



Diversity in EV Behavior



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2026 AEIC/WLRA Load Research Conference

Goal: Develop representative EV Load Shape for Residential Home Charging

- Ability to scale up for long term system forecasting sales and peak
- Identify circuits with high EV penetration/growth and assess circuit peak impact
- Inform rate design process

Approach:

- Leverage off separately metered home EV charging data and match to existing population.
 - Separately metered data points are not a preservative sample. Up until now, we have just used an average of available separately metered data.

“Plans based on averages assumptions are wrong on average.” Sam L. Savage

SDG&E 2025 IEPR Calculation

Annual Miles Driven: 10,917

Average Miles per kWh: 3.48

Average Annual kWh per Vehicle: 3,137

Average Number of Charging Days: 207 (56%)

Average Daily kWh: **8.59**

Monthly Residential Charging:

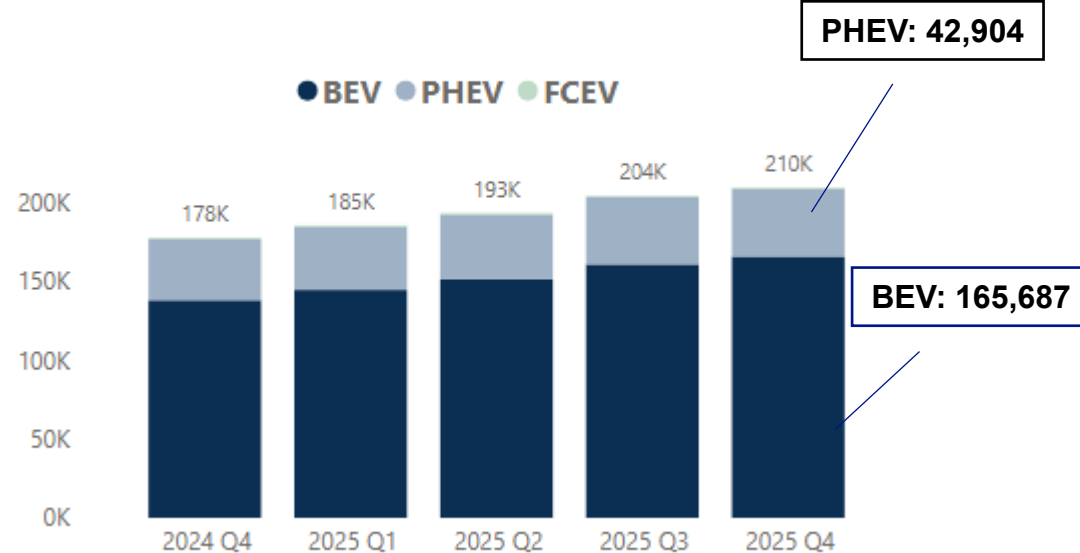
$$(3137 \div 365) = 8.59 * 30.3 = \mathbf{260.414 \text{ kWh}}$$

San Diego EV population

As of Q4 2025

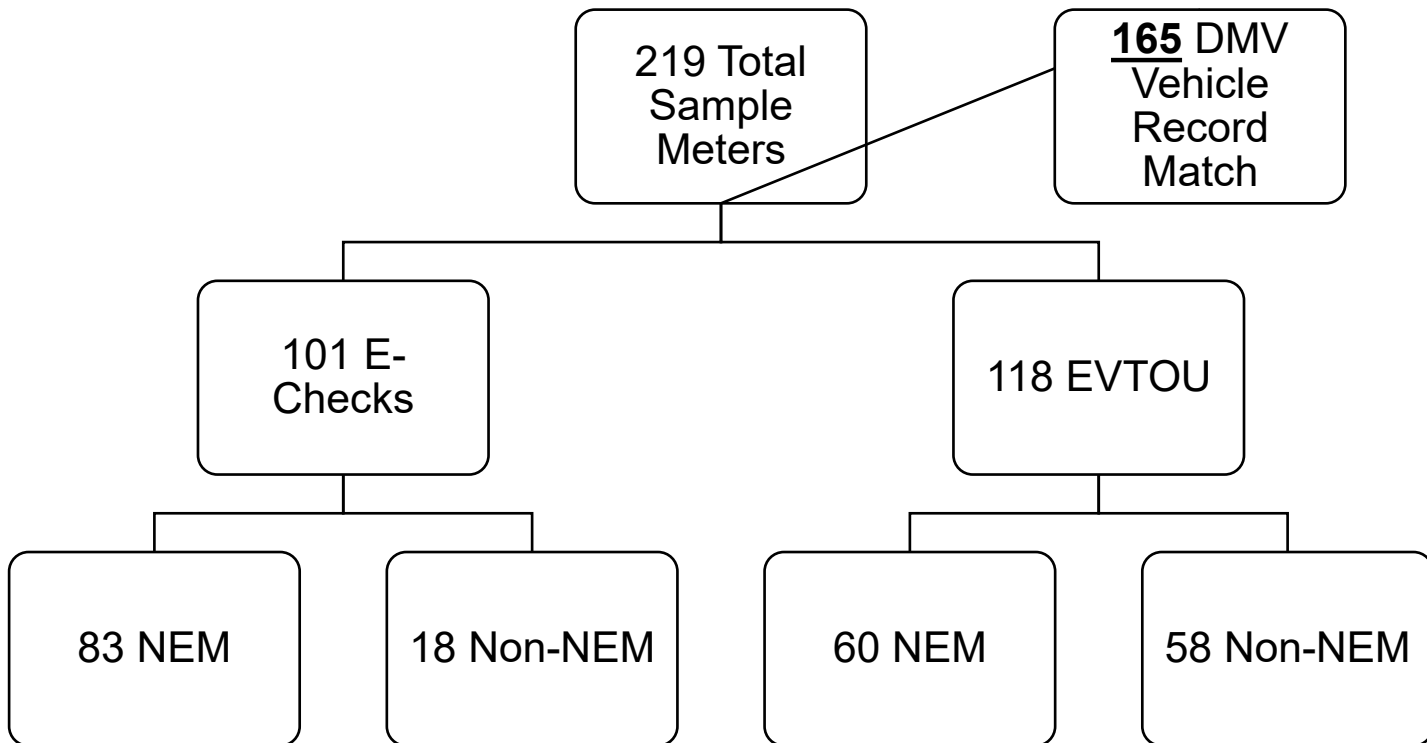
- Approximately 209k EV's in SDG&E Service Territory, according to DMV
- We have ~1.3 million on residential time-of use and tiered rates.
- Current there are 3 EV-Specific Rates Offered at SDG&E:
 1. EVTOU5
 2. EVTOU
 3. TOUELEC
- While only ~87k on EV Rates in 2025
 - ~34.7k in 2022
 - ~44.5k in 2023
 - ~66.6k in 2024

Cumulative PEV+ Historical



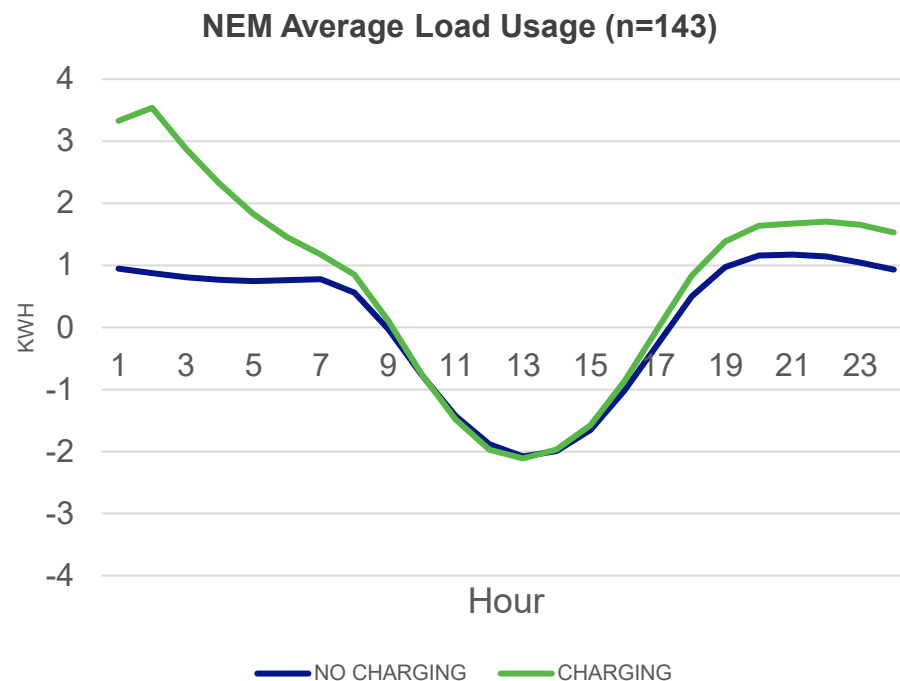
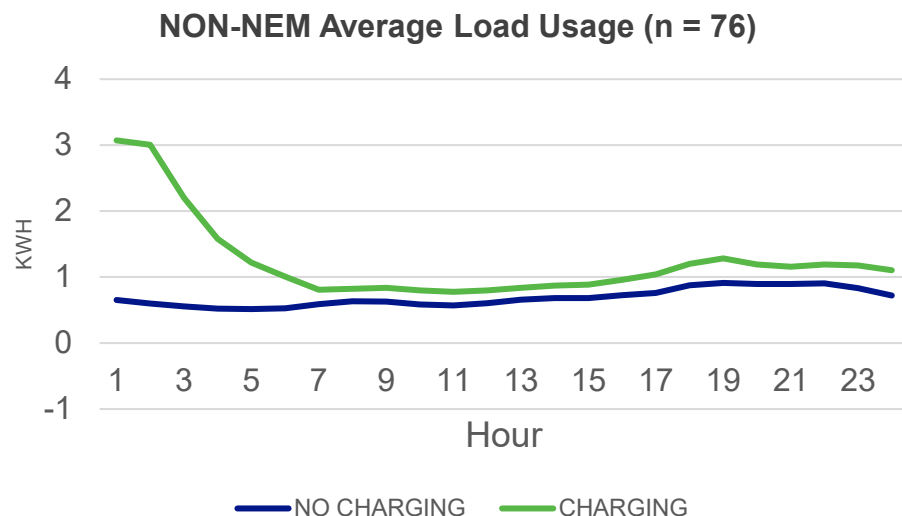
SDG&E EV Sample

- Separate meter is installed on a home's meter panel to capture EV-only loads.
- When no charging is happening, meter reports 0s *
Charger might consume small amounts of load throughout the day(< ~0.05 kwh)
- Currently in the process of trying to get more sample meters installed through the capital project.



NON-NEM vs NEM Average House Load Shape

Average House Load From Separately Metered Sample. n=219

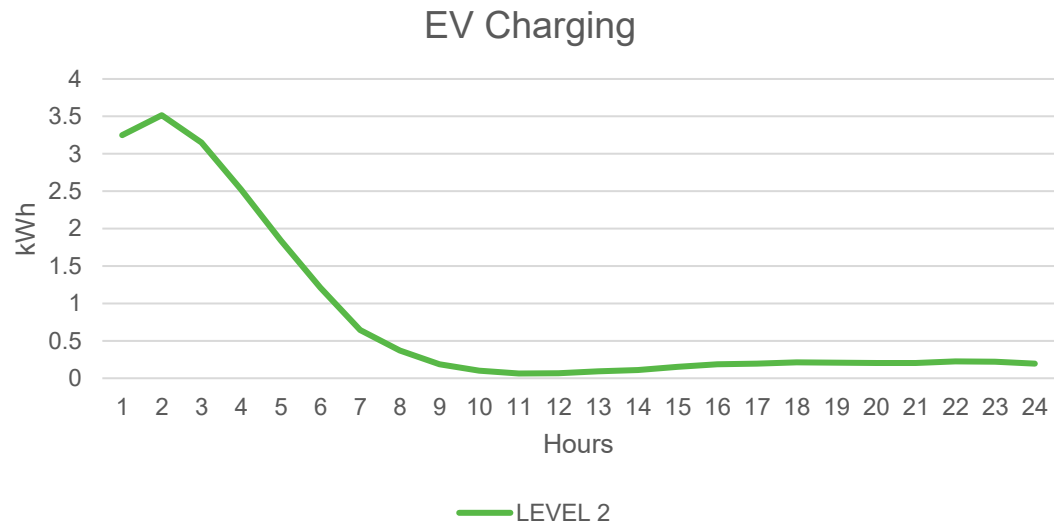
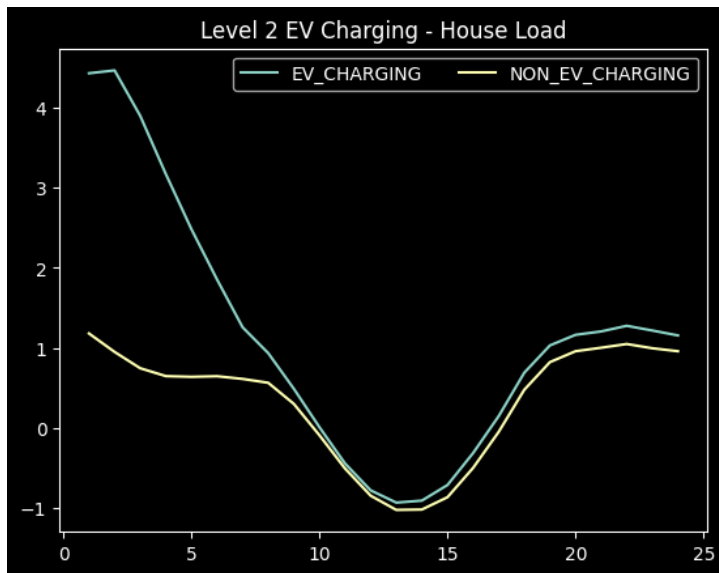


- Labeled as a “Charging Day” if separately metered EV exceeds 1 kWh of total daily load.
 - Some EV chargers have “phantom draw” which pulls at 0.01 kWh every hour.

