been below NREL's estimated ratio of EVSE ports per 1,000 EVs since Q1 2022. 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 over time. For example, the number of registered EVs grew by 9.1% in Q4, while the number of public and workplace Level 2 EVSE ports grew by 5.2%. Although roughly 21% of the 15 million light-duty EVs in NREL's analysis were on the road as of Q4, 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 NREL's Scenario of 2030 Infrastructure Requirements in the United States

Port Level	EVSE per 1,000 EVs in Q4 2022 (including Tesla)	EVSE per 1,000 EVs in Q4 2022 (excluding Tesla)	NREL – EVSE per 1,000 EVs Needed in 2030 To Support 15 Million EVs
DC fast	9.0	3.6	1.8
Level 2	37.1	33.6	40.1

The ratio of 350 kW DC fast EVSE ports per 1,000 EVs in Q4 was 0.5, both with and without Tesla EVSE ports (Table 2). Using Atlas' estimated ratios of the number of 350 kW DC fast and Level 2 EVSE ports per 1,000 EVs as a proxy for how much infrastructure (excluding Tesla) is sufficient to meet charging needs in 2030, Table 2 suggests the opposite of Table 1—that public and workplace Level 2 EVSE ports have surpassed current charging needs in terms of the total amount of infrastructure currently available, while there is still a significant need for more DC fast EVSE ports.

Table 2. Current Public and Workplace EVSE per 1,000 EVs Versus Atlas' Scenario of 2030 Infrastructure Requirements in the United States

Port Level	EVSE per 1,000 EVs in Q4 2022 (including Tesla)	EVSE per 1,000 EVs in Q4 2022 (excluding Tesla)	Atlas – EVSE per 1,000 EVs Needed in 2030 To Support 57.5 Million EVs
DC fast (350 kW)	0.5	0.5	4.4
Level 2	37.1	33.6	5.8

2 Electric Vehicle Charging Infrastructure Trends

The purpose of this report is to identify EV charging infrastructure trends for Q4 of 2022. In Q4, the number of EVSE ports in the Station Locator grew by 5.7%, or 8,394 EVSE ports. Public EVSE ports grew by 6.3%, or 8,082 ports, and account for the majority of EVSE ports in the Station Locator (Figure 4). Private EVSE ports increased by 1.6%, or 312 EVSE ports. As of Q4, 87.2% of EVSE ports in the Station Locator were public and 12.8% were private, compared with 84.5% public and 15.5% private in Q4 2019.

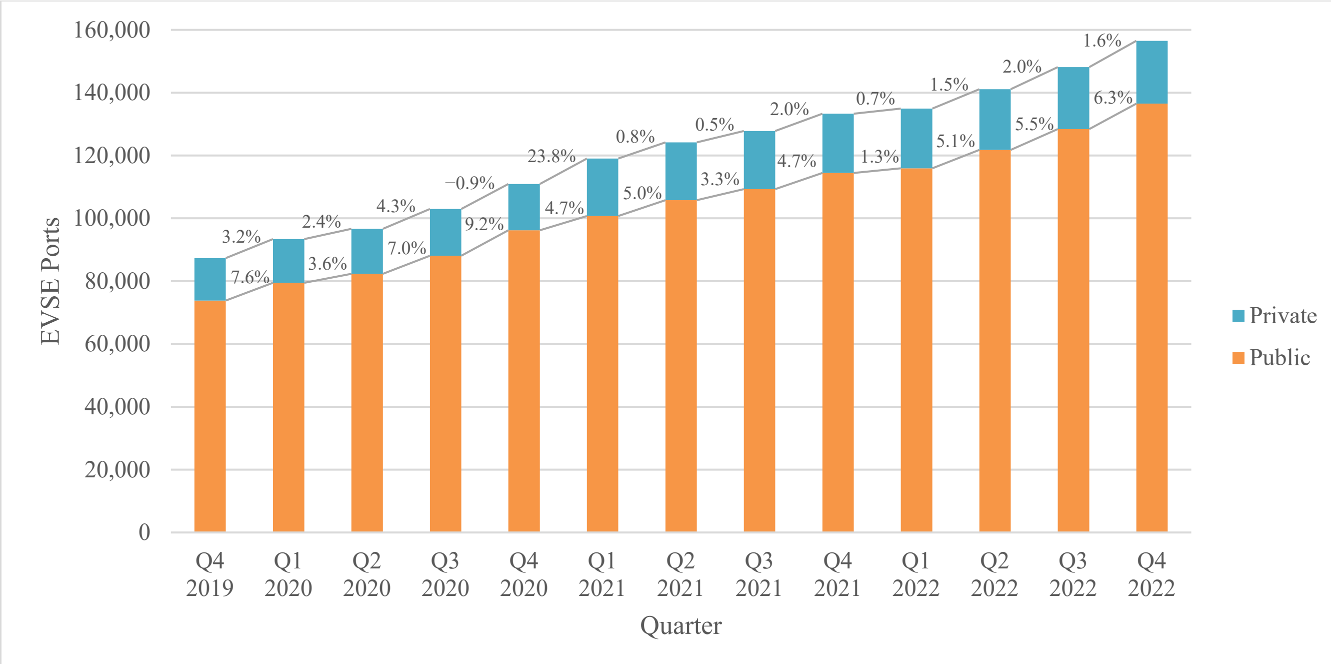

Figure 4. Quarterly growth of EVSE ports by access.

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 Q4 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 Q4, the number of public EVSE ports in the Station Locator increased by 8,082, bringing the total number of public EVSE ports in the Station Locator to 136,513 and representing a 6.3% increase since Q3 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 5, the majority of public EVSE ports in the Station Locator are Level 2, followed by DC fast and Level 1. However, DC fast EVSE ports have increased by the greatest percentage compared to other charging levels in almost every quarter since Q4 2019 (Figure 5). DC fast EVSE ports made up 20.8% of public EVSE ports as of Q4 2022, compared with 16.7% in Q4 2019.

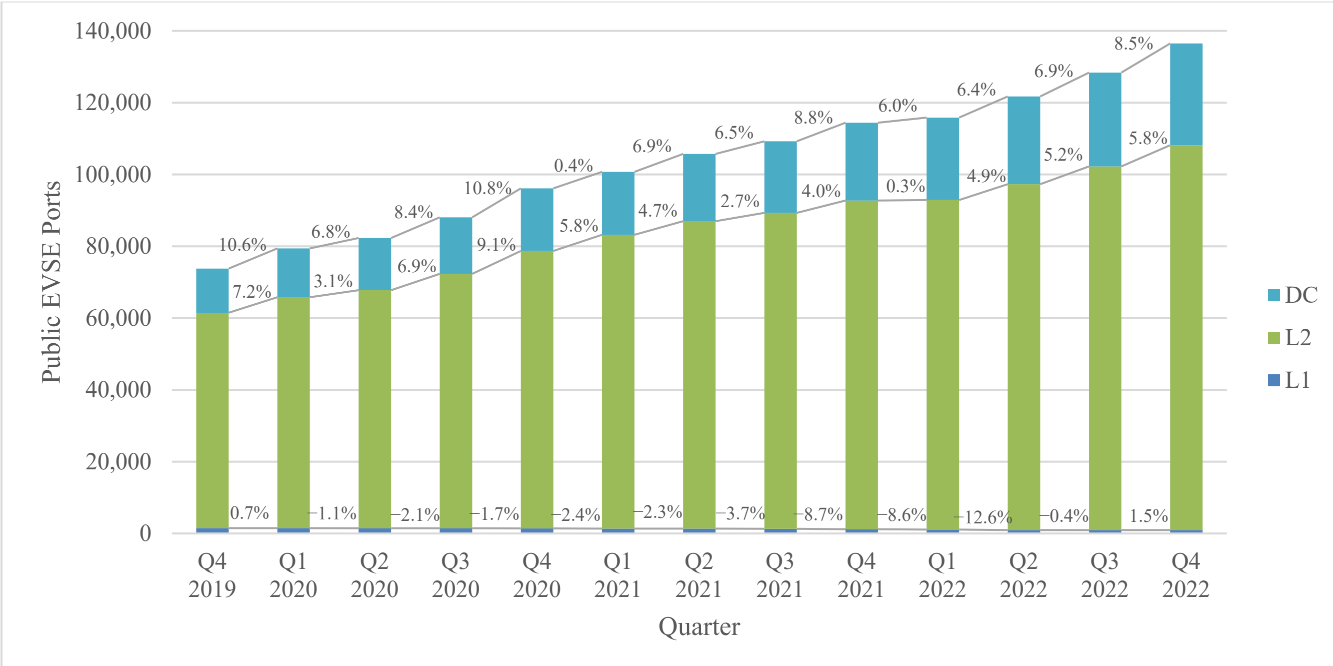

Figure 5. Quarterly growth of public EVSE ports by charging level.

Note: Figure excludes legacy EVSE ports that are not classified by charging level and are no longer manufactured. As of Q4, there were 40 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, the power output of DC fast EVSE ports ranges from 24 kW to 350 kW. DC fast EVSE ports with power outputs of 50 kW and 150 kW are common, though the number of DC fast EVSE ports at higher power levels are steadily increasing, as seen in Figure 5.

