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CASE STUDIES: *City Public & Curbside* EV CHARGING STRATEGIES

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Policy Brief

EV Equity Initiative

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CASE STUDIES: CITY PUBLIC AND CURBSIDE EV CHARGING STRATEGIES

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ABOUT THIS REPORT

The Center for Law, Energy & the Environment (CLEE) developed this policy brief as part of its EV Equity Initiative, which seeks to build locally tailored, community driven, and replicable approaches to the development of electric vehicle and mobility infrastructure in underserved communities in California and US cities. Funding for the Initiative comes from the Volkswagen CO_2 Cy Pres Settlement Fund. To develop this brief, CLEE researched city programs that are leading efforts to expand EV charging infrastructure to the curbside and public right-of-way, and the authors conducted interviews with directors from most of these programs. This brief is intended to guide local leaders as they plan and execute public EV charging infrastructure development with a focus on equitable investment.

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ABOUT THE CENTER FOR LAW, ENERGY & THE ENVIRONMENT

CLEE channels the expertise and creativity of the Berkeley Law community into pragmatic policy solutions to environmental and energy challenges. CLEE works with government, business, and the nonprofit sector to help solve urgent problems requiring innovative, often interdisciplinary approaches. Drawing on the combined expertise of faculty, staff, and students across the University of California, Berkeley, CLEE strives to translate empirical findings into smart public policy solutions to better environmental and energy governance systems.

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INTRODUCTION

This brief provides a preliminary overview of electric vehicle (EV) charging programs that have focused on public, curbside, and public right-of-way (PROW) installations in select US and international cities.

The purpose of this brief is to identify potential policy strategies, opportunities, and challenges for California cities to deliver public charging to priority populations.[1] As California and other states transition to one hundred percent zero-emission new vehicle sales by 2035,[2] local governments will play a crucial role in addressing known and potential inequities in the EV transition, from access to vehicle charging to the health benefits of vehicle electrification.[3]

Curbside, PROW and related strategies may be particularly valuable for city governments seeking to advance equitable access to EV charging for priority populations and underserved communities. These approaches have the potential to bring convenient charging to residents who are likely to lack access to charging in private driveways or

1 This analysis was developed with particular focus on advancing implementation of the City of Oakland's Zero Emission Vehicle Action Plan actions PC-1 (public right-of-way charging ordinance), PC-2 (residential curbside charging strategy), and PC-3 (charging in frontline communities program). The plan includes an explicit focus on equity in planning and investment actions and calls for "assess[ment of] emerging best practices from other jurisdictions in facilitating residential curbside public EV charging" to inform the city's curbside strategy.

2 See California Air Resources Board (CARB), Advanced Clean Cars II (webpage), available at https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii.

3 See, e.g., Chih-Weh Hsu and Kevin Fingerman, "Public electric vehicle charger access disparities across race and income in California," Transport Policy (January 2021), available at https://www.sciencedirect.com/science/article/pii/S0967070X20309021; Jaye Mejia-Duwan et al., "Emissions redistribution and environmental justice implications of California's clean vehicle rebate project," PLOS Climate (May 2023), available at https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000183.

garages, in multifamily dwelling parking lots, or at workplaces; they can also promote investment in charging near key commercial corridors and community facilities and in dense urban environments.

However, curbside and related public charging programs are not inherently equity-oriented. Local governments pursuing these strategies will need to carefully and deliberately structure their plans to meet the needs of priority populations and ensure equitable distribution of investment, planning capacity, and policy emphasis, in addition to overall effectiveness. As the City of Oakland's Zero Emission Vehicle (ZEV) Action Plan notes with regard to curbside charging, "Frontline communities have unique mobility and public infrastructure needs, which require more staff involvement, education, and outreach in project development and implementation.... Simply installing an EV charger in these communities with no additional amenities, education, or programming may not be helpful or immediately relevant."[4]

Thus, while Oakland and other cities may identify curbside and related strategies as key steps to ensure equitable charging access, these strategies will require careful crafting and substantial stakeholder input.

This brief is based on analysis of and interviews with leaders from the following programs.[5]

- Amsterdam demand response charging pilot
- Berkeley, California residential curbside permitting pilot
- London curbside programs
- Los Angeles streetlight charging program
- Melrose, Massachusetts streetlight charging pilot
- New York City curbside pilot program
- Portland, Oregon public right-of-way code update project and utility pole charging pilot
- Seattle public right-of-way permitting pilot and curbside charging program
- Washington, DC residential curbside program and permitting program

Each program's design and context is distinct, but they share some common elements and approaches. Broad archetypes include:

- Publicly led direct installation and ownership through municipal utility (e.g., Los Angeles, Seattle) or private/investor-owned utility (e.g., Amsterdam, Melrose, New York, Portland)
- Permitting and ordinance regimes for private installation and ownership (e.g., Portland, Seattle, Washington DC)
- Early-stage, permit-only pilot for private installation and ownership (e.g., Berkeley, Seattle)
- Allowance and guidelines for Level 1 charging cords in the residential PROW (e.g., Portland, Seattle, Washington DC)

4 City of Oakland, Zero Emission Vehicle Action Plan (January 2023), p. 60, available at https://www.oaklandca.gov/projects/zero-emission-vehicle-action-plan.

5 These programs were selected to highlight a diversity of early approaches and city environments. They are not meant to represent all approaches or urban contexts.