Subtractive Approach For House Data

- Model looked for demand and TOU responsiveness, but missed LVL1 charging and midday charging (50% EV owners have PV)
- Only 60% of customers are on EV Rates
- Applied against Single Family Homes
- Trained off customers on EV rates

Avg Charging Day – Avg Non-Charging Day = Avg EV Charging



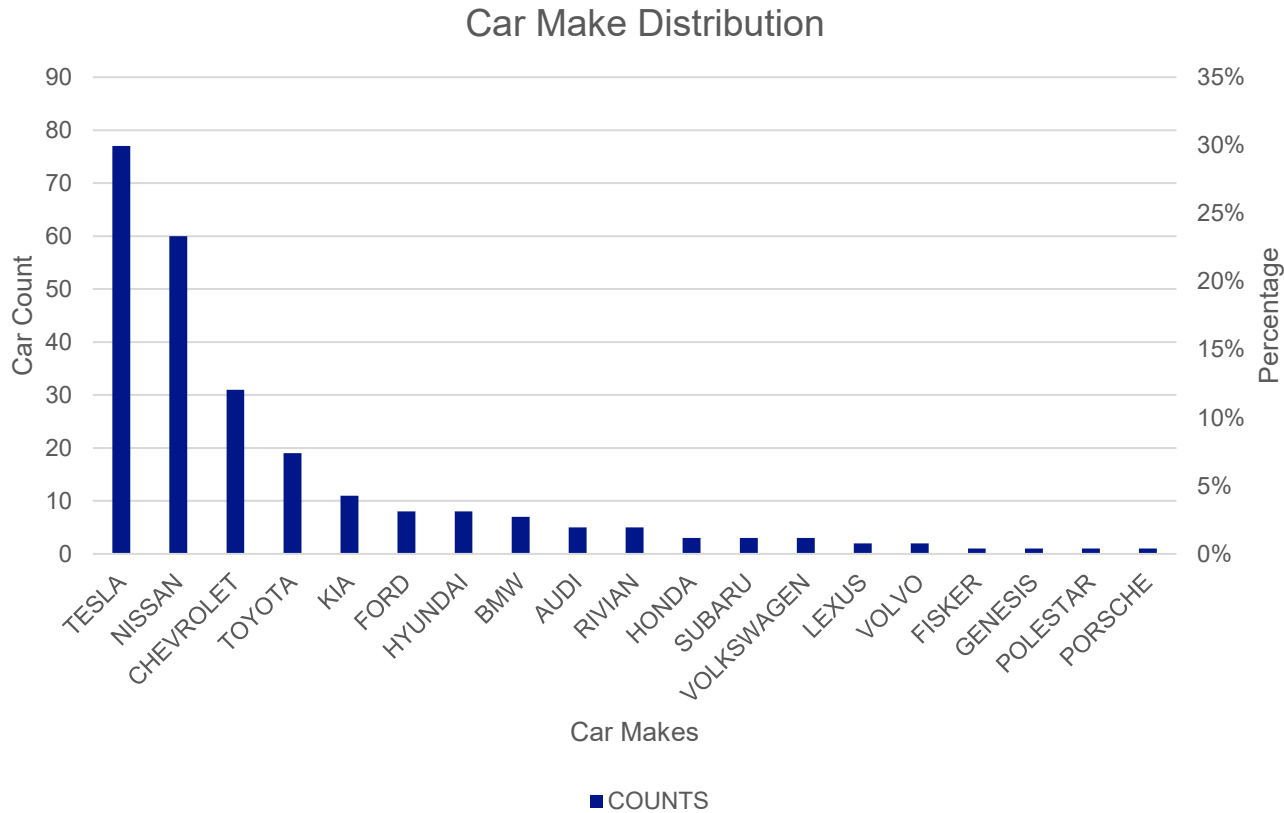
DMV Data + Sample Match

Out of 219, 165 Premises had a DMV vehicle match to the address

Number of Cars	Sample	Avg Max Demand	Avg EV Monthly kWh	Avg LF
1	101	5.9	189.2	4%
2	49	6.5	274.8	5%
3	11	7.8	429.7	6%
4	4	9.1	584.7	9%
Total	165	7.3	369.6	6%
Single EV	101	5.9	189.2	4%
Multi EV	64	7.1	343.3	6%

Car Make Distribution Sample

165 Premises with 248 Total Registered Cars



Make	COUNTS	PCT
TESLA	77	33%
NISSAN	60	25%
CHEVROLET	31	12%
TOYOTA	19	7%
KIA	11	4%
FORD	8	3%
HYUNDAI	8	3%
BMW	7	2%
AUDI	5	2%
RIVIAN	5	2%
HONDA	3	1%
SUBARU	3	1%
VOLKSWAGEN	3	1%
LEXUS	2	1%
VOLVO	2	1%
FISKER	1	1%
GENESIS	1	0%
POLESTAR	1	0%
PORSCHE	1	0%

Population Car Make Distribution

Top 20 Car Models (Snapshot from 2022)

Population		
Make	Count	Pct
TESLA	65,402	50%
CHEVROLET	8,948	7%
TOYOTA	7,828	6%
FORD	7,143	5%
BMW	6,380	5%
HYUNDAI	4,623	4%
NISSAN	4,005	3%
KIA	3,595	3%
VOLKSWAGEN	2,739	2%
AUDI	2,730	2%
VOLVO	2,524	2%
JEEP	2,242	2%
MERCEDES-BENZ	1,654	1%
HONDA	1,541	1%
RIVIAN	1,397	1%
CHRYSLER	1,281	1%
PORSCHE	1,243	1%
FIAT	1,017	1%
POLESTAR	646	0%
SUBARU	539	0%

Car Make and Model Specific EV-Only Load Shape

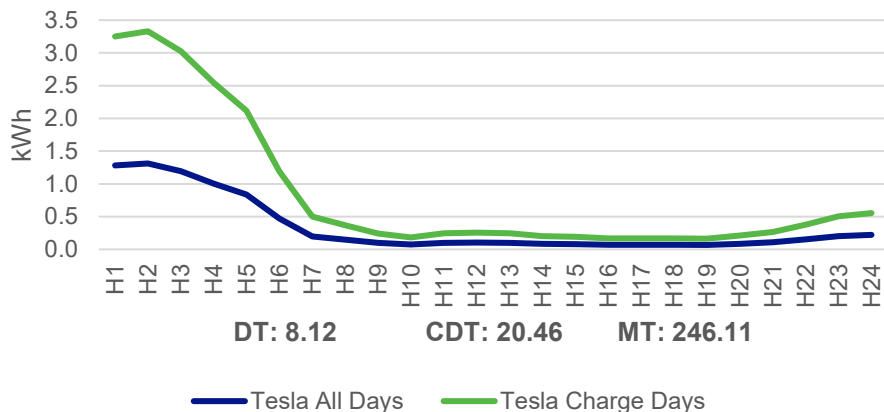
DT = Daily Total

CDT = Charge-Days Daily Total

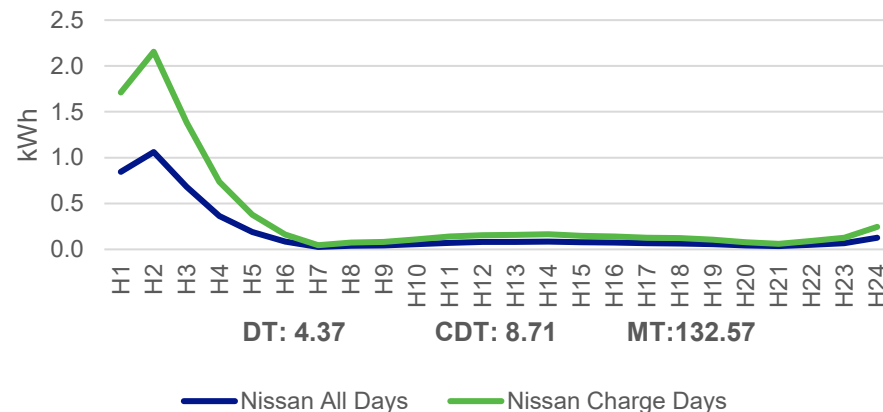
MT = Monthly Total

(Single Car Only)

