



Use and Siting of Electric Vehicle Charging Stations in Juneau, Alaska

Robin Steuteville, Ranjit R. Desai, and Anne E. Corrigan

National Laboratory of the Rockies

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Technical Report
NLR/TP-5400-100007
June 2026

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List of Acronyms

AELP	Alaska Electric Light & Power Company
EV	electric vehicle
JUMP	Juneau Upgrades to Modernized Power
MMFH	manufactured and multifamily housing
kWh	Kilowatt-hour

Executive Summary

This report details trends of electric vehicle (EV) charging in Juneau, Alaska and delivers early findings for the optimal locations of new chargers to serve residents of manufactured and multifamily housing (MMFH). Electrical meter data of Level 2 EV chargers from six public charging stations over five years and 250 residential chargers over two years were analyzed to evaluate existing demand patterns, and a composite score was created to identify optimal locations for future charging stations that target residents of MMFH in Juneau.

Public charging station use is very location-dependent, with three chargers, including a charger near residential housing, in use more than 60% of days during the peak hour of the day (which ranges from 10 a.m. to 7 p.m.) illuminating potential need for additional public chargers in those areas. Residential charger use typically occurs overnight—opposite to most public charging stations—and spikes after 10 p.m. This suggests that Alaska Electric Light & Power's (AELP) time-of-use charging program, which lowers electricity rates at 10 p.m. to incentivize overnight charging, is very effective. Residential charging data also shows that households tend to charge 15.5 hours per week, or 9.3% of the time, meaning that multiple households could likely share one charger if available near MMFH locations. This fact is supported by residential charging session analysis, which shows that the median household has around 1.6 night charging sessions per week. The EV siting analysis found optimal locations for new EV chargers to serve MMFH based on high housing density, low access to public chargers, and unconstrained electrical feeders. A cluster of MMFH parcels in Douglas demonstrated the highest composite scores considering all factors—the only area to have a perfect score of 2.25. With this information, AELP may anticipate loads associated with EV charging and effectively target areas to expand charging access for MMFH residents.

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1 Introduction

Juneau, Alaska, a city of approximately 32,000 (www.census.gov 2026) residents, can be accessed only by boat or plane—there are no roads connecting Alaska’s capital city to other towns. Alaska Electric Light & Power Company (AELP), the local electric utility, delivers electricity to the grid from five hydropower plants. Considering the relatively low electricity rates but high imported fuel costs, programs exist that support adoption of certain electric appliances, including air source heat pumps (ASHPs) and electric vehicles (EVs) (AELP 2026; U.S. EIA 2026). From 2014 to 2024, the percent of Juneau vehicle registrations that are EVs has increased from 0.04% to 3.4% (Experian 2025). However, technology adoption and programs that support it are most underutilized by residents of manufactured and multifamily homes (MMFH) due to limited access to funds, infrastructure that lies outside of their control, and complex ownership or governance relationships. The Juneau project of the U.S. Department of Energy’s Energy Technology Innovation Partnership Project (ETIPP) program aims to estimate potential impacts of technology adoption and evaluate the circumstances within MMFH.

The ETIPP project, titled Juneau Upgrades to Modernized Power in manufactured and multifamily housing and known as JUMP, is led by the National Laboratory of the Rockies (NLR) with objectives, guidance, and data provided by AELP. The JUMP project includes analysis of energy consumption and demand before and after heat pump installation in real Juneau homes, building modeling to estimate widespread heat pump adoption for different MMFH building types, and an assessment of current EV utilization and potential siting for new chargers. Community engagement and subsequent qualitative analysis support the research by investigating community insights around technology adoption in MMFH. This suite of analyses aims to effectively inform AELP program development by reporting findings for present and future scenarios and evaluating multiple technologies under a single project umbrella. Partner organizations—including Renewable Energy Alaska Project (REAP), the ETIPP Alaska regional partner, Alaska Heat Smart (AHS) and Information Insights (ii)—supported the ETIPP project through project ideation, data collection, community engagement, and implementation brainstorming. JUMP project results beyond this report can be located through the NLR publications database.

This report details trends of electric vehicle (EV) charging in Juneau, Alaska and delivers early findings for the optimal locations of new chargers to serve residents of manufactured and multifamily housing (MMFH). Electrical meter data of Level 2 EV chargers (i.e., AC power level delivering 3kW to 19.2 kW) from six public charging stations over five years and 250 residential chargers over two years were analyzed to evaluate existing demand patterns, and a composite score was created to identify optimal locations for future charging stations that target residents of MMFH in Juneau.

2 Data and Methods

2.1 Data Cleaning and Preparation

2.1.1 Public Charging Station Data

Electrical meter data from six public charging stations (Level 2 EV chargers: AC power level delivering 3kW to 19.2 kW) in Juneau were cleaned, prepared, and analyzed to understand trends in public charging station use. The analysis included data for July 2020 through April 2025, although not all stations had data for the entire time period. While other public charging stations exist across Juneau, they were not included if there was no independent meter data available (e.g. electrical use from the charger was combined with the building or other circuits). The data were provided directly to NLR by AELP.

Reading errors, data anomalies (such as negative kWh usage), and duplicate readings were removed during data cleaning. Where there were multiple readings for a specific time period, non-estimated readings and nonzero readings were chosen over estimated readings or readings that showed no usage. If there were still multiple conflicting readings after removing lower-quality data, readings for that time period were excluded.

2.1.2 Residential Charging Data

Electrical meter data from 250 residential chargers (Level 2) in Juneau were cleaned, prepared and analyzed from June 2023 through May 2025 to identify trends in home charging. The dataset was provided by AELP from households registered in AELP's time-of-use rate program and underwent a rigorous cleaning process. To ensure data quality and consistency, records with negative or null kWh utilization were eliminated. Subsequently, the hourly time-series data were validated; if any address had missing or negative kWh utilization values for any hour on a particular date, the complete set of data for that address on that date was expunged from the dataset. Finally, all commercial locations were removed, homing analysis on residential sites. This filtering reduced the total number of unique addresses from 261 to 250.

After cleaning the data, a variable for approximate charging sessions was generated, a feature that is not present in the original AELP data. For this analysis, a session is defined as any period of consecutive hours where nonzero kWh utilization was recorded, assuming this represented a continuous charging event. Session *start* and *end* times, as well as total kWh utilization for the session, were then saved as a separate session data frame, amounting to 17,325 sessions. To better understand the difference between night and day charging sessions, sessions were split into two categories: Night starts between 12 p.m. and 3 a.m. ending before 12 p.m. the next day, and Day includes all other sessions.

2.1.3 Geospatial Data

Geospatial data was cleaned and joined to compile the necessary parameters to calculate a composite score to evaluate EV charging station siting for each MMFH housing location in the Juneau area. The City and Borough of Juneau provided parcel shapefiles with the number of units and the land use type for land parcels in the Juneau area. For analysis, the parcel data was filtered to include only MMFH property types: condominiums, apartment buildings, mobile homes, fourplexes, triplexes, duplexes, and townhouses, resulting in 1,927 parcels which were

considered as potential EV charger locations. Separately, the parcel data was used to calculate all residential parcels near each MMFH housing location/ potential charger site. The parcel data were also checked for discrepancies, such as cases where parcels with known units were marked as having zero units, which was the case for some condominium and apartment buildings. In these cases, newer condominium and apartment building data were applied with the older data to fill gaps. Geospatial data for streets, public charging station locations, and utility grid feeder areas were also cleaned and joined before analysis.

2.2 Composite Score Analysis

A *composite score* using several factors identifies the ideal placements for future public charging stations that serve MMFH. The goal was to find MMFH housing areas of high density where there was currently minimal to no access to public chargers and where chargers could be easily added with little to no local feeder constraints. The composite score included three components: distance to the nearest public charger, number of units within a quarter-mile radius, and feeder constraint rating (feeders were ranked as unconstrained, moderately constrained, or constrained). Ultimately, every MMFH location across Juneau was assigned a score for each component and for two composite scores (combining multiple components).

Component values were normalized from 0 to 1 using the identified benchmark values and weighted based on their importance to siting, which was determined with input from AELP. See Equation (1) to calculate the composite score:

$$\text{Composite score} = \min\left(d/d_b, 1\right) + \min(u/u_b, 1) + f * f_w \quad (1)$$

where:

d = distance to nearest charger

d_b = 5 miles, benchmark distance to nearest charger

u = number of units within a 0.25-mile radius

u_b = 400 units, benchmark number of units within a 0.25-mile radius

f = feeder score

f_w = 0.25, feeder score weight (other elements have a weight of 1.0).

Using the road network, the distance to the nearest public charger from each MMFH parcel was calculated. MMFH locations with greater distance values were preferable as they highlight greater need for an EV charger. A benchmark distance of 5 miles was set, so that all MMFH locations more than 5 miles from a public charger were assigned a score of one, and locations less than 5 miles from the nearest public charger received a score between zero and one, depending on the distance. In other words, beyond 5 miles, all locations have equally no access to a public charger; within a radius of less than 5 miles, EV charger access improves as distance decreases.

Note that 5 miles is much farther than would be ideal or practical for at-home charging purposes, with a quarter mile, which is used as the radius for calculating the number of nearby units, being more reasonable; however, the goal was to understand the variance between MMFH locations and identify locations with the greatest need. Recognizing that very few MMFH locations in the

Juneau area have access to a public charger within a quarter-mile radius, it was necessary to expand that radius to provide results with greater resolution and that could distinguish between locations even when both locations had no charging station access within a reasonable home-charging distance.

