Assessing the Business Case for Hosting Electric Vehicle Charging Stations in New York State

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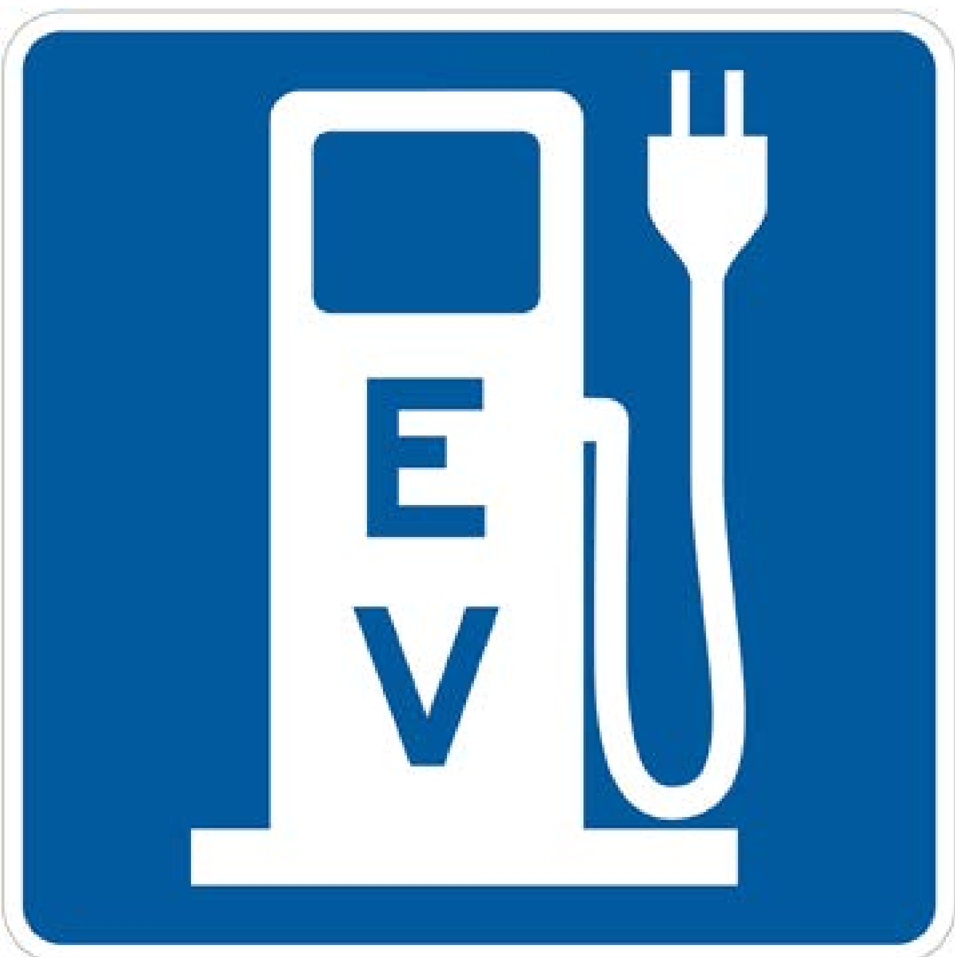

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Assessing the Business Case for Hosting Electric Vehicle Charging Stations in New York State

Final Report

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Notice

Abstract

This white paper evaluates the business case of hosting a Level 2 electric vehicle (EV) charging station in New York. The analysis relied on charging use data provided by the New York State Energy Research and Development Authority (NYSERDA) along with real-world data on equipment use, costs, revenue, and assumptions derived from industry reports and original research. The report explored scenarios that vary charging use and revenue sources to better understand the key factors that drive profitability from hosting these stations. The main findings from the analysis are that user fees are essential to cover costs, workplace charging stations have the highest utilization among various location types, and charging stations must be used more than once per day to achieve profitability.

Keywords

electric vehicles, EV, EV charging stations, business models, financial analysis

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Executive Summary

As the electric vehicle (EV) market grows, so does the demand for public charging stations. Public charging infrastructure expansion is limited by high upfront costs of equipment and installation, uncertain usage of charging services, and consumers' willingness to pay for public charging. To date, public funding has been an important component of cost recovery and value maximization for station hosts.

This white paper evaluates the business case of hosting a Level 2 charging station in New York State. The analysis uses the charging-use data provided by the New York State Energy Research and Development Authority (NYSERDA) along with real-world data on equipment use, costs, revenue, and assumptions derived from industry reports and original research. In addition, the report explores scenarios that vary charging-use and revenue sources to better understand the key factors that drive profitability from hosting these stations. The goal of the report is to harness real-world experience to establish an understanding of current charging behavior and inform future efforts to expand the EV market in New York.

ES.1 Background

New York State is a leader when it comes to supporting transportation electrification through public policies and programs. Three State investor-owned utilities have been approved to invest over $11 million in various charging infrastructure programs. These policies, combined with others such as State-funded vehicle and charging station rebates, helped deploy over 34,600 EVs by the end of 2018, reaching goals set in the first phase of the Charge NY initiative.

Despite progress, New York continues to lag behind other leading EV states in terms of EV adoption per capita and the gap between vehicle adoption and public charging infrastructure appears to be increasing.

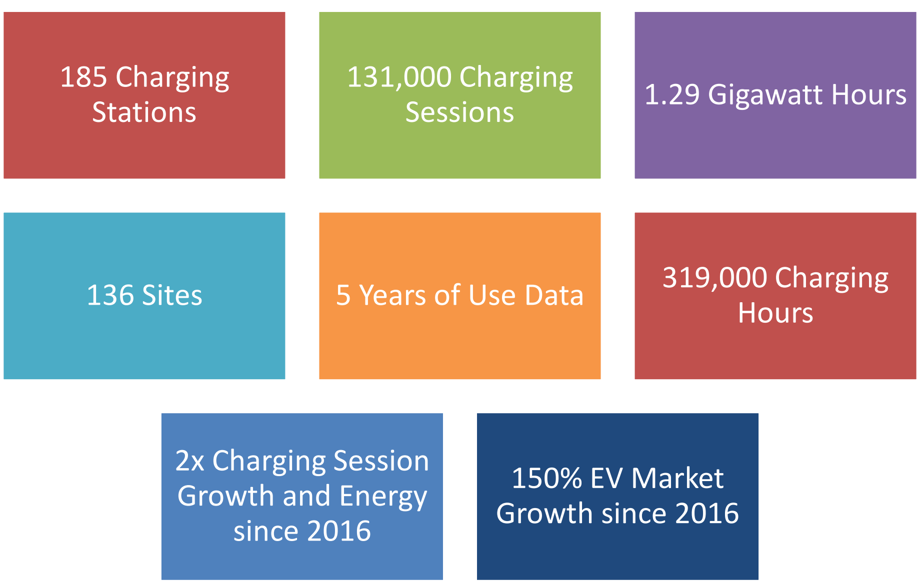
As of October 2018, there were 2,400 public Level 2 ports and more than 300 public DC fast charging ports across the State. Based on EV adoption forecasts from the International Council on Clean Transportation (ICCT), the major metropolitan areas in New York only have 15 percent of the public infrastructure required to meet the needs of projected EV drivers in 2025. A focus on infrastructure development and analysis into the business case for hosting charging stations is needed to address these gaps and identify solutions.

ES.2 Data Sources and Business Case Assessment Methodology

This analysis relies on data received from NYSERDA's initial Level 2 incentive program collected over a five-year period from 2013 to 2018. Stations varied by land use and location type, with concentrations in areas of the State with strong EV markets such as Long Island, New York City, Rochester, Albany, and Ithaca. Some of the location types include workplaces, universities or medical campuses, and parking garages (see all categories in Table 2). Charging station use varied across sites, with many stations experiencing growth in use between 2016 and 2018. Overall, charging use increased by 30 percent annually on average for stations of the same location type during this time period.

A total of 185 charging stations at 136 sites were analyzed for this study. In order to run an analysis that included estimates of the real-world profitability of the stations and various scenarios, the sites were aggregated into categories. The categories, referred to as archetypes, were developed to systematically look at the characteristics of a charging site that could affect its value proposition. In all, 46 archetypes were used in this study (see appendix B for more information). More than 70 percent of these sites offer free charging, and more than 60 percent have limited access. Only 38 percent are fully accessible to the public. A discounted cash flow assessment was completed to identify the profitability and investment payback, where applicable, based on stations' actual use, development costs, and revenue using data made available by NYSERDA. In addition, thousands of additional scenarios were evaluated for the stations by varying the charging use, direct and indirect revenue, and equipment and operating costs. The scenarios map the sensitivity to profitability and investment payback.

ES-1. Charging-Use Summary Statistics



ES.3 Summary of Findings

ES.3.1 Clear Patterns in Station Usage Emerged

One-quarter of stations were used for between 3.5 and 5.25 hours per session and provided between seven and nine kilowatt-hours per session on average. This narrow band of use for so many stations across location types reveals a common pattern that can serve as a reference point for charging service providers.

ES.3.2 User Fees are Essential to Cover Costs

User fees in some form are an essential part of a charging service business model to cover operating costs and the upfront capital costs. Operating costs can become burdensome for hosts of high-use stations that do not collect any form of fee or revenue. Owner-operators seeking payback from their charging stations are faced with a tradeoff between faster cost recovery through higher time- and session-based fees and ensuring users are not deterred by unattractive fees. Session- and energy-based user fees are the only form of direct revenue considered in this analysis. For the 70 percent of stations that offered free charging, the fee that would have been required to break even ranged from as low as $0.08 per kilowatt-hour to as high as $10.60 per kilowatt-hour.

ES.3.3 Workplace Stations Achieved the Highest Utilization

The highest use stations in terms of total number of sessions tended to be at universities or medical campuses, followed by parking garages outside of New York City. Stations located at multifamily dwellings delivered more total energy per station than all locations besides those at the universities or medical centers.

ES.3.4 A Base Utilization of More than One Session a Day is Required to Achieve Profitability

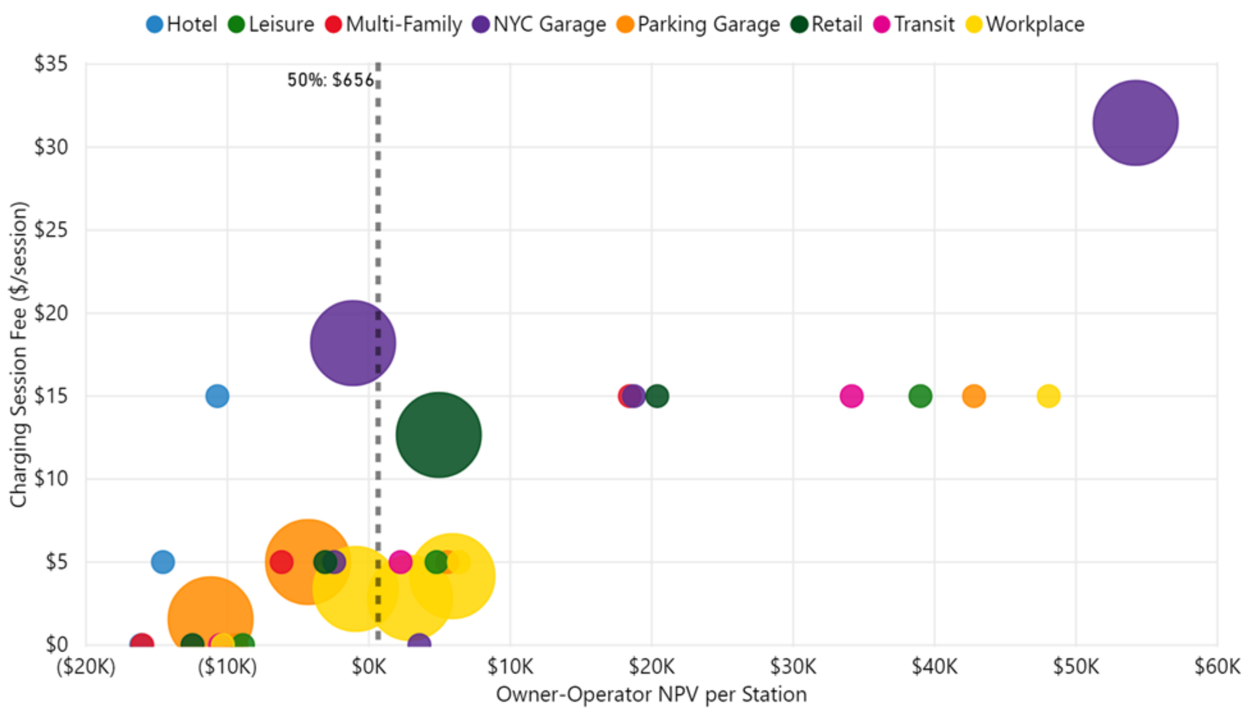
The revenue from a charging station depends on session charging time, the number of charging sessions per day, and any charging-use fees. When utilization was below one session per day, only a third of the scenarios achieve profitability for all archetypes. In these low-use scenarios, annual growth rate matters more with higher growth rates allowing more archetypes to reach profitability. Nevertheless, more than 55 percent of scenarios analyzed with a revenue source were not profitable, even for archetypes that had stations in use more than twice a day in the first year.

ES.3.5 Seven of 12 Archetypes That Charged a Fee Reached Profitability in the Base Case

For the 39 out of 46 archetypes that did not achieve profitability, five archetypes charged a user fee of some kind. Low utilization prevented these sites from reaching profitability despite the average 30 percent annual growth rate. Overall, 41 percent of the scenarios analyzed achieved profitability. On a per-station basis, the median net present value (NPV) was about negative $3,600 and the median debt was just under $6,000.

Figure 1. Owner-Operator Net Present Value per Station and Session Fees by Archetype

This chart shows the profitability of stations that charge a session fee for access. These stations could also charge an energy-based user fee. Larger circles indicate real-world session fees. Scenarios shown: 20,250.



ES.3.6 Electricity Costs Have a Minimal Effect on Profitability

While electricity costs are an important factor for operating expenses, the effect of these costs on profitability appears to be minimal. Only 34 percent of scenarios were profitable when the default electricity cost ($0.05 per kilowatt-hour) from the base case analysis was used.[1] Decreasing the electricity cost by 40 percent to $0.03 per kilowatt-hour only increased the number of positive scenarios a fraction of a percent, whereas more than doubling the cost resulted in 29 percent of profitable scenarios.

ES.3.7 Public Funding Has a Positive Effect on Profitability

Of the more than 30,000 scenarios that included a NYSERDA grant worth between $5,000 and more than $20,000 depending on the site, 56 percent achieved profitability. Of these profitable scenarios, over 75 percent achieved payback in five years or fewer. When the public grant was excluded, only 36 percent of scenarios achieved profitability.

ES.3.8 Indirect Benefits Have Noticeably Positive Effect on Profitability

Other factors such as indirect benefits have a noticeable effect on the profitability of a charging station at the levels modeled. The only indirect benefits considered in this analysis came from extra revenue EV drivers spend at retail locations while charging their vehicles. The additional revenue increased the profitability by between 7 and 250 percent depending on the archetype with all but two improving by more than 100 percent.

ES.3.9 Valuing Environmental Benefits Can Greatly Improve the Business Case for High-Use Stations

When assuming higher usage, carbon emissions savings potential over the lifetime of a charging station increases to 1,417 tons over the maximum of 566 tons measured in the base case. Using the last estimate for the social cost of carbon estimated by the federal government ($36 per ton in 2015), the societal value of these charging stations ranges from $84 to $59,514 over the life of the equipment. Monetizing these environmental benefits could be a valuable source of revenue for charging site hosts. At the time of this research, New York State had a carbon price on electricity use through the Regional Greenhouse Gas Initiative, but no price was in place for the transportation sector.

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1 The default electricity cost was the average energy charge (cents per kilowatt-hour) for commercial electricity users in New York State and does not include any fixed or demand charges.

With a growing EV market and station utilization estimated to be increasing by 30 percent per year, the business case for Level 2 charging will get better for many locations. Profitability is possible but making the business case will continue to be challenging as owner-operators identify suitable revenue sources, both direct fees and value captured from indirect benefits that will help contribute to a strong statewide EV market. As initiatives to expand the public charging station accelerate, this analysis can help inform targets for charging station providers and regulatory agencies in New York State.

1 Introduction

Electric vehicles (EV) are a cornerstone of New York State's Reforming the Energy Vision (REV) strategy seeking to enhance the resilience, affordability, and sustainability of the State's energy sector [1]. As the leading source of greenhouse gas emissions in New York, the transportation sector represents a core focus of efforts to achieve an 80 percent reduction in greenhouse gas emissions statewide by 2050 [2, 3]. As a part of broad commitments to promote clean transportation, Governor Cuomo launched the Charge Ready NY program in September 2018 to accelerate the deployment of electric vehicle charging throughout the State [4, 5].

Charge Ready NY is a $5 million rebate incentive program, administered by the New York State Energy Research and Development Authority (NYSERDA), that reduces the costs to purchase and install Level 2 charging stations for light-duty EV use in public, workplace, or multiunit dwelling (MUD) locations. Applications for the rebate of $4,000 per charging port will be accepted until December 2021 or until funds are exhausted. As part of the program, site hosts are required to operate the charging equipment and provide charging data to NYSERDA for a minimum of four years. Charge Ready NY is a component of the broader Charge NY program, first launched in 2013 and revamped in 2018, which established a goal to install 10,000 charging stations by 2021 to support the growth of the light-duty EV market [6, 7]. Goals to promote medium- and heavy-duty electrification are addressed by other programs and targeted by funding from the Volkswagen Settlement.

A previous charging station incentive program, the NYSERDA Electric Vehicle Supply Equipment (EVSE) Demonstration Program, PON 2301, offered funding for Level 2 charging stations in 2011 and 2012 with a total of $8 million available. The program was designed to support demonstration projects that validated light-duty EV charging technology and helped to accelerate vehicle electrification in the State. NYSERDA ran this program to help advance the understanding of charging technologies and their costs while simultaneously collecting performance data. These efforts did not necessarily consider the business case for owning, operating, and/or hosting a charging station.