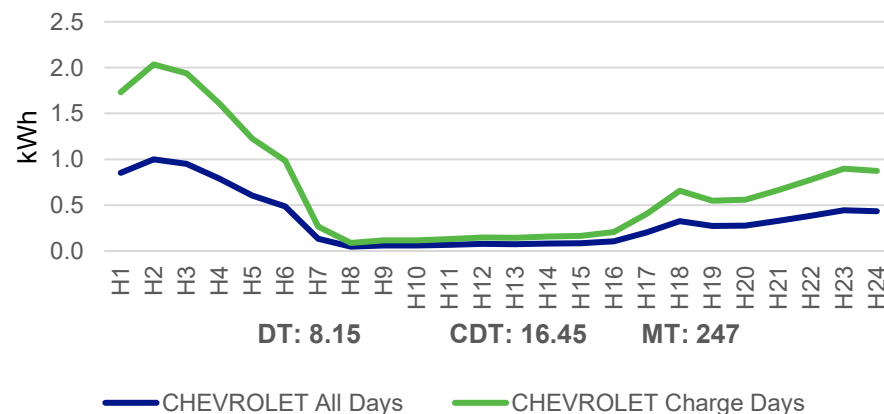
Tesla – n=30/77



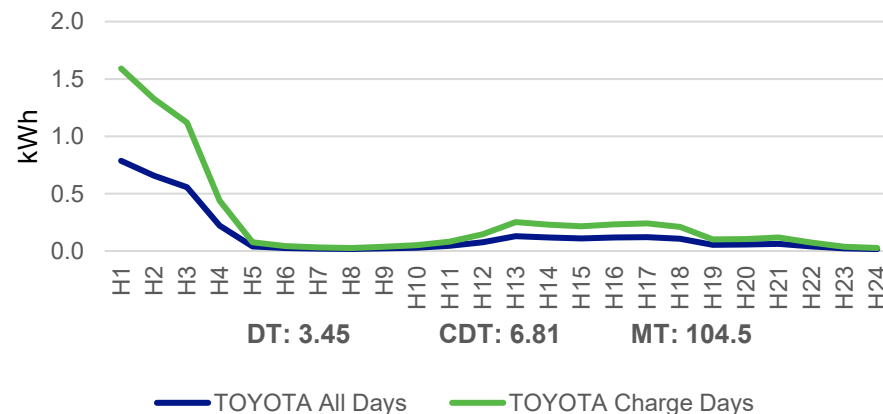
Nissan – n= 32/60



CHEVROLET – n=13/31



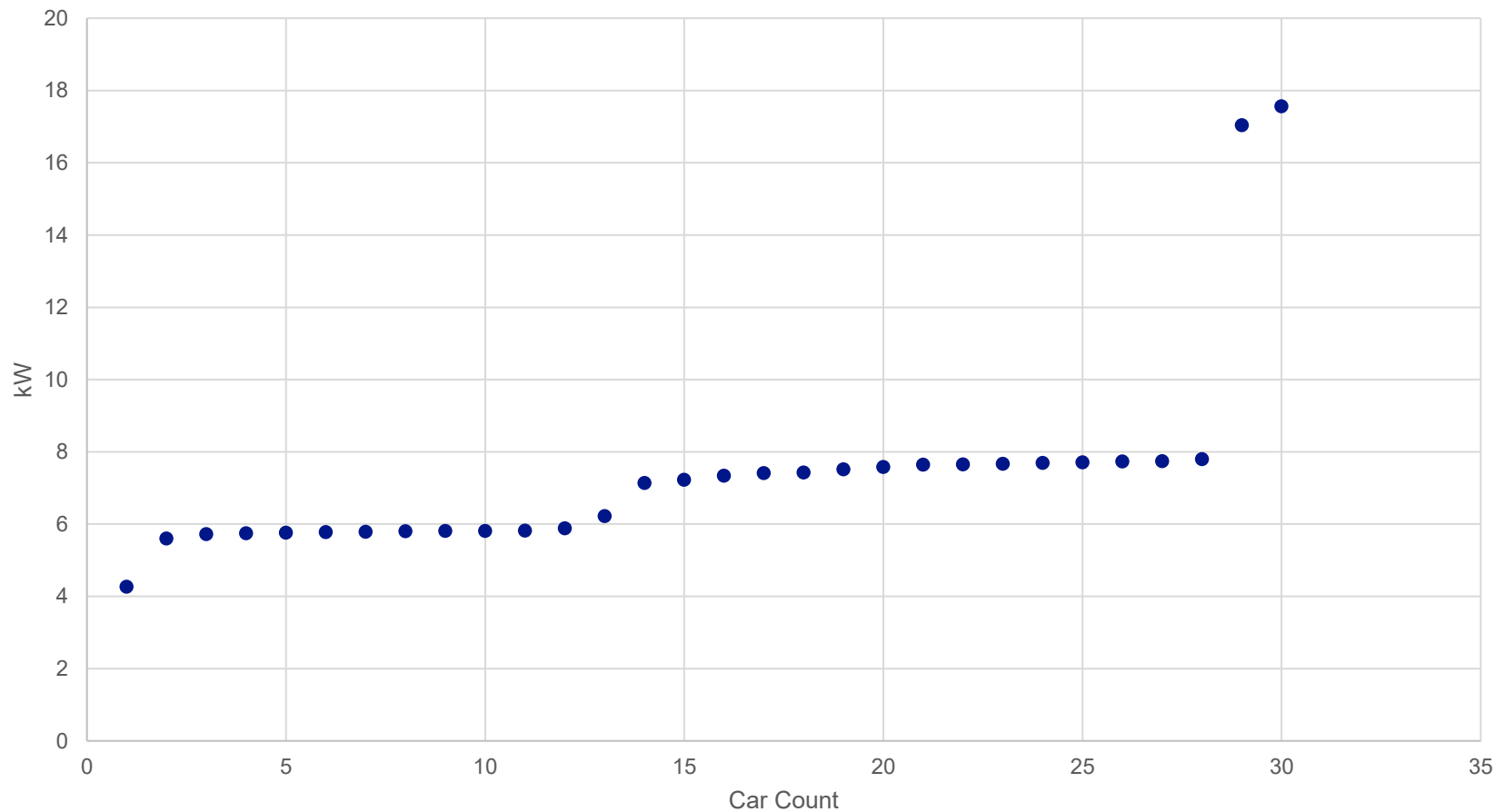
TOYOTA – n= 7/19



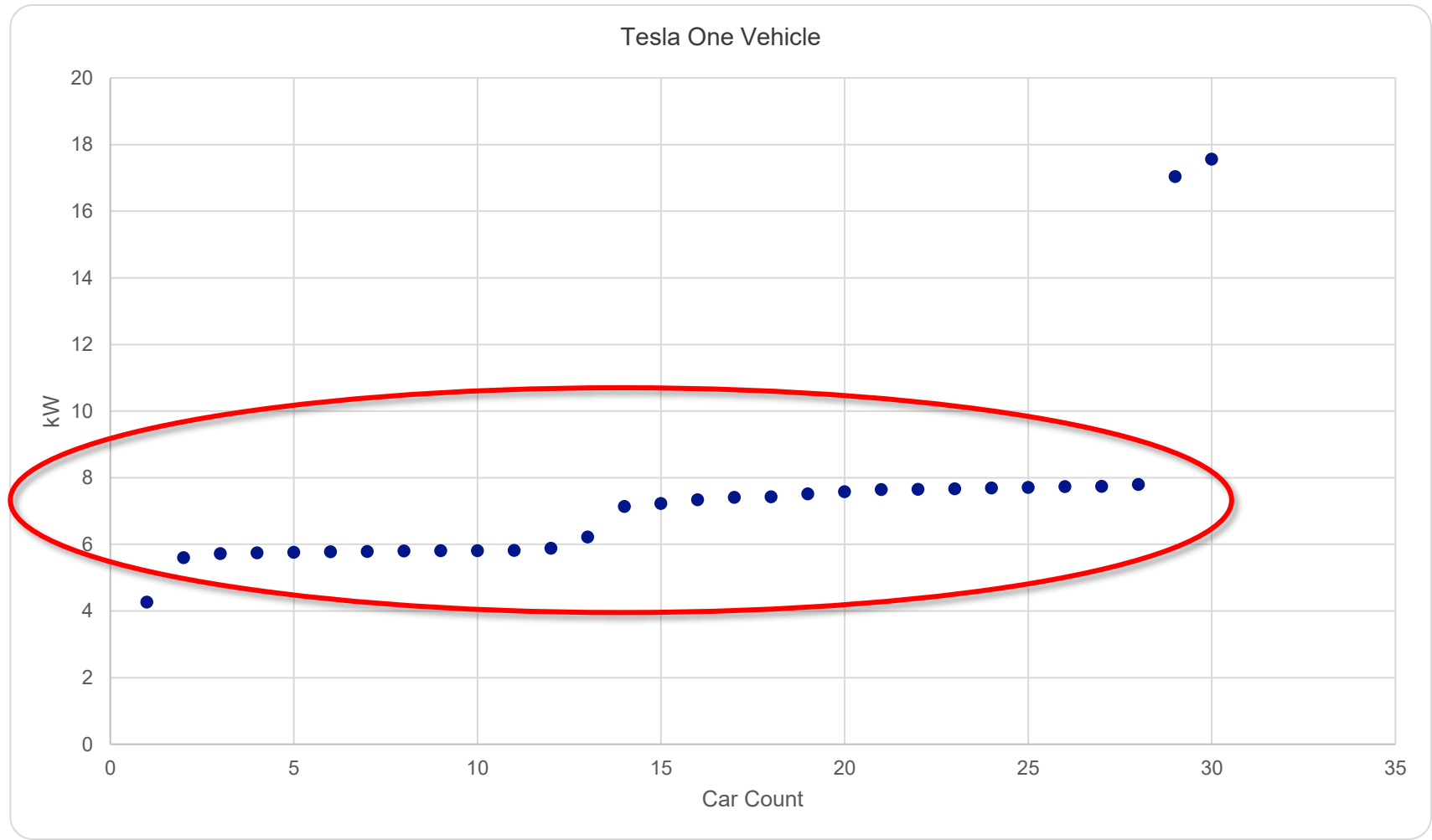
Tesla Max Demands



Tesla One Vehicle

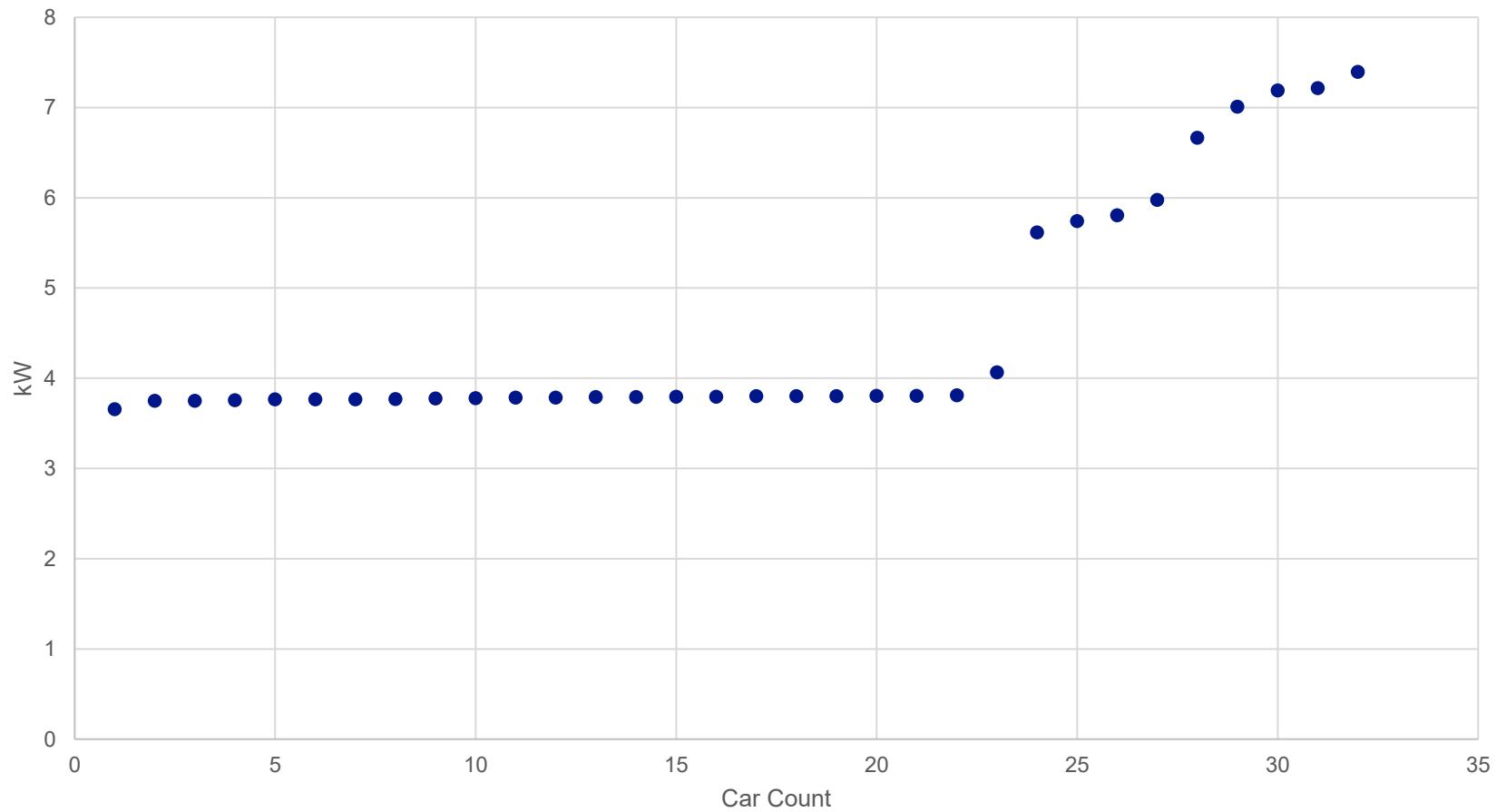


Tesla Max Demands

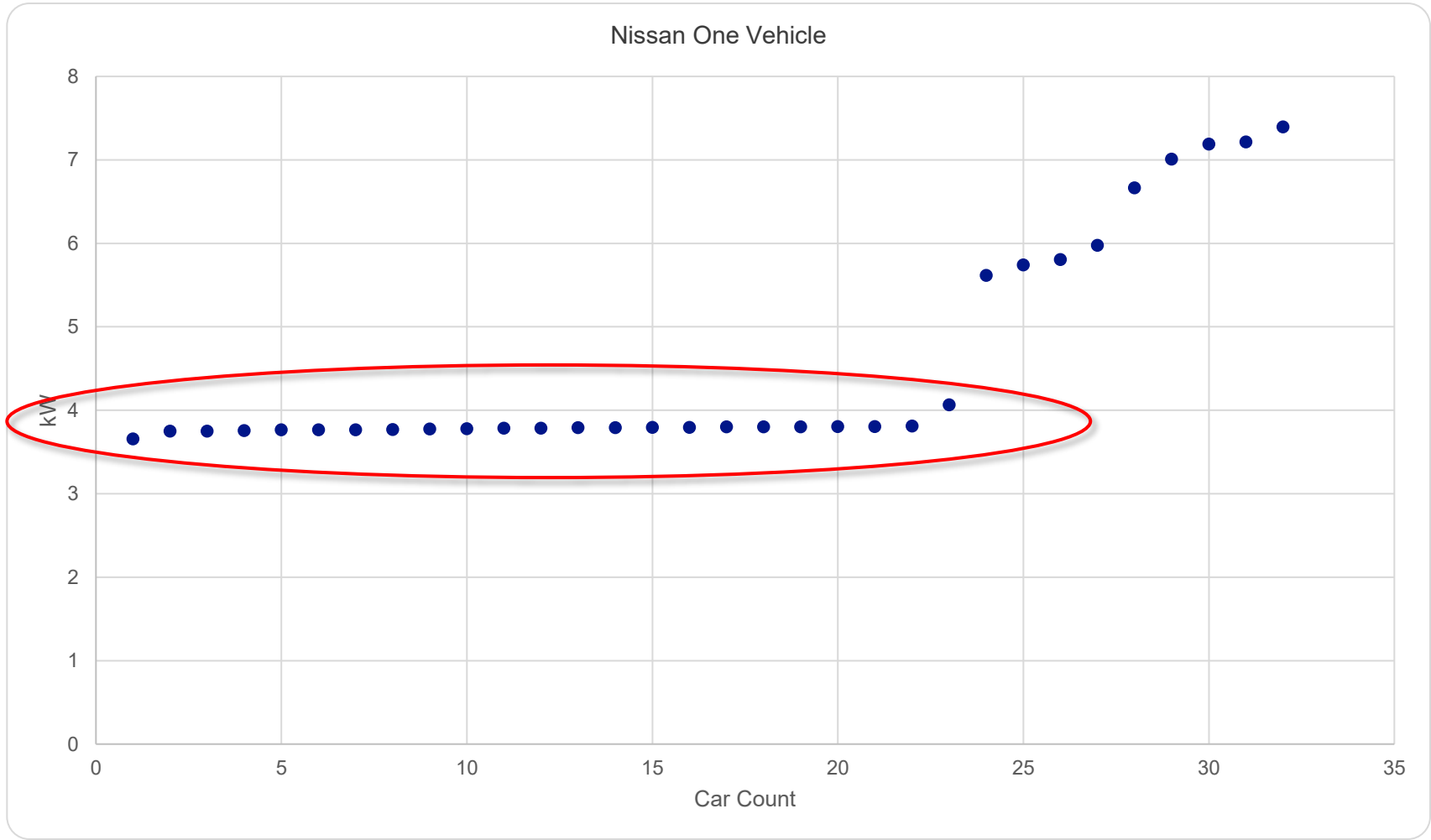


Nissan Max Demands

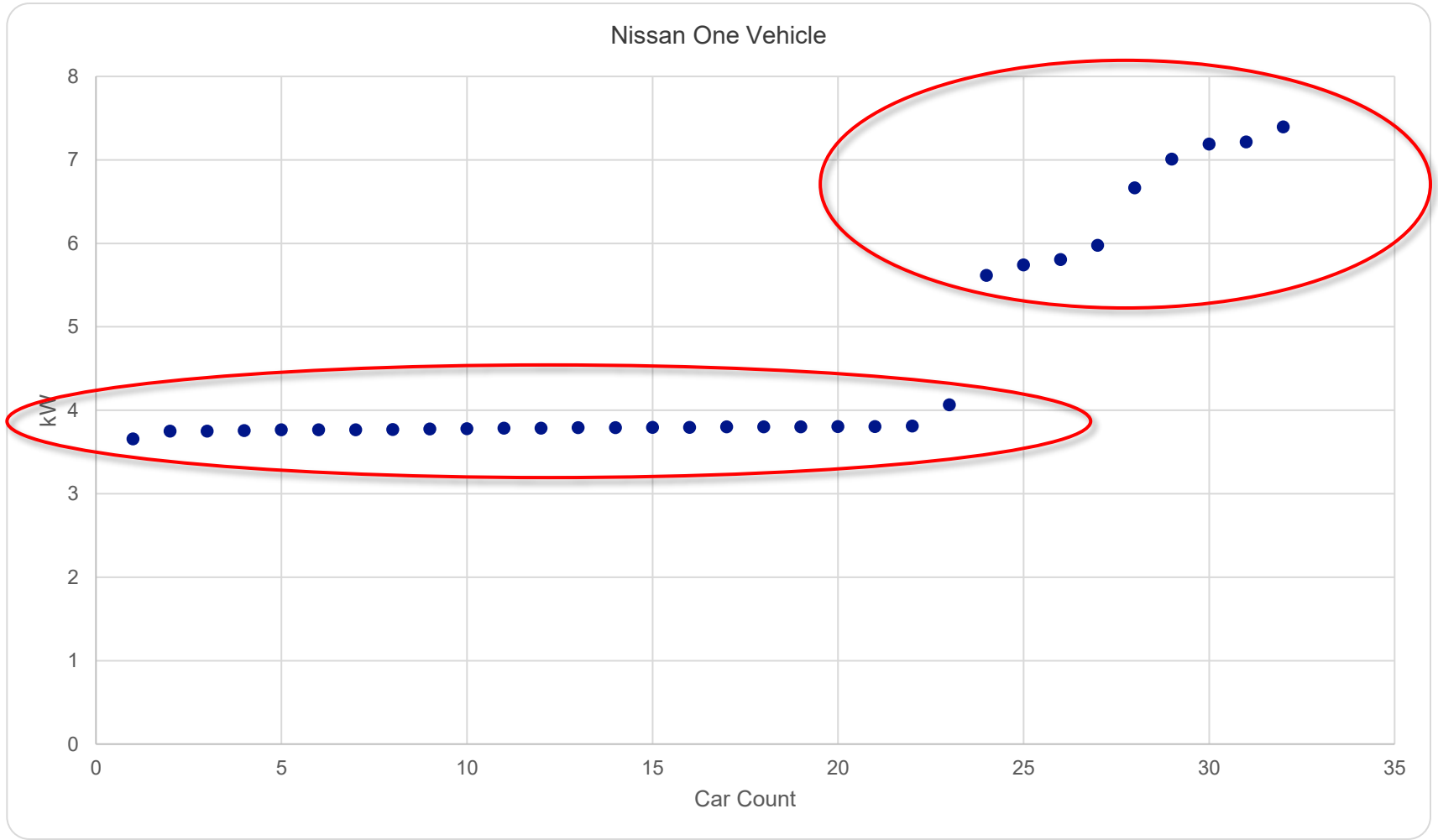
Nissan One Vehicle



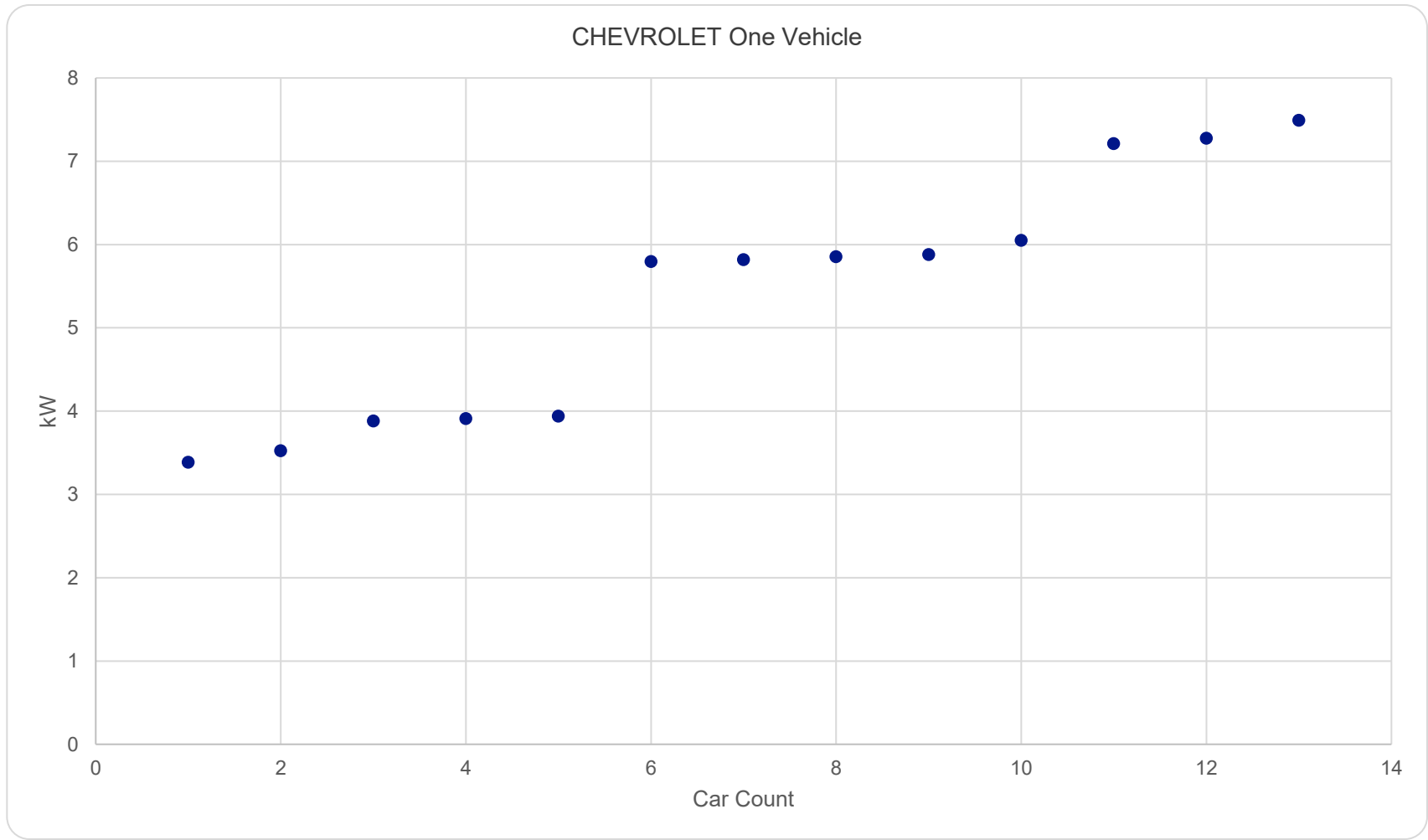
Nissan Max Demands



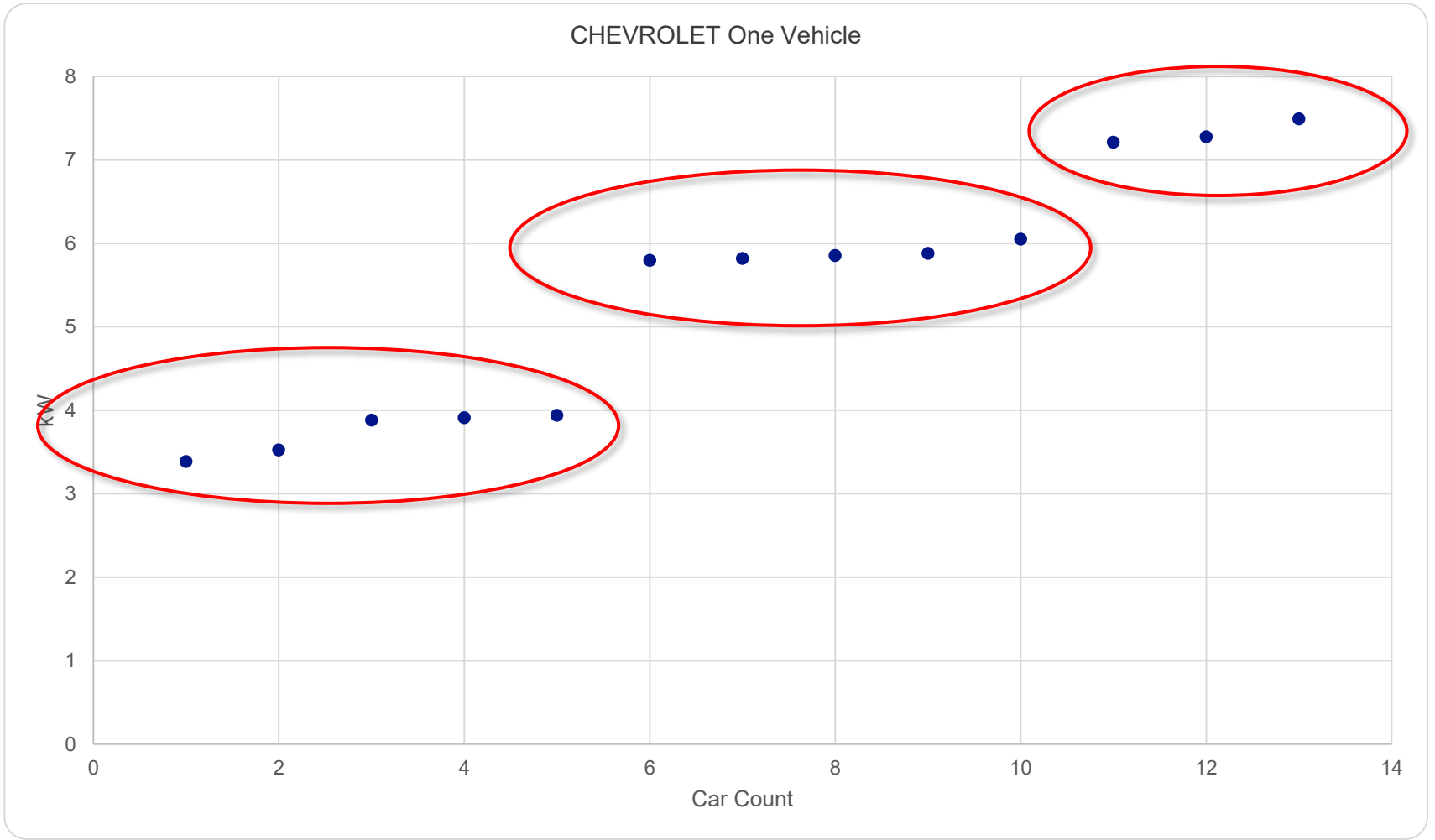
Nissan Max Demands



Chevrolet Max Demands