To represent the number of households potentially served by the charger, the number of housing units within a quarter mile of each MMFH location were summed. A greater number of units is optimal because it reflects charging access for more people. The benchmark number of units was set at 400, meaning that MMFH locations with at least 400 units within a quarter-mile radius received a unit access score of one, whereas locations with fewer than 400 units nearby were given a lower unit access score. The unit access score was calculated in two ways: 1) sum of units in all residential buildings, and 2) sum of units within MMFH buildings only. These two versions of household access were each carried through to the composite score, so two component scores were calculated for all MMFH/potential EV charger locations. Table 1 lays out this distinction alongside component values for each composite score. Because the MMFH unit access score comes from data that are a subset of all residential units, it is inherently a lower value and resulted in a lower overall composite score. The composite score using all residential units enabled identification of a wider variety of potential optimal locations, whereas the composite score using only MMFH units identified fewer, more precise locations because of the lower value it provided.

Each MMFH location was assigned one of three values for the feeder score based on how constrained the local feeder was: 1 (unconstrained), 0.5 (moderately constrained), or 0 (constrained). Because the feeder location was a less precise measurement, with each feeder covering a large portion of units, and was of lower concern according to AELP, this component received a lower weight than the other two components. At present, the grid does not face constraint concerns, but analysis delivers long-term insight. The final feeder score was multiplied by 0.25, giving it a quarter of the weight of the other values.

Table 1.

Composite Score A (max total = 2.25)		Composite Score B (max total = 2.25)	
<i>Component</i>	<i>Max value</i>	<i>Component</i>	<i>Max value</i>
Distance to nearest public charger	1	Distance to nearest public charger	1
Number of all residential units within a quarter-mile radius	1	Number of MMFH units within a quarter-mile radius	1
Feeder score	0.25	Feeder score	0.25

The composite score was the sum of the distance to the nearest charger score, the unit access score, and the feeder score for a total ranging from 0 and 2.25. Higher scores indicate optimal

MMFH locations for new EV chargers, whereas lower scores mean that a location is less preferred. The composite score provides information that no single metric could easily show because a single weighted combined value allows for the easy identification of areas where all requirements are met. Its simplicity allows it to be replicated or updated as needed, with the benchmark values for each metric and the relative weights all easily adjusted.

3 Results

3.1 Utilization Analysis

3.1.1 *Public Charging Station Utilization Analysis*

Trends in usage by time of day were analyzed for each public charging station in the dataset. Figure 1 shows the average hourly kWh utilization for each charging station, split by weekday and weekend. Figure 2 shows the percentage of days each charger was in use, by hour. These results show that location plays a large role in utilization behavior, with behaviors significantly varying by location. Notably, the Basin Road station, which is located among residential housing in the downtown area, is most likely to see overnight charging, signaling that it could be used by residents as an alternative to home charging. Also, some chargers (Twin Lakes and Harris Harbor) had higher weekday utilization, whereas others (Eaglecrest and Eagle Valley Center) had more weekend utilization, showing that weekday versus weekend usage also changes by location. Twin Lakes, Basin Road, and Eaglecrest are all used frequently, with the chargers in use more than 60% of the time during the peak hour of the day for each station (which varies widely from one station to another, from 10 a.m. to 7 p.m.). Frequent usage, especially at the Basin Road location, highlights that there could be an additional need for chargers, including in residential areas.

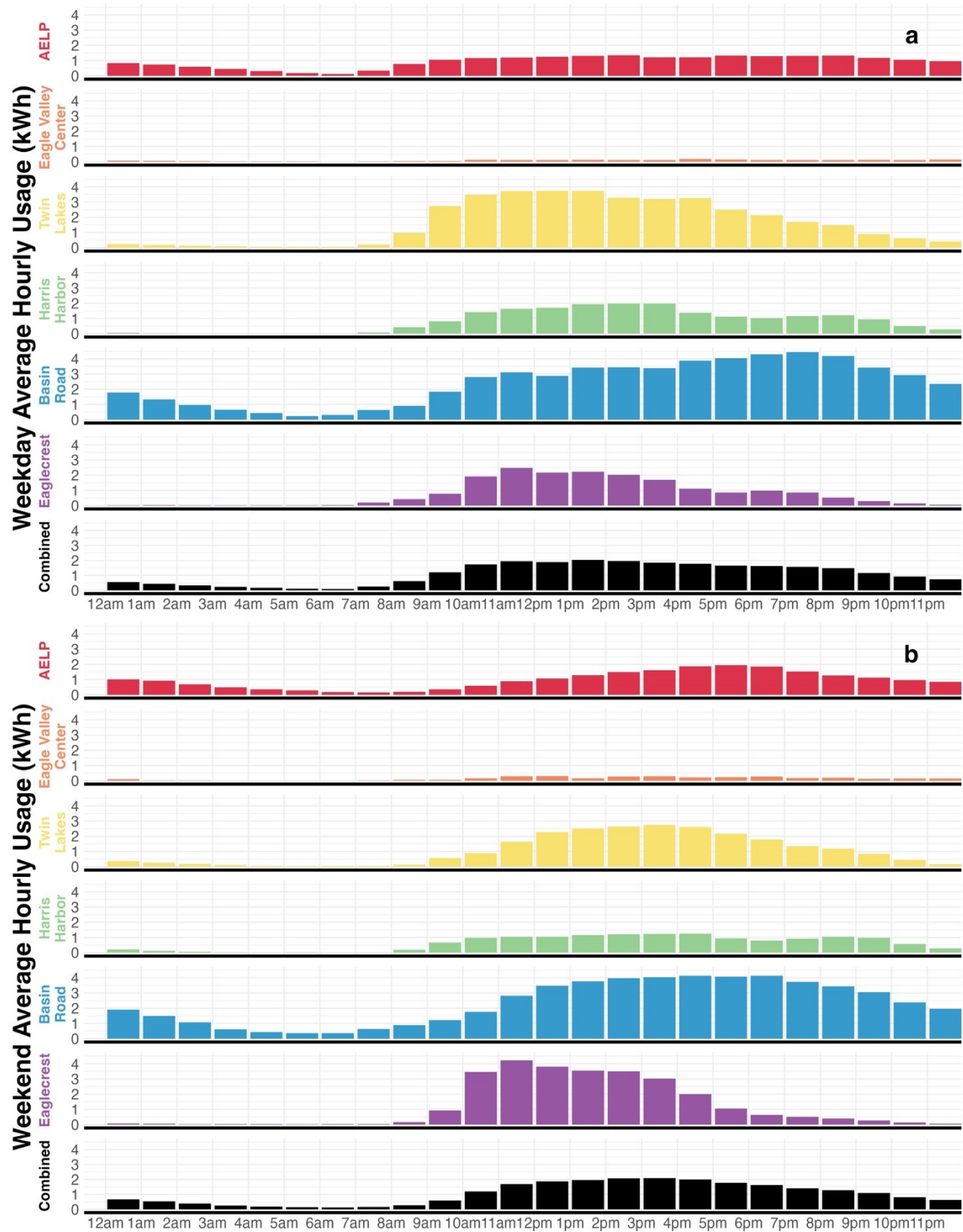
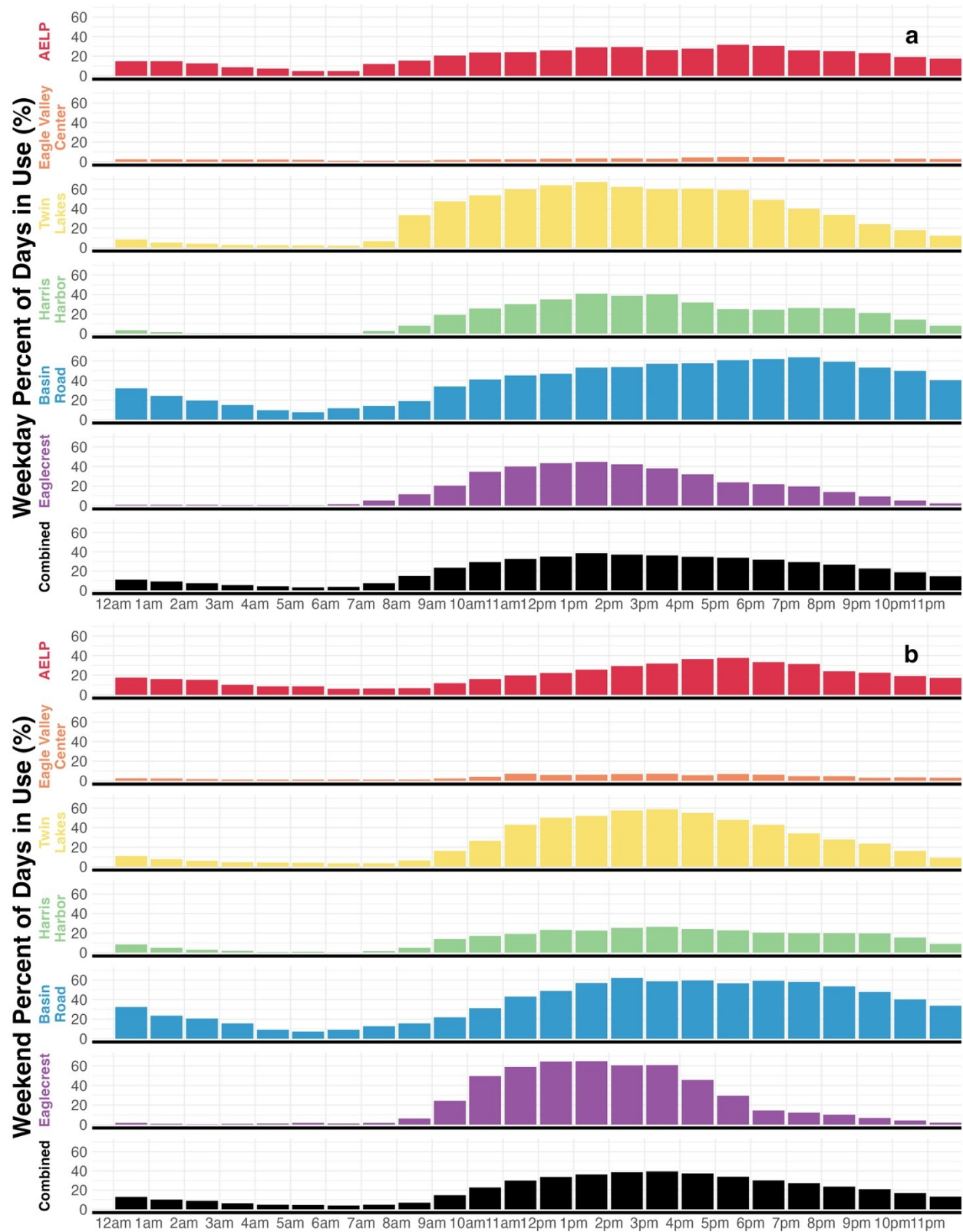


Figure 1. (a) Weekday average hourly utilization, in kWh, for each public station in the dataset. (b) Weekend average hourly utilization, in kWh, for each public station in the dataset.



