plugNYC

May 2023

NEW YORK CITY DOT

NYC DOT Curbside Level 2 EV Charging Pilot: Evaluation Report

Contents

5 Letter from Commissioner Rodriguez

7 Executive Summary

11 Background

14 Details of the Curbside EV Level 2 Charging Pilot Program

18 Implementation Process

21 Evaluation Criteria

30 Challenges and Opportunities

31 Conclusions and Next Steps

33 Appendices

Letter from Commissioner Rodriguez

Climate change is one of the greatest threats of our time, posing huge challenges to the future of our economy, communities, and environment. With transportation accounting for 28% of New York City's greenhouse gas emissions, we must shift to more sustainable modes of transportation to reduce our collective carbon footprint. The Administration of Mayor Eric Adams is committed to advancing initiatives that move us closer to achieving our goal of carbon neutrality by 2050. Reducing emissions from transportation is also crucial to the city's efforts to both improve air quality and the health of our communities.

NYC DOT has made great strides in making it easier for New Yorkers to reliably travel around the city without a car. We have worked hard to make our streets safer through Vision Zero, which combined with the City's extensive network of bike lanes, expansion of bikeshare and e-scooter share, and programs to prioritize buses, has helped grow the share of trips made via sustainable modes (biking, transit, walking) to over two-thirds of all trips. We must continue these efforts to achieve our climate goals and for our collective well-being.

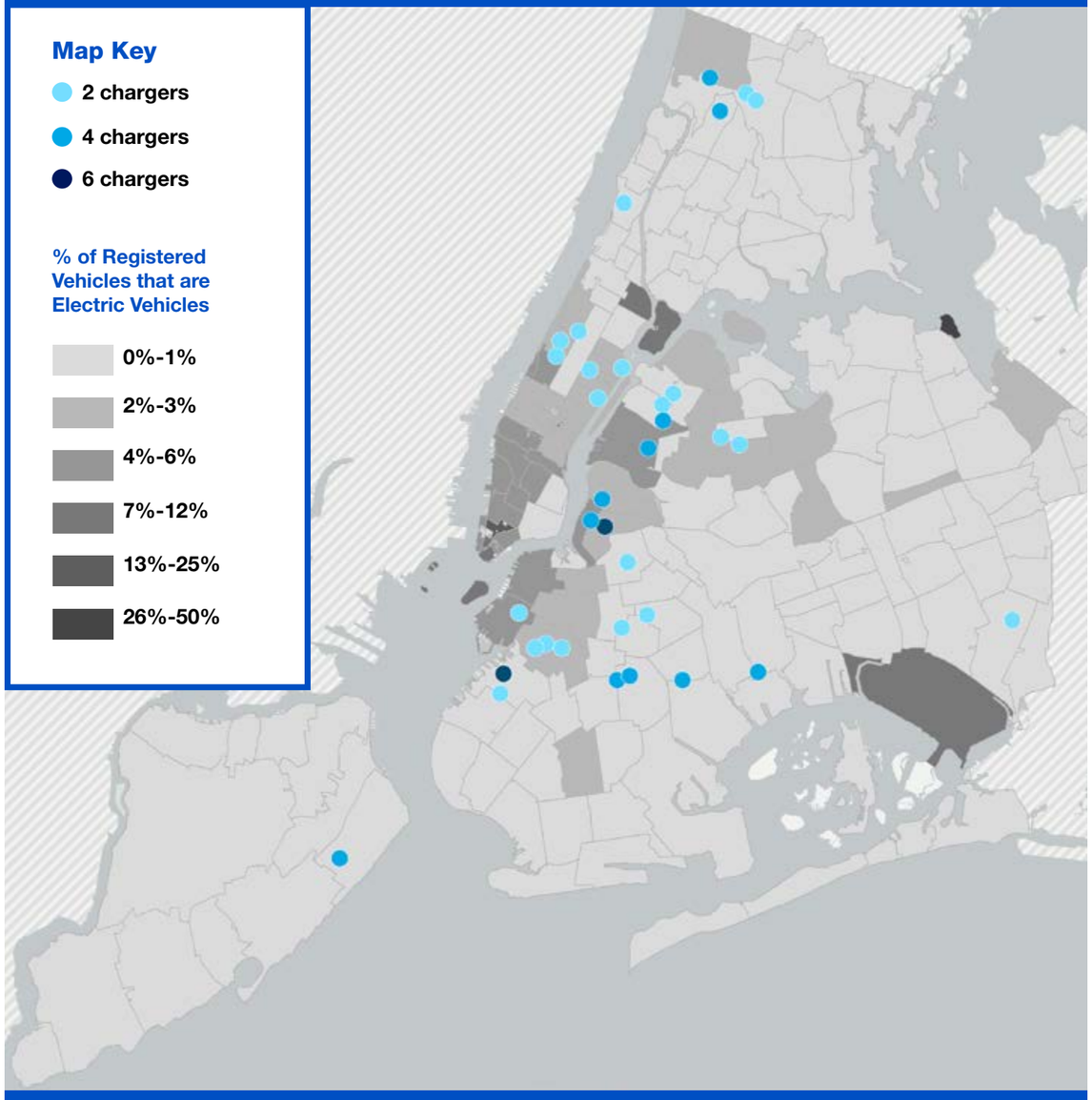
Still, for some New Yorkers, driving will continue to be a part of how they navigate the city. It is therefore essential that we support the development of a comprehensive charging network for electric vehicles (EVs) across the five boroughs to actively support a transition to greener alternatives. In particular, we must focus on areas the private sector has thus far overlooked, including low- and moderate-income neighborhoods. As part of this strategy, we are expanding access to fast charging across the city, turning our parking lots and garages into EV charging hubs, and testing new approaches—curbside Level 2 charging, the focus of this report.

Half of New Yorkers rely on on-street parking to store their cars and lack access to home charging. Curbside charging is a promising way to bridge this gap and we are proud to announce the results of our curbside Level 2 charging pilot, a collaborative effort with our partners at Con Edison and FLO that included 100 chargers across the five boroughs. The results of the first 18 months of the program are positive: the program expanded access to chargers, especially outside of Manhattan, the charging units functioned well, and sites in communities with high EV ownership were well used. Overall utilization — the percentage of time the charger was plugged into an EV — reached 34% in December 2022 with nearly 50,000 total charging sessions.

I want to thank our partners at Con Edison and FLO for collaborating with us on this important effort. The findings in this report will inform our approach as we seek to further expand charging options for all New Yorkers.

Commissioner Ydanis Rodriguez

Locations of Pilot Chargers



Executive Summary

To help avoid the most catastrophic effects of climate change, New York City must decarbonize its transportation system. After buildings, the tranportation sector is the city's second-greatest source of greenhouse gas (GHG) emissions, accounting for 28% of total emissions. While the New York City Department of Transportation (NYC DOT) seeks to increase the share of New Yorkers who walk, bike, and take transit, the agency also recognizes that some New Yorkers will continue to drive due to limited access to transit alternatives, family or work obligations, disabilities or physical limitations, or personal preference. This includes drivers of taxi and for-hire vehicles, which are among the highest-mileage fleets in New York City. NYC DOT is working to accelerate the adoption of electric vehicles (EVs), which will be critical to achieving the City's commitment to reach carbon neutrality by 2050.

One of the major hurdles to advancing EV ownership in New York City is the availability of charging. In *PlaNYC: Getting Sustainability Done*, the City outlines its initiatives to accelerate the adoption of EVs. These initiatives include ensuring that New Yorkers are no more than 2.5 miles from a fast charging hub by 2035 and mandating private parking garages and lots makes EV charging available by 2030 Citywide, the number of chargers is growing, but they are most often sited in high-income neighborhoods or require payment in parking garages. Notably, more than half of the chargers installed by the private sector are in Manhattan. Accelerating EV adoption will require greater investment in EV charging in the outer boroughs, including in low- and moderate income neighborhoods. Some of this investment could go towards curbside Level 2 chargers, which can affordably fill charging network gaps with a modest impact on the electrical grid.

In June 2021, NYC DOT, in partnership with Con Edison, launched the city's first curbside EV charging pilot program. This pilot includes 100 public on-street Level 2 chargers distributed across 35 locations in the five boroughs. Level 2 chargers take advantage of the fact that vehicles typically spend most of their time parked—in New York City the average personal vehicle is driven only eight miles a day. During this idle time, EVs can charge where drivers park, e.g. at home, the curb, work, or a store. The goals of the public curbside Level 2 charging pilot are to:

- **Understand the usage patterns of curbside Level 2 chargers in a range of different neighborhood contexts, varying by average income and EV adoption rate, and street types;**
- **Test the operational feasibility of curbside Level 2 charging on the streets of New York City, including the frequency of blocked spaces, vandalism issues, and system up-time performance;**
- **Understand how the presence of EV chargers may impact car owner attitudes towards EVs; and,**
- **Inform how the City could deploy additional curbside Level 2 chargers.**

NYC DOT selected sites with geographic and economic diversity as a guiding principle. The agency considered input from the community and elected officials, in addition to market factors and the desire to test curbside chargers in a mix of different curb contexts. Chargers were installed across 20 community districts in the five boroughs, with an average of three charging spaces installed per district. All sites are marked with the newly introduced "Electric Vehicle Charging Only" curb regulation sign. Vehicles in spaces signed with this new regulation must be EVs and actively charging.

The first 18 months of the curbside Level 2 charging program have produced promising results. During the evaluation period, there were nearly 50,000 charging sessions initiated by 7,200 unique users. Overall utilization of the system, or the percentage of time the chargers were connected to a vehicle, reached 34% in December 2022. The efficiency rate of the system, i.e., the percentage of time that vehicles were actively charging while plugged in, was 81%. Utilization varied significantly by location. The ten busiest sites were in use over 54% of the time. As expected, these sites were typically located in areas with above-average rates of EV adoption and higher average household incomes. The ten least-busy sites had utilization rates below 22%. The characteristics of these sites were less uniform, though many were in low- and moderate-income areas with below-average rates of EV adoption. While the City's goal is to support EV adoption and charger utilization across all neighborhoods, it is clear that adoption is happening at different rates across the city, leading to a variation in utilization. Vandalism was rare and system uptime was over 99.9%.