To date, these programs have largely focused on basic planning and operational questions, with limited focus on equity considerations. Many of the programs are still in the early stages of development, and the development of general process and design strategies is a vital first step toward equitable site selection, financing, and more under the broad umbrella of publicly accessible charging. In addition, program design will ultimately derive from city-specific factors including governmental structure, electric utility type, existing EV and curb management strategies, geography and community needs, and funding availability.

KEY FINDINGS

Jurisdictions seeking to build strategies for curbside and PROW charging deployment as a means to promote access to EV infrastructure can learn from these examples of city leadership.

However, these early pilots include only a handful of explicitly equity-centered strategies, including siting frameworks to ensure equal distribution across city districts and consultation with a group of community-based organizations. To ensure future pilots and full-scale programs promote equity in decarbonized transit, leaders should build them around needs assessment, community consultation, and investment decision-making that increase mobility and address pollution in priority communities.[6] Key learnings from these programs include:

- **Prioritizing equity can be challenging for strategies based on private EVSE providers.** Portland's effort to update the city code to facilitate PROW installation by private electric vehicle supply equipment (EVSE) providers has the potential to promote and accelerate investment across the city but includes no mechanism to ensure investment in underserved communities, which may have lower demand for charging in early years. On the other hand, Seattle's publicly-run curbside pilot program, in which an expert panel selected sites from thousands of public applications, was able to require geographic distribution across the city and to prioritize sites that met certain equity-oriented criteria (including applications from ride-hailing drivers and residents who receive utility bill subsidies).
- **Utility leadership is vital to fast-rollout public programs.** In Los Angeles and Seattle, municipal utilities have partnered with city transportation and

6 See, e.g., Greenlining Institute, Mobility Equity Framework (2018), available at https://greenlining.org/publications/mobility-equity-framework-how-to-make-transportation-work-for-people/.

public works departments to lead publicly owned and operated streetlight and utility-pole charger installations. In Melrose and New York, particularly engaged private utilities co-developed similar pilot programs working with the city. In both contexts, the utility's ability and willingness to co-lead the program and own/manage some of the infrastructure was central to the program's effectiveness. For cities in investor-owned utility (IOU) service territory, it may be crucial to establish a strong program relationship with the IOU or to explore alternatives that bypass IOU infrastructure where possible.

- **Systematic approaches can yield substantial public benefits.** New York's Level 2 curbside pilot installed chargers in all five boroughs, formed a relationship with the IOU on charging, and developed utilization and uptime data that will inform future programs. Portland's PROW permitting program established programmatic charging efforts within the relevant city agencies, laying groundwork for subsequent iterations.
- **Residential Level 1 cord cover programs can safely improve accessibility at low cost.** Allowing residents to run charging cables from homes across the PROW to vehicles parked at curbside (subject to compliance with placement, design, and safety guidelines for cord coverings), as Portland, Seattle (which pioneered the approach), and Washington, DC have done, is a low-cost alternative to full-scale infrastructure installation. These programs can allow residents to bypass permitting processes, instead relying on guidelines and the potential for enforcement action under existing PROW management codes. However, since no formal permit is issued, success can be difficult to track.
- **Residential permit-based approaches may have limited effectiveness.** Berkeley's program created a bespoke permitting and approval process for residents without a driveway or garage to install curbside charging, but by placing all the permitting and installation costs on the applicant, it generated few installations overall and did not serve priority or underserved communities. Seattle's permit-based approach for PROW charging in high-density areas generated too many conflicts with competing curb uses, utility and transit infrastructure, and lack of public support.
- **Private EVSE suppliers require long-term permits and franchise agreements to make investment decisions.** Multiple cities' existing encroachment/public space use permits can work for EV charging installations but have one-year terms, which are insufficient for a private company to base a long-term EV infrastructure investment. Cities will need to create longer-term permits for EV charging–either bespoke permits specific to EV infrastructure or modifications to existing permits–in order to draw market actors to the curbside and PROW.
- **Drop-down streetlight/utility pole charger technology can save costs and is a viable solution to address vandalism.** By installing chargers at elevation on streetlights and utility poles, programs can save significant costs compared to ground-mounting pedestals (because new electrical infrastructure and sidewalk trenching/disturbance are not necessary) and can avoid complex and lengthy street use permit reviews. Charging cables that lower to the user only when the unit is accessed via payment app (or potentially credit card) also enhance pedestrian safety and reduce vandalism risk.

- **Local governments can lead on innovative charging, payment, and infrastructure models.** The City of Amsterdam and the local utility piloted a grid management strategy that uses demand response-enabled chargers to reduce charging speed during peak demand periods, allowing the existing power grid to accommodate far more EV chargers than otherwise. In London, the borough of Merton promotes financial accessibility in its charger procurement by selecting a supplier that offers monthly pricing packages, lowering costs for high-mileage end users. The borough of Barnet selected a supplier whose "flat-and-flush" EVSE design, like streetlight chargers, limits the charging infrastructure's visual and material impression on the streetscape, meeting residents' needs for a low-impact public system.

The remainder of the brief provides detailed discussion of the individual programs.

CASE STUDIES

AMSTERDAM FLEXPOWER PROGRAM[7]

The City of Amsterdam's FlexPower program uses demand response technology to manage the grid's capacity and optimize usage of local renewable energy as a means to integrate growing demand for EV charging into the existing power grid. Amsterdam implemented two pilot versions of the FlexPower program from 2017 to 2022 with an aim to evaluate the technical feasibility of the smart charging system. Amsterdam has since taken action to scale the program's newest model–FlexPower3–for citywide use, while the Netherlands' National Charging Infrastructure Agenda has incorporated this model into a successor program for national-scale implementation.