3.1.2 Residential Charger Utilization Analysis

Residential (home) charger use was also studied in Juneau. Note that this analysis focuses on households with at-home charging, and MMFH is not represented in this data. Given the lack of access to chargers for MMFH households, and therefore the lack of data on how those chargers might be used, this is the best data available to estimate how public chargers might be used if they were provided as an alternative to home charging for MMFH housing locations. It is possible, however, that utilization will be different for the MMFH population.

Figure 3 and Figure 4 show average hourly kWh usage by month and day of the week, respectively, whereas Figure 5 shows average daily kWh usage over time. In all cases, most charging happens overnight, with a clear increase in utilization at 10 p.m. for all days of the week and all months. AELP uses a lower electricity rate to encourage people to charge after 10 p.m., and these results suggest that this is an effective incentive.

From these results, it is possible to identify which months and days have the highest kWh utilization. February has notably more usage on average than any other month, possibly because of cold temperatures draining batteries more quickly. Tuesday and Thursday evenings show the highest usage of the days of the week, whereas Sunday has the lowest average utilization. Notably, there has been hardly any increase in average daily kWh utilization by households during the 2-year time frame these data cover, apart from seasonal variation.

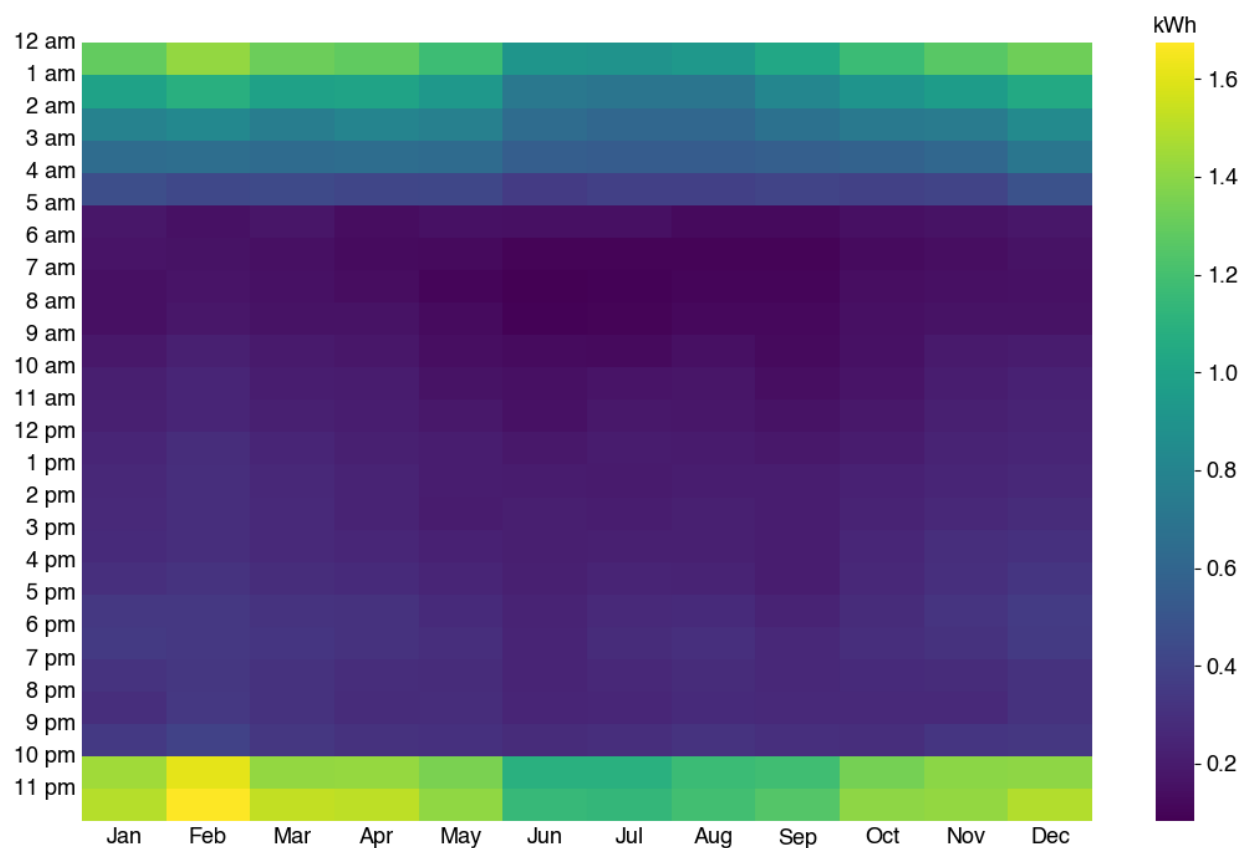


Figure 3. Average kWh usage by month and hour of the day for residential chargers from June 2023 through May 2025

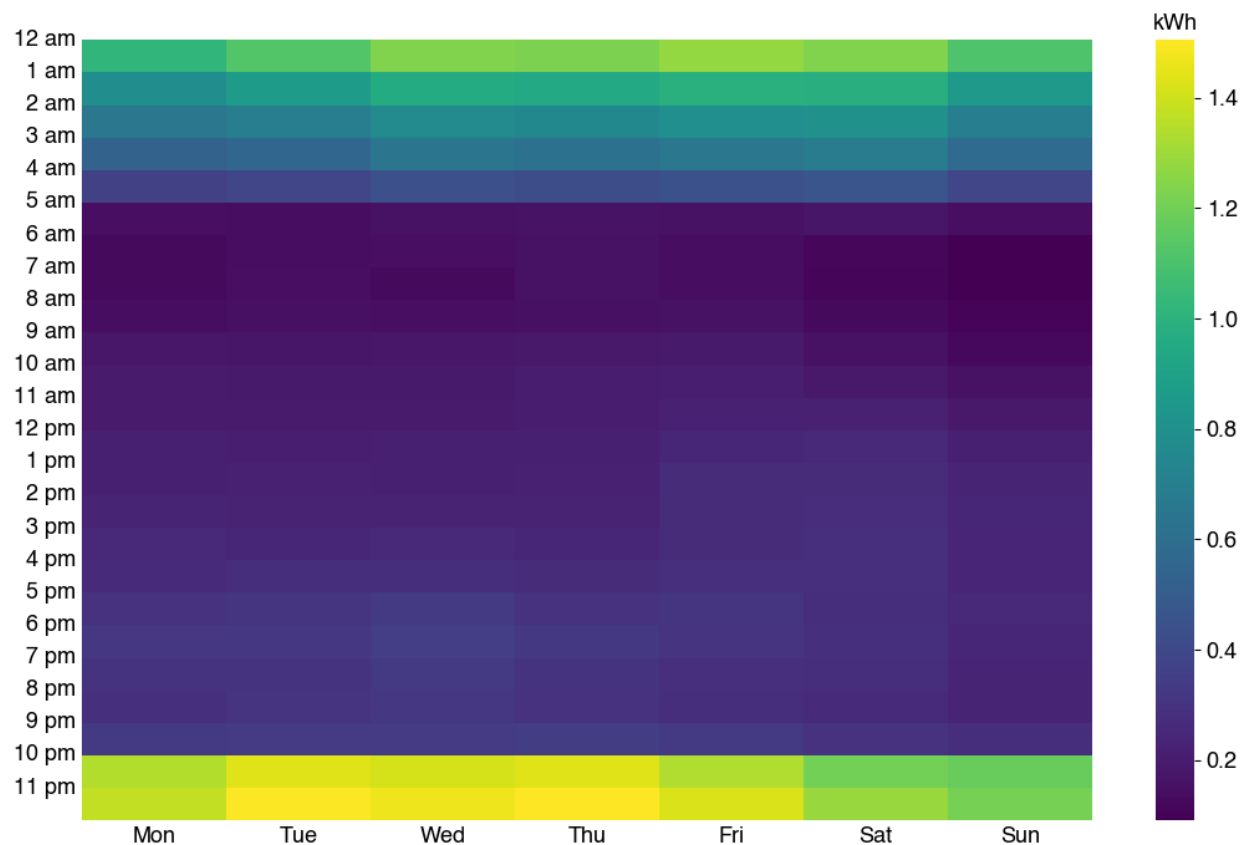


Figure 4. Average kWh usage by day of the week and hour of the day for residential chargers from June 2023 through May 2025

