Appendix C
Electric Vehicle Charging Infrastructure

Table C1. Electric Vehicle Charging Infrastructure

(Number)

	Locations[a]							Ports						
	With Public Ports Only	With Private Ports Only	With Public and Private Ports	With Networked Ports Only[b]	With Non-Networked Ports Only[c]	With Networked and Non-Networked Ports	Total	DC[d] Fast-Charging Ports	Level 2 Charging Ports	Level 1 Charging Ports	Legacy Charging Ports	Total	DC[d] Fast-Charging Ports per Location[e]	Level 2 Charging Ports per Location[f]
2007 Year	NA	NA	NA	NA	NA	NA	432	NA	NA	NA	NA	NA	NA	NA
2008 Year	NA	NA	NA	NA	NA	NA	440	NA	NA	NA	NA	NA	NA	NA
2009 Year	NA	NA	NA	NA	NA	NA	484	NA	NA	NA	NA	NA	NA	NA
2010 Year	NA	NA	NA	NA	NA	NA	626	NA	NA	NA	NA	NA	NA	NA
2011 Year	NA	NA	NA	NA	NA	NA	2,100	NA	NA	NA	NA	5,070	NA	NA
2012 Year	NA	NA	NA	NA	NA	NA	6,200	NA	NA	NA	NA	15,192	NA	NA
2013 Year	NA	NA	NA	NA	NA	NA	8,100	NA	NA	NA	NA	19,472	NA	NA
2014 Year	NA	NA	NA	NA	NA	NA	10,957	1,494	20,636	3,781	NA	25,913	NA	NA
2015 Year	12,267	1,235	1,474	9,583	4,502	891	14,976	7,046	45,497	4,203	597	57,343	3.20	3.34
2016 Year	16,078	1,734	1,532	12,756	5,007	1,581	19,344	10,874	60,635	4,085	362	75,956	3.55	3.49
2017 Year	19,721	1,812	1,455	15,659	5,203	2,126	22,988	12,554	75,236	3,764	453	92,007	3.74	3.62
2018 Year	21,920	1,890	1,448	17,166	5,379	2,713	25,258	11,739	83,681	2,905	108	98,433	3.89	3.59
2019 Year	24,374	2,205	1,339	19,238	5,959	2,721	27,918	14,898	93,239	3,080	92	111,309	3.94	3.68
2020 Year	28,325	1,912	1,522	22,748	6,239	2,772	31,759	19,337	109,590	2,808	61	131,796	4.17	3.83
2021 Year	45,583	2,460	1,577	39,581	7,212	2,827	49,620	24,575	130,059	3,797	56	158,487	3.98	2.92
2022 Year	52,801	2,708	1,704	48,627	8,082	504	57,213	30,193	152,306	3,415	45	185,959	4.07	2.98
2023 Year	64,515	3,183	1,184	60,085	8,109	688	68,882	41,722	170,519	3,263	29	215,533	4.14	2.83
2024 January	65,260	3,212	1,151	60,869	8,101	653	69,623	42,775	171,963	3,203	29	217,970	4.15	2.83
February	65,915	3,253	1,143	61,619	8,050	642	70,311	43,781	173,216	3,191	29	220,217	4.14	2.83
March	66,650	3,283	1,149	62,396	8,047	639	71,082	44,866	175,167	3,191	29	223,253	4.14	2.84
April	67,863	3,313	1,151	63,628	8,056	643	72,327	46,387	178,750	3,192	29	228,358	4.14	2.85
May	68,444	3,329	1,140	64,153	8,097	663	72,913	47,333	180,977	3,193	29	231,532	4.14	2.87
June	69,231	3,349	1,142	64,962	8,105	655	73,722	48,218	182,927	3,192	29	234,366	4.13	2.88
July	70,034	3,653	1,125	66,044	8,091	677	74,812	49,156	186,752	3,187	29	239,124	4.12	2.90
August	70,494	3,698	1,113	66,556	8,072	677	75,305	50,518	188,728	3,176	29	242,451	4.17	2.91
September	70,966	3,708	1,106	67,082	8,030	668	75,780	51,360	186,820	3,173	29	241,382	4.18	2.87
October	71,825	3,783	1,066	67,819	8,221	634	76,674	52,443	189,944	3,147	29	245,563	4.18	2.89
November	72,469	3,796	1,055	68,517	8,173	630	77,320	53,861	191,109	3,140	28	248,138	4.21	2.89
December	73,083	3,793	1,047	69,176	8,122	625	77,923	54,728	189,195	3,136	28	247,087	4.20	2.84
2025 January	74,051	3,728	1,036	70,202	8,276	337	78,815	55,868	190,406	2,903	28	249,205	4.19	2.83
February	74,687	3,730	1,037	70,839	8,278	337	79,454	56,666	191,313	2,903	28	250,910	4.20	2.83
March	75,152	3,740	1,037	71,310	8,281	338	79,929	58,301	194,414	2,903	28	255,646	4.26	2.86
April	74,831	3,756	1,034	70,992	8,299	330	79,621	58,829	194,618	2,913	28	256,388	4.38	2.87
May	75,237	3,739	1,005	71,935	7,831	215	79,981	59,974	193,406	2,725	26	256,131	4.41	2.84
June	75,113	3,787	963	71,888	7,797	178	79,863	61,426	191,957	2,723	25	256,131	4.45	2.84
July	75,740	3,799	955	72,566	7,758	170	80,494	62,379	193,704	2,717	25	258,825	4.45	2.84
August	76,220	4,361	938	72,935	8,418	166	81,519	63,603	199,963	3,049	25	266,640	4.47	2.90
September	76,846	4,374	913	73,564	8,405	164	82,133	64,783	201,028	3,049	25	268,885	4.49	2.90
October	77,021	4,379	904	73,787	8,363	154	82,304	65,870	201,437	3,034	25	270,366	4.51	2.91
November	77,404	4,374	889	74,262	8,262	143	82,667	67,554	202,104	3,008	24	272,690	4.57	2.91
December	77,718	4,377	874	74,638	8,196	135	82,969	69,277	202,663	3,005	24	274,969	4.62	2.91
2026 January	76,530	4,695	430	73,494	8,034	127	81,655	69,654	199,470	2,979	24	272,127	4.73	2.92
February	76,987	4,696	430	73,957	8,036	120	82,113	70,390	200,108	2,979	24	273,501	4.73	2.92
March	77,219	4,695	428	74,201	8,022	119	82,342	71,386	200,797	2,979	22	275,184	4.76	2.92
April	77,793	4,695	422	74,796	7,997	117	82,910	72,378	201,726	2,977	21	277,102	4.76	2.92
May	78,373	4,700	422	75,398	7,980	117	83,495	73,888	203,158	2,976	21	280,043	4.82	2.92
June	79,076	4,703	419	76,123	7,961	114	84,198	74,085	204,779	2,973	21	281,858	4.80	2.91
July	79,748	4,688	423	76,867	7,880	112	84,859	75,215	206,819	2,705	21	284,760	4.83	2.92
August	R 79,633	R 4,646	414	R 76,878	R 7,727	88	R 84,693	R 76,341	R 207,049	R 2,713	14	R 286,117	R 4.87	2.94
September	80,328	4,597	417	77,582	7,673	87	85,342	78,009	208,612	2,707	14	289,342	4.93	2.94

