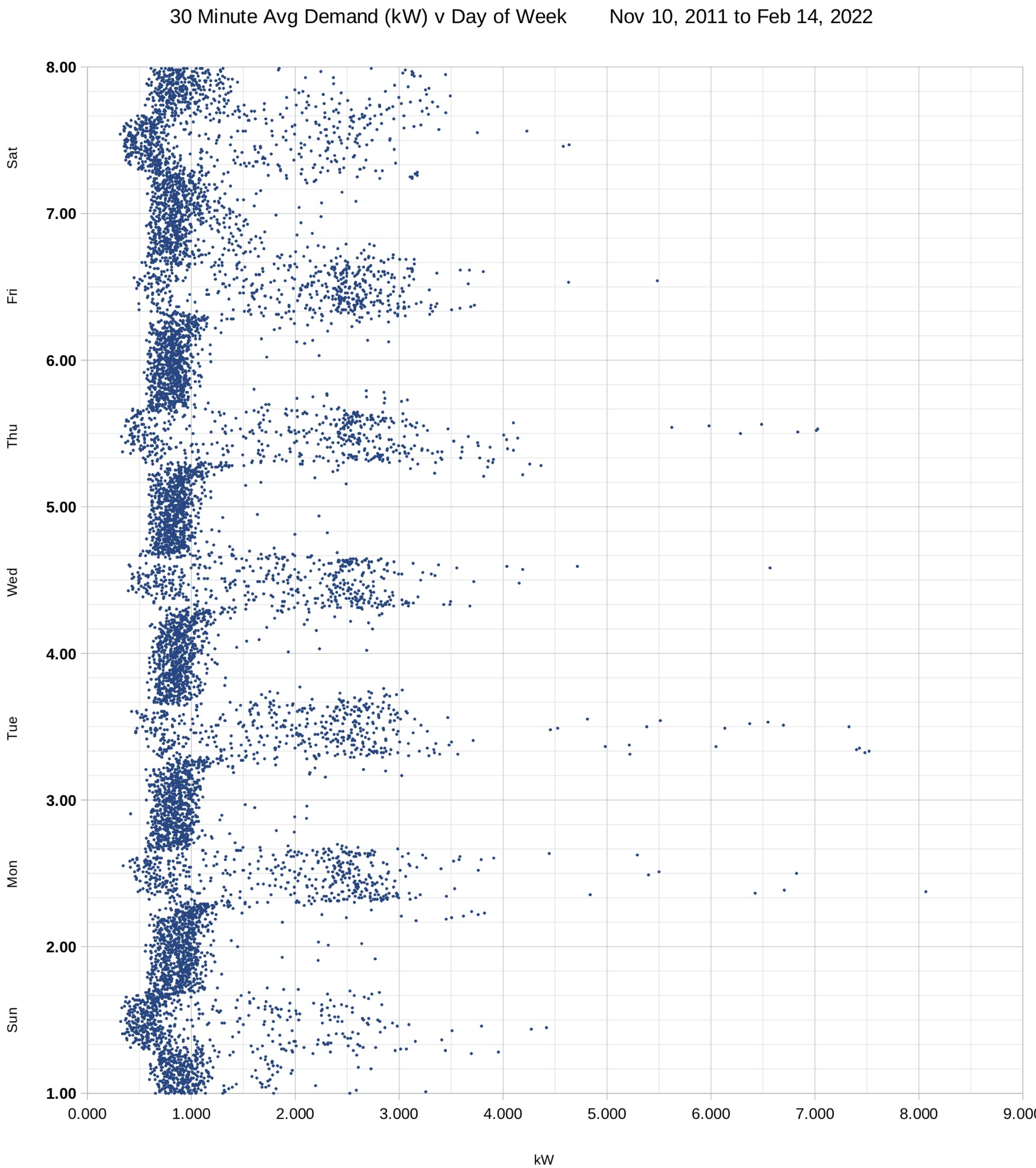
Mason Highway Electrical Consumption Peaks, Nov 10, 2011 to Feb 14, 2022

The chart below shows averaged peak 30 minute demand by day of week (Sunday...Saturday). Each dot represents the average of two 15 minute periods; there are around 9,300 dots, 96 per day.

The vertical axis is by day of week. The whole number and heavier grid lines fall on Midnight, i.e., the end of one day and beginning of the next. For example, Friday ends, and Saturday begins, at 7.00. Noon would be halfway between, at 7.50. The vertical grid is sub-divided into six 4-hour periods by lighter lines falling on 4am, 8am, noon, 4pm, and 8pm (x.17, x.33, x.50, x.67, x.83).

The horizontal axis shows the averaged kW demand during each 30 minute period. I use 30 minute periods because those are what can trigger "Demand Charges" for each kW above 5 kW.

Note the heavy concentration of dots around 1 kW between the hours of ~ 6PM to 6AM. these represent a night time "base load", likely related to heating and refrigeration loads. However, there are occasional peaks near 3 kW during that time- possibly an air compressor or pump cycling.



An interesting feature of that night time baseline is that it shifts lower during mid-day - most likely reflecting the higher daytime temperatures in Winter and thus decreased heating demands. If air conditioning is used in Summer I would expect an reverse pattern - lower baseline at night and higher during the day.

That night time base load is of significance if an electric vehicle (EV) was to be charged. If the baseline is around 1.2 kW, then, on average, 3.8 kW would be available for overnight charging without exceeding the 5 kW demand charge ("DC") threshold.

If we assume that at least one DC will occur, as seems probable from the graph above, avoiding another DC would require keeping under 6 kW, thus leaving 4.8 kW for night time charging. At 3 miles/kWh, typical for a passenger EV, 4.8 kW over the 12 hours from 6PM to 6AM would add around 170 miles worth of charge to the EV; less of course for a heavier vehicle.

However, it would be vital that the EV charger be monitoring total building energy consumption and adjusting it to keep under threshold, otherwise those occasional surges could trip off many DC. Such chargers are available, including one from Emporia which appears to use the data already being provided by our existing Emporia monitoring system.

As expected, the majority of peaks occur in the 6AM to 6PM daylight/work period. The great majority of these fall below 4 kW - lighting, various tools being used, etc.

From an earlier study of 8,225 periods over ~ 86 days we see the following distribution:

# occur	cumul	Cumul%	descript	# DC
5322	5322	64.7	<= 1	
1464	6786	82.5	> 1, <= 2	
1190	7976	97.0	> 2, <= 3	
195	8171	99.3	> 3, <= 4	
16	8187	99.5	> 4, <= 4.5	
8	8195	99.6	> 4.5, <= 5	
10	8205	99.8	> 5, <= 6	1 DC
12	8217	99.9	> 6, <= 7	2 DC
7	8224	100.0	> 7, <= 8	3 DC
1	8225	100.0	> 8, <= 9	4 DC

99.6% fell below the 5 kW threshold and triggered no DC

99.8% fell below the 6 kW threshold, costing 1 DC, and 99.9% fell below 7 kW (2 DC)

Note that only 1 peak above 8 kW occured in the 96 days examined. That single peak added a fourth Demand Charge, adding an extra $18 to that month's bill. Given the monthly average of ~ 900 kWh/month, each DC adds around 10% to the monthly bill. The 4 DCs in the month of the above 8 kW peak added ~ 40% to the total.

Similarly, peaks above 7 kW are relatively rare - only 8, or ~ 3 per month. Strategies to trim peaks deserve attention - avoiding peaks above 7 kW can trim 20% off the monthly costs.

There are feasible approaches - ways to monitor energy usage in real time and to "shave" 30-minute peaks by temporarily disconnecting non-critical loads. These need further investigation.