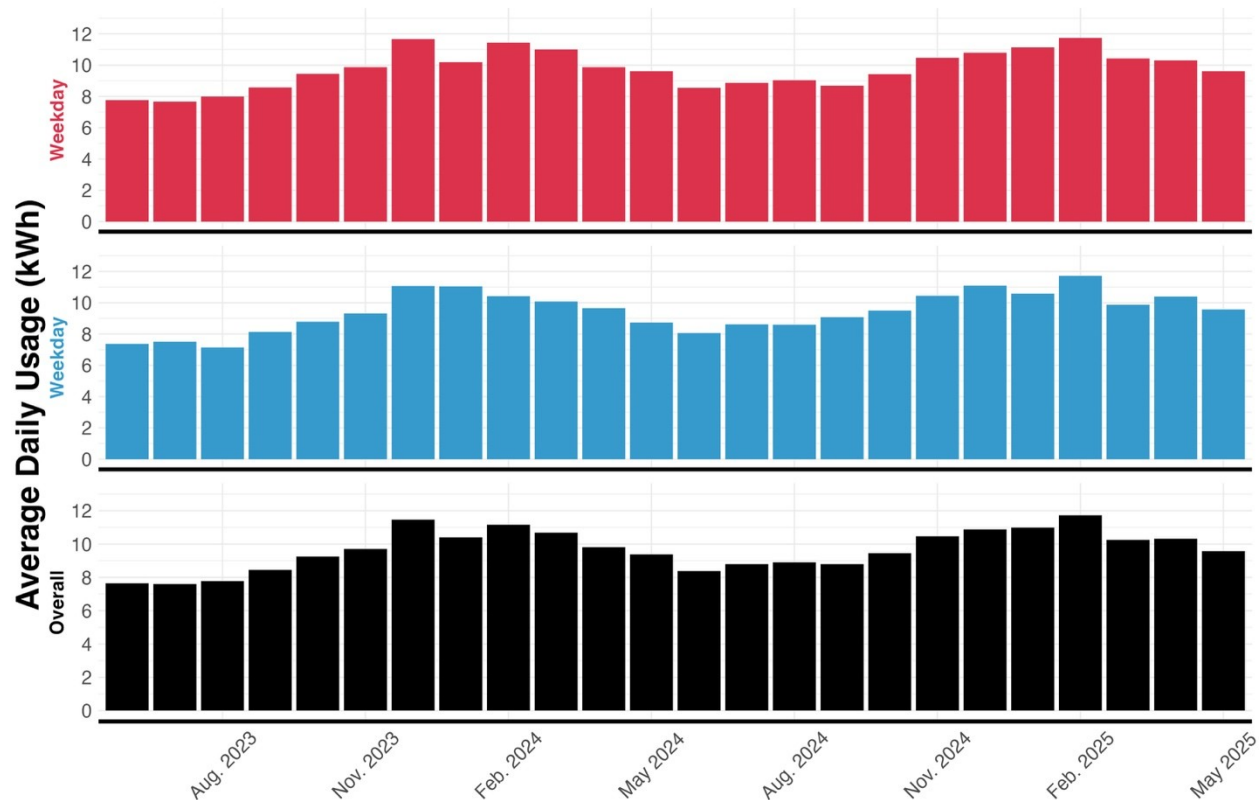


Figure 5. Average daily usage (kWh) over time for all residential chargers by weekday, weekend, and overall

To gain a broader picture of how often at-home chargers are in use, Figure 6 shows the distribution of the average number of hours per week spent charging per household. Figure 7 shows similar results but with the percentage of time rather than number of hours. These results show that the median household charges their vehicle for approximately 15.5 hours per week, or approximately 9.3% of the time. This is important when identifying the potential benefits of providing public chargers in residential neighborhoods that currently lack private, at-home charging, such as MMFH housing, because it suggests, in theory, multiple families could benefit from a single charging port.

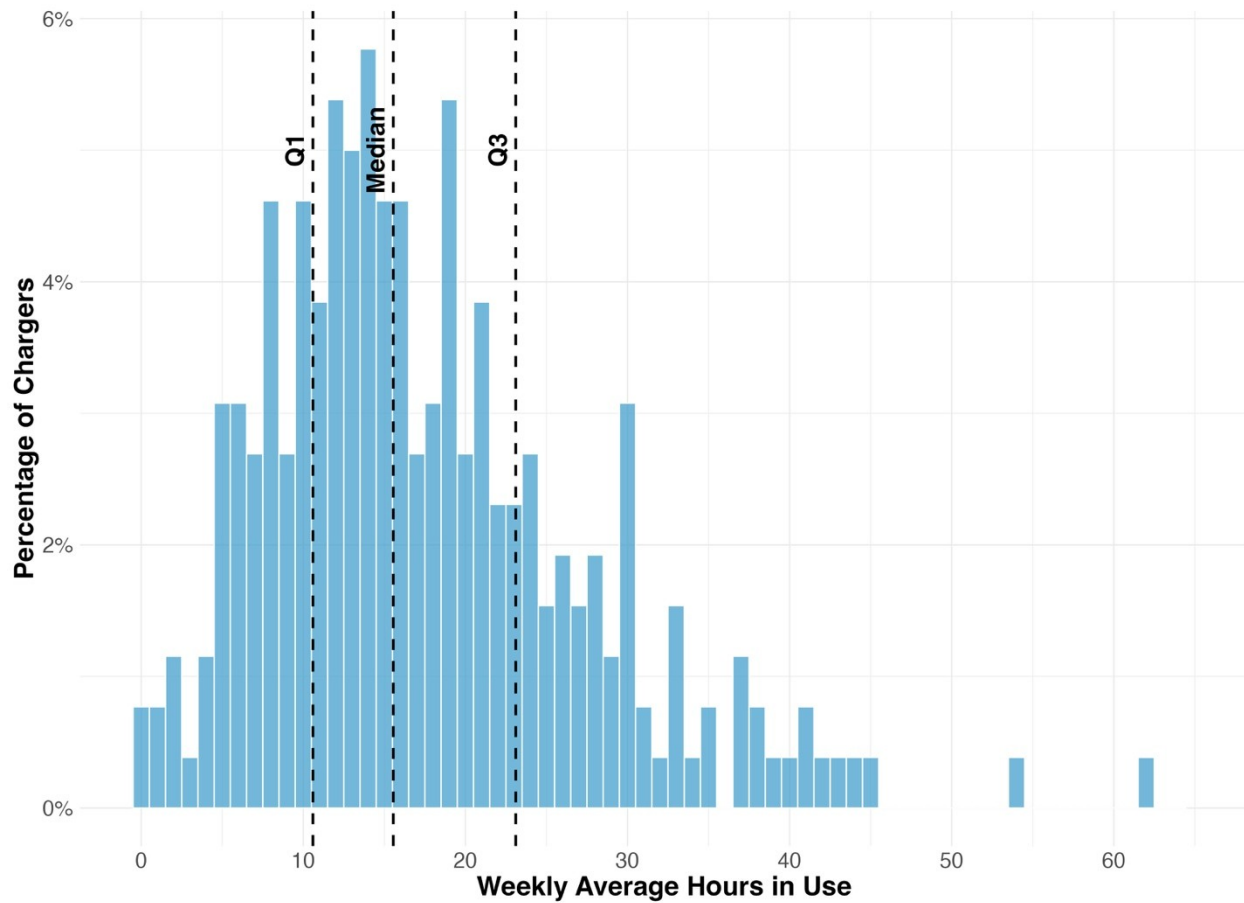


Figure 6. Histogram of average hours residential chargers were in use by household from June 2023 through May 2025

