



New York State Electric Vehicle Charging Station Quarterly Report

Report Period January through March 2017

Final Report

New York State Energy Research and Development Authority

NYSERDA's Promise to New Yorkers:

NYSERDA provides resources, expertise, and objective information so New Yorkers can make confident, informed energy decisions.

Mission Statement:

Advance innovative energy solutions in ways that improve New York's economy and environment.

Vision Statement:

Serve as a catalyst – advancing energy innovation, technology, and investment; transforming New York's economy; and empowering people to choose clean and efficient energy as part of their everyday lives.

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Table of Contents

Notice.....	ii
List of Figures	iii
1 Introduction.....	1
2 Charging Station Usage in New York	2
3 Data Comparisons to Previous Quarter	4
4 Analysis of EV Registrations in New York State.....	8
Appendix A: NYSERDA Electric Vehicle Charging Infrastructure Report.....	A-1

List of Figures

Figure 1. Growth in Installed EVSE Ports Supported by NYSERDA Funding	4
Figure 2. Change in Station Occupancy and Electricity Dispensed	5
Figure 3. Total Registered EVs in New York State	8
Figure 4. Battery Electric Vehicles in New York State	8
Figure 5. Plug-in Hybrid Electric Vehicles in New York State	9
Figure 6. Number and Percentage of EVs among All Registered Vehicles in each NYS County	10

1 Introduction

The New York State Energy Research and Development Authority (NYSERDA) made financial grant awards in 2012 and 2013 to more than a dozen organizations to install Level 2 electric vehicle (EV) charging stations (also referred to as electric vehicle supply equipment [EVSE]) across New York State. These installations support Governor Andrew M. Cuomo's Charge NY initiative. The initiative set the goal of a statewide network of up to 3,000 public and workplace charging stations to support up to 40,000 plug-in vehicles on the road by 2018. Since the program's inception in 2013, New York State supported the installation of over 700 charging ports (bringing the statewide total to more than 1,700), as well as research and demonstration projects on new EV technologies and policies, and revised regulations to clarify charging station ownership rules.

The NYSERDA-funded EVSE projects represent a wide range of business models and approaches for providing public charging infrastructure. One NYSERDA program goal is to learn how the stations are used, including which types of locations and business models are the most promising. By doing so, NYSERDA is paving the way for future private sector charging station investment. Charging station usage data and analysis are shared with the public through these quarterly data reports.

2 Charging Station Usage in New York

The NYSERDA Electric Vehicle Charging Infrastructure Report in Appendix A summarizes the usage of EVSE installed by the NYSERDA program. Only EVSE with at least one charging event during the past quarter were included in the analysis, which does not reflect the total number of charging stations installed to date through the program. The first page overview in Appendix A is most useful to electric utilities. Subsequent pages present usage statistics based on various station attributes, which are useful to current and future EVSE site owners. Data was collected for every charging port, which means that a charging station with two charging connections (a dual port station) was counted as two ports.

EVSE access types are defined as follows:

- **Public EVSE** are available to any EV driver.
- **Limited EVSE** are installed specifically for, but not necessarily restricted to, a select group (e.g., employees, apartment building tenants, or hotel guests).

EVs are likely connected to a charging station the entire time that they are in dedicated parking spaces. However, the vehicles only draw power until the battery pack is finished charging. The Charging Demand plot on the first page of Appendix A shows the total electrical power used by all active NYSERDA-funded stations at different times of the day. This data indicates the total electrical grid impact from EVs charging at NYSERDA-funded public stations. It is important to note that this data does not reflect all EV charging in the State. Public charging stations not funded by the NYSERDA project and home charging were not included in this analysis.

The remaining five pages of data analysis in Appendix A include the same table and charts for various charging station subsets including: access type, required payment, land use type, region, and venue. Site owners who are considering installing charging stations can use this data and analysis to understand how sites similar to theirs are used and which attributes may lead to better utilization.

The data tables include summary results for charging events (total and average per week), energy consumed (total, average per week, and average per charging event), average time with a vehicle connected (percentage and hours), and average time with a vehicle drawing power (percentage and hours). The energy consumed is an indication of the electrical energy required from the host location. The average time a vehicle is connected is the duration drivers stay at the location as a consumer, client, or employee.

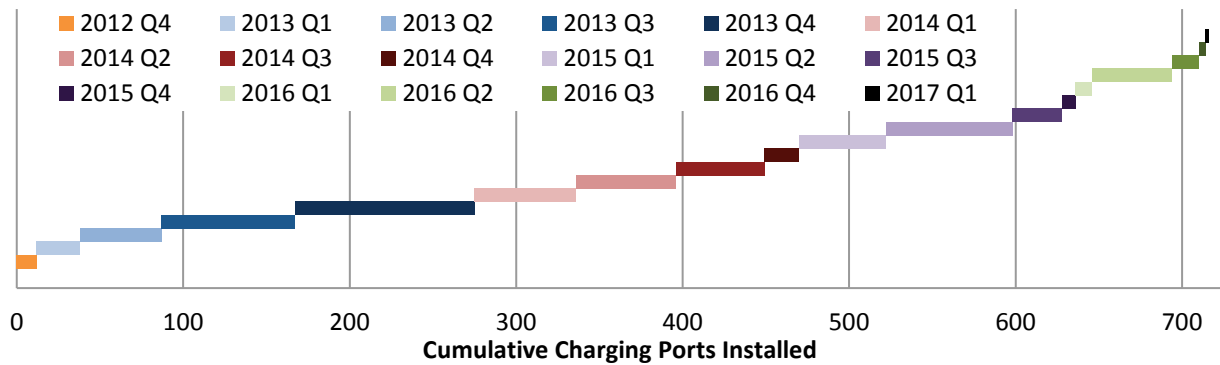
If the average time a vehicle draws power is significantly less than the average time a vehicle is connected, then the EV is occupying the station longer than necessary and should move to allow other EVs to charge. Site owners can use all of these metrics to help decide whether installing EVSE is a beneficial investment (directly or indirectly). These results also provide insight into whether or not to charge EV drivers for using the station and the most appropriate fee structure to use (fees can be set by session, time, or energy consumed).

The three line charts on the last five pages of Appendix A display the differences in length of time a vehicle is connected, differences in length of time a vehicle is drawing power, and differences in energy consumed to show variations in charging behavior within the EVSE groups (e.g., a large portion of retail location charging events are very short, compared to a more uniform distribution of charge event durations for parking lots/garages in New York City). The final bar chart displays the range of charging events per port per week which shows the difference between the most and least utilized ports as compared to the average for those charging stations.