Key stakeholders in Amsterdam's FlexPower pilot program included Liander (utility company/grid owner), Vattenfall, Total Energy and Equans (charging station operators), the City of Amsterdam (charging station owner), and information analysis teams from Hogeschool van Amsterdam and ElaadNL. The pilot outcomes demonstrated potential to yield significant grid cost reductions in larger-scale iterations. FlexPower's newest model allows the grid to accommodate significantly more EV chargers in a given network relative to a static grid system.

The FlexPower system's "Smart Static Charging Profile" manages grid strain by "adapting the charging profile to the forecasted demand and availability of local renewables." The system uses standard demand response protocols to maximize the efficiency of

7 Analysis based on Amsterdam University of Applied Sciences report, ElaadNL report, city program webpage, EU program webpage, and interviews with Frank Geerts, ElaadNL Smart Charging Program Director, and Hugo Niesing, Resourcefully Founder and Director.

EV charging: As residential solar energy production surges in the middle of the day, EV chargers deliver greater power and faster charging speeds to vehicles. During morning and late afternoon demand peaks, charging power diminishes to offset systemwide increased energy usage and renewable source reduction. The charging station operator is responsible for calibrating each station's capacity based on the charging schedule sent by the grid operator. In the first two versions of FlexPower, charging capacity was individualized to each station, whereas FlexPower3 determines station capacity collectively by district, according to average demand. This alteration, combined with the demand response mechanism, reduces the base power level reserved for each EV charger from about 11 kW to 3.5 kW and removes a second charging peak that would otherwise strain the grid during the late evening. This allows the grid to accommodate up to 3-4 times more charging stations in a given network as compared to a static system, albeit with customers receiving lower-power charging at multiple times throughout the day.

To facilitate access, the City of Amsterdam provides a comprehensive map of charging stations that shows each station's plug type and charging method. In addition, residents can request new EV chargers to be constructed; location requests are evaluated by the city along a range of technical criteria (e.g., proximity to existing chargers, technical feasibility, road safety) then installed by a station provider and grid operator in a period of 6-8 months after the initial request, if approved.

The grid operator is the FlexPower system's primary beneficiary, with substantial savings accrued through maintenance reductions and averted investments in grid expansion, allowing more chargers to be installed and to operate on existing grid infrastructure. The system relies on users' willingness to accept reduced charging speeds during peak hours (and EVSE providers' willingness to supply it), which program officials attribute to effective public communication and a receptive city culture. Program officials also noted that parking times during peak hours typically exceed charging needs, so few users experience significant changes in total charge received. While individual and EVSE provider incentives to use FlexPower are limited, the City of Amsterdam is planning to require FlexPower smart charging for all new public charging installations, demonstrating the systemwide benefits of the model.

BERKELEY RESIDENTIAL CURBSIDE ELECTRIC VEHICLE CHARGING PILOT PROGRAM[8]

The city of Berkeley initiated the program in December 2014 as a three-year pilot to create 25 curbside charging locations and later extended it through December 2020. The goal was to test "whether these strategies can be an effective means of removing a barrier to EV adoption while also assuring that the PROW continues to serve the general public." The program was a collaboration between the city's public works and planning and development departments. Although the program received extensive interest from potential applicants (particularly in the first three years of the pilot when grant funding covered application and permit fees), only seven applicants followed through with curbside installations.

8 Analysis based on review of the city's pilot program manual and interview with Sarah Moore, Berkeley Sustainability Program Manager.

Key program components included:

- Chargers were installed and maintained at resident's sole expense.
- Curbside installation was only permitted when at-home/property charging was not feasible. Residents with existing driveways/garages were ineligible; residents with an adequate area in the front yard were allowed to install a curb cut in the PROW and construct a parking space deed restricted for EV charging. (Four of the seven pilot program installations were of this type.)
- Installation conferred no right to the parking space or change in parking requirements (including required signage stating the space remained public).
- Level 1 and Level 2 charging were permitted.
- Charging stations were intended for private use by the owner, maintained by a security enclosure or use of a power disconnect switch at the property. If public, chargers had to be Americans with Disabilities Act (ADA)-compliant and accessible at no cost at all times.
- Electrical conduit was run from the home panel to the new charging station located in the curbside planting strip, routed perpendicular to and under the sidewalk, typically requiring trenching. Cords could not cross sidewalks or driveways and stations had to meet city placement and design criteria.

Application components and requirements included an informational handout to all block residents regarding the project (plus publicly posted notice and opportunity for comment); minor encroachment, engineering, and electrical permits issued by the city; and, starting in 2018, an approximately $400 application fee and $2200 in permit and inspection fees, plus hardware costs.

It appears that the program struggled for three key reasons:

- The high cost of permitting and installation–generally between $5,000 and $20,000, entirely on the homeowner–limited public interest in participating.
- The additional requirements for residents to make chargers open to the public (ADA accessibility, 24/7 operability, and zero payment for use) meant that the residents who did apply for the program only elected to install chargers for personal use.
- These factors combined to limit overall program uptake and render minimal equity benefits, since charging installations were generally limited to private use in front of single-family residences. (The timing of the program–very early in the development of the EV and EVSE markets–also likely contributed to its limited success.)

