Memorandum

To: Seattle City Light
From: Logan Pierce, Peter Slowik, International Council on Clean Transportation
Date: November 7, 2024
Re: Draft charging gap analysis of Seattle City Light service territory

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INTRODUCTION

Seattle is one of the leading cities in the United States in its transition to zero-emission vehicles. In 2021, the city published its Clean Transportation Electrification Blueprint that outlined several ambitious and achievable goals to reduce emission across its transportation sector and expand zero-emission mobility.[1] One such goal is for the city to have electrical infrastructure installed and operational to stay ahead of transportation electrification, and to enable the city to meet its target that electric vehicles (EVs) would represent 30% of all vehicle registrations in the city by 2030.[2] In 2023, EVs, which include battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), accounted for more than one-third of new cars registered in Seattle.[3] To support continued growth in EV sales, the city will need to build out a charging infrastructure network to meet increasing charging demand.

ICCT's 2021 Seattle charging gap analysis report found that achieving the city's 30% EV stock target in 2030 would require a local citywide network of over 3,000 publicly accessible (i.e., public Level 2, DC fast, and workplace chargers) and over 70,000 home chargers would be needed to support the EV transition.[4] This memo updates ICCT's 2021 Seattle charging gap analysis, expanding the geographic scope to include six additional zip codes within the Seattle City Light territory – bringing the total number of zip codes in the analysis to 30 – and applies the newest data on electric and light-duty vehicle (LDV) registrations. We estimate home and non-home charging needs to support projected light-duty EV adoption throughout the 30 zip codes consistent with an EV growth trajectory such that EVs represent 30% of the total LDV stock in 2030. We first summarize updates to our methodology, data sources, and parameters. We follow this with a presentation of estimates for home and non-home charging needs in the 30 zip codes, between 2024 and 2038. Additionally, we assess the gap between charging deployment as of 2023 and what will be needed in later years, as well as the gap in installed

1 Office of Sustainability and Environment, "Seattle's Clean Transportation Electrification Blueprint" (2021), https://www.seattle.gov/documents/Departments/OSE/ClimateChange/TE/Final%20Transportation%20Electrification%20Blueprint.pdf.
2 Listed goals for changes to transportation in Seattle, Office of Sustainability and Environment, accessed June 25, 2024, https://www.seattle.gov/environment/environmental-progress/transportation.
3 Discussions with Seattle City Light staff.
4 Chih-Wei Hsu, Peter Slowik, Nic Lutsey, *City charging infrastructure needs to reach electric vehicle goals: The case of Seattle*, (ICCT, Washington, DC: 2021), https://theicct.org/publication/city-charging-infrastructure-needs-to-reach-electric-vehicle-goals-the-case-of-seattle/.

charging capacity. Results are developed at the zip code level to have a granular understanding of charging needs and EV adoption throughout the city.

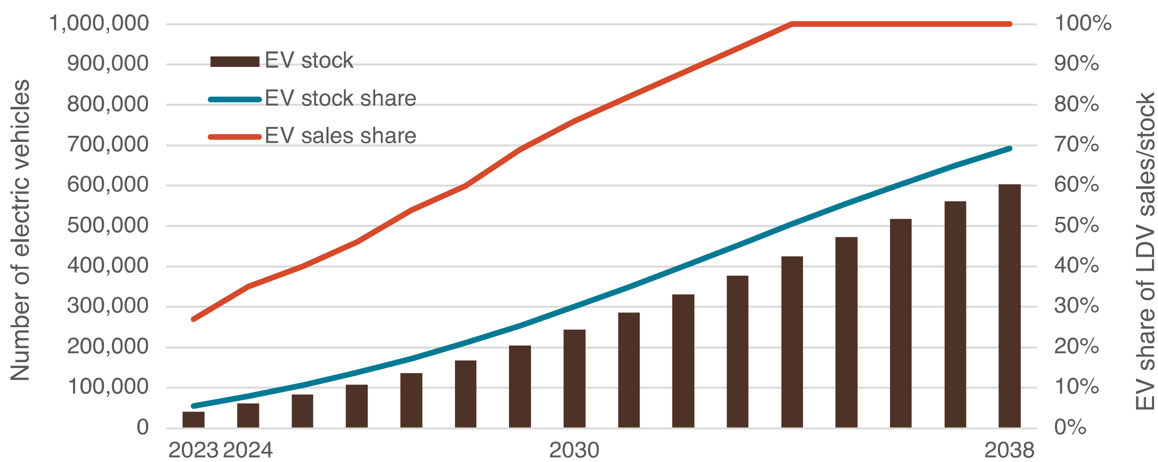
Data sources and methodology

This analysis follows the methodology from ICCT's 2024 Seattle Clean Fuel Standard credit model for estimating the growth in the stock of light-duty electric vehicles (EVs) and light-duty EV charging needs within City Light's service territory.[5] We use an ICCT stock turnover model to project the number of EVs in City Light's service territory and the associated energy demands across the timeline of this analysis, and we used ICCT's EV CHARGE model to derive the charging infrastructure needs to support this stock of EVs.[6] The modeling assumptions used in this analysis align with the Clean Fuel Standard credit model analysis with selected updates to key parameters, such as trajectory of EV sales and stock growth, the distribution of EVs across housing types within zip codes in City Light's service territory, the evolution of the capacity (i.e. power) of new charging infrastructure deployment, and others. These updated parameters are described in detail in this section. Additionally, we provide a brief discussion of the utilization assumptions in this analysis.

Updated parameters

The modeled EV adoption trajectory aligns with City Light's need to ensure adequate charging infrastructure to support 30% of the LDVs in its service territory being EVs by 2030. **Figure 1** illustrates this trajectory, showing the growth in the EV sales share of new LDVs between 2023 and 2038 with the red line, the resulting growth in the light-duty EV stock shown by the brown bars, and the growth in the EV stock share of LDVs shown by the blue line.

Figure 1
Assumed EV adoption trajectory in City Light's service territory between 2023 and 2038



To achieve a 30% EV stock share in 2030, EV adoption would need to grow from 27% of new sales in 2023 to 76% by 2030. This would be an accelerated EV adoption trajectory compared

5 Jane O'Malley, Nikita Pavlenko, *Seattle City Light CFS credit model*, (in press)
6 "EV CHARGE v1.2 Documentation", The International Council on Clean Transportation, access to June 25, 2024, https://theicct.github.io/EVCHARGE-doc/.

to Washington's statewide requirements, which align with the Advanced Clean Cars II regulation passed by the California Air Resources Board in 2022 and would see the statewide EV sales share reach 68% by 2030.[7] Continuing along this trajectory, City Light's service territory would reach a 100% EV sales share in 2034—one year prior to the state's requirements. In 2030, a 30% EV stock share would mean about 244,000 EVs on the roads in the 30 zip codes analyzed, of which we estimate 17% would be PHEVs and the remaining 83% being BEVs. A more detailed breakdown of EV sales and stock by powertrain and citywide EV sales share and stock share are shown in **Table A1** in the Appendix.

The experience of owning and charging an EV is affected by access to home charging, which is in turn affected by the type of home one lives in and the likelihood of having access to off-street parking where either an outlet to charge from already exists or it is relatively easier to install an outlet or home charger. Each of City Light's zip codes have unique housing distributions and thus will have varying levels of access to home charging and subsequent reliance on public charging infrastructure. To properly capture this dynamic, we apply data from the U.S. Census Bureau on the zip code-level housing distributions for the zip codes in City Light's service territory that we analyzed.[8] **Table A2** in the appendix details the housing distributions by zip code. During the early stages of EV adoption most adopters are those who are more likely to have access to convenient charging at home, particularly those living in single-family detached homes. As such, we model each zip code with a higher share of single-family detached homes, initially, and adjust the distribution as the EV stock share increases (decreasing the share of single-family detached homes and increasing the share of all other homes) until it matches the distribution shown in **Table A2** by the time a 50% EV stock share is reached.