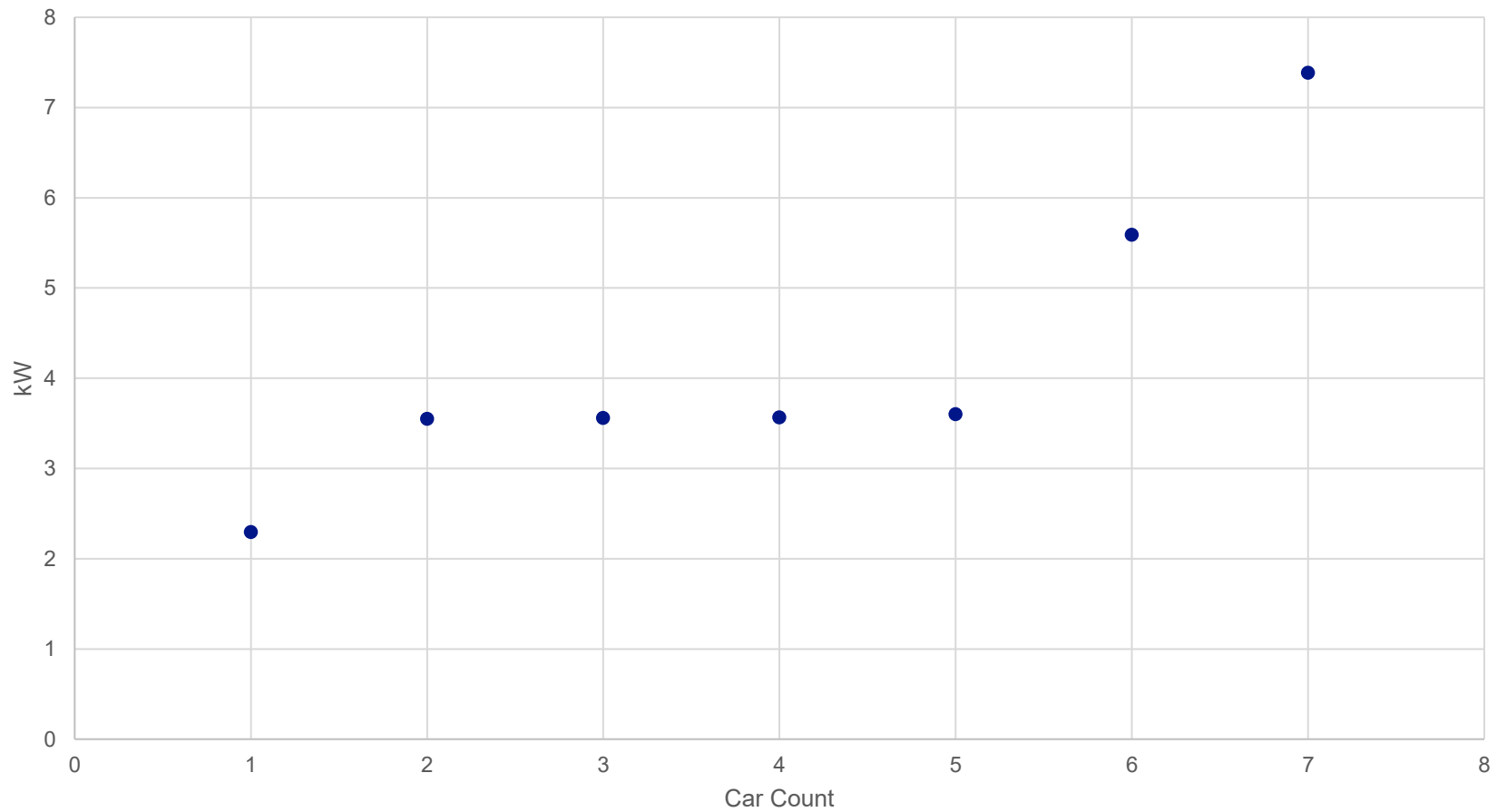
Chevrolet Max Demands



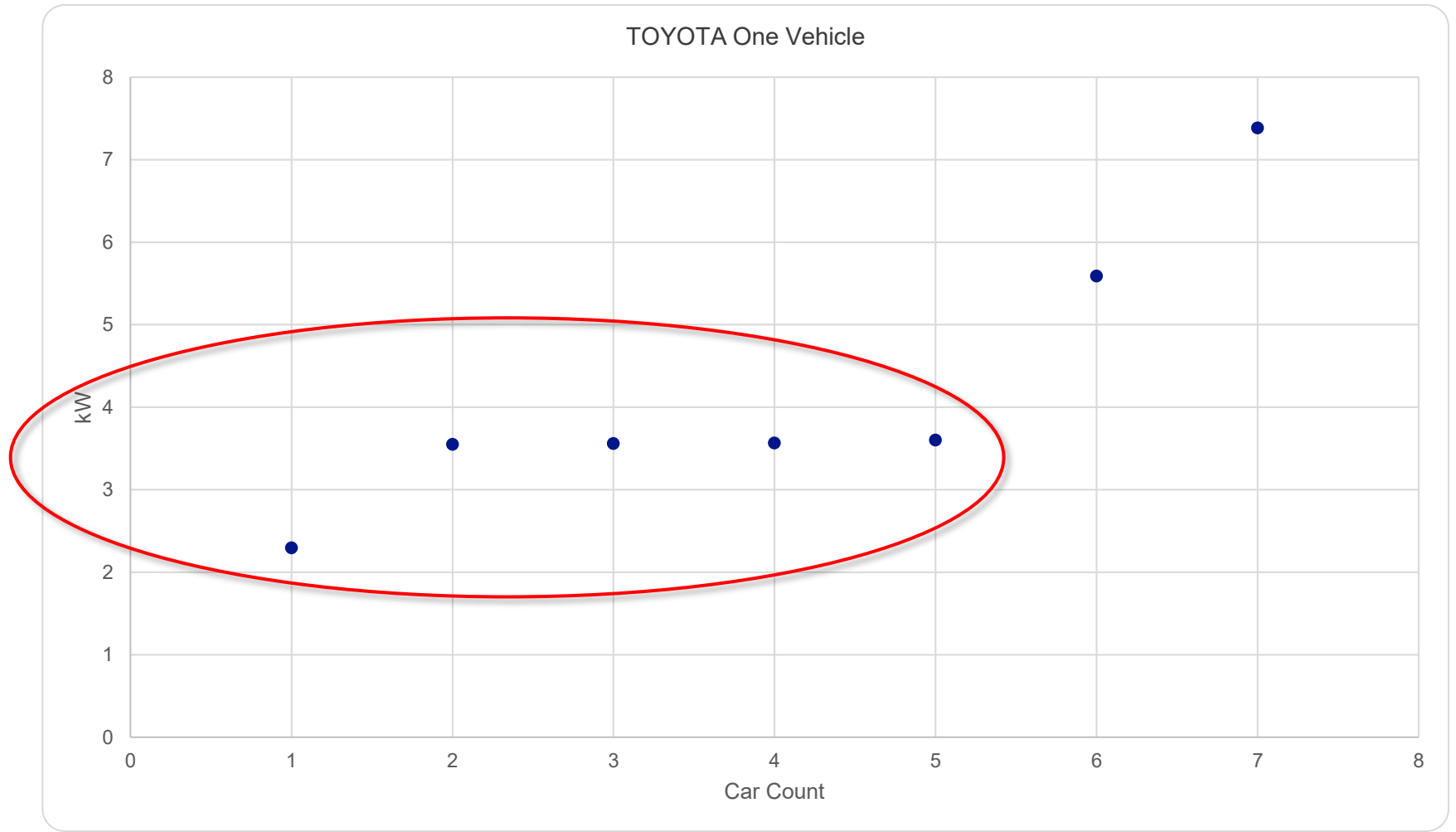
Toyota Max Demands



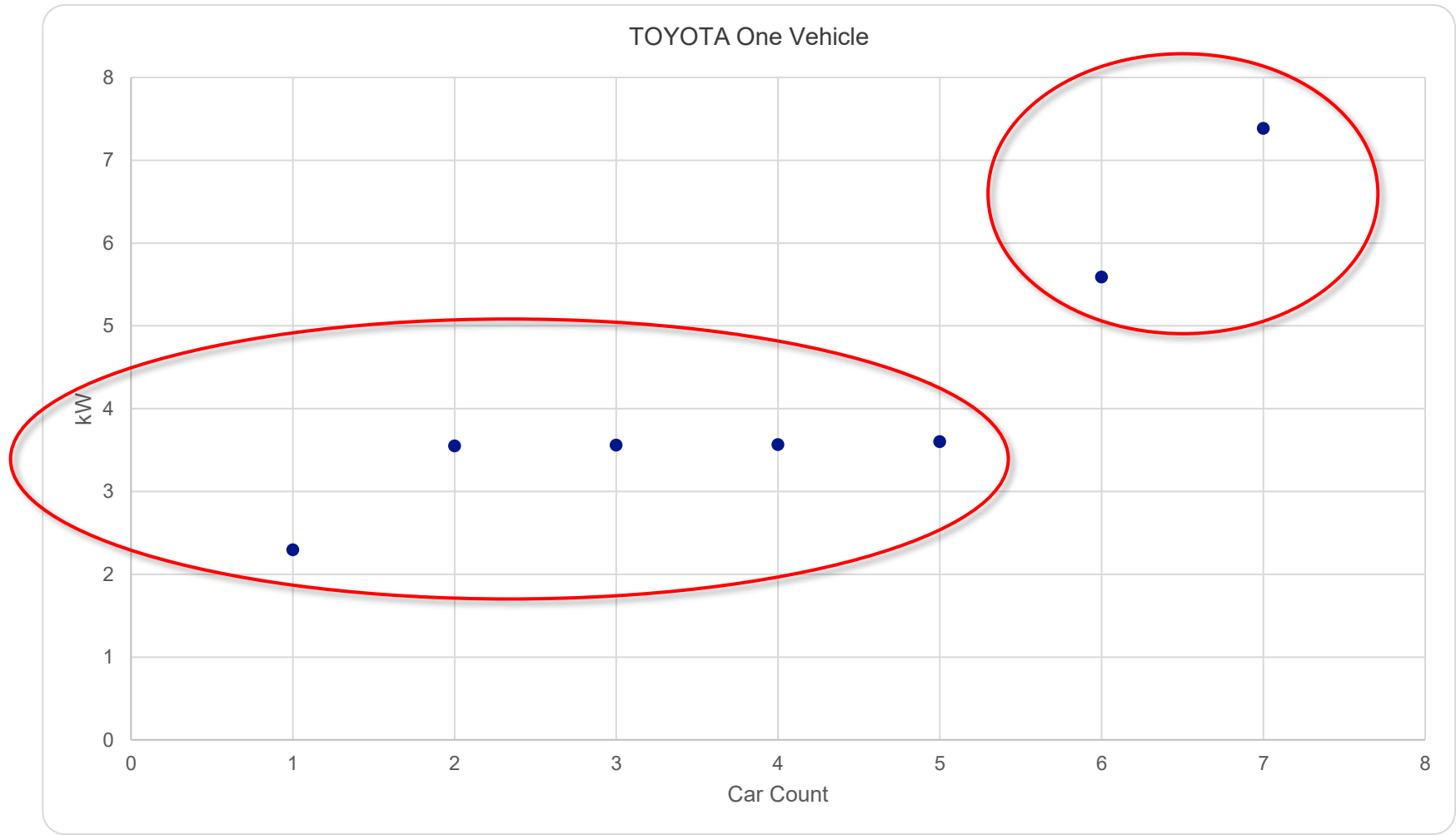
TOYOTA One Vehicle



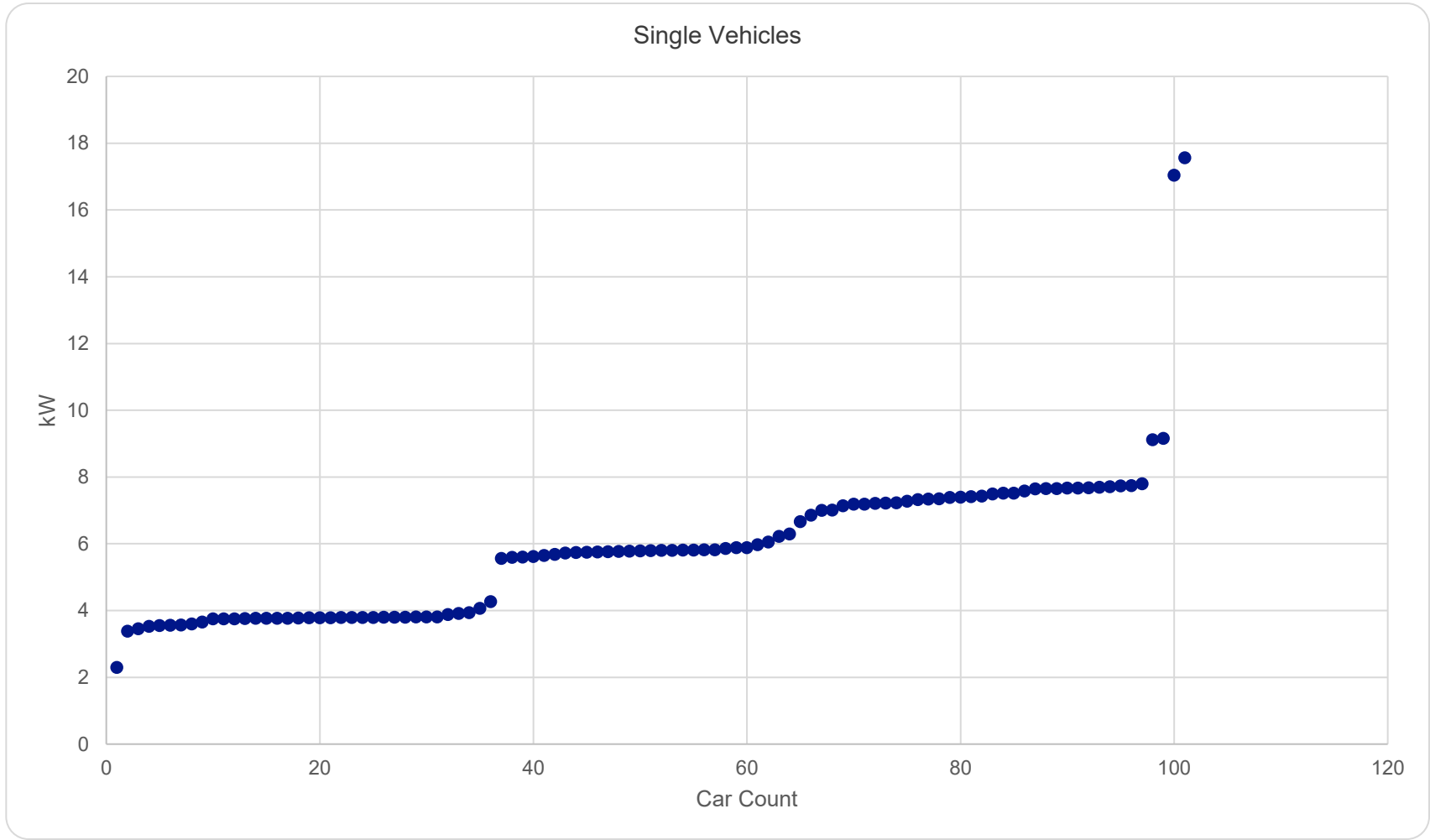
Toyota Max Demands



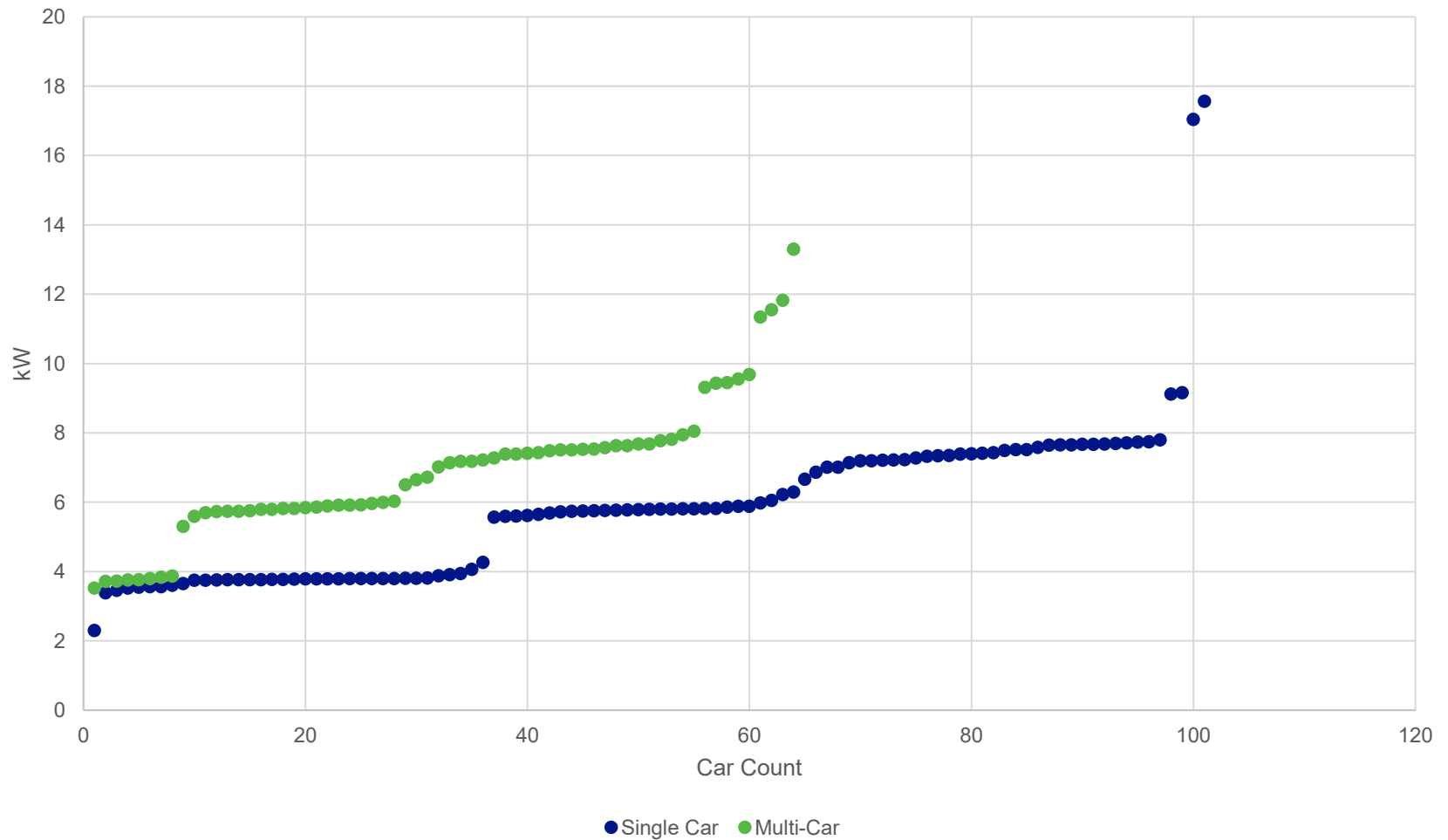
Toyota Max Demands



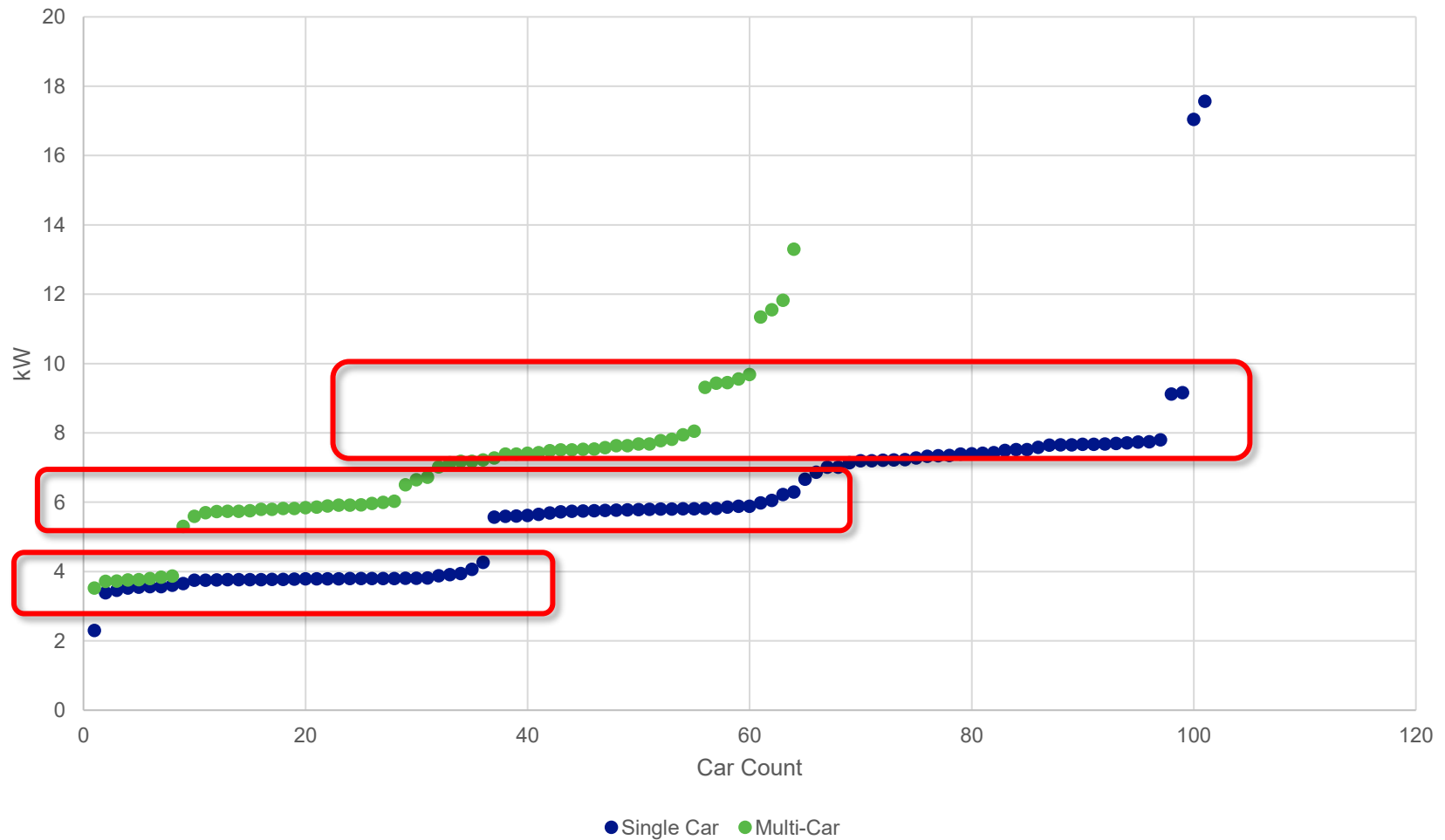
Single Car Max Demands Scatter Plot



Single Car vs Multi-Car Max Demand Scatter Plot



Single Car vs Multi-Car Max Demand Scatter Plot

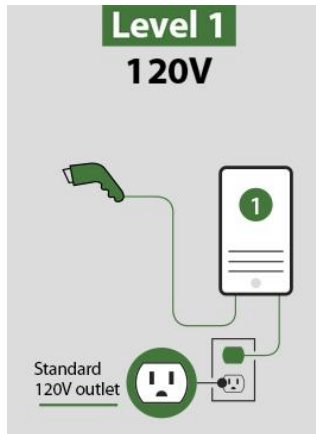


Car Manufacturer Provided Chargers

EV chargers that come with the car. Options of 120-volt or 220-volt