One of the biggest challenges in the first eighteen months was the frequency of internal combustion engine (ICE) vehicles blocking chargers. NYC DOT installed time-lapse cameras to monitor a subset of locations and found that on average ICE vehicles blocked access to charging stations about 20% of the time. About 70% of these illegally parked vehicles were in the spaces for less than half an hour. NYC DOT will continue working with the New York City Police Department (NYPD) on enforcing the "Electric Vehicle Charging Only" regulation to ensure charger access. To date NYPD has issued over 3,200 violations to vehicles illegally parked in these spaces.

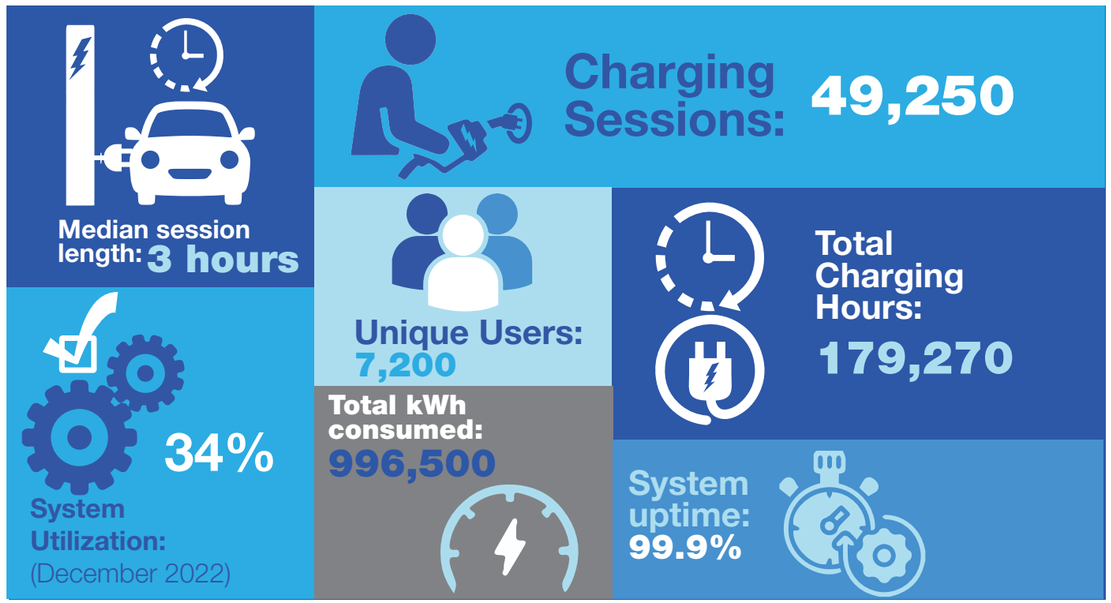
This report provides one of the first comprehensive evaluations of a curbside Level 2 EV charging program in the world. By benchmarking usage patterns and performance, this report provides valuable insights for policymakers and stakeholders in major cities. Overall, charger performance in the first eighteen months exceeded initial expectations. The data in this report demonstrate that:

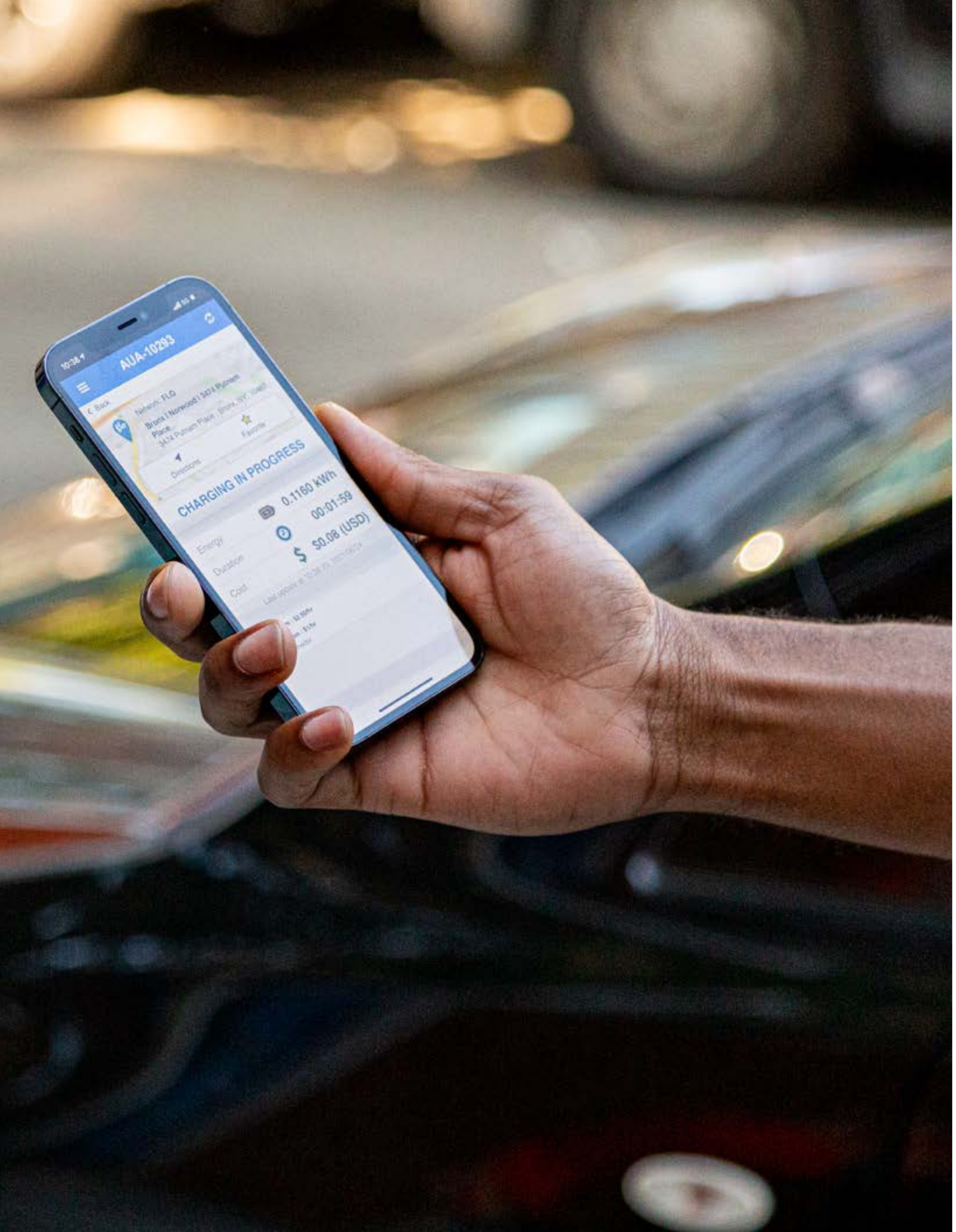
- **Curbside Level 2 charging charging can fill an immediate charging need in areas with above average EV adoption and limited off-street parking.**
- **Curbside Level 2 charging charging in areas with lower EV adoption can increase charging access equity; utilization will be lower in these areas in the near to medium term.**
- **Curbside Level 2 charging charging is operationally feasible: Properly designed and maintained curbside chargers can achieve a high uptime performance in New York City.**
- **Blocked charger spaces will likely remain a problem, but present more of an inconvenience to users than a fundamental challenge to program effectiveness.**

As the program moves into its second year of operation, Con Edison, FLO, and NYC DOT will further evaluate the impact of the program on the purchase decisions of vehicle owners and the frequency of blocked spaces. The partners will also continue outreach and marketing efforts to improve project awareness.

Looking forward, NYC DOT will consider approaches to the expansion of Level 2 charging that are consistent with our overall policy goal: We want fewer New Yorkers to drive, but for those that do, we want them to drive electric. Curbside Level 2 charging is one of the City's many initiatives to support the transition to EVs.To that end, a potential future expansion of this program should:

- **Be flexible, allowing the program size and approach to change in response to new charging technology and evolving consumer preferences.**
- **Be targeted, focusing on neighborhoods and market segments where curbside charging can have the greatest impact at the least cost.**
- **Support the city goals to electrify high-mileage fleets, especially taxis and FHVs and the City's own fleet of light-duty vehicles.**
- **Leverage utility, state, and federal funding opportunities, including new funding programs in the Bipartisan Infrastructure Bill and the Inflation Reduction Act.**
- **Explore different charger designs, including units that are smaller and easier and cheaper to install or remove, to maintain flexibility in the use of curb space.**
- **Use public-private partnerships for implementation to speed deployment, leverage private investment, and reduce financial exposure to the City.**





Background

In June 2021, the New York City Department of Transportation (NYC DOT), in partnership with Con Edison, launched the city's first curbside electric vehicle (EV) charging pilot program. The pilot includes 100 on-street Level 2 chargers distributed across 35 locations in the five boroughs. Up to 20 additional chargers have been or are in the process of being installed for a separate, but related, pilot that serves the City's municipal fleet. The focus of this report is the public curbside chargers. The goals of the public curbside Level 2 charging pilot are to:

- **Understand the usage patterns of curbside Level 2 chargers in a range of different neighborhood contexts, varying by average income and EV adoption rate, and street types;**
- **Test the operational feasibility of curbside Level 2 chargers on the streets of New York City, including the frequency of blocked spaces, vandalism issues, and system up-time performance;**
- **Understand how the presence of EV chargers might impact car owner attitudes towards EVs; and,**
- **Inform how the City could deploy additional curbside Level 2 chargers.**

This progress report describes the implementation process and preliminary findings from the first 18 months of the curbside charging pilot, which is one element of the city's comprehensive EV strategy.

Why drivers need to shift to EVs

In the face of the mounting climate crisis, New York City is committed to becoming carbon neutral by 2050. After buildings, the transportation sector is the city's second largest source of greenhouse gas (GHG) emissions, accounting for 28% of emissions. Of these emissions, the roughly 1.8 million light-duty vehicles registered in the city generate 80%. To ensure the City meets its climate goals, there needs to be a radical change in our transportation system.