Since the creation of the charging funding program, the challenges associated with building and maintaining a network of charging stations that can serve the EVs in New York State have persisted. The recent transition from an innovative demonstration program to Charge Ready NY, a capital cost-focused rebate program, indicates maturity in the charging infrastructure market and the desire to limit the investment of public funds to what is necessary to support this market. In order to better understand the scope of this requirement, and to encourage future hosts to participate in these programs, NYSERDA is attempting to better understand the business case for a site host of a Level 2 charging station. Through developing understandings of initial use and funding requirements, the State can establish a more comprehensive idea of what is necessary to bridge the gap from the public- to private-funded charging stations.

This paper assesses the value proposition of hosting Level 2 charging stations in New York State by drawing from data received from (1) NYSERDA's initial Level 2 incentive program, (2) the EValuateNY tool maintained by Atlas Public Policy that assembles an array of data from public and private initiatives related to the EV Market, (3) the EV Charging Financial Analysis Tool, (4) site host charging and cost data, and (5) information from New York utilities.

2 Background

Over the last ten years, New York has set statewide goals for clean transportation and promoted a number of policies and programs supporting EV adoption and charging deployment. New York State's support for charging infrastructure began in the early days of the EV market with the NYSERDA EVSE Demonstration Program, PON 2301, in 2011. Since then, the State has continued its push to encourage market growth by lowering upfront costs through Charge NY, which first launched in 2013 with goals to deploy between 30,000 and 40,000 EVs by 2018. The State implemented an EV rebate in 2017 and launched the Charge Ready NY program in 2018 to accelerate progress. Increased engagement from the electric utility industry in New York is a promising recent development and provides evidence that interest in the EV market is growing (see Box 1).

Box 1. Utility Programs for Electric Vehicle Charging

As of late 2018, the New York Public Services Commission has approved the requests of three New York investor-owned utilities for various charging infrastructure programs. The programs are valued at more than $11 million and focus on rate incentives for charging use or supportive infrastructure aside from the charging station, referred to as "make-ready." These supportive policies could improve the business case for hosting charging stations.

Central Hudson Gas & Electric Corporation: The company has developed a new strategic focus on EV Initiatives with the purpose of increasing EV adoption through stakeholder participation and advocacy, increasing the employee EV experience, and demonstrating leadership in EV policy (Program Value: $49,197).

Consolidated Edison Company: A variety of programs including a residential electricity rate incentive for charging, a fast charging rate incentive, and a demonstration program for electric school buses (Program Value: $6,210,250).

National Grid: An education program along with a charging electricity rate incentive (Program Value: $5,000,000).

Charging infrastructure expansion has been dependent on public funding in absence of viable business models for providing charging services. A 2014 Center for Climate and Energy Solutions (C2ES) study for the Washington State Legislature concluded that "charging station business models that rely solely on direct revenue from EV charging services are currently not financially feasible." The study showed that private investors are interested in projects with a five-year or shorter payback period and must capture value from indirect sources of revenue associated with the charging services, such as retail sales near EV stations [8]. The study led to the State creation of a pilot program to demonstrate new business models for providing charging services, which resulted in investments in infrastructure of more than $2.5 million [9].

A similar 2015 report funded by the United States Department of Energy looked at the business case for public charging stations in New York State and came to the same conclusions regarding the importance of value capture. The study identified three barriers to private investments in charging infrastructure [10]:

- High upfront costs of equipment and installation
- Demand uncertainty for charging services
- Consumers' willingness to pay for public charging

The sophisticated financial analysis conducted in both studies demonstrate that as the EV market grows, the viability of public charging business models that include value capture will increase and eventually become sustainable without direct public sector support.

The lack of real-world data on charging use and direct revenue represented a considerable limitation for these studies. The report is one of the first business case analyses for charging services using real-world data.

The next sections of the report provide an overview of the status of the EV and charging market in New York State, details on the NYSERDA grant program that served as the basis for this study, and a description of the data used in the analysis.

2.1 Electric Vehicle and Charging Market in New York State

Increasing EV sales in the United States reflect a growing interest in electrifying the light-duty transportation sector. A 2018 survey by AAA found that one in five Americans say they are likely to buy an EV at some point in the future [11]. Since May 2016, there has been a streak of monthly sales records, with sales in each month in 2018 greater than in 2017 and 2016 [12]. In 2018, the U.S. EV market surpassed the one-million milestone for cumulative EV sales.

Growth in the EV charging market has been driven by considerable advances in battery and charging technologies. All-electric vehicles capable of 200 miles on a single charge are available in a number of vehicle segments. Several automakers plan to ramp up delivery of new long-range models in late 2019 and 2020. For comparison, the 2014 Nissan LEAF had only 84 miles of range at a price less than $35,000 while the 2019 Nissan LEAF has over 150 miles of range at the same price [13, 14]. As EV range increases, the charging needs of drivers is expected to shift to a greater demand for public fast charging. However, Level 2 charging will remain important for residential, workplace, and public locations with longer dwell times.

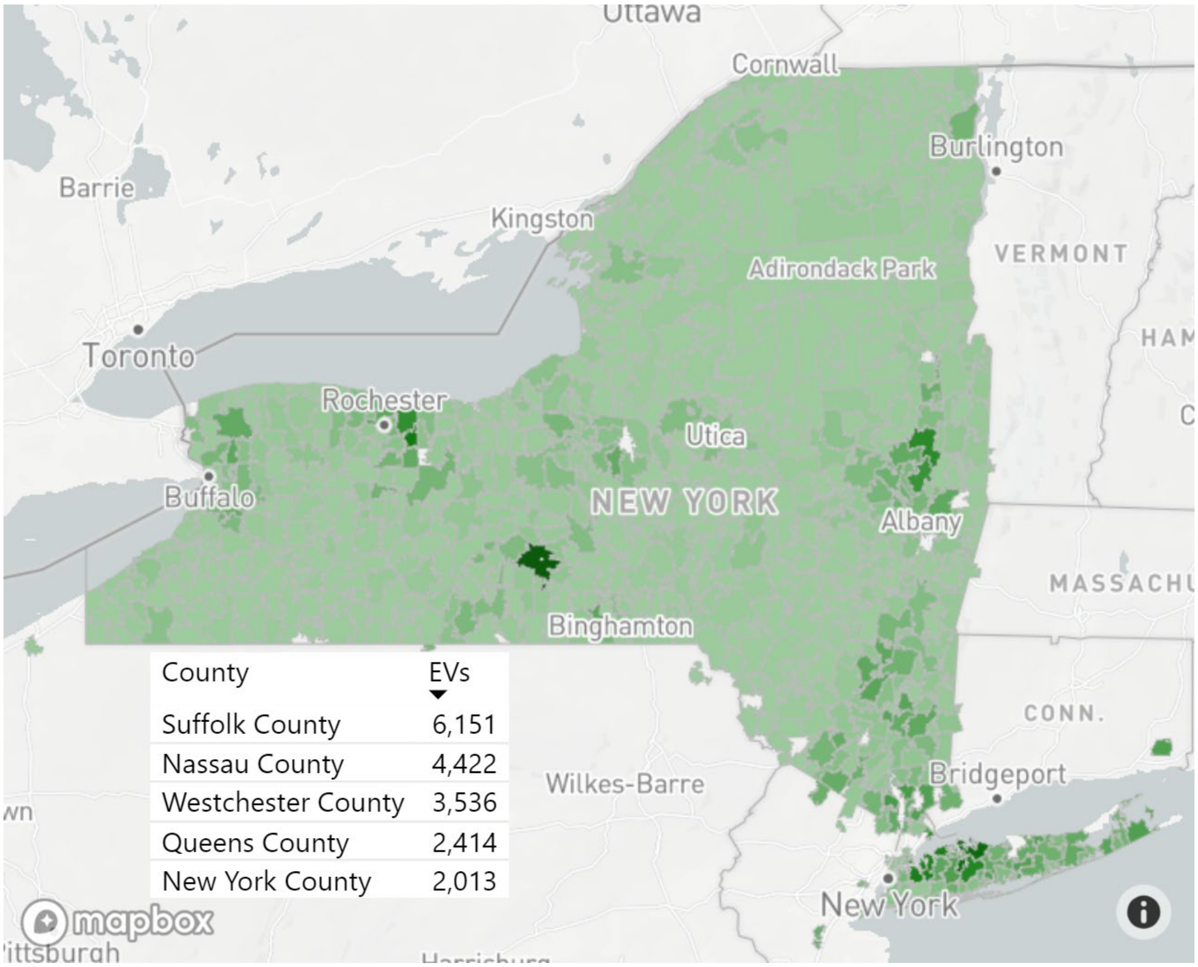
New York is also one of ten states that follows California's Zero Emission Vehicle (ZEV) program, a technology-forcing program that requires automakers to make an increasing number of zero emission vehicles for sale in all states that follow the program. Estimates as of early 2019 indicate the program could result in zero emission and plug-in hybrids making up eight percent of new vehicle sales in California in 2025 [15]. The ZEV program is a key driver of EV sales growth in New York, aiming to reach 850,000 EVs by 2025. These goals will increase the number of public charging stations required to satisfy the market.

In New York, more than 34,600 EVs were registered statewide as of November 2018; of this total, nearly 22,000 are plug-in hybrids. The top five counties for EVs are concentrated around Long Island and New York City. Other large concentrations of EVs exist in cities including Rochester, Albany, and Ithaca (see Figure 1).

Figure 2. Registered Electric Vehicles in New York State as of November 2018

This map shows EV deployment by ZIP code. The darker green indicates where EVs based on ZIP codes are concentrated. The table within the map shows the top five counties for EV deployment, which are all on Long Island or in and around New York City.

Source: EValuateNY

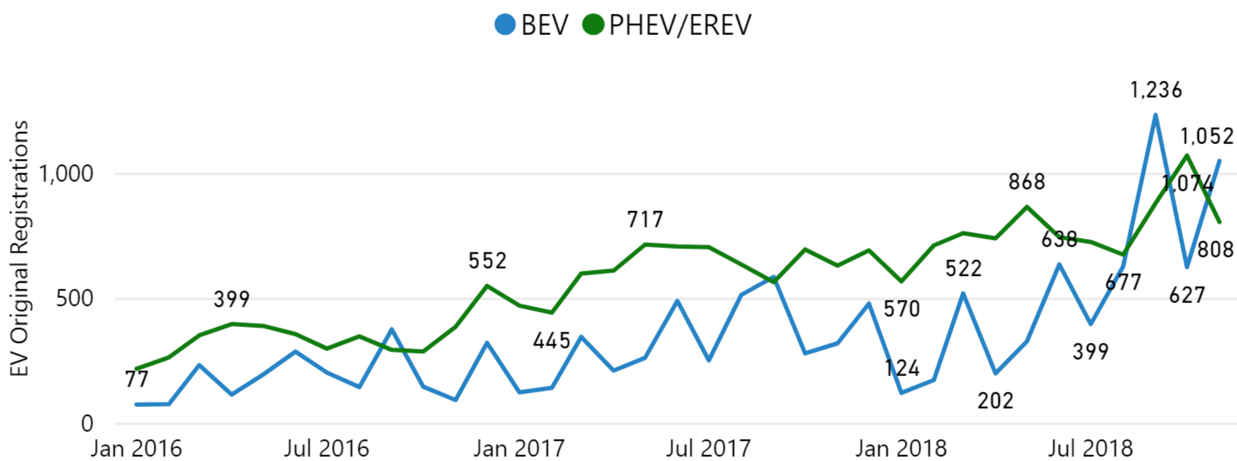


New EV registrations have been steadily growing in the State, reaching over 2,000 in September of 2018 alone (see Figure 2). Mirroring trends in the national market, New York saw a significant rise in registrations of the all-electric Tesla Model 3 during this time period. The new offering from Tesla was the market leader in 2018 in New York and nationwide. Outside strong sales for Tesla, plug-in hybrid sales typically outperform all-electric sales in the State.

Figure 3. New Electric Vehicle Registrations in New York State (January 2016 through November 2018)

EV registrations in New York have been steadily increasing over the last two years.

Source: EValuateNY

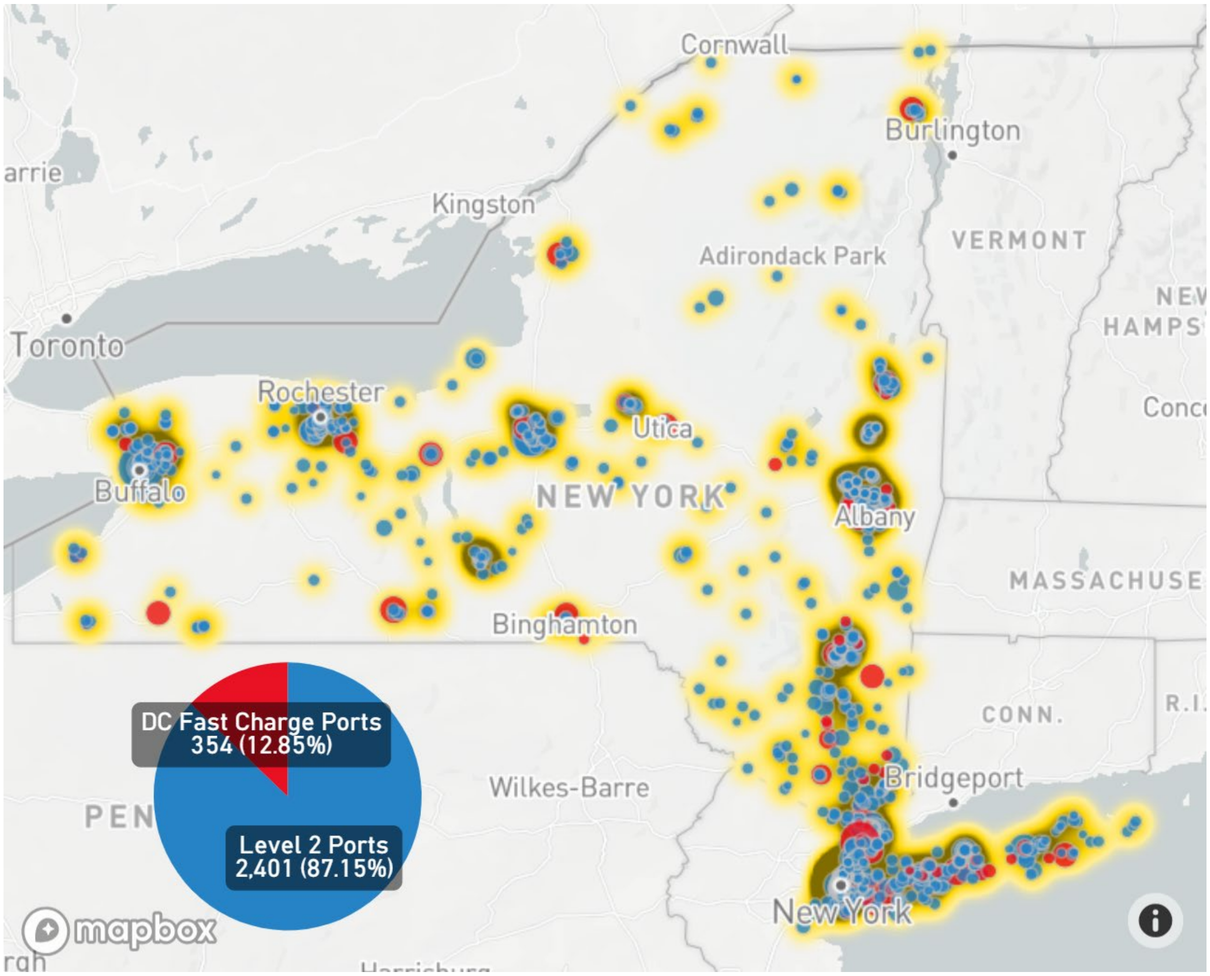


The publicly available charging network in the State is also growing, with nearly 2,400 public Level 2 ports and more than 300 DC fast charging ports as of October 2018. Charging deployment mirrors EV deployment throughout the State, with higher density on Long Island, in and around New York City, as well as in Ithaca, Albany, and Rochester. Concentrations of charging stations also exist in Buffalo, Syracuse, and Utica. Despite high concentrations of both EVs and charging infrastructure in areas such as Long Island, charging station development still lags behind EV adoption. See Figure 3 for a map of all publicly available Level 2 and DC fast charging stations.

Figure 4. Electric Vehicle Charging in New York State as of October 2018

This map shows publicly available Level 2 and DC fast charging stations, with larger dots indicating more charging stations. The heat map shows the concentration of the stations in certain regions, especially New York City and Long Island, where the darker yellow indicates a higher concentration of stations in a given area.

Source: EValuateNY



In order to build a robust EV market in New York, charging infrastructure must grow in lockstep with vehicle deployment to enable travel across the State and within metropolitan regions. On a per capita basis, New York lags behind other leading EV states like Oregon and Washington along with its neighbor New Jersey (see Table 1) in terms of adoption for both all-electric and plug-in hybrid vehicles. The gap in adoption for all-electric vehicles is notable. According to a 2019 ICCT study, the major metropolitan areas in New York only have 15 percent of the necessary future infrastructure deployment to meet the organization's forecast for EV adoption in 2025 [16]. As the State looks to grow its EV market, a continued focus on infrastructure is warranted.

Table 1. Electric Vehicle Adoption Per Capita in Select States as of December 2018

Data compiled on per capita EV deployment in four states highlights how New York lags in EV adoption.

Source: Atlas EV Hub

State	BEVs per 1k People	PHEVs per 1k People	EVs per 1k People
Washington	3.82	1.84	5.66
Oregon	3.35	2.34	5.69
New Jersey	1.32	1.22	2.54
New York	0.78	1.21	1.99

2.2 NYSERDA Electric Vehicle Charging Demonstration Program

The data used in this study were collected through the NYSERDA EVSE Demonstration Program, PON 2301, which awarded $8 million for innovative vehicle charging programs in two rounds between December 2011 and August 2012 (stations were deployed through 2016). The program funded only Level 2 charging stations in the following areas:

- **Public locations** including supermarkets, malls and retail outlets, train stations, hotels, restaurants, and parking garages and parking lots
- **Workplace charging locations**
- **Multiunit dwellings** such as townhouse communities or large apartments, condominiums, or rental communities of six or more residents
- **Private businesses for their fleets**

The grant program covered the costs of EV charging equipment, electric supply and metering equipment, electrical conduit and wiring, and directly-related site work.