Of the 28,339 public DC fast EVSE ports in the Station Locator, power output data are currently available for 60.5%; Figure 6 is therefore based on power output data for 17,134 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.

As shown in Figure 6, the number of EVSE ports with a power output greater than 349 kW grew by the largest percentage in Q4 (34.1%). This growth can be primarily attributed to new 350 kW EVSE port installations on the Electrify America and EVgo networks. The growth of EVSE ports with a power output between 250 kW and 349 kW is due to new 250 kW installations on the Tesla Supercharger network.

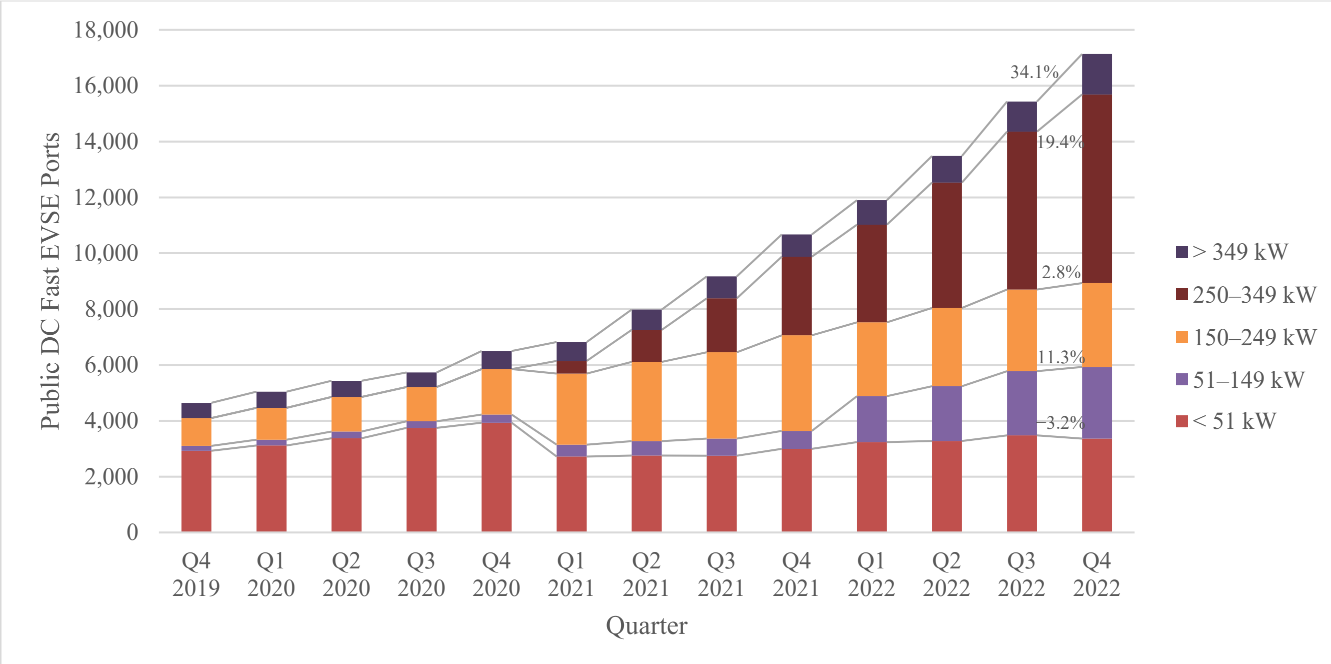

Figure 6. Quarterly growth of public DC fast EVSE ports by power output.

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, Schayowitz, and Klotz 2021).

Finally, there are currently three types of connectors available for DC fast chargers: CHAdeMO, CCS, and Tesla. As noted in Section 1.1, 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 available in the United States with the CHAdeMO connector standard. Currently, 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 December 31, 2022, approximately 68% of registered all-electric vehicles in the United States were Teslas and therefore compatible with the Tesla connector, 26% were compatible with the CCS connector, and 6% were compatible with the CHAdeMO connector (Experian Information Solutions 2023).[9] Of the 33,933 DC fast connectors in the Station Locator as of Q4, Tesla connectors grew by the largest percentage (11.4%), followed by CCS connectors (5.0%) (Figure 7). Despite CHAdeMO-compatible vehicles making up the smallest percentage of registered EVs, the number of CHAdeMO connectors in the Station Locator continued to grow (4.1%) in Q4. 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 20.2% in Q4 2022.

[9] These figures exclude plug-in hybrid electric vehicles since most are not compatible with DC fast EVSE ports.

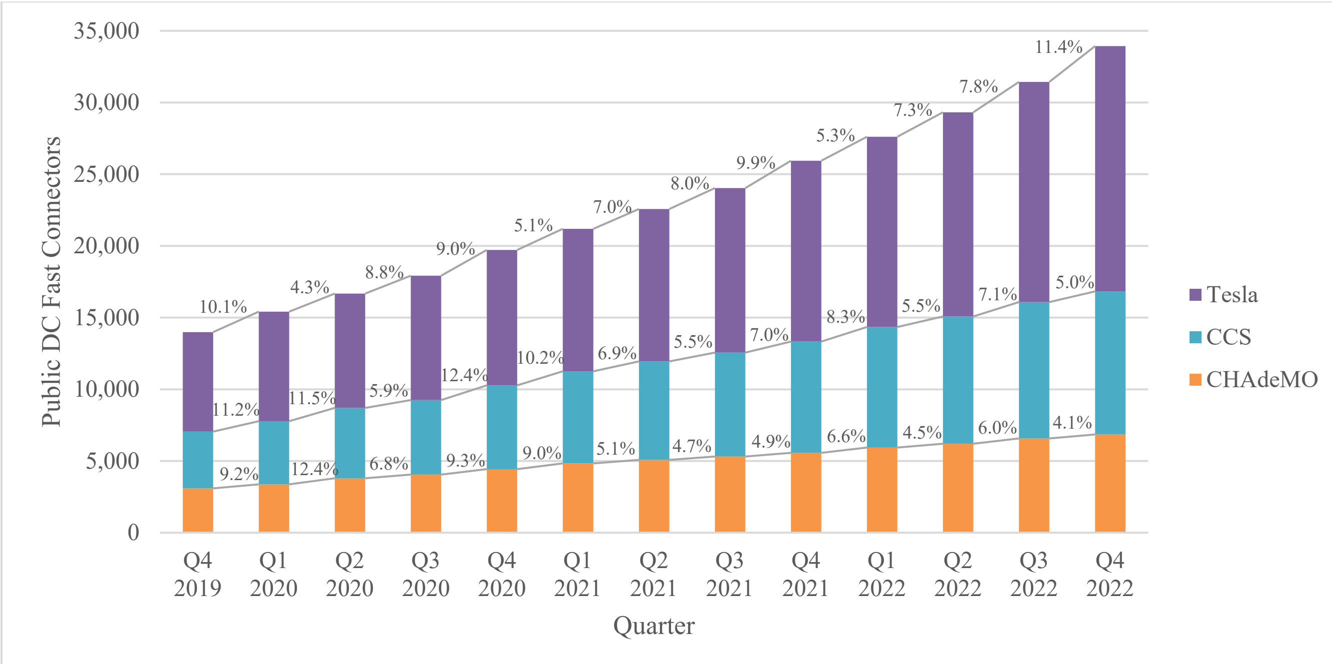

Figure 7. Quarterly growth of public DC fast connectors by type.

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

2.1.2 By Network

As with previous quarters, the ChargePoint network continued to account for the largest number of public EVSE ports (40.6%) in the Station Locator in Q4, and Level 2 EVSE ports continued to make up the majority of ChargePoint's network (Figure 8). 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 had the largest share of public DC fast EVSE ports (60.3%) in Q4, followed by Electrify America (12.7%) and EVgo (8.4%) (Figure 9).