[a] Includes all of the electric vehicle (EV) charging ports located at a single location regardless of who is able to access the ports, what charging network they belong to, or the level of charging. Ports are determined to be at the same location based on latitude, longitude, and AFDC equipment ID number.

[b] Networked ports are connected to the internet, can communicate with their EV service provider, have a dedicated platform that allows users to find the chargers, and pay to charge. The service provider can manage who can access the port and the cost of charging. The charging infrastructure may also be able to communicate directly with drivers, other charging infrastructure, and utilities.

[c] Non-networked ports are not connected to the internet and provide only basic charging capabilities.

[d] Direct current.

[e] Calculated as the total number of DC fast charging ports divided by the total number of locations with DC fast charging ports (available in the microdata file). Includes only locations with DC fast charging ports.

[f] Calculated as the total number of Level 2 charging ports divided by the total number of locations with Level 2 charging ports (available in the microdata file). Includes only locations with Level 2 charging ports.

R=Revised. NA=Not available.

Notes: • Does not include data on charging infrastructure at single-family residential locations. • See "Appendix C Methodology and Sources" and end of section. • See "Electric Vehicle" in Glossary. • Data are at end of period. • Geographic coverage is the 50 states and the District of Columbia.

Web Page: See http://www.eia.gov/totalenergy/data/monthly/#appendices (Excel and CSV files) for all available national and state annual and monthly data beginning in June 2015 and monthly microdata file.

Sources: See end of section.