In the first round of the program, grant awardees installing charging stations at public, workplace, and multifamily building locations were eligible to receive up to 80 percent of the total eligible product costs and grant awardees installing charging stations for fleet vehicles were eligible to receive up to 50 percent of the total eligible product costs, up to $1 million per proposer in each instance. In the second round of the program, all grant awardees were eligible to receive up to 65 percent of the total eligible product costs, regardless of location type, up to $1 million per proposer.

In order to be eligible for funding, projects were required to incorporate at least one of the following elements: vehicle-to-grid (V2G) applications; smart charging such as demand response charging; time-of-day and staggered charging; connection to distributed generation that could be used to charge the vehicles (the installation of distributed power generation was not an eligible expense); aggregation of V2G applications through an Energy Services Company (ESCO); parking space reservation systems such as online and through cell phones; or innovative payment systems.

Awardees were also required to provide reports to NYSERDA detailing EV charging usage semiannually for a period of four years after installation.

2.3 Charging-Use and Cost Data Used in this Report

For the report, NYSERDA provided the underlying data for the analyses of charging station use and station profitability for the charging owner-operator. The data sets provided included: EV charging characteristics from a subset of stations deployed with NYSERDA grant funds; the session-level charging use at these stations; the capital, construction, data access, and warranty costs for these stations; and any cost share from partners provided as part of the grant program.

A total of 185 charging stations at 136 sites were analyzed for this study. For these stations, data were available on the installation and operating costs of the equipment along with its use. The selected charging station sites also met the site selection criteria described in the *Business Case Assessment Methodology (section 4 of this report).*

More than 70 percent of these sites offer free charging, and more than 60 percent of the sites have limited access. Only 38 percent of the sites are fully accessible to the public. Nearly all sites are accessible 24 hours daily, except sites at a parking garage that are limited to the hours the garages are open.

The location of the charging sites analyzed are spread across nine categories and all land-use types, as detailed below. Several of the parking lot or garage locations serve multiple venues, such as workplaces, retail stores, or entertainment facilities. University or medical campus, workplace, and parking lots were the most common site location type. Suburban was the most common land-use type, closely followed by urban locations.

Table 2. Charging Sites Analyzed by Location and Land-Use Type

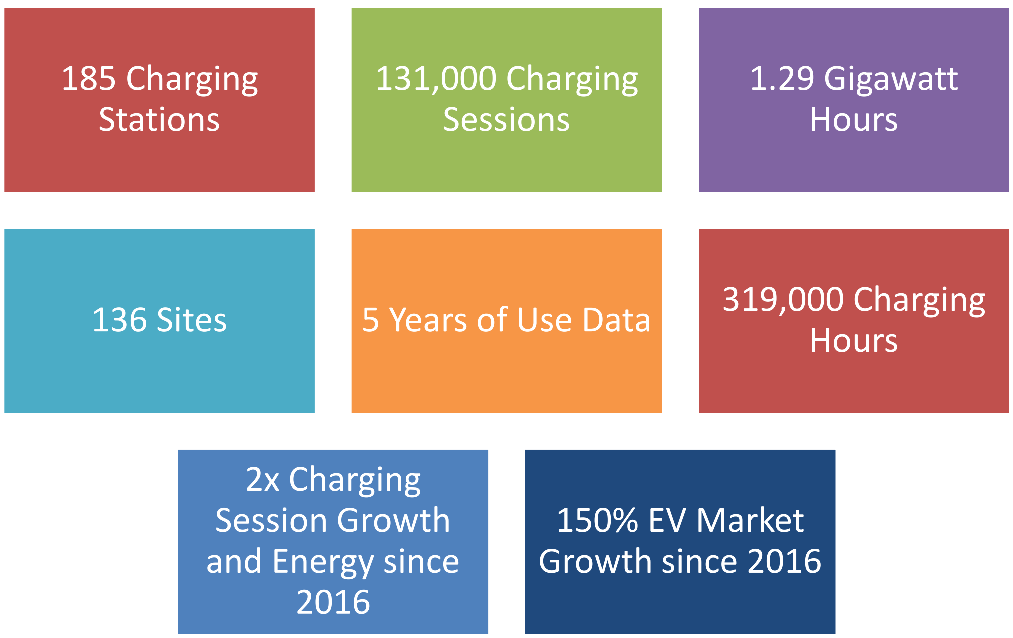
Location Type	Sites	Stations
Hotel	6	12
Leisure Destination	4	6
Multifamily	6	12
Parking Lot/Garage (non-NYC)	28	33
Parking Lot/Garage (NYC)	26	38
Retail Location	3	3
Transit Station	1	3
University or Medical Campus	32	45
Workplace	30	33
Total	**136**	**185**

Land-Use Type	Sites	Stations
Rural	12	12
Suburban	73	96
Urban	51	77
Total	**136**	**185**

3 Charging Use from NYSERDA-Funded Stations

For this report, charging-use data from the selected sites were analyzed at the 185 stations at 136 sites funded over the course of NYSERDA's EVSE Demonstration Program from January 2013 through October 2018. The rich, session-level data provided a basis to assess the business case of hosting the charging stations. In all, over 131,000 charging sessions delivered nearly 1.3 gigawatt hours of energy to EVs during the five-year period.[2]

Figure 5. Charging-Use Data Summary Statistics



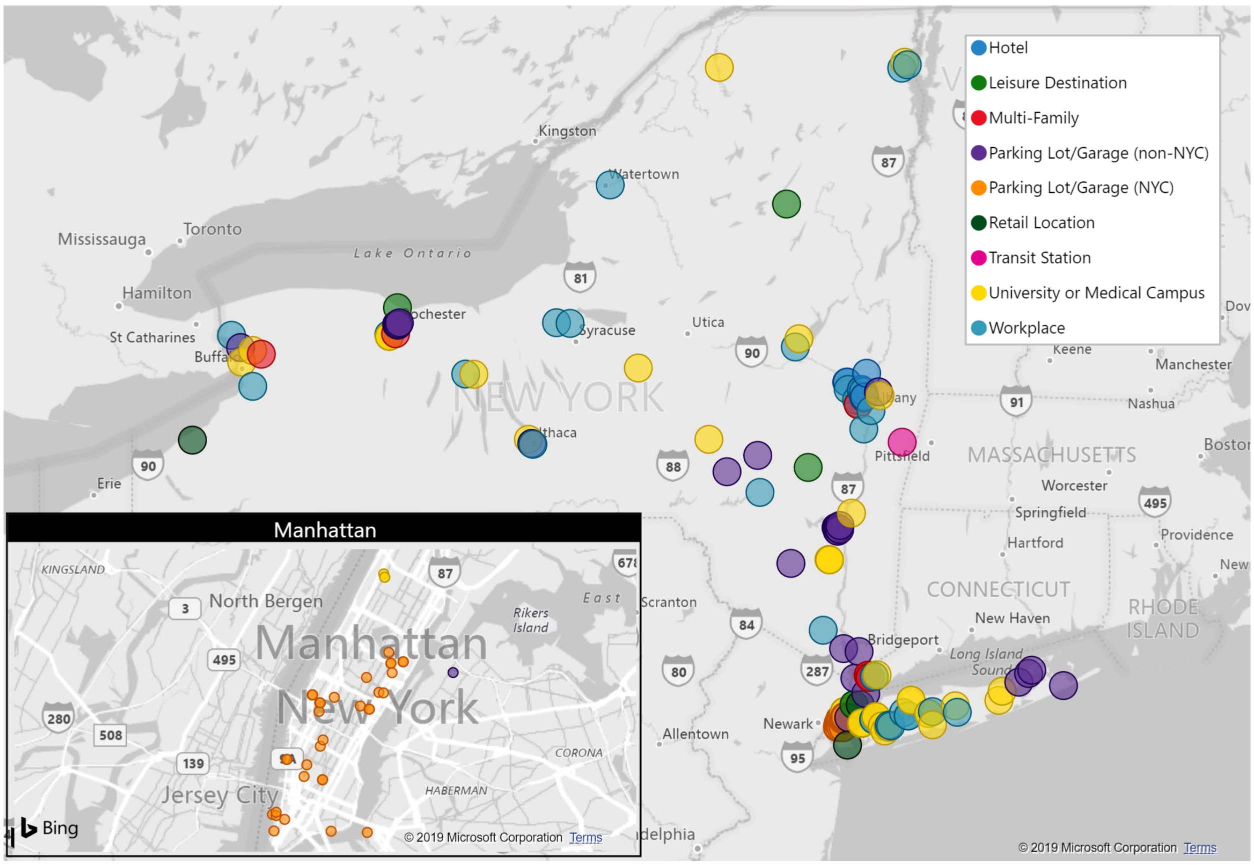
Level 2 charging-use data were available from stations at various locations across the State, which were primarily concentrated in population centers like New York City and Albany, although 12 charging sites were located in rural areas. The larger concentrations of Level 2 charging stations tracked through the NYSERDA program generally line up with those seen for all publicly available charging stations (see Figure 3). Charging stations at workplaces, multifamily dwellings, universities, medical campuses, and parking garages were spread throughout the State, which could mean charging use at these stations are representative. Stations at other location types were more unique, such as the single transit station in

2 Charging sessions with no delivered energy or no time duration were ignored.

Latham (see Figure 6), which may not be representative of transit station charging use in other types of locations.

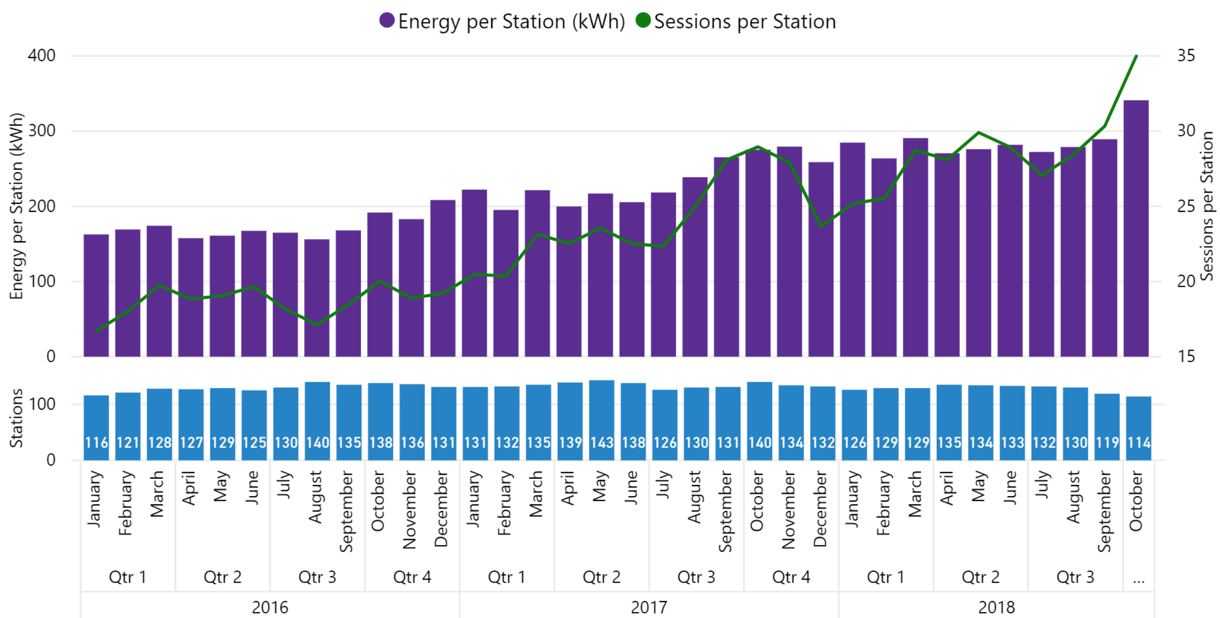
Figure 6. Charging Stations by Location Type

Charging sites from across the State were assessed at several types of locations, including parking garages, workplaces, and hotels. Sites shown:136.



Overall, the number of charging sessions and energy delivered has more than doubled since January 2016, while the overall EV market grew by 150 percent. Although utilization data were available for 185 individual stations, fewer than 145 stations had charging-use data for every month. Notably, the number of charging sessions and the amount of energy delivered remained steady, even though 26 fewer stations were measured in October 2018 compared to October 2017. This was likely due to stations being offline or beyond their required data-sharing agreement (see Figure 7).

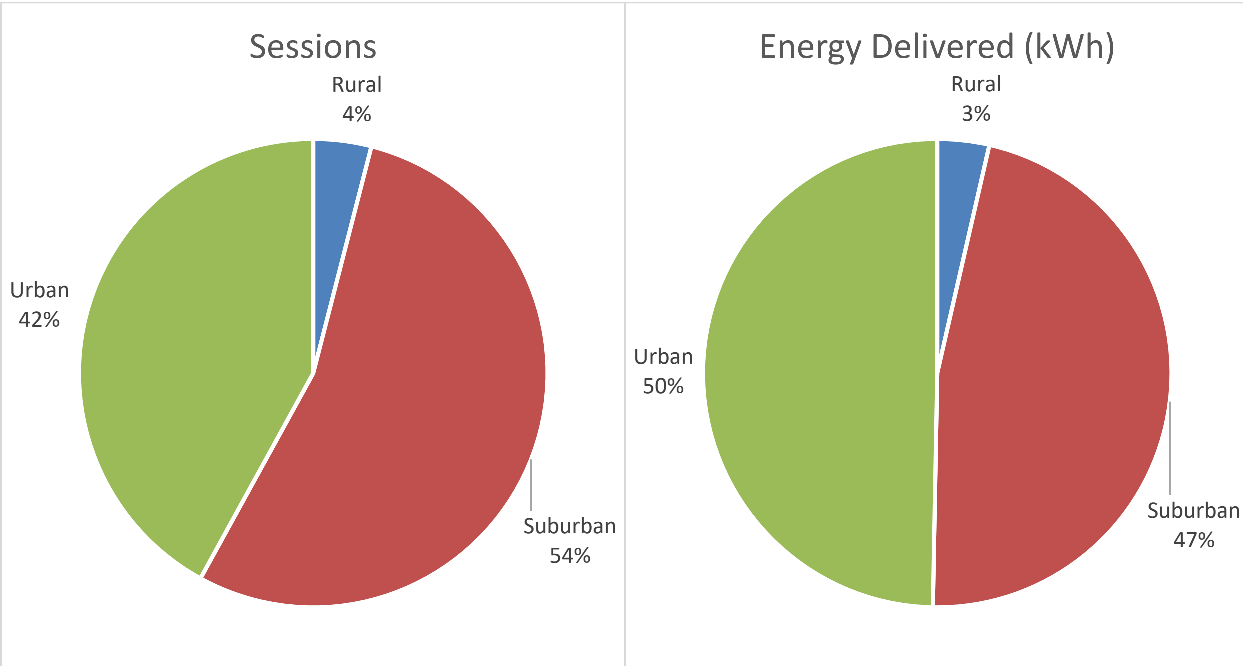
Figure 7. Monthly Charging Use (2016-2018)



From a land-use perspective, most charging sessions occurred in suburban locations while total energy delivered was higher at urban sites (see Figure 8). Overall, urban stations delivered 38 percent more energy than suburban stations on a per-station basis. The small share of charging sessions and amount of energy delivered in rural areas is not only because there were fewer stations included in the data. Rural stations delivered 37 percent less energy per charging session and had 38 percent fewer charging sessions per station compared to suburban stations. The fewer charging sessions is likely due to the smaller number of EVs in rural areas compared to the suburbs, while the reduced energy use per session could be because of the charging locations and/or small sample size (fewer than 15 stations in rural areas were measured).

Figure 8. Charging Sessions and Energy Delivered by Land-Use Category

These charts show the total number of charging sessions and amount of energy delivered by land-use type (rural, suburban, and urban). Data are from 2013 through October 2018.



When looking at charging use by location type, the most use occurred at university or medical campus locations followed closely by parking garages or lots outside New York City. More than 80 times the total number of charging sessions occurred at university or medical campuses than at hotel sites even though only three times the number of stations were at these sites. Charging at parking lots outside of New York City had the second largest number of charging sessions; sessions at these sites lasted more than twice as long as those at university and medical campuses even though the actual time charging per session was only 20 percent longer (see Table 3). In these cases, it is possible the reason for parking at these lots went beyond the need to recharge an EV, although the need to have access to an EV charging station could have been a factor in choosing the facility.

Table 3. Charging Use by Location Type

Charging-use data by location type is shaded in a gradient with green indicating the higher end of usage and red indicating the lower end. University or medical campuses had the largest usage, and transit stations and hotels had the lowest.