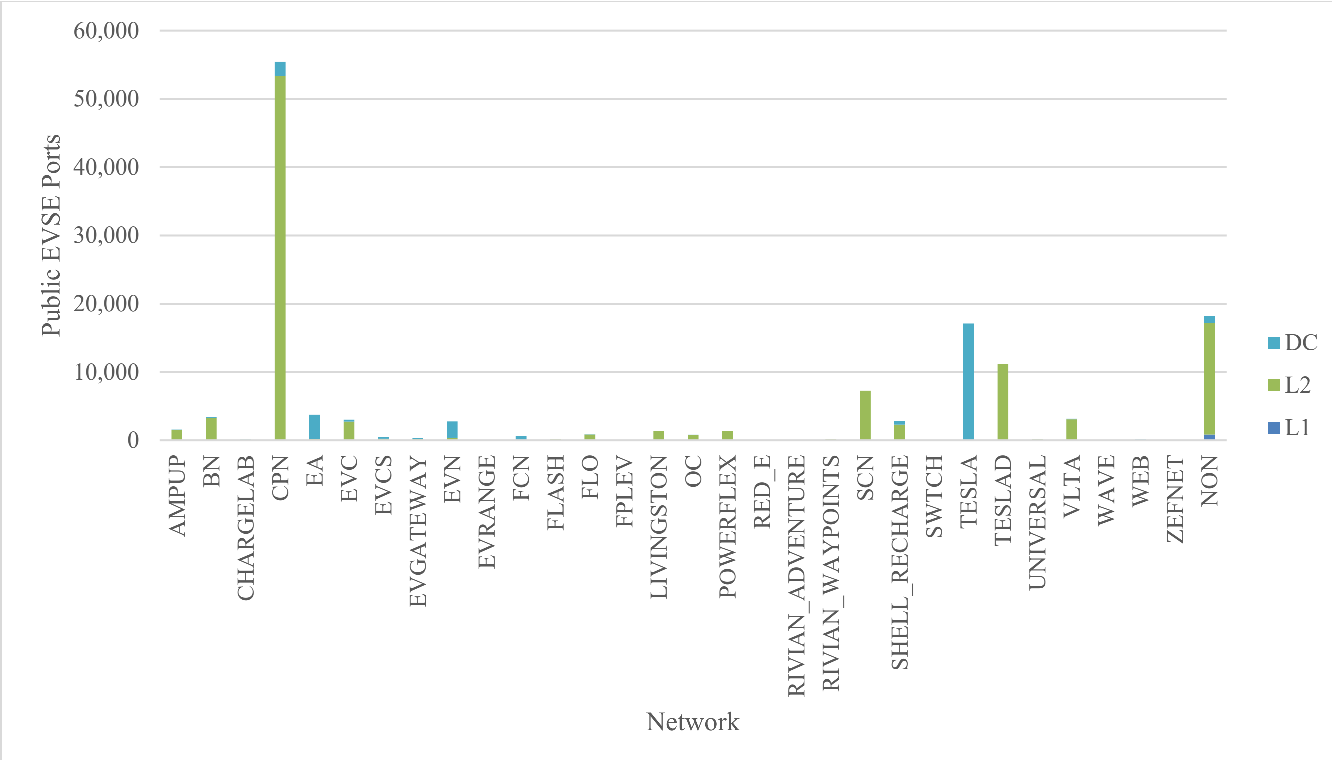

Figure 8. Breakdown of public EVSE ports by network and charging level in Q4 2022

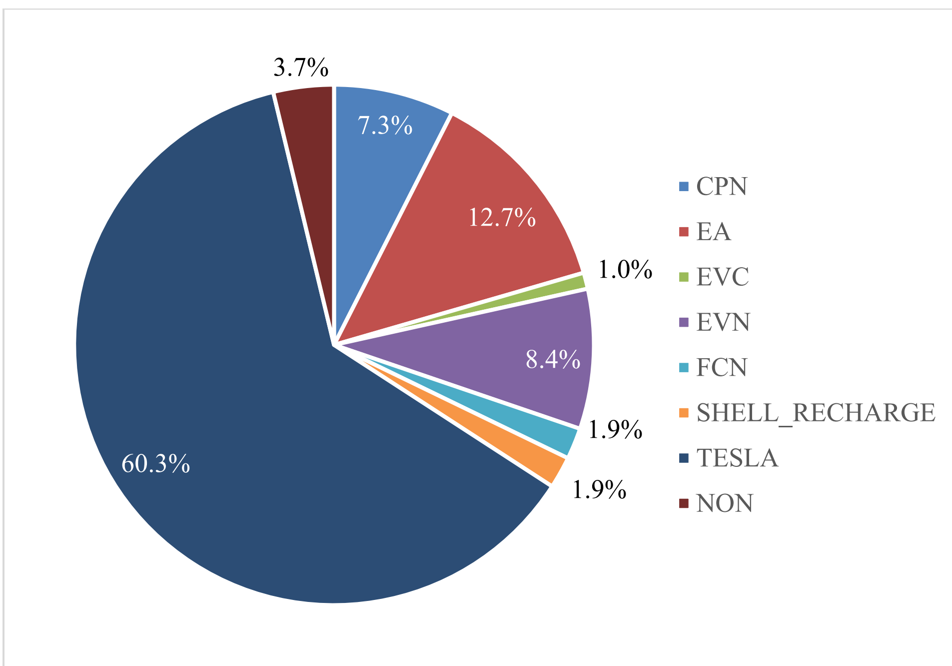

Figure 9. Breakdown of public DC fast EVSE ports by network in Q4 2022.

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

Figure 10 shows the growth of each network in Q4, and Table 2 includes the percent growth of each network over the last four quarters. Similar to Q3 2022, the growth of many networks in Q4 2022 was largely a result of the Station Locator's manual data collection process, as noted in

Section 1. For example, the networks with some of the biggest percent increases were due to large updates shared by these networks in Q4, including AmpUp (387.8%), EV Range (62.5%), Livingston Energy Group (24.0%), and Universal EV Chargers (208.3%) (Table 2).

The significant increase of EVSE ports on the Rivian Waypoints network and Rivian Adventure Network, on the other hand, was not a result of the manual data collection process, as Rivian's station data are imported and updated on a nightly basis via an application programming interface (API) (see the end of this section for networks updated via an API). This increase of the Rivian Waypoints network reflects a rapid expansion of the network across the country—including Colorado, Illinois, and Tennessee—while the increase of the Rivian Adventure Network reflects new installations in California and Colorado.

The number of EVSE ports on the Blink network decreased slightly (−0.8%) in Q4 (Table 3). Although the number of Level 2 EVSE ports decreased, the number of DC fast EVSE ports slightly increased.