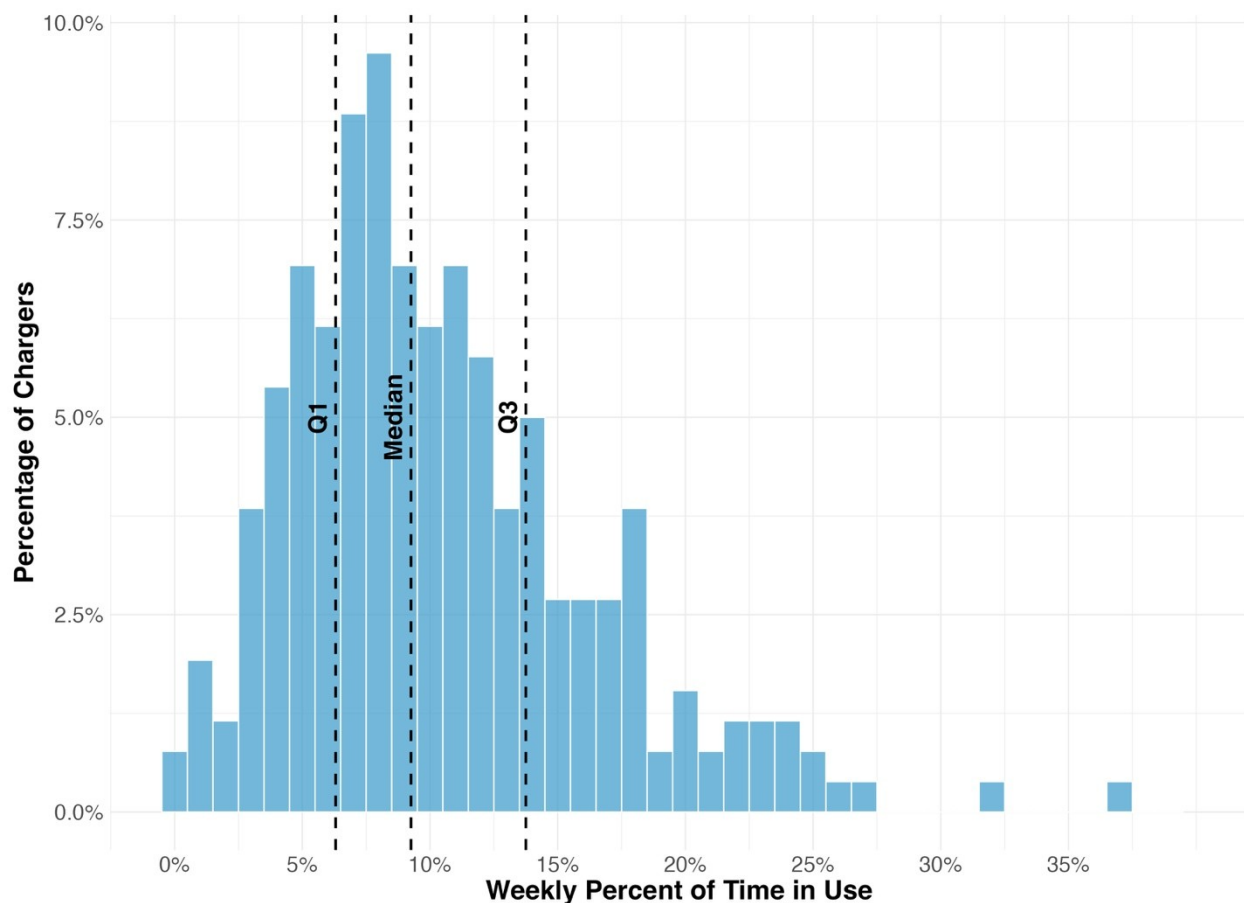


Figure 7. Histogram of average percentage of time residential chargers were in use by household from June 2023 through May 2025

Besides utilization data, session data—estimated from utilization data, as described in Section 2: Data and Methods—were also analyzed. These results provide a clearer understanding of a typical at-home charging session, including how long sessions last, how often they occur, and the average kWh utilization per session.

Figure 8 shows the distribution of the average number of sessions per week by household for night and day sessions, and Figure 9 shows the same results excluding sessions lasting less than 2 hours. Figure 10 includes the charging time per session for day and night sessions, and Figure 11 shows the resulting kWh utilization for night and day sessions. These results show that although households have fewer night sessions, night sessions typically last much longer, with a median charging time of 4 hours compared to 2 hours for day sessions. In fact, once short sessions are excluded, the median number of night sessions is greater than the median number of day sessions, suggesting that longer sessions are more likely to occur overnight. Utilization per session follows a similar trend, with night sessions consuming much more kWh of power than day sessions.

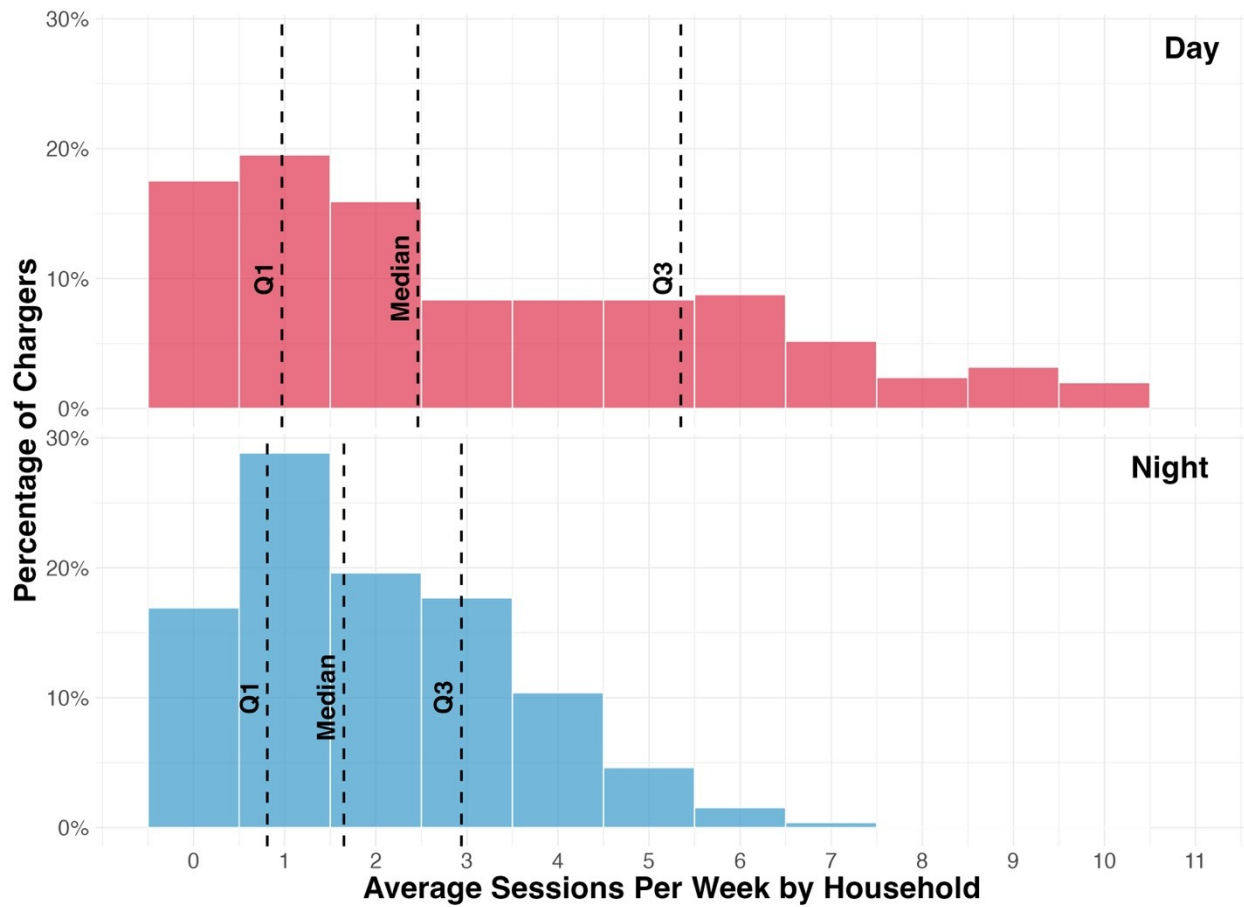


Figure 8. Histogram of average sessions per week by household and session type (day vs. night) from June 2023 through May 2025

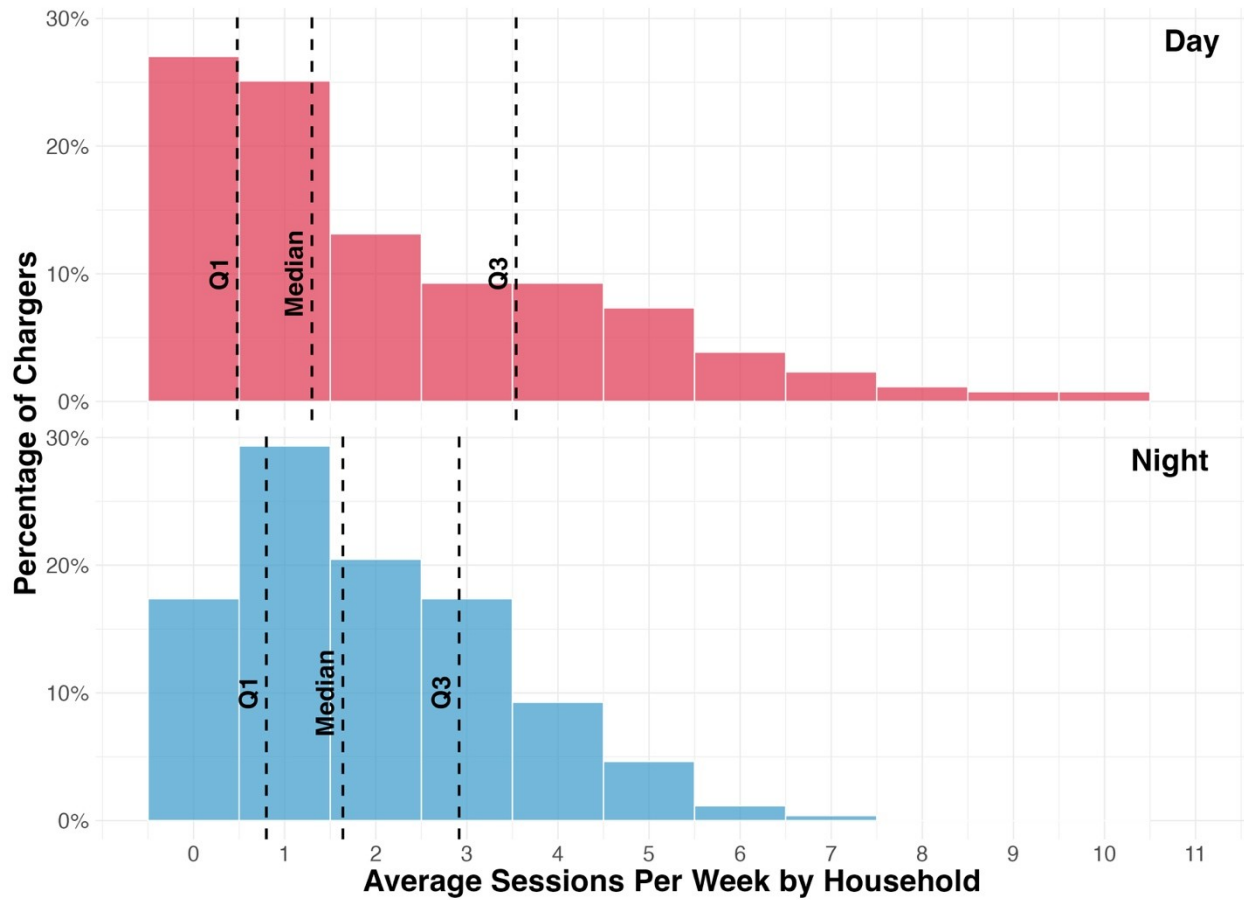


Figure 9. Histogram of average sessions per week by household and session type (day vs. night), excluding sessions shorter than 2 hours, from June 2023 through May 2025

