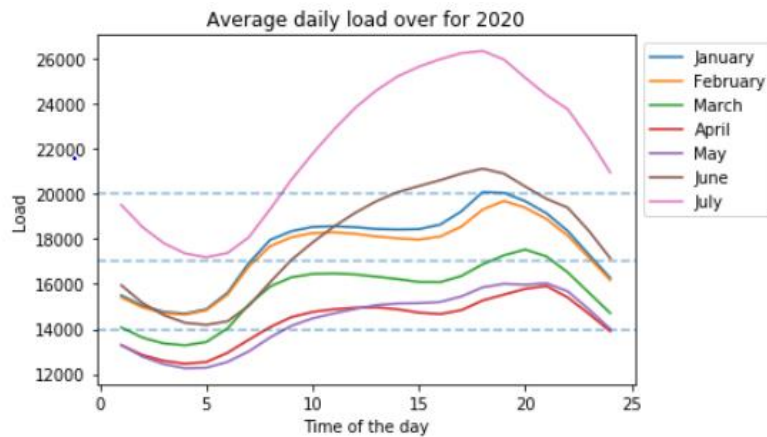


Modeling of Peaker Plant Application Profile

The following section puts forth a basic approach to assess the size of Second use electric vehicle batteries to mimic the behavior of Peaker plants throughout the year. As per Clean Energy Group's report (Clean Energy Group, n.d.), New York's peakers generate one of the most polluted and expensive electricity during peak load. Thus, the use case under consideration was that of NYC (New York City). As per the data obtained from NYISO (Energy Online, 2020), electricity load data for January 2020 to July 2020 (Current date as of analysis) was extracted and used for modeling. The data was averaged for the entire duration of the month, amounting to a single value every hour for every month for New York City.

The trend of load over 2020 is as follows:



Certain underlying assumptions follow the modeling methodology:

1. Units of Load are in MWh
2. Fluctuations in the load data over days is negligible
3. Excess load has been manually set for base loads of 14000 MWh, 17000 MWh and 20000 MWh

Battery capacity for second use batteries have been evaluated taking into account the following values:

First use battery capacity	85 kWh
Working capacity of 2 nd use battery	70% (Ambrose, n.d.)
Maximum charge	80%

Based on this, for a 'x' MWh of excess load, number of second use batteries are estimated as:

$$n_s = \frac{x \cdot 1000}{85 \cdot 0.7 \cdot 0.8}$$

The value is then rounded off to the next integer.

i. Base load: 14000 MWh

	January	February	March	April	May	June	July
1	9698	9266	3138	2658	2661	11756	28145
2	7534	7220	2726	2572	2558	8121	23600

3	6329	6083	2674	2520	2491	5641	20333
4	5960	5754	2658	2496	2455	4098	18239
5	6876	6643	2688	2510	2460	3679	17452
6	10227	9834	2960	2593	2512	4416	18339
7	16285	15604	7844	2709	2606	7581	21546
8	20996	19710	11492	3216	2729	12383	27265
9	22782	21547	13379	5251	3486	16932	33275
10	23666	22386	14060	6314	4997	20498	38620
11	23801	22554	14151	6864	6022	23719	43516
12	23601	22242	13958	7163	6929	26536	47944
13	23237	21710	13506	7239	7704	28901	51526
14	23129	21338	13011	6842	8039	30758	54376
15	23205	21084	12417	6173	8108	31999	56340
16	24133	21701	12380	5882	8347	33185	57888
17	26849	23738	13650	6679	9468	34549	59106
18	30770	27208	16036	8657	11336	35549	59570
19	30603	28957	17852	9840	12046	34534	57809
20	28909	27585	19041	11031	11865	31895	54096
21	26450	25261	17630	11604	12179	29392	50585
22	22826	21858	14380	9252	10524	27583	47665
23	18006	17367	10223	5917	6819	22825	41618
24	13250	12799	6081	2787	2851	17260	34783