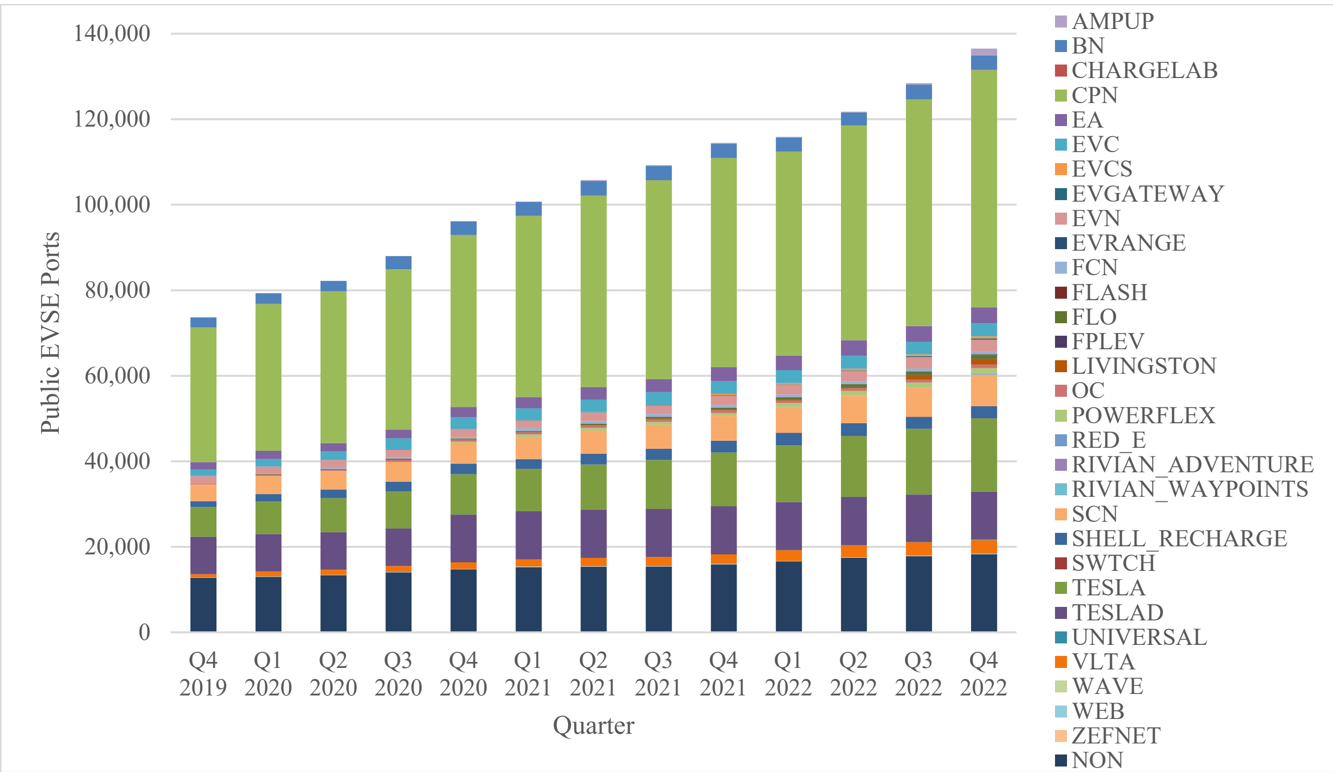

Figure 10. Quarterly growth of public EVSE ports by network

Table 3. Growth of Public EVSE Ports by Network Over the Last Four Quarters

Network	Q1 2022 Growth	Q2 2022 Growth	Q3 2022 Growth	Q4 2022 Growth
AmpUp	2.3%	10.7%	61.9%	387.8%
Blink	−0.5%	−8.1%	13.2%	−0.8%
ChargeLab	0.0%	0.0%	1,180.0%	65.6%
ChargePoint	−2.6%	5.4%	5.4%	4.6%
Electrify America	6.0%	4.0%	2.6%	1.7%
EV Connect	1.2%	0.3%	−2.4%	2.8%
EV Charging Solutions	3.2%	23.3%	−3.5%	22.7%
evGateway	8.2%	25.2%	80.5%	11.2%
EVgo	3.2%	8.5%	9.1%	4.3%
EV Range	N/A	N/A	N/A	62.5%
Francis	0.0%	0.0%	−1.4%	2.6%
FLASH	N/A	N/A	N/A	N/A
FLO	11.6%	30.2%	21.2%	8.3%
FPL EVolution	760.0%	−22.1%	0.0%	0.0%
Livingston Energy Group	0.0%	47.9%	287.4%	24.0%
OpConnect	−7.0%	6.4%	11.5%	18.8%
PowerFlex	42.8%	17.8%	7.8%	17.9%
Red E Charging	N/A	N/A	N/A	N/A
Rivian Adventure Network	N/A	N/A	161.5%	50.0%
Rivian Waypoints	N/A	64.3%	30.4%	160.0%
SemaConnect	3.6%	6.7%	5.7%	7.3%
Shell Recharge	5.8%	1.2%	−6.4%	2.1%
SWTCH Energy	N/A	−13.3%	46.2%	47.4%
Tesla Supercharger	5.3%	7.4%	7.8%	11.5%
Tesla Destination	0.0%	0.5%	−1.3%	0.6%
Universal EV Chargers	N/A	N/A	N/A	208.3%
Volta	13.4%	11.9%	9.5%	2.7%
Webasto	0.0%	0.0%	0.0%	0.0%
ZEF Energy	16.7%	0.0%	85.7%	0.0%
Non-networked	4.3%	5.2%	2.3%	2.3%
Total	**1.3%**	**5.1%**	**5.5%**	**6.3%**

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 29 networks listed below, 12 of which update on a nightly basis via an API (marked with asterisks). FLASH and Red E Charging are new to the Station Locator as of Q4. In addition, the Station Locator contains non-networked (NON) station data, which include 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)*
- EV Range (EVRANGE)
- Francis Energy (FCN)
- FLASH (FLASH)
- FLO (FLO)*
- FPL EVolution (FPLEV)
- Livingston Energy Group (LIVINGSTON)
- OpConnect (OC)*
- PowerFlex (POWERFLEX)
- Red E Charging (RED_E)
- Rivian Adventure Network (RIVIAN_ADVENTURE)*
- Rivian Waypoints (RIVIAN_WAYPOINTS)*
- SemaConnect (SCN)*
- Shell Recharge (SHELL_RECHARGE)*
- SWTCH Energy (SWTCH)
- Tesla Supercharger (TESLA)
- Tesla Destination (TESLAD)
- Universal EV Chargers (UNIVERSAL)
- Volta (VLTA)
- Webasto (WEB)*
- ZEF Energy (ZEFNET)

2.1.3 By Region

As shown in Figure 11, the California region continues to have the largest share of the country's public EVSE ports (29.2%). However, the North Central region grew by the largest percentage in Q4 (8.6%), primarily as a result of new Level 2 installations on the ChargePoint network, as well as the addition of the FLASH and Red E Charging stations to the Station Locator. Although FLASH has installed infrastructure across the country, Red E Charging is building out infrastructure in Michigan. With the exception of the North Central and Mid-Atlantic regions, DC fast EVSE ports grew at a faster rate than Level 2 EVSE ports in each region in Q4, with the Southeast region seeing the largest percentage growth in DC fast EVSE for the fourth quarter in a row (Table 4).

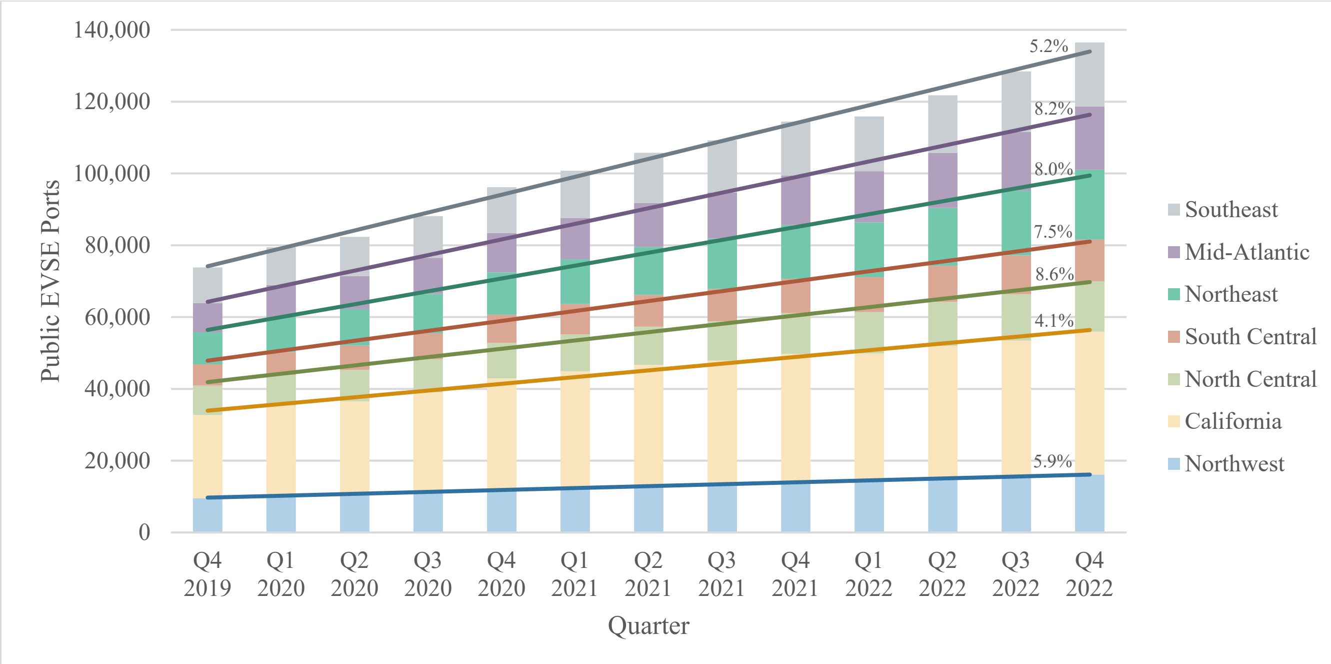

Figure 11. Quarterly growth of public EVSE ports by Clean Cities region.

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

Table 4. Growth of Public Level 2 and DC Fast EVSE Ports by Clean Cities Region in Q4 2022

Clean Cities Region	Level 2 EVSE Port Growth	DC Fast EVSE Port Growth
California	2.9%	8.8%
Mid-Atlantic	8.9%	6.0%
North Central	8.9%	7.8%
Northeast	7.7%	10.5%
Northwest	5.8%	6.9%
Southeast	4.4%	8.2%
South Central	6.2%	11.8%

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 12) (Clean Cities Coalition Network 2023a). See the Q1 2020 report for more information about the Clean Cities Coalition Network (Brown et al. 2020).

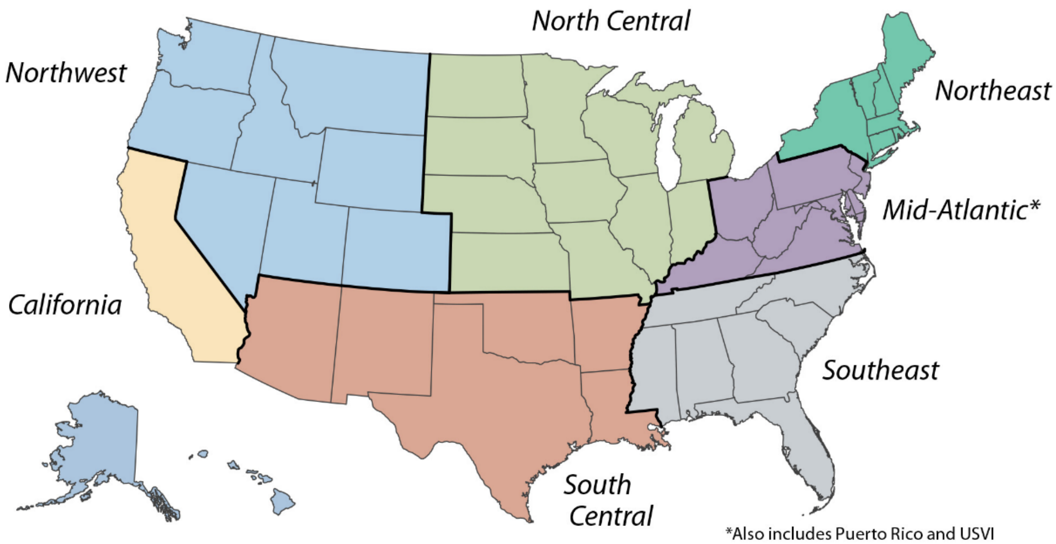

Figure 12. Clean Cities regions.

