



Charge NY

New York State Electric Vehicle Charging Station Quarterly Report

Report Period October through December 2016

Final Report



New York State Energy Research and Development Authority

May 2017

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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Report Period October through December 2016

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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 over 1,600) 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 use by, 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 EV-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.

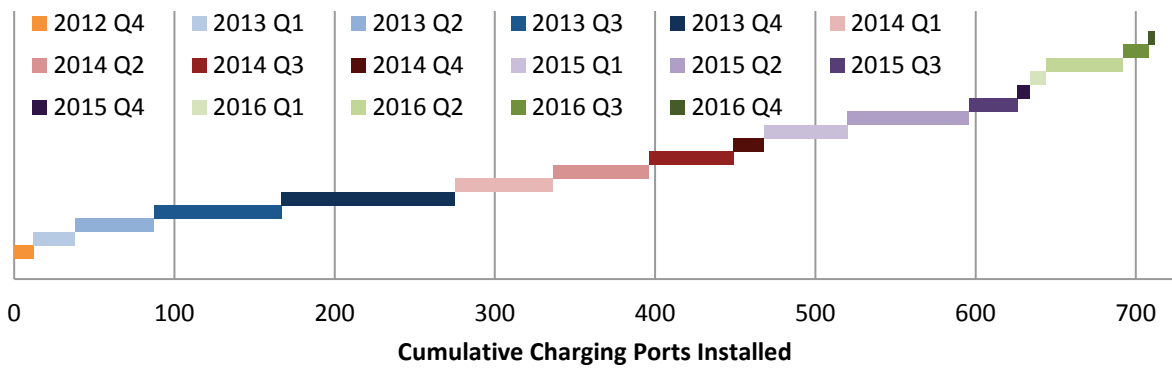
If the average time a vehicle draws power is significantly less than the average time a vehicle is connected, then the EV is occupying the station longer than necessary and should move to allow other EVs to charge. Site owners can use all of these metrics to help decide whether installing EVSE is a beneficial 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

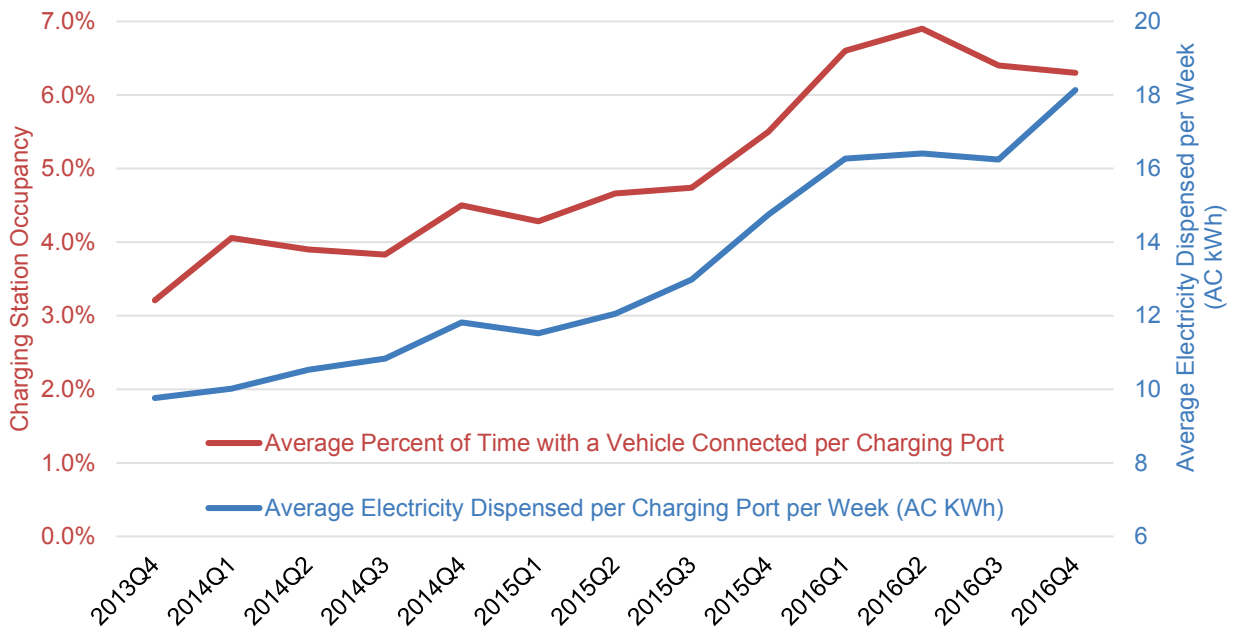
Figure 1 shows the quarterly growth of installed charging stations through NYSERDA’s program. Between December 2012 and December 2016, the NYSERDA EV Charging Station Program funded the installation of 712 charging ports (508 stations at 301 unique locations). During the last quarter, four new charging ports were installed.