ii. Base load: 17000 MWh

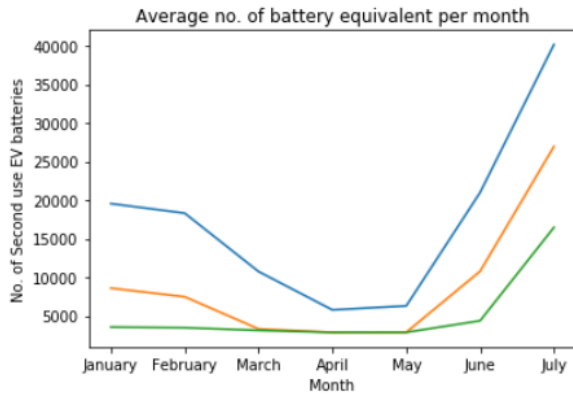
	January	February	March	April	May	June	July
1	3101	3082	2816	2658	2661	3191	14940
2	3007	2993	2726	2572	2558	3033	10395
3	2955	2944	2674	2520	2491	2926	7128
4	2939	2930	2658	2496	2455	2859	5034
5	2979	2969	2688	2510	2460	2841	4247
6	3125	3108	2809	2593	2512	2873	5134
7	3388	3359	3022	2709	2606	3011	8341
8	7791	6505	3180	2821	2729	3220	14060
9	9577	8342	3263	2909	2833	3727	20070
10	10461	9181	3292	2956	2899	7293	25415
11	10596	9348	3296	2980	2944	10514	30311
12	10396	9037	3288	2993	2983	13331	34739
13	10032	8505	3269	2997	3017	15696	38321
14	9924	8132	3248	2980	3032	17553	41171
15	10000	7879	3222	2951	3035	18794	43135
16	10928	8496	3220	2938	3046	19980	44683
17	13644	10533	3276	2973	3094	21343	45901

18	17565	14003	3380	3059	3176	22344	46364
19	17398	15751	4647	3111	3207	21329	44604
20	15704	14380	5836	3163	3199	18690	40891
21	13245	12056	4425	3188	3213	16187	37379
22	9621	8653	3309	3086	3141	14378	34460
23	4801	4162	3128	2941	2981	9620	28413
24	3259	3240	2948	2787	2808	4055	21578

iii. Base load: 20000 MWh

	January	February	March	April	May	June	July
1	3101	3082	2816	2658	2661	3191	3904
2	3007	2993	2726	2572	2558	3033	3706
3	2955	2944	2674	2520	2491	2926	3564
4	2939	2930	2658	2496	2455	2859	3474
5	2979	2969	2688	2510	2460	2841	3440
6	3125	3108	2809	2593	2512	2873	3478
7	3388	3359	3022	2709	2606	3011	3618
8	3593	3537	3180	2821	2729	3220	3867
9	3671	3617	3263	2909	2833	3418	6865
10	3709	3654	3292	2956	2899	3573	12210
11	3716	3661	3296	2980	2944	3713	17106
12	3707	3648	3288	2993	2983	3836	21534
13	3691	3625	3269	2997	3017	3939	25115
14	3687	3609	3248	2980	3032	4348	27966
15	3690	3598	3222	2951	3035	5589	29930
16	3731	3625	3220	2938	3046	6775	31478
17	3849	3714	3276	2973	3094	8138	32696
18	4360	3865	3380	3059	3176	9139	33159
19	4193	3941	3459	3111	3207	8124	31399
20	3939	3882	3511	3163	3199	5485	27686
21	3833	3781	3450	3188	3213	3961	24174
22	3675	3633	3309	3086	3141	3883	21255
23	3466	3438	3128	2941	2981	3676	15208
24	3259	3240	2948	2787	2808	3435	8373

There can be some trends seen in the data. Firstly, as the base load is increased, peak demand is only needed for a lower amount of time, and thus, the second use EV battery equivalent is lower. It can also be seen that the equivalent reached its lower value in April and then rose steeply until July.



In addition to it, certain trends could also be observed for the entire day. For all peak loads, the demand increases from around 8 am and reaches its maximum around 4 pm, thereby declining further.