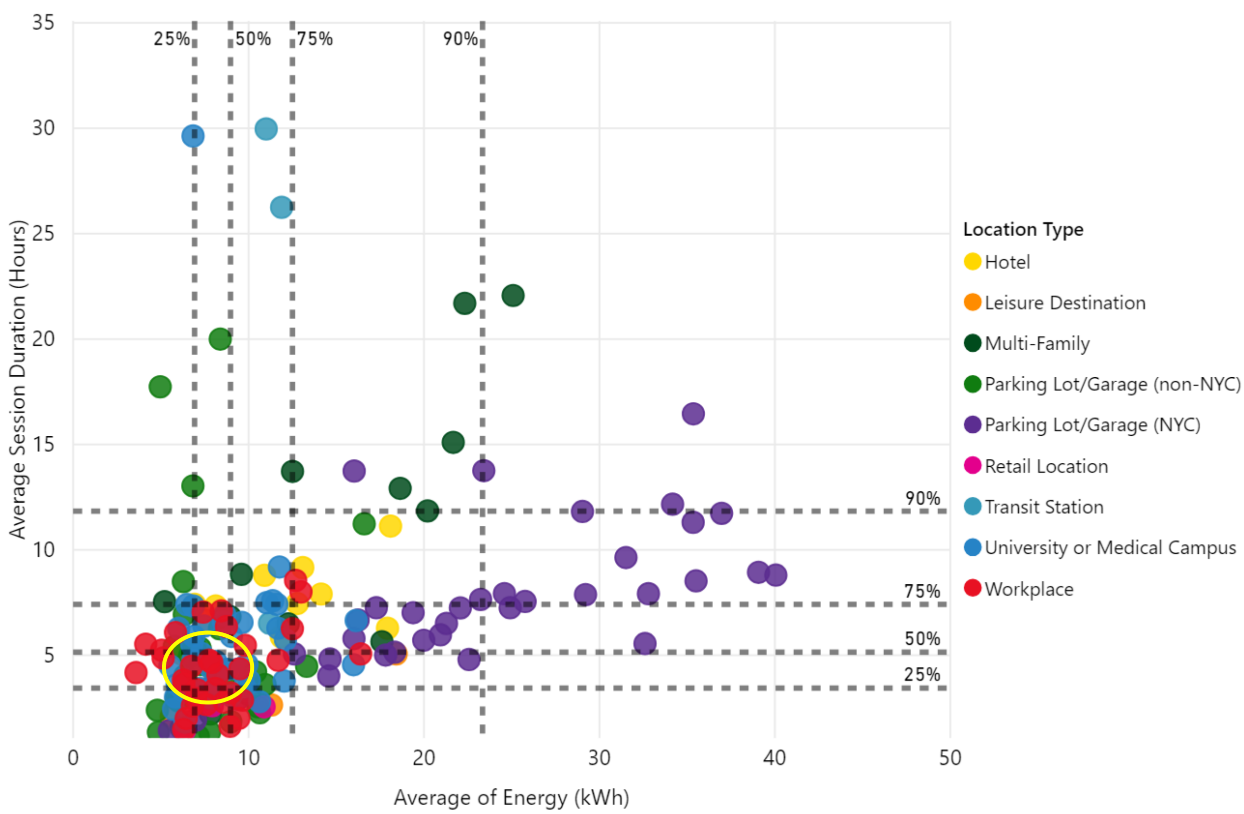
Location Type	Sites	Stations	Period	Total Sessions	Sessions per Day	Energy per Session (kWh)	Charging Duration per Session (Hours)	Session Duration per Session (Hours)
Hotel	6	12	11/7/2013 - 10/30/2018	646	0.03	10.69	2.52	6.62
Leisure Destination	4	6	1/19/2013 - 10/31/2018	5,939	0.47	7.72	2.02	3.73
Multifamily	6	12	3/23/2014 - 11/1/2018	5,815	0.29	16.55	3.83	12.30
Parking Lot/Garage (non-NYC)	28	33	5/25/2013 - 11/1/2018	34,919	0.53	7.29	2.06	6.89
Parking Lot/Garage (NYC)	26	38	2/20/2013 - 11/1/2018	7,947	0.10	25.40	4.59	8.84
Retail Location	3	3	10/27/2013 - 10/30/2018	2,055	0.44	8.22	2.02	2.60
Transit Station	1	3	2/20/2018 - 11/1/2018	516	0.68	11.34	3.48	17.30
University or Medical Campus	32	45	4/8/2013 - 11/1/2018	50,815	0.56	8.68	2.34	5.17
Workplace	30	33	4/4/2013 - 10/31/2018	22,271	0.33	7.88	2.22	4.35

The earlier comparison of usage between location types shifts when looking at the data from a per station perspective. Ranking the stations based on total sessions and energy delivered on an aggregate and per-station basis reveals that stations at multifamily dwellings deliver more total energy per station than all but university or medical campus stations. These stations are likely the primary place for their users to recharge their EVs. Charging at parking lots and garages in New York City along with workplaces decreased the most when averaging across stations; this change is perhaps because drivers who use these stations require less energy to fully recharge their vehicles' batteries. In addition, charging stations at retail locations and leisure destinations increased the most when calculated on a per-station basis.

Breaking apart the charging use to each station reveals that most stations provided fewer than 10 kilowatt-hours of energy per session and the typical session lasted less than five hours. One-quarter of stations were used for between 3.5 and 5.25 hours per session and provided between 7 and 9 kilowatt-hours on average per session (Figure 9). This narrow band of use for such a large number of stations reveals a common usage trend that could serve as a benchmark for charging service providers when managing their own stations, as shown by the yellow circle area in Figure 9. One exception to this finding is the large number of high-energy capacity Tesla vehicles in New York City, as evidenced by the high per-session energy use at some stations in New York City garages. Charging at garages for these vehicles may have substituted for charging at vehicle owner residences, where it was likely unavailable.

Figure 9. Average Session Length and Energy Delivered per Session by Station and Location Type

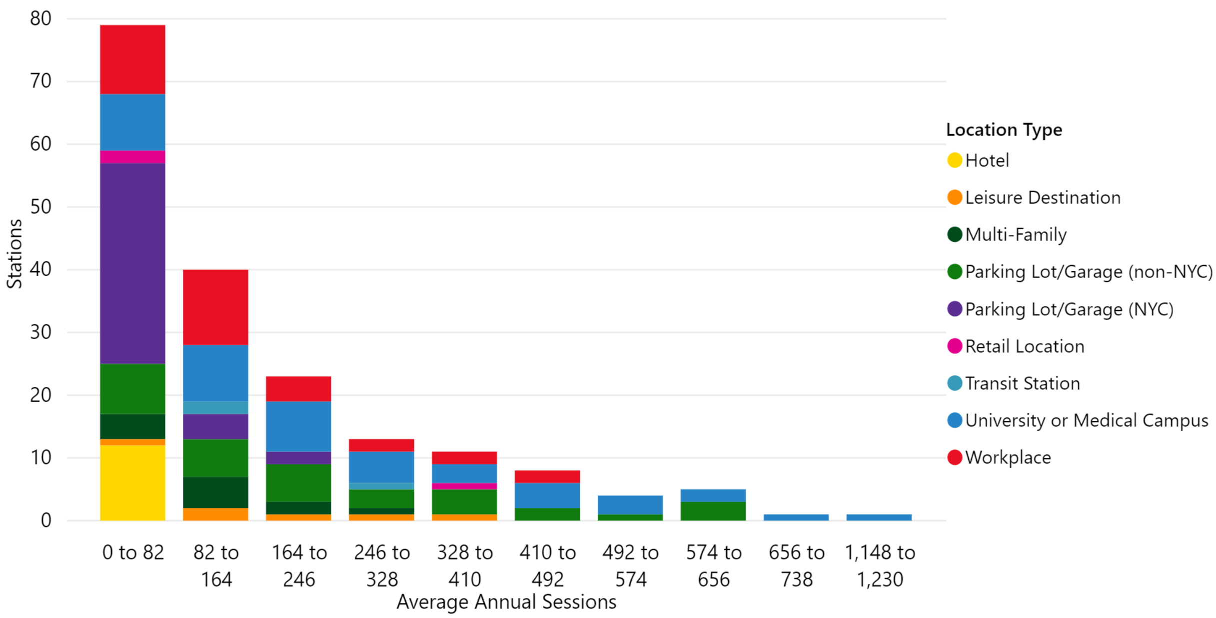
The chart shows the average length of a charging session and amount of energy delivered by charging station and location type. The 25, 50 (median), and 90 percentile lines are shown to offer a perspective on how most charging stations are used. Data are from 2013 through October 2018. Charging stations shown: 185.



Charging station utilization varied across sites with many stations experiencing growth between 2016 and 2018. Overall, charging utilization increased by 30 percent annually on average for stations of the same location type. Most charging stations were used fewer than 200 times annually on average. Only 11 stations were used more than 500 times (see Figure 10) with a maximum of nearly 1,230 sessions at a single station in 2017. Some of the more highly utilized stations include charging stations located at university campuses, urban retail locations, and parking garages.

Figure 10. Charging Station Count of Average Annual Sessions by Location Type

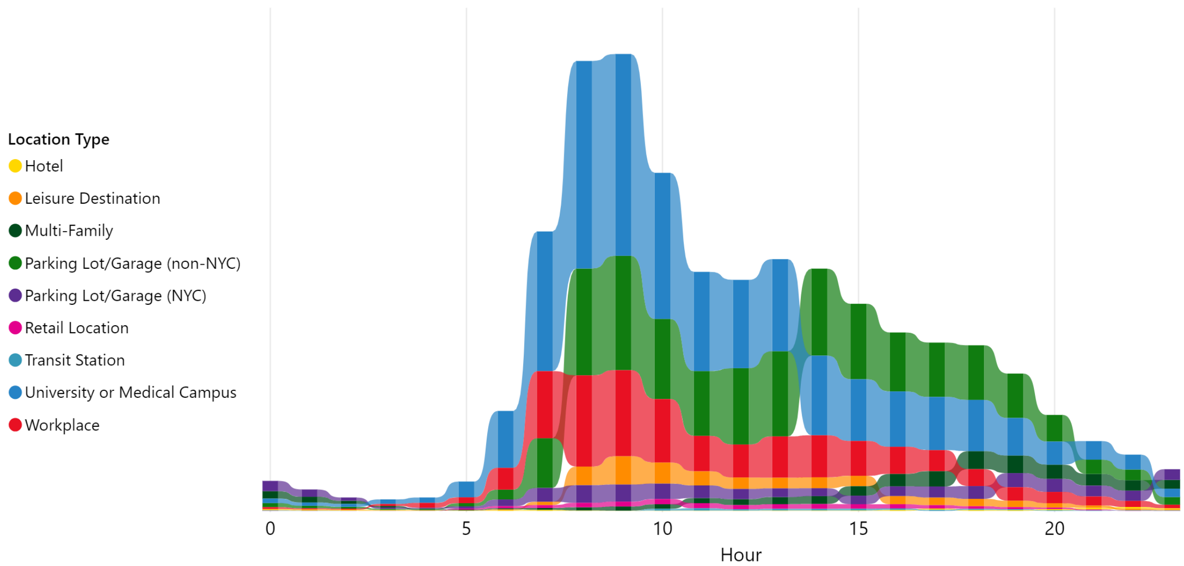
This histogram shows the number of charging stations that fit into a range of average annual sessions. Data are from 2013 through October 2018.



Looking at utilization by time of day, charging sessions were most active at the start of the work day at university or medical campuses, parking lots and garages, and workplaces. Of the very few charging sessions that occurred during the overnight period, most were at multifamily dwellings. The rest occurred at parking lots and garages in New York City, offering evidence that these stations are used by local residents. Based on Figure 11, it is evident that many charging sessions only lasted a few hours at the start of the work day, indicating that EV drivers using these stations did not require much energy to fill up; the reason for these shorter charging sessions may be because the drivers had started the day at a full charge and only had short commutes.

Figure 11. Charging Sessions by Time of Day

This chart shows active charging sessions by location and time of day. Most charging sessions occurred at the start of the work day. The locations with the most charging sessions have wider bands and are positioned at the top of the figure. Data are from 2013 through October 2018.



The charging-use analysis was used to guide the approach to the business case analysis for hosting charging stations and helped inform assumptions that were made for the financial analysis. The next section of the report describes the methodology used to complete the business case assessment.

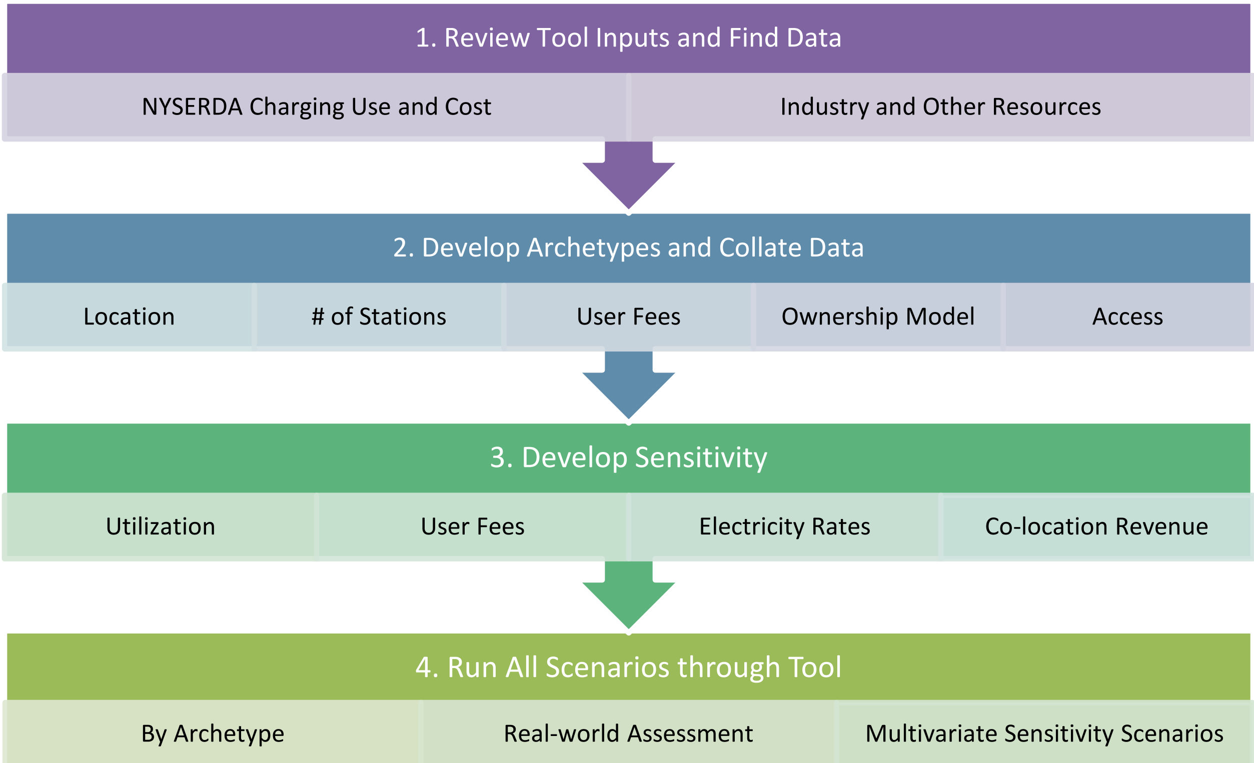
4 Business Case Assessment Methodology

The central goal for this report is to evaluate the cost-effectiveness of hosting EV charging stations in New York State using the charging and cost data provided by NYSERDA along with assumptions on equipment use, costs, and revenue derived from industry reports and original research.

A discounted cash flow assessment was completed to identify the profitability and investment payback, where applicable, based on stations' actual use and revenue using data made available by NYSERDA. In addition, thousands of additional scenarios were evaluated for these stations by varying the charging use, direct and indirect revenue, and equipment and operating costs. These scenarios map the sensitivity to profitability and investment payback.

Below is a diagram describing the process undertaken to complete the business case assessment. Beginning with data assembly and defining assumptions, the charging stations available were categorized to discern differences in the analysis results. A multivariate analysis was then completed on the stations available with over 75,000 scenarios using the EV Charging Financial Analysis Tool, a publicly available Excel tool maintained by Atlas Public Policy and designed to evaluate the potential return on investment of specific charging sites (see Box 1).

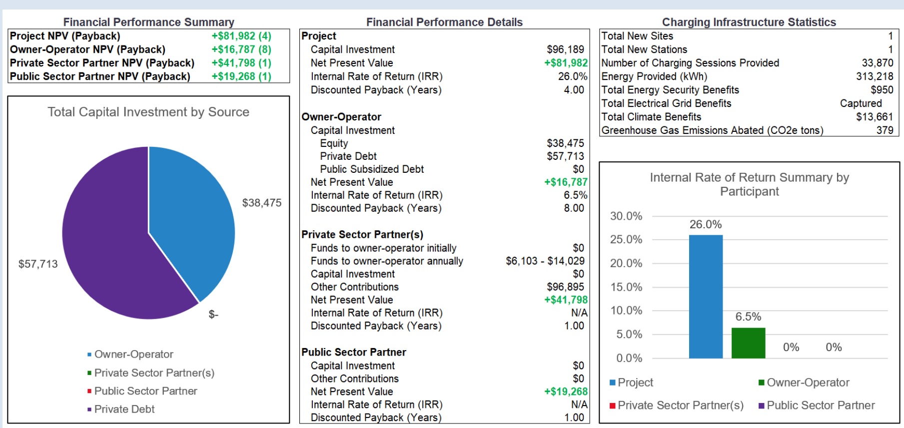
Figure 12. Methodology Process



Box 1. Electric Vehicle Charging Financial Analysis Tool

The EV Charging Financial Analysis Tool equips users with critical information on the financial performance of electric vehicle charging projects. The Microsoft Excel-based tool is capable of evaluating a variety of business arrangements, including sophisticated public-private partnerships. The tool uses the discounted cash flow method to evaluate the financial performance of a charging project through a variety of revenue streams over the lifetime of the charging equipment. The tool is highly flexible, with over 100 inputs and supports customizable sensitivity variables.

The tool includes a special mode whereby a multivariate analysis can be completed by running thousands of scenarios that vary input fields. The mode was used to complete the multivariate



Visit https://atlaspolicy.com/rand/ev-charging-financial-analysis-tool to download the EV Charging Financial Analysis Tool from Atlas's website. The tool was originally developed by the Cadmus Group and the Center for Climate and Energy Solutions and has been maintained by Atlas Public Policy since 2015.

For this report, the EV Charging Financial Analysis Tool was used to evaluate single Level 2 charging sites with one or more stations at each site. Many critical inputs were taken directly from the NYSERDA data or derived from the data where noted:

- Upfront equipment, installation, and operating cost data.
- NYSERDA grants and private partnership capital contributions.
- Direct revenue through energy-based user fees or per-session fees, which were derived in some cases.
- Initial annual charging utilization per station at a charging site.
- Growth rate of charging use per station was derived based on session use from January 2016 through October 2018.
- Average duration of a charging session, which includes the time the vehicle was plugged in and not charging.
- Average amount of energy delivered per charging session.

Other inputs used in the analysis were chosen with input from industry stakeholders from previous research. The full list of assumptions is included in appendix A.