As EV and battery technology improve, EVs will be able to charge faster but will need faster charging infrastructure that can deliver energy as fast as the EV can accept it. As such, we anticipate that over time an increasing share of higher rated power DC fast chargers will be installed to better match the specifications of newer EVs on the road and improve throughput of publicly accessible DC fast charging infrastructure. For the different types of non-home charging infrastructure considered in our analysis, which are the same charger types analyzed in the our 2024 national charging gap analysis,[9] we model the shares of newly installed chargers by rated power over time as shown in **Table 1**.

Table 1
Assumed share of newly installed non-home chargers by type and rated power in 2024 and 2038

7 "Washington clean cars" Washington Department of Ecology, accessed June 25, 2024, https://ecology.wa.gov/air-climate/air-quality/vehicle-emissions/clean-cars & "Advanced Clean Cars II", California Air Resources Board, accessed June 25, 2024, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii.

8 U.S. Census Bureau "Selected Housing Characteristics." American Community Survey, ACS 5-Year Estimates Data Profiles, Table DP04, 2022, https://data.census.gov/table/ACSDP5Y2022.DP04?q=DP04&g=860XX00US98057,98101,98102,98103,98104,98105,98106,98107,98108,98109,98115,98116,98118,98119,98121,98122,98125,98126,98133,98134,98136,98144,98146,98148,98155,98166,98168,98178,98188,98199. Accessed on April 17, 2024.

9 Logan Pierce, Peter Slowik, *Assessment of U.S. electric vehicle charging needs and announced deployments through 2032*, (ICCT, Washington, DC, 2024), https://theicct.org/wp-content/uploads/2024/03/ID-89-–-Chargers-2032_final-v2.pdf.

Charger type (Level)	Share of newly installed chargers in 2024 (nominal power)	Share of newly installed chargers in 2038 (nominal power)
Workplace (Level 2)	70% (9.6 kW), 30% (7.2kW)	70% (9.6 kW), 30% (7.2kW)
Public overnight (Level 2)	100% (9.6 kW)	100% (9.6 kW)
Public destination (Level 2)	100% (9.6 kW)	100% (9.6 kW)
Public destination (DCFC)	25% (50 kW), 32.5% (150 kW), 40% (250 kW), 2.5% (350 kW)	10% (50 kW), 40% (150 kW), 42.5% (250 kW), 7.5% (350 kW)
Public en-route (DCFC)	80% (150 kW), 20% (250 kW)	55% (150 kW), 37% (250 kW), 8% (350 kW)

For Level 2 chargers we assume the shares remain consistent over time. Non-home Level 2 chargers in theory would be installed in spaces where EVs would park for an extended period where prioritizing throughput on charger is less urgent. In addition, Level 2 chargers would likely be installed at locations where there's less available power capacity which would make it difficult to install higher power Level 2 chargers. 9.6 kW chargers were selected as the most common power rating for Level 2 chargers because that aligns with the guidelines for chargers deployed in City Light's curbside EV charging program.[10] For DC fast chargers in 2024 we model shares of newly installed chargers that result in a weighted average rated power of 170 kW, which is roughly equal to the weighted average rated power of DC fast charging infrastructure deployed in Seattle as of January 2024.[11] From there we model decreasing shares of lower rated 50 kW chargers in favor of higher rated 150, 250, and 350 kW chargers. By 2038, the weighted average rated power of public destination DC fast chargers is 198 kW and 203 kW for public en-route DC fast chargers.

Likewise, with home charging we anticipate that many EV drivers will initially charge using a standard household outlet (Level 1) in their garage or along their driveway, but that over time, as battery and charging technology improve, they will upgrade to a Level 2 home charger; also as consumer understanding around EVs develops, new EV drivers will bypass Level 1 outlets to install a Level 2 upon purchasing an EV. As such, we model a decreasing share of Level 1 home charging access in favor of more Level 2 home charging access as shown in **Table 2.**

Table 2
Assumed share of home Level 1 and Level 2 charging

Year	Share of homes with Level 1 charging	Share of homes with Level 2 charging
2023	34%	66%

10 "Curbside Level 2 Electric Vehicle Charging", Seattle city light, accessed June 25, 2024, https://www.seattle.gov/city-light/in-the-community/current-projects/curbside-level-2-ev-charging.
11 Eco-Movement (counts of installed electric vehicle charging infrastructure in Seattle, accessed April 2024)

2024	32%	68%
2025	30%	70%
2026	28%	72%
2027	26%	74%
2028	24%	76%
2029	22%	78%
2030	20%	80%
2031	18%	82%
2032	16%	84%
2033	14%	86%
2034	12%	88%
2035	10%	90%
2036	8%	92%
2037	6%	94%
2038	4%	96%

We estimate about one-third of home chargers in 2023 are Level 1 home chargers with the remaining being Level 2 chargers. By 2030, we project just one-fifth of home chargers are Level 1 and that by 2038 less than 5% are.

Early EV adopters in 2024 typically have relatively higher home charging access. As the EV market expands to drivers without home access to charging, there will be more demand for public charging and less overall access to home charging. Meanwhile, another segment of the population who have the ability to charge at home will increasingly choose to do so as they look to have more convenient and lower cost charging to public chargers. We weighed the power of the first trend higher, anticipating an initial and gradual decline in rates of home charging access at both single-family and multifamily homes before 2030, as shown in **Table 3**.

Table 3
Assumed home charging access by housing type

Year	EV stock share	House	Apartment
2024	7.4%	89%	54%
2030	30%	77%	43%
2038	68.3%	69%	59%

A proxy for home charging access is having a driveway where there's a greater likelihood of being near an outlet or the electrical service where a home charger install would be relatively easy. We examined GIS data from City Light on the number of single-family homes in its service territory with driveways and found that roughly only half have driveways. We assume home charging access will trend towards access to off-street parking via driveways over time, as such we model continued decline in home charging access for single-family homes from 2030 to 2038. If relatively more or less people park off-street in residential neighborhoods, relatively less or more curbside charging infrastructure would be needed, respectively. As for multifamily homes, we model a rebound and increase in access to home charging from 2030 to 2038, assuming that investment and supporting policies to make home charging access more equitable between single- and multifamily homes will take place. Under the National Electric

Vehicle Infrastructure Formula program and the Charging and Fueling Infrastructure program, Seattle can apply for billions of dollars in federal grants to make investments in community charging projects, like retrofitting multifamily homes to install charging infrastructure.[12] Authorities having jurisdiction in Washington can also adopt building codes and streamline permitting processes, among a slew of other policies, to support the expansion of charging at multifamily homes in Seattle.[13]

In addition to estimating the number of chargers needed in each zip code to support the modeled EV adoption trajectory, we want to assess where the gaps in charging deployment in City Light's service territory are. To do so we examined a dataset from Eco-movement of the stock of chargers deployed in each of the zip codes included in this analysis. **Table 4** and **Table 5** summarize the public charger stock in City Light's service territory by rated power level through 2023. These data are input as the charger stock as of 2023 in the model. Because there's uncertainty as to the types of locations and/or use cases for the chargers in Eco-movement we designate all chargers as public destination chargers for the purposes of our analysis.

Table 4
Level 2 charger stock in City Light's service territory through 2023 (Eco-movement)

	3.7 kW	7.4 kW	11 kW	22 kW	43 kW
Counts	21	1418	106	3	1
Share	1.4%	91.5%	6.8%	0.2%	0.1%

For Level 2 chargers, we only use the data in **Table 5** to establish the public Level 2 charger stock in City Light's service territory through 2023. Future year power distribution is informed by City Light's curbside charger program guidelines for Level 2 chargers to be offer at least 9.6kW. If the average Level 2 charging power were relatively higher or lower than this value, relatively fewer or more chargers would be needed, respectively.

Table 5
DCFC charger stock in City Light's territory through 2023 (Eco-movement)

	25 kW	50 kW	150 kW	250 kW	350 kW
Counts	4	62	72	64	21
Share	1.8%	27.8%	32.3%	28.7%	9.4%

For DC fast chargers, we calculate the weighted average power deployed in City Light's service territory to be around 170 kW. We use that value as the baseline for the weighted average of the assumed power distribution of newly installed DC fast chargers. The assumed charger power distribution in future years shifts towards higher power chargers, resulting in an increase in the weighted average power of DC fast chargers, as summarized in **Table 1**.

