



Appendix D. Electric Vehicle Consumption

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Disclaimer

This appendix presents EIA's most recent experimental estimates for EV electricity consumption and provides an overview of the methodology used to construct them in the technical notes. These estimates are based on models and are subject to model error. We advise data users to exercise caution when incorporating these data in their analyses. EIA is releasing these estimates to solicit comments on the potential uses of the data, the methodology, and possible enhancements that would be most valuable. EIA plans to regularly reassess whether methodological improvements need to be made, based on this feedback and internal evaluations, before adopting the new estimates as official statistics assured to meet the same high data quality standards applied to EIA's traditional statistical products. Comments may be directed to InfoElectric@eia.gov.

Methodology

The model estimates monthly light-duty electric vehicle (EV)¹ consumption of electricity for each state based on the number of EVs, average number of miles driven on electricity, and EV fuel economy. Adjustments are made based on data availability from various input sources, to bring lagged data up to the current reporting period, and to adjust national and regional data down to state-level estimates.

The modeling methodology is hierarchical and is composed of a top-level model having components that are estimated using sub-models, which are described in the subsequent sections of this report. The top-level model is based on the average electricity consumed by nameplate (vehicle make and model) and model year in a state and month multiplied by the number of EVs for a particular nameplate and model year in that state and month. Lower-level sub-models estimate the number of EVs based on EV registrations and sales data and the average monthly EV consumption of electricity by EV nameplate and model year based on average estimated monthly vehicle miles traveled on electricity, a utility factor, EV fuel economy, and a weather correction factor.

The top-level model is defined as follows:

$$kWh_{s,m} = \sum_{np=1}^{NP} \sum_{my=1}^{MY} (EV\ stocks_{s,m,np,my} * EV\ kWh_{s,m,np,my})$$

where:

$kWh_{s,m}$ is the total consumption in kilowatt-hours (kWh) by EVs in state s and month m

$EV\ stocks_{s,m,np,my}$ is the number of on-road EVs in state s and month m for EV nameplate np and model year my

$EV\ kWh_{s,m,np,my}$ is the average electricity consumed in kWh by EV nameplate np from model year my in state s and month m

MY is the number of model years for each EV nameplate np

NP is the number of nameplates for light-duty EVs listed on [fueleconomy.gov](https://www.fueleconomy.gov)

¹ Light-duty battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) are vehicles weighing less than 8,500 lbs including passenger cars and light trucks.

Vehicle stocks

This sub-model estimates the number of EVs in the top-level model using monthly EV registration and sales data for each state. Registrations rather than cumulative sales are preferred because they account for scrappage and represent the stock of licensed vehicles. Because monthly registration data by state, nameplate, and model year are not available for recent months, estimated monthly sales values by state, nameplate, and model year are cumulatively added to the most recently available end-of-year registration data to create monthly registration estimates for each state, nameplate, and model year.

Specifically, this sub-model is defined as follows:

$$EV\ stocks_{s,m,np,my} = EV\ registrations_{s,m_0,np,my} + \sum_{m_t=m_0+1}^m (EV\ sales_{m_t,np,my} * sales\ state\ allocation_{s,m_t})$$

where:

$EV\ registrations_{s,m_0,np,my}$ is the number of registered EVs by state s , EV nameplate np , and model year my by the end of the month m_0 (December of the latest available historical year for state registration data)

$EV\ sales_{m_t,np,my}$ is the national-level EV sales in month m_t for EV nameplate np and model year my

$sales\ state\ allocation_{s,m_t}$ is the share of total new EV registrations in state s in the most recently available new EV registration data month m_t

Sales state allocation shares are calculated as follows:

$$sales\ state\ allocation_{s,m_t} = \frac{new\ EV\ registrations_{s,m_t}}{\sum_{s=1}^S new\ EV\ registrations_{s,m_t}}$$

where:

$new\ EV\ registrations_{s,m_t}$ is the number of new EVs registered by state s in the most recently available new EV registration data month m_t

S is all fifty U.S. states and the District of Columbia

In more recent months where sales data must be used, monthly EV scrappage and EVs moving between states are not considered in the model.