In order to run an analysis that included estimates of the real-world profitability of the stations and various scenarios, the sites were aggregated into categories. These categories, referred to as archetypes, were developed to systematically look at the characteristics of a charging site that could affect its value proposition. Below is a list of the most common characteristics that changed at each charging site and make up the 46 archetypes created for the analysis:

- **Location Type**: A series of categories defined by NYSERDA as Hotel, Leisure Destination, Multifamily, Parking Lot/Garage (non-NYC), Parking Lot/Garage (NYC), Retail Location, Transit Location, University or Medical, and Workplace. These location types were used in the section of the report on *Charging Use from NYSERDA-Funded Stations.* For the financial analysis, the University or Medical category was combined with the Workplace category at the recommendation of NYSERDA.
- **Land-Use Type**: Defined as either Urban, Suburban, or Rural
- **Charging Station Type**: Dual or Single
- **Access**: Public or Limited
- **Payment Requirement**: Either Yes or No
- **Number of Charging Stations per Site**: Number ranging from 1 to 8
- **Ownership Model**: A way to identify who contributed to the initial investment in the station. The ownership model was based on whether the site host, a contractor, or a third party owns the charging equipment. All stations had a contribution from a NYSERDA grant.

To see a full list of the archetypes and the characteristics analyzed, see appendix B.

A one-degree sensitivity[3] analysis was also completed for all combinations of key factors related to profitability to better understand the magnitude of their effects on the charging station return on investment. This sensitivity analysis resulted in a multivariate analysis of more than 75,000 scenarios. Included in this sensitivity were the following inputs:

- **Utilization Rate**: A measure of the rate at which the number of charging stations increases over a year. This is an indicator of the growth in demand for EV charging stations. For the analysis, the calculated average (30 percent) was used along with 15 percent and 60 percent annual growth.
- **Initial Utilization**: A measure of the initial demand for an EV charging station. For each station, the actual utilization was used along with values 50 percent above and 50 percent below the actual value.
- **Electricity Retail Price**: The cost of electricity per kilowatt-hour to the owner operator in the first year. Values of $0.03, $0.05, and $0.11 per kilowatt-hour were used.
- **Energy-Based User Fee**: The cost to users for use of the charging station in dollars per kilowatt-hour. The actual fee was used along with values 50 percent above and 50 percent below the actual value.
- **Per-Charge Session User Fee**: The cost to users for use of the charging station independent of energy use. The actual or a derived fee was used along with values 50 percent above and 50 percent below this value.
- **Co-location Revenue Captured**: The sharing with a charging owner-operator of a portion of the revenue generated by EV drivers at the charging site. Scenarios in this case assume the charging owner-operator is not the same entity as the site host. The analysis assumed a driver generates $1 of revenue per minute of charging for the site host with a maximum of $20 per session. It was assumed that the site host would share 10 percent of this revenue with the charging owner-operator.
- **Public Funding**: The NYSERDA EV Charging Demonstration Program lowered the upfront costs of deploying charging equipment and thus the profitability of these stations is likely different than those without any public support. In order to better understand the value proposition of new stations that are privately funded, it was necessary to evaluate stations with and without any public funding.

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3 One-way sensitivity analyses change the values for one factor in the model over a range while holding all other factors constant.

5 Business Case Analysis Results

This section summarizes the analysis results beginning with a description of the key drivers of profitability, including costs, revenue, and charging use, relying only on data directly from NYSERDA. The results are then presented for a discounted cash flow analysis of the stations integrating actual use, cost, and pricing data, henceforth referred to as the base case analysis. A positive net present value (NPV) indicated that the station was profitable. The payback period on the charging investment is also considered in the base case analysis. Finally, the results of a multivariate scenario analysis are described to reveal alternative ways for these charging sites to potentially achieve profitability and a payback within the expectations of many investors (five years).

As described in the *Business Case Assessment Methodology (section 4 of this report)*, stations were grouped into 46 archetypes to simplify the process of analyzing charging-use and cost data from the 185 stations at 136 sites. Throughout this section, most results are presented using the archetype category (location type). The University or Medical category was combined with the Workplace category at the recommendation of NYSERDA.

5.1 Key Drivers of Profitability

A charging station is profitable when revenue to the charging owner operator exceeds upfront capital costs and ongoing operating costs over the expected life of the equipment (10 years). For the analysis, the upfront capital costs include charging station equipment, station installation, and electricity service and grid upgrades. Operating costs include a variable electricity cost based on station use along with fixed annual costs (i.e., warranty, maintenance, and data and communications).[4] Revenue streams can come from direct sources, such as energy-based user fees or per-session fees, or indirect sources by capturing the value of charging services as an amenity or benefit of some other kind.

5.1.1 Cost Factors

Installation and equipment costs not covered by the NYSERDA grant or a private sector contribution[5] was considered debt for the charging station owner-operator. Revenue to the owner-operator from the

[4] Site lease costs were not considered in the analysis because most sites did not charge these fees.

[5] The private sector partner is either the site host when the equipment is owned and operated by a third-party service provider or the project contractor when the site host owns the equipment.

stations must exceed this debt plus annual operating costs in order for the site to be profitable. Initial debt for owner-operators ranged from only $100 to around $27,000.

No clear pattern emerges when comparing these costs by location. For example, the lowest and highest costs for charging sites were both in urban environments. In addition, charging stations serving leisure sites were among the most and least expensive. While suburban sites tended to be more expensive than rural and urban locations, one of the least cost sites was located at a suburban transit hub (see Table 4).

Table 4. Capital Costs by Location

This table shows capital costs by archetype category, land use, and number of charging stations per site. The colors are a gradient with green indicating lower costs and red indicating higher costs.

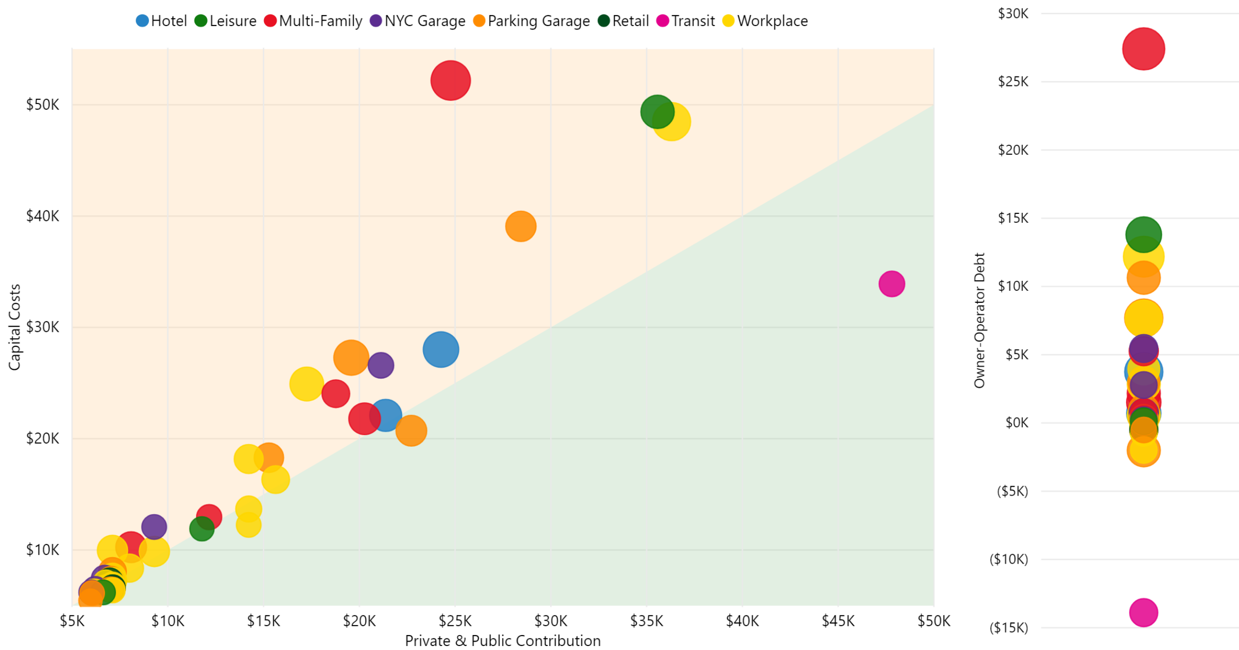
Archetype Category	Land-Use Type	Sites per Archetype	Charging Stations per Site	Average of Capital Costs per Station[6]	Max of Capital Costs per Station	Min of Capital Costs per Station
Hotel	Urban	1	2	$14,005.03	$14,005.03	$14,005.03
Multifamily	Suburban	4	2	$12,847.17	$17,393.67	$10,253.25
Leisure	Suburban	1	4	$12,341.52	$12,341.52	$12,341.52
Hotel	Suburban	5	2	$11,047.14	$11,047.14	$11,047.14
Workplace	Suburban	41	1.6	$8,586.12	$16,162.58	$6,126.13
Parking Garage	Suburban	21	1.4	$8,358.29	$13,637.34	$5,448.78
Workplace	Urban	13	1.5	$8,217.76	$12,455.00	$6,610.56
Parking Garage	Urban	6	2	$8,099.85	$9,769.87	$6,429.83
Parking Garage	Rural	1	1	$8,075.12	$8,075.12	$8,075.12
Workplace	Rural	8	1	$7,829.90	$9,869.37	$6,384.82
Multifamily	Urban	2	2.5	$7,245.31	$8,013.17	$6,477.46
Retail	Rural	1	1	$7,189.56	$7,189.56	$7,189.56
Transit	Suburban	1	5	$6,781.47	$6,781.47	$6,781.47
Retail	Urban	2	1	$6,608.58	$6,611.16	$6,606.00
NYC Garage	Urban	26	1.8	$6,557.90	$7,420.38	$6,035.12
Leisure	Rural	2	1	$6,195.78	$6,195.78	$6,195.78
Leisure	Urban	1	2	$5,951.56	$5,951.56	$5,951.56

6 Capital costs do not include deductions resulting from NYSERDA grants.

In some cases, the contribution from NYSERDA and a private sector partner exceeded the upfront costs to help offset the first four years of operational costs related to communications and data management. For these cases, the debt value is negative. See Figure 12 for capital costs and public and private funding contributions by archetype and the range of owner-operator debt.

Figure 13. Upfront Capital Costs and Private and Public Funding Contributions

This chart shows the average upfront capital costs to install the stations at a site by archetype category compared to upfront funding contributions from NYSERDA and a private sector partner, which considered annual data management costs for four years. The partner could be the site host if they do not own the station or the project contractor if the station is owned by the site host. The size of the circle is proportional to the upfront capital costs per station. Archetypes shown: 46.



Operating costs were another key driver of profitability. These costs were more consistent across sites because the analysis did not differentiate their fixed costs on the location. In general, these fixed operating costs, including data and communication costs, warranty, and maintenance, are noticeably smaller compared to capital costs as a share of lifetime costs.

As station use increases, the share of electricity cost as a percentage of the total operating costs increases. Electricity cost, which is the only variable cost used in the analysis, is directly proportional to charging station use. In year one, the share of operating cost attributed to electricity was below 25 percent for all archetypes. By the end of the expected life of the equipment, electricity use represented 80 percent or more of total operating cost in most cases (see Table 5 and Figure 13).

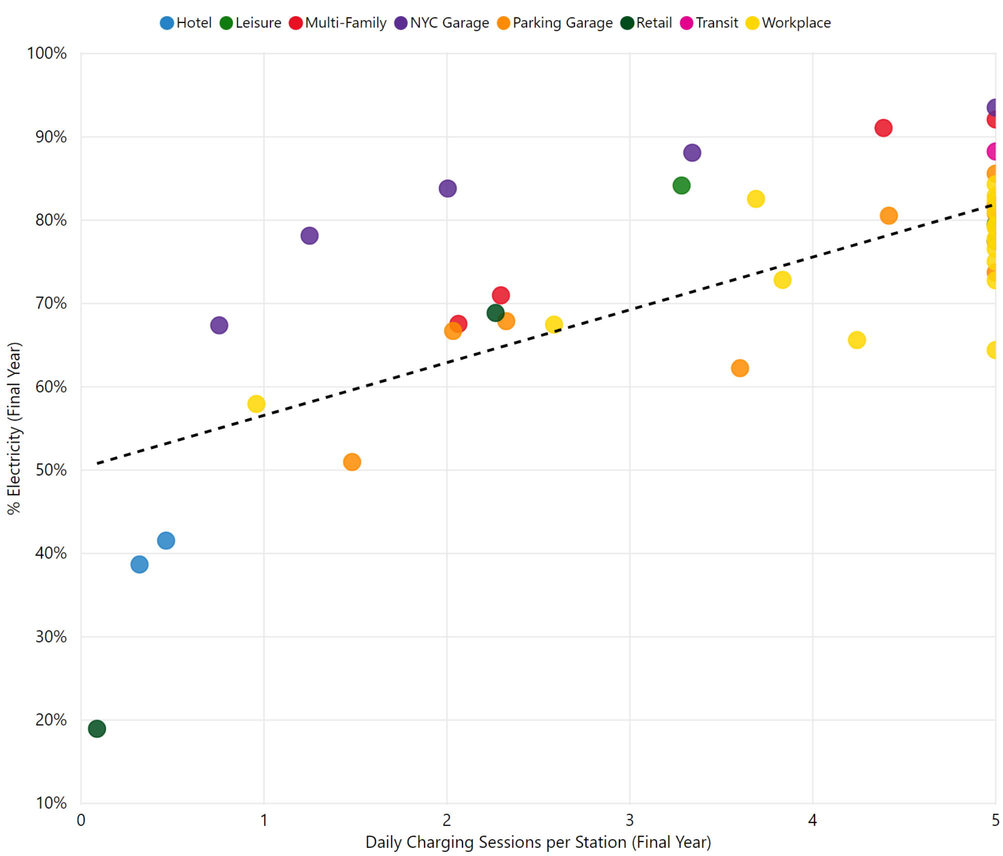
Table 5. Electricity Share of Operating Cost and Annual Sessions

This table shows electricity's share of operating costs and the annual sessions per station in the first and final year of the project. The values in the final year are estimates from the analysis. The estimates for the number of daily sessions in the final year is unrealistic for transit locations.

Group	% Electricity (Year 1)	Annual Sessions (Year 1)	% Electricity (Final Year)	Sessions per Day (Final Year)
Hotel	12%	14	40%	0.4
Leisure	16%	204	81%	4.4
Multifamily	16%	150	81%	3.8
NYC Garage	20%	110	82%	2.5
Parking Garage	20%	244	73%	3.9
Retail	23%	196	55%	2.5
Transit	8%	207	88%	5.0
Workplace	22%	353	75%	4.4

Figure 14. Share of Operating Costs for Electricity Compared to Utilization

This chart shows the share of operating costs from electricity in relation to the charging station utilization. All values are from the final year of life of the charging equipment. The concentration around five sessions per day is because the analysis assumed that was the maximum use of a station. Archetypes shown: 46.



5.1.2 Revenue Factors

The first of two key factors driving revenue was user-based fees at the station, though 34 out of 46 archetypes had no fee for access or use. Of course, these stations could not be profitable unless indirect revenue sources are attributed to the stations' use. Among the 12 station archetypes that charged a fee, some charged an energy-based fee while others charged a time- or session-based fee. Two archetypes included both a session fee and an energy-based user fee. It is important to note that the EV Charging Financial Analysis Tool cannot model per-hour fees, so these fees were converted to session fees based on the average duration of a charging session and the hourly fee. This calculation resulted in session fees as high as $18.22 and $31.46 in the NYC Garage archetypes, which is likely due to the high cost of parking in New York City. While this method reflects the actual cost to users, these session fees may be unrealistic if the number of sessions per day increases at stations that tend to have long charging sessions, such as those that are used as substitutes for home charging. See Table 6 for a breakdown of user fees by archetype. Higher time- and session-based fees will always improve the profitability of a station, but the key for station management is to find a balance between generating sufficient revenue to exceed costs and not deterring users with unattractive fees.

Table 6. User Fees by Archetype

This table shows user fees at stations by archetype used in the analysis. Some sites charged an energy-based user fee, a time- or session-based fee, or both.

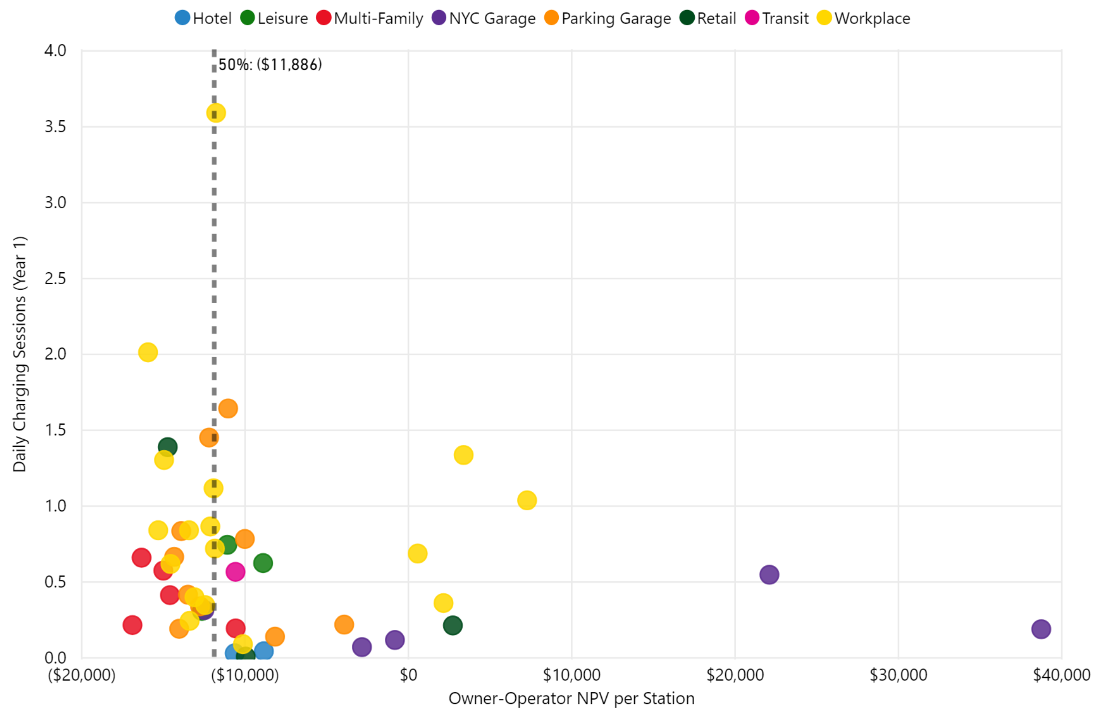
Archetype	Energy-base User Fee ($/kilowatt-hour)	Session Fee ($/session)
NYC Garage B	$0.49	-
NYC Garage C	-	$18.19
NYC Garage D	$0.49	$31.46
NYC Garage E	$0.49	-
Rural Workplace B	-	$4.16
Suburban Multifamily C	$0.20	-
Suburban Parking Garage E	-	$5.00
Suburban Parking Garage F	-	$1.55
Suburban Workplace F	-	$2.84
Suburban Workplace G	$0.60	$3.51
Suburban Workplace H	-	$3.38
Urban Retail C	-	$12.66

The second factor that affects revenue is charging use. The average annual growth in number of sessions at charging stations from 2016 through October 2018 was 30 percent, which was used as the default annual growth rate in the analysis for all archetypes. The initial utilization for each archetype was calculated based on actual use at the charging sites that fit those archetypes. Considering the average session length was several hours, utilization was capped at five sessions per day to avoid unrealistic conclusions. As a result, many stations were expected to reach peak utilization by the expected end of their life (see Figure 13). This indicates that there is a maximum revenue that can be generated by a station, constrained by the number of sessions possible per day and a reasonable user fee. The results presented on cash flow and multivariate scenario analysis dive deeper into the limits of these factors.