Charger utilization

12 "Technical Assistance and Resources for States", Joint Office of Energy and Transportation, accessed June 25, 2024, https://driveelectric.gov/states.

13 Logan Pierce, Anh Bui, *Electric vehicle charging at multifamily homes in the United states: barriers, solutions, and selected equity considerations*, (ICCT: Washington, DC, 2024), https://theicct.org/publication/promoting-equity-ev-transition-barriers-and-solutions-to-charging-at-multi-family-homes-us-apr24/.

Fundamental to estimating charging infrastructure needs is the amount of daily utilization (i.e. the hours per day a charger is actively supplying energy) each charger gets. Different analyses can assume more or less utilization that would lead to comparatively fewer or greater charging needs, respectively. In this analysis we apply utilization assumptions consistent with those in the Seattle CFS analysis, as shown in **Table 6**.

Table 6
Assumed charger utilization by charger type (consistent with assumptions in the Seattle CFS analysis)

Year	EV stock share	Workplace Level 2	Public overnight Level 2	Public destination Level 2	Public destination DCFC	Public en-route DCFC
2024	7.4%	4.1 hours	5.3 hours	5.7 hours	3.1 hours	3.1 hours
2030	30%	4.6 hours	5.8 hours	7 hours	4 hours	4 hours
2038	68.3%	4.8 hours	6 hours	7.4 hours	4.3 hours	4.3 hours

Consistent with the findings in Bauer et al. 2021, utilization increases logarithmically with increasing EV stock share.[14] Over the course of the analysis we assume utilization grows from as little as 3.1 hours per day (13%) to up to 7.4 hours per day (31%) depending on the type of charger. These assumptions, while more bullish than the utilization assumed in our national charging gap analysis, reflect relatively higher EV adoption in Seattle when compared with most of the country.[15] That said, these assumptions are by no means outside the bounds of real-world observed charger utilization. In Q1 2024, EVgo reported nationwide utilization of its DC fast network at about 19% (4.6 hours), whereas our assumptions for DC fast charger utilization in Seattle increase to 18% by 2038.[16] Likewise, curbside Level 2 chargers in New York City have been reported to have utilization as high as 72% in 2024, or 17.3 hours per day.[17] We estimate higher utilization for Level 2 chargers than for DC fast chargers in Seattle, but utilization remains below 30% (7.2 hours/day) until after 2030.

Results

This section summarizes the analytical findings of this work. First, we present the City Light service territory home and non-home charging needs by type. We then compare the resulting charging needs in 2030 with existing public charging deployment as of 2023 to understand City Light's progress towards meeting the estimated charging deployment needs. Lastly, we share maps of City Light's service territory and the non-home charging and power needs by zip code, to better visualize which regions charging and power needs are greatest.

14 Gordon Bauer, Chih-Wei Hsu, Mike Nicholas, Nic Lutsey, *charging up America's: assessing the growing need for US charging infrastructure through 2030*, (ICCT: Washington, DC, 2021), https://theicct.org/publication/charging-up-america-assessing-the-growing-need-for-u-s-charging-infrastructure-through-2030/.

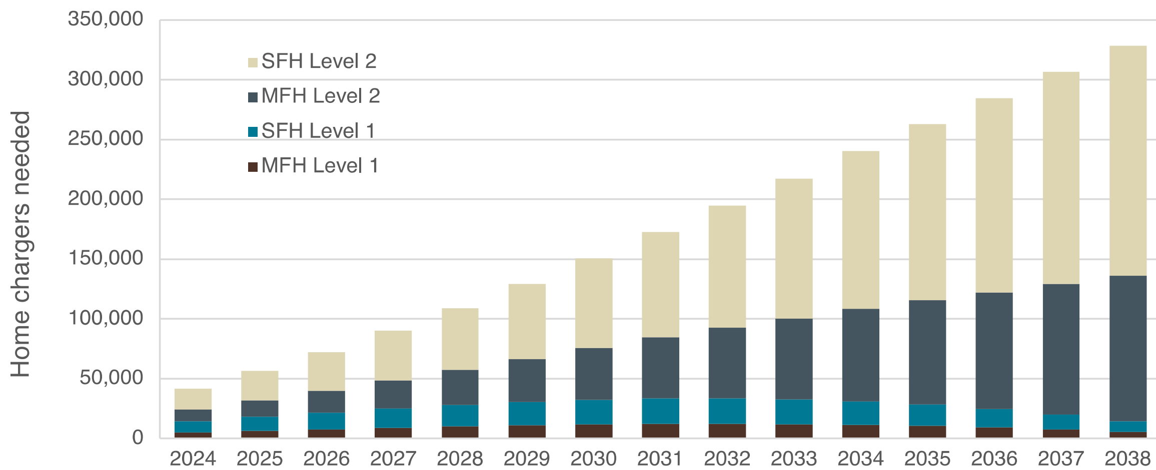
15 Logan Pierce, Peter Slowik, *Assessment of U.S. electric vehicle charging needs and announced deployments through 2032*, (ICCT, Washington, DC, 2024), https://theicct.org/wp-content/uploads/2024/03/ID-89-–-Chargers-2032_final-v2.pdf.

16 "*Evgo Doubles Down on Commitment to Begin NACS Deployments in 2024*," EVgo, accessed June 25, 2024, https://www.evgo.com/press-release/evgo-doubles-down-on-commitment-to-begin-nacs-deployments-in-2024/.

17 "NYC's curbside EV chargers are popular—and often blocked," *autoblog*, March 30, 2024, https://www.autoblog.com/2024/03/30/nycs-curbside-ev-chargers-are-popular-and-often-blocked/.

Figure 2 shows the estimated number of home chargers needed in City Light's service territory from 2024 to 2038, broken down by the type of home, single-family or multifamily home, and by the level of the home charger, Level 1 or Level 2. An estimated 42,000 home chargers will be needed by the end of 2024 which grows to about 150,000 in 2030 and almost 330,000 by 2038. About 36% of the chargers we estimate will be needed at multifamily homes in 2024, which slightly increases to 37% in 2030 and 39% in 2038; the remaining home chargers will be installed at single-family homes. Where home chargers are ultimately deployed will depend on the housing type distribution and the housing stock throughout the City Light's service territory. **Table A3** in the appendix provides a detailed breakdown of the home charging needs by zip code in 2030.

Figure 2
Projected need for home chargers within Seattle City Light's service territory, 2024 through 2038

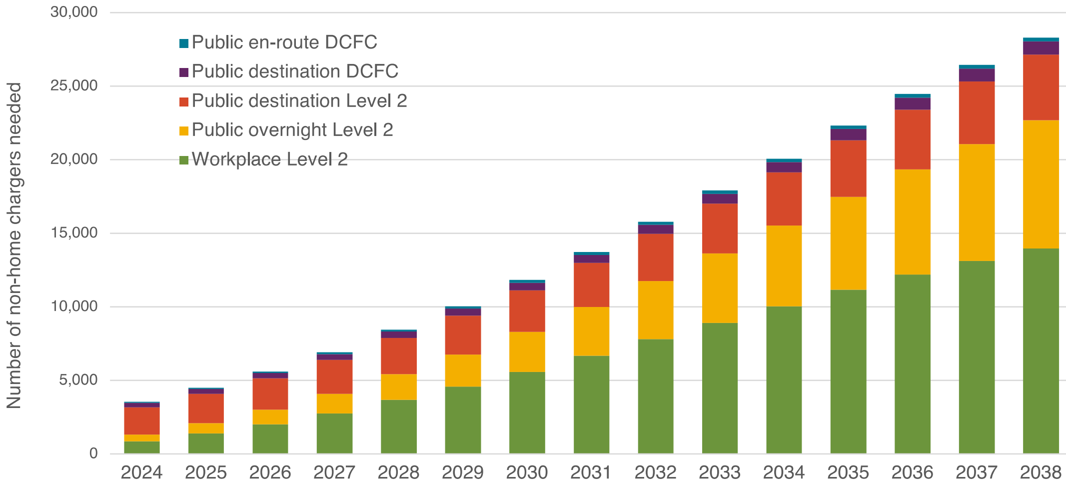


As mentioned in the section discussing updated parameters, we anticipate Level 1 home charging will become less prevalent over time as EV drivers opt to upgrade their existing Level 1 outlet to a Level 2 charger, and as new EV drivers bypass Level 1 charging to install a Level 2 charger upon purchasing an EV. While the share of Level 1 home chargers decreases over time, in accordance with **Table 3**, the absolute number of Level 1 chargers is expected to increase as the growth of City Light's EV market outpaces the shift away from Level 1 chargers towards Level 2 chargers. This trend tops out in 2032 and the number of Level 1 chargers decreases thereafter as the pace of growth of Seattle's EV market settles.