3 Data Comparisons to Previous Quarter

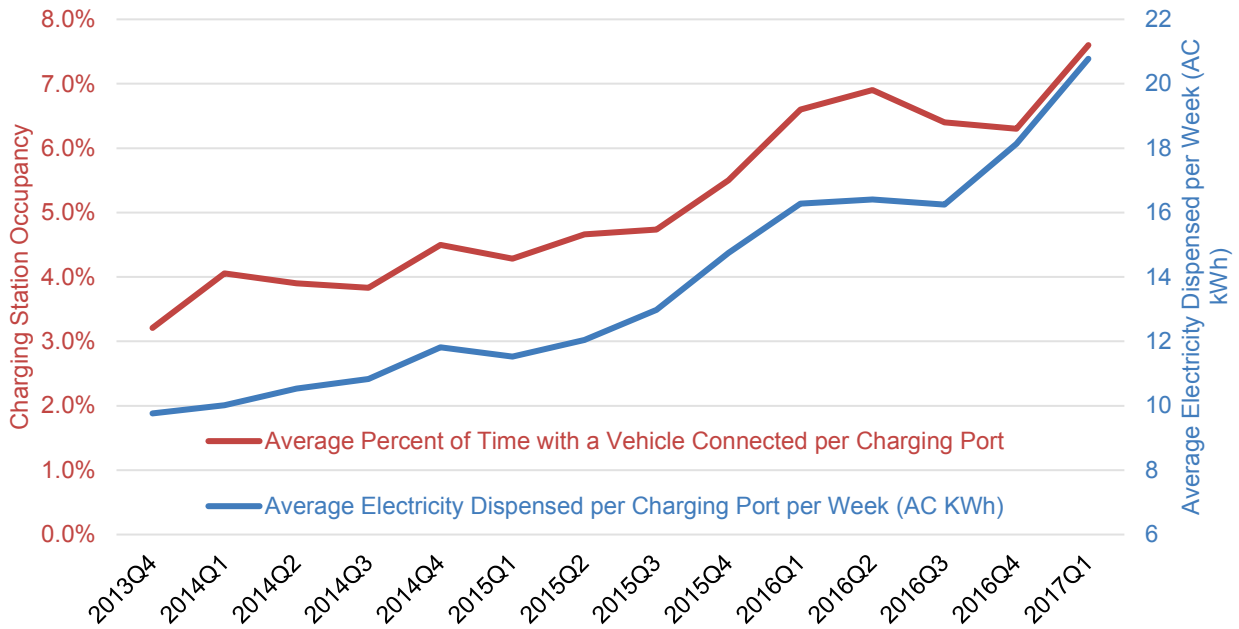
Figure 1 shows the quarterly growth of installed charging stations through NYSERDA’s program. Between December 2012 and March 2017, the NYSERDA EV Charging Station Program funded the installation of 716 charging ports (510 stations at 304 unique locations). During the last quarter, two new charging ports were installed.

Figure 1. Growth in Installed EVSE Ports Supported by NYSERDA Funding



On average, an EV was connected to these charging stations 7.6% of the time in the past quarter, a 20% increase from the previous quarter. Figure 2 shows the change in average percent of time with a vehicle connected per charging port and average electricity dispensed per charging port per week (AC KWh) throughout the data monitoring period of the NYSERDA EV Charging Station Program.

Figure 2. Change in Station Occupancy and Electricity Dispensed



Tables 1 and 2 show the 2017 Q1 charging station occupancy (percentage time with a vehicle connected) data results by subset, including both the average and the percent change compared to 2016 Q4 (highest results are highlighted in green).

Table 1. Percentage of Time with a Vehicle Connected with Access Type, Payments, and Land Use

Access Type	2017 Q1 Average	Change from 2016 Q4	Payment	2017 Q1 Average	Change from 2016 Q4	Land Use	2017 Q1 Average	Change from 2016 Q4
Limited	9.8%	9%	Free	7.9%	20%	Urban	8.6%	13%
Public	6.2%	32%	For Fee	5.6%	37%	Suburban	7.5%	25%
						Rural	3.1%	24%

Table 2. Percentage of Time with a Vehicle Connected by Region and Venue

Region	2017 Q1 Average	Change from 2016 Q4	Venue	2017 Q1 Average	Change from 2016 Q4
Long Island	14.5%	37%	Parking (non-NYC)	13.5%	45%
Finger Lakes	14.0%	36%	Multi-Family	13.4%	-17%
Hudson Valley	9.2%	14%	University/Medical	10.4%	12%
New York City	6.2%	7%	Parking (NYC)	6.2%	19%
Capital District	5.2%	13%	Transit	6.1%	27%
Western NY	3.9%	11%	Workplace	5.6%	22%
Southern Tier	2.8%	4%	Leisure Destination	3.3%	3%
Central NY	2.6%	-7%	Retail Location	2.7%	4%
North Country	2.3%	21%	Hotel	1.6%	-27%
Mohawk Valley	1.3%	8%			

Overall charging station occupancy significantly increased in the first quarter of 2017 as compared to the fourth quarter of 2016 as shown by Figure 2. This 20% increase in occupancy also resulted in a 16% increase in the amount of time a vehicle was drawing power and an 8% increase in total electricity consumed. The peak electricity demand for all charging stations also increased from 247 kW in the fourth quarter of 2016 to 295 kW this quarter, which occurred at 9:45 a.m. on a weekday. The median peak weekday demand was 206 kW, up from 189 kW last quarter. Overall, charging stations are occupied more than twice as long as necessary, which may indicate a need to better manage how stations are used in order to support the growing number of EVs in the State.

Limited access stations are occupied significantly more than public access stations (9.8% for limited vs. 6.2% for public), because EVs remain plugged into limited access stations (7.4 hours per charge event on average) almost twice as long as public access stations (4.1 hours per charge event). However, the shorter connection times at public access stations allow for more turnover (2.6 charging events started per public access port per week vs. 2.3 for limited access stations) and both types of stations result in a similar average percent of time with a vehicle drawing power at 3.5% for public and 3.7% for limited access.

Almost 90% of the NYSERDA program stations reporting usage this past quarter did not impose a usage fee. The free stations experience a higher percentage of time occupied and dispensing power, with more charging events started per charging port per week (2.6 for free stations vs. 1.6 for stations with a fee). However, EV drivers that use stations with a fee draw power for a longer period of time, which indicates they were likely relying on this station for a required charge as opposed to simply plugging in because it's available and free.

Many of the charging stations in an urban setting are located in and around New York City where there is a much higher portion of battery EVs with larger battery packs, specifically Teslas. This likely contributes to the longer period of time drawing power and more electricity consumed per charging events for urban-based charging stations. The challenge of finding parking spaces in urban areas may contribute to the longer average periods of time (six hours) for EVs to stay connected in this setting as compared to 4.8 hours for suburban settings and four hours for rural settings. Shorter connection times help free up the station for use by other EVs. This helps explain why charging stations in suburban settings experienced more charging events started per charging port per week (2.6) than the urban-based charging stations (2.4).