These initial findings suggest that relying on individual residents to invest in high-cost, process-intensive curbside/PROW charging infrastructure may not be a viable pathway for large-scale charging access. Rather, individual residents may be expected to invest in at-home garage or driveway charging installations, while local governments and third-party EVSE providers will be responsible for installations in public spaces that require thorough permitting procedures and significant capital investments.

LONDON RESIDENTIAL CHARGING PROGRAMS[9]

The United Kingdom's national and subnational governments offer municipalities several application-based funding streams to support local EV charging infrastructure. In London, city funding secured from national schemes cover about 75 percent of capital costs for charging station delivery, with the remaining 25 percent usually funded by individual boroughs. (London has 32 boroughs with populations between 100,000 and 400,000.) The following sections outline two London borough programs that direct government funding toward charging installations that are intended to support EV use for residents who lack off-street parking access.

Merton: Streetlight Charging

The borough of Merton initiated a project to add over 500 streetlight-mounted EV chargers to its existing inventory upon securing £750,000 from the UK Office for Zero Emission Vehicles' On Street Residential Charge Point Scheme. Merton has executed the charging station procurement process using the Transport for London's (TfL) Go Ultra Low City Scheme contract framework. Within the framework, boroughs elect suppliers on the basis of three criteria: 1) highest revenue share paid to the borough, 2) lowest average "Pay As You Go" (PAYG) price to end users, and 3) lowest overall cost of services incurred per EV charger. Costs can include supply and installation, ground works such as earthing, street works permits and parking suspensions.

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Merton selected Char.gy as its supplier based on the company's low cost of services compared to other suppliers, and optional charging packages (offered as an alternative to the conventional PAYG per-kilowatt-hour (kWh) rate) that provide various kWh levels for a prepaid, flat monthly fee that is lower than the conventional rate. In addition, the provider uses 100 percent renewable energy, which aligns with TfL program goals.

Char.gy's monthly flat rate kWh packages are particularly beneficial for high mileage users like taxi drivers. However, a survey process eliminated a significant proportion of the borough's existing streetlights as viable candidates for EV charger installation on the basis of technical readiness issues, narrowing the project's available selection of charging sites.

9 Analysis based on Merton borough website, Merton committee report, London EV Infrastructure Strategy, Barnet Council webpage, Trojan Energy webpage, and interview with Robert Poole, Barnet EV Infrastructure Service Manager.

Barnet: Ground-Level Charging

Barnet London Borough Council has commenced a program to install 500 street-light and 793 ground-level residential charging stations throughout the borough. A £5.19 million grant award from the UK Office for Zero Emissions Vehicles' On-Street Residential Charge Point Scheme will cover 60 percent of total project costs.

In the first phase of its program implementation, Barnet has established an acclaimed partnership with a private supplier, Trojan Energy (TE). TE will supply the program's ground-level residential infrastructure using a "flat and flush" design that positions the station's plug access point level to the ground, with associated power infrastructure located in underground charging "cabinets" placed up to 100 meters away in more discreet spots. The design leaves pavement clear and accessible to pedestrians when the stations are not being operated. As residents generally responded unfavorably to standalone charging stations and their corresponding aboveground power bays, TE's flat design with a distant and underground power source offers an appealing alternative.

Residents must use their own cord to connect their vehicle to TE stations, and individual cord distribution is managed by the Council in effort to ensure that charging stations are only used by residents who live in their nearby vicinity. This council-level distribution responds to residents' concern about potential traffic spikes and overuse of charging stations in residential areas. The council serves as the project manager, coordinating the range of stakeholders involved in charger delivery and usage.

Barnet's EVSE supplier choice and program implementation reflects ongoing public engagement to address station design and PROW use concerns. The Council is working to establish a set of policies and procedures to further guide public communication regarding charging infrastructure. The use of public funding for installation (provided through a generous grant) offers two key advantages over private funding pathways: the borough retains control over the charging tariff, facilitating lower prices for residents, and the borough can retain a share of charging revenue as a funding stream.

LOS ANGELES STREETLIGHT CHARGING PROGRAM[10]

Los Angeles's streetlight EV charging program is an initiative of the city's Bureau of Street Lighting (BSL), with city-installed and -owned Level 2 chargers on streetlights owned by the city and served by the Los Angeles Department of Water and Power (DWP), a municipal electric utility. The program has installed approximately 700 chargers to date at locations throughout the central and western parts of the city.

The program initiated with a mayoral target of 10,000 EV chargers in the city and a BSL program to replace existing bulbs with energy efficient LED bulbs citywide, which reduced the electricity demand for lighting at each pole substantially below the available supply–freeing capacity for other uses such as EV charging. The chargers

10 Analysis based on review of city program website, interview with Clinton Tsurui, Los Angeles Bureau of Street Lighting Smart City Group, and presentation by Michael Samulon, Los Angeles Director of Vehicle Electrification.

rely entirely on existing streetlight infrastructure, with chargers attached to poles and existing 240-volt electrical service without need for upgrades.

The program aims to install 150 chargers per year, spread evenly across city council districts; the program team generally does not consult with communities on charger placement but targets locations with adequate capacity that are located near multifamily apartment buildings. When selecting a location, BSL consults with the Los Angeles Department of Transportation (DOT) to check for conflicts with current and planned transit, bike, and pedestrian infrastructure, but does not conduct formal consultation with community groups. Once DOT confirms the location, DPW installs the charger and DOT installs an EV charging-only sign at the spot.