Home charging needs in Seattle are far greater than the needs for non-home chargers, however as Seattle's EV market moves away from early adopters, who are more likely to have home charging access, demand for non-home charging infrastructure at workplaces and other public locations will increase. **Figure 3** shows the estimated non-home chargers needed in City Light's service territory from 2024 to 2038. We estimate approximately 3,600 non-home chargers will be needed by the end of 2024, almost double of what has been installed as of the end of 2023.[18] Non-home charging needs increase to about 12,000 by 2030 and about 28,000 in 2038.

18 Eco-Movement (counts of installed electric vehicle charging infrastructure in Seattle, accessed April 2024)

Figure 3
Projected need for non-home chargers, by type, within Seattle City Light's service territory, 2024 through 2038



We estimate most of the non-home chargers needed will be Level 2 chargers at workplaces, on curbsides in residential neighborhoods, and in other public locations. Workplace chargers are expected to account for most of the non-home Level 2 chargers needed because of the convenience they offer commuting EV drivers, particularly those without home charging. About 5,600 workplace Level 2 chargers will be needed by the end of 2030, representing about 47% of all non-home chargers and 50% of non-home Level 2 chargers in that year; these needs increase to about 14,000 chargers in 2038 representing 49% of all non-home chargers and 51% of non-home Level 2 chargers. Public overnight Level 2 chargers comprise the second largest need for chargers with about 2,700 chargers needed in 2030, or 23% of all non-home chargers and 24% of non-home Level 2 chargers; by 2038 about 8,700 public overnight Level 2 chargers will be needed representing 31% of non-home chargers and 32% of non-home Level 2 chargers. Like workplace chargers, public overnight chargers can supplement a lack of home charging access, serving as a proxy for a home charger when deployed in residential neighborhoods.

Public destination Level 2 chargers, installed at a variety of sites, make up the remaining non-home Level 2 chargers needed. Because we assume all the existing non-home Level 2 chargers, as of 2023, are public destination, these initially account for 63% non-home Level 2 chargers, but then grow slowly with less than a 10% year-over-year increase in the number of chargers each year analyzed, whereas public overnight and workplace chargers initially see triple digit and then double digit percentage year-over-year increases in chargers through at least 2036. About 2,800 public destination Level 2 chargers are needed in 2030, representing 24% of non-home chargers and 25% of non-home Level 2 chargers, and by 2038 about 4,500 public destination Level 2 chargers will be needed, representing 16% of all non-home chargers and non-home Level 2 chargers alike.

As of 2023, 13% of non-home chargers in City Light's service territory are DC fast chargers, which reflects the charging behavioral preference for EV drivers to use slower charging that is often cheaper and more convenient. We expect this preference will persist as EV adoption increases, and by 2030 we estimate 6% of non-home chargers needed in City Light's service territory will be DC fast chargers, decreasing further to 4% by 2038. Most of these chargers will be public destination DC fast chargers rather than public en-route chargers, indicating most DC fast chargers will be used to support daily charging needs, supplementing those lacking, or with limited, home charging access. In 2030, about 500 public destination and 200 public en-route DC fast chargers will be needed, and by 2038 about 900 and 250, respectively.

As with home chargers, where these non-home chargers are deployed throughout Seattle will depend on the characteristics of each region such as the amount of EVs, commute patterns, and access to home charging (or the lack thereof). **Table A4** in the appendix details the non-home charging needs in each zip code, by type, in 2030.

To better understand City Light's progress towards meeting its communities' charging infrastructure needs we compare charging deployment as of 2023 with targets in later years. **Table 8** summarizes the total number of Level 2 and DC fast chargers deployed as of 2023, consistent with the findings from Eco-movement presented in **Table 5** and **Table 6**, as well the estimated number of Level 2 and DC fast chargers needed in 2030 and the relative gap between those numbers.

Table 7
City Light's non-home charging gap between 2023 and 2030

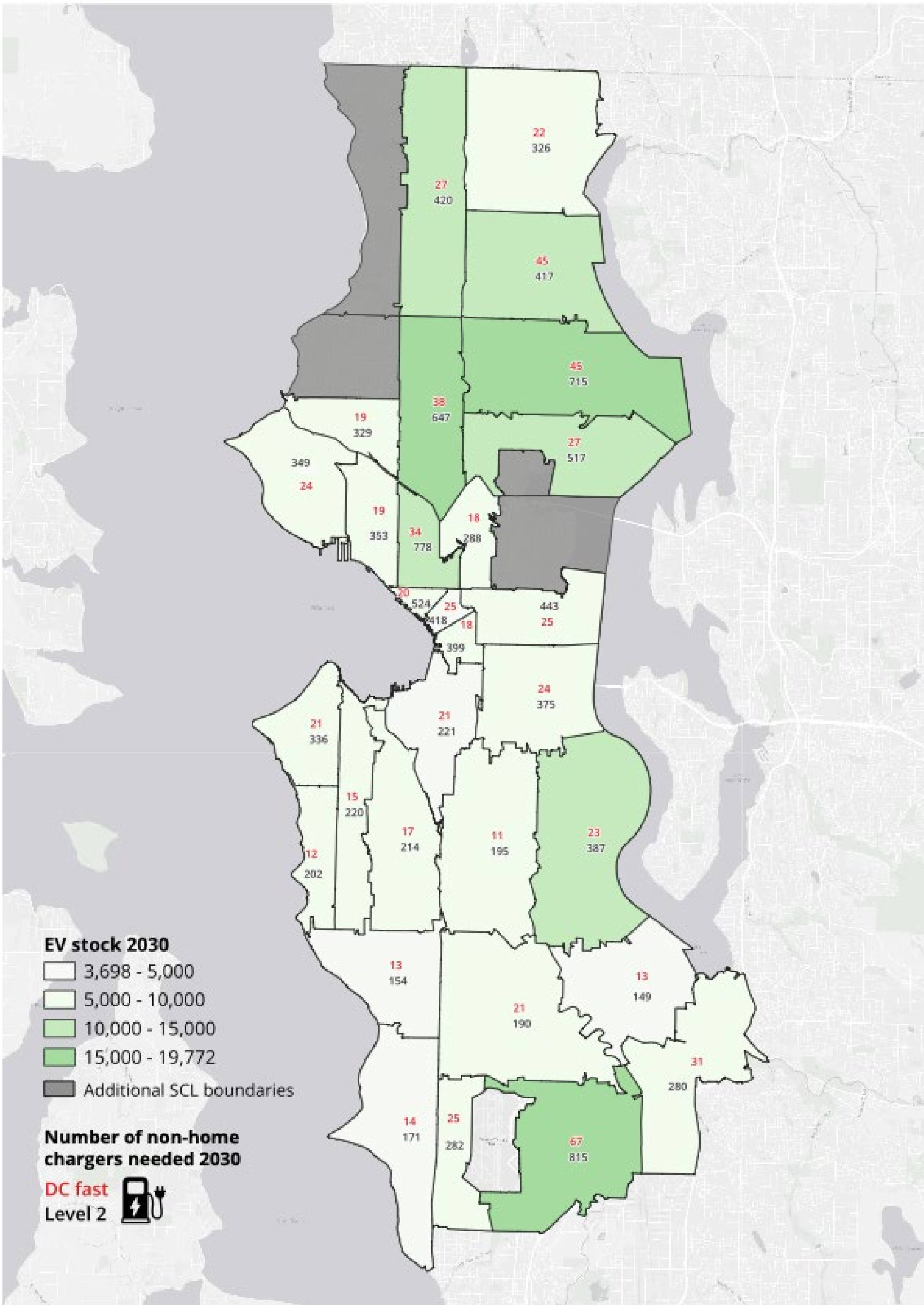
Non-home Level 2			Non-home DCFC			Total non-home		
Number of chargers			Number of chargers			Number of chargers		
2023	2030	Gap	2023	2030	Gap	2023	2030	Gap
1549	11,114	7.2x	223	734	3.3x	1,772	11,848	6.7x

As shown, the number of Level 2 chargers in City Light's service territory would need to increase more than sevenfold and the number of DC fast chargers would need to more than triple by 2030 to satisfy estimated non-home charging needs. Overall, non-home charging needs would need to increase nearly sevenfold. **Table A5** in the appendix details the Level 2 and DC fast non-home charging gaps in each zip code. In practice, and as will be discussed later in the section, the precise number of chargers needed can be adjusted if there is sufficient capacity to support energy demands of EVs in City Light's service territory Fewer higher power chargers can be deployed in lieu of many slow chargers if so desired, and EV drivers can be reasonably expected to adjust their charging behavior accordingly.