Charging stations in the Long Island and Finger Lakes Regions, which already were the most frequently occupied in the State, both had increases of more than 35% since the last quarter in the average time a vehicle was plugged in, bringing the average occupancy rate above 14% in both regions. This is 50% higher than the next closest region, Hudson Valley, at 9.2% average occupancy and more than twice as high as any of the other seven regions in the State. New York City, with a larger population of EVs with large battery packs (Teslas), has a much higher average electricity amount consumed per charging event.

Charging stations in multiuse parking lots outside of New York City experienced a 45% increase in occupancy since last quarter and were the type of venue with the highest occupation rate in the first quarter of 2017, at 13.5%. Multifamily dwelling charging stations have EVs connected the longest per charge event (15.1 hours), while retail locations have the shortest EV connection time per charge event (1.3 hours). Retail locations and university or medical campuses average the largest number of charging events per week with 3.5.

4 Analysis of EV Registrations in New York State

The following graphs analyze EV registration data from the NYS Department of Motor Vehicles over time, by model, and location, as of March 31, 2017.

Figure 3. Total Registered EVs in New York State

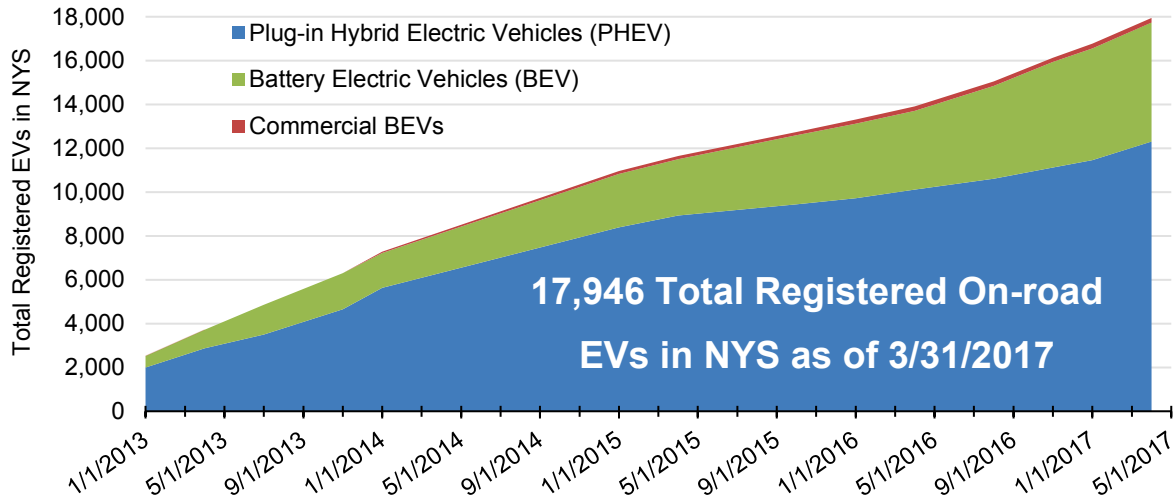


Figure 4. Battery Electric Vehicles in New York State

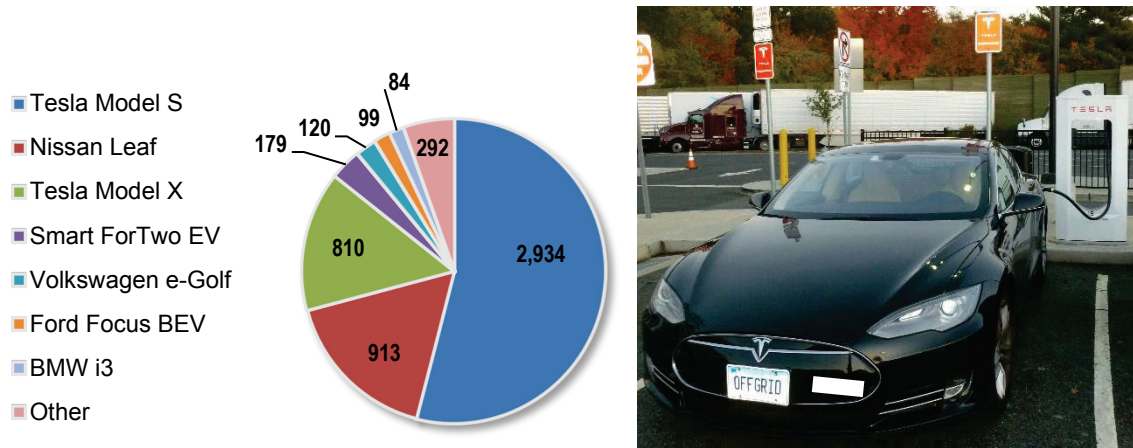


Figure 5. Plug-in Hybrid Electric Vehicles in New York State

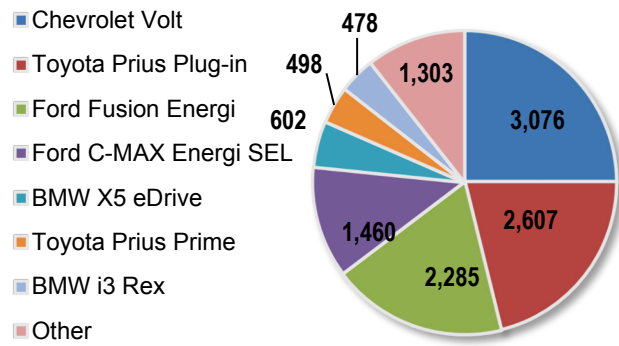
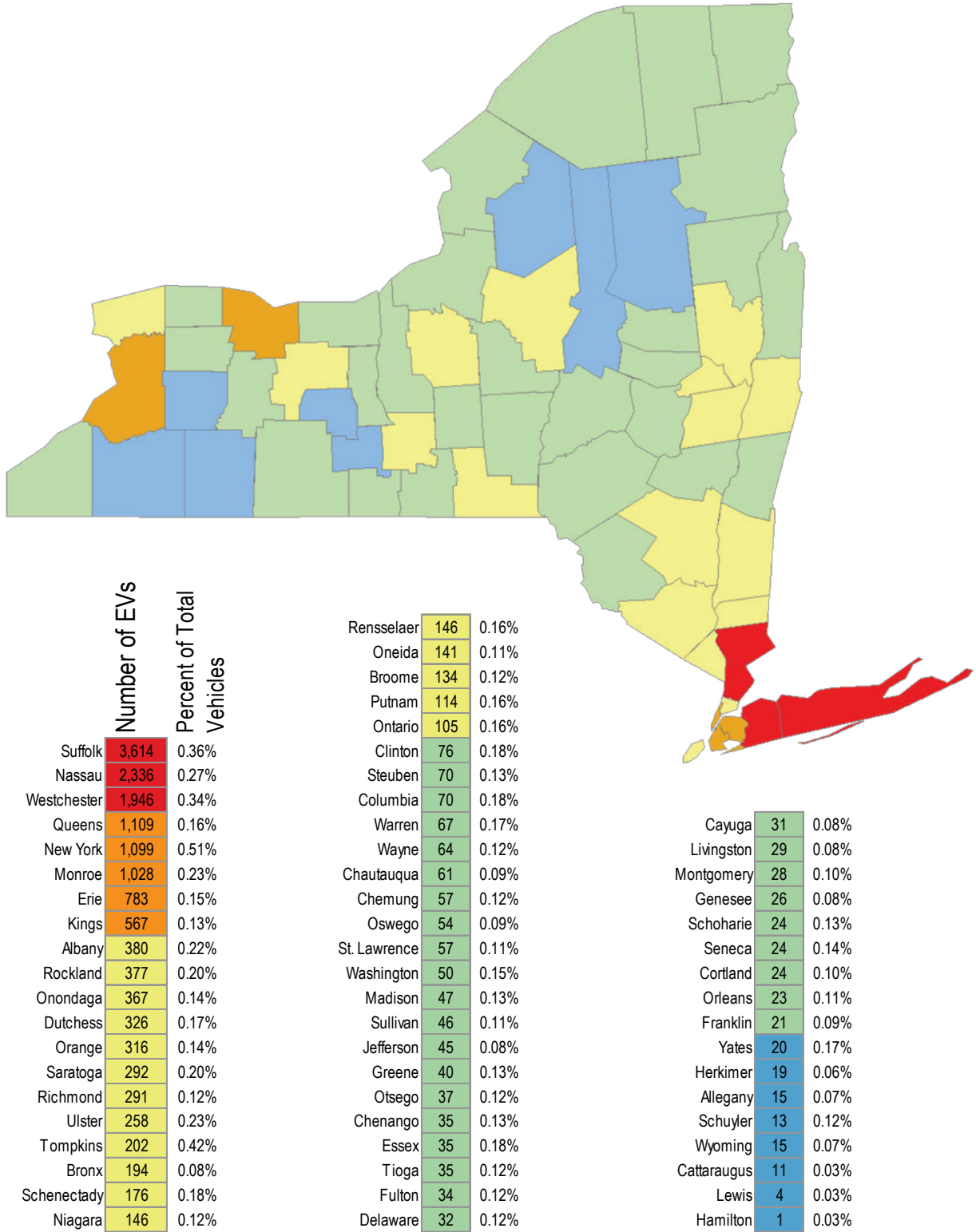


Figure 6. Number and Percentage of EVs among All Registered Vehicles in each NYS County



Appendix A: NYSERDA Electric Vehicle Charging Infrastructure Report

NYSERDA Electric Vehicle Charging Infrastructure Report

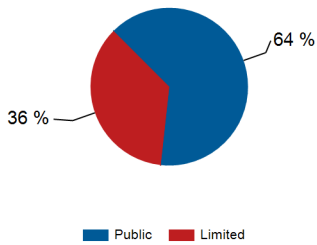
Report period: January 2017 through March 2017

New York State

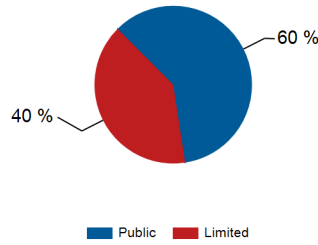
EVSE Usage - By Access Type

	Public	Limited ³	Total
Number of charging ports ¹	323	201	524
Number of charging events ²	10,603	5,902	16,505
Electricity consumed (AC MWh)	83.59	55.53	139.13
Percent of time with a vehicle connected	6.2%	9.8%	7.6%
Percent of time with a vehicle drawing power	3.5%	3.7%	3.6%

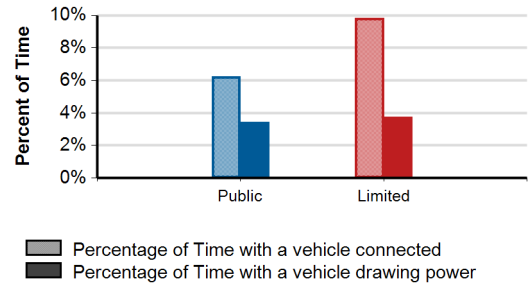
Number of Charging Events



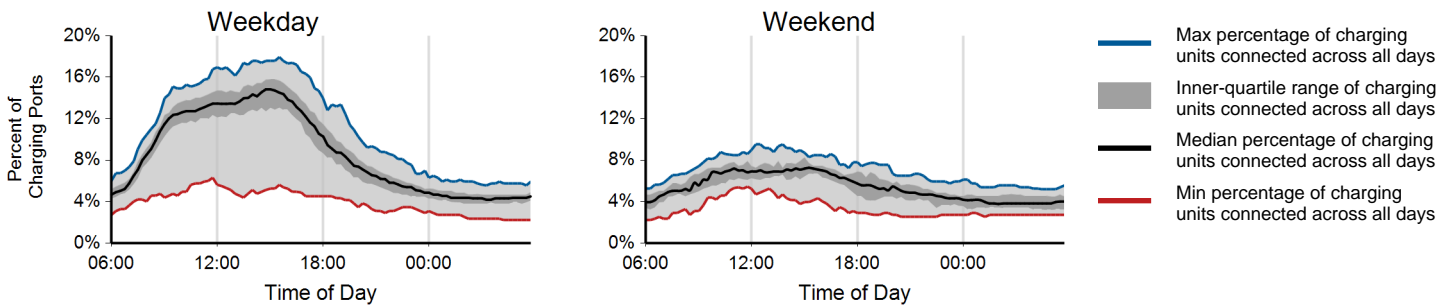
Electricity Consumed



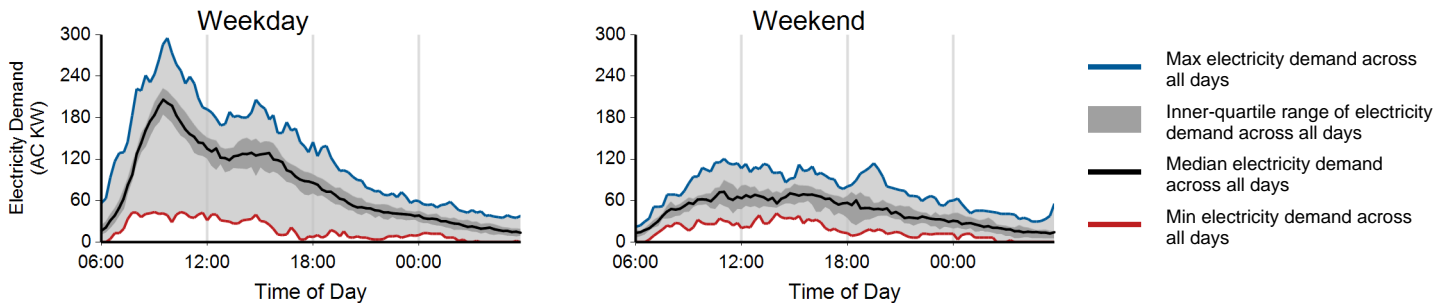
Charging Unit Utilization



Charging Availability: Range of Percentage of All Charging Ports with a Vehicle Connected versus Time of Day⁴