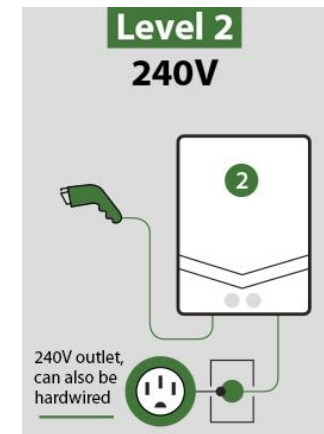


Battery and Charging Technology



EV/PHEV Make Battery Size:

1. Rivian Max (140 kWh)
2. Tesla (80 kWh)
3. Chevrolet Bolt (66 kWh)
4. Nissan Leaf S (62 kWh)
5. Toyota Prius Prime (13.6 kWh)



Level 1 Charging – Max Demand of
1.4 kW

Charger/Installation Cost: Free (Comes with Car)

Full Charging Times:

- Rivian Max: **100** hrs.
- Tesla Model 3: **57.14** hrs.
- Chevrolet Bolt: **47.14** hrs.
- Nissan Leaf: **44.29** hrs.
- Prius Prime: **9.71** hrs.

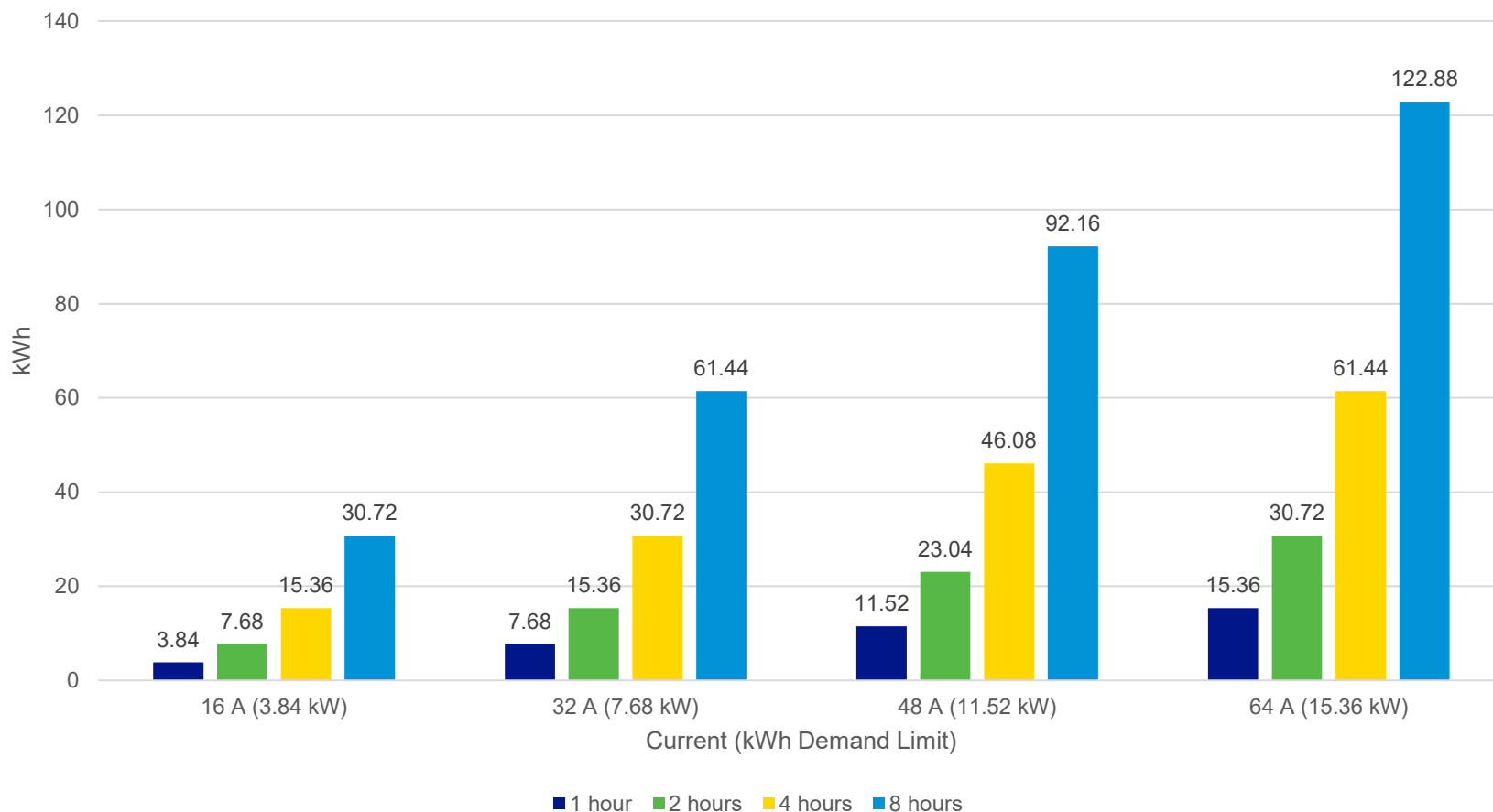
Level 2 Charging – Median Max Demand of