Data Source

The U.S. Energy Information Administration (EIA) receives administrative electric vehicle (EV) charging infrastructure data from the U.S. Department of Energy, Office of Critical Minerals and Energy Innovation Alternative Fuels Data Center (AFDC).[1] AFDC collects and publishes location-level charging infrastructure data that allows alternative fuel vehicle owners to find fueling and charging stations near them or along a route. AFDC receives daily updates from many of the networked providers.[2] Networked providers that do not provide daily updates provide regular updates. AFDC contacts non-networked[3] providers every two years to determine if the stations are still in service.[4] AFDC does not collect data on charging infrastructure at single-family residential locations.

Historical annual data (2007-2014)

Historical annual data come from the AFDC Alternative Fueling Station Counts by State (https://afdc.energy.gov/stations/states?count=total&include_temporarily_unavailable=false&date=) and are included in the 2023 historical data file (https://afdc.energy.gov/files/docs/historical-station-counts.xlsx?year=2023). Estimated location counts for 2011-2013 are from AFDC analysis (https://afdc.energy.gov/data/10964).

Historical monthly data (June 2015 – December 2021)

The National Laboratory of the Rockies (NLR), which manages the AFDC, provided the historical data to EIA. The data began in June 2015 and went through December 2021, however not all months were available. The table below shows the months of data EIA received. For the months that are blacked out, EIA did not receive any data.

2015	2016	2017	2018	2019	2020	2021
			January	January	January	January
	February	February	February	February	February	February
	March	March	March	March	March	March
	April	April	April	April	April	April
		May		May	May	
June	June	June	June	June	June	June
	July		July	July	July	July
August		August	August	August	August	August
September	September	September	September	September	September	September
		October	October	October	October	October
November	November	November	November	November		November
		December	December	December	December	December

Monthly updates (January 2022 – present)

Beginning in January 2022, EIA began pulling the data through the AFDC API[5] on the last business day of every month.

Data

EIA uses multiple variables from the AFDC database to develop the MER PDF, excel, CSV, microdata and monthly state data output files. AFDC variables of interest include:

- Location information – station name, ID, fuel type code, open date, access code, status code, facility type, EV renewable source, EV pricing
- Physical location information – latitude, longitude, street address, city, state, zip, intersection/directions
- Charing port information – EV network, EV connector types, EV DC fast num, EV level 1 EVSE num, EV level 2 EVSE num, EV other EVSE

Historical data series included variables with different names but with the same data. The charging port information was structured differently in historical datasets. Work was completed to convert the data in the historical datasets into the same format as the current datasets.

Data quality

The EV charging infrastructure data are administrative data and do not have the same level of statistical accuracy as data published from many of EIA's surveys.

Coverage

The data do not represent the entire population or a statistically representative subset of the population of EV charging infrastructure. Instead, the data represent the known to NLR EV charging infrastructure at the time of the data pull. NLR works with EV charging network providers to receive daily updates.[6] The accuracy and timeliness of the networked providers charging infrastructure will continue to improve as additional networked providers convert to providing daily updates to NLR. There are also non-networked public and private EV chargers, and it is harder to track when these ports become available for use or are decommissioned. These challenges result in less EV charging infrastructure reported than exists, but it is unknown how many additional EV charger locations and ports exist. It is likely that the networked EV charging infrastructure are more accurately represented than the non-networked charging infrastructure. It is also likely that that the public charging infrastructure is more accurately represented than the private charging infrastructure due to a lack of incentive for the owners of private charging infrastructure to make the existence of their ports known to the public.

Data Cleaning

EIA has not verified the accuracy of the administrative data and only conducted minimal cleaning of the data. The cleaning EIA did complete included:

- Fixing latitudes and longitudes if they equaled 0, 0 or 1, -1, to facility creation of location ID
- Normalizing the naming convention of several variables including the electric network providers and the facility type
- Removing charging infrastructure outside of the United States, that had not opened yet, and non-EV locations

Breaks in series

There was a break in series in the number of charging locations between December 2020 and January 2021 because of a definitional change to align with the international standard – Open Charge Point Interface (OCPI).[7]

Duplicate observations

It is likely that duplicate observations exist. Duplicate observations may be introduced multiple ways:

- Multiple people adding the same charging port
- Updates to the networked providers database creating the appearance of a new charging port
- Changes in the underlying data structure of the historical data series creating the appearance of new ports
- EIA's imputation of number of charging ports to the date the charging port opened, not the date it first appeared

Because EIA cannot verify if these are duplicates, the details of the possibly duplicated charging infrastructure remain in the database.