Charging Demand: Range of Aggregate Electricity Demand versus Time of Day⁴ for All Charging Ports



¹ Includes all EVSE ports in use during the reporting period and have reported data to INL.

² A charging event is defined as the period when a vehicle is connected to a charging unit, during which power is transferred.

³ Limited Access EVSE are primarily for use by employees or tenants (including paying guests at hotels) and are placed where these EV drivers would normally park, but others (such as visitors or customers) may be able to plug in on a more limited basis.

⁴ Weekends start at 6:00am on Saturday and end 6:00am Monday local time.

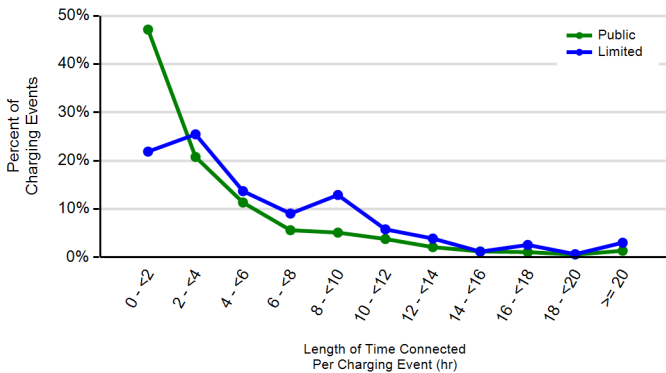
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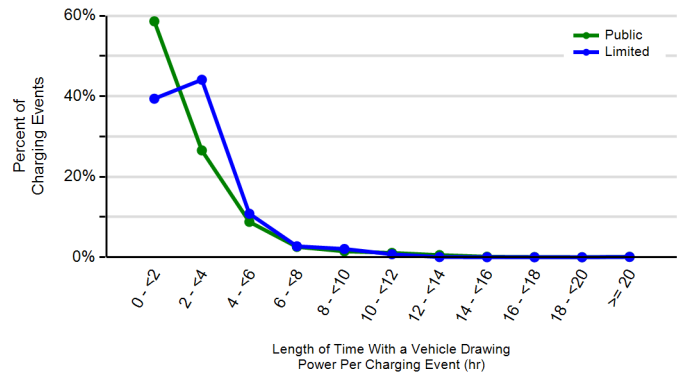
EVSE Usage - By Access Type

	Public	Limited ³
Number of charging ports ¹	323	201
Number of charging events ²	10,603	5,902
Charging energy consumed (AC MWh)	83.6	55.5
Average percent of time with a vehicle connected per charging port	6.2%	9.8%
Average percent of time with a vehicle drawing power per charging port	3.5%	3.7%
Average number of charging events started per charging port per week	2.6	2.3
Average electricity consumed per charging port per week (AC kWh)	20.2	21.7
Average length of time with vehicle connected per charging event (hr)	4.1	7.2
Average length of time with vehicle drawing power per charging event (hr)	2.3	2.7
Average electricity consumed per charging event (AC kWh)	7.9	9.4

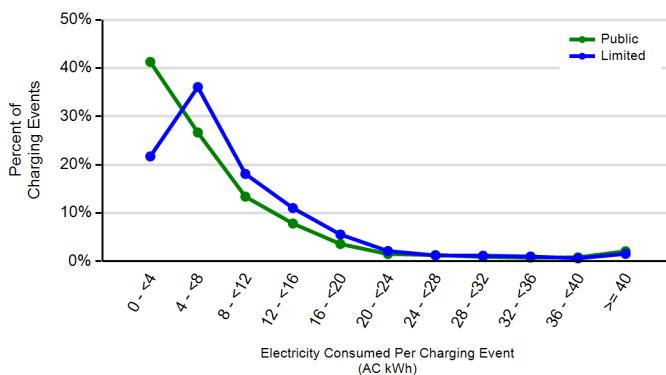
Distribution of Length of Time with a Vehicle Connected per Charging Event



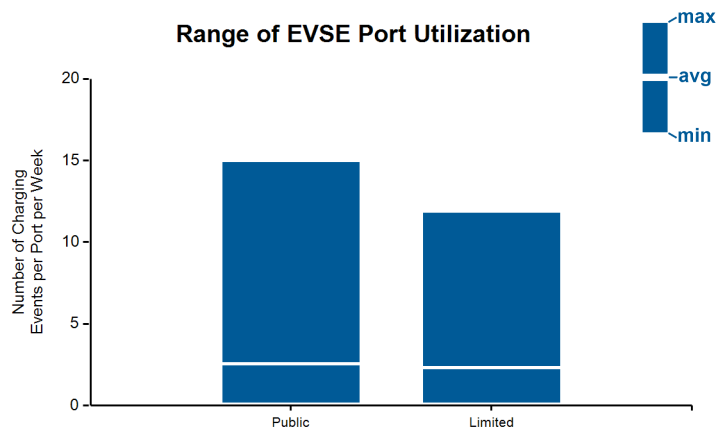
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



¹ Includes all EVSE ports in use during the reporting period and have reported data to INL.

² A charging event is defined as the period when a vehicle is connected to a charging unit, during which power is transferred.

³ Limited Access EVSE are primarily for use by employees or tenants (including paying guests at hotels) and are placed where these EV drivers would normally park, but others (such as visitors or customers) may be able to plug in on a more limited basis.