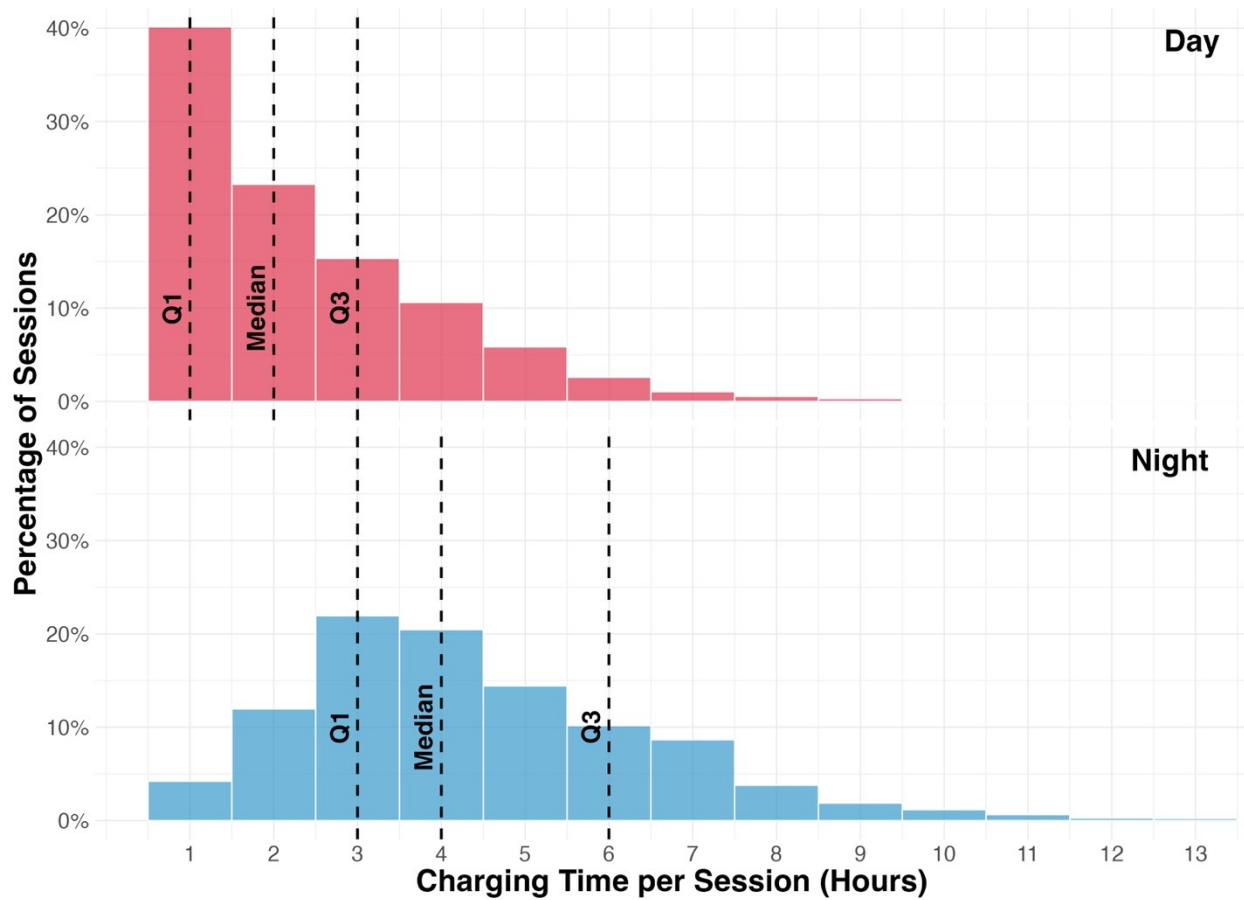


Figure 10. Histogram of charging time per session (hours) by session type (day vs. night) for sessions at residential chargers from June 2023 through May 2025

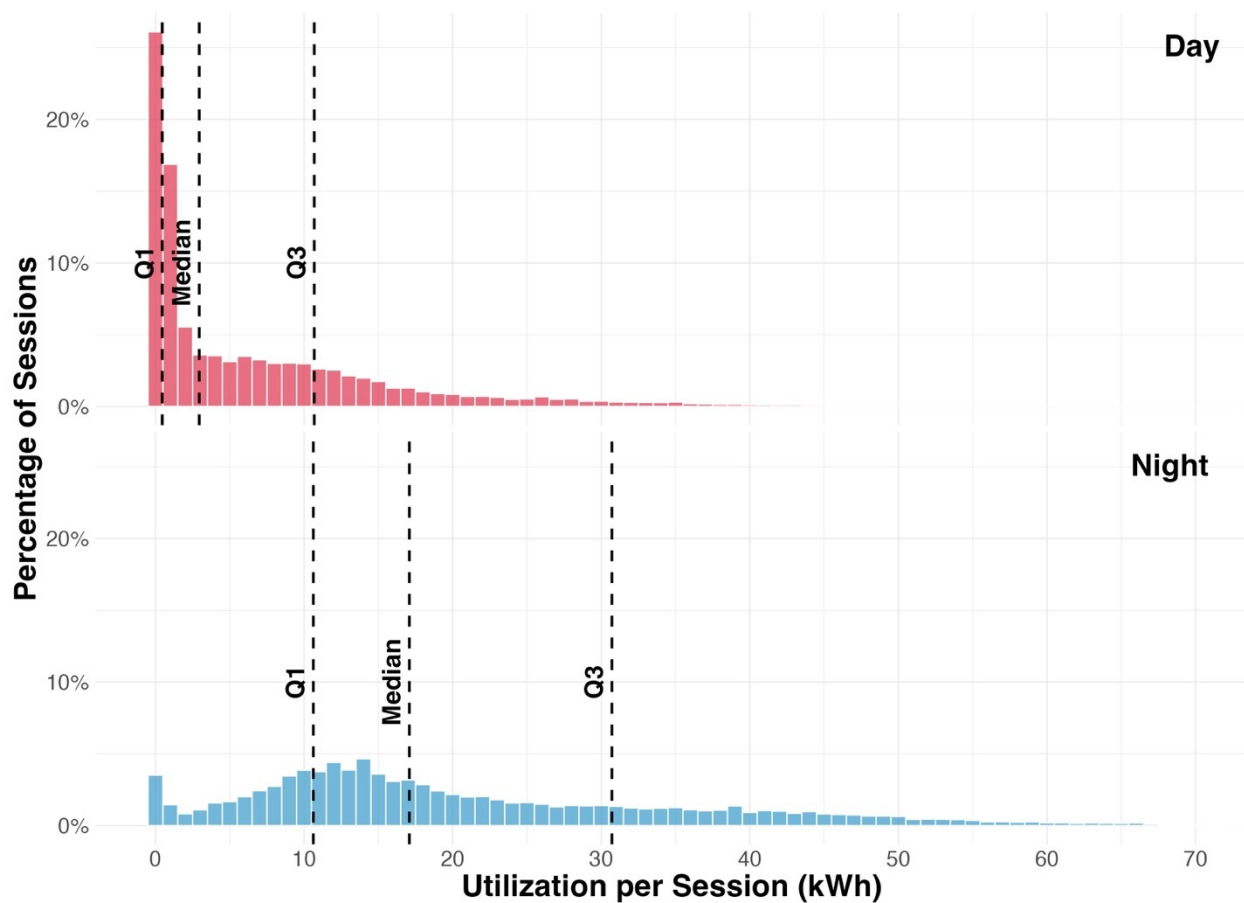


Figure 11. Histogram of utilization (in kWh) per session by session type (day vs. night) for sessions at residential chargers from June 2023 through May 2025

3.2 Composite Score Analysis of Potential Public Charging Station Locations

With the feasibility of using public chargers as a shared resource for MMFH residents confirmed by the charging utilization analysis, a composite score was used to identify potential MMFH locations for chargers. For each MMFH land parcel in the Juneau area, a composite score was calculated, with the highest-scoring areas identified as the optimal locations for EV chargers to be added near MMFH. Three components made up the score, as described in Table 1. The composite score was calculated separately using the number of MMFH units within a quarter-mile radius and using the total number of all residential units within a quarter-mile radius, providing two scores for each location. (By definition, the latter is always a higher score). Note that all three components have positive spatial autocorrelation, meaning that nearby locations are likely to have similar composite scores, and the highest-scoring areas are typically a cluster of parcels rather than a single parcel. See Section 2: Data and Methods for further details. The feeder score holds less influence based on AELP input; at present, the grid does not face constraint concerns, but analysis delivers long-term insight. Components were summed to create the final composite scores.

Figure 12 and Figure 13 show both versions of the composite score: The first (A) uses residential access as defined by all residential units, and the second (B) uses only MMFH units. Composite

score B uses the MMFH unit access score, which, as a subset of all residential units, is inherently lower than the unit access score based on all residential units. In turn, composite score A is also greater than B. Composite score A provides more variety in ideal charging station locations, with two high-scoring regions shown on the map, one in Douglas and the other in Mendenhall Valley. Composite score B, on the other hand, provides more precise results, with smaller high-scoring regions and only one clear highest-scoring region, in Douglas. This demonstrates that although a couple regions meet the density benchmark and have other characteristics meeting or exceeding the benchmark values when all residential housing is included, the area that meets the density benchmark with only MMFH housing is much smaller. When coupled with current public charger accessibility and feeder data, a small area of Douglas stands out as the highest scoring location.