The city's ownership of the light poles and (through DWP) the electrical wiring and supply is pivotal to the city's ability to install and operate the infrastructure. Vandalism of screens, cables, and entire charging units has been a challenge, with maintenance and replacement costs limiting the potential to reach revenue positivity in the program.

The speed of Los Angeles's installations highlight the value of centralized ownership of relevant assets and decisions by municipal entities. Preliminary insights include:

- The city's ownership (together with the municipal utility) of the physical and electrical assets are crucial to the program's success–unified control of the infrastructure allows fast approval and installation and eliminates competing use concerns for the electricity freed by the LED switch (i.e., in other cities, wireless networks have added communications systems that compete with charging).
- The city has not prioritized equity as much as utilization in site selection, and generally has not sought significant public input. Instead, chargers are distributed equally among council districts in areas with the fewest competing curb uses and most electrical capacity.
- Single chargers in curbside locations generally face more vandalism than chargers in parking lots and other areas with cameras or more passers-by.

These initial findings suggest that cities with municipal electric utilities have the potential to scale streetlight charging, which offers relatively low-cost and low-complexity installations at the curbside. However, leading with existing streetlight infrastructure and electrical capacity may limit city leaders' ability to focus installations in high equity-priority areas (such as near multifamily buildings and key community resources in lower-income communities).

To target equity-priority areas, the Los Angeles Department of Transportation created the BlueLA EV car-share program, a subscription-based pilot effort involving 40 curbside parking and charging locations (managed by Blink Mobility) with budget office, city council, and community-based organization input on site selection.[11] This program is separate from the streetlight charging program and offers an example of more equity-centered program design. Future policy briefs in this series will discuss shared mobility programs as an equity strategy.

11 For more information, visit https://ladot.lacity.gov/bluela.

MELROSE, MASSACHUSETTS/NATIONAL GRID PILOT PROGRAM[12]

Melrose, Massachusetts (a city of 30,000 in the Greater Boston metro area) initiated a pilot effort to install 16 Level 2 chargers on utility-owned streetlights at 10 sites with a mix of single and dual chargers. The city anticipated installation cost savings of 70 percent compared to traditional in-ground chargers, due to the lack of trenching needed to lay in-ground cable. The project is billed as the "first deployment of elevated, pole-mounted EV chargers by an investor-owned utility in the United States." National Grid, the local IOU in Melrose, funded the pilot with funds approved by the state's public utilities commission. Chargers are located on utility poles co-owned by National Grid and Verizon, and chargers are owned and managed by the city. Users access and pay for charging through the AmpUp app.

The utility and the city selected sites and conducted public notice processes via the local traffic commission to notify neighboring properties. Program leaders sought wooden poles without other mounted infrastructure or risers located near activity hubs but away from intersections. Parking spots adjacent to the chargers are designated for EV charging only and police issue traffic citations for violations. The city aimed to locate some of the chargers near a 200+ unit residential property but faced challenges with opposition from homeowners on neighboring streets.

The success of the small-scale pilot demonstrates the possibility of IOU-led investment under the right circumstances. Preliminary insights include:

- National Grid/Verizon co-ownership of the utility poles meant that each site selection required two separate engineering reviews and approvals, which was burdensome for the city. For future installations, single-ownership sites or pre-review between National Grid and Verizon would be preferable.
- Use of elevated chargers that only descend upon initiation of payment helps limit unit maintenance costs and the potential for damage/vandalism/pedestrian accidents.
- The city's direct ownership and management of the chargers could lead to maintenance and cost issues, though it has not to date.
- National grid had to install new transformers to support the chargers in some cases but still estimated costs to be 55-70 percent less than ground-mounted chargers.

While the project did not include any explicitly equity-focused elements, it demonstrates the potential for smaller jurisdictions to develop ambitious public charging initiatives.

12 Analysis based on review of city program website, press release, UC Berkeley and National grid reports (on file), and interview with Martha Grover, Melrose Sustainability Manager.

NEW YORK CURBSIDE LEVEL 2 CHARGING PILOT[13]

New York's Department of Transportation (NYC DOT) partnered with Con Edison, the local IOU, on a pilot program to install 100 publicly accessible curbside Level 2 chargers at 35 locations throughout the city beginning in 2017 with installations in 2021 and 2022. The pilot emerged from the mismatch between existing public charging largely in Manhattan and downtown Brooklyn when the majority of car owners live in outer boroughs, and the general reliance on street parking as opposed to garage parking; and from the city climate action plan's goals of ensuring that New Yorkers are no more than 2.5 miles from fast charging by 2035 and mandating that private parking lots make EV charging available by 2030. Goals of the pilot included understanding curbside charger use; testing operational feasibility; and informing additional deployment.

New York's public utilities commission provided funding for the pilot to Con Edison, which was responsible for site engineering and construction. Con Edison contracted with FLO to provide chargers and run billing and maintenance. NYC DOT authorized use of the PROW. NYC DOT selected pilot sites based on geographic, economic, market, and curb context factors, including input from communities (13 community board meetings and an online feedback portal) and elected officials (30 briefings). The project prioritized equity by intentionally selecting sites where there is limited access to public chargers and reaching all five boroughs. NYC DOT also sought multi-use sites such as hospitals that could serve employees and neighborhood residents.

FLO priced charging at $2.50/hr at peak times and $1.00/hr overnight; chargers were accessible by credit card or proprietary app. Usage rates varied from approximately 20 percent to approximately 55 percent (largely correlated with local EV adoption rates), with over 99 percent uptime and low vandalism. Approximately 80 percent of use occurred in peak daytime hours and use efficiency was approximately 80 percent (meaning low rate of overstay once charging was complete). Chargers were installed at both non-metered spaces and metered spaces (where drivers had to pay for parking as well), with slightly higher use efficiency at metered spaces.