Figure 4 depicts a map of City Light's service territory. The map shows the Level 2 (in black) and the DC fast (in red) non-home charging needs, in 2030, in each of the zip codes analyzed. Each zip code is shaded green in accordance with the size of the EV stock estimated in each region in 2030; the darker the region, the greater the stock of EVs. A few of the regions that are shown in gray have been omitted from the analysis. 98112 (includes parts of Washington Park, Madison Park Denny Blaine, Montlake, and Stevens), 98117 (includes parts of Olympic Manor, North Beach, Sunset Hill, Phinney Ridge, Loyal Heights, Whittier Heights, Crown Hill, and Greenwood) and 98177 (includes parts of Blue Ridge, Broadview, and Shoreline) were omitted for lack of vehicle registration and sales data, 98154, 98164, and 98174 were omitted because they are too small to analyze—each contain a single city block in Downtown Seattle, and 98195 was omitted because it is wholly comprised of the University of Washington. Seattle-Tacoma International Airport is left blank because it is not part of City Light's service territory, instead receiving power from the Port of Seattle.[19]

19 "Airport Tenant Utilities", Port of Seattle, accessed August 1, 2024, https://www.portseattle.org/page/airport-tenant-utilities.

Figure 4
Map of Seattle City Light service territory with non-home charging needs and EV stock estimates, by zip code, in 2030

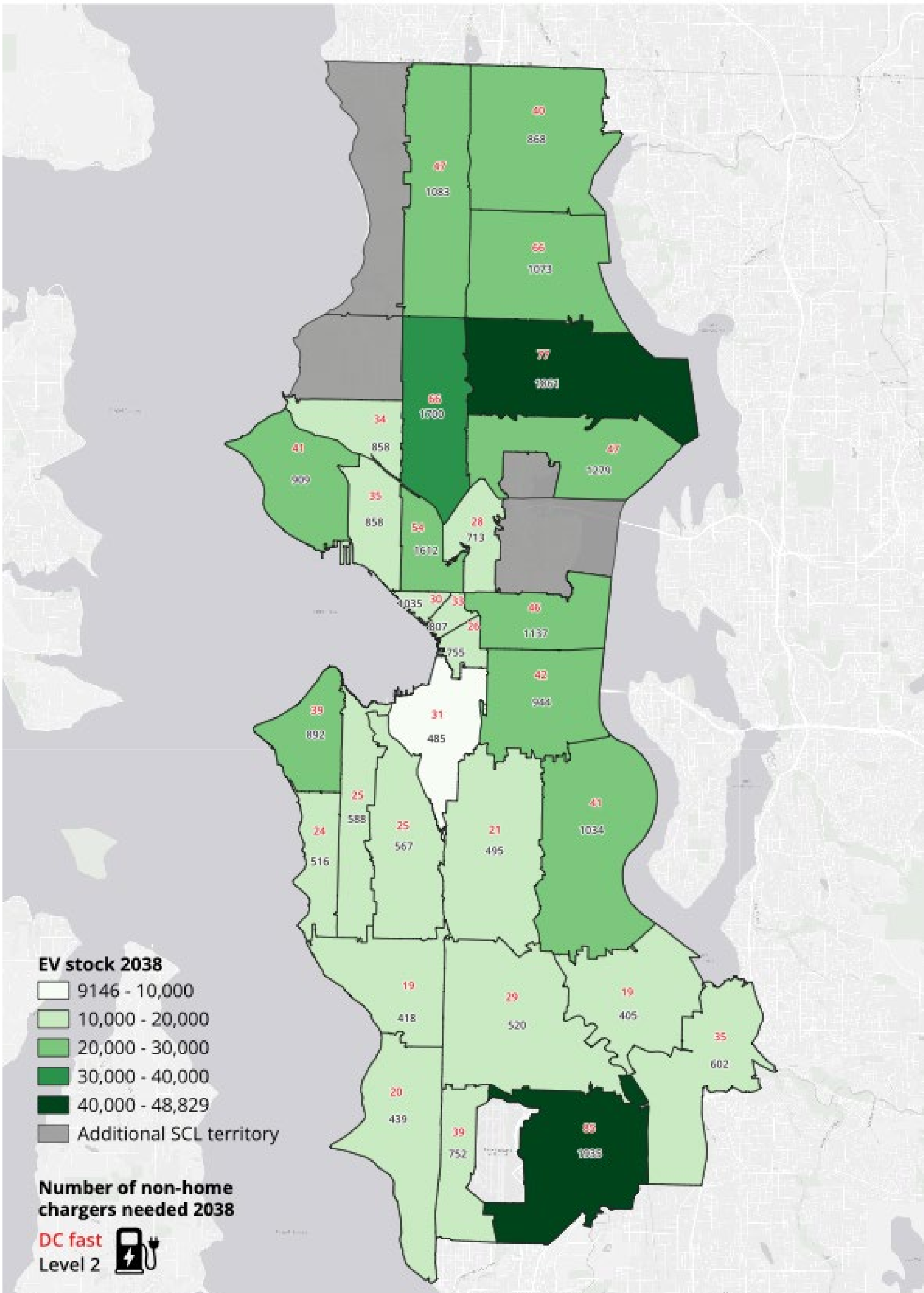


In 2030, Seattle is modeled to reach a 30% citywide EV stock share comprised of about 244,000 EVs. The stock of EVs in each zip code ranges from about 3,700 to about 20,000. The top 10 zip codes by EV stock, most of which are in the northern part of Seattle and City Light's service territory, except for 98188 near Seattle-Tacoma International airport, together account for about half of the EVs in 2030 with the remaining 20 zip codes representing the other half.

The top 10 zip codes by total non-home chargers needs mostly overlap with the top 10 zip codes by EV stock, showing the correlation that where there are more EVs there will also need to be more non-home chargers. 98101 and 98121 are outliers in this regard, having the tenth and the fifth-most non-home chargers needs, respectively, while being ranked 26th and 17th, respectively, in EV stock. These regions are unique in that they are centrally located in downtown Seattle and thus are projected to have large numbers of workplace chargers to support EV drivers that commute into these regions. **Table A6** in the appendix presents the results above alongside rankings for each zip code by projected EV stock and estimated charging needs.

Figure 5 shows the same map of City Light's service territory overlayed with the non-home charging needs and estimated EV stock, by zip code, in 2038. As shown, there is a significant uptick in EV adoption among all regions as the map is notably darker than **Figure 4**.