To understand why specific areas have higher or lower scores, each individual component score was presented.

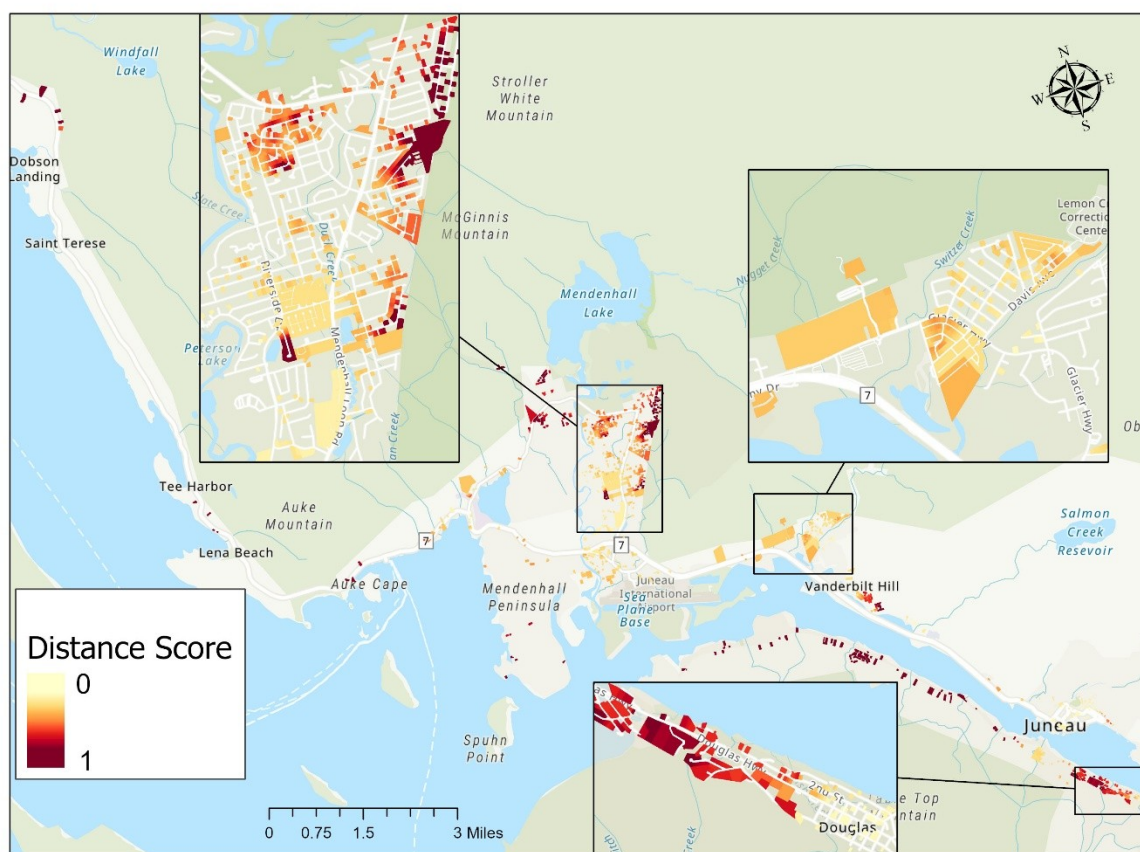


Figure 14 shows the distance to the nearest charger score. In this case, areas with higher scores are areas without a public charger currently nearby. Figure 15 and Figure 16 show the MMFH unit access score and the residential unit access score, respectively. The MMFH unit access score only counts MMFH units within a quarter-mile radius of the location, whereas the residential unit score counts all residential units within the radius, leading to a score that will always be greater than or equal to the MMFH unit score. Note that because of the larger number of units

counted, the residential unit score does not provide much variation, with large swaths of Juneau having the max score of 1. Areas of higher density are more likely to have a public charger, meaning that the locations with the highest unit access scores rarely align with the highest-scoring locations for distance to the nearest charger. This is where the composite score can be helpful to highlight any areas of overlap.

Feeder scores are not included as their own visual because of the sensitivity of feeder constraint data. The feeder scores were down-weighted compared to the other scores, meaning that the feeder only accounted for one-ninth of the overall score, whereas the unit score and the distance to the nearest charger score each counted for four-ninths of the overall score; however, the feeder score did have an impact on differentiating between areas of high composite scores. Specifically, the feeder score enabled the high-scoring area of Douglas to out-score the high-scoring area of Mendenhall Valley.

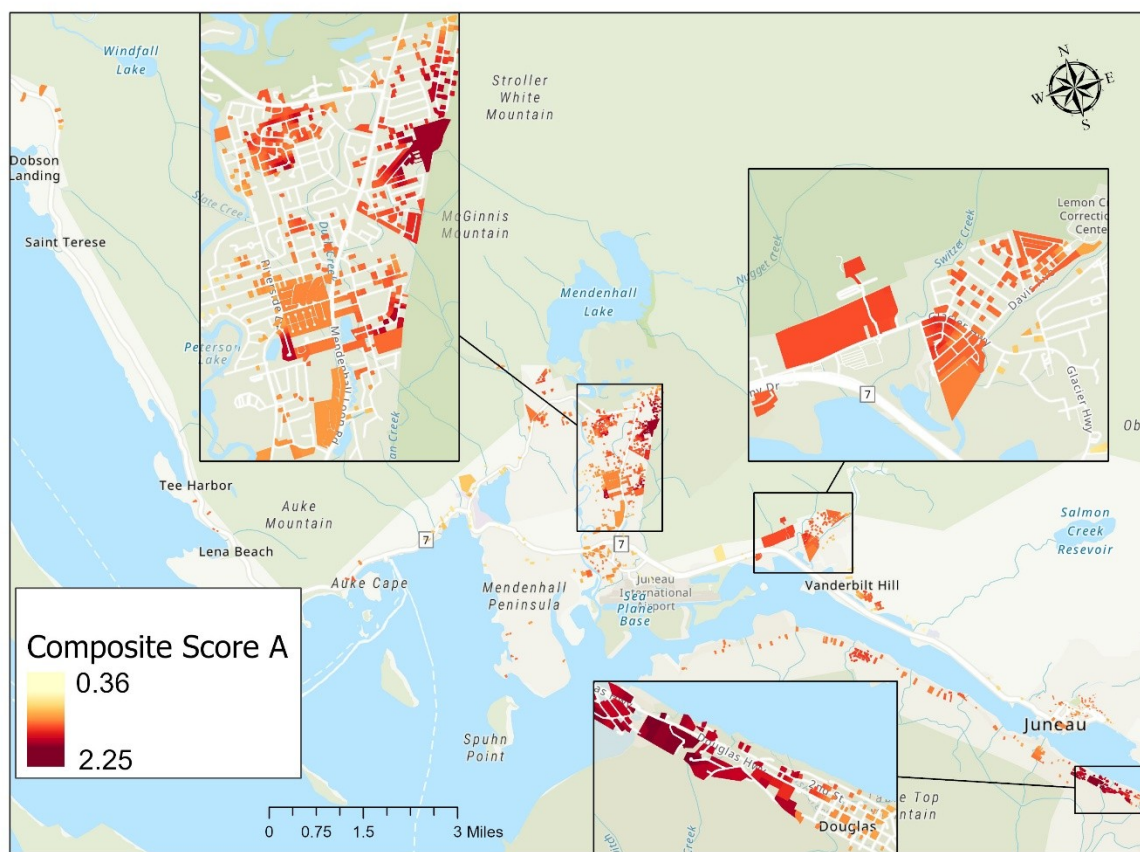


Figure 12. Composite score A for MMFH unit locations considered in the analysis. This score used the residential unit access score.