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



On average, an EV was connected to these charging stations 6.3% of the time in the past quarter, a 2% decrease 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 2016 Q4 charging station occupancy (percentage time with a vehicle connected) data results by subset, including both the average and the percent change compared to 2016 Q3 (highest results are highlighted in green).

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

Access Type	2016 Q4 Average	Change from 2016 Q3	Payment	2016 Q4 Average	Change from 2016 Q3	Land Use	2016 Q4 Average	Change from 2016 Q3
Limited	9.0%	6%	Free	6.6%	0%	Urban	7.6%	8%
Public	4.7%	-10%	For Fee	4.1%	-15%	Suburban	6.0%	0%
						Rural	2.5%	0%

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

Region	2016 Q4 Average	Change from 2016 Q3	Venue	2016 Q4 Average	Change from 2016 Q3
Long Island	10.6%	6%	Multi-Family	16.1%	50%
Finger Lakes	10.3%	3%	Parking (non-NYC)	9.3%	-7%
Hudson Valley	8.1%	-1%	University/Medical	9.3%	0%
New York City	5.8%	-3%	Parking (NYC)	5.2%	-7%
Capital District	4.6%	-2%	Transit	4.8%	-24%
Western NY	3.5%	-5%	Workplace	4.6%	2%
Central NY	2.8%	12%	Leisure Destination	3.2%	3%
Southern Tier	2.7%	-23%	Retail Location	2.6%	0%
North Country	1.9%	-17%	Hotel	2.2%	16%
Mohawk Valley	1.2%	N/A			

Overall charging station occupancy was virtually unchanged in the fourth quarter of 2016 as compared to the third quarter of 2016 as shown by Figure 2, but most other factors increased. There were eight more charging ports utilized, a 3% increase in the number of charging events, a 16% increase in the total amount of electricity dispensed by all of the charging stations, and a 10% higher percentage of time that an EV was drawing power from the charging stations. This implies that more charging occurred even though the EVs are spending slightly less time at the charging stations. EVs still spend significant time plugged into a charging station after their batteries are fully charged (the average length of time with an EV drawing power is 2.2 hours while they are plugged in for 4.6 hours on average), but the stations are more efficiently utilized than in previous quarters. The slight decrease in percentage of time with a vehicle connected was attributed to significantly less plug-in time at For Fee stations, which experienced a drop from 4.8% to 4.1%.

The Rochester and Finger Lakes Region continues to maintain the highest average percentage of time with a vehicle drawing power per charging port, at 4.8%. Charging stations in Long Island significantly increased their average percentage of time with a vehicle drawing power per charging port from 2.8% in the third quarter of 2016 to 3.6% in the fourth quarter of 2016, leading it to rank second among the 10 regions of the state. New York City charging stations ranked third with EVs drawing power from those chargers 3.4% of the time on average. The highest average percentage of time with a vehicle drawing power per charging port among venue types was multifamily dwellings at 5.0% and university or medical campuses at 4.6%. Usage rates for these two venue types significantly increased from the previous quarter when the average time an EV drew power was 3.1% and 4.0% for multifamily dwellings and university or medical campuses, respectively.

