Electric Loads by State in 2030 from Medium- and Heavy-Duty Electric Vehicles

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Abstract

This brief analyzes the impacts of electric medium- and heavy-duty vehicles (e.g., trucks and buses) on hourly electric demand by state. We find that by 2030, these vehicles will add about 1,000 megawatts (MW) to peak load in Texas, about 500 MW to peak load in California, and 200-500 MW of peak load in 14 other states. These new loads should be factored into electric system planning including generation, transmission, and distribution. Often these loads will be on specific distribution circuits and will sometimes require new or expanded substations. Since new and expanded substations can take five years or more to propose, design, and build, plans need to be made today for loads expected by 2030.

Introduction

In the next few years, power demand from electric trucks is likely to grow substantially; electric utilities, utility commissions, and regional grid administrations will need to plan for these loads, as explained in a companion ACEEE Tool Kit, *Utility Planning for Electric Truck and Bus Fleets: An Overview* (Nadel 2024). Loads can range from a few megawatts (MW) per site for school bus and delivery van depots to 20-40 megawatts (MW) for large truck depots and truck stops.

Most electric vehicles currently use level 2 (208 or 240 volt) and level 3 chargers (the latter often called DC direct chargers which are typically 0.15-0.25 MW per plug). However, larger vehicles will often use a new charger standard now being developed, with individual chargers needing 1-2 MW each. These loads will often be concentrated on a limited number of distribution feeders, often requiring new or upgraded distribution feeders and sometimes new or upgraded substations. This shift is starting with fleets of school buses, transit buses, and delivery vans and will eventually affect other medium-duty trucks (e.g., delivery trucks) and ultimately heavy-duty trucks, such as 18-wheelers.

This short topic brief examines available load shapes and recent state forecasts for electricity use by these vehicles in 2030. By combining these two sources of data we can estimate power needs by hour of the day, allowing utilities and regulators to begin to plan for the impact of medium- and heavy-duty vehicles on peak electricity demand.

Methodology

We begin with forecasts of medium- and heavy-duty vehicle sales, mileage, and electricity use by state. These forecasts are contained in *Near-Term Infrastructure Deployment to Support Zero-Emission Medium- and Heavy-Duty Vehicles in the United States*, published in May 2023 by the International Council on Clean Transportation (Ragon et al. 2023). We then take estimates of 24-hour load shapes for these vehicles developed by Lawrence Berkeley National Laboratory for the California Energy Commission (Crisostomo 2021) and apply these to estimate average load by state for each of three periods that are often peak-demand periods—mid-afternoon (3-4 pm), evening (8-9 pm), and early morning (7-8 am). Depending on the state, electricity demand often peaks on summer afternoons or evenings, or early on winter mornings.

The load shape used is illustrated in figure 1. Based on this load shape, we estimated the percentage of medium- and heavy-duty vehicle charging load that will occur in each hour, as shown in table 1. These load shapes do not include the influence of possible load management programs such as time-of-use rates that could cause some fleets to shift more of their loads to the nighttime, where that is feasible.

Please note that these figures are highly approximate since there is substantial uncertainty in both the projected loads and the load shapes. Thus, this analysis provides a rough estimate of potential 2030 loads by state. Each utility and state should conduct its own analysis to develop a more detailed state-specific forecast.

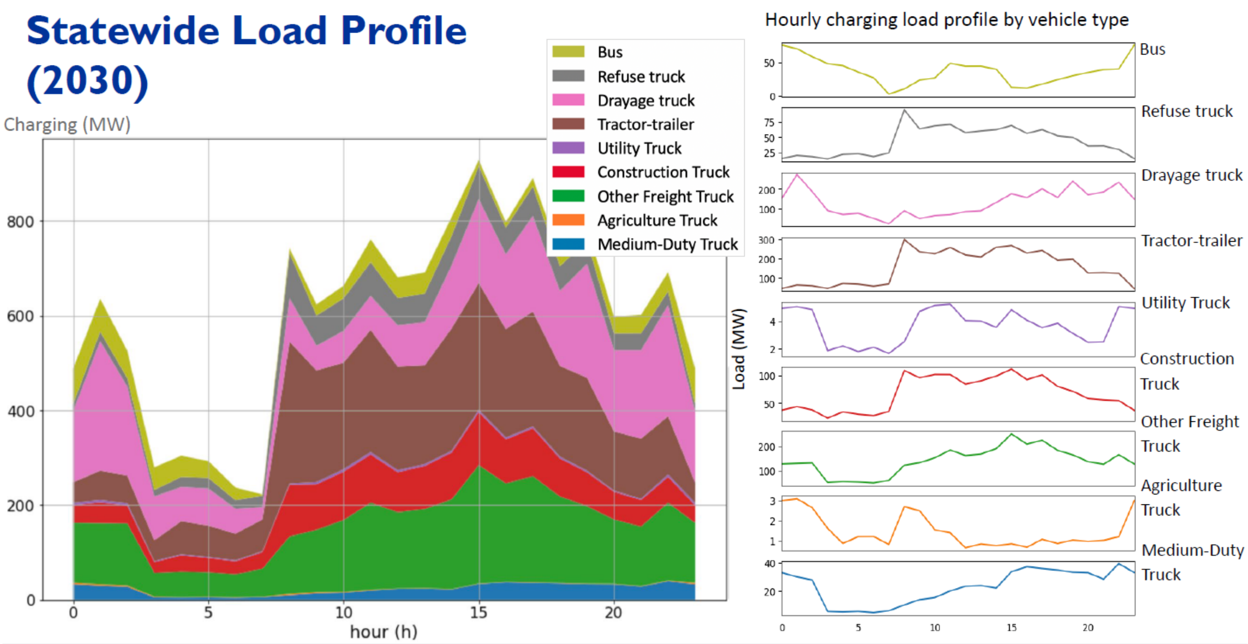

Figure 1. Medium and heavy-duty vehicle load shapes. *Source*: Crisostomo 2021 .