Source: Clean Cities Coalition Network (2023b)

2.1.4 By State

In Q4, the five states that had the largest percent growth of EVSE ports per 100 EVs were Illinois, Delaware, New Jersey, Alaska, and Louisiana, all of which outpaced the growth in the United States as a whole (Table 5). The growth in Illinois is primarily driven by new Level 2 EVSE port installations at Commonwealth Edison locations, all of which are on the ChargePoint network. Additionally, New Jersey ranked among the top five states with the largest growth of EVSE ports per 100 EVs for the second quarter in a row. Similar to Illinois, the majority of this growth is due to new Level 2 EVSE port installations on the ChargePoint network.

Table 5. Top Five States With the Largest Growth of EVSE Ports per 100 EVs in Q4 2022[10]

State	EVSE Ports per 100 EVs in Q3 2022	EVSE Ports per 100 EVs in Q4 2022	Growth of EVSE Ports per 100 EVs in Q4 2022
Illinois	4.7	5.8	21.6%
Delaware	6.0	7.1	19.4%
New Jersey	3.3	3.8	16.4%
Alaska	5.3	6.1	15.6%
Louisiana	7.7	8.8	13.9%

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 2022).

[10] See Appendix A for the growth of EVSE ports per 100 EVs in all states in Q4.

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 13, public EVSE ports are predominantly located in suburban census tracts, followed by urban and rural tracts. DC fast EVSE ports showed the largest growth across all density categories (7.8% overall) compared with Level 2 (5.9% overall) and Level 1 (1.1% overall) EVSE port growth. As shown in Figure 13, DC fast EVSE ports grew by the largest percentage in urban areas, followed closely by suburban areas. Rural areas had the slowest growth in EVSE ports across all charging levels.

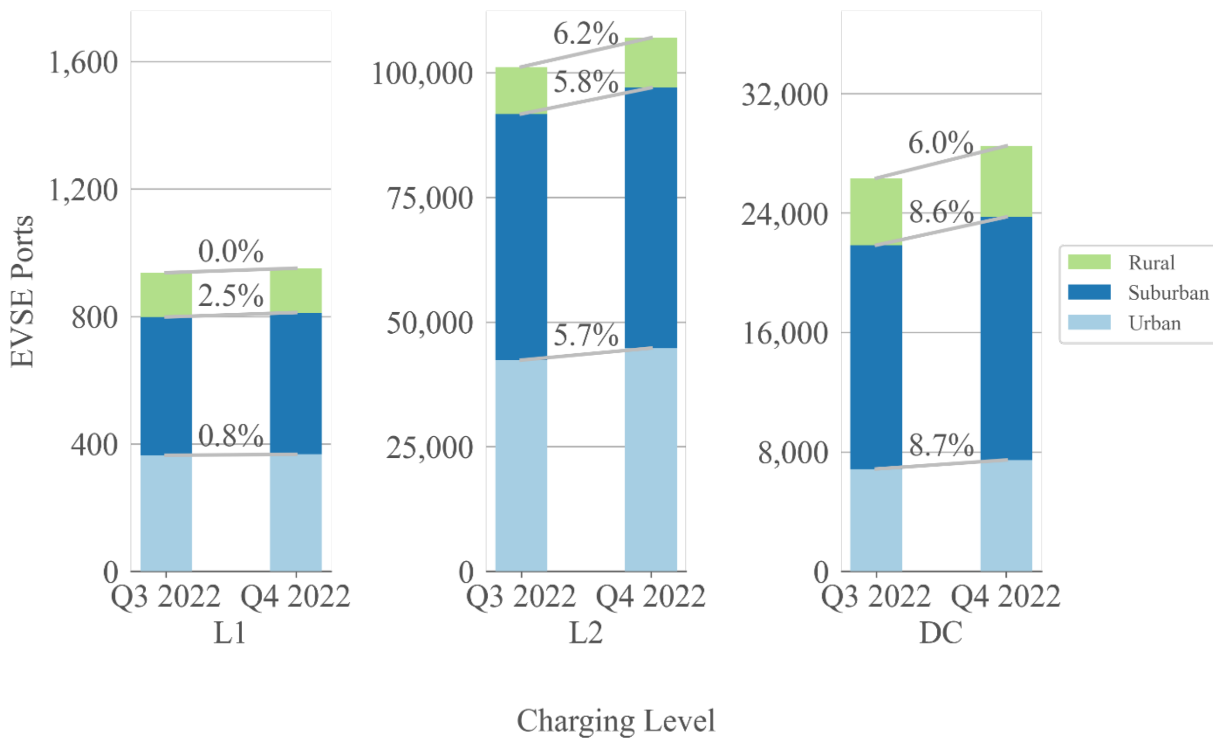

Figure 13. Q4 2022 growth of public EVSE ports by neighborhood type and charging level.

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.

2.1.6 By Disadvantaged Community Designation

President Biden issued Executive Order 14008 early in his presidency to ensure that the benefits of his administration's climate investments flow to communities that have been historically underserved and disproportionately burdened by climate change, pollution, and environmental hazards (Argonne National Laboratory 2023). The Justice40 Initiative, which came out of Executive Order 14008, directs 40% of the overall benefits of certain federal investments, including the NEVI Formula Grant Program, to disadvantaged communities (DACs). Although charging infrastructure funded by the NEVI Formula Grant Program has not yet been deployed, this section focuses on the growth of EVSE ports in both DACs and non-DACs for comparison. The map in Figure 14 shows the census tracts classified as DACs across the United States.

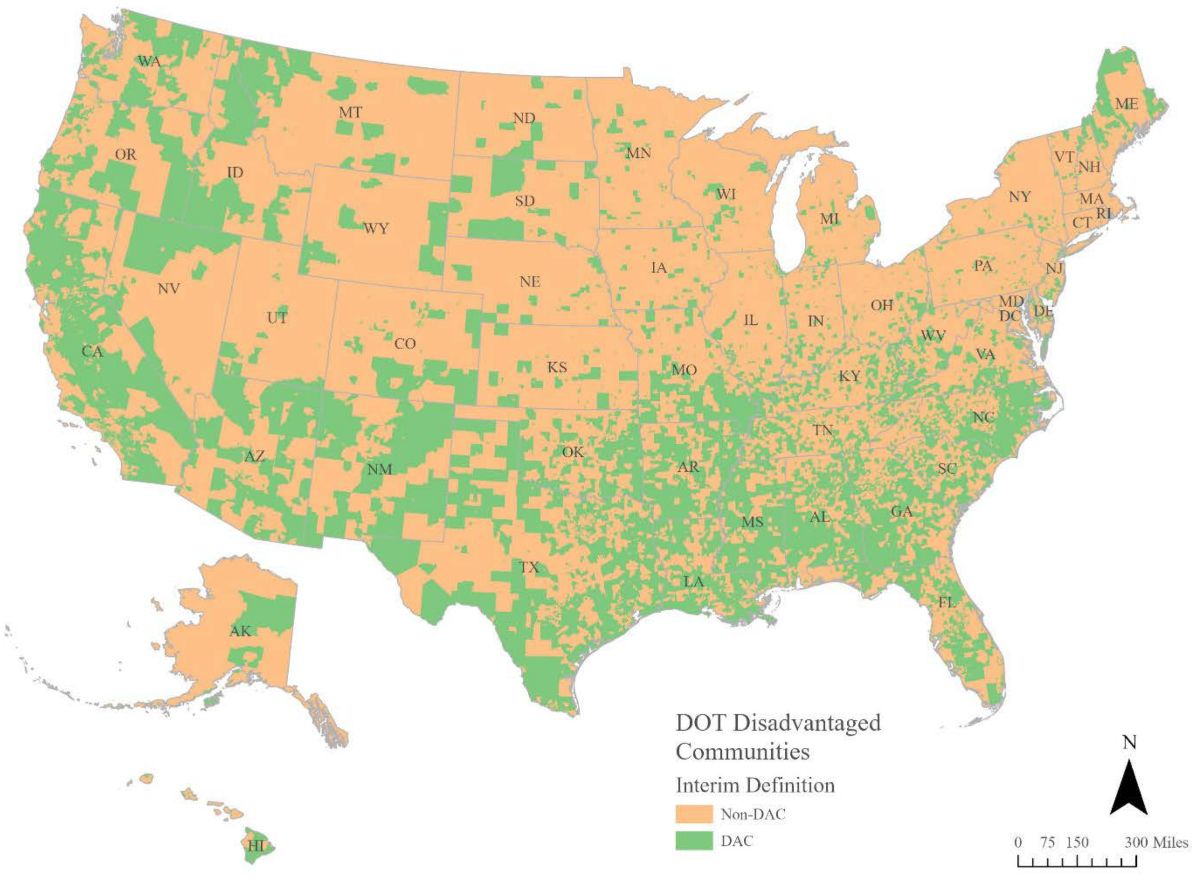

Figure 14. Display of the disadvantaged communities across the United States.