Figure 5
Map of Seattle City Light service territory with non-home charging needs and EV stock estimates, by zip code, in 2038

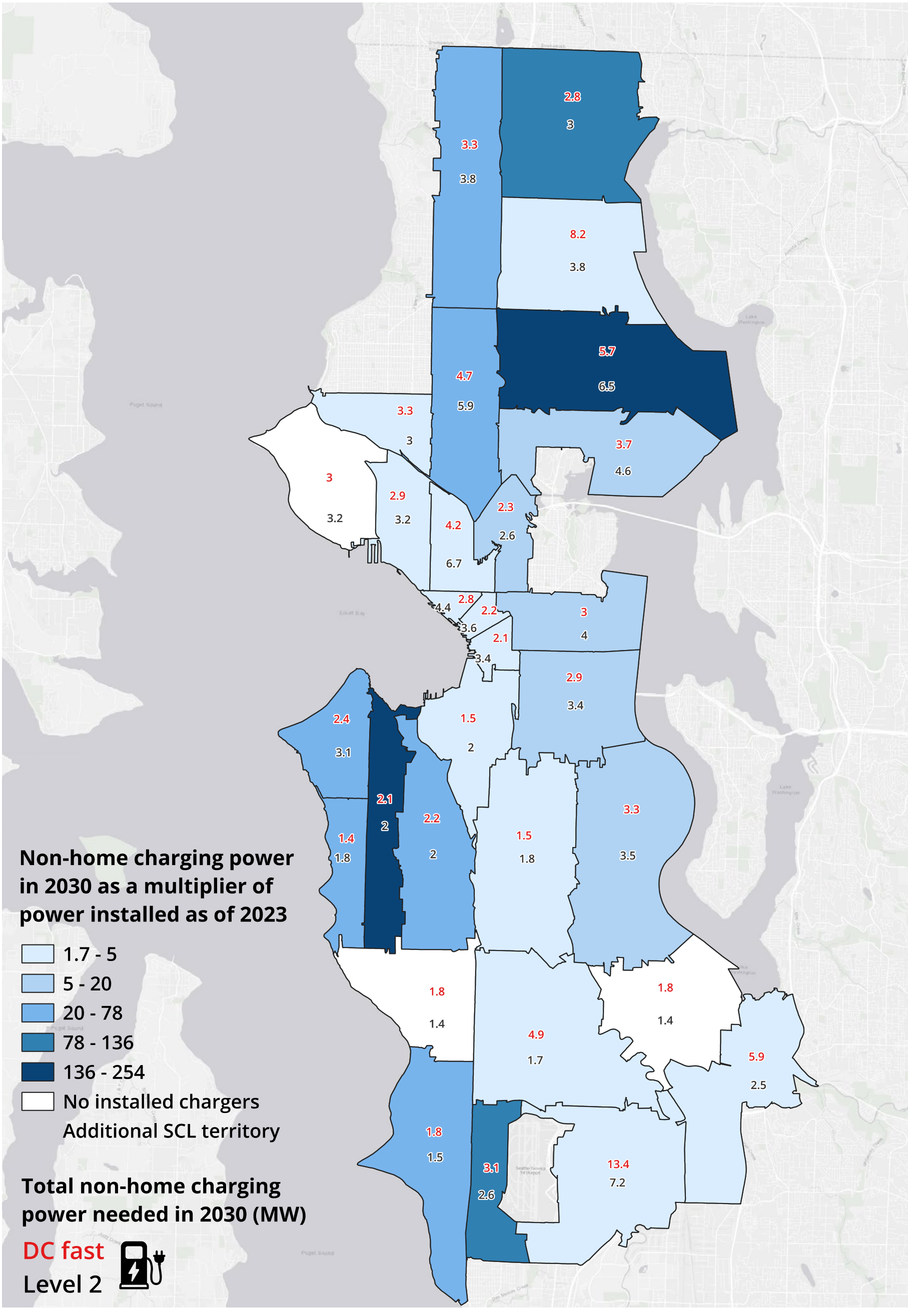


In 2038, the EV stock and stock share in City Light's service territory are about 600,000 vehicles and about 68%, respectively. Zip code EV stocks range about 9,000 to about 49,000. The trends in EV adoption persist from 2030 as the regions with the greatest adoption in 2030 are the same in 2038, and these are the regions with the greatest non-home charging needs.

The findings of relative number of Level 2 and DC fast charging needs are based on the best available data of how EV drivers charge, but changes in charging behavior could lead EV drivers to meet their charging needs using different chargers than what’s been modeled here. Given this possibility, it’s important to understand the amount of power (i.e. capacity) that is needed for non-home charging. The capacity needed, along with our assumptions for utilization, reflect the amount of energy that will satisfy the charging needs of vehicles that reside in, and travel to, each region in City Light’s service territory.

Figure 6 shows the non-home charging capacity needed in each of the zip codes analyzed. DC fast non-home charging capacity needs are labeled in red and Level 2 non-home charging capacity needs are labeled in black, both in MW of power needed. Regions are shaded blue in accordance with the scale of growth in capacity between what is installed as of 2023 and what is needed in 2030. Darker regions have a larger gap between the amount of capacity needed and what is already installed. The white regions indicate zip codes where no non-home charging has been installed as of 2023. As before, the gray regions show other zip codes in City Light's service territory that have been omitted from this analysis.

Figure 6
Map of Seattle City Light service territory with estimated non-home charging capacity needs



The regions that require the most non-home charging capacity generally do not need to grow their capacity too much relative to what is installed as of 2023. As previously discussed, these regions tend to also have the greatest amount of EV adoption indicating that chargers are being deployed where EVs are owned and driven. The one outlier in this regard is 98115, which has only 48 kW of non-home power installed as of 2023 and will need to grow to over 12 MW by 2030—a 2,540% increase, which is the largest gap. The zip codes where no non-home chargers have been installed yet have relatively less non-home charging capacity needs than the other zip codes. 98146 and 98178 in the southern part of City Light's territory have the second lowest and the lowest capacity needs, respectively, and 98199 is ranked 15th out of 30. **Table A7** in the appendix presents the data in **Figure 6** alongside the rankings for each zip code by both capacity needed and the size of the capacity gap.

Key Findings

This memo assesses the charging infrastructure deployment gap and projected charging infrastructure needs of 30 zip codes within City Light's service territory through 2038. We draw the following reflections from the analysis:

- **Continued EV market growth requires continued charging deployment.** By 2030 Seattle endeavors to have 30% of its light-duty vehicle registrations be EVs. This could lead to about 244,000 EVs across City Light's service territory. We estimate that an EV stock of this size will require more than 150,000 home chargers to be installed at single- and multifamily homes, as well as 12,000 non-home chargers at workplaces (~5,600 Level 2 chargers), residential curbsides (~2,700 Level 2 chargers), alongside highways (~200 DC fast chargers), and at other public locations (~2,800 Level 2 chargers and ~500 DC fast chargers). The number of Level 2 and DC fast non-home chargers deployed would need to increase by more than sevenfold and triple, respectively, from what's installed as of 2023; overall, the total number of non-home chargers deployed in City Light service territory would need to increase by nearly sevenfold.

- **Charging needs in Seattle will continue to grow in tandem with growth in its EV market.** By 2038, the stock of EVs across City Light's service territory could grow to over 600,000 vehicles or about 68% of registered light-duty vehicles. This stock could require about 330,000 home chargers and 28,000 non-home chargers.

- **Charging needs vary across Seattle by zip code in accordance with trends in EV adoption.** We find that future non-home charging needs in City Light's service territory are concentrated in areas where EV adoption is projected to be the highest. Primarily throughout the northern region of City Light's service territory and near Seattle-Tacoma International Airport. Likewise, estimated non-home charging capacity is greatest in zip codes with high EV adoption. That said, zip codes with lower EV adoption have been somewhat overlooked in terms of charging deployment, having relatively larger gaps in capacity that will need to be filled to support projected EV adoption.

Charging infrastructure planning and deployment is complex and involves coordination between government and municipal agencies, private sector charging companies, and utilities. Recent ICCT research has documented announced charging investments and utility actions to help accelerate charging deployments nationwide.[20] Further research can investigate how Seattle might leverage additional outside resources from public, private and utility sector investments to fill gaps in charging deployment, as well as how the city can prioritize its own funding to deploy chargers in underserved communities and communities to advance EV and charging access and equity.

20 Logan Pierce, Peter Slowik, *Assessment of U.S. electric vehicle charging needs and announced deployments through 2032*, (ICCT, Washington, DC, 2024), https://theicct.org/wp-content/uploads/2024/03/ID-89-–-Chargers-2032_final-v2.pdf.

Appendix

Table A1 summarizes the EV adoption projection from 2024 through 2038 applied in this analysis. EV sales, stock, sales share, and stock share, by powertrain (i.e. BEV or PHEV), are shown for each year.