NYC DOT is pursuing a multi-pronged strategy to reduce the carbon footprint of the transportation sector. The agency is undertaking a wide range of efforts to dramatically increase the proportion of trips that are made by transit, biking, and walking. Two-thirds of trips in the five boroughs are already made by these sustainable modes, but even more New Yorkers will need to get out of their cars to achieve our climate goals. More information on NYC DOT's comprehensive efforts to make walking and biking safer and easier, and to make taking the bus faster and more reliable, can be found in NYC DOT's NYC Streets Plan.

The agency also recognizes that some New Yorkers will continue to drive because they lack access to transit alternatives, have family or work obligation that require it, have a disability, or simply prefer driving. This also includes drivers for taxi and for-hire vehicles, which are among the highest

mileage fleets in New York City. To address the harmful emissions from these vehicles, NYC DOT is seeking to accelerate the adoption of electric vehicles. According to a study by the City of New York and Con Edison, the city will need to support 1.5 million EVs by 2050 in order to achieve net-zero GHG emissions.

In *PlaNYC: Getting Sustainability Done*, the City outlines its initiatives to accelerate the adoption of EVs. These initiatives include ensuring that New Yorkers are no more than 2.5 miles from a fast charging hub by 2035, mandating private parking garages and lots to makes EV charging available by 2030, and implementing TLC's High-Volume For-Hire Vehicle Green Rides Initiative, which will transition the High-Volume FHV fleet to EVs by 2030 (with an exception for wheelchair-accessible vehicles). The charging initiatives build on the efforts in Electrifying New York: An Electric Vehicle Vision Plan for New York City. Moving forward, NYC DOT will take a flexible approach, modifying its initiatives, including its curbside charging program, in response to advances in charging technology, changes in consumer preferences, and the availability of federal and other funding opportunities. Greater emphasis will also be placed on working with agency partners, such as the New York City Taxi and Limousine Commission (TLC), Department of Citywide and Administrative Services (DCAS), and the Economic Development Corporation (EDC) to make targeted investments in charging infrastructure. For example, the curbside charging program plays a role in supporting EV adoption in communities with limited access to off-street parking

NYC DOT will also continue to view curbside Level 2 charging within the larger context of improving curb management and balancing the many demands for curb space in New York City, including for loading and deliveries, short- and long-term parking, public space, expanded sidewalks, bike lanes and parking, Citi Bike and shared mobility stations, and other uses. NYC DOT will continue to seek to balance these needs in ways that advance the agency's safety, sustainability, mobility, and equity goals.

What are EV Chargers?

Electric vehicle supply equipment (EVSE), commonly referred to as EV chargers, provides power to EVs, including fully electric vehicles and plug-in hybrid vehicles that use a combination of gasoline and electricity. In general, there are three levels of EV charging, which deliver different charging experiences due to the amount of power (or range) they can provide within a given period of time.

Level 1 chargers charge a vehicle using a standard wall outlet. These chargers can provide up to 5 miles of range per hour, with charging loads ranging from 1 – 3 kW. Given the low power level, these chargers are most appropriate for home charging, typically overnight.

Level 2 chargers charge a vehicle with moderately stepped-up electric power, similar to a plug for a clothes dryer or air conditioner. These chargers provide 20 to 30 miles of range per hour of charging (depending on vehicle model), with charging loads ranging from 3 to 20 kW. Given the medium power level, these chargers are most appropriate for charging while parked for one or more hours at home, work, or while shopping. NYC DOT's curbside chargers, and the vast majority of EV chargers in the U.S., are Level 2 chargers.

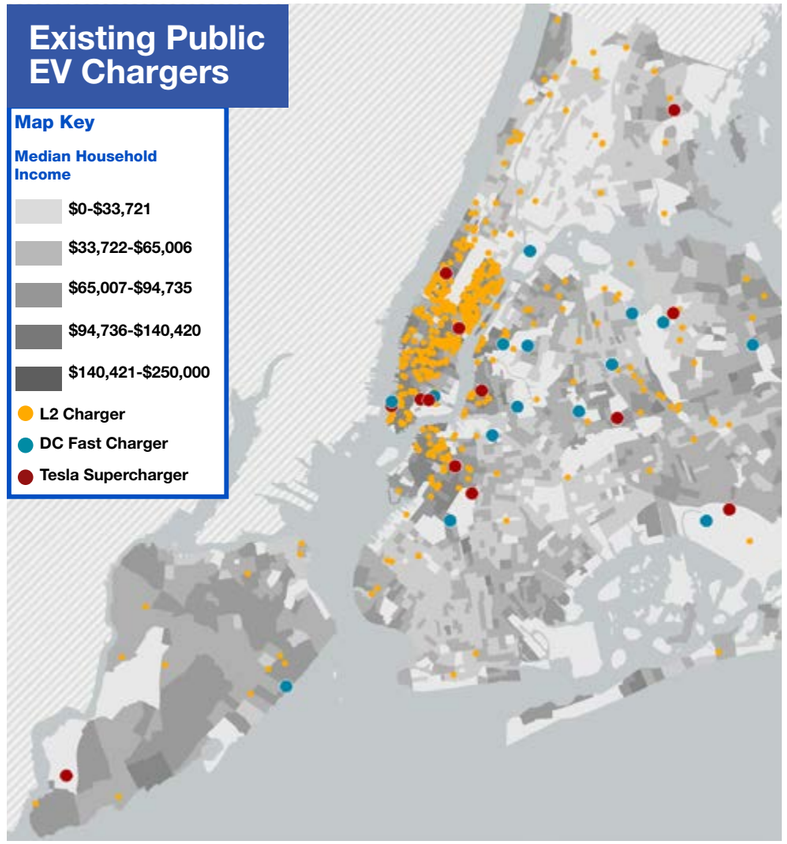
Fast chargers, sometimes referred to as direct current fast chargers (DCFC) or Level 3 chargers, use much higher amounts of electric power. These chargers can provide 60 to 200 or more miles of charge in 20 minutes. Charging loads of fast chargers start at 50 kW, but can go as high as 350 kW. Tesla has its own version of fast chargers, "Superchargers," which can only be used by Tesla vehicles due to their proprietary connectors, though the company recently announced plans to open up many of its fast chargers to all EVs.

The charging ranges provided above are estimates based on existing industry standards. Real-world charging times differ between vehicle models due to battery sizes and the charging rates that a given vehicle can accommodate. For example, while there are fast chargers that can provide 350 kW to a vehicle, a Ford Mach-E can only accommodate a peak charging rate of 150 kW, thereby limiting the flow of energy to the vehicle.

Why did NYC DOT Launch a Curbside Level 2 charging Pilot?

Two of the primary barriers to mass EV adoption in New York City are range anxiety and the overall availability of charging. Some prospective EV owners worry that a vehicle's battery will die mid-trip and they will be stranded due to a lack of EV charging locations. Creating a network of convenient fast charging will be critical to addressing range anxiety. In addition, a large network of public and private Level 2 chargers will be needed to support the everyday charging needs of new EV owners. Most EV investment will be done by private actors, either individual EV owners or the growing number of EV charging companies, but the city can play an important role in addressing market gaps and supporting the electrification of high mileage fleets like taxis and FHVs.

There is currently a spatial mismatch between where chargers are located and where the bulk of New York City car owners live. The majority of the 1,900 public EV chargers in the city are in the Manhattan core, or in inner Brooklyn, where the average household income is higher and car ownership is low. This charging is also expensive, as drivers must typically pay both for parking and charging. However, most of New York City's car owners live in the outer boroughs, where public charging is currently scarce. Additionally, about half of all car owners rely on on-street parking to store their vehicles, often in neighborhoods with very limited off-street parking.



Curbside Level 2 charging offers the potential to provide public charging in neighborhoods where the majority of car owners park on-street, including low- and moderate-income neighborhoods where private investment is lacking. Level 2 chargers are a good fit for the curbside, as they are compact, affordable for users, and can provide a meaningful charge during a typical curbside parking session, which can last from one to two hours in a metered zone and up to 12 or more hours in an unmetered area. Moreover, Level 2 chargers are much less expensive to install than DC fast chargers, which typically require significant electrical upgrades to support, and are therefore better suited for large-scale installation.

Curbside EV Charging in Peer Cities

London

With over 5,300 on-street charge points, which including over 1,300 retrofitted streetlights, London is home to one of the largest curbside charging networks in the world. Transport for London expects curbside chargers will play an important role in London's effort to quadruple the number of public EV chargers by 2030.

Los Angeles

Starting in 2016, the Los Angeles Bureau of Street Lighting began installing curbside chargers on the city's existing streetlight poles. Since the program's inception, over 500 curbside chargers have been installed. The City of Los Angeles is exploring paths forward to expand curbside charging.

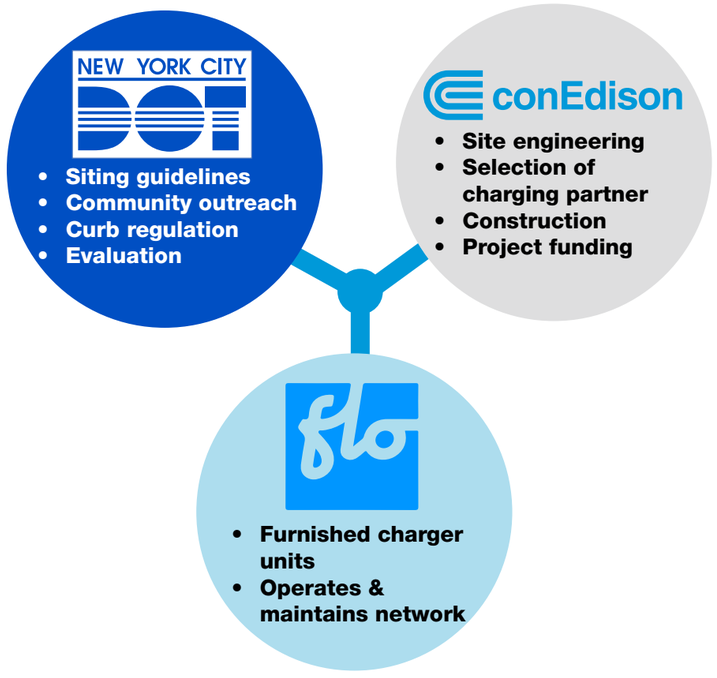
Paris

The city of Paris has created a network of over 270 curbside charge points. Over 1,800 new curbside EV chargers will be added across the city in the near term to support growing EV adoption. EVs accounted for 12% of new vehicle sales in France during the first seven months of 2022.