Note: Alaska and Hawaii are not to scale.

Overall, 33.7% of public EVSE ports across all charging levels are in DACs, up slightly from 32.9% from the previous quarter. As shown in Figure 15, Level 1 EVSE ports increased by 5.4% in DACs in Q4, while Level 2 EVSE ports increased 5.2%. DC fast EVSE ports grew by the largest percentage, with a 9.3% increase in Q4.

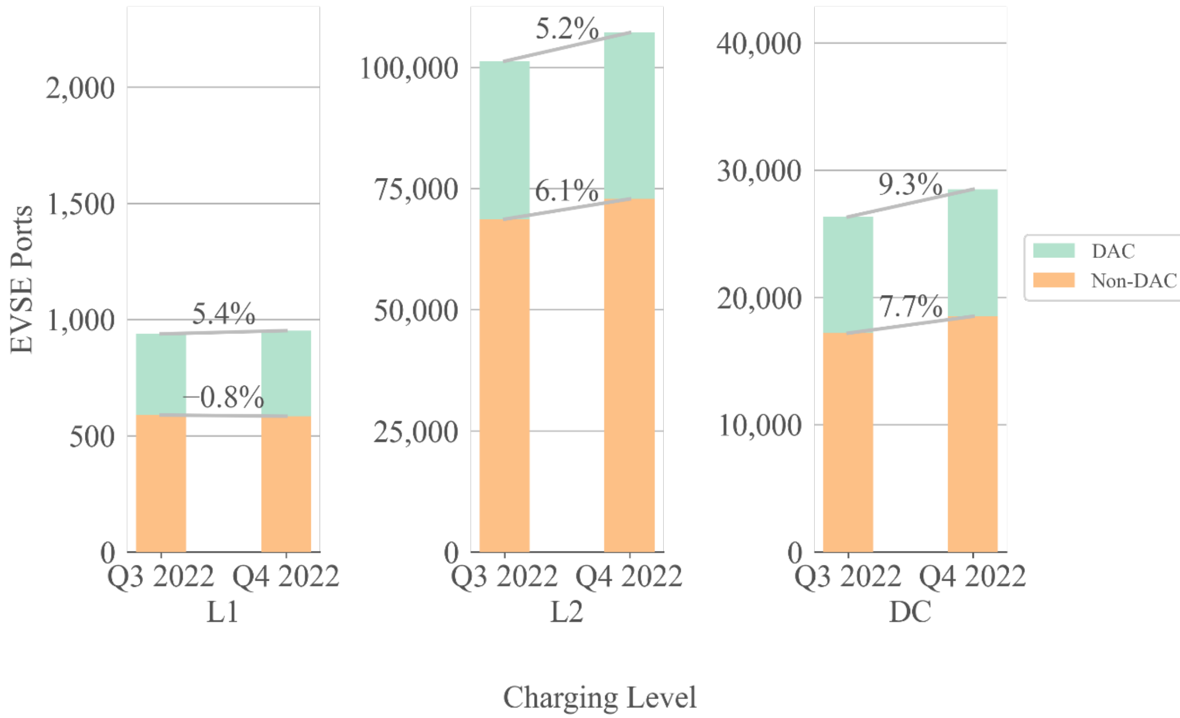

Figure 15. Q4 2022 growth of public EVSE ports by DAC designation and charging level.

Note: These graphs are not to scale.

The Station Locator team used a joint interim guidance map for DACs developed by DOE and the U.S. Department of Transportation for the NEVI Formula Grant Program for this section of the analysis. GIS shapefiles with these data are hosted by Argonne National Laboratory (2023). The DAC shapefile was prepared by aggregating several social, economic, and environmental features into a spatial data set. There are two interim definitions for DACs: one from DOE and one from the U.S. Department of Transportation. This analysis uses the latter, which accounts for 22 census tract-level indicators under six categories of transportation disadvantage: transportation access, health, environment, economic, resilience, and social (U.S. Department of Transportation 2023).

2.2 Private Charging Trends

The number of private EVSE ports in the Station Locator reached 20,002 in Q4, representing an increase of 1.6% and the addition of 312 private EVSE ports since Q3. The following sections break down the growth of private EVSE ports by level, as well as by three specific types: workplace, multifamily housing, 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 data collection in these areas.

2.2.1 By Charging Level

As shown in Figure 16, the majority of private EVSE ports in the Station Locator are Level 2. In Q4, private Level 2 EVSE ports grew by the largest percentage (1.8%), followed by private DC fast EVSE ports. While the percentage of private DC fast EVSE ports grew by 1.2%, this only represents the addition of four ports. Meanwhile, the share of private Level 1 EVSE ports slightly declined by 0.2%, representing a decrease of four EVSE ports.

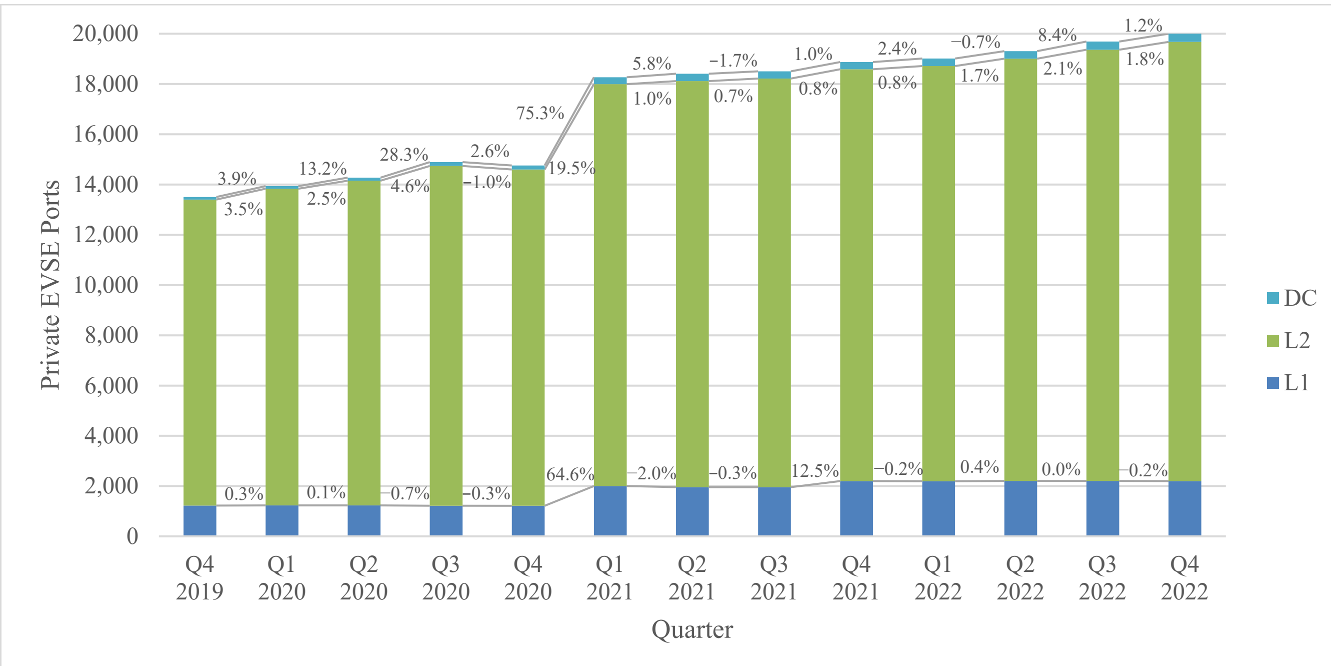

Figure 16. Quarterly growth of private EVSE ports by charging level.

Note: Figure excludes legacy EVSE ports that are not classified by charging level and are no longer manufactured. As of Q4, there were three private legacy EVSE ports in the Station Locator. Additionally, the percentages in this figure indicate the percent growth between each quarter. Finally, the large increase in Q1 2021 is primarily attributed to the addition of federally owned EVSE ports from NREL's Federal Fleets team.

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 17), 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. As previously noted, private workplace charging data are likely underrepresented in the Station Locator.

In Q4, there was a slight decrease of 0.4% in private EVSE ports at workplaces, bringing the total number of EVSE ports to 10,240 (Figure 17). As discussed in Appendix B.2, 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 in Q4 is attributable to this process.