11.25 kWh (**3.3 kW** - **19.2 kW+**)

Charger + Installation Cost: (\$300 - \$500) + (\$1000 - \$2500)
Full Charging Times:

- Rivian Max: **12.44** hrs. (**42.42** hrs. – **7.29** hrs.)
- Tesla Model 3: **7.11** hrs. (**24.24** hrs. – **4.17** hrs.)
- Chevrolet Bolt: **5.87** hrs. (**20** hrs. – **3.44** hrs.)
- Nissan Leaf: **5.51** hrs. (**18.79** hrs. – **3.23** hrs.)
- Prius Prime: **1.21** hrs. (**4.12** hrs. – **43 mins**)

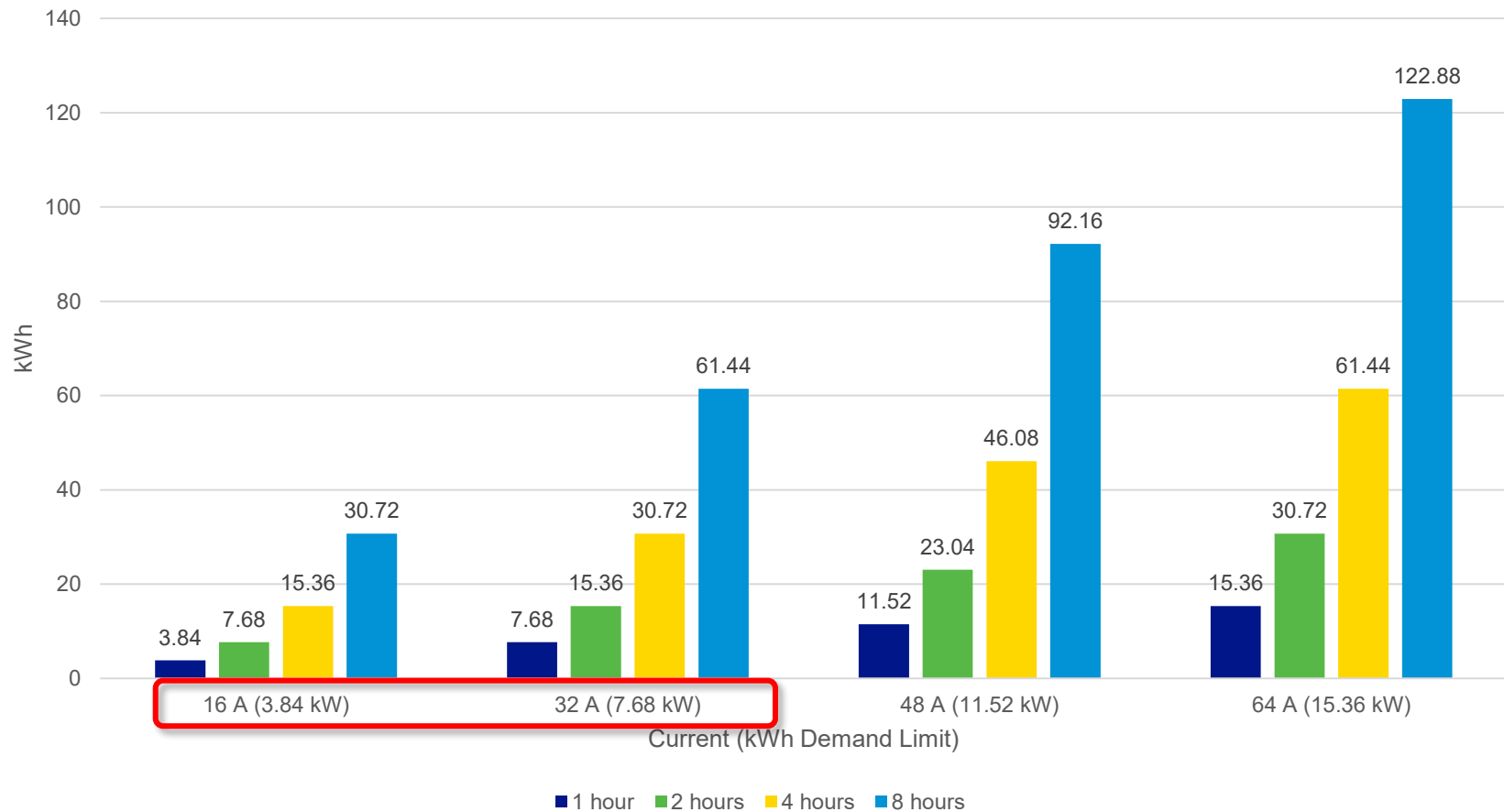
Charging Energy Output by Current and Session Duration

These reference levels assume **240 V** charging and approximate real power as **kW = Volts × Amps ÷ 1000**