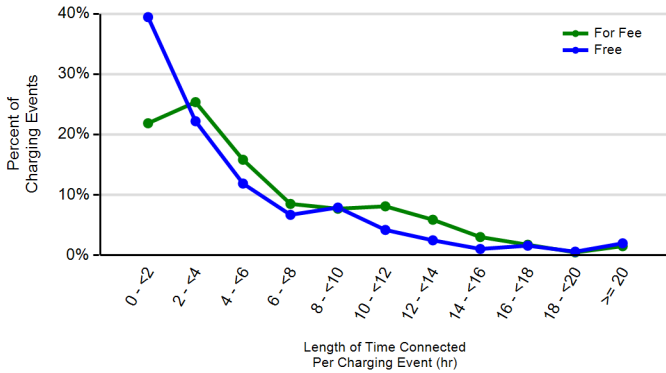
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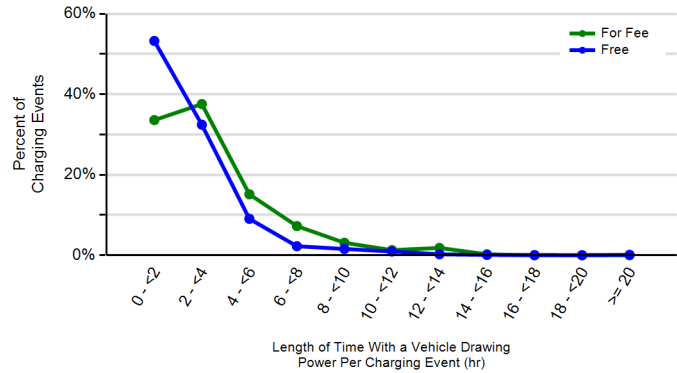
EVSE Usage - By Required Payment

	For Fee	Free
Number of charging ports ¹	62	462
Number of charging events ²	1,258	15,247
Charging energy consumed (AC MWh)	15.0	124.1
Average percent of time with a vehicle connected per charging port	5.6%	7.9%
Average percent of time with a vehicle drawing power per charging port	3.1%	3.6%
Average number of charging events started per charging port per week	1.6	2.6
Average electricity consumed per charging port per week (AC kWh)	18.8	21.0
Average length of time with vehicle connected per charging event (hr)	6.0	5.1
Average length of time with vehicle drawing power per charging event (hr)	3.3	2.4
Average electricity consumed per charging event (AC kWh)	11.9	8.1

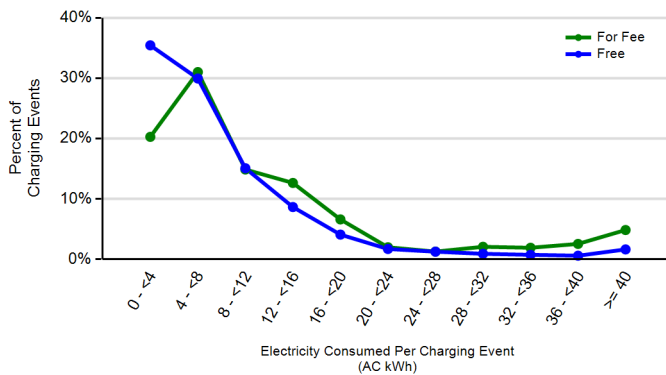
Distribution of Length of Time with a Vehicle Connected per Charging Event



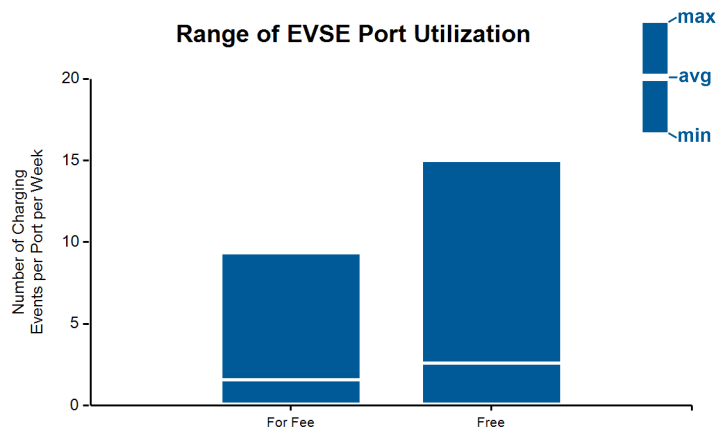
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



¹ Includes all EVSE ports in use during the reporting period and have reported data to INL.

² A charging event is defined as the period when a vehicle is connected to a charging unit, during which power is transferred.

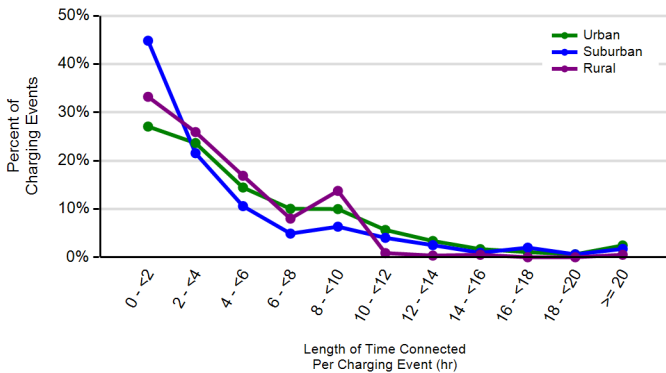
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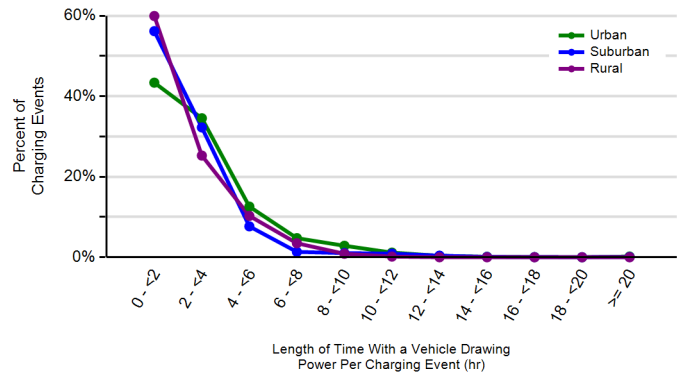
EVSE Usage - By Land Use Type

	Urban	Suburban	Rural
Number of charging ports ¹	190	300	34
Number of charging events ²	5,872	10,058	575
Charging energy consumed (AC MWh)	63.8	70.5	4.8
Average percent of time with a vehicle connected per charging port	8.6%	7.5%	3.1%
Average percent of time with a vehicle drawing power per charging port	4.2%	3.4%	1.7%
Average number of charging events started per charging port per week	2.4	2.6	1.3
Average electricity consumed per charging port per week (AC kWh)	26.2	18.4	11.1
Average length of time with vehicle connected per charging event (hr)	6.0	4.8	4.0
Average length of time with vehicle drawing power per charging event (hr)	2.9	2.2	2.1
Average electricity consumed per charging event (AC kWh)	10.9	7.0	8.4