EV electricity consumed

This sub-model estimates the average electricity consumed by nameplate (vehicle make and model) and model year in a state and month, which is used in the top-level model. It uses the average EV miles travel multiplied by the vehicle's fuel economy and a weather correction. The weather correction is applied because both cold and hot temperatures significantly decrease battery efficiency, increasing electricity consumption per mile traveled.

Specifically, this sub-model is defined as follows:

$$eV\ kWh_{s,m,np,my} = \sum_{d=1}^{D_m} (weather\ correction_{s,d} * kWh_per_mile_{np,my} * avg.eVMT_{s,m,np,my} / D_m)$$

where:

$weather\ correction_{s,d}$ is the vehicle fuel economy correction for state s on day d based on the average daily high and low temperatures recorded at a state representative airport and the effect that average temperature has on the EV range due to decrease in battery efficiency calculated by [Geotab](#)

$kWh_per_mile_{np,my}$ is the combined city and highway vehicle fuel economy that is estimated by the U.S. Environmental Protection Agency (EPA) for EV nameplate np and model year my

$avg.eVMT_{s,m,np,my}$ is the average vehicle miles traveled on electricity in state s during month m for EV nameplate np and model year my , which is estimated using the sub-model described in the next section

D_m is the total days in month m

Electric vehicle miles traveled

This sub-model of the EV electricity consumed sub-model estimates the average EV miles traveled on electricity in each state for each month by EV nameplate and model year. Data for EV miles traveled are only available at the census division level and for certain powertrains. To account for these issues, the model uses census-division-level EV travel data assigned to component states for the five powertrain categories, EV100, EV200, EV300, PHEV20, and PHEV50, as used in the EIA National Energy Modeling System (NEMS) [Transportation Sector Demand Module](#)². Because data for EV miles traveled are only available on an annual basis, and with a lag, monthly EV miles traveled by state are based on the year-over-year change in total state-level vehicle miles traveled. The EPA combined city and highway utility factor is also applied to include only the portion of travel that uses electricity.

Specifically, this sub-model is defined as follows:

$$\begin{aligned} avg.eVMT_{s,m,np,my} \\ = adjusted\ avg.VMT_{s,m_r,np,my} * current\ month\ adjustment_{s,m} \\ * utility\ factor_{np,my} \end{aligned}$$

with m_r being the same calendar month as m but in the most recent EV odometer data year

where:

$adjusted\ avg.VMT_{s,m_r,np,ny}$ is the adjusted average EV miles traveled in state s in month m_r of the reference year for which the latest odometer data are available for EV nameplate np and model year my

$current\ month\ adjustment_{s,m}$ is a temporal adjustment for state s to the adjusted average VMT from month m_r of the most recent EV odometer data year to the current month m

$utility\ factor_{np,my}$ is the portion of EV miles traveled that uses electricity only for EV nameplate np and model year my ; the utility factor equals 1 for BEV and is less than 1 for PHEVs

² U.S. Energy Information Administration (July 2022), [Transportation Sector Demand Module of the National Energy Modeling System: Model Documentation](#), pg. 136-137.

Since EV odometer data are only produced annually at the census-division level and can lag by more than one year, the data needs to be adjusted to monthly values for individual states to create monthly estimates. The following adjustment converts the yearly data to an average monthly value in that same reference year and converts it from a census-division-level value to a state-level value. Since EV odometer data are only available by powertrain categories, the model uses these categories to represent their underlying EV nameplates and model years.

$$\begin{aligned} & \text{adjusted avg.} VMT_{s,m_r,np,my} \\ &= avg.VMT_{cd,y_r,pt} * \left(\frac{all VMT_{s,m_r}}{\sum_{m_r \in y_r} all VMT_{s,m_r}} \right), \forall [s \in cd \ \& \ (np, my) \in pt] \end{aligned}$$

where:

$avg.VMT_{cd,y_r,pt}, \forall [s \in cd \ \& \ (np, my) \in pt]$ is the average EV vehicle miles traveled in census division cd , representing all component states s , for the most recent EV odometer data year y_r by powertrain category pt , where this value is constant for all EV nameplates np and model years my in a powertrain category pt

$all VMT_{s,m_r}$ is the U.S. Department of Transportation Federal Highway Administration's total vehicle miles traveled in state s during month m_r for the most recent EV odometer data year y_r

The following factor adjusts the average EV miles traveled for the year-over-year change in monthly values since the reference month m_r (the most recent available year y_r of average EV odometer data) up through month $(m - 12)$ (last available complete year of all VMT data for all months).