5.2 Site Profitability Analysis Results

A strong business case for hosting charging stations relies on demonstrating profitability for owning and operating the charging equipment. For the base case analysis, only seven out of 12 archetypes that charged a fee reached profitability over the life span of the charging stations. Only charging sites at garages, workplaces, and retailers were profitable and only the NYC Garage archetype category achieved profitability on average (see Figure 14). Overall, a strong link between utilization and profitability is not evident from the base case analysis, because most of the sites analyzed did not charge a user fee.

Figure 15. Profitability by Archetype Category



Profitable stations were located in urban, suburban, and rural locations. These profitable sites were operated by either the site hosts or a contractor. The payback at these sites, the year when the site achieves profitability, ranged from one year to 10 years, which represents the maximum life of the equipment. Investors carefully consider payback periods when making investment decisions and often seek out investments with a payback of five years or less. Sites that achieved profitability in the first year were high-use stations that charged user fees considerably higher than the operating costs.

Table 7. Profitable Sites by Archetype

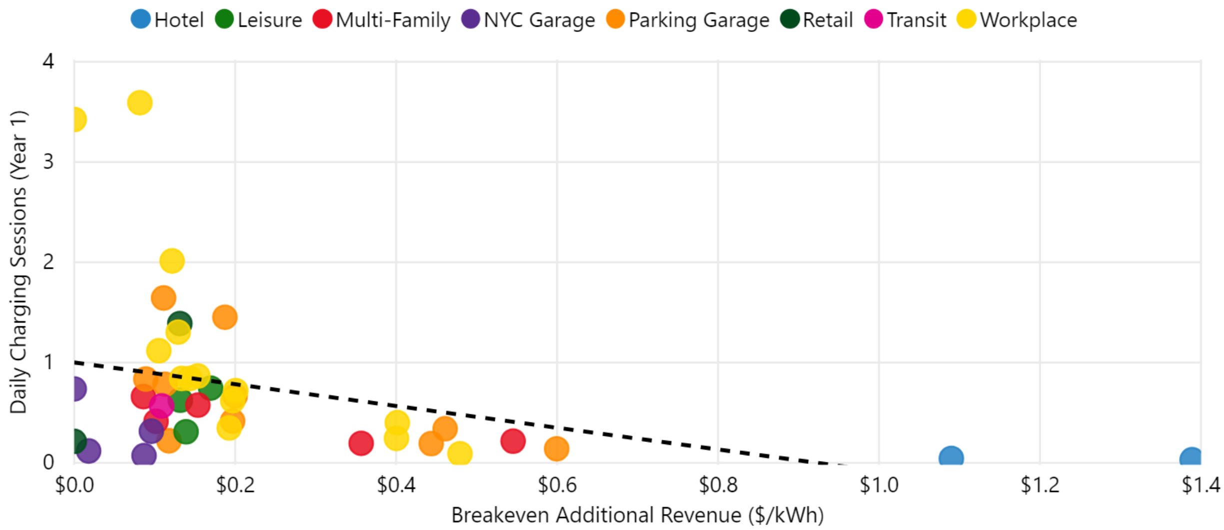
This table shows the calculated inputs for the base case analysis including charging use, revenue sources, capital expenses, and grants. It also shows the results of the discounted cash flow analysis.

Archetype	Owner-Operator NPV	Owner-Operator Payback	Annual Sessions per Station (Year 1)	Session User Fee	Energy User Fee	Initial Capital Expenses	NYSERDA Grant
NYC Garage B	$88,413	1	279	$0.00	$0.49	$26,587	$21,130
NYC Garage D	$38,747	1	69	$31.46	$0.49	$7,420	$6,708
Rural Workplace B	$7,269	1	379	$4.16	$0.00	$6,385	$5,275
Suburban Workplace F	$3,383	5	488	$2.84	$0.00	$7,038	$4,894
Suburban Workplace G	$2,152	9	132	$3.51	$0.60	$9,963	$5,275
Suburban Workplace H	$1,144	9	251	$3.38	$0.00	$12,252	$10,549
Urban Retail C	$2,723	9	78	$12.66	$0.00	$6,611	$5,275

For the 39 out of 46 archetypes that did not achieve profitability, five archetypes charged a user fee of some kind. For these sites, utilization was fewer than 100 sessions per year in the first year of operation. Low utilization prevented these sites from reaching profitability despite the average 30 percent annual growth rate. These sites would need to charge between an additional $0.02 and $0.60 per kilowatt hour to break even.

For sites that did not charge a fee (34 out of 46 archetypes), the break-even price ranged from as low as $0.08 per kilowatt-hour to as high as $10.60 per kilowatt-hour. Higher break-even prices were associated with the rural retail location archetype measuring fewer than 10 sessions per year. For comparison, the archetype with the lowest break-even price had over 1,000 charging sessions in its first year. See Figure 16 for the results of the break-even analysis for each archetype.

Figure 16. Break-Even Additional Revenue by Initial Annual Utilization



The next section explores the various factors that affect the profitability of each archetype through a multivariate sensitivity analysis.

5.3 Sensitivity Analysis Results

In order to understand the potential for all archetypes to achieve profitability, a sensitivity analysis was completed using various configurations of user fees, station utilization, electricity costs, public-private partnerships, and innovative business models. This multivariate analysis resulted in the execution of more than 75,000 scenarios for the 46 archetypes. The various configurations are summarized in Table 8.

Table 8. Sensitivity Analysis Input Values

Inputs	Default	Low Sensitivity Value	High Sensitivity Value
Charging-use growth rate	30%	15%	60%
Initial average charging use	As measured	50% below measured	50% above measured
Electricity price	$0.05/kilowatt-hour	$0.03/kilowatt-hour	$0.11/kilowatt-hour
Charging energy and session length	As measured	50% below measured	50% above measured
Energy-based user fee	Actual fee, when applicable	$0.20/kilowatt-hour	$0.60/kilowatt-hour
Session-based user fee[7]	Actual fee, when applicable	$5/session	$15/session
NYSERDA grant	With NYSERDA grant	Without NYSERDA grant	
Revenue sharing model	N/A	10% revenue sharing, customers spend $1 per minute with a max of $20 per session	

Overall, 41 percent of the scenarios analyzed achieved profitability. This figure does not include scenarios where no direct or indirect revenue sources existed since those scenarios could not be profitable. On a per-station basis, the median NPV was about negative $3,600 and the median debt was just under $6,000.

[7] No sensitivity scenario was run with both a session-based and energy-based user fee even though some archetypes charged both fees.

Figure 17. Owner-Operator Debt and Net Present Value for Scenarios from Sensitivity Analysis

5.3.1 Charging Use

This section discusses scenario results related to charging use where the NYSERDA grant was removed, making it more difficult to achieve profitability. In addition, user fees, electricity costs, the revenue sharing model, and the charging-use factors were varied. For charging use, the annual growth rates considered were 15, 30 (default), and 60 percent. The range of values for growth encompasses the necessary growth needed to meet the ZEV goals of the State at 50 percent year-over-year, which could also mirror the growth needed for infrastructure. For initial charging use, the measured use was considered along with twice that amount and no growth.

In general, the NPV increases as use of charging equipment increases so long as a fee is assessed that is higher than the electricity cost. As the growth rate or initial charging use increases, more archetypes become profitable. In fact, all the high-use scenarios for the archetype from the workplace category are profitable.

A base utilization of more than one session a day or more is needed to reliably achieve profitability regardless of the growth rate. When utilization was below one session per day, only a third of the scenarios achieve profitability for all archetypes. In these low-use scenarios, annual growth rate matters more with higher growth rates allowing more archetypes to reach profitability. Even still, more than 55 percent of scenarios analyzed with a revenue source are not profitable, even for archetypes that have stations used more than twice a day in the first year. See Table 9 for a summary of profitability results based on initial utilization and usage growth rates.

Table 9. Net Present Value per Station with Initial Utilization and Usage Growth Rate

Initial Sessions per Day	0 to 1.35			1.35 to 2.69			2.69 to 4.04			5.38 to 6.73		
Archetype Category	15%	30%	60%	15%	30%	60%	15%	30%	60%	15%	30%	60%
Hotel												
NPV	($15,724)	($14,971)	($10,736)									
% Profitable	0%	0%	6%									
Leisure												
NPV	($1,330)	$7,401	$18,039									
% Profitable	30%	47%	69%									
Multi-Family												
NPV	($9,903)	($3,032)	$9,171									
% Profitable	15%	33%	55%									
NYC Garage												
NPV	($2,718)	$4,771	$20,266									
% Profitable	18%	34%	66%									
Parking Garage												
NPV	($5,454)	$1,428	$11,757	$20,366	$26,532	$30,139						
% Profitable	18%	33%	57%	65%	70%	74%						
Retail												
NPV	($11,341)	($7,650)	$932	$16,023	$23,623	$28,261						
% Profitable	3%	18%	36%	66%	71%	74%						
Transit												
NPV	($2,637)	$6,497	$18,222									
% Profitable	26%	51%	72%									
Workplace												
NPV	($3,712)	$4,535	$14,622	$17,886	$24,547	$28,605	$30,874	$32,866	$33,880	$40,719	$40,719	$40,719
% Profitable	25%	42%	62%	68%	74%	76%	77%	78%	78%	85%	85%	85%

In addition to utilization, the length of a charging session and the amount of energy delivered help determine station profitability. Session time appears to be less consequential. For example, a session-based fee structure would not be conducive for stations that have long average charging times. Figure 18 and Figure 19 convey how the station profitability changes with differences in session length and energy delivered. Although there is a range in profitability for various session lengths and energy delivered per session, there is no clear pattern in the data that indicates a direct relationship.

Figure 18. Charging Session Time and Net Present Value per Station

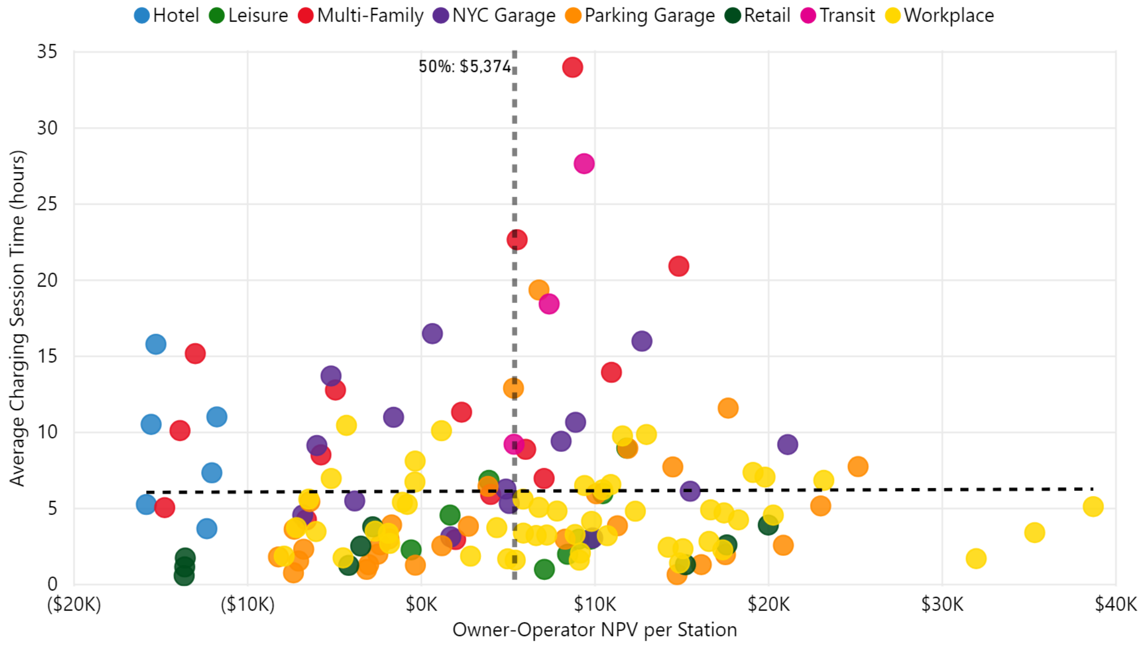
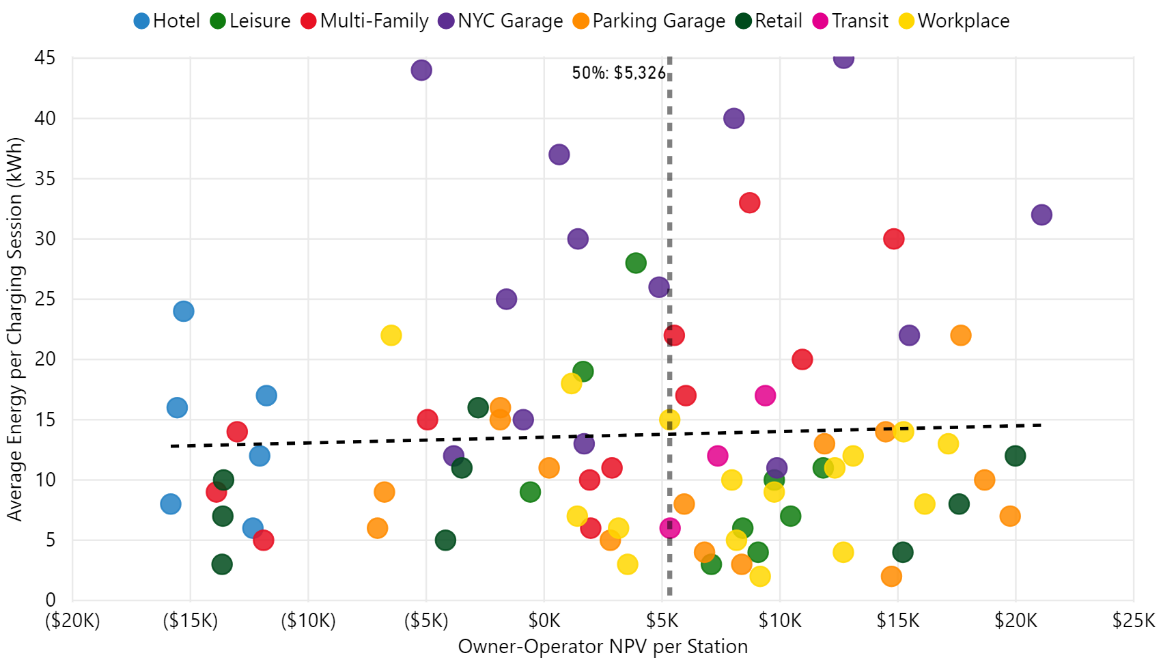


Figure 19. Charging Energy Delivered and Net Present Value per Station



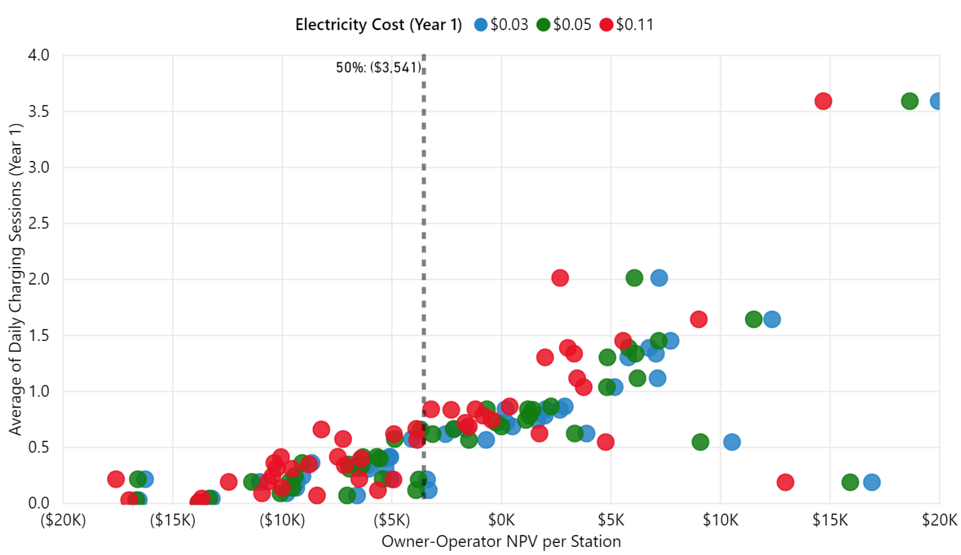
5.3.2 Electricity Costs

This section discusses scenario results related to electricity costs where the default user fees defined in the NYSERDA data are used and the NYSERDA grant was removed, making it more difficult to achieve profitability. In addition, the revenue sharing model, the charging-use factors, and initial charging use and annual charging-use growth were varied.