Chargers are mostly curbside pedestals with tall drop-down cord management units. All spaces were marked with EV charging-only signs; one of the greatest challenges facing the pilot was parking space blockage by non-EV vehicles, which resulted in over 3,200 parking tickets issued.

The highest-use sites were almost exclusively in higher-income, higher-EV-ownership areas of Manhattan and Brooklyn, with lowest-use sites concentrated in lower-income areas of outer boroughs. The pilot encountered minimal vandalism and utility infrastructure-related challenges. While the pilot was small in scale for a city as large as New York, the relatively high usage rates, uptime, and efficiency at a range of locations throughout the city demonstrate the ability of city agencies to collaborate with an IOU to locate curbside chargers in strategic locations. In addition, the comprehensive city-led pilot approach yielded highly valuable public outreach and utilization data outputs, which can inform future rounds of public and private investment.

13 Analysis based on NYC DOT's program evaluation report.

PORTLAND, OREGON CURBSIDE CHARGING PROGRAMS

Portland Electric Vehicle Charging in the Public Right-of-Way Code Project[14]

The Portland Bureau of Transportation (PBOT) developed a city code/ordinance update program to facilitate charging in the PROW based on direction from the city's 2017 EV Strategy (which included a PROW element) and 2022 Climate Emergency Workplan (which included a multi-agency mandate to make it easier for residents to charge away from home). The process included an assessment of existing conditions (including various COVID-19 demand recovery scenarios), development of a location framework (including focus on sites "around the corner" from major demand districts), site selection, and stakeholder engagement (city-internal and external) on the final policy proposal, which includes updates to the PROW parking, encroachment permit, and utility permit city codes and the parking manual.

The program is based solely on private/third-party applications for installation for general public use. There is no current plan for publicly owned or managed infrastructure. The project team determined that the existing city code definition of "public utilities" includes EVSE installers and thus allowed the city to grant the companies franchises to operate in the PROW. The process took approximately 2 years and a final code proposal for PROW charging was submitted to the city council in early 2023.

Preliminary insights include:

- Explicit instruction from the city EV and climate action plans helped PBOT and associated agencies develop a discrete curbside strategy and ordinance update.
- Focusing approvals on "around the corner" locations can minimize conflicts with competing uses of the PROW and transit space while still providing access to services and demand.
- To make the permit/code update process easier, the city team focused solely on EV chargers first - ebikes and other chargers created too much complexity in design and competing use issues.
- The market-based strategy does not explicitly focus on equity and ultimately is based on private companies' applications. But the PBOT team is developing an equity framework that will likely include a location-based ratio requirement with the goal of eliminating charging deserts and ensuring a well distributed network of public chargers across the city.
- To support equitable distribution, PBOT is only allowing the PROW chargers to be installed in 34 "designated centers" where they expect to see development growth, where zoning is for multi-family housing and mixed use–this creates some challenges because the city has a lot of single-family housing without dedicated parking, but it is viewed as a starting point for the buildout of charging infrastructure.

14 Analysis based on PBOT program progress report, city code and regulatory provisions, and interview with Hannah Morrison, PBOT Transportation Planner.

- For residents of single-family housing who lack dedicated parking, the city already allows running Level 1 charging cables from the home to charge street-parked cars. Users must follow city design, safety, and placement guidelines for cord covers/ramps and must lack access to a driveway or garage; no permit is required.

The program demonstrates a programmatic, regulatory approach: city leaders crafted a set of stand-alone requirements for PROW EV charging, with preselected zones for applications based on city-determined feasibility and priority. The goal is to create optimal conditions for investment by private EVSE providers within parameters set by the city. Combined with an allowance and guidelines for residential Level 1 charging cords in the PROW, the program has the potential to expand EV charging access for those without private driveway access while avoiding the commitment of public funds for infrastructure. In addition, the program has empowered PBOT to lead on future charging infrastructure initiatives–a crucial step.

Portland General Electric Utility Pole Pilot[15]

Portland, Oregon city leaders collaborated with Portland General Electric (PGE), the local electric utility, to install two Level 2 chargers on utility poles, which were available free of charge during the course of the pilot period. PGE initiated the program through a standard public utility commission tariff approval process, agreeing to offer the charging at no cost in order to satisfy de minimis revenue impact requirements under the applicable proceeding.

The city and PGE used data on multifamily housing proximity, EV use rates, ADA ramp and parking spot proximity, and pole criteria (age, other infrastructure, presence of risers etc.) to select the two pilot locations. The city provided 60 potential locations based on these criteria, from which PGE selected two. PGE identified a 19-step approval process from site selection and engineering to permitting, construction, and commissioning.

Residents were offered free two-hour charging between 7:00 am and 7:00 pm through the Plugshare app. Neighbors were given notice via door hangings that also cautioned against purchasing an EV on the basis of the chargers, since they might not be permanently available.

PGE identified a number of learnings from the pilot, including reduced installation costs per charging port ($2000-$4000 versus $5000-$12,000 for new in-ground chargers), the safety benefits of retractable charger cords, and the need for parking spaces dedicated to charging. Through Oregon's Clean Fuels Program, PGE was able to generate credits from the sale of electricity for charging that exceeded PGE's cost of providing electrical capacity and energy to supply the stations, suggesting a path to revenue-positivity after recouping capital costs. PGE identified "flexible franchise agreements" with municipalities as a future need to take advantage of revenue from clean fuels credits, charger utilization, and other sources.

