Appendix F
Electric Vehicle Charging Infrastructure

Table F1. Electric Vehicle Charging Infrastructure
(Number)

	Locations[a]							Ports					DC[d] Fast-Charging Ports per Location[e]	Level 2 Charging Ports per Location[f]
	With Public Ports Only	With Private Ports Only	With Public and Private Ports	With Net-worked Ports Only[b]	With Non-Net-worked Ports Only[c]	With Net-worked and Non-Net-worked Ports	Total	DC[d] Fast-Charging Ports	Level 2 Charging Ports	Level 1 Charging Ports	Legacy Charg-ing Ports	Total		
2015 Year	12,189	1,217	1,426	9,513	4,483	836	14,832	6,802	43,657	4,168	597	55,224	3.23	3.23
2016 Year	15,990	1,716	1,472	12,671	4,988	1,519	19,178	10,606	58,501	4,042	362	73,511	3.57	3.40
2017 Year	19,619	1,779	1,384	15,553	5,183	2,046	22,782	12,271	72,635	3,721	453	89,080	3.77	3.52
2018 Year	21,791	1,841	1,362	17,024	5,349	2,621	24,994	11,429	80,454	2,857	108	94,848	3.94	3.49
2019 Year	24,169	2,136	1,224	19,006	5,917	2,606	27,529	14,531	88,600	2,982	92	106,205	3.97	3.54
2020 Year	28,159	1,837	1,140	22,313	6,199	2,624	31,136	18,870	100,375	2,708	61	122,014	4.20	3.59
2021 Year	45,139	2,344	1,156	38,839	7,157	2,643	48,639	23,982	117,316	3,521	56	144,875	3.99	2.70
2022 January	45,226	2,342	1,149	41,289	7,216	212	48,717	24,222	117,445	3,384	53	145,104	4.00	2.70
February	44,788	2,346	1,149	40,779	7,304	200	48,283	24,704	116,401	3,380	51	144,536	4.03	2.70
March	45,160	2,348	1,153	41,116	7,343	202	48,661	25,240	117,513	3,285	51	146,089	4.06	2.71
April	45,936	2,365	1,163	41,871	7,390	203	49,464	25,736	119,698	3,155	51	148,640	4.07	2.71
May	46,899	2,367	1,172	42,578	7,655	205	50,438	26,432	121,988	3,157	51	151,628	4.11	2.71
June	47,661	2,355	1,180	43,294	7,694	208	51,196	27,005	123,667	3,154	51	153,877	4.17	2.70
July	48,407	2,357	1,184	44,013	7,714	221	51,948	27,551	125,058	3,122	46	155,777	4.18	2.70
August	49,318	2,361	1,189	44,814	7,820	234	52,868	28,018	126,710	3,088	46	157,862	4.18	2.68
September	49,406	2,445	1,192	44,941	7,872	230	53,043	26,817	128,377	3,034	45	158,273	3.97	2.71
October	49,877	2,474	1,187	45,360	7,947	231	53,538	27,429	128,836	3,028	45	159,338	3.99	2.70
November	50,323	2,482	1,184	45,805	7,964	220	53,989	27,801	129,982	3,027	45	160,855	4.01	2.70
December	**51,306**	**2,533**	**1,176**	**46,823**	**7,980**	**212**	**55,015**	**29,023**	**131,850**	**3,135**	**45**	**164,053**	**4.09**	**2.69**
2023 January	51,563	2,498	1,163	47,154	7,870	200	55,224	29,446	130,507	3,095	39	163,087	4.08	2.66
February	52,401	2,452	924	47,760	7,824	193	55,777	29,959	130,328	3,043	36	163,366	4.08	2.64
March	53,204	2,475	923	48,499	7,920	183	56,602	30,964	131,919	3,040	35	165,958	4.13	2.63
April	53,790	2,518	912	49,103	7,939	178	57,220	31,455	133,090	3,033	34	167,612	4.11	2.63
May	54,440	2,519	913	49,746	7,951	175	57,872	32,075	134,703	3,040	33	169,851	4.11	2.64
June	55,133	2,530	903	50,432	7,973	161	58,566	33,081	134,945	3,022	30	171,078	4.15	2.61
July	55,633	2,525	899	50,942	7,957	158	59,057	33,809	135,520	3,134	29	172,492	4.16	2.61
August	56,094	2,516	891	51,487	7,904	110	59,501	34,340	136,449	3,129	29	173,947	4.17	2.61
September	55,951	2,513	891	51,344	7,902	109	59,355	34,967	130,206	3,129	29	168,331	4.17	2.51
October	56,798	2,513	894	52,193	7,903	109	60,205	35,641	131,955	3,137	29	170,762	4.18	2.50
November	57,623	2,601	897	53,048	7,967	106	61,121	36,969	134,075	3,139	29	174,212	4.23	2.51
December	**58,153**	**2,617**	**897**	**53,561**	**8,004**	**102**	**61,667**	**37,977**	**135,505**	**2,970**	**29**	**176,481**	**4.25**	**2.52**
2024 January	58,964	2,674	865	54,399	8,003	101	62,503	39,207	137,545	2,932	29	179,713	4.22	2.53
February	R 59,662	2,662	861	R 55,145	7,941	99	R 63,185	R 40,167	R 138,358	2,920	29	R 181,474	R 4.20	2.53
March	60,175	2,672	864	55,658	7,955	98	63,711	41,034	139,478	2,922	29	183,463	4.22	2.53

[a] Includes all of the electric vehicle 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. Does not include data on charging infrastructure at single-family residential locations.
[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.
Notes: • See "Appendix F 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.

Appendix F Methodology and Sources

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 Energy Efficiency and Renewable Energy 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 (June 2015 – December 2021)

The National Renewable Energy Laboratory (NREL), 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 NREL EV charging infrastructure at the time of the data pull. NREL 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 NREL. 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 NREL. 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 October MERs, to correspond with the release of data in the State Energy Data System (SEDS).[8]

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 NREL 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/

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