$$\begin{aligned} & \text{current month adjustment}_{s,m} \\ &= \prod_{m_j=(m_r+n*12 \ (n=0,1,2...\frac{(m-m_r)}{12}-1))}^{(m-12)} 1 + \frac{(all VMT_{s,m_{j+12}} - all VMT_{s,m_j})}{all VMT_{s,m_j}} \end{aligned}$$

where:

$all VMT_{s,m_r}$ is the U.S. Department of Transportation Federal Highway Administration's total vehicle miles traveled in state s during month m_r for the most recent EV odometer data

Potential sources of model error

The following list consists of identified potential sources of error in the model-based estimates:

Vehicle stocks:

- For preliminary monthly estimates, monthly EV scrappage and EVs moving between states are not considered in the model.
- Since state EV registration data are lagged, cumulative EV sales are used to estimate monthly state EV registrations, which could cause an over- or under- estimation of the EV stocks within a state.

- Interstate movement of vehicle sales could cause an over- or under- estimation of the EV stocks within a state.
- EV scrappage is not considered, which could cause an over-estimation of electricity consumption if scrappage increases considerably.

Vehicle miles traveled:

- Average EV miles traveled at the state level are derived from census division level values.
- Average EV miles traveled by nameplate and model year are derived from powertrain categories.
- The utility factor does not account for the possibility that many short trips are taken which could result in only electricity being consumed in PHEVs.
- The utility factor does not account for the possibility a PHEV has not been plugged into an electric power source resulting in only gasoline being consumed.
- Variability in driving patterns within a powertrain category could cause an over- or under-estimation of electricity consumption.

Fuel economy:

- Fuel economy factors do not account for decreasing efficiency due to vehicle age and deferred maintenance.
- Fuel economy factors do not account for non-weather related degradation.

Schedule for preliminary and final published data

The estimates provide preliminary monthly estimates based on available data until various final annual data are received. Preliminary published monthly estimates for a given reference year will be finalized after the following:

- Final annual vehicle registration data, provided by a third-party source, being processed and available for the model to consume, which typically occurs with a 12 or 13-month lag from the end of the reference year.
- Final EV odometer readings, provided by a third-party source, being processed and available for the model to consume, which typically occurs with a 12 or 13-month lag from the end of the reference year.

This schedule is separate from the finalization of Electric Power Monthly numbers in the Electric Power Annual.

Data sources and references

The model relies on the following data sources and types of data to estimate electricity consumption for EVs:

- *EV registrations* are third-party data from [S&P Global Mobility Vehicles in Operation](#) dataset based on state vehicle registration administrative data from the end of a calendar year.
- *EV sales* are third-party data from [Wards Intelligence](#).

- *new EV registrations* are third party data based on state-level new electric vehicle registration administrative data compiled by the [Alliance for Automotive Innovation](#) using Information provided by S&P Global Mobility (2011-2018, November 2019-present) and Hedges & Co (January 2019-October 2019).
- *kWh_per_mile* are administrative data published by EPA on [fueleconomy.gov](#).
- *weather correction* uses research conducted by [Geotab](#) and daily high and low temperature readings at airports from the U.S. National Oceanic and Atmospheric Administration ([NOAA](#)).
- *avg.VMT* are third-party odometer reading data from [S&P Global Mobility](#).
- *all VMT* are based on vehicle miles traveled from the U.S. Department of Transportation [Federal Highway Administration's Traffic Volume Trends](#).
- *utility factor* are administrative data published by EPA on [fueleconomy.gov](#).

A full list of all light-duty electric vehicles can be found at [fueleconomy.gov](#).