In the fourth quarter of 2016, 14 charging stations averaged between nine and 15 weekly charging events started per week. These sites included 10 charging station ports at Price Chopper Supermarkets and four charging station ports at three different universities—SUNY Buffalo, SUNY Poly College of Nanoscale Science and Engineering in Albany, and Rochester Institute of Technology. Another 21 charging ports averaged at least seven charging events started per week. These included retail locations (Price Chopper Supermarkets and Kohl’s stores), universities (SUNY Buffalo, SUNY Albany, and Rochester Institute of Technology), workplaces (IBM and Taitem Engineering), municipal parking (New York City and Rochester), Peconic Bay Medical Center, and Tarrytown Metro North Train Station.

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 by location, as of December 31, 2016.

Figure 3. Total Registered EVs in New York State

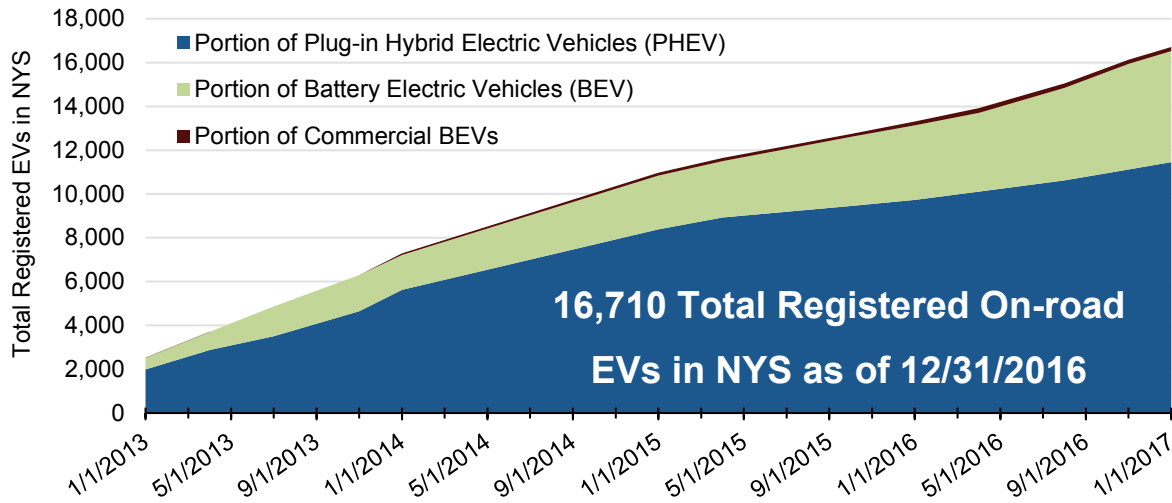


Figure 4. Battery Electric Vehicles in New York State

- Tesla Model S
- Nissan Leaf
- Tesla Model X
- Smart ForTwo EV
- Volkswagen e-Golf
- Ford Focus BEV
- BMW i3
- Other

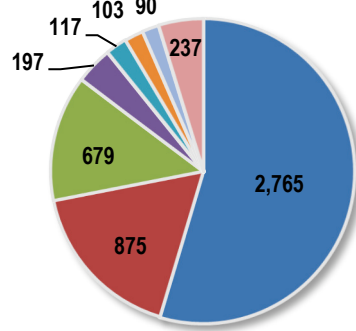


Figure 5. Plug-in Hybrid Electric Vehicles in New York State



- Chevrolet Volt
- Toyota Prius Plug-in
- Ford Fusion Energi
- Ford C-MAX Energi SEL
- BMW i3 Rex
- BMW X5 eDrive
- BMW i8
- Other