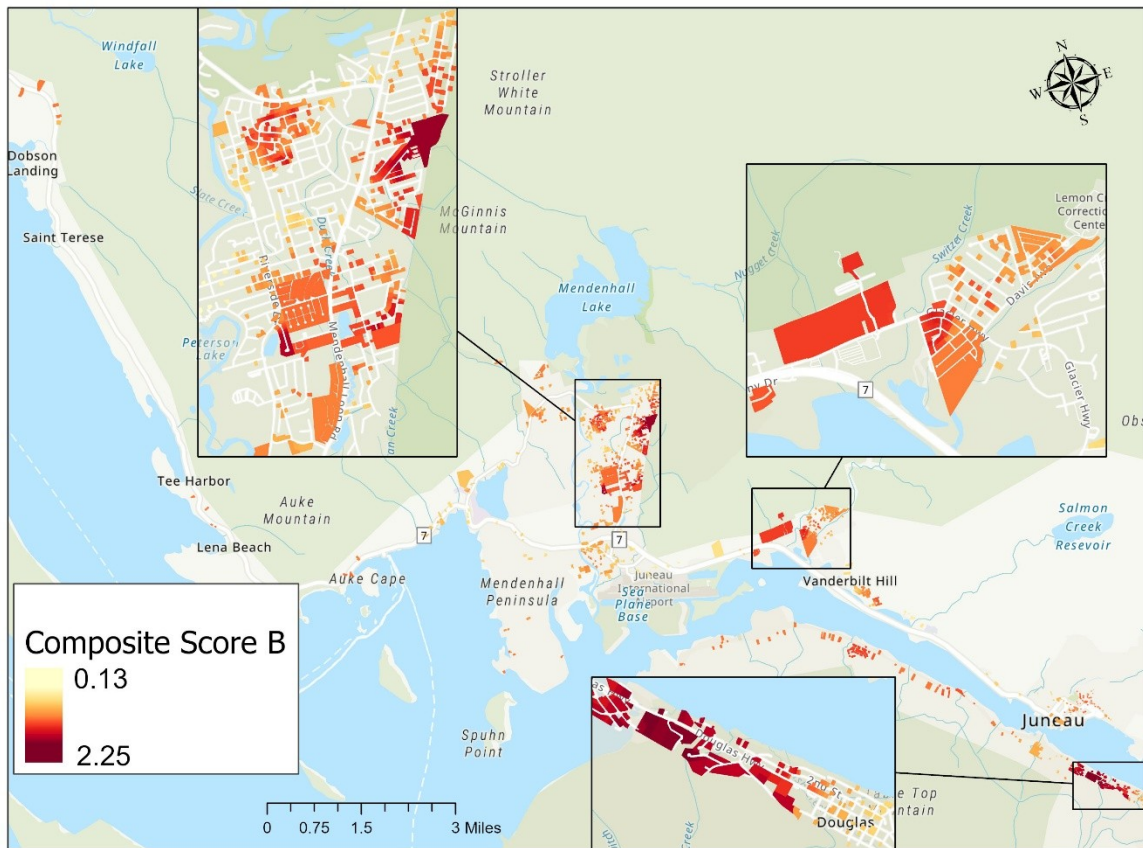


Figure 13. Composite score B for MMFH unit locations considered in the analysis. This score used the manufactured and MMFH unit access score.

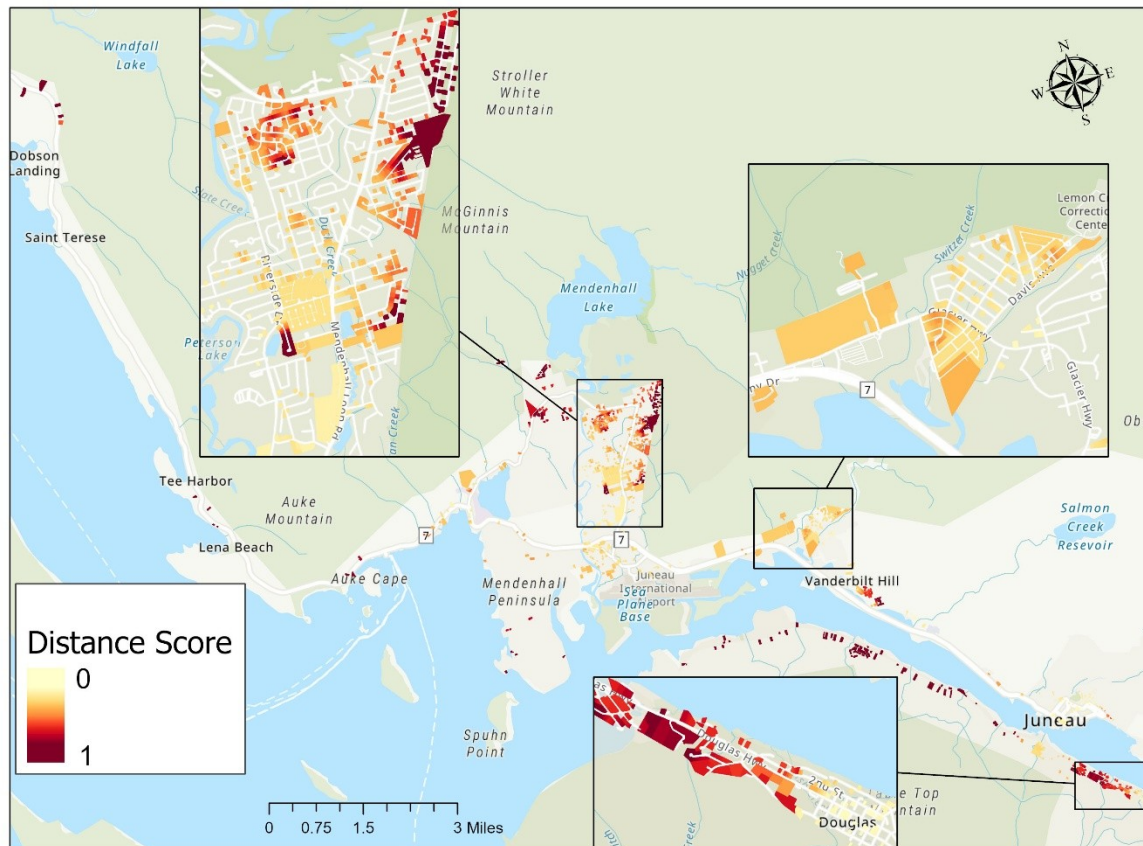


Figure 14. Distance to the nearest charger score for MMFH unit locations considered in the composite score analysis. Locations were given a score between 0 and 1, with higher scores being farther from a public charger.

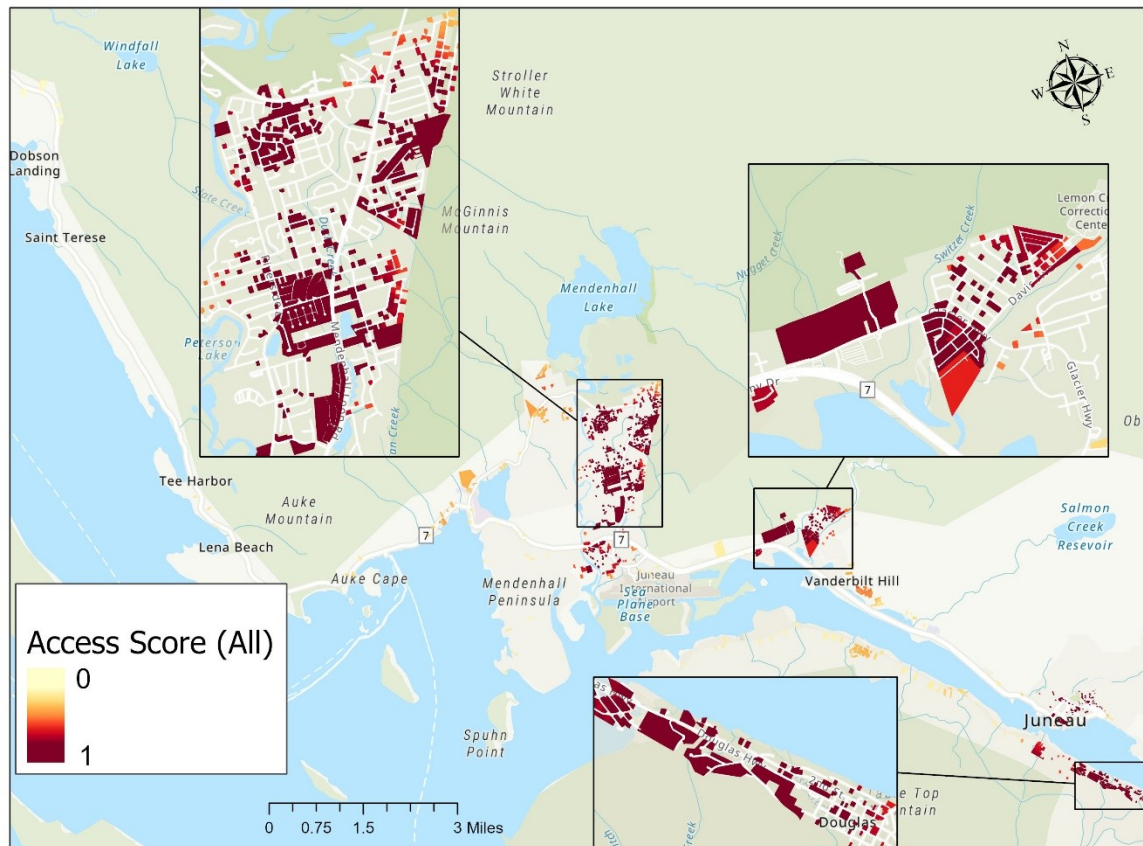


Figure 16. Residential unit access score for MMFH unit locations considered in the composite score analysis. Locations were given a score between 0 and 1 based on how many residential units were within a quarter mile of the location. This value was used to calculate composite score A.

4 Conclusion and Impact

This report includes wide-ranging analyses of EV chargers in Juneau, Alaska, including a utilization analysis of public and residential (home) chargers and a composite score analysis to identify optimal placements for public chargers near MMFH.

The utilization analysis illuminated differences in charging behaviors between public and residential charging, with public charging mainly occurring during the day and residential charging mainly occurring at night. Several public chargers, including a charger near residential housing, reported high utilization, suggesting a potential need for additional chargers in those areas. The residential charger analysis further identified common charging behaviors for households with home chargers, showing that these households tend to have 1.6 night charging sessions per week and use their charger 9.3% of the time, or 15.5 hours per week. This suggests a single charger may have availability, enabling use by multiple households, if those households were all granted access. Using the number of night sessions per week, it is also possible to estimate the number of ports needed to service a specific number of households with EVs, which can be used by AELP to approximate how many chargers might need to be installed at a specific location. Note that these results are limited due to a lack of data on how charging stations are used specifically by the MMFH population, since, in this study, residential charging from non-MMFH was used as a proxy.

The composite score analysis showed two potential optimal areas for public chargers near residential housing, one in Mendenhall Valley and one in Douglas, with the latter containing the highest-scoring locations. Even with a simple three-element composite score, it is possible to identify optimal areas for public chargers. These results could be used for future decision-making and to identify potential areas in need of charging stations.

5 References

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