Table D.1. U.S. Estimated Consumption of Electricity by Light-Duty Electric Vehicles Types, 2018 - November 2023 (Megawatthours)

Period	Plug-in Hybrid Electric Vehicle (PHEV)	Battery Electric Vehicle (BEV)	Total
Annual Totals			
2018	756,806	824,899	1,581,706
2019	884,161	1,175,714	2,059,875
2020	1,073,251	1,827,049	2,900,300
2021	1,242,674	2,276,123	3,518,797
2022	1,660,675	3,462,418	5,123,093
Year 2021			
January	88,258	154,973	243,231
February	86,786	152,535	239,321
March	96,666	174,005	270,672
April	89,050	164,799	253,849
May	97,019	183,044	280,064
June	102,597	193,393	295,990
July	115,817	211,403	327,221
August	111,956	204,311	316,267
September	108,028	198,504	306,532
October	113,981	211,253	325,234
November	112,431	206,461	318,892
December	120,084	221,442	341,526
Year 2022			
January	123,739	231,131	354,870
February	119,255	226,414	345,668
March	131,517	256,460	387,977
April	126,589	252,453	379,042
May	135,057	275,434	410,491
June	135,646	280,377	416,024
July	142,471	301,765	444,236
August	143,316	307,915	451,231
September	142,044	310,196	452,240
October	150,809	332,571	483,380
November	146,802	324,080	470,882
December	163,430	363,622	527,052
Year 2023			
January	158,563	358,588	517,150
February	153,196	348,853	502,049
March	173,672	405,031	578,702
April	159,215	373,987	533,203
May	173,205	413,408	586,612
June	176,005	426,480	602,485
July	185,631	456,299	641,930
August	189,182	465,585	654,767
September	189,875	471,339	661,215
October	201,798	500,967	702,765
November	197,292	494,346	691,638
Year to Date			
2021	1,122,590	2,054,681	3,177,271
2022	1,497,245	3,098,796	4,596,041
2023	1,957,633	4,714,883	6,672,516

Notes:

Light-duty vehicles are vehicles weighing less than 8,500 lbs including passenger cars and light trucks.

Plug-in hybrid electric vehicle (PHEV) is a vehicle that can both (1) plug into an electric power source and store power in a battery pack and (2) use petroleum-based or other liquid- or gas-based fuel to power an Internal combustion engine (ICE).

Battery electric vehicle (BEV) is an all-electric vehicle that receives power by plugging into an electric power source and storing the power in a battery pack. BEVs do not use any petroleum-based or other liquid- or gas-based fuel during operation.

Note: Values for 2021 and prior are final. Values for 2022 and 2023 are preliminary. Electric Vehicle electricity end-use consumption is included across multiple end-use sectors in electricity sales to ultimate customers. PHEV consumption only includes electricity consumption,. it does not include any gasoline consumption.

Totals may not equal sum of components due to independent rounding.

Estimates are model based. These estimates are not discretely allocated to any of the end-use sector balances. See full data disclaimer and technical notes.

Data source: The estimates published in these tables are based on a model that uses administrative and third-party data from the U.S. Environmental Protection Agency,. National Oceanic and Atmospheric Administration, U.S. Department of Transportation, S&P Global Mobility, Wards Intelligence, Alliance for Automotive Innovation, Hedges & Co, and Geotab.

Table D.2. Estimated State and Regional Consumption of Electricity by Light-Duty Electric Vehicles, Year-to-Date through November 2023 and 2022 (Megawatthours)