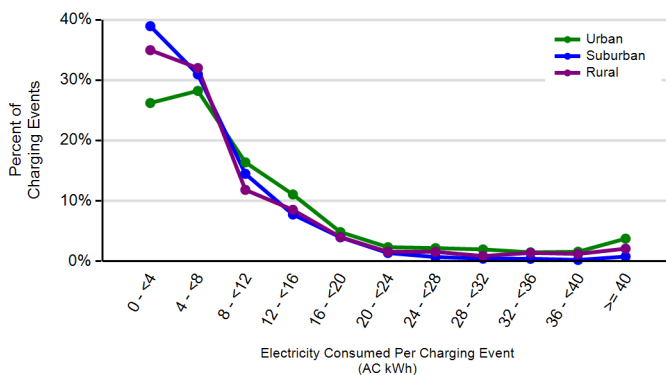
Distribution of Length of Time with a Vehicle Connected per Charging Event



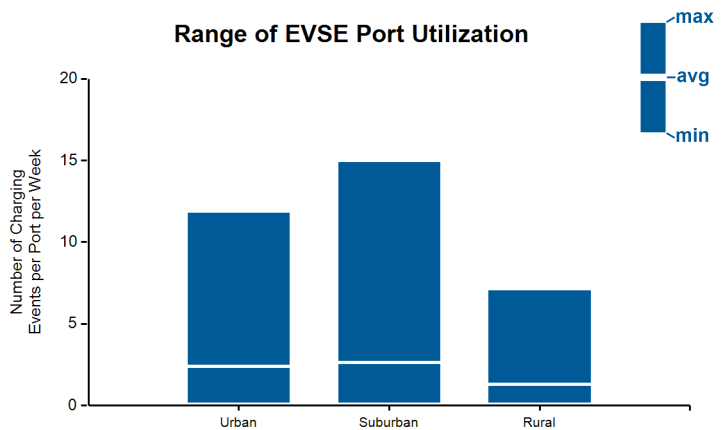
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



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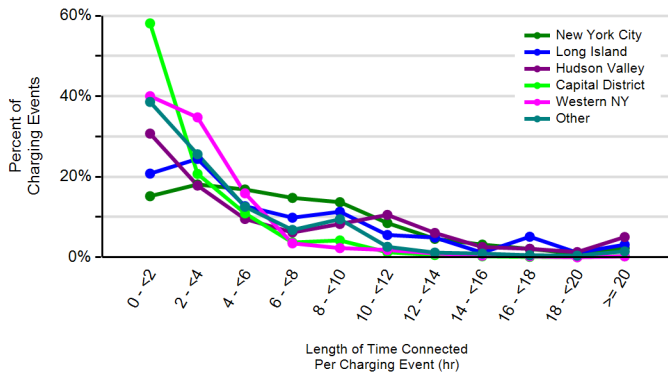
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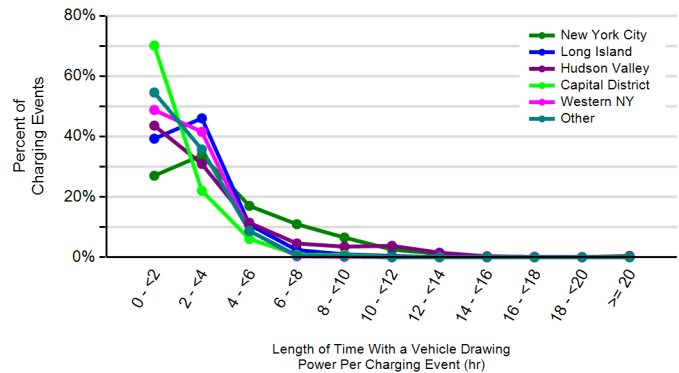
EVSE Usage - By Region

	New York City	Long Island	Hudson Valley	Capital District	Syracuse/Central NY	Rochester/Finger Lakes	Mohawk Valley	North Country	Western NY	Southern Tier
Number of charging ports ¹	90	73	107	103	21	37	11	23	48	11
Number of charging events ²	1,681	2,979	2,565	4,563	430	2,092	104	538	1,272	281
Charging energy consumed (AC MWh)	28.2	28.5	24.7	26.1	2.1	15.2	0.8	2.8	9.1	1.7
Average percent of time with a vehicle connected per charging port	6.2%	14.5%	9.2%	5.2%	2.6%	14.0%	1.3%	2.3%	3.9%	2.8%
Average percent of time with a vehicle drawing power per charging port	3.7%	4.9%	3.7%	3.3%	1.4%	5.8%	1.0%	1.7%	2.8%	2.1%
Average number of charging events started per charging port per week	1.5	3.2	1.9	3.5	1.6	4.4	0.8	1.8	2.1	2.0
Average electricity consumed per charging port per week (AC kWh)	24.6	30.6	18.1	19.7	7.9	32.1	5.5	9.3	14.7	11.8
Average length of time with vehicle connected per charging event (hr)	7.0	7.6	8.3	2.5	2.7	5.4	3.0	2.2	3.2	2.3
Average length of time with vehicle drawing power per charging event (hr)	4.2	2.6	3.3	1.6	1.5	2.2	2.2	1.5	2.3	1.8
Average electricity consumed per charging event (AC kWh)	16.8	9.6	9.6	5.7	4.9	7.3	7.2	5.1	7.1	5.9

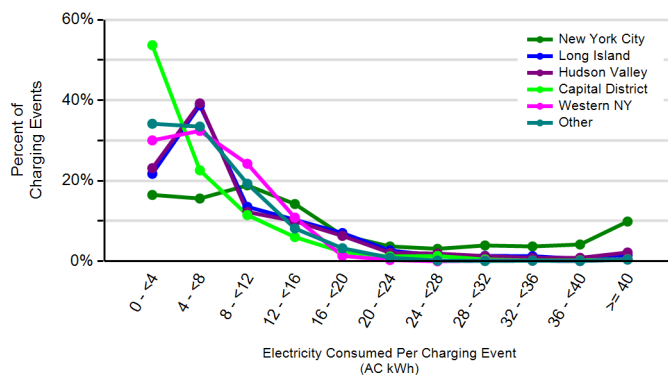
Distribution of Length of Time with a Vehicle Connected per Charging Event⁴



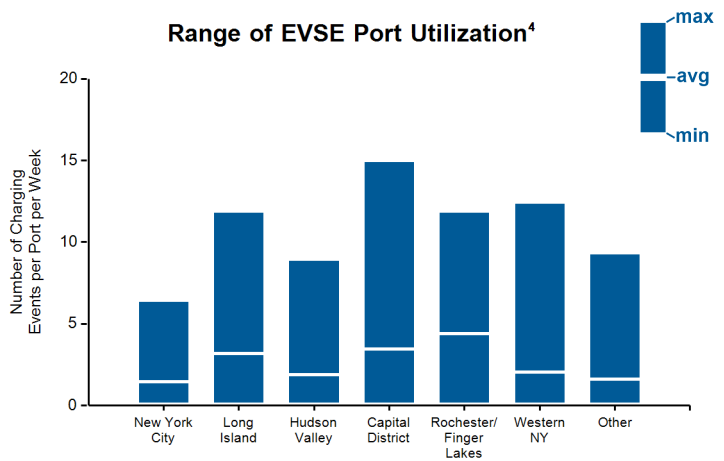
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event⁴



Distribution of AC Energy Consumed per Charging Event⁴



Range of EVSE Port Utilization⁴



¹ Includes all EVSE ports in use during the reporting period and have reported data to INL.