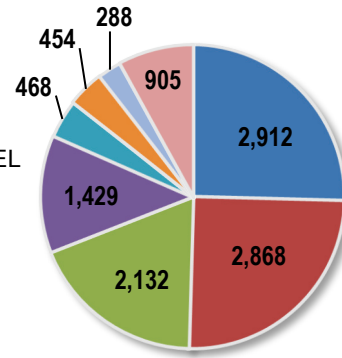
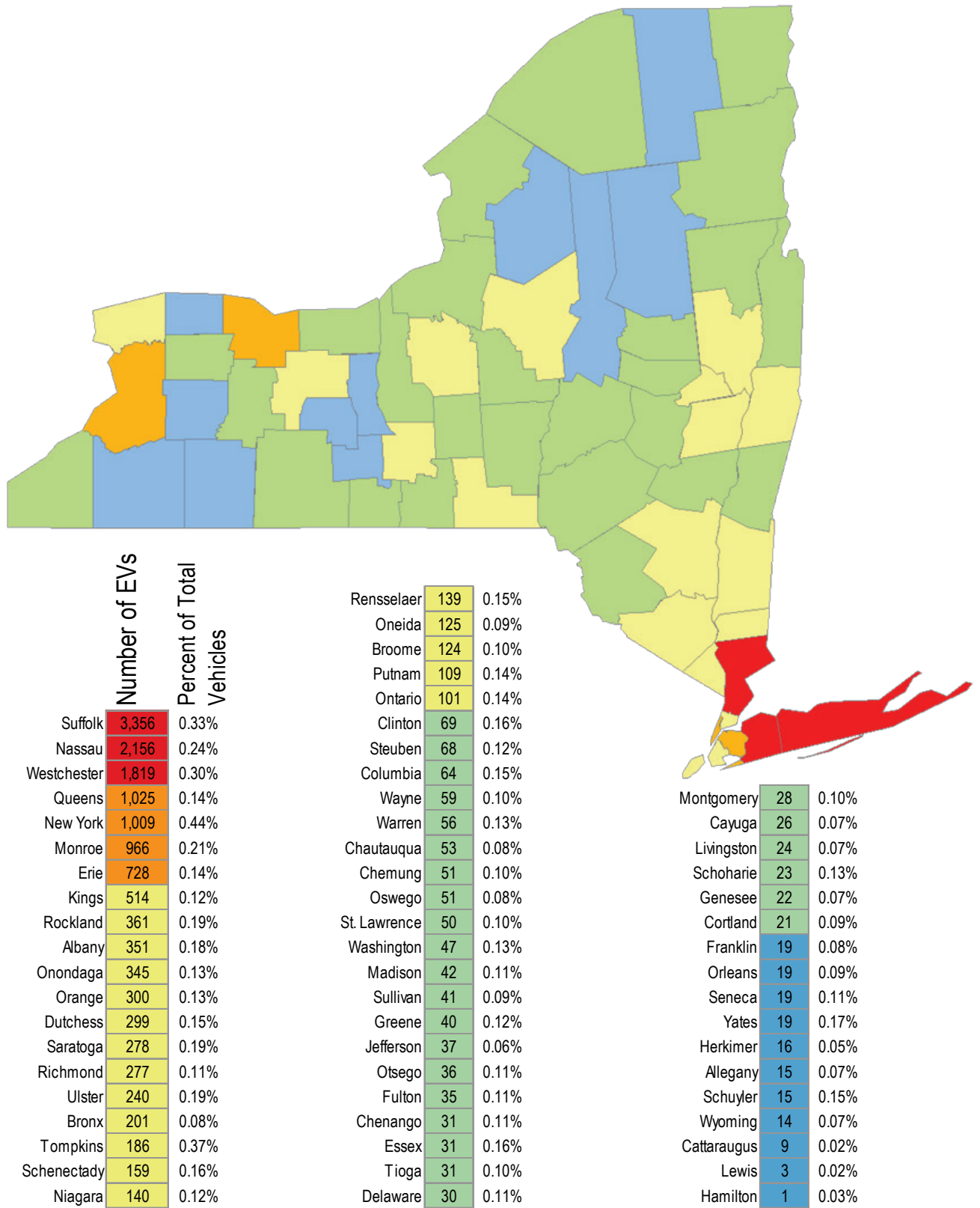


Figure 6. Number and Percentage of EVs among All Registered Vehicles in each NYS County