Census Division	Monthly		Year to Date	
and State	November 2023	November 2022	November 2023	November 2022
New England	34,342	22,950	315,531	218,297
Connecticut	7,059	4,809	68,507	49,328
Maine	1,943	1,611	20,436	15,309
Massachusetts	19,905	12,214	170,425	112,710
New Hampshire	2,114	1,681	22,460	16,511
Rhode Island	1,515	1,146	14,869	10,150
Vermont	1,806	1,490	18,834	14,291
Middle Atlantic	72,928	47,869	657,994	440,235
New Jersey	25,590	15,466	224,198	141,834
New York	30,732	21,326	288,792	200,871
Pennsylvania	16,605	11,078	145,004	97,530
East North Central	54,355	40,539	518,979	380,065
Illinois	22,399	14,199	192,931	131,133
Indiana	5,257	3,996	54,490	39,469
Michigan	11,535	9,585	116,321	89,924
Ohio	10,144	8,568	103,004	80,777
Wisconsin	5,020	4,191	52,233	38,762
West North Central	23,401	17,444	213,587	147,849
Iowa	2,254	1,929	22,582	16,943
Kansas	2,317	2,005	23,439	17,130
Minnesota	9,220	6,563	80,005	56,840
Missouri	7,250	4,950	64,324	40,090
Nebraska	1,654	1,391	15,691	11,584
North Dakota	270	246	3,066	1,978
South Dakota	437	360	4,481	3,285
South Atlantic	115,695	73,126	1,074,341	689,615
Delaware	1,843	1,329	16,957	11,065
District of Columbia	1,544	1,093	17,407	13,061
Florida	46,748	28,092	436,632	267,551
Georgia	14,615	9,808	137,855	96,229
Maryland	16,349	10,414	139,981	92,784
North Carolina	14,511	9,258	133,672	83,689
South Carolina	3,532	2,364	36,345	25,085
Virginia	15,913	10,299	149,352	95,706
West Virginia	640	471	6,141	4,446
East South Central	11,585	8,436	115,414	81,844
Alabama	2,697	1,808	26,513	16,832
Kentucky	2,306	1,794	22,392	17,141
Mississippi	789	522	7,749	5,265
Tennessee	5,793	4,312	58,761	42,607
West South Central	48,077	32,269	459,458	297,034
Arkansas	1,043	839	11,428	8,554
Louisiana	1,786	1,120	17,768	11,149
Oklahoma	9,042	4,944	78,292	35,836
Texas	36,206	25,366	351,971	241,495
Mountain	57,476	41,167	557,963	381,136
Arizona	16,875	12,212	170,613	119,261
Colorado	19,397	14,258	180,775	120,526
Idaho	1,685	1,581	18,332	14,092
Montana	1,037	1,065	12,341	8,387
Nevada	8,061	5,489	79,635	54,658
New Mexico	2,032	1,675	20,510	14,618
Utah	8,121	4,625	72,690	47,244
Wyoming	270	262	3,067	2,350
Pacific Contiguous	268,694	183,322	2,707,369	1,922,326
California	226,068	156,069	2,312,688	1,644,510
Oregon	14,623	10,677	137,400	97,788
Washington	28,003	16,577	257,282	180,029
Pacific Noncontiguous	5,085	3,760	51,881	37,639
Alaska	415	475	5,914	4,353
Hawaii	4,671	3,285	45,967	33,286
U.S. Total	691,638	470,882	6,672,516	4,596,041

Notes:
Light-duty vehicles are vehicles weighing less than 8,500 lbs including passenger cars and light trucks.
Plug-in hybrid electric vehicle (PHEV) is a vehicle that can both (1) plug into an electric power source and store power in a battery pack and (2) use petroleum-based or other liquid- or gas-based fuel to power an Internal combustion engine (ICE).
Battery electric vehicle (BEV) is an all-electric vehicle that receives power by plugging into an electric power source and storing the power in a battery pack. BEVs do not use any petroleum-based or other liquid- or gas-based fuel during operation.
Note: Values for 2021 and prior are final. Values for 2022 and 2023 are preliminary. Electric Vehicle electricity end-use consumption is included across multiple end-use sectors in electricity sales to ultimate customers. PHEV consumption only includes electricity consumption, it does not include any gasoline consumption.
Totals may not equal sum of components due to independent rounding.
Estimates are model based. These estimates are not discretely allocated to any of the end-use sector balances. See full data disclaimer and technical notes.
Data source: The estimates published in these tables are based on a model that uses administrative and third-party data from the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, U.S. Department of Transportation, 'S&P' Global Mobility, Wards Intelligence, Alliance for Automotive Innovation, Hedges & Co, and Geotab.

Table D.3. Estimated State and Regional Consumption of Electricity from Light-Duty Vehicles, Annual (Megawatthours)