Table 1. Percentage of medium- and heavy-duty vehicle charging load in each hour of the day

Hour ending	% of total kWh
1	4.39%
2	3.66%
3	1.95%
4	2.16%
5	2.05%
6	1.74%
7	1.57%
8	5.15%
9	4.35%

10	4.60%
11	5.29%
12	4.67%
13	4.74%
14	5.57%
15	6.48%
16	5.57%
17	6.20%
18	5.15%
19	5.29%
20	4.18%
21	4.18%
22	4.81%
23	3.13%
24	3.13%

Source: Based on load shape in figure 1.

Results

Applying the methodology described above, we find that Texas has the largest loads from trucks and buses—about 1,000 MW in 2030 during the afternoon peak. California is second—725 MW during the afternoon and nearly 500 MW in the evening when loads in California generally peak. To put these figures in perspective, in 2023, the peak electric demand was about 85,500 MW in Texas[1] and 44,500 MW in California.[2] Fourteen other states have hourly loads of 200 MW or more during the afternoon—Florida, Illinois, Ohio, Pennsylvania, Indiana, Alabama, South Carolina, New York, North Carolina, Arizona, Georgia, Utah, Tennessee, and Louisiana. Estimates for 48 states plus the District of Columbia can be found in table 2. These new loads should be factored into electric system planning including generation, transmission, and distribution. Often these loads will be on specific distribution circuits and will sometimes require new or expanded substations. Since new and expanded substations can take five years or more to propose, design, and build, plans need to be prepared today for loads expected by 2030.

[1] www.ercot.com/news/release/2023-09-14-ercot-provides-new .

[2] www.caiso.com/Documents/Key-Statistics-Sep-2023.pdf .

Table 2. Estimated hourly loads by state in 2030 for medium- and heavy-duty vehicle charging

Rank (MWh)	State	Daily MWh from MHDV charging	MW at 8:00	MW at 15:00	MW at 20:00
1	Texas	15,481	797	1003	647
2	California	11,196	577	725	468
3	Florida	7,318	377	474	306
4	Illinois	5,958	307	386	249
5	Ohio	5,226	269	339	218
6	Pennsylvania	5,035	259	326	210
7	Indiana	4,962	256	322	207
8	Alabama	4,790	247	310	200
9	South Carolina	4,233	218	274	177
10	New York	4,231	218	274	177
11	North Carolina	4,218	217	273	176
12	Arizona	3,990	205	259	167
13	Georgia	3,758	194	244	157
14	Utah	3,511	181	228	147
15	Tennessee	3,413	176	221	143
16	Louisiana	3,374	174	219	141
17	Minnesota	2,972	153	193	124
18	Missouri	2,928	151	190	122
19	Wisconsin	2,612	135	169	109
20	Arkansas	2,419	125	157	101
21	Michigan	2,398	123	155	100
22	Washington	2,398	123	155	100
23	Kansas	2,349	121	152	98
24	Virginia	2,317	119	150	97
25	Oregon	2,229	115	144	93
26	New Jersey	2,047	105	133	86
27	Maryland	2,023	104	131	85
28	Mississippi	1,978	102	128	83
29	Oklahoma	1,921	99	124	80
30	Kentucky	1,885	97	122	79

31	Colorado	1,849	95	120	77
32	Massachusetts	1,732	89	112	72
33	Iowa	1,656	85	107	69
34	Connecticut	1,441	74	93	60
35	New Mexico	1,161	60	75	49
36	West Virginia	1,157	60	75	48
37	Idaho	1,051	54	68	44
38	Wyoming	946	49	61	40
39	Nevada	853	44	55	36
40	North Dakota	798	41	52	33
41	Maine	748	39	49	31
42	Nebraska	714	37	46	30
43	Montana	525	27	34	22
44	Delaware	500	26	32	21
45	South Dakota	486	25	31	20
46	New Hampshire	410	21	27	17
47	Rhode Island	318	16	21	13
48	Vermont	276	14	18	12
49	District of Columbia	75	4	5	3
U.S. total		139,865	7,203	9,063	5,846

Note: Alaska and Hawaii not included. Daily MWh from ICCT (Ragon et al. 2023). MW estimated from load shapes in table 1.

References

Crisostomo, N. 2021. *Medium and Heavy-Duty Vehicle Load Shapes*. Sacramento, CA: California Energy Commission. www.energy.ca.gov/sites/default/files/2021-09/5%20LBNL-FTD-EAD-HEVI-LOAD%20Medium-%20and%20Heavy-Duty%20Load%20Shapes_ADA.pdf.

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