While lowering electricity costs improves the NPV for the owner-operator, the effect of these costs on profitability appears to be minimal. As mentioned in *Key Drivers of Profitability* (section 5.1 of this report), electricity costs are the only variable cost considered in the analysis and make a large portion of operating costs as utilization increases. Even though the NPV may change considerably on a percentage basis as electricity costs change, the number of scenarios yielding a profitable station does not change much.

Only 34 percent of scenarios were profitable when the default electricity cost ($0.05 per kilowatt-hour) from the base case analysis was used. Decreasing the electricity cost by 40 percent to $0.03 per kilowatt-hour only increased the number of positive scenarios a fraction of a percent, whereas more than doubling the cost resulted in 29 percent of profitable scenarios.

Figure 20. Owner-Operator Net Present Value and Average Sessions per Station by Electricity Price



5.3.3 User fees

This section discusses scenario results related to session-based user fees including session- and energy-based fees. The NYSERDA grant was removed, making it more difficult to achieve profitability in this part of the analysis. In addition, user fees, the revenue sharing model, the charging-use factors, and initial charging use and annual charging-use growth were varied.

User fees are an essential part of charging service business models that seek to cover operating costs and upfront capital costs. Session- and energy-based user fees are the only form of direct revenue considered in this analysis.

Higher fees resulted in more revenue because the analysis did not adjust consumer demand based on the price of the service. For energy user fees, for example, nearly all archetype categories were profitable on average with a $0.60 per kilowatt-hour user fee, which is a very high price for low-powered charging. Few archetype categories achieved profitability, however, when the energy fee was $0.20 or lower even though that amount is nearly double the highest expected cost of electricity. Session fees had a similar effect, with higher fees resulting a in greater change of profitability for any archetype. See Figure 21 and Figure 22 for more information.

Figure 21. Owner-Operator Net Present Value per Station and Session Fees by Archetype Category

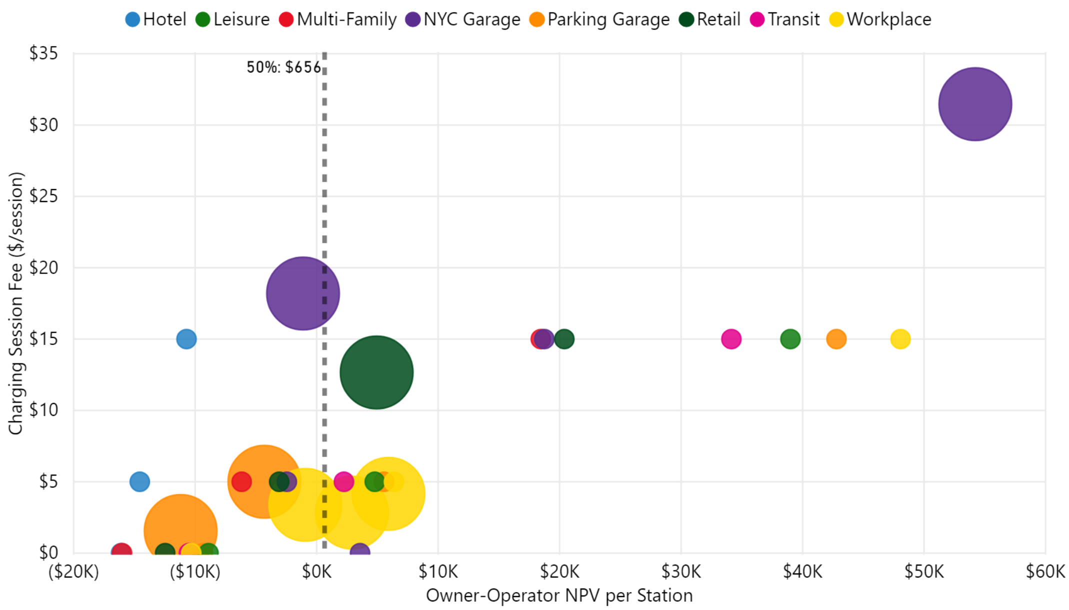
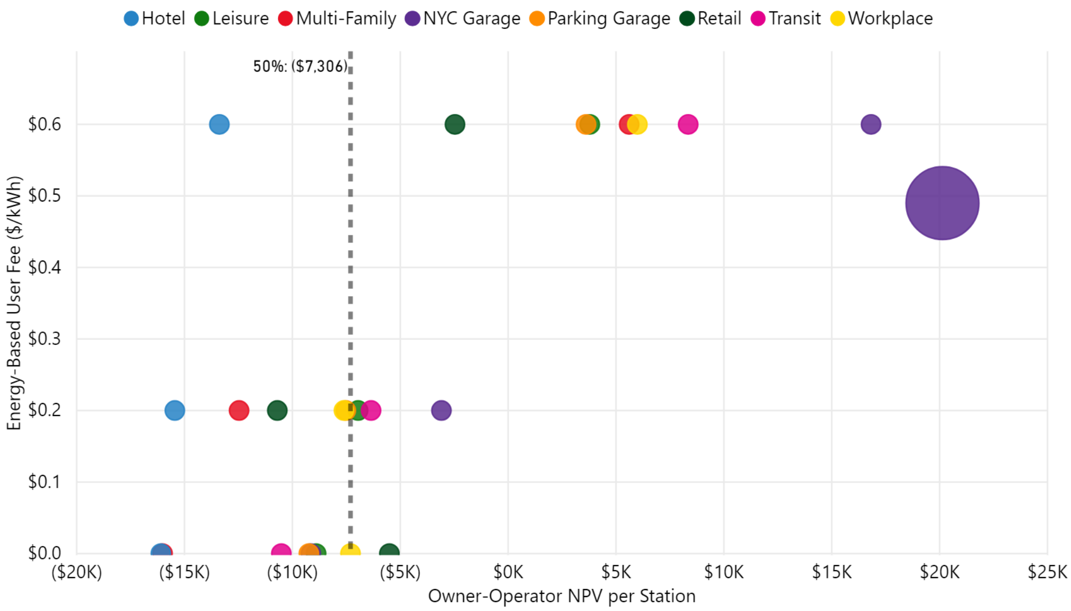


Figure 22. Owner-Operator Net Present Value per Station and Energy Fees by Archetype Category



5.3.4 NYSERDA Grant

This section discusses scenario results related to the NYSERDA grant, which was valued at between $5,000 and more than $20,000 depending on the site. This analysis did not include scenarios where no direct nor indirect revenue sources existed since those scenarios could not be profitable. In addition, user fees, the revenue sharing model, the charging-use factors, and initial charging-use and annual charging-use growth were varied.

The grant from NYSERDA made a noticeable difference in reducing upfront capital costs for the charging projects for all archetypes and the analysis results indicates a charging station project through a public-private partnership is a promising investment. Of the more than 30,000 scenarios that included a NYSERDA grant, 56 percent achieved profitability. Of these profitable scenarios, 75 percent achieved payback in five years or fewer, a key metric for many investors. When the NYSERDA grant was excluded, only 36 percent of scenarios achieved profitability.

5.3.5 Revenue Sharing Model

Revenue from installing a charging station can come from indirect sources such as increased consumer spending at the charging site. Money spent by EV drivers while charging in the area can also benefit an owner-operator. For this analysis, a one-dollar-per-minute revenue was estimated with a maximum of $20 per charging session. Of this additional revenue, the owner-operator captured 10 percent, or up to $2 per session.

Overall, the revenue share model had a noticeable effect on the profitability of a charging station for an owner-operator. Nearly half (48 percent) of the scenarios analyzed with the revenue share model achieve profitability, while only 35 percent of scenarios without revenue sharing were profitable. The additional revenue increased the profitability by between 7 and 250 percent depending on the archetype with all but two improving by more than 100 percent.

Table 10. Net Present Value of Owner-Operator Depending on Revenue Share Model

This table shows the effects on average of the revenue share model. There appears to be noticeable improvement in the profitability of the station with this business model.

Archetype Group	No Revenue Share	Revenue Share	NPV Improvement (%)
Hotel	($11,037)	($10,266)	7%
Leisure	$4,598	$11,422	148%
Multifamily	($3,199)	$1,631	151%
NYC Garage	$5,056	$9,299	84%
Parking Garage	$4,485	$11,747	162%
Retail	($1,843)	$2,759	250%
Transit	$4,669	$11,029	136%
Workplace	$5,733	$14,031	145%

5.3.6 Environmental and Other Indirect Benefits

A major motivation for encouraging EV growth and supporting charging infrastructure development is the environmental benefits associated with switching drivers from gasoline-powered vehicles to EVs. This motivation is particularly true in New York, which has some of the cleanest electricity in the United States.[8]

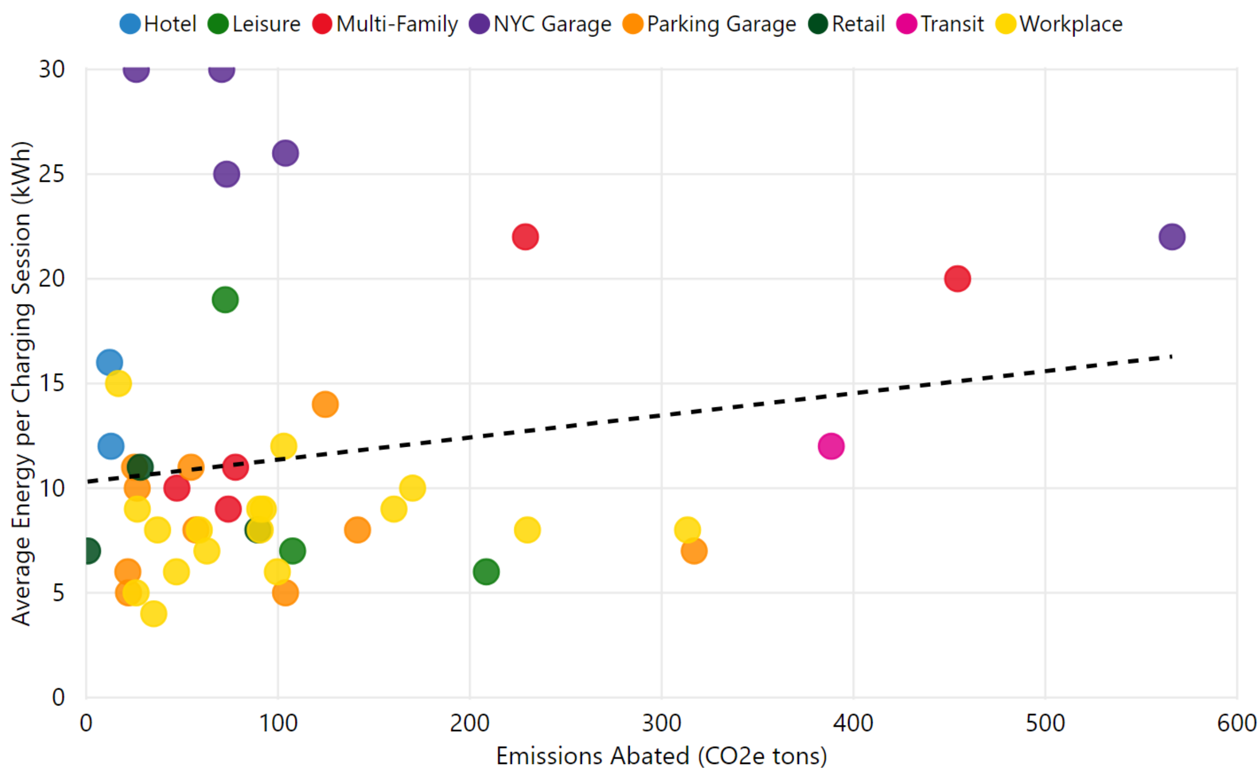
The EV Charging Financial Analysis Tool estimates the potential environmental benefits based on the electrical grid emissions from the electricity delivered by the charging stations compared to the emissions from a gasoline-equivalent vehicle (see appendix A for all related assumptions).

With the base utilization, the amount of carbon emissions estimated to be abated ranged from approximately two tons to 566 tons of carbon over the lifetime of the charging station. In the cases where utilization is assumed to be higher, estimates increase to up to 1,417 tons of carbon over the lifetime of the charging station.

8 Using 2016 data from the U.S. Environmental Protection Agency's eGRID, the weighted average of emissions from electricity is 478.67 pounds of carbon-dioxide equivalent for every megawatt-hour generated. The average for the entire United States is 1,004.17. Visit https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid for more information.

Using the last estimate for the social cost of carbon estimated by the federal government ($36 per ton in 2015), the societal value of these charging stations range from $84 to $59,514 over the life of the equipment. Monetizing the environmental benefits from hosting charging stations could be a valuable source of revenue for charging site hosts.

Figure 23. Carbon Emissions Abated



6 Conclusion

Making the business case for charging stations is challenging and there is no standard formula to overcome the costs and achieve the utilization needed to make a profit for any site. NYSERDA's charging-use and cost data allowed for a real-world assessment of the business case for Level 2 charging stations in New York State that outlines several options owner-operators have to address these challenges. Expanding beyond the real-world data through a multivariate analysis expands the range of scenarios where site profitability is possible.

Level 2 stations funded by NYSERDA were located across the State in urban, suburban, and fewer rural locations. Station deployment matches the high concentrations seen for all publicly available charging stations in the State. Highest use stations tended to be at universities or medical campus, followed by parking garages outside of New York City. When looking at the data, multifamily dwellings also did well, delivering more energy per station than all stations except for the universities or medical centers as the multifamily dwellings were likely the primary charging stations for those EVs.

Typical charging sessions lasted less than five hours and provided fewer than 10 kilowatt-hours of energy. As expected, workplace sites saw the most activity at the start of the workday. Few stations had overnight charging, with the exception of multifamily dwellings and some garages in New York City, indicating these stations may be used by local residents.

For the base case, using just the NYSERDA data, 39 of 46 archetypes did not achieve profitability. In most cases, profitability was not possible to directly assess as sites did not charge a user fee. In some cases, profitability even with a user fee was not possible due to low utilization. For the sites that offered free charging, the fee that would have been required to break even ranged from as low as $0.08 per kilowatt-hour to as high as $10.60 per kilowatt-hour. The higher fees are for sites that had very low utilization, or as few as 10 sessions per year. This further emphasizes the importance of station utilization for a direct revenue-based model.

The scenario analyses drew the following conclusions:

- One-quarter of stations were used for between 3.5 and 5.25 hours per session and provided between seven and nine kilowatt-hours per session on average. This narrow band of use for such a large number of stations reveals a common usage trend that could serve as a benchmark for charging service providers when managing their own stations.

- User fees in some form are an essential part of a charging service business model to cover the operating and upfront capital costs. This analysis did not assess other types of value derived from charging stations.
- High utilization can be a burden to site hosts without a user fee or other form of revenue to derive from station use.
- Workplace charging stations were highly utilized relative to other stations, but the charging service was typically provided as an amenity at no cost to employees, making it difficult to assess their profitability directly.
- A base utilization of more than one session a day is needed to reliably achieve profitability regardless of the growth rate.
- The revenue from a charging station depends on session charging time, the number of charging sessions per day, and any charging-use fees.
- Seventy-five percent of scenarios that achieved profitability with a NYSERDA grant had a payback in five years or fewer. Of the more than 30,000 scenarios that included a NYSERDA grant worth between $5,000 and more than $20,000 depending on the site, 56 percent achieved profitability. When the NYSERDA grant was excluded, only 36 percent of scenarios achieved profitability.
- While electricity costs are an important factor for operational expenses, the effect of these costs on profitability appears to be minimal.
- The revenue share model has a noticeable effect on the profitability of a charging station.

For Level 2 charging stations in New York State, profitability is possible. The owner-operators need to find a balance in costs and revenue. Any incentive that reduces costs, like the NYSERDA grants, gives the owner-operators a better chance at reaching profitability. Identifying avenues for revenue generation and high utilization are also key strategies. Assigning adequate and reasonable user fees and/or capturing indirect benefits from hosting stations is also an important consideration. However, these user fees and indirect benefits are not valuable without a user base. Therefore, ensuring a user base is critically important, which seemed to be best managed by workplaces, parking garages, and multifamily dwellings.

As charging station equipment and installation costs decrease and more incentives are made available, continued network expansion will occur. With a growing EV market and increased utilization, estimated to be 30 percent per year, the business case for Level 2 charging will get better for many locations. However, making the business case will still be a challenge as owner-operators identify suitable revenue sources, both direct fees and value captured from indirect benefits, that will help contribute to a strong statewide EV market.

References

[1] New York State, "Reforming the Energy Vision," [Online]. Available: https://rev.ny.gov/. [Accessed February 2019].

[2] New York State Energy Research and Development Authority, "2015 New York State Energy Plan," 2015. [Online]. Available: https://energyplan.ny.gov/Plans/2015.aspx. [Accessed 28 February 2019].

[3] New York State Energy Research and Development Authority, "New York State Greenhouse Gas Inventory: 1990-2015," September 2018. [Online]. Available: https://www.dec.ny.gov/docs/administration_pdf/nyserdaghg2015.pdf. [Accessed 28 February 2019].

[4] New York State Energy Research and Development Authority, "Charge Ready NY," [Online]. Available: https://www.nyserda.ny.gov/All-Programs/Programs/ChargeNY/Charge-Electric/Charging-Station-Programs/Charge-Ready-NY. [Accessed 31 January 2019].

[5] New York State Energy Research and Development Authority, "Governor Cuomo Launches First Electric Vehicle Charging Station Installation Rebate Initiative for Public and Private Locations," 18 September 2018. [Online]. Available: https://www.nyserda.ny.gov/About/Newsroom/2018-Announcements/2018-09-18-Governor-Cuomo-Launches-First-Electric-Vehicle-Charging-Station-Installation-Rebate-Initiative-for-Public-and-Private-Locations. [Accessed 28 February 2019].