Table A1
EV sales and stock projections, 2024 through 2038, modeled in this analysis

Year	BEV sales	PHEV sales	Total EV sales	EV share of new vehicle sales	BEV stock	PHEV stock	Total EV stock	EV share of vehicle stock
2023	10,143	1,962	12,105	27%	33,027	8,407	41,434	5%
2024	16,406	3,174	19,580	35%	49,150	11,477	60,626	8%
2025	19,000	3,676	22,676	40%	67,736	15,010	82,746	11%
2026	21,192	4,100	25,292	46%	88,339	18,915	107,254	14%
2027	25,013	4,839	29,853	54%	112,533	23,491	136,024	17%
2028	27,897	5,397	33,295	60%	139,314	28,545	167,859	21%
2029	32,116	6,213	38,330	69%	169,933	34,332	204,265	25%
2030	35,336	6,836	42,172	76%	203,311	40,627	243,938	30%
2031	38,110	7,373	45,483	82%	238,861	47,312	286,172	35%
2032	40,930	7,919	48,849	88%	276,480	54,387	330,867	40%
2033	43,253	8,368	51,621	94%	315,548	61,760	377,308	45%
2034	45,762	8,854	54,616	100%	356,096	69,437	425,533	51%
2035	45,661	8,834	54,495	100%	395,261	76,877	472,137	56%
2036	46,103	8,920	55,023	100%	433,295	84,134	517,429	60%
2037	46,638	9,023	55,661	100%	469,922	91,143	561,065	65%
2038	47,366	9,164	56,530	100%	504,994	97,870	602,864	69%

Table A2 details the housing distributions, by dwelling type, for the 30 zip codes analyzed in City Light's service territory. Initially, we adjust the distribution in each region to have a greater share of single-family detached homes because early adopters are more likely to live in single-family homes. As the EV stock share increases, we decrease the share of single-family homes and increase the share of all other housing types until the distribution matches the shares shown below, once a 50% EV stock share is reached.

Table A2
Housing distribution by zip code and dwelling type for zip codes considered in analysis

	Housing shares[21]				
Zip code	Single-family detached	Single-family attached	Multifamily home	Other home	Neighborhoods within[22]
98057	25%	3%	72%	1%	West Hill, Renton, Valley
98101	1%	0%	99%	0%	Downtown Seattle, Pike Place Market, Denny Triangle, First Hill
98102	13%	5%	81%	1%	Portage Bay, Montlake, Eastlake, Capitol Hill
98103	39%	10%	51%	0%	Greenwood, Phinney Ridge, Fremont, Wallingford, Green Lake, North College Park
98104	1%	0%	99%	0%	Downtown Seattle, Pioneer Square, First Hill, Chinatown-Internation District
98105	33%	3%	64%	0%	Laurelhurst, Windemere, Ravenna, Wallingford, Bryant, University District
98106	52%	11%	36%	1%	Riverview, North Delridge, Highland Park, High Point, South Delridge, Highline
98107	26%	11%	62%	1%	West Woodland, Fremont, Ballard
98108	63%	11%	25%	1%	Beacon Hill, Georgetown, South Beacon Hill, New Holly, South Park, Southern Heights
98109	10%	2%	87%	0%	East Queen Anne, North Queen Anne, Lower Queen Anne, Westlake, South Lake Union
98115	62%	4%	34%	0%	View Ridge, Ravenna, Wedgwood, Roosevelt, Lake City, Maple Leaf, Sand Point
98116	43%	8%	50%	0%	Alki, North Admiral, Genese
98118	64%	7%	29%	0%	Seward Park, Columbia City, Rainier Beach, Brighton, Dunlap, South Beacon Hill
98119	24%	4%	71%	0%	North Queen Anne, Lower Queen Anne, West Queen Anne, Interbay
98121	2%	0%	98%	0%	Pike Place Market, Denny Triangle, Belltown
98122	21%	5%	74%	0%	Madrona, Leschi, Mann, Minor, Capitol Hill
98125	48%	3%	49%	0%	Lake City, Maple Leaf, Pinehurst
98126	57%	9%	34%	0%	Fauntleroy, North Admiral, Gatewood, Fairmount Park, North Delridge, Roxhill, High Point
98133	43%	6%	50%	1%	Shoreline, Haller Lake, Bitter Lake
98134	0%	0%	100%	0%	SoDo
98136	69%	5%	26%	0%	Fauntleroy, Seaview, Gatewood, Fairmount Park
98144	43%	12%	45%	0%	Leschi, Mt Baker, North Beacon Hill, Atlantic
98146	70%	3%	27%	1%	Salmon Creek, Arbor Heights, Highline, Northeast Burien
98148	42%	3%	56%	0%	Five Corners, North Hill, Sunnydale, Manhattan
98155	70%	4%	25%	0%	Sheridan Beach, Horizon View, Brookside, Shoreline, Turtle Rock
98166	67%	1%	31%	0%	Three Tree Point, Maplewild, Normandy Park, Seahurst, Gregory Heights, Five Corners, Lake Burien, Linde Hill Park, Downtown Burien
98168	61%	2%	35%	2%	Highline, Northeast Burien, Foster Heights, Riverton, Allentown, Southern Heights, Tukwila, Cascade View, Cedarhurst, Latona-SeaTac
98178	74%	2%	23%	1%	Rainier Beach, West Hill
98188	36%	3%	57%	4%	Tukwila, Thorndyke, McMicken Heights, Angle Lake shore Acres Tukwila South, Riverton Heights, McVan-McMicken Heights, Rancho Vista, Outlying SeaTac
98199	60%	7%	33%	0%	Briarcliff, Southeast Magnolia, Lawton Park, Interbay

Table A3 details the estimated home charging needs in each zip code, in 2030, by type. Variations in the numbers of home chargers needed reflect differences in EV adoption and the number of residential units and the housing distribution in each zip code.

21 Numbers in table are rounded.
22 Neighborhood information received from https://www.homes.com.

Table A3
Estimated home charging needs in 2030, by level and housing type, for zip codes in City Light's service territory

Zip code	SFH Level 1	SFH Level 2	MFH Level 1	MFH Level 2	Home total
98057	305	897	376	1,109	2,687
98101	44	165	451	1,706	2,366
98102	227	830	458	1,673	3,188
98103	1,368	5,041	734	2,708	9,851
98104	39	136	474	1,690	2,339
98105	707	2,625	633	2,348	6,313
98106	633	2,365	183	680	3,861
98107	545	2,046	457	1,719	4,767
98108	660	2,475	108	401	3,644
98109	307	1,164	920	3,497	5,888
98115	2,163	8,051	560	2,083	12,857
98116	739	2,734	375	1,387	5,235
98118	1,336	4,972	270	1,004	7,582
98119	372	1,377	461	1,702	3,912
98121	67	252	599	2,275	3,193
98122	486	1,807	675	2,511	5,479
98125	910	3,362	452	1,671	6,395
98126	688	2,549	178	659	4,074
98133	896	3,343	466	1,740	6,445
98134	0	0	343	1,357	1,700
98136	686	2,500	118	430	3,734
98144	852	3,153	361	1,336	5,702
98146	593	2,194	106	391	3,284
98148	631	2,468	398	1,557	5,054
98155	1,193	4,441	199	740	6,573
98166	530	1,965	124	457	3,076
98168	609	2,321	163	621	3,714
98178	603	2,256	88	329	3,276
98188	1,211	3,624	864	2,587	8,286
98199	1,044	3,916	257	961	6,178
Total	**20,444**	**75,029**	**11,851**	**43,329**	**150,653**

Table A4 details the estimated non-home charging needs in each zip code, in 2030, by type. Variations in the number of chargers reflect differences in EV adoption, access to home charging, or the lack thereof, and the housing stock distribution.