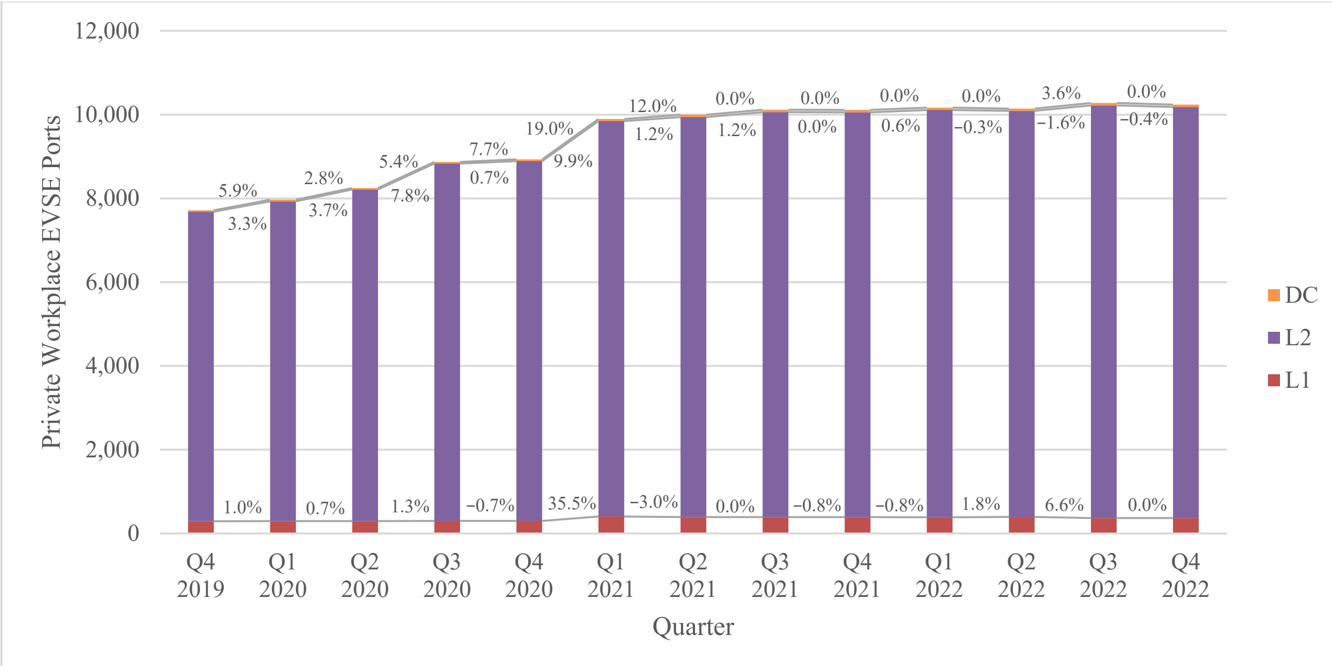

Figure 17. Quarterly growth of private workplace EVSE ports by charging level.

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. As shown in Figure 18, multifamily housing EVSE ports in the Station Locator are either Level 1 or Level 2. The number of multifamily EVSE ports grew from 1,179 in Q3 to 1,246 in Q4, representing an increase of 5.7%, primarily due to new installations in Massachusetts (Figure 18). Overall, EVSE ports at multifamily housing represent 6.2% of private EVSE ports in the Station Locator.

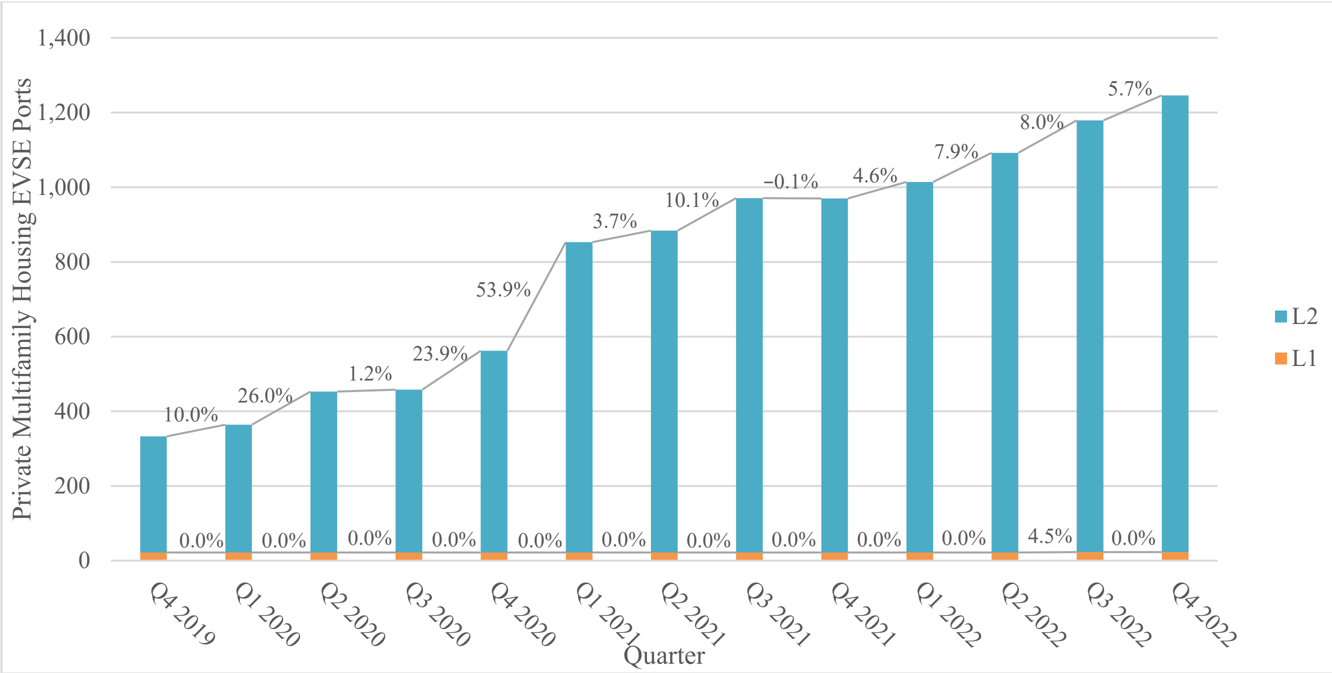

Figure 18. Quarterly growth of private multifamily housing EVSE ports by charging level.

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

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 Federal Highway Administration weight classes (i.e., light-duty, medium-duty, or heavy-duty vehicles). As of Q4, the team has collected this information for 87.5% of private EVSE ports in the Station Locator, of which 45.0% 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 19 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 Q4 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 light-duty vehicles, such as sedans, SUVs, and pickup trucks; unsurprisingly, the majority of fleet charging EVSE ports are used to charge light-duty vehicles (Figure 19). Additionally, the majority of fleet charging EVSE ports are Level 2 (Figure 19).

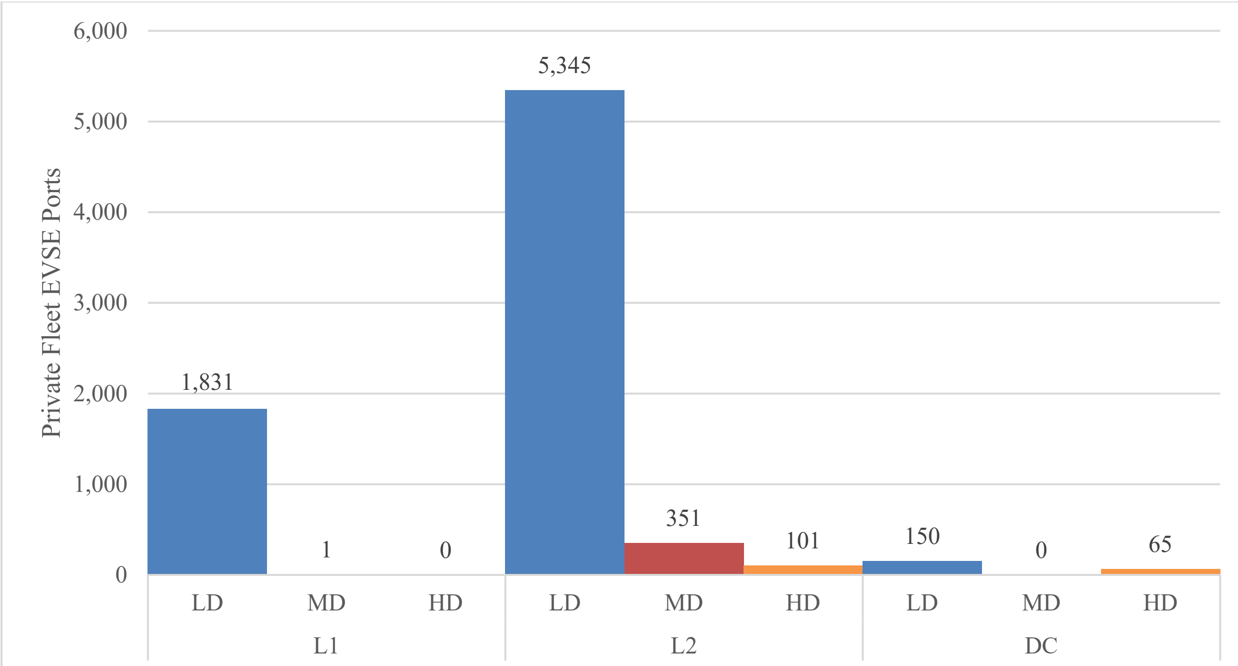

Figure 19. Breakdown of private fleet EVSE ports by charging level and fleet type in Q4 2022.