Details of the Curbside EV Level 2 Charging Pilot Program

New York City's curbside Level 2 EV charging pilot is a collaboration between NYC DOT and Con Edison. Under the Reforming the Energy Vision program, the New York State Department of Public Service provided Con Edison funding to pilot curbside charging within their service area. NYC DOT authorized use of the public right of way and led site selection and community outreach, while Con Edison was responsible for site engineering, construction, and procuring a charging company to operate and maintain the chargers. Con Edison selected FLO, a Canadian EV charging company, as its provider; FLO provided the chargers and is responsible for customer billing and payments, as well as charger maintenance.

On June 24th, 2021, NYC DOT, Con Edison, and FLO announced the launch of the curbside charging pilot. The first six chargers that went into service were in the Norwood and Riverdale neighborhoods in the Bronx. As new chargers were installed, Con Edison conducted public education sessions at over 20 locations to raise awareness about the program and how to use the chargers. NYC DOT and Con Edison will continue to conduct outreach throughout the term.



Charger Design and Pricing

The chargers that were installed as a part of this pilot are based on FLO's SmartTWO units, which are deployed on the streets of Montreal and other cities. Design modifications were made to ensure that the units are consistent with the look of New York City's existing street furniture. Each curbside Level 2 unit has two chargers, allowing two vehicles to charge simultaneously, and features retractable cables with a counterweight mechanism that prevents the cables from obstructing the sidewalk when chargers are not in use. As a part of the pilot, 50 public charging units were installed, providing 100 charge points.

Users can initiate charging sessions using FLO's mobile app (which is available on the Apple App Store and Google Play Store) or an RFID card. The cost to charge is $2.50 an hour during peak hours (6am-9pm) and $1.00 an hour overnight. Drivers pay these costs as long as the vehicle is plugged into the charger. This payment structure incentivizes drivers to charge overnight in order to reduce the strain on the local electrical grid. These units were installed and are operated by Con Edison.

All charging sites are marked with NYC DOT's new "Electric Vehicle Charging Only" curb regulation sign, which can be seen in the graphic above. Vehicles in spaces signed with this regulation must be EVs and actively charging. Non-compliant drivers are subject to a fine of $95. Other posted parking regulations (e.g. Alternate Side Parking) and meter fees are also applicable where relevant.

To ensure that communities understood what this new on-street infrastructure was and why it was installed, NYC DOT also installed pedestrian-level signage, in English and Spanish, at each charging site. The signage describes the benefits of EVs and the program's parking rules.

Site Allocation

NYC DOT considered a number of factors when planning where chargers would be deployed for the curbside charging pilot. The first consideration was to exclude the area of Manhattan south of 60th Street from the project, as NYC DOT did not want to encourage additional car trips to, from, or within the Manhattan core. Moreover, NYC DOT found the number of existing chargers in the area to be sufficient.

NYC DOT and Con Edison worked to identify neighborhoods where curbside chargers should be installed. Con Edison supported NYC DOT in site allocation efforts, primarily from a grid interconnection perspective. Siting was informed by the *Curb Enthusiasm* study, which was funded by the New York State Energy Research & Development Authority (NYSERDA) and produced in partnership with NYC DOT. The study outlines considerations, guidelines, and strategies for curbside EV charging deployments based on interviews, geographic analyses, and independent research. NYC DOT considered the following five priority factors:

- **Community input:** From the beginning of this project's planning phase, it was NYC DOT's intention to only install chargers in communities where there was support from elected officials and other community stakeholders (e.g. community boards). NYC DOT and its project partners brought in stakeholders early in the planning process and gave them the opportunity to be involved in the demonstration.
- **Equity:** In order for the city to meet its climate goals, EVs must be adopted by all communities across the five boroughs. NYC DOT was intentional about siting a portion of chargers in communities where the private sector is installing less EV charging infrastructure, especially low and moderate-income neighborhoods. NYC DOT also sought to have at least one program site in each borough.
- **Market factors:** Using a combination of public datasets on local land uses, demographics, and transportation characteristics (i.e. vehicle ownership, length of commute, etc.), NYC DOT and its project partners performed analyses to identify areas around the City where chargers would align with car trips.
- **User groups:** One of the key recommendations of the *Curb Enthusiasm* report was to site chargers where there are multiple potential user groups. For example, siting a charger near a medical facility could attract usage from two groups. During the day, workers at the hospital who commute by car could use the charger, while residents of the adjacent neighborhood could charge overnight.
- **Typologies:** The *Curb Enthusiasm* report laid out four site typologies best suited for curbside Level 2 chargers, including local streets, spur streets off commercial corridors, angled parking, and under viaducts/elevated structures.

For this pilot, NYC DOT installed chargers across 20 Community Districts in the five boroughs. On average, about three curbside chargers were installed per district.

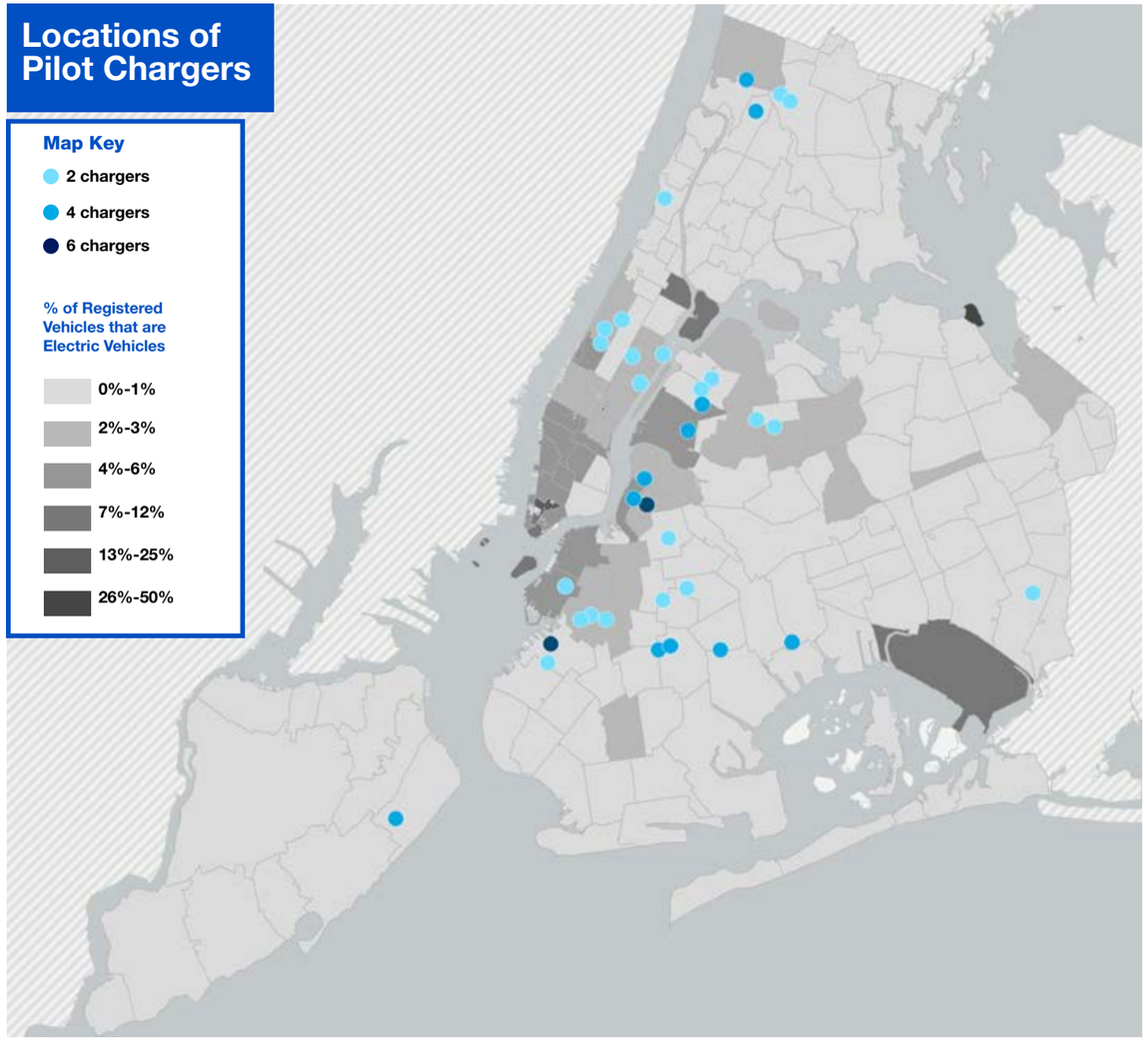
Curbside Chargers Count	
Bronx	12
Brooklyn	52
Manhattan	14
Queens	18
Staten Island	4
	100

Community Outreach

Leading up to the implementation of the pilot, New Yorkers were able to suggest locations to NYC DOT where they wanted and did not want chargers installed via an online feedback portal on the agency's website. In total, NYC DOT received over 730 comments online from community members – the overwhelming majority (96%) of which were supportive of curbside charging across the five boroughs.

In addition to the online feedback portal, NYC DOT consulted elected officials, community boards, schools, and medical facilities throughout the site selection process. During the conversations with these stakeholders, one of the major concerns was the impact that the project would have on local parking supply. NYC DOT worked with stakeholders to ensure that chargers were deployed in areas with community support. Moreover, if there were site-specific complaints, NYC DOT worked with its partners to identify alternative locations.

Overall, NYC DOT staff conducted over 30 briefings for elected officials and attended 13 community board meetings across the city to better understand specific community siting concerns. Additionally, NYC DOT conducted multiple rounds of outreach, with initial outreach covering sites that were of interest, while later rounds were used to confirm site feasibility and selection.



Implementation Process

The curbside Level 2 EV charging pilot took about four years to implement. The COVID-19 pandemic caused significant project delays in 2020 and 2021, slowing the design and construction process.

Marketing and Public Awareness

To encourage EV adoption, as well as charger use, NYC DOT, Con Edison, and FLO have continually promoted the project. NYC DOT created PlugNYC, the city's brand for its EV charging programs, and has regularly posted on its social media accounts (Facebook, Instagram, and Twitter) about the project, including when new sites are activated. Both Con Edison and FLO have also been amplifying messaging about the program and benefits of EV charging through social media, televised ads, and at events such as the New York International Auto Show. The project team will continue to monitor public awareness through the term of the program.