Creation of the location and port id

In most historical datasets, the AFDC data included an equipment ID variable that is helpful to identify EV charging locations. However, this variable was inadequate to track EV charging location overtime for a couple reasons:

1. Between February 2017 and January 2018, 10 monthly datasets are missing equipment IDs
2. Ports located at the same location could have different equipment IDs for various reasons:
    a. Co-located public and private ports have different equipment IDs
    b. Co-located networked and non-networked ports have different equipment IDs
    c. Ports that either came online or were added to the AFDC database at different times have different equipment IDs
    d. Changes in underlying systems could cause an already established port to receive a new equipment ID

For these reasons, EIA created a new ID variable called the "Location ID" using latitude and longitude pairings and equipment ID. It is common for a location ID to be associated with multiple latitudes and longitudes parings as well as multiple equipment IDs due to responses to these variables changing in the historical datasets.

To allow for variation across ports at a location, EIA created a "Port ID" variable using access group (public versus private access), network provider, port level (DC fast charger, Level 2, Level 1, or Legacy), and equipment ID. Every unique combination of the previously mentioned variables received a different Port ID.

Imputation

EIA imputes all missing and incomplete data. Historical datasets had missing subsets of data, so EIA had to fill in the missing data. The missing subsets varied from large (all private charging ports) to small (ports missing for one month and then reappearing during the next month). EIA filled in the missing month with the port count data from the following month.

EIA also imputed data in months that we did not receive any data from NLR. EIA imputed the data using data from the first month following the missing month if the location open date was during the missing month or prior. We did not extend the life of any ports if the last month they appeared in was the month prior to the missing month. We assumed the last month in service was the last month the port appeared, not during the missing month.

In addition, we imputed to remove errors that only appear in one month. For each historical month, EIA compared the previous and following months. If those months were equal but the middle month was different, then EIA updated the middle month to match the other months. New EV ports require a long time lag to install, so it is unlikely that the number of ports would change for a single month then return to their original number.

It is common for EV infrastructure to be added to the AFDC website months or years after the location came online. Because of this, EIA also backfilled EV charging port data to cover all months since the port was available, not only when it appeared in the AFDC database. The MER conducts this backfill imputation twice per year, in the May and November MERs, to correspond with the release of data in the State Energy Data System (SEDS).[8]

Data quality analysis

In December 2023 and January 2024, we conducted a data quality evaluation study to assess the accuracy of the number of electric vehicle (EV) charging ports and charging locations. The study relied on a virtual ground truthing process that compared the number of charging ports listed for 120 randomly sampled charging locations from the August 2023 MER File compared to what EIA observed in online resources available, particularly online street-level imagery. A paired t-test found no significant mean difference between the MER File charging port counts versus observed charging port counts at a 99% confidence level. The MER File reflected the observed number of charging ports approximately 94% of the time, and the MER File reflected the observed number of charging ports within an absolute value difference of two charging ports approximately 99% of the time. The study also identified potential sources of error that contributed to charging port count differences but based on the quantitative findings of the study, these possible sources of error seemed to have limited effect on the MER File's accuracy. Overall, the study findings show that the MER File's data quality accuracy was generally high at reflecting observable charging port counts.

Available data

In addition to the monthly and annual national data, monthly state level data and a microdata file are also available at http://www.eia.gov/totalenergy/data/monthly/#appendices.

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1. Alternative Fuels Data Center: https://afdc.energy.gov/stations/#/find/nearest
2. Networked ports are connected to the internet, can communicate with their EV service provider, have a dedicated platform that allows users to find the chargers and pay to charge. The service provider can manage who can access the station and the cost of charging. The charging infrastructure may also be able to communicate directly with drivers, other charging infrastructure, and utilities.
3. Non-networked ports are not connected to the internet and provide only basic charging capabilities.
4. Details on the EV charging infrastructure data received by AFDC: https://afdc.energy.gov/stations/#/find/nearest?show_about=true
5. AFDC API details: https://developer.nrel.gov/docs/transportation/alt-fuel-stations-v1/all/
6. For more details of the networked providers NLR is currently receiving daily updates from see: https://afdc.energy.gov/stations/#/find/nearest?show_about=true
7. For more details on the OCIP see https://afdc.energy.gov/stations/#/find/nearest?show_about=true
8. For more information on SEDS see https://www.eia.gov/state/seds/