Appendix A: NYSERDA Electric Vehicle Charging Infrastructure Report

NYSERDA Electric Vehicle Charging Infrastructure Report

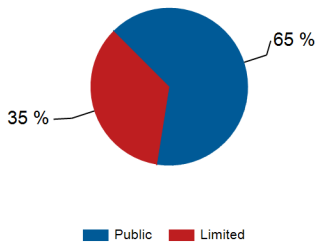
Report period: October 2016 through December 2016

New York State

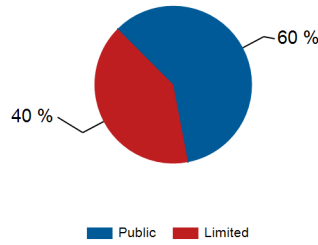
EVSE Usage - By Access Type

	Public	Limited ³	Total
Number of charging ports ¹	338	206	544
Number of charging events ²	10,494	5,646	16,140
Electricity consumed (AC MWh)	76.84	52.30	129.15
Percent of time with a vehicle connected	4.7%	9.0%	6.3%
Percent of time with a vehicle drawing power	2.9%	3.3%	3.1%

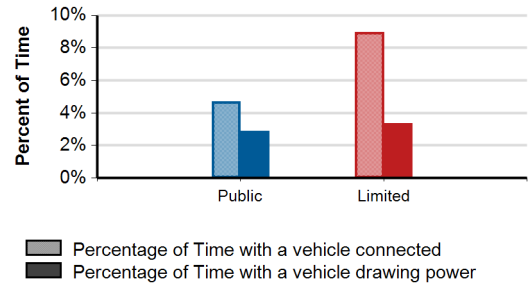
Number of Charging Events



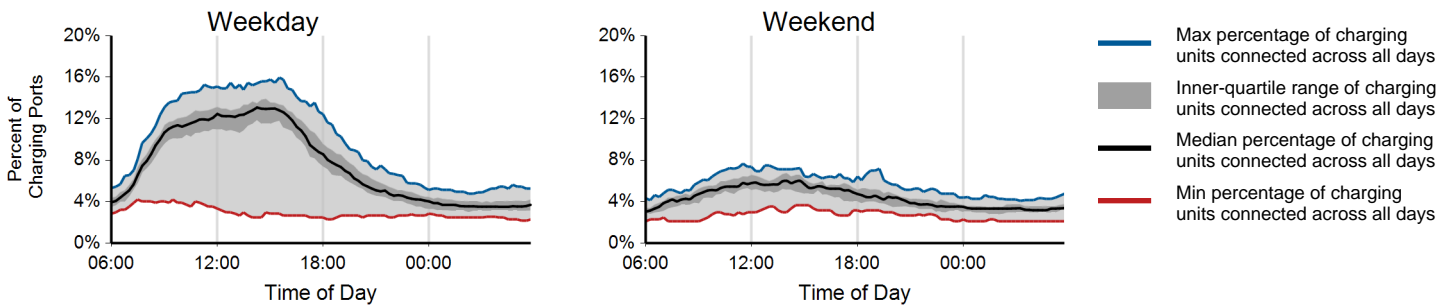
Electricity Consumed



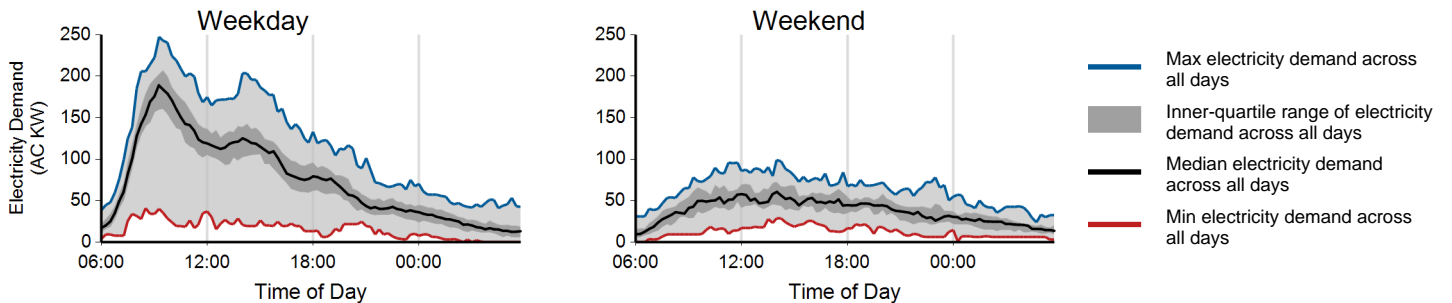
Charging Unit Utilization



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.