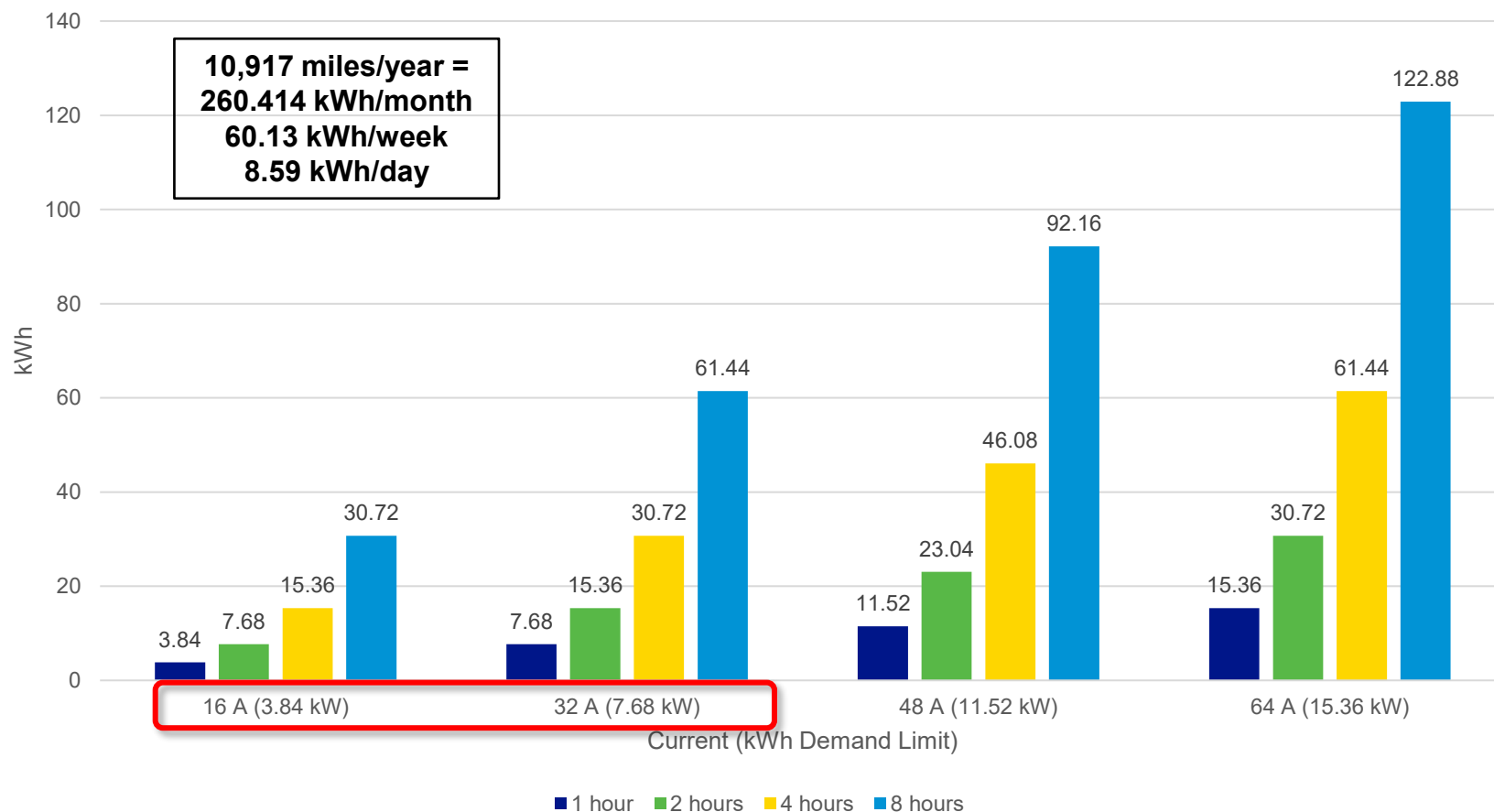
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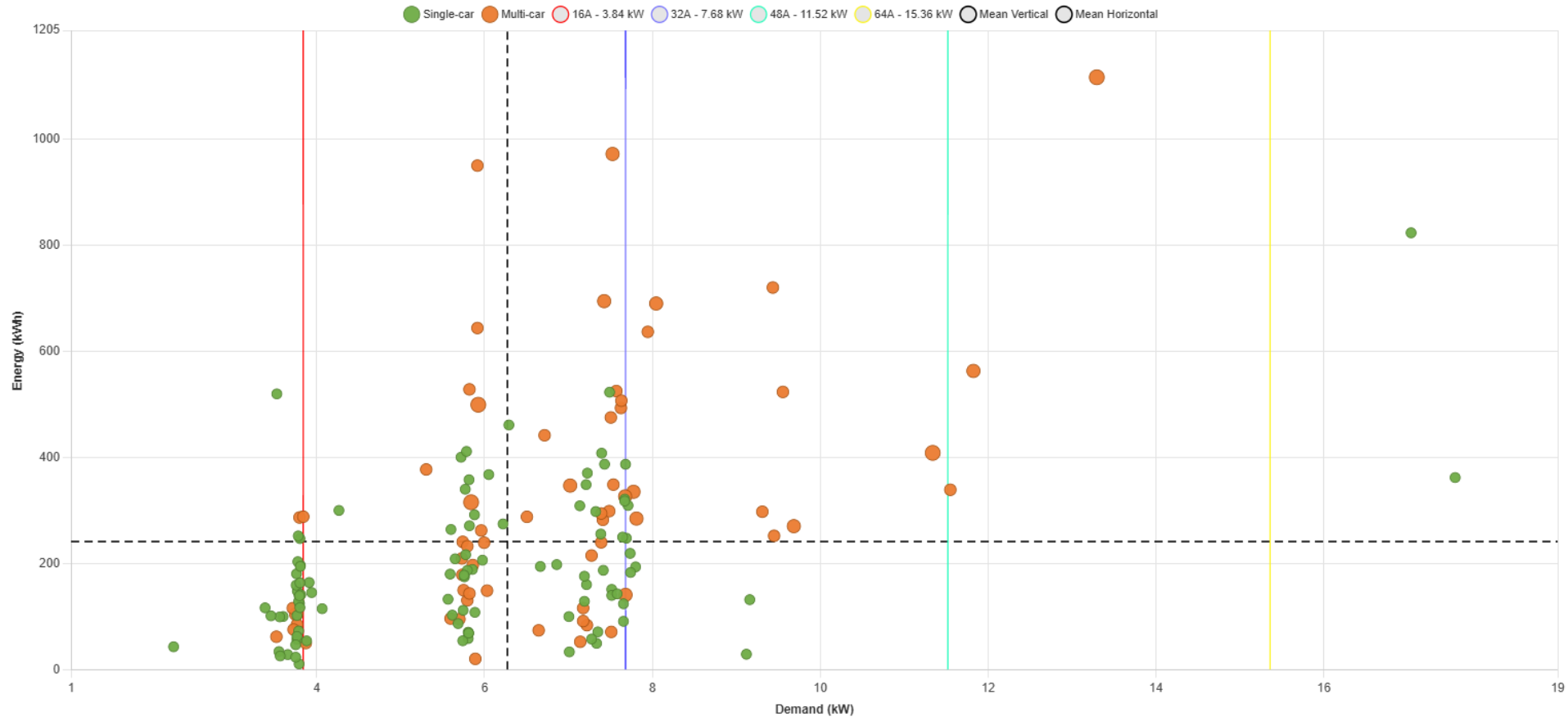


Charging Energy Output by Current and Session Duration

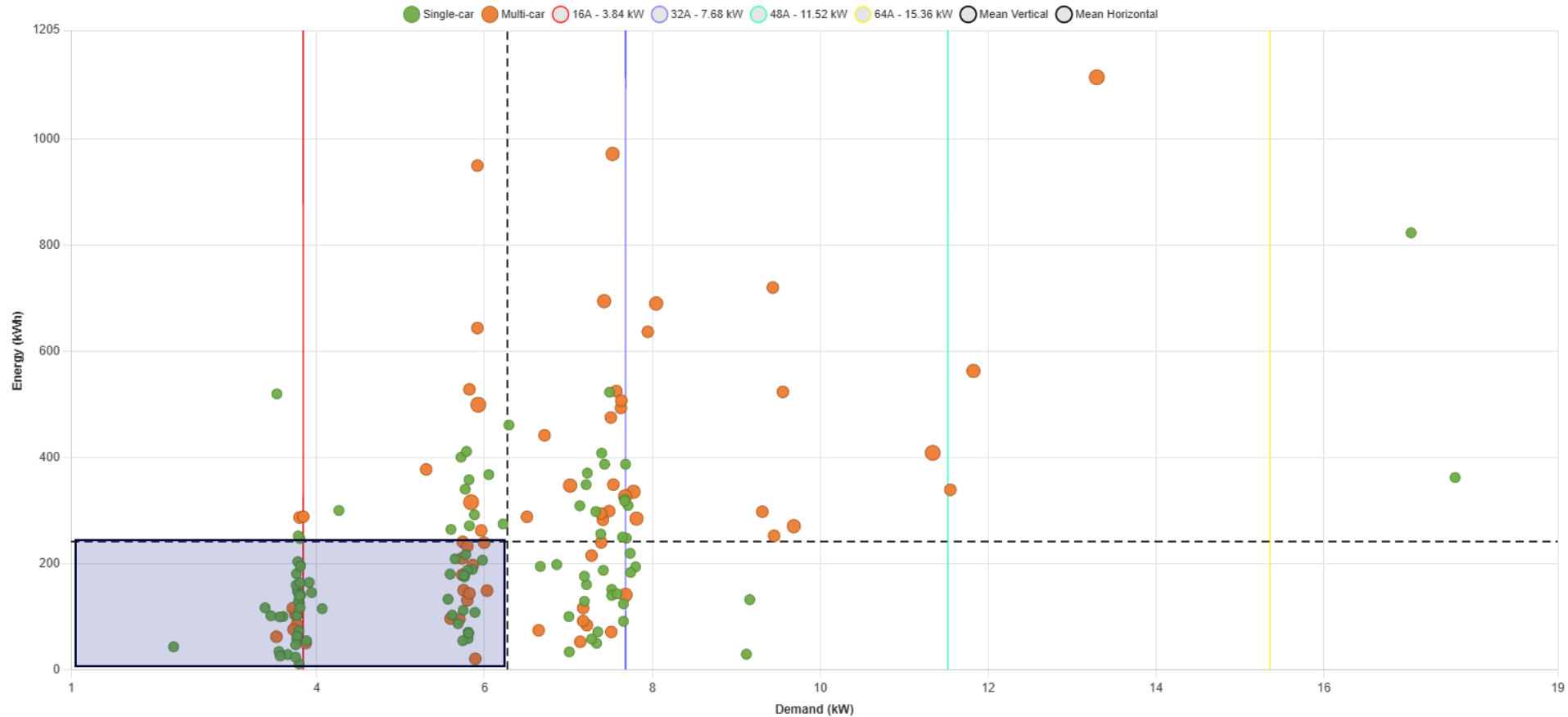
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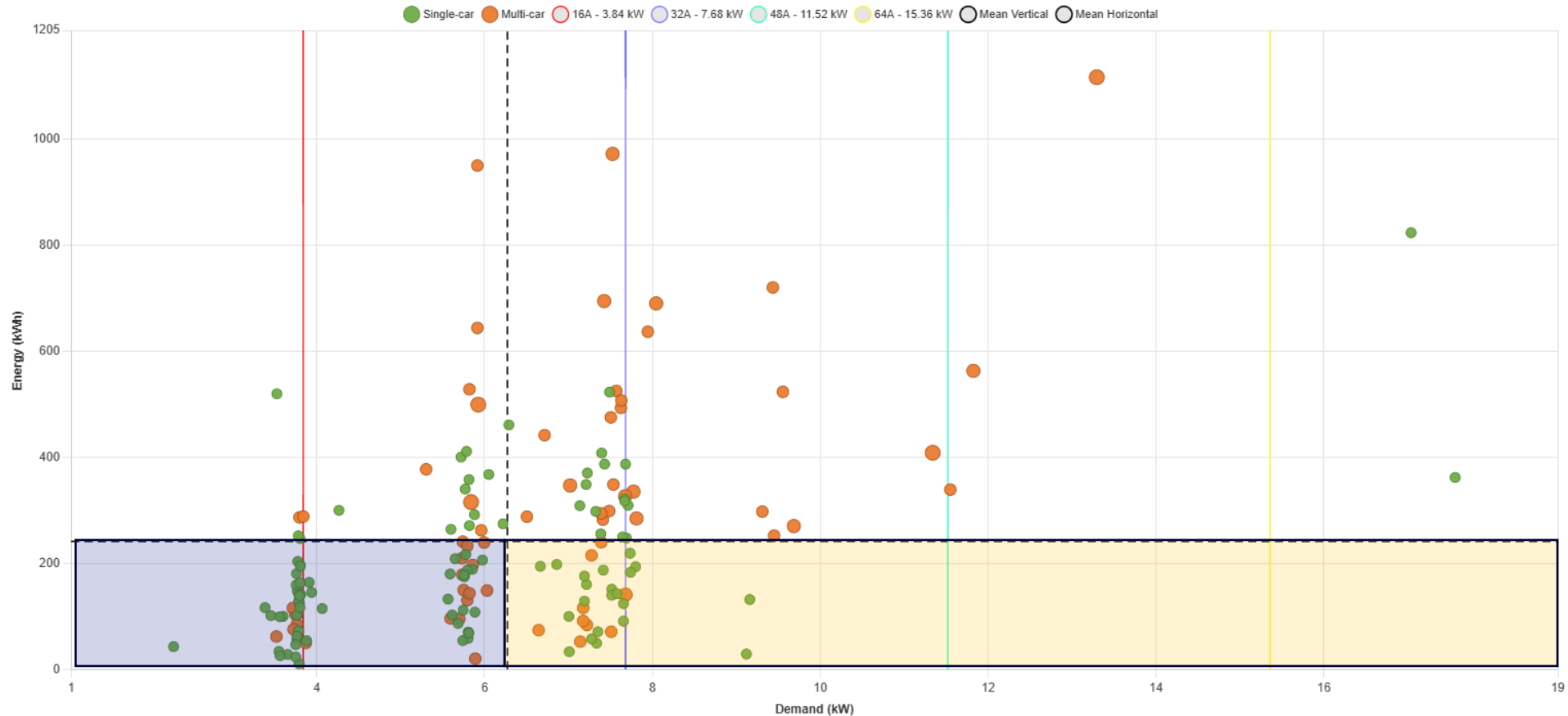
Max Demand vs Monthly Energy Scatter Plot