15 Analysis based on PGE program white paper (on file).

SEATTLE CURBSIDE CHARGING PROGRAMS

Seattle Electric Vehicle Charging in the Right-of-Way Permit Pilot Program[16]

Seattle's Electric Vehicle Charging in the Right-of-Way pilot program ran from July 2017 to December 2019 and allowed installation of curbside EV charging stations in the PROW. According to the city's evaluation report, the pilot "assessed the permitting process, installation challenges, EV charging behavior, and equity considerations in advance of potentially developing another pilot or a permanent" program. Equity considerations identified by staff included community concern around gentrification and displacement, need for greater financial support to access EVs, and cultural and language barriers. The program was intended to focus on serving priority communities and ensuring equitable expansion of EV adoption. The pilot was led by Seattle's Department of Transportation (SDOT) in collaboration with the Office of Sustainability and Environment and the Seattle City Light electric utility. Through December 2018, the pilot led to two DC Fast charger installations at one location (by Seattle City Light); none of the 67 other applications met criteria.

SDOT identified the following reasons for application failure:

- City staff review stage:
    - Sidewalk width, parking width, and accessibility requirements
    - Cost of electrical service
    - Conflict with ROW uses such as transit-only lanes
    - Applicant business changes
- Street use permit stage:
    - Physical barriers such as trolley wires and underground water pipes
    - Conflict with transit, bike, and pedestrian ROW demands
    - Lack of public support
    - Construction costs due to site challenges
- Electrical service connection application stage:
    - Electrical connection costs due to site challenges

Key takeaways from SDOT's program analysis include:

- PROW use should prioritize transit, pedestrians, and accessibility, with chargers focused in residential areas, off-street alternatives, and pre-selected sites.
- Community co-design of charging sites, funded outreach, and a PROW EVSE equity toolkit are needed to address equitable access concerns.
- Annual renewal of the street use permit did not support the business investment case, which relies on at least 3-5 years of certainty.

16 Analysis based on SDOT evaluation report.

- Permits should contemplate a full range of charging types and electrical needs.
- Clarity and coordination between accessibility and physical site selection criteria are needed, including disability access requirement updates.
- Application assistance, initial guidance on site feasibility, and multi-site applications are needed to expedite processes.

This early curbside-focused pilot found that the PROW in high-density and mixed-use districts holds several conflicts for EV charger placement–transit, pedestrian, and bicycle lanes; trolley wires and other electrical infrastructure; and physical accessibility–that render some of these locations extremely challenging for private investment in chargers. In addition, the annual renewal requirements associated with the city's existing PROW use permit limited the business case for investment in infrastructure. These challenges suggest that cities will need to develop comprehensive approaches to siting and permitting PROW charging infrastructure, with advance site selection to identify least-conflict and preferred charging zones and permit processes ready to meet the complexity and capital-intensive nature of charging installations–whether stand-alone permits for EV charging or adjustments to existing permits to meet the technical and business case needs.

Seattle Curbside Level 2 Charging Program[17]

Seattle Department of Transportation (SDOT) and Seattle City Light (SCL) collaborated on a pilot program to install public curbside Level 2 chargers based on a public opt-in/request process. The city team opened a public, free application for charging sites in front of residential locations that lack access to off-street parking. SCL and SDOT selected 31 sites from 1800 applications, with a focus on geographic distribution (two sites in each council district), power and curbside availability, and additional application points for applicants who are transportation network company (TNC) drivers and who qualify for utility discounts. The program includes three installation types: existing wooden utility pole, newly constructed metal streetlight pole, and ground pedestal, with EVSE LLC-designed charger units that have retractable cords (the same as used in Melrose and Los Angeles). In practice, existing wooden utility poles have proven challenging for installation due to their age and the potential physical vulnerability of existing overhead wires.

Chargers are installed, owned, and operated by SCL. Customers pay the cost of energy consumed (and any applicable parking fee if located in a paid parking space) but no additional charging session fee. Chargers are publicly accessible with no reservation system, and spaces are designated as 2-hour parking in Residential Parking Areas (RPZ areas) and 4-hour parking in non-RPZ areas, with parking enforcement for time violations. (Residential parking permit restrictions also apply.)

SDOT convened an internal strategic group to resolve curb management, disability access, traffic, and other considerations during the application process. SDOT has ju-

17 Analysis based on SDOT Level 2 curbside program website, sidewalk cord guidance, and interviews with Armand Shahbazian (SDOT mobility program), Katherine Rice (SDOT curb management program), and Jacob Orenberg (Seattle City Light).

risdiction over the public space and public power permits needed for installation. The site selection team prioritized locations near existing curb cuts to address accessibility concerns, and SDOT is in the process of determining how accessibility guidelines for charging stations in the PROW will be adopted by the city.

As with the Los Angeles streetlight program, the existence of a municipal utility was essential to success–it facilitated work within the city processes, eased pressure on profit generation, and opened access to utility infrastructure and poles. In addition, SCL is evaluating its ability to generate low carbon fuel standard credits as an element of the program's financial viability. The city team was able to prioritize equity through some site selection criteria (such as lack of access to off-street parking and priority for TNC drivers and utility discount recipients) but plans to increase focus on charger distribution in underserved areas in future installations.