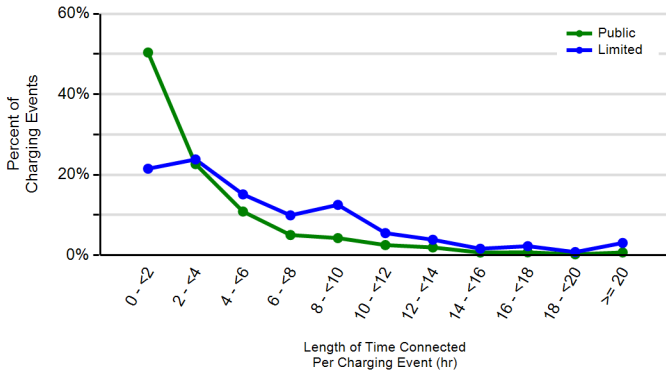
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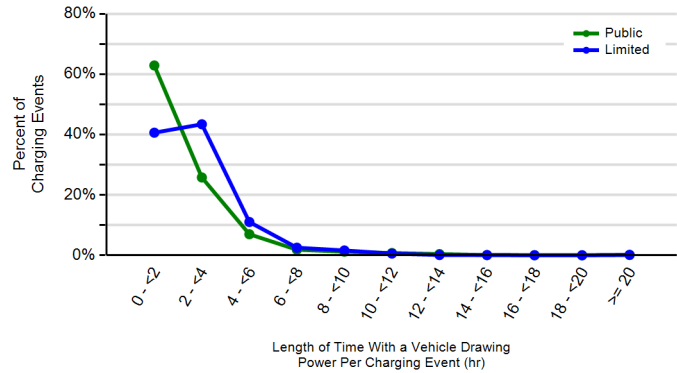
EVSE Usage - By Access Type

	Public	Limited ³
Number of charging ports ¹	338	206
Number of charging events ²	10,494	5,646
Charging energy consumed (AC MWh)	76.8	52.3
Average percent of time with a vehicle connected per charging port	4.7%	9.0%
Average percent of time with a vehicle drawing power per charging port	2.9%	3.3%
Average number of charging events started per charging port per week	2.4	2.1
Average electricity consumed per charging port per week (AC kWh)	17.3	19.5
Average length of time with vehicle connected per charging event (hr)	3.3	7.1
Average length of time with vehicle drawing power per charging event (hr)	2.0	2.7
Average electricity consumed per charging event (AC kWh)	7.3	9.3

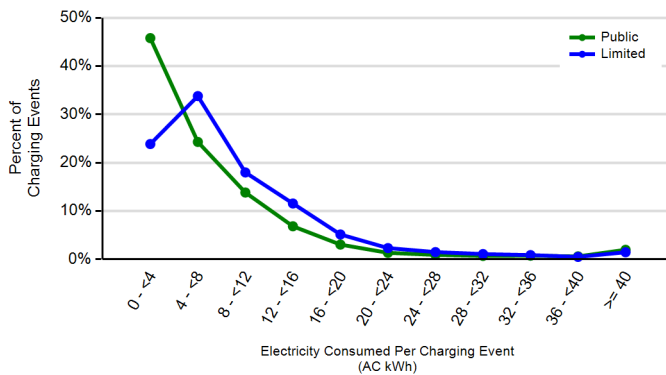
Distribution of Length of Time with a Vehicle Connected per Charging Event