² A charging event is defined as the period when a vehicle is connected to a charging unit, during which power is transferred.

³ Regions with less than 10 EVSE ports are not individually represented, and are combined and reported as 'Other'.

⁴ Only 5 or 6 regions with the most EVSE ports are individually represented, with the remaining regions combined and shown as 'Other'.

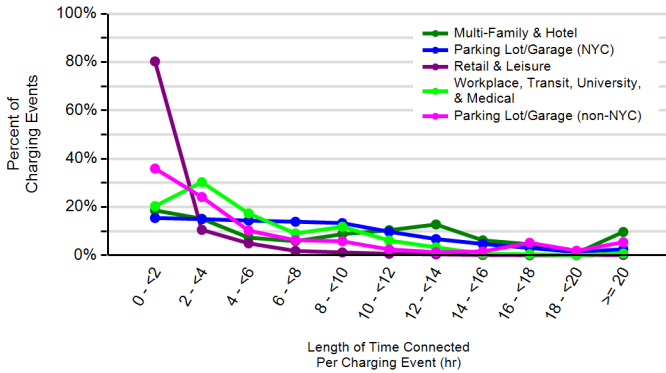
NYSERDA Electric Vehicle Charging Infrastructure Report

Report period: January 2017 through March 2017

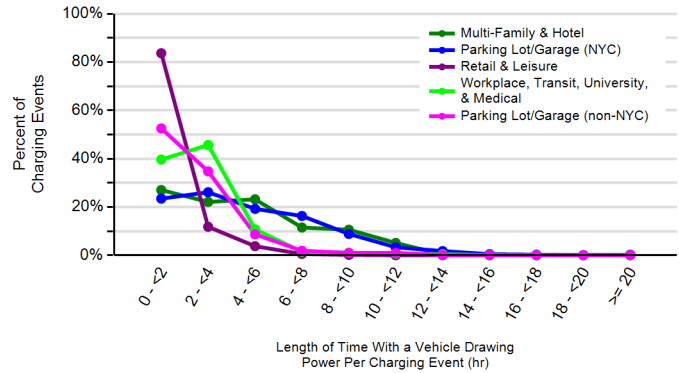
EVSE Usage - By Venue

	Parking Lot/Garage (non-NYC)	Parking Lot/Garage (NYC)	Retail Location	Workplace	Multi-Family	Hotel	University or Medical Campus	Leisure Destination	Transit Station
Number of charging ports ¹	86	63	84	72	19	29	113	19	37
Number of charging events ²	3,250	1,088	3,803	1,730	365	184	5,007	339	582
Charging energy consumed (AC MWh)	23.3	22.6	13.8	14.3	7.0	2.6	45.1	3.2	5.7
Average percent of time with a vehicle connected per charging port	13.5%	6.2%	2.7%	5.6%	13.4%	1.6%	10.4%	3.3%	6.1%
Average percent of time with a vehicle drawing power per charging port	4.1%	3.8%	2.2%	3.1%	4.5%	0.9%	5.2%	1.9%	3.1%
Average number of charging events started per charging port per week	3.0	1.3	3.5	1.9	1.5	0.5	3.5	1.4	1.2
Average electricity consumed per charging port per week (AC kWh)	21.2	27.9	12.7	15.4	28.9	6.9	31.5	13.2	12.2
Average length of time with vehicle connected per charging event (hr)	7.7	7.7	1.3	5.0	15.1	5.3	5.0	4.0	8.2
Average length of time with vehicle drawing power per charging event (hr)	2.3	4.7	1.0	2.8	5.1	3.1	2.5	2.3	4.2
Average electricity consumed per charging event (AC kWh)	7.2	20.7	3.6	8.2	19.3	13.9	9.0	9.5	9.8

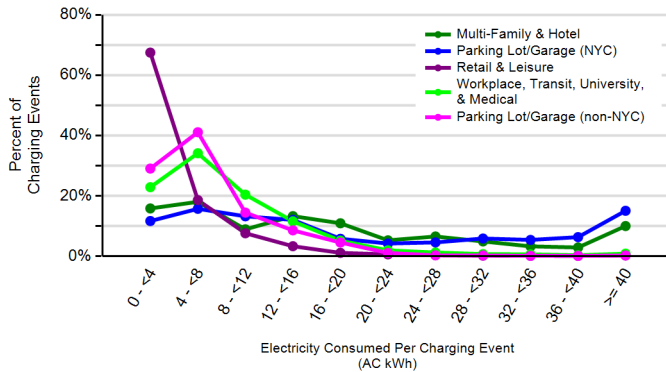
Distribution of Length of Time with a Vehicle Connected per Charging Event



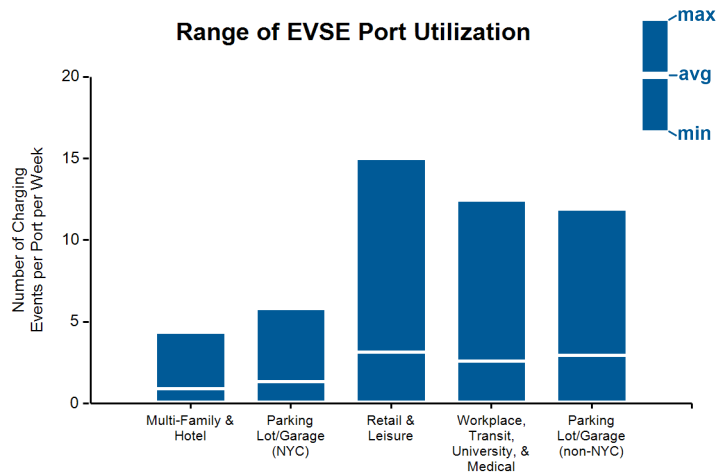
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



¹ Includes all EVSE ports in use during the reporting period and have reported data to INL.

² A charging event is defined as the period when a vehicle is connected to a charging unit, during which power is transferred.

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