Census Division and State	2018	2019	2020	2021	2022
New England	62,275	87,619	124,522	156,907	245,234
Connecticut	15,563	20,941	28,468	35,242	54,576
Maine	3,786	5,206	7,661	10,355	17,086
Massachusetts	31,226	45,385	66,194	83,038	127,780
New Hampshire	4,445	6,329	8,975	11,380	18,436
Rhode Island	2,607	3,617	5,027	6,828	11,380
Vermont	4,648	6,141	8,198	10,063	15,977
Middle Atlantic	119,930	172,717	240,008	305,618	497,621
New Jersey	33,718	49,392	73,052	95,579	161,302
New York	58,910	85,905	114,569	142,969	225,793
Pennsylvania	27,302	37,421	52,387	67,071	110,526
East North Central	130,271	162,974	221,420	272,690	426,741
Illinois	42,290	55,586	78,963	95,944	148,717
Indiana	12,856	16,430	22,944	28,899	44,206
Michigan	33,812	37,680	47,696	59,039	100,172
Ohio	25,426	33,822	47,269	59,898	90,029
Wisconsin	15,888	19,456	24,547	28,909	43,618
West North Central	45,346	62,614	86,650	109,121	168,025
Iowa	5,495	7,210	10,043	12,599	19,225
Kansas	5,685	7,468	10,578	13,163	19,413
Minnesota	16,902	24,600	33,074	42,451	64,479
Missouri	12,425	16,757	23,768	29,129	45,835
Nebraska	3,306	4,463	6,353	8,170	13,132
North Dakota	576	815	1,060	1,333	2,264
South Dakota	957	1,302	1,774	2,277	3,677
South Atlantic	182,531	241,810	363,587	483,500	776,230
Delaware	2,825	3,881	5,765	7,815	12,488
District of Columbia	3,015	4,355	6,863	9,203	14,312
Florida	61,910	83,061	132,187	180,482	299,240
Georgia	37,063	43,959	57,870	70,714	107,348
Maryland	25,261	34,437	52,157	69,024	105,629
North Carolina	21,435	28,804	44,077	58,614	95,493
South Carolina	6,319	7,954	11,979	16,722	28,122
Virginia	23,453	33,766	50,335	67,835	108,642
West Virginia	1,250	1,593	2,354	3,091	4,957
East South Central	22,830	29,805	44,832	57,719	91,878
Alabama	4,801	6,321	9,167	11,645	19,093
Kentucky	4,997	6,292	9,538	11,972	19,063
Mississippi	1,273	1,675	2,432	3,540	5,866
Tennessee	11,760	15,517	23,695	30,562	47,856
West South Central	74,670	94,763	140,531	189,618	334,836
Arkansas	2,006	2,810	3,476	5,313	9,532
Louisiana	2,769	3,839	5,109	7,131	12,539
Oklahoma	6,381	9,186	10,884	20,903	42,848
Texas	63,514	78,929	121,063	156,271	269,918
Mountain	106,703	150,481	223,479	282,179	426,539
Arizona	34,678	48,110	73,474	92,775	132,521
Colorado	33,339	50,374	72,552	89,198	137,347
Idaho	3,769	4,734	7,098	9,212	15,760
Montana	1,895	2,570	3,543	5,098	9,443
Nevada	13,136	17,726	27,848	37,331	60,422
New Mexico	4,066	5,396	7,858	10,263	16,430
Utah	15,215	20,757	29,963	36,719	52,008
Wyoming	606	814	1,143	1,583	2,608
Pacific Contiguous	821,296	1,037,850	1,427,814	1,629,783	2,114,154
California	713,974	901,134	1,232,482	1,403,840	1,810,448
Oregon	34,450	43,421	62,702	76,083	109,049
Washington	72,872	93,295	132,630	149,860	194,656
Pacific Noncontiguous	15,854	19,241	27,457	31,662	41,835
Alaska	1,635	1,815	2,882	3,473	4,906
Hawaii	14,219	17,426	24,575	28,189	36,929
U.S. Total	1,581,706	2,059,875	2,900,300	3,518,797	5,123,093

Notes:
Light-duty vehicles are vehicles weighing less than 8,500 lbs including passenger cars and light trucks.
Electric vehicle (EV) is a general term for any on-road licensed vehicle that can plug into an electric power source and uses electric power to move. EVs plug into a source of electricity and store power in a battery pack for all or part of their power needs. Includes Battery electric vehicles (BEVs) and Plug-in Hybrid Vehicles (PHEVs).
Note: Values for 2021 and prior are final. Values for 2022 are preliminary. Electric Vehicle electricity end-use consumption is included across multiple end-use sectors in electricity sales to ultimate customers. PHEV consumption only includes electricity consumption, it does not include any gasoline consumption.
Totals may not equal sum of components due to independent rounding.
Estimates are model based. These estimates are not discretely allocated to any of the end-use sector balances. See full data disclaimer and technical notes.
Data source: The estimates published in these tables are based on a model that uses administrative and third-party data from the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, U.S. Department of Transportation, S and P Global Mobility, Wards Intelligence, Alliance for Automotive Innovation, Hedges & Co, and Geotab.