[6] New York Power Authority, "Charge NY," [Online]. Available: https://www.nypa.gov/innovation/programs/chargeny. [Accessed 28 February 2019].

[7] New York Power Authority, "EVolve NY," [Online]. Available: https://www.nypa.gov/innovation/programs/evolveny. [Accessed 28 February 2019].

[8] Center for Climate and Energy Solutions (C2ES), "Business Models for Financially Sustainable EV Charging Networks," March 2015. [Online]. Available: https://www.c2es.org/site/assets/uploads/2015/03/business-models-ev-charging-infrastructure-03-15.pdf. [Accessed 21 February 2019].

[9] Washington Department of Transportation, "Electric Vehicle Charging Infrastructure," Washington Department of Transportation, 2019. [Online]. Available: https://www.wsdot.wa.gov/Funding/Partners/EVIB.htm. [Accessed 24 February 2019].

[10] Center fo Climate and Energy Solutions (C2ES), "Strategic Planning to Implement Publicly Available EV Charging Stations: A Guide for Businesses and Policymakers," November 2015. [Online]. Available: https://www.c2es.org/document/strategic-planning-to-implement-publicly-available-ev-charging-stations-a-guide-for-businesses-and-policymakers/. [Accessed 31 January 2019].

[11] AAA, "1-in-5 U.S. Drivers Want an Electric Vehicle," AAA, 8 May 2018. [Online]. Available: https://newsroom.aaa.com/2018/05/1-in-5-us-drivers-want-electric-vehicle. [Accessed 23 August 2018].

[12] Atlas Public Policy, "Atlas EV Hub," August 2018. [Online]. Available: https://www.atlasevhub.com. [Accessed August 2018].

[13] Autoweek, "2014 Nissan Leaf SL review notes," Autoweek, 5 May 2014. [Online]. Available: https://autoweek.com/article/car-reviews/2014-nissan-leaf-sl-review-notes. [Accessed 24 February 2019].

[14] Nissan, "2019 Nissan LEAF Charging & Range," Nissan, 2019. [Online]. Available: https://www.nissanusa.com/vehicles/electric-cars/leaf/range-charging.html. [Accessed 24 February 2019].

[15] California Air Resources Board, "Advanced Clean Cars Program," California Air Resources Board, March 2019. [Online]. Available: https://ww2.arb.ca.gov/index.php/our-work/programs/advanced-clean-cars-program/about. [Accessed 22 March 2019].

[16] International Council on Clean Transportation, "Quantifying the electric vehicle charging infrastructure gap across U.S. markets," 23 January 2019. [Online]. Available: https://www.theicct.org/publications/charging-gap-US. [Accessed 31 January 2019].

[17] Union of Concerned Scientists, "New Data Show Electric Vehicles Continue to Get Cleaner," 8 March 2018. [Online]. Available: https://blog.ucsusa.org/dave-reichmuth/new-data-show-electric-vehicles-continue-to-get-cleaner. [Accessed August 2018].

[18] Smart Columbus, "Smart Columbus kickstarts EV charging deployments at multi-unit dwellings," November 2018. [Online]. [Accessed 31 January 2019].

[19] U.S. EIA, "Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector,," 26 Feb 2019. [Online]. Available: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a. [Accessed 22 Feb 2019].

Appendix A. Tool Inputs

Tool inputs are separated into separate tables for market, owner-operator, private sector, and public sector.

A.1. Market

EV Charging Financial Analysis Input Field	Values	Source
Market Assumptions		
EV fuel economy [miles per kilowatt-hour]	3.5	Atlas estimate used to calculate public benefits.
Conventional vehicle replacement fuel economy [mpg]	30	Atlas estimate used to calculate public benefits.
Energy security benefit [$per gasoline gallon displaced]	$0.01	Oak Ridge National Laboratory research found total benefit per EV of $2,040 by replacing a 40 mile per gallon vehicle with 207,000 lifetime miles.
Electrical grid benefit [$per megawatt-hour]	$14.58	From Ratepayer Impact Measure Test of Case Study 3 (public charging) from EPRI Report: % Benefit x Assumed rate of $0.075/kWh.
Electrical grid emissions rate [carbon dioxide equivalent pounds per megawatt-hour]	478.67	Total carbon dioxide equivalent per megawatt-hour for the weighted average of the three electrical grids in New York using the U.S. Environmental Protection Agency's eGrid.
Climate benefit [$per ton of greenhouse gas emissions abated]	$36	2015 social Cost of Carbon using 3% discount rate.
Use traffic-derived values [1] or direct inputs [2]	N	Disable this method for estimating utilization rate.
Direct Utilization Values		
Expected annual utilization growth rate [%]	30%	Used median value from 2016-2018 NYSERDA charging data.
[Station Type 1] Initial average utilization [# of charging sessions per station per year]	4 to 1,880	Average from 2016-2018 NYSERDA charging data.

A.2. Owner-Operator

EV Charging Financial Analysis Input Field	Values	Source
Expected equipment lifespan [years]	10	Atlas assumption confirmed by NESCAUM for newer charging stations. NYSERDA suggested six to seven years.
Charging Station Capital Cost		
Charging station equipment cost per type 1 station [$]	$3,100 to $6,888	Range from NYSERDA data.
Construction and equipment installation cost per type 1 station [$]	$1,398 to $11,607	Range from NYSERDA data.
Energy storage cost per type 1 site [$]	N/A	Not applicable for this analysis.
Photovoltaic energy system cost per type 1 site [$]	N/A	Not applicable for this analysis.
Electric utility upgrades and grid interconnection cost per type 1 site [$]	$33 to $3,000	Range from NYSERDA data.
Lease and property transaction costs per type 1 site (one-time fee) [$]	-	Assumption based on input from NYSERDA and NESCAUM: Most of the L2 stations are not paying leasing fees.
Host site identification and screening and design per type 1 site [$]	$1,000.00	Assumption based on input from NESCAUM and verified by charging provider.
Total number of type 1 stations [#]	1 to 5	NYSERDA data by archetype
Total number of type 1 sites [#]	1	Assume only one site for all archetypes.
Charging Station Utilization		
Maximum number of charging sessions per type 1 station [sessions/year/station]	1,825	Assumed maximum based on charging sessions and charging time data.
Energy Usage		
Average charging energy per type 1 session [kWh/session]	3.64 to 30	Average from 2016-2018 NYSERDA charging data by archetype.
Maximum power draw (type 1 station) [kW/session]	19	Maximum from Level 2 standard.
Average time of charging session (type 1 station) [minutes]	70 to 1,360	Average from 2016-2018 NYSERDA charging data by archetype.

A.2 continued

EV Charging Financial Analysis Input Field	Values	Source
Charging Station Revenue [Operating Revenue - Direct]		
Per-energy user fee (type 1 station) [$/kWh]	$0.20 to $0.60	Average NYSERDA data by archetype. Assumed to be zero otherwise.
Per-charge event user fee (type 1 station) [$/session]	$1.56 to $31.46	Average NYSERDA data by archetype. Assumed to be zero otherwise.
Electricity		
Electricity retail price in first year (type 1 station) [$/kWh]	$0.05	Average of New York State electricity costs. Estimated by Atlas.
Monthly electricity fixed charges (type 1 site) [$]	$25	Average of New York State electricity costs. Estimated by Atlas.
Annual compounded growth rate in electricity price (type 1 station) [%]	0.25%	Atlas assumption from the EIA.
Share of onsite energy generation (type 1 station) [%]	N/A	Not applicable for this analysis.
Demand charge (type 1 station) [$/kW/month]	-	Assume no demand charge for Level 2 charging stations.
Demand charge threshold (type 1 station) [kWh/month]	-	Assume no demand charge for Level 2 charging stations.
Maximum load at site excluding charging stations (type 1 station) [kW]	0	Atlas assumption.
Maintenance cost		
Annual maintenance cost (type 1 station) [$]	Varied	Assumption as 5 percent of equipment cost based on input from NESCAUM and verified by charging provider.
Communications cost		
Annual communications cost (average per type 1 site/year) [$]	$750	Average from NYSERDA data by archetype.
Communications cost		
Warranty Cost		
Annual warranty cost (type 1 station) [$]	$700	Estimate based on input from NYSERDA.

A.2 continued

EV Charging Financial Analysis Input Field	Values	Source
Host site lease or access cos		
Host site lease or access cost (average per type 1 site/year) [$]	$0	Assumption based on input from NYSERDA and NESCAUM: Most of the L2 stations are not paying leasing fees.
Additional Revenue Assumptions		
Number of subscribers in first year [subscribers/year]	-	Atlas assumption. Use in model only if appropriate.
Annual growth rate in number of subscribers [%]	-	Atlas assumption. Use in model only if appropriate.
Subscription fee [$/subscriber/year]	-	Atlas assumption. Use in model only if appropriate.
Annual advertising revenue (In-station advertising) [$]	-	Atlas assumption. Use in model only if appropriate.
Owner-operator share of energy security benefit [%]	0%	Atlas to research.
Owner-operator share of electrical grid benefit [%]	0%	Atlas to research.
Owner-operator share of climate benefit [%]	0%	Atlas to research.
Additional Cost Assumptions		
Sales, General, and Administrative [% of Revenue]	5%	Atlas assumption.
Initial Capitalization Assumptions		
Percent Equity Funded [%]	40%	Atlas assumption.
Assumed EBITDA exit multiple	0	Atlas assumption.
Owner-Operator Cost of Equity		
Risk Free Rate	1.25%	Atlas assumption.
Market Risk Premium	10%	Atlas assumption.
Maximum Debt Term [years]	10	Atlas assumption.
Owner-Operator Cost of Debt (Long Term) [%]	8%	Atlas assumption.

Table A.2 continued

EV Charging Financial Analysis Input Field	Values	Source
Income Statement Assumptions		
Interest Income [$]	0	Atlas assumption.
Other Income, Net [$]	0	Atlas assumption.
Other Special Charges [$]	0	Atlas assumption.
Interest Expense Rate [%] (Revolving Line of Credit)	0%	Atlas assumption.
Income Tax Rate [%]	20%	Atlas assumption.
Projected Shares Outstanding (Millions)	1	Atlas assumption.
Current assets		
Accounts Receivable [% of Revenue]	0%	Atlas assumption.
Other Receivable [% of Revenue]	0%	Atlas assumption.
Prepaid Expenses [% of Revenue]	0%	Atlas assumption.
Non-Current Assets		
Intangibles (Goodwill)	0%	Atlas assumption.
Other Non-Current Assets	0%	Atlas assumption.
Current Liabilities		
Accounts Payable [% of Revenue]	0%	Atlas assumption.
Revolving Line of Credit [% of Revenue]	0%	Atlas assumption.

A.3 Private Sector

EV Charging Financial Analysis Input Field	Values	Source
Private Sector Partner Inputs		
Private Sector Weighted Average Cost of Capital (WACC)	10.3%	Atlas assumption.
Private Sector Cost of Goods Sold [% of Revenue]	80%	Atlas assumption.
Private Sector Marginal Tax Rate	20%	Atlas assumption.
Revenues		
Private sector captures host site lease/access fees?	N	Atlas assumption. Use if applicable
Average expected revenue per customer per minute [$]	$1	Atlas assumption. Use if applicable
Type 1 stations capture customer traffic revenue	Y	Atlas assumption. Use if applicable
Maximum retail revenue per customer per session (type 1 station) [$]	$20	Atlas assumption. Use if applicable
Capture the electrical grid benefits	Y	Atlas assumption.
Costs		
Annual customer revenue sharing agreement (from sales) [% of revenue]	10%	Atlas assumption.
Per station subsidy (type 1 station) [$]	$0 to $7,042.27	Average from NYSERDA data by archetype. Range includes with grant and no grant scenarios.
Annual flat fee (paid to owner-operator) [$]	-	If applicable.

A.4 Public Sector

EV Charging Financial Analysis Input Field	Values	Source
Public Sector Cost of Capital [%]	5%	Atlas assumption. Use if applicable.
Public sector funded portion of debt [% of debt needed]	0%	Atlas assumption. Use if applicable.
Term [years]	10	Atlas assumption. Use if applicable.
Rate (APR) [%]	5%	Atlas assumption. Use if applicable.
Public sector funded portion of equity investment [% of equity needed]	0%	Atlas assumption. Use if applicable.
Public sector equity has capped annual returns?	N	Atlas assumption. Use if applicable.
Annual equity return cap [%]	5%	Atlas assumption. Use if applicable.
Non-shareholder contribution to capital (grants, etc.) [% of equity needed]	0%	Atlas assumption. Use if applicable.
Other annual non-revolving support (grants, etc.) [$]	$0 to $36,304	Average from NYSERDA data by archetype. Range includes with grant and no grant scenarios.

Appendix B. Archetype Definitions

The 185 stations at 136 sites were grouped into 46 archetypes, defined below.

Archetype	Location Type	Land-Use Type	Charging Station Type	Access	Payment Required?	#Stations /Site	Ownership Model	Stations	Sites
NYC Garage A	NYC Garage	Urban	Dual	Public	No	1	Site Host	4	4
NYC Garage B	NYC Garage	Urban	Single	Public	Yes	4	Contractor	2	1
NYC Garage C	NYC Garage	Urban	Dual	Public	Yes	1	Site Host	2	2
NYC Garage D	NYC Garage	Urban	Dual	Public	Yes	1	Contractor	8	8
NYC Garage E	NYC Garage	Urban	Single	Public	Yes	2	Contractor	22	11
Rural Garage B	Parking Garage	Rural	Dual	Limited/Private	No	1	Site Host	1	1
Rural Leisure	Leisure	Rural	Dual	Public	No	1	Site Host	2	2
Rural Retail	Retail	Rural	Dual	Public	No	1	3rd Party Station Owner	1	1
Rural Workplace A	Workplace	Rural	Dual	Limited/Private	No	2	Site Host	6	6
Rural Workplace B	Workplace	Rural	Dual	Limited/Private	Yes	2	Site Host	1	1
Rural Workplace C	Workplace	Rural	Dual	Public	No	2	Site Host	1	1
Suburban Hotel	Hotel	Suburban	Single	Limited/Private	No	2	Contractor	10	5
Suburban Leisure	Leisure	Suburban	Dual	Public	No	4	Site Host	2	1
Suburban Multifamily A	Multifamily	Suburban	Dual	Limited/Private	No	1	Site Host	2	2
Suburban Multifamily B	Multifamily	Suburban	Single	Limited/Private	No	2	Site Host	2	1
Suburban Multifamily C	Multifamily	Suburban	Dual	Limited/Private	Yes	3	Site Host	3	1

Appendix B Continued

Archetype	Location Type	Land-Use Type	Charging Station Type	Access	Payment Required?	#Stations /Site	Ownership Model	Stations	Sites
Suburban Parking Garage A	Parking Garage	Suburb an	Dual	Limited/P rivate	No	1	Site Host	13	13
Suburban Parking Garage B	Parking Garage	Suburb an	Dual	Public	No	1	Site Host	2	2
Suburban Parking Garage C	Parking Garage	Suburb an	Dual	Public	No	1	3rd Party Station Owner	2	2
Suburban Parking Garage D	Parking Garage	Suburb an	Single	Public	No	2	Site Host	2	1
Suburban Parking Garage E	Parking Garage	Suburb an	Dual	Public	Yes	1	Site Host	1	1
Suburban Parking Garage F	Parking Garage	Suburb an	Dual	Public	Yes	2	3rd Party Station Owner	1	1
Suburban Parking Garage G	Parking Garage	Suburb an	Dual	Public	No	2	Site Host	1	1
Suburban Transit A	Transit	Suburb an	Single	Limited/P rivate	No	5	Site Host	3	1
Suburban Workplace A	Workplace	Suburb an	Dual	Limited/P rivate	No	2	Site Host	19	19
Suburban Workplace B	Workplace	Suburb an	Dual	Limited/P rivate	No	4	Site Host	16	8
Suburban Workplace C	Workplace	Suburb an	Dual	Public	No	2	Site Host	1	1
Suburban Workplace D	Workplace	Suburb an	Dual	Public	No	2	3rd Party Station Owner	1	1
Suburban Workplace E	Workplace	Suburb an	Dual	Public	No	4	3rd Party Station Owner	1	1
Suburban Workplace F	Workplace	Suburb an	Dual	Public	Yes	2	Site Host	1	1
Suburban Workplace G	Workplace	Suburb an	Dual	Limited/P rivate	Yes	2	Site Host	8	8
Suburban Workplace H	Workplace	Suburb an	Dual	Limited/P rivate	Yes	4	Site Host	2	1

Appendix B continued

Archetype	Location Type	Land-Use Type	Charging Station Type	Access	Payment Required?	#Stations /Site	Ownership Model	Stations	Sites
Suburban Workplace I	Workplace	Suburban	Dual	Limited/Private	No	6	Site Host	3	1
Urban Hotel B	Hotel	Urban	Single	Limited/Private	No	2	Contractor	2	1
Urban Leisure	Leisure	Urban	Dual	Public	No	2	Site Host	2	1
Urban Multifamily A	Multifamily	Urban	Dual	Limited/Private	No	2	Site Host	2	1
Urban Multifamily B	Multifamily	Urban	Dual	Limited/Private	No	3	Site Host	3	1
Urban Parking Garage B	Parking Garage	Urban	Dual	Limited/Private	No	1	Site Host	2	2
Urban Parking Garage C	Parking Garage	Urban	Dual	Public	No	4	Site Host	8	4
Urban Retail B	Retail	Urban	Dual	Limited/Private	No	1	Site Host	1	1
Urban Retail C	Retail	Urban	Dual	Limited/Private	Yes	1	Site Host	1	1
Urban Workplace A	Workplace	Urban	Dual	Limited/Private	No	2	Site Host	5	5
Urban Workplace B	Workplace	Urban	Dual	Limited/Private	No	4	Site Host	6	3
Urban Workplace C	Workplace	Urban	Dual	Public	No	2	3rd Party Station Owner	1	1
Urban Workplace D	Workplace	Urban	Dual	Public	No	2	Site Host	2	2
Urban Workplace F	Workplace	Urban	Single	Limited/Private	No	4	Site Host	4	2

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