

## 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).<sup>1</sup> 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.<sup>2</sup> Networked providers that do not provide daily updates provide regular updates. AFDC contacts non-networked<sup>3</sup> providers every two years to determine if the stations are still in service.<sup>4</sup> 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<sup>5</sup> 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
- ... Charging 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.<sup>6</sup> 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 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).<sup>7</sup>

### *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 pairings 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).<sup>8</sup>

## 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](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](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](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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