April 2017
Con Edison issued Request for Information for partner to install curbside Level 2 chargers

June 2018
NYC DOT began outreach to elected officials

November 2018
Curb Enthusiasm report released

December 2018
Online feedback portal launched

April 2019
Community Board outreach began

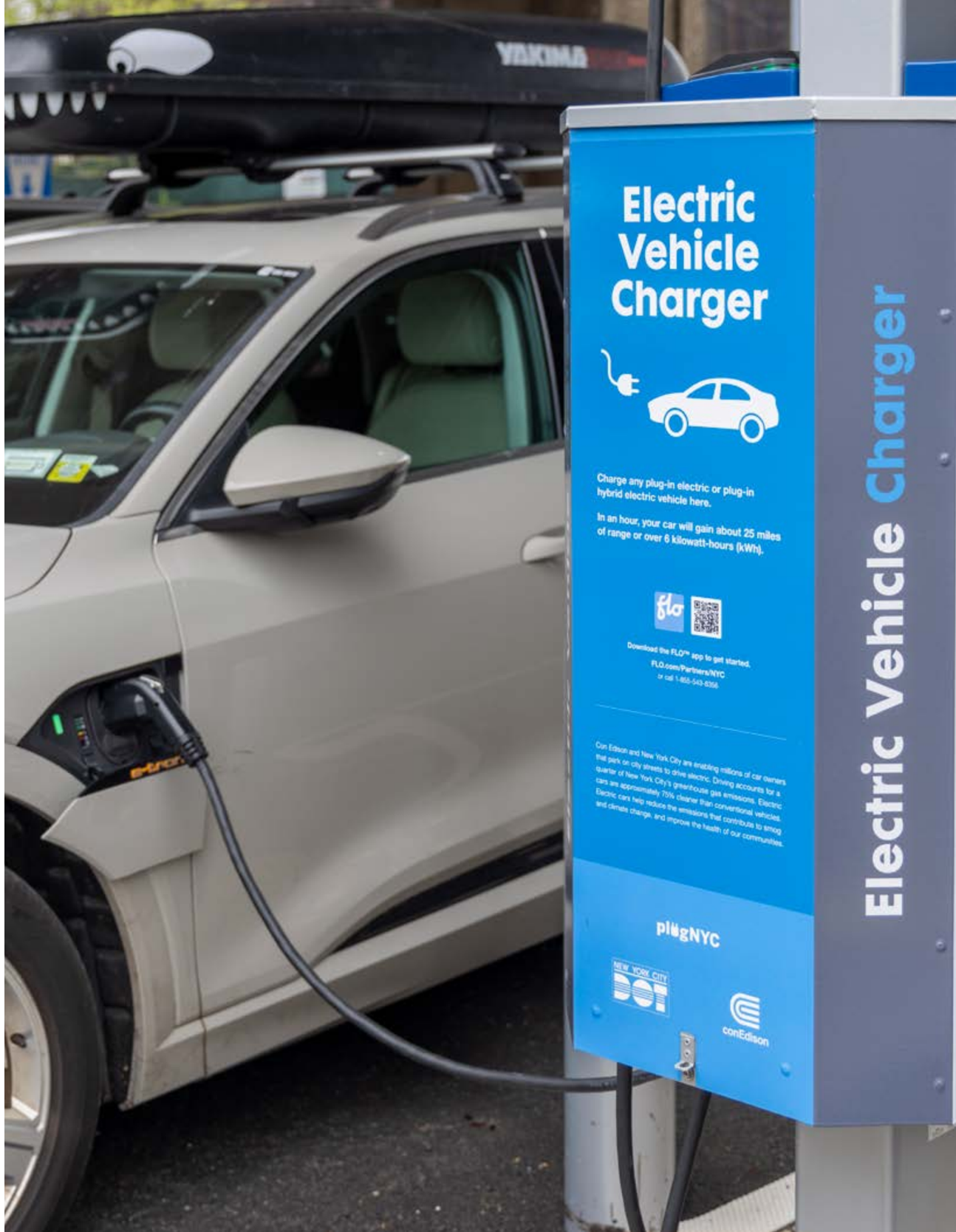
June 2019
Electric Vehicle Charging Only curb regulation adopted

August 2020
Demonstration agreement between Con Edison and NYC DOT registered

May 2021
Installation of chargers begins

June 2021
First public chargers were commissioned; pilot began

July 2022
All public chargers installed and in-service



Enforcement and NYPD Coordination

With the introduction of the “Electric Vehicle Charging Only” curb regulation, NYC DOT began coordinating with the New York City Police Department (NYPD) to reduce the frequency of blocked spaces. During the program’s launch, NYC DOT briefed, as well as prepared and distributed materials for, NYPD’s Traffic Enforcement Agents within precincts where chargers would be installed. Since then, NYC DOT and NYPD have responded to comments from the public and elected officials, and have increased enforcement at locations where spaces have been more frequently blocked. NYC DOT and NYPD will continue to collaborate on enforcement of the new EV charging curb regulation.

Evaluation Criteria

This pilot seeks to balance the needs of the City, Con Edison, FLO, users, and participating communities. To evaluate the performance of the pilot against these goals, NYC DOT and Con Edison sought to answer the following questions:

Usage

- **Overall utilization and efficiency: Were the chargers used and when were they used?**
- **Site variation: How did utilization and efficiency vary across sites with different characteristics?**
- **User characteristics: Who was using the chargers?**

Operational Feasibility

- **System uptime: Were the chargers typically in working order? Was vandalism an issue?**
- **Frequency of blocked chargers: How often were chargers blocked by non-EVs?**

Attitudes Toward EV Adoption

- **Public awareness: Were EV users and the public aware of the chargers?**
- **EV adoption: Did the program impact the purchase decisions of potential car buyers?**

A number of data sources are being used to conduct the evaluation of the curbside Level 2 charging The primary data source is the monthly report that Con Edison and FLO provide as a part of the pilot agreement. The report includes summaries of charger use and membership enrollment. In addition to the monthly report, NYC DOT and Con Edison are leveraging Con Edison’s regular customer surveys, a customer survey completed by FLO, and the Parking Violations Issuance dataset (the latter is available on the city’s OpenData portal) to evaluate the project. As a part of the pilot, Con Edison conducts two surveys per year on customers across the city. Surveys are sent primarily to customers in zip codes where chargers have been installed. The content of the survey focuses on charger awareness and opinions towards EV adoption.

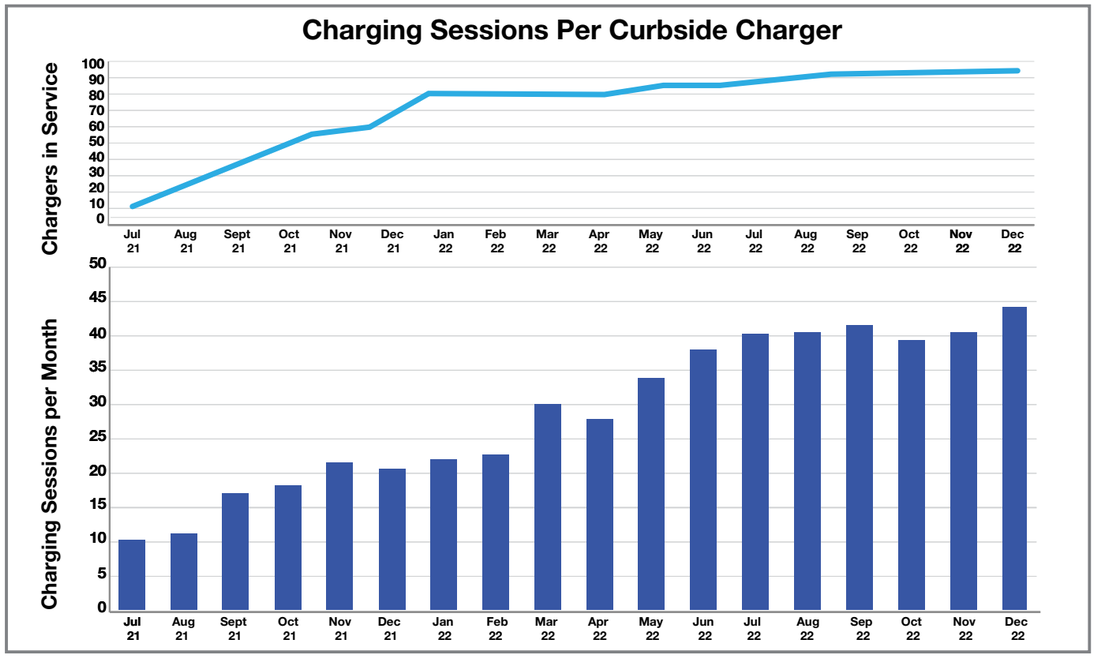
The Parking Violations Issuance dataset provides a record of summonses that have been issued to drivers that did not comply with stated curb regulations. With summonses as a proxy, this data helps to provide context on which chargers are being blocked, as well as how often.

Charger Use: Sessions, Utilization, and Efficiency

Utilization is one of several factors NYC DOT considered in its evaluation of the curbside Level 2 charging pilot. The agency intentionally selected sites in areas with above-average EV adoption to test the upper end of potential charger demand, as well as in areas with average and below-average EV adoption to promote equitable access and to determine baseline use. Utilization is helpful in showing the growth in demand over time and to compare the charging patterns between charging sites located in communities with different characteristics. It should not, however, be used as the sole criterion for determining which charging sites were successful and which were not. Chargers were purposely sited in low- and moderate-income neighborhoods with few EVs in an effort to spur EV adoption and to ensure equitable access to charging. Lower utilization rates at these charger locations were expected.