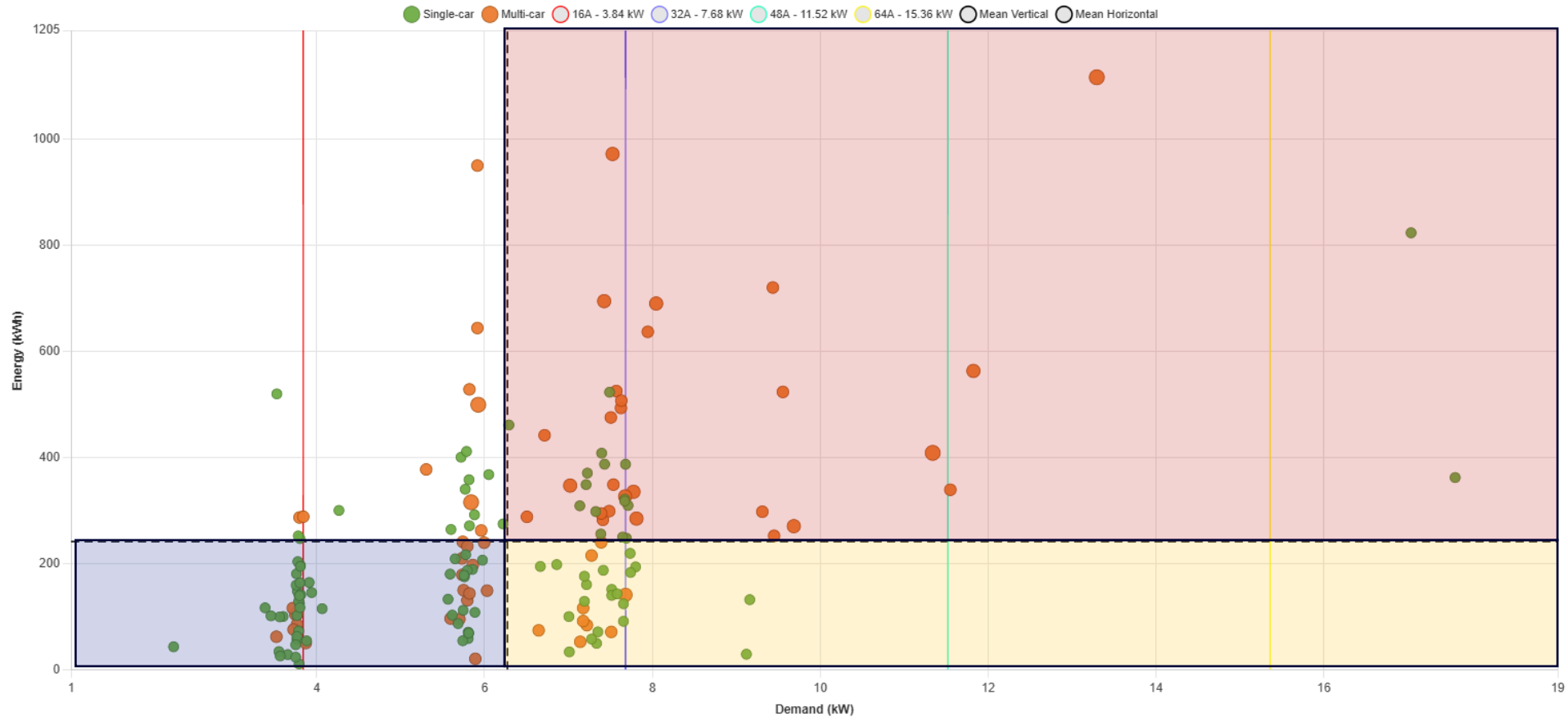
Max Demand vs Monthly Energy Quadrants



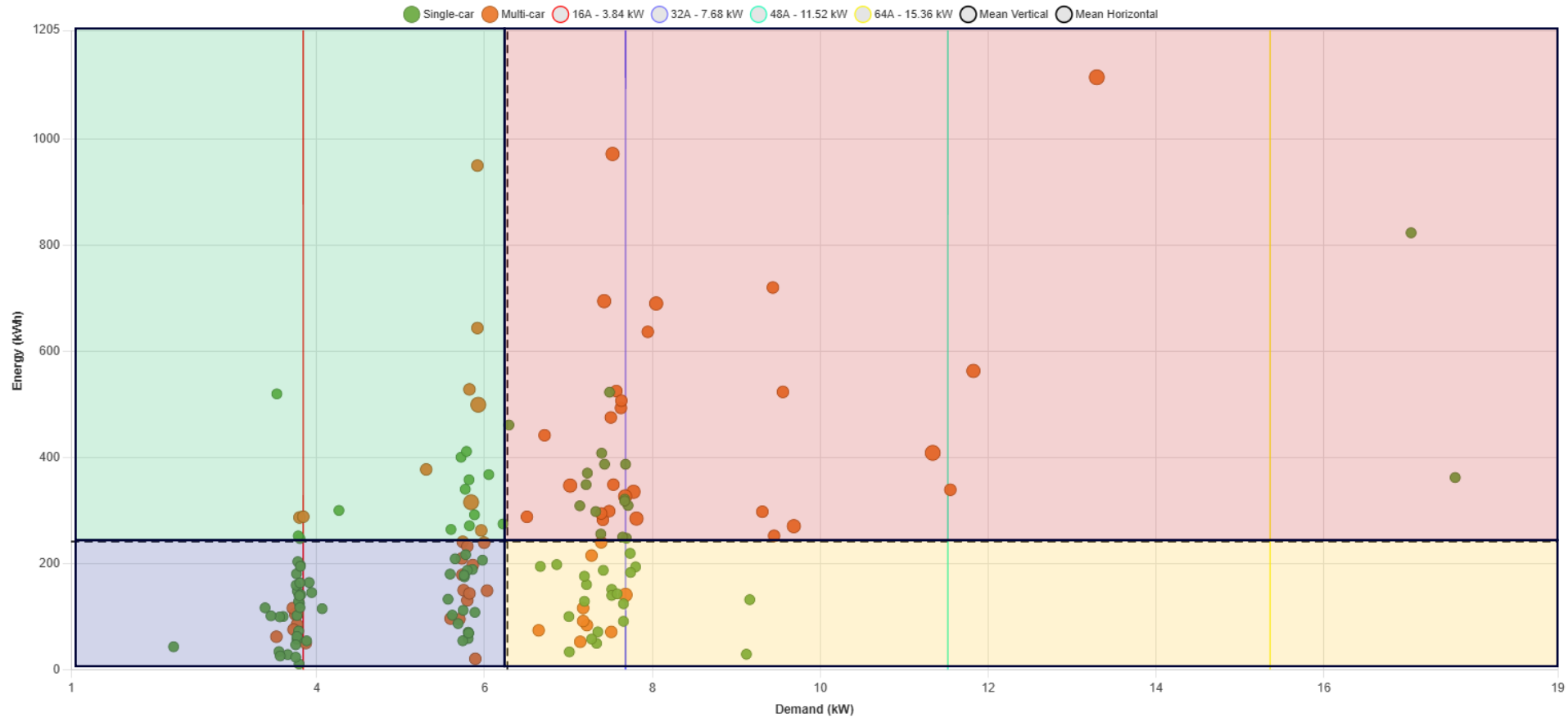
Max Demand vs Monthly Energy Quadrants



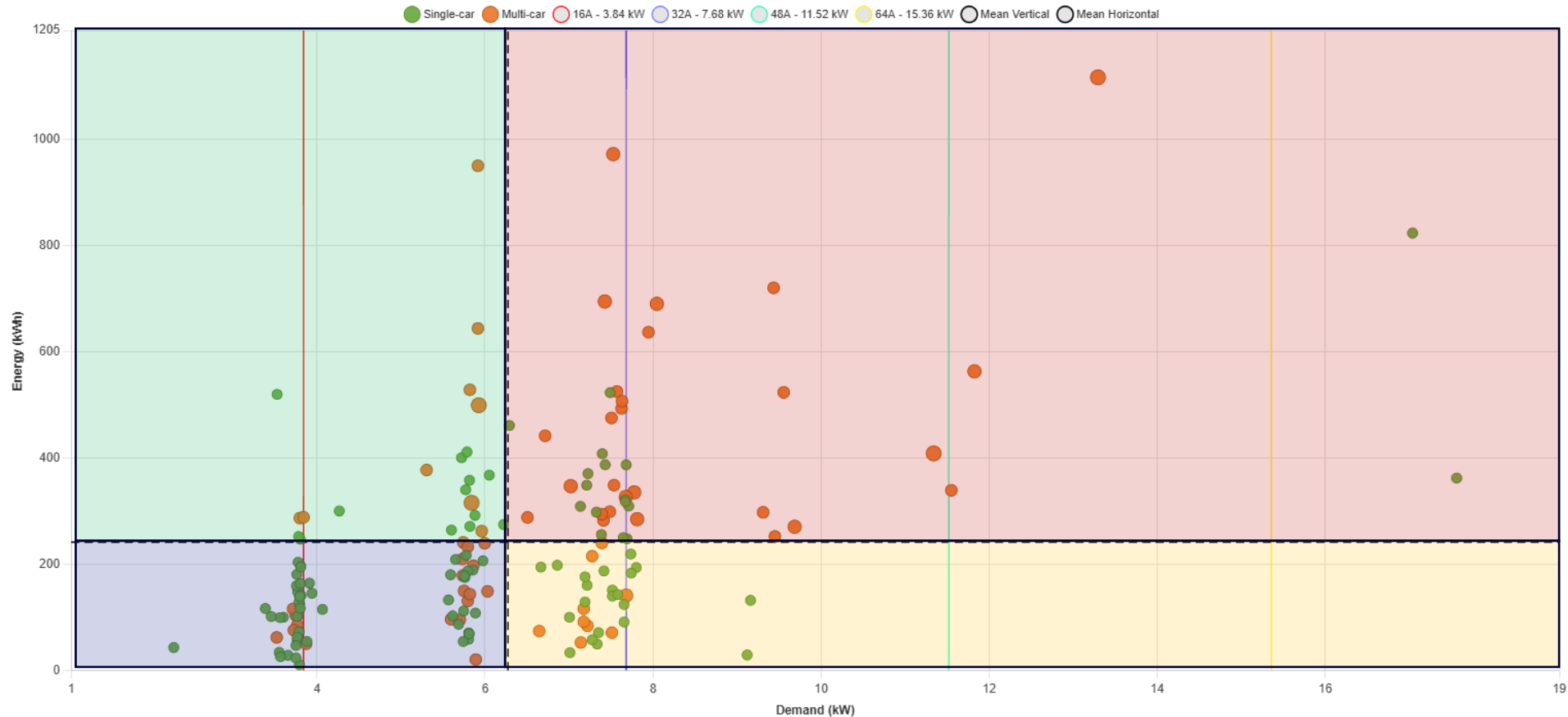
Max Demand vs Monthly Energy Quadrants



Max Demand vs Monthly Energy Quadrants

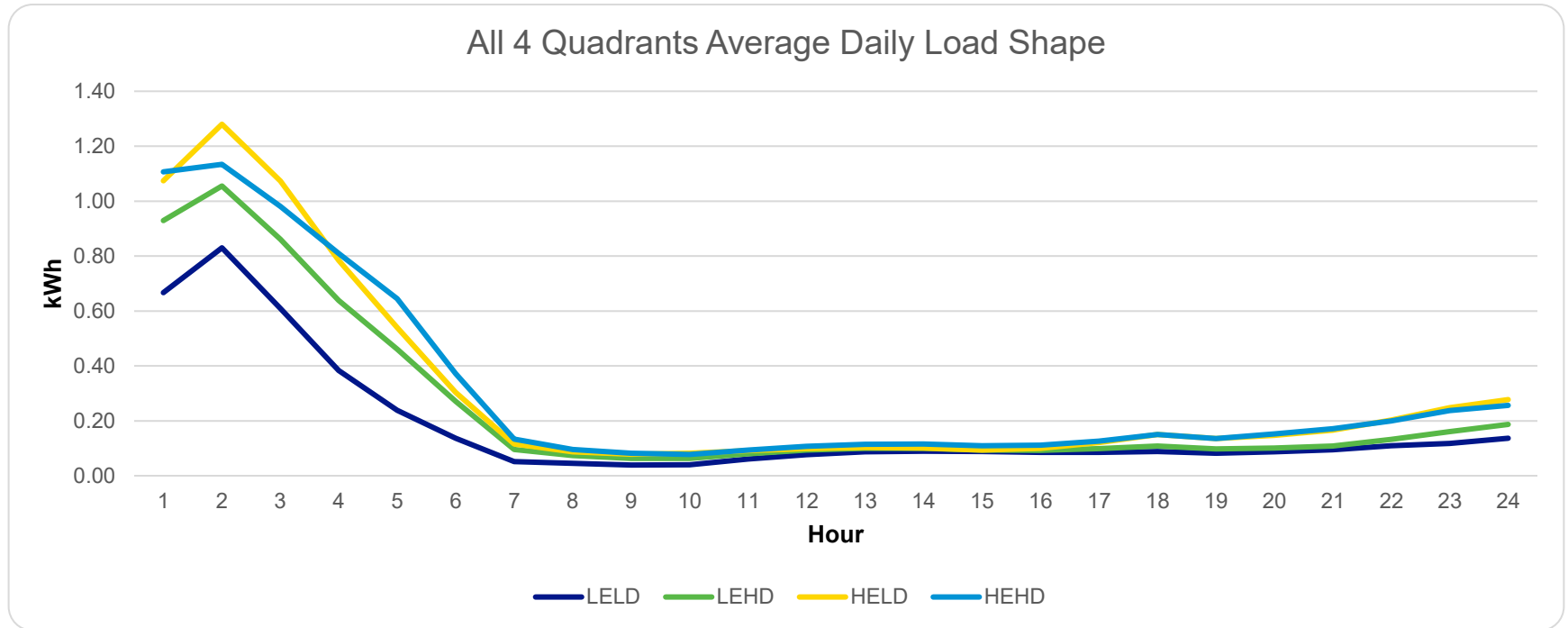


Max Demand vs Monthly Energy Quadrants



Demand \approx Car Make/EV Charger Energy \approx Customer Behavior

Load Shapes For All 4 Quadrants (Single Car Only)



	LELD	LEHD	HELD	HEHD	AVERAGE
DAILY TOTAL	4.33	6.06	7.45	7.52	6.34
MONTHLY TOTAL	131.15	183.65	225.85	227.76	192.11
			HE Average: 226.81		

Blind Spots



Public Charging



Multi-Car Identification



Population-Represented
Sample



DMV Registration Data Match

Next Steps