Table A4
Estimated non-home charging needs in 2030, by type, for zip codes in City Light's service territory

Zip code	Public overnight Level 2	Public destination Level 2	Workplace Level 2	Public destination DCFC	Public en-route DCFC	Public Level 2 total	DCFC total	Level 2 total	Non-home total
98057	71	95	114	26	5	166	31	280	311
98101	77	214	127	21	4	291	25	418	443
98102	81	66	141	12	6	147	18	288	306
98103	169	109	369	26	12	278	38	647	685
98104	81	180	138	13	5	261	18	399	417
98105	132	119	266	18	9	251	27	517	544
98106	52	37	125	11	6	89	17	214	231
98107	92	55	182	13	6	147	19	329	348
98108	41	46	108	7	4	87	11	195	206
98109	163	343	272	24	10	506	34	778	812
98115	188	96	431	30	15	284	45	715	760
98116	89	52	195	15	6	141	21	336	357
98118	91	62	234	14	9	153	23	387	410
98119	88	95	170	14	5	183	19	353	372
98121	103	258	163	15	5	361	20	524	544
98122	125	86	232	18	7	211	25	443	468
98125	106	78	233	38	7	184	45	417	462
98126	54	33	133	9	6	87	15	220	235
98133	105	87	228	18	9	192	27	420	447
98134	66	49	106	18	3	115	21	221	242
98136	48	36	118	8	4	84	12	202	214
98144	92	77	206	16	8	169	24	375	399
98146	36	22	96	8	5	58	13	154	167
98148	84	44	154	17	8	128	25	282	307
98155	77	50	199	14	8	127	22	326	348
98166	39	34	98	9	5	73	14	171	185
98168	47	33	110	15	6	80	21	190	211
98178	34	22	93	8	5	56	13	149	162
98188	186	289	340	58	9	475	67	815	882
98199	93	45	211	16	8	138	24	349	373
Total	**2,710**	**2,812**	**5,592**	**529**	**205**	**5,522**	**734**	**11,114**	**11,848**

Table A5 details the number of deployed non-home chargers in each zip code, as of 2023 and the number of non-home chargers needed in 2030 to measure the gap in relative charging deployment.

Table A5
Gaps in non-home charging deployment, by zip code, between existing chargers as of 2023 and needed chargers in 2030

Zip code	Level 2	DCFC

	2023	2030	Gap	2023	2030	Gap
98057	58	280	4.8	22	31	1.4
98101	184	418	2.3	21	25	1.2
98102	32	288	9.0	0	18	—
98103	31	647	20.9	2	38	19.0
98104	151	399	2.6	5	18	3.6
98105	63	517	8.2	5	27	5.4
98106	9	214	23.8	1	17	17.0
98107	13	329	25.3	13	19	1.5
98108	22	195	8.9	5	11	2.2
98109	278	778	2.8	4	34	8.5
98115	6	715	119.2	0	45	—
98116	10	336	33.6	1	21	21.0
98118	12	387	32.3	6	23	3.8
98119	57	353	6.2	8	19	2.4
98121	219	524	2.4	15	20	1.3
98122	33	443	13.4	10	25	2.5
98125	28	417	14.9	28	45	1.6
98126	4	220	55.0	0	15	—
98133	36	420	11.7	1	27	27.0
98134	26	221	8.5	14	21	1.5
98136	10	202	20.2	0	12	—
98144	33	375	11.4	2	24	12.0
98146	0	154	—	0	13	—
98148	3	282	94.0	1	25	25.0
98155	8	326	40.8	0	22	—
98166	12	171	14.3	1	14	14.0
98168	6	190	31.7	15	21	1.4
98178	0	149	—	0	13	—
98188	205	815	4.0	43	67	1.6
98199	0	349	—	0	24	—
Total	**1549**	**11,114**	**7.2**	**223**	**734**	**3.3**

Table A6 details the Level 2, DC fast, and total non-home charging needs and EV projections in 2030, in each zip codes analyzed and consistent with the results in **Figure 4**. It also provides rankings by EV stock and by the total number of non-home chargers needed showing there's generally overlap between the areas with greatest EV adoption and where most non-home chargers are needed.

Table A6
Estimated non-home charging needs, by type, and EV projections by zip code

Zip code	Level 2	DC fast	Total non-home chargers needed	Ranking by number of non-home chargers needed	EV stock	Ranking by size of EV stock
98057	280	31	311	19	5,108	24
98101	418	25	443	10	4,675	26
98102	288	18	306	21	5,728	19
98103	647	38	685	4	15,823	3
98104	399	18	417	11	5,331	22
98105	517	27	544	5	10,793	5
98106	214	17	231	24	5,637	20
98107	329	19	348	17	7,730	14
98108	195	11	206	27	5,094	25
98109	778	34	812	2	10,697	6
98115	715	45	760	3	19,772	1
98116	336	21	357	16	8,332	13
98118	387	23	410	12	10,924	4
98119	353	19	372	15	6,780	16
98121	524	20	544	5	6,193	17
98122	443	25	468	7	9,466	9
98125	417	45	462	8	10,152	7
98126	220	15	235	23	6,007	18
98133	420	27	447	9	10,044	8
98134	221	21	242	22	3,698	30
98136	202	12	214	25	5,544	21
98144	375	24	399	13	8,981	12
98146	154	13	167	29	4,570	27
98148	282	25	307	20	7,405	15
98155	326	22	348	17	9,450	10
98166	171	14	185	28	4,473	28
98168	190	21	211	26	5,159	23
98178	149	13	162	30	4,446	29
98188	815	67	882	1	16,506	2
98199	349	24	373	14	9,419	11

Table A7 details the public Level 2, workplace Level 2, DC fast, and total non-home charging capacity needed in 2030 in the zip codes analyzed, consistent with the results in **Figure 6**. The gap is a measure of the total non-home charging capacity needed in 2030 divided by the non-home charging capacity than has been installed as of 2023. Capacity installed as of 2023 can be calculated by dividing the total capacity needed by the gap. Rankings of zip codes by both the size of the gap and the total non-home capacity needed are provided for reference. Total non-home capacity needed may not sum precisely because of rounding.

Table A7

Estimated non-home charging capacity needed, by charger type, and charging capacity gap for zip codes in City Light's service territory in 2030

Zip code	Public Level 2 capacity needed (MW)	Workplace Level 2 capacity needed (MW)	DCFC capacity needed (MW)	Total non-home capacity needed (MW)	Gap	Ranking by size of gap	Ranking by total non-home capacity needed
98057	1.5	1.0	5.9	8.4	1.7	27	6
98101	2.4	1.1	2.2	5.7	1.9	23	18
98102	1.4	1.2	2.3	4.9	19.5	11	22
98103	2.7	3.3	4.7	10.6	27.9	8	5
98104	2.2	1.2	2.1	5.5	3.8	19	20
98105	2.3	2.4	3.7	8.3	6.7	14	7
98106	0.8	1.1	2.2	4.1	31.3	7	23
98107	1.4	1.6	3.3	6.3	2.5	21	14
98108	0.8	1.0	1.5	3.2	3.8	18	28
98109	4.3	2.4	4.2	10.9	4.4	16	4
98115	2.7	3.8	5.7	12.2	254.0	1	2
98116	1.3	1.7	2.4	5.4	39.2	6	21
98118	1.4	2.1	3.3	6.8	6.8	13	11
98119	1.7	1.5	2.9	6.0	3.1	20	16
98121	3.0	1.4	2.8	7.2	2.0	22	8
98122	1.9	2.1	3.0	6.9	5.2	15	10
98125	1.7	2.1	8.2	11.9	1.9	24	3
98126	0.8	1.2	2.1	4.1	137.0	2	24
98133	1.8	2.0	3.3	7.1	23.0	10	9
98134	1.1	0.9	1.5	3.5	3.9	17	25
98136	0.8	1.0	1.4	3.2	43.6	5	27
98144	1.6	1.8	2.9	6.3	17.5	12	13
98146	0.6	0.8	1.8	3.2	—	—	29
98148	1.2	1.4	3.1	5.6	78.1	4	19
98155	1.2	1.8	2.8	5.8	78.3	3	17
98166	0.7	0.9	1.8	3.3	24.7	9	26
98168	0.8	1.0	4.9	6.6	1.7	26	12
98178	0.5	0.8	1.8	3.1	—	—	30
98188	4.1	3.0	13.4	20.5	1.7	25	1
98199	1.3	1.9	3.0	6.2	—	—	15
Total	**50.0**	**49.5**	**103.4**	**202.9**	**2.8**	—	—