Note: LD = light-duty, MD = medium-duty, and HD = heavy-duty

The Station Locator team continues to expand its private fleet data collection efforts, especially for fleets that are installing charging infrastructure for medium- and heavy-duty vehicles such as school bus fleets and public transit fleets. Additionally, the Station Locator team is tracking the development of medium- and heavy-duty 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

During the final quarter of 2022, federal investments in EVs and EV charging infrastructure continued to make headlines. The United States Postal Service announced that it plans to acquire at least 66,000 EVs for its delivery fleet by 2028, which would make it the largest electric fleet in the nation (United States Postal Service 2022). Additionally, the Federal Transit Agency announced the availability of nearly $1.7 billion to support state and local governments to purchase low- or zero-emission buses and necessary charging equipment through the Low or No Emission Vehicle Program (Federal Transit Agency 2023). As a result of these two initiatives, the Station Locator team expects to see growth of medium- and heavy-duty EV charging infrastructure across the nation in future years to support these fleets.

In the private sector, bp pulse and Hertz announced a partnership to build a network of DC fast charging stations at high-demand locations, such as airports (bp 2022). The first planned site is at a Hertz location at Los Angeles International Airport and is partially funded by a $2-million grant from the California Energy Commission awarded to bp pulse and Hertz. Next, Mercedes-Benz is joining the EV charging infrastructure market by building their own charging network of 10,000 chargers across North America by 2030 (Mercedes-Benz Group 2023). The charging locations will be primarily near shopping and food centers, with the goal of offering safe charging and protection from the weather. Mercedes-Benz is partnering with ChargePoint for EV charging stations and MN8 for solar energy and battery storage. Finally, Shell USA announced the acquisition of Volta for $169 million, further expanding its public charging footprint and marking the third major consolidation of EVSPs in 2022 (Shell 2023).

Finally, the Station Locator data collection and management processes will continue to impact future EVSE port counts as well. As noted in Section 1.1, the Station Locator team's counting logic aligns 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 Q4, all manually collected data, as well as EVSE ports on the ChargePoint, Electrify America, EV Connect, EVgo, SemaConnect, Shell Recharge, 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 to help keep the Station Locator as up to date as possible. Finally, the Station Locator team is making a concerted effort to collect power data for all DC fast EVSE ports and may add new fields to the Station Locator to support Bipartisan Infrastructure Law funding initiatives. 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, as well as the growth of private EV charging by charging level and use type (i.e., workplace, multifamily housing, and fleet) in Q4 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 Q4, Level 2 EVSE ports accounted for the majority of both public and private EVSE ports in the Station Locator (78.5% and 87.4%, respectively). Overall, there was a 5.7% increase in the number of EVSE ports in the Station Locator. Although public Level 2 EVSE ports grew by the largest number in Q4, public DC fast EVSE ports grew at the fastest rate (8.5%). California continues to lead the country in terms of the total number of public EVSE ports available (39,812), though public charging infrastructure grew by the largest percentage in the North Central region in Q4 (8.6%).

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 EVSE ports installed has surpassed projected 2030 infrastructure requirements, while the number of Level 2 EVSE ports installed is 19.5% of the way toward meeting those requirements. However, the majority (60.3%) 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 41.1% and 17.6%, 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 Q4 is 10.5% and 34.9%, respectively, of the projected 2030 needs. This decreases to 4.4% and 32.6%, 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 5,223 public EVSE ports have been installed each quarter. To meet the Biden administration's goal by 2030, an average of 12,982 public EVSE port installations will be required each quarter for the next 8 years, equating to an average quarterly growth rate of 4.6%.

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. Q4 2022 Growth of Public EVSE Ports per 100 EVs by State

State	EVSE Ports per 100 EVs in Q3 2022	EVSE Ports per 100 EVs in Q4 2022	Growth of EVSE Ports per 100 EVs in Q4 2022
AK	5.3	6.1	15.6%
AL	8.0	8.7	8.8%
AR	12.8	13.6	6.9%
AZ	4.3	4.6	7.8%
CA	4.4	4.5	4.1%
CO	7.4	8.0	8.0%
CT	6.0	6.6	8.4%
DC	12.4	14.1	13.1%
DE	6.0	7.1	19.4%
FL	5.4	5.7	6.5%
GA	8.6	8.9	4.3%
HI	4.4	4.7	7.6%
IA	9.0	9.1	2.1%
ID	4.6	4.9	5.5%
IL	4.7	5.8	21.6%
IN	5.5	5.9	6.9%
KS	12.7	13.0	1.7%
KY	7.7	7.9	2.5%
LA	7.7	8.8	13.9%
MA	9.9	10.9	10.6%
MD	8.3	8.6	4.0%
ME	11.1	11.7	5.1%
MI	6.9	7.4	6.9%
MN	5.7	6.3	11.1%
MO	12.6	12.9	2.3%
MS	12.4	12.3	−1.3%
MT	9.1	9.3	2.4%
NC	7.0	7.3	5.2%
ND	21.3	22.2	4.3%
NE	9.5	9.7	1.8%
NH	5.2	5.7	9.3%
NJ	3.3	3.8	16.4%

State	EVSE Ports per 100 EVs in Q3 2022	EVSE Ports per 100 EVs in Q4 2022	Growth of EVSE Ports per 100 EVs in Q4 2022
NM	6.9	7.1	2.9%
NV	6.4	7.0	9.1%
NY	9.1	9.7	6.8%
OH	7.2	8.0	11.9%
OK	7.2	7.4	2.5%
OR	4.7	4.9	3.8%
PA	6.8	7.3	6.8%
RI	13.2	14.3	8.7%
SC	7.7	7.9	2.6%
SD	12.5	12.8	2.4%
TN	7.8	8.1	3.0%
TX	5.3	5.8	8.3%
UT	7.7	7.9	2.4%
VA	6.7	7.0	4.7%
VT	13.1	13.8	5.3%
WA	4.5	4.8	5.2%
WI	6.0	6.4	7.2%
WV	16.1	17.2	7.0%
WY	20.0	21.8	8.6%

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 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 EVSE ports and EV charging stations in the Station Locator from January 2010 through January 2020 (Brown et al. 2020).

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. 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 dedicated 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 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, including the integration of OCPI-based APIs. In Q4, SemaConnect's OCPI-based API was integrated into the Station Locator. See Section 1.1 for more information on the OCPI protocol.

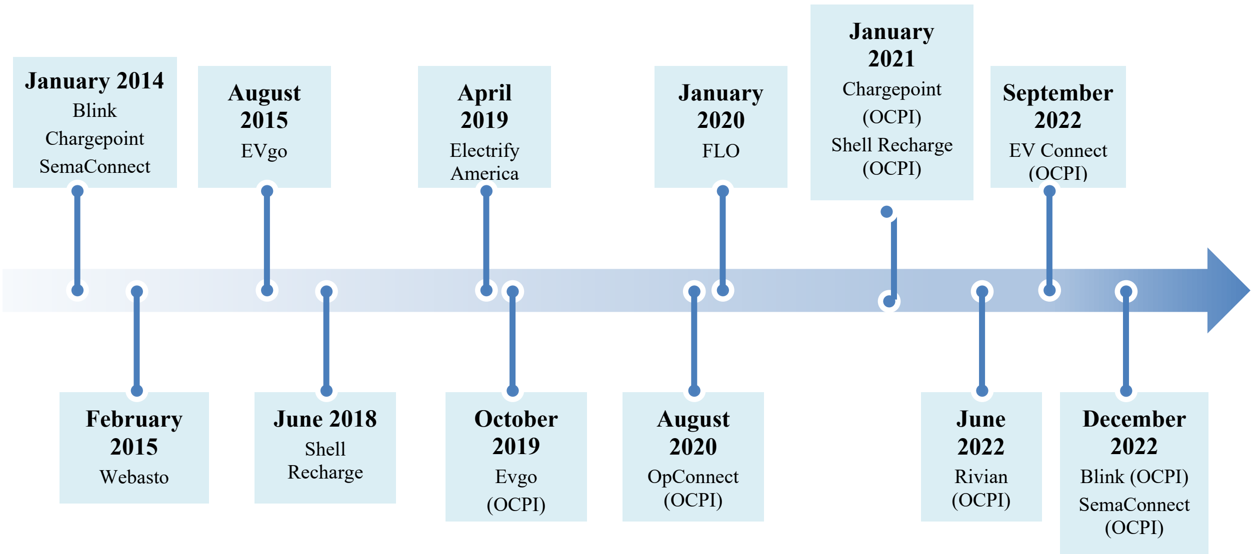

Figure B-2. Timeline of API integrations in the Station Locator

As of the end of Q4, there were 57,460 available and temporarily available public and private charging stations in the database, which are available on the Station Locator or accessible via API or data download (AFDC 2023b). Of those, approximately 79% 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, Tesla and Volta. In Q4, the Station Locator team received an updated list of stations from AmpUp, FLASH, Livingston Energy Group, and Tesla. 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.