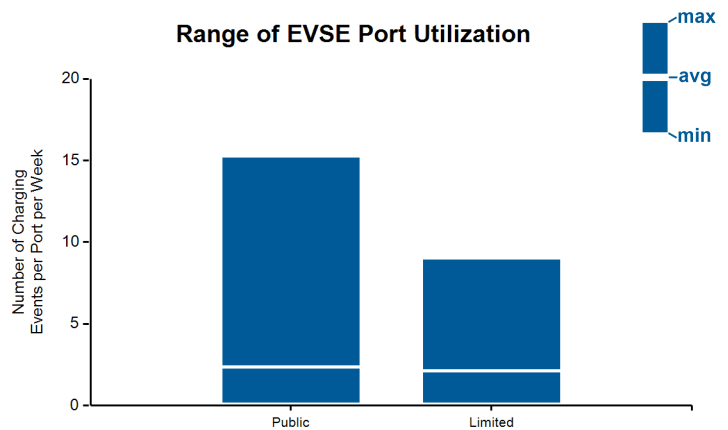
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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.

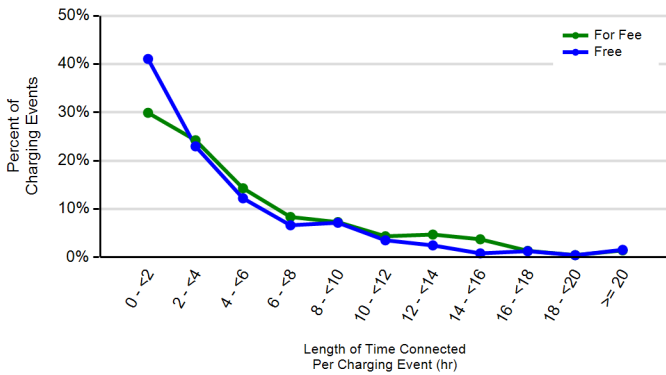
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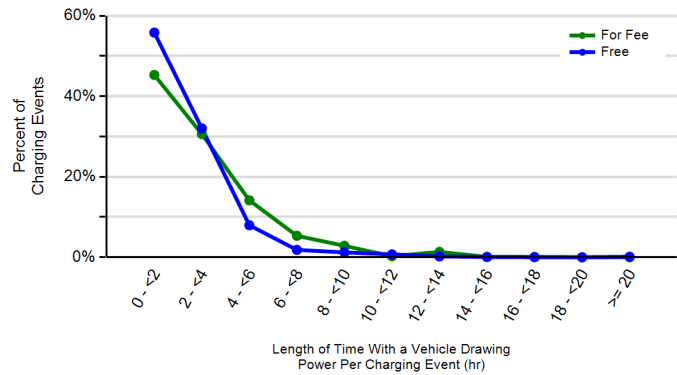
EVSE Usage - By Required Payment

	For Fee	Free
Number of charging ports ¹	67	477
Number of charging events ²	1,127	15,013
Charging energy consumed (AC MWh)	12.3	116.8
Average percent of time with a vehicle connected per charging port	4.1%	6.6%
Average percent of time with a vehicle drawing power per charging port	2.2%	3.2%
Average number of charging events started per charging port per week	1.3	2.4
Average electricity consumed per charging port per week (AC KWh)	14.1	18.7
Average length of time with vehicle connected per charging event (hr)	5.4	4.6
Average length of time with vehicle drawing power per charging event (hr)	2.9	2.2
Average electricity consumed per charging event (AC kWh)	10.9	7.8

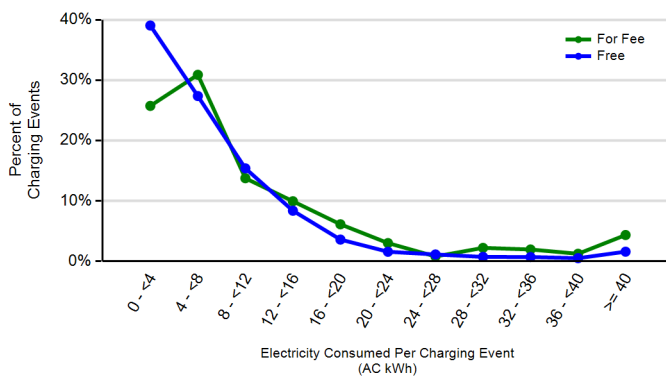
Distribution of Length of Time with a