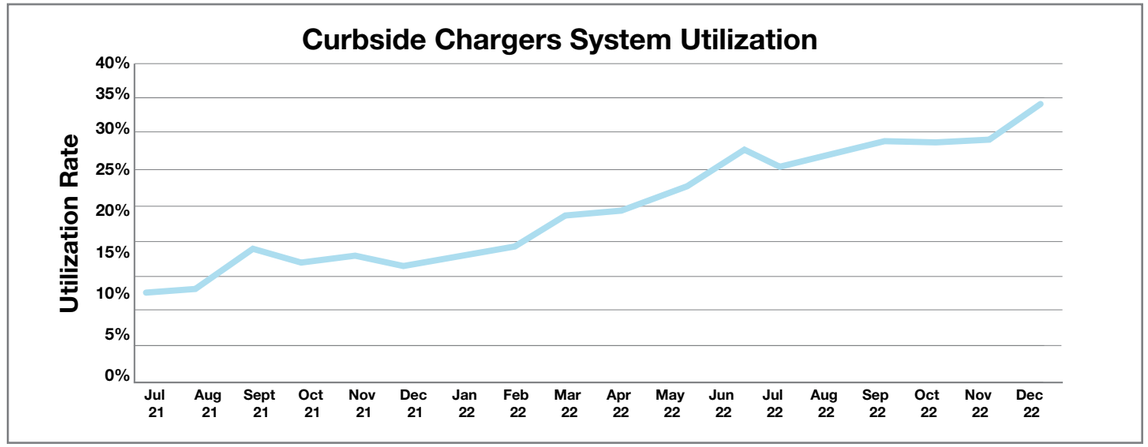
Charging Sessions and Utilization

Over the course of the first eighteen months of the pilot, drivers initiated 49,250 charging sessions. The number of sessions grew steadily month to month as new chargers were brought into service, almost doubling between December 2021 and June 2022 (a period during which nearly all 100 chargers were in service). By May 2022, nearly half of the chargers provided over 120 sessions per month. About 79% of charging sessions occurred during peak hours (6 AM – 9 PM) and 21% occurred in the overnight period.



Curbside charging utilization has trended positively over the course of the first eighteen months of the pilot, though growth has recently slowed. The utilization rate is defined as the percentage of time the charger was plugged into an EV. The system's overall utilization reached 34% in December 2022 – nearly double what it was at the beginning of the year. Median site utilization by June 2022 was 28%. NYC DOT also examined efficiency rate, which is the percentage of time a vehicle is actively charging while plugged in. For example, if a vehicle is plugged in for five hours but is only actively charging for four—because the battery reaches full capacity—then the efficiency rate for that session would be 80%. The extra hour the vehicle remains plugged in is referred to as overstay time. A breakdown of utilization and efficiency rate by site is provided in the appendix of this report.

NYC DOT seeks to minimize overstay time during peak hours (6 AM-9 PM) in order to facilitate charger access. A vehicle staying plugged in for hours after it is done charging deprives other EV owners of the opportunity to charge. During the off-peak period (9 PM-6 AM), the pilot sought to allow for more overstay time to facilitate overnight charging (it is unrealistic, for example, to expect an EV owner to move their vehicle out of a charging space at 3 AM). The hourly price of curbside charging reflected these preferences, with a higher rate of $2.50 during the day to promote turnover and a lower rate of $1 during the overnight to allow for longer sessions. The overall efficiency rate of the pilot was 81%. This indicates that drivers are largely using these spaces to charge their vehicles and not simply for EV parking.

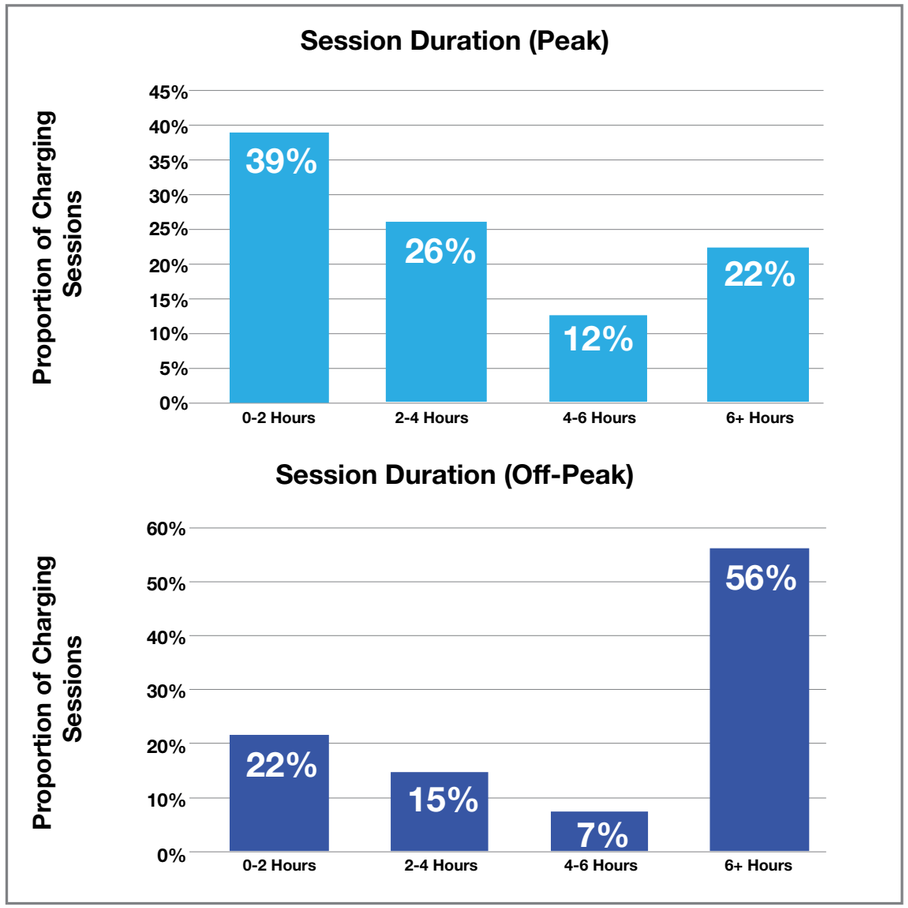


At the high end of the utilization spectrum, eleven sites have utilization rates greater than 54%, with six sites over 60%. The ten least-busy sites have utilization rates below 22%, with five sites below 10%. Fewer than five sites in the pilot experienced utilization rates below 5% for more than four consecutive months. More commonly, a site experienced low utilization for the first month or two after installation, then saw progressively higher levels of use as the site become more visible to the public. The project team will continue to work to increase public awareness of the system throughout the term of the project. One key factor that the project team will be observing in the remaining years of the pilot is whether there is a seasonality to charging, as weather can impact vehicle use and battery chemistry, thereby impacting travel range.

Session Length

By design, Level 2 charging is different from the gas station model, where a driver periodically goes to a fueling station to fully refill their tank. The Level 2 model seeks to take advantage of the fact that the typical car spends most of its life parked—the average vehicle in New York City is driven only eight miles per day. EVs can be charged during these idle hours in the places the vehicle most commonly parks, e.g. at home, the curb, work, or a store. An EV driver need not get a full charge in one charging session. Rather, by opportunistically charging at several locations throughout the week or month, EV drivers can maintain a charge of 80% of more without ever having to go to a fueling station.

Over the course of the study period, the median charging session was just over 3 hours, with sessions mostly ranging between one-and-a-half and six hours. Generally, there was not a strong relationship between a charger's median session length and its utilization rate.



Except for the overnight period, NYC DOT does not want to encourage charging sessions over 6 hours, the typical period of time needed for an EV to achieve a charge of 80% or more at a Level 2 charger. Once an EV is fully charged, the vehicle should move out of the curbside charging space to allow another EV access. About 22% of charging sessions in the first eighteen months of the pilot were initiated during the overnight period. Charging sessions tend to be shorter in the peak versus the off-peak. Only 22% of peak sessions included charging over 6 hours, whereas 56% of off-peak sessions did. This is likely reflective of overnight charging during the off-peak.

Characteristics of Most and Least Used Chargers

From month to month, the ten sites that were most heavily used—based on utilization and monthly session count—are, with one exception, on the Upper West Side and Upper East Side of Manhattan, and in Carroll Gardens and Park Slope in Brooklyn. In December 2022, these sites had utilization rates ranging from 54% to 69%. These neighborhoods are transit-rich, with households that have a median household income over 50% greater than the city's average, and with EV adoption rates that are, at the minimum, twice as high as the citywide average. Moreover, the twenty chargers in these neighborhoods are proximate to some of the city's major commercial corridors, employment hubs (one of the most used sites is immediately adjacent to New York Presbyterian Columbia University Irving Medical Center), and attractions (i.e. major parks). The high utilization rate at these charging sites is consistent with high pre-existing levels of EV ownership, the scarcity of off-street parking (and therefore opportunities for home charging), and the concentration of destinations.

On the opposite end of the spectrum, the least-used stations were in a more heterogenous group of neighborhoods, although average incomes tended to be lower. These ten sites included chargers in neighborhoods like Brownsville, East New York, Sunset Park, and Bushwick in Brooklyn, Astoria, Laurelton, and Long Island City in Queens, Norwood in the Bronx, and Dongan Hills in Staten Island (the program's newest site). Of these ten sites, two were commissioned into service in 2022. Based on the data from the system's other chargers, chargers have their worst performance in the first two to three months of operation, usually breaking the 5% utilization threshold thereafter. October 2022 was the first full month when all curbside Level 2charging sites had utilization rates above 5%. One site did fall below 5% utilization in December.

The two sites that had been in service for over six months and continued to have low utilization—Norwood and Laurelton—share comparable EV ownership rates that are one-third the citywide average, and they have also seen little to no investment in EVSE from the private sector. However, the median household income in both areas differs significantly – with Norwood's being nearly half that of the citywide average, while Laurelton's approaches $95,000. The parking dynamics in both neighborhoods also differ. Whereas Norwood is a dense neighborhood with residents who largely depend on curbside parking, most households in Laurelton have access to off-street parking via their driveways or garages. The results in Laurelton may indicate that curbside Level 2 charging may be less critical in residential areas with plentiful off-street parking, which provides the opportunity for home charging.

Of the 35 locations where curbside Level 2 chargers were installed, over a third required drivers to pay for parking in addition to their charging sessions, while the others were on non-metered streets with Alternate Side Parking regulations. In December 2022, the median session at a charger at a non-metered space was comparable to the median session at a charger at a metered space. However, efficiency rates were slightly higher at metered spaces (85% versus 79%).

