Appendix F
Electric Vehicle Charging Infrastructure

Table F1. 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]
2015 Year	**12,212**	**1,217**	**1,432**	**9,540**	**4,470**	**851**	**14,861**	**6,872**	**44,615**	**4,168**	**597**	**56,252**	**3.21**	**3.29**
2016 Year	**16,012**	**1,716**	**1,481**	**12,700**	**4,973**	**1,536**	**19,209**	**10,679**	**59,550**	**4,044**	**362**	**74,635**	**3.55**	**3.45**
2017 Year	**19,650**	**1,780**	**1,395**	**15,592**	**5,167**	**2,066**	**22,825**	**12,346**	**73,804**	**3,723**	**453**	**90,326**	**3.75**	**3.57**
2018 Year	**21,835**	**1,845**	**1,374**	**17,079**	**5,334**	**2,641**	**25,054**	**11,508**	**81,849**	**2,863**	**108**	**96,328**	**3.92**	**3.54**
2019 Year	**24,241**	**2,144**	**1,240**	**19,094**	**5,905**	**2,626**	**27,625**	**14,636**	**90,449**	**3,012**	**92**	**108,189**	**3.95**	**3.61**
2020 Year	**28,258**	**1,849**	**1,162**	**22,432**	**6,188**	**2,649**	**31,269**	**18,989**	**102,659**	**2,740**	**61**	**124,449**	**4.18**	**3.65**
2021 Year	**45,296**	**2,363**	**1,188**	**39,028**	**7,148**	**2,671**	**48,847**	**24,128**	**120,072**	**3,572**	**56**	**147,828**	**3.98**	**2.75**
2022 January	45,394	2,360	1,182	41,486	7,210	240	48,936	24,370	120,241	3,435	53	148,099	3.99	2.75
February	44,972	2,364	1,182	40,991	7,298	229	48,518	24,856	119,254	3,431	51	147,592	4.03	2.75
March	45,346	2,364	1,188	41,330	7,337	231	48,898	25,396	120,409	3,336	51	149,192	4.05	2.76
April	46,131	2,382	1,198	42,095	7,383	233	49,711	25,898	122,639	3,206	51	151,794	4.06	2.76
May	47,105	2,385	1,206	42,812	7,649	235	50,696	26,594	124,965	3,210	51	154,820	4.10	2.76
June	47,876	2,373	1,215	43,538	7,688	238	51,464	27,172	126,682	3,207	51	157,112	4.16	2.75
July	48,637	2,375	1,220	44,273	7,709	250	52,232	27,736	128,161	3,175	46	159,118	4.17	2.75
August	49,562	2,378	1,226	45,087	7,816	263	53,166	28,207	129,893	3,143	46	161,289	4.17	2.73
September	49,833	2,463	1,229	45,396	7,868	261	53,525	27,009	131,880	3,089	45	162,023	3.96	2.76
October	50,355	2,492	1,225	45,866	7,945	261	54,072	27,665	132,432	3,083	45	163,225	3.98	2.74
November	50,861	2,499	1,224	46,371	7,963	250	54,584	28,055	133,733	3,082	45	164,915	3.99	2.75
December	**51,904**	**2,558**	**1,215**	**47,451**	**7,980**	**246**	**55,677**	**29,287**	**135,798**	**3,190**	**45**	**168,320**	**4.07**	**2.74**
2023 January	52,217	2,527	1,202	47,831	7,879	236	55,946	29,742	134,647	3,158	39	167,586	4.06	2.71
February	53,149	2,482	963	48,532	7,832	230	56,594	30,285	134,639	3,106	36	168,066	4.06	2.68
March	54,066	2,504	963	49,383	7,928	222	57,533	31,301	136,432	3,103	35	170,871	4.10	2.68
April	54,780	2,547	953	50,098	7,948	234	58,280	31,876	137,931	3,096	34	172,937	4.08	2.68
May	55,574	2,558	956	50,890	7,964	234	59,088	32,563	140,021	3,103	33	175,720	4.08	2.68
June	56,808	2,589	946	52,122	7,991	230	60,343	33,977	141,393	3,085	30	178,485	4.10	2.66
July	57,589	2,594	943	52,917	7,980	229	61,126	34,796	142,761	3,197	29	180,783	4.10	2.66
August	58,430	2,610	935	53,850	7,940	185	61,975	35,423	144,755	3,192	29	183,399	4.09	2.66
September	58,989	2,640	936	54,424	7,956	185	62,565	36,240	139,764	3,192	29	179,225	4.07	2.55
October	59,777	2,653	934	55,212	7,963	189	63,364	36,834	141,720	3,190	29	181,773	4.08	2.55
November	60,351	2,660	927	55,768	7,986	184	63,938	38,373	142,649	3,192	29	184,243	4.15	2.55
December	**60,708**	**2,670**	**909**	**56,126**	**7,995**	**166**	**64,287**	**39,130**	**143,005**	**3,025**	**29**	**185,189**	**4.16**	**2.55**
2024 January	61,136	2,708	874	56,576	8,029	113	64,718	39,995	143,628	2,987	29	186,639	4.16	2.55
February	61,448	2,694	866	56,940	7,960	108	65,008	40,735	143,753	2,975	29	187,492	4.16	2.55
March	61,714	2,693	867	57,213	7,958	103	65,274	41,525	144,369	2,975	29	188,898	4.18	2.56
April	62,116	2,695	864	57,615	7,961	99	65,675	42,416	145,559	2,973	29	190,977	4.19	2.57
May	62,446	2,794	862	58,044	7,961	97	66,102	43,061	147,051	2,974	29	193,115	4.18	2.58
June	63,237	2,801	861	58,815	7,986	98	66,899	44,132	148,759	2,968	29	195,888	4.17	2.59
July	63,954	2,837	861	59,568	7,988	96	67,652	44,915	149,783	2,971	29	197,698	4.14	2.58
August	R 64,132	2,850	857	R 59,770	7,972	97	R 67,839	R 46,198	R 150,722	2,964	29	R 199,913	R 4.18	2.60
September	64,313	2,858	857	60,010	7,923	95	68,028	47,119	152,729	2,961	29	202,838	4.23	2.63

[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. 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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