Seattle also allows residents to run Level 1 cords from homes to sidewalk parking spaces to charge their vehicles, subject to SDOT-issued guidance regarding placement, safety, and design of the cord cover as well as standard parking restrictions. Residents who comply with the requirements are not obligated to obtain a street use permit.

WASHINGTON, D.C. CURBSIDE CHARGING PROGRAMS[18]

Washington, D.C.'s EV Charging Station Program consists of two initiatives that aim to expand curbside charging in the District and incentivize greater EV use. The first initiative addresses the safety hazard posed by electric cords' extension across sidewalks by offering a set of guidelines for cord coverage. The second initiative creates a standard operating procedure and permitting process for vendors seeking to install curbside charging stations in eligible District areas.

Guidelines: Charging Cord Crossing the Public Right-of-Way

The DC Department of Transportation (DDOT) allows residents to extend charging cords across the street to vehicles parked at the curbside, subject to compliance with DDOT's cord cover guidelines. (No permit is required as long as guidelines are followed.) Guideline enforceability is derived from existing DC Code § 10-1181.02, which generally prohibits unsafe private structures from occupying the PROW and grants the city authority to remove such structures. Key guideline components include:

- Only Level 1 charging cords may cross the PROW; Level 2 is prohibited.
- EV charging cords should cross perpendicular to the sidewalk.
- EV charging cords must be covered by "a highly visible, stable, and secure low-angle cable ramp while charging." The covers must maintain high visibility at night.

18 Analysis based on DDOT website, cord guidelines, permitting procedures document, public space permit, and EV charging station regulations, and interview with Tasin Malik, DDOT Transportation Planner.

- Cord covers must comply with a range of specifications for height, width and ramp steepness that adhere to ADA requirements.
- Failure to abide by the guidelines may result in equipment removal and public space restoration at the user's expense.

Electric Vehicle Curbside Charging Station Program

DDOT has also amended the city's existing permitting specifications for public occupancy of the right-of-way to incorporate the installation of charging stations in eligible curbside areas, which include residential blocks and business corridors. The updated city code adds a permitting category for EV charging stations and a corresponding permit fee, yielding a standalone permit document for EV chargers. Key procurement requirements and procedures include:

- Only dual-port and Level 2 or Direct Current Fast Chargers are eligible for permit.
- Permit acquisition is restricted to commercial vendors; residents seeking a new charger location are encouraged to coordinate with vendors and neighborhood affiliates.
- Before proceeding through DDOT's permitting process, the vendor must 1) obtain documentation that affirms planning and support from the city's investor-owned utility company, Pepco, and 2) notify community members of charging station plans.
- Once completing preliminary procedures, the vendor submits an EV Charging Station Permit application to DDOT, which is then reviewed by representatives from several possible DC divisions. The Public Space Committee makes the final review and decision.
- Once a vendor's EV charger permit application is approved, Pepco supports installation by acquiring Underground Conduit and Public Space Occupancy permits, upgrading grid capacity, and connecting the charger to the grid.
- The vendor must pay an annual permit fee of $2,400 per two charging ports, prorated for installations in new locations.

DDOT officials chose to use a public space permit for EV charger installations in part because they felt that DDOT's Public Space Regulation Division was best positioned to coordinate the component parts of charger approvals. However, the EV Curbside Charging Station Program has not had any vendor applicants after about a year of operation; officials believe the cost of installation and maintenance are too high relative to the current expected charger revenue in the EV market.

PROMOTING AND SECURING EQUITY IN PUBLIC CHARGING PROGRAMS

These case studies detail a range of city efforts to extend public EV charging availability to the curbside and PROW and the key planning and operational challenges cities face when seeking to expand public EVSE infrastructure.

While publicly accessible and curbside charging will be a core part of city strategies to ensure equitable access to EVs, even these leading cities are only in the early stages of optimizing curbside and PROW charging for priority populations. For cities' publicly accessible charging infrastructure to advance mobility equity, city programs will need to build on the strategies highlighted in this brief by addressing the localized needs and accessibility challenges of priority populations along each step of planning and installation. To promote equity in program design, cities should consider incorporating into their curbside and PROW charging strategies measures such as:

- Prioritized site selection in lower-income and underserved communities.
- Community input on investment decisions including site selection, mode preference, amenities and design.
- Discounts and cost-reduction measures for lower-income drivers (e.g., subsidized charging rates, and free or reduced-cost hardware).
- Strategies such as car share, mobility hubs, and co-location with other transportation services.

To secure equity throughout curbside and PROW charging program implementation as well as broader EV and mobility programs, cities should also:

- Include community benefits agreements and/or other economic development opportunities in mobility infrastructure programs to maximize the benefits of new investment for priority populations.[19]
- Avoid undue or unintended consequences to priority populations by shifting decision-making power to those impacted by the deployment of charging infrastructure.
- Ensure that priority communities where charging infrastructure will be deployed are also provided with targeted EV incentives and awareness campaigns.

Local governments in the US and abroad are taking action to develop comprehensive and reliable EV charging networks. As charging accessibility remains a key barrier to EV adoption for all, cities will increasingly look to the curbside and PROW to expand convenient charging options for EV drivers. The pilots and programs in this brief represent vital first steps and highlight the measures cities will need to adopt to truly promote equity in the EV transition.

19 See The Greenlining Institute, "Achieving Electrification Equitably: Principles for EV Charging Infrastructure for Everyone" (October 20, 2022), available at https://greenlining.org/2022/achieving-electrification-equitably/.

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