User Characteristics

In October 2022, FLO conducted a survey of 268 users who had downloaded their mobile app. Over half of respondents reported having charged their vehicles at one of the curbside Level 2 chargers at least once a month. Drivers who primarily park their vehicles on-street, who largely reported living in multi-unit dwellings and represented half of the survey's respondents, were more inclined to be frequent users. There was also an overwhelmingly positive sentiment towards local EV charging – nearly 90% of respondents looked favorably upon having public EV chargers in their neighborhood. Over half of respondents reported not having curbside Level 2 chargers in their neighborhoods.

System Uptime

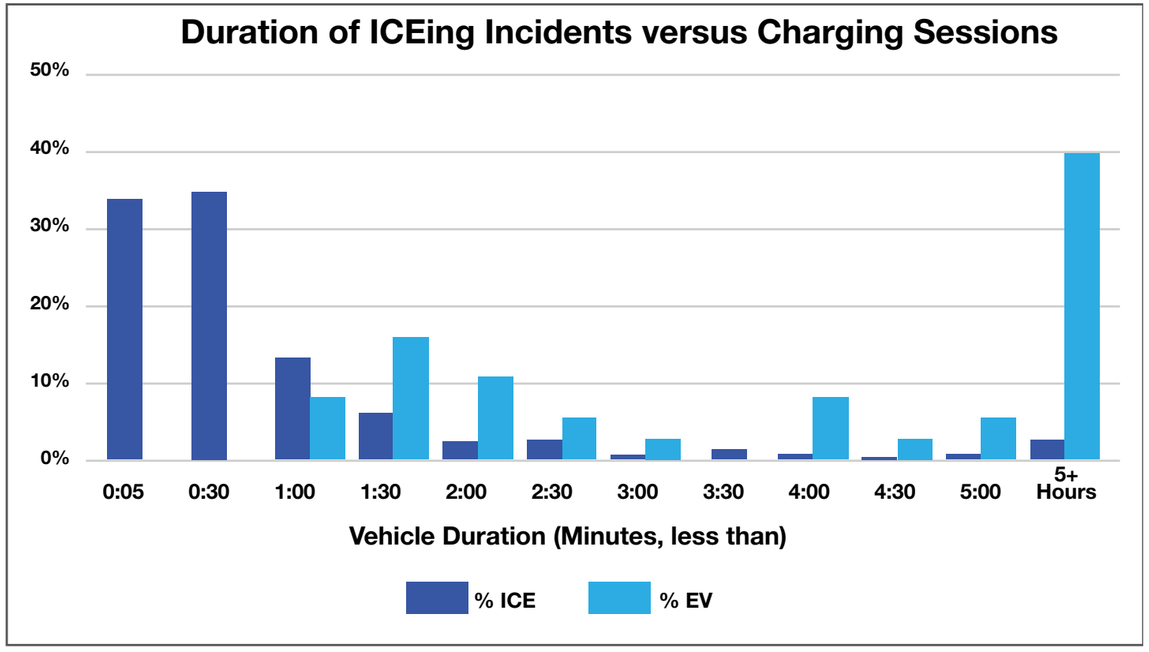
Throughout the first eighteen months of the program, charger uptime was near-perfect. System uptime averaged around 99.9%, with few customer complaints about chargers malfunctioning. This bodes well for reliability, particularly as a recent JD Power Survey indicates that inoperable chargers have been hampering the overall customer experience for EV drivers nationwide. The project team will continue monitoring system uptime throughout the term of the pilot, with FLO providing on-site maintenance as necessary. There were no major issues with vandalism.

Blocked Chargers

To gain a better understanding of parking behavior at the curbside charging spaces, NYC DOT deployed time-lapse cameras at five locations. Cameras were temporarily mounted onto poles near the chargers and left to capture images for two to three non-holiday weekdays. Each image captured the activity at those charging spaces and the images were processed for classification. The main purpose of the time-lapse analysis was to identify how often access to these chargers was being blocked by internal combustion engine (ICE) vehicles, which degrades a user's experience with the charging system and overall customer sentiment. Data was collected across a subset of locations in Brooklyn, Manhattan, and Queens with different typologies and utilization levels.

Time-lapse data from five locations showed that blocking by ICE vehicles, or "ICEing," unfortunately occurred on a regular basis. However, most of these blockages were brief: 70% of the non-compliant vehicles were typically in the EV charging space for less than half an hour. This pattern indicates that ICE drivers who blocked spaces saw the opportunity to park and run a quick errand in the area. Although there was variation by site, EVs typically parked in the spaces for a greater share of the day than ICE vehicles. At most of the observed sites, EVs occupied spaces about 40% of the time, while spaces were blocked by non-compliant vehicles 20% of the time, and empty for the remainder.

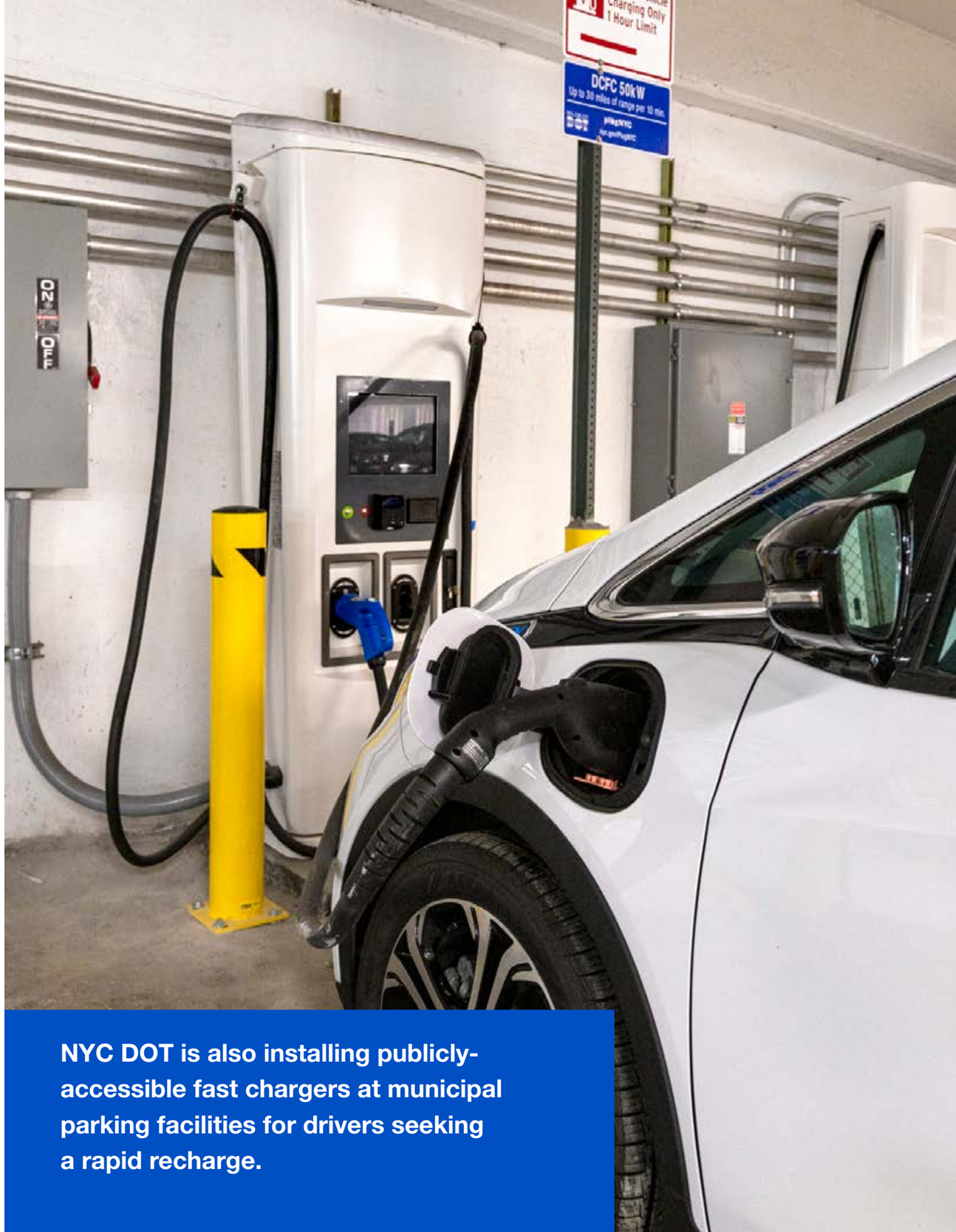
NYC DOT is working closely with the NYPD to reduce instances of blocked spaces. During the eighteen-month pilot study period, over 3,200 summonses were issued to non-compliant vehicles blocking curbside charging spaces. Using the results from the time-lapse analysis, as well as input from members of the community, NYC DOT and NYPD were able to make strategic decisions on where enforcement was needed to reduce instances of ICEing. NYC DOT will continue to deploy time-lapse cameras and perform related analyses throughout the term of the pilot to better understand and reduce non-compliant behavior at the curb.



EV Registrations and User Growth

When the pilot began in the summer of 2021, about 15,000 EVs were registered in New York City. Since then, EV adoption has increased steadily by 2-3% on average per month, and as of December 2022 there were 25,800 EVs registered in the city. The number of drivers using the curbside Level 2 chargers also grew steadily as more chargers were brought on-line. Between January and June 2022 alone, the number of unique users system-wide grew 83% from 774 to 1,417. Although this data is positive, no conclusions can be drawn as to whether the curbside Level 2 charging pilot influenced the rate of EV adoption, as other factors, including purchase incentives, growing EV model choice, and private and public investment in other EV charging, were at play during the pilot period.

The two main data sources that NYC DOT is using to track EV adoptions are New York State Department of Motor Vehicles (NYSDMV) registrations and Con Edison's user surveys. The registrations provide context on larger EV ownership trends while the surveys can track how the presence of the chargers influences EV purchases in host neighborhoods. As of May 2022, when Con Edison conducted its latest survey, the lack of local charging stations remains the biggest concern for those considering buying or leasing an EV, as indicated by 44% of respondents. Limited range, recharge time, and vehicle cost follow closely behind, though these generally reflect a need for more EV education and additional models on the market. Adoption and survey data from the second year of the pilot will allow NYC DOT to better investigate whether the program is influencing the vehicle buying decisions of New Yorkers.



NYC DOT is also installing publicly-accessible fast chargers at municipal parking facilities for drivers seeking a rapid recharge.

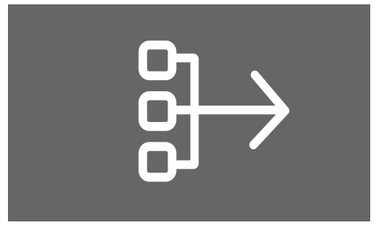
Challenges and Opportunities

A number of challenges arose during the first eighteen months of the pilot. The most notable issue was charger access being blocked by ICE vehicles. As with any on-street initiative, there is an adjustment period required for drivers to familiarize themselves with, and adhere to, newly introduced curb regulations. NYC DOT and Con Edison continue to work with the NYPD to educate the public on the program, ensure that the curbside chargers are not blocked by ICE vehicles, and support the NYPD's efforts to issue tickets to non-compliant vehicles. Additionally, automated enforcement could be leveraged as a tool to deter non-EV drivers from blocking the spaces.

During the construction phase of this project, NYC DOT and Con Edison also encountered sub-surface conflicts with existing infrastructure, thus rendering a handful of potential sites infeasible. While in the long-term, these instances did not impact the pilot's operations, they did cause delays in charger deployments. While the risk of encountering sub-surface and other conflicts is unavoidable in the five boroughs, NYC DOT will continue working with stakeholders to conduct due diligence to minimize this risk to the greatest extent possible in future installations.

On a positive note, there were several concerns that came up during project planning that did not prove to be major issues during the pilot. Most notably, there were very limited instances of vandalism that compromised charger service. As a result, system uptime was perfect or near-perfect every month.

Conclusions and Next Steps



Overall, the program's performance in its first eighteen months exceeded expectations. The data analysis in this report demonstrates that:

- **Curbside Level 2 charging can help meet existing charging needs in areas with above average EV adoption and limited off-street parking.**
- **Curbside Level 2 charging is operationally feasible: Properly designed and maintained curbside chargers can achieve a high uptime performance in New York City.**
- **Curbside Level 2 charging in areas with lower EV adoption can increase charging access equity; utilization will be lower in these areas.**
- **Blocked charger spaces will likely remain an issue, but present more of an inconvenience to users than a fundamental challenge to program effectiveness.**

As the program moves into its second year of operation, Con Edison, FLO, and NYC DOT will further evaluate the impact of the program on the purchase decisions of vehicle owners through surveys of users and the general public. In addition, the agency will use time-lapse cameras to monitor the frequency of blocked spaces at additional locations, as well as continue to analyze site specific factors that may drive utilization patterns. The partners will also continue public outreach and marketing efforts to improve awareness of the curbside Level 2 chargers.

Curbside Level 2 charging is one of several key City strategies to support the transition to EVs. Looking forward, NYC DOT will consider approaches to the expansion of curbside Level 2 charging that are consistent with our overall policy goal: We want fewer New Yorkers to drive, but for those that do, we want them to drive electric. To that end, a potential future expansion of curbside charging should:

- **Be flexible, allowing the program size and approach to change in response to new charging technology and evolving consumer preferences.**
- **Be targeted, focusing on neighborhoods and market segments where curbside Level 2 charging can have the greatest impact at the least cost.**
- **Support the City's goals to electrify high-mileage fleets, especially taxis and FHVs and the city's own fleet of light-duty vehicles.**
- **Leverage utility, state, and federal funding opportunities, including new funding programs in the Bipartisan Infrastructure Bill and the Inflation Reduction Act.**
- **Explore different charger designs, including units that are smaller and easier and cheaper to install and remove, to maintain flexibility in the use of curb space.**
- **Use public-private partnerships for implementation to speed deployment, leverage private investment, and reduce the financial exposure of the City.**

Acknowledgements/Recognition

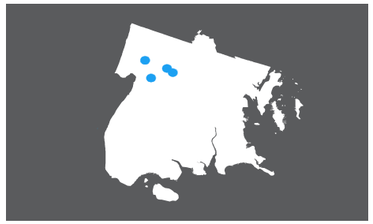
NYC DOT
Commissioner Ydanis Rodriguez
Joseph Fuccillo
William J. Carry
Eric Beaton
Josh Benson
Charles Ukegbu
Susan McSherry
Mark Simon
Luis R. Gonzalez
Mike Marsico
David Stein

Con Edison
Raghusimha Sudhakara
Britt Reichborn-Kjennerud
Roy Rada
Joe Morreale

FLO
Frank Fata
Jean-Christophe La Forge
Jose Hollanda

Appendix: Site Profiles

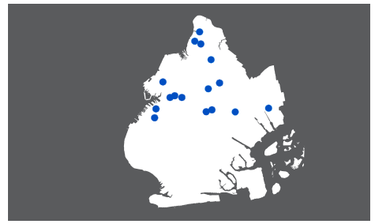
Bronx



	Street	From	To	Chargers	Installed
1	Broadway	West 242th Street	West 240th Street	4	June 2021
2	Putnam Place	East Gun Hill Road	Reservoir Oval West	2	June 2021
3	Dekalb Avenue	East Gun Hill Road	East 212th Street	2	November 2021
4	Bedford Park Boulevard	Goulden Avenue	Paul Avenue	4	November 2021

	Utilization (Dec 22)	Sessions (Dec 22)	Efficiency (Dec 22)	Power Provided (Dec 22)	Median Session Length (Dec 22)
1	31%	216	85%	4,291	2:07:34
2	31%	81	72%	1,899	2:48:15
3	19%	47	93%	1,432	5:31:44
4	49%	212	79%	6,197	5:23:22

Brooklyn



	Street	From	To	Chargers	Installed
1	Linden Boulevard	East 96th Street	Rockaway Parkway	4	September 2021
2	Marcus Garvey Boulevard	Broadway	Park Avenue	2	December 2021
3	Brooklyn Avenue	St. Marks Ave	Prospect Place	2	December 2021
4	Stuyvesant Avenue	Fulton Street	Chauncey Street	2	December 2021
5	Lenox Road	New York Avenue	East 34th Street	4	December 2021
6	Elton Street	Flatlands Avenue	Locke Street	4	September 2021
7	Meeker Avenue	Metropolitan Ave	Rodney Street	6	September 2021
8	Norman Avenue	Dobbin Street	Guernsey Street	4	September 2021
9	North 4 Street	Bedford Avenue	Berry Street	4	December 2021
10	13 Street	5th Avenue	4th Avenue	2	June 2022
11	8 Street	6th Avenue	7th Avenue	2	December 2021
12	Court Street	1st Place	Carroll Street	2	August 2021
13	Prospect Park West	5th Street	6th Street	2	August 2021
14	Clarkson Avenue	40th Street	Albany Avenue	4	October 2021
15	43 Street	5th Avenue	4th Avenue	2	December 2021
16	3 Avenue	33rd Street	34th Street	6	October 2021

	Utilization (Dec 22)	Sessions (Dec 22)	Efficiency (Dec 22)	Power Provided (Dec 22)	Median Session Length
1	19%	118	80%	2,665	2:52:26
2	22%	81	95%	1,797	2:58:44
3	40%	106	75%	2,385	2:34:34
4	62%	134	69%	3,663	4:00:26
5	25%	127	82%	3,326	3:58:31
6	11%	69	81%	1,389	2:33:33
7	32%	263	87%	5,772	3:13:49
8	40%	255	84%	5,592	2:48:40
9	40%	328	87%	5,799	1:48:08
10	41%	90	78%	2,644	4:47:59
11	64%	145	80%	4,197	4:12:57
12	59%	164	81%	3,915	3:13:28
13	54%	148	80%	3,607	2:58:56
14	17%	94	90%	2,503	4:30:02
15	50%	121	83%	3,347	4:16:20
16	23%	247	92%	4,617	2:35:38

Manhattan

	Street	From	To	Chargers	Installed
1	East 67th Street	York Avenue	1st Avenue	2	August 2021
2	East 78th Street	Park Avenue	Lexington Avenue	2	August 2021
3	West 76th Street	Amsterdam Avenue	Columbus Ave	2	May 2022
4	West 84th Street	Amsterdam Avenue	Columbus Ave	2	June 2022
5	West 93rd Street	Central Park West	Columbus Ave	2	July 2021
6	Fort Washington Avenue	W 164th Street	W 165th Street	2	October 2021
7	East End Drive	East 88th Street	East 87th Street	2	August 2021

	Utilization (Dec 22)	Sessions (Dec 22)	Efficiency (Dec 22)	Power Provided (Dec 22)	Median Session Length
1	47%	131	80%	3,116	3:37:01
2	64%	164	76%	4,183	3:17:16
3	46%	126	79%	2,999	2:56:56
4	50%	136	83%	3,396	3:18:37
5	60%	171	73%	3,543	2:28:04
6	55%	137	71%	3,004	2:58:22
7	69%	164	78%	4,326	3:51:01

Queens

	Street	From	To	Chargers	Installed
1	35th Street	30th Avenue	28th Avenue	2	May 2022
2	33rd Street	31st Avenue	Broadway	2	August 2021
3	38th Street	36th Avenue	35th Avenue	4	August 2021
4	41st Avenue	81st Street	Baxter Avenue	2	May 2022
5	Queens Boulevard	34th Street	33rd Street	4	December 2021
6	72nd Street	37th Avenue	35th Avenue	2	October 2021
7	225th Street	Merrick Boulevard	135th Avenue	2	September 2021

	Utilization (Dec 22)	Sessions (Dec 22)	Efficiency (Dec 22)	Power Provided (Dec 22)	Median Session Length
1	8%	40	93%	554	1:13:29
2	20%	79	84%	1,402	2:05:15
3	25%	182	91%	3,843	2:16:45
4	55%	124	84%	3,901	5:09:59
5	20%	113	86%	2,820	3:52:05
6	62%	98	77%	2,039	2:37:59
7	2%	10	98%	131	1:46:50

Staten Island

	Street	From	To	Chargers	Installed
1	Mason Avenue	Seaview Avenue	Delaware Avenue	4	July 2021

	Utilization (Dec 22)	Sessions (Dec 22)	Efficiency (Dec 22)	Power Provided (Dec 22)	Median Session Length
1	8%	47	75%	1,074	2:47:28

plugNYC

Eric Adams
Mayor

Ydanis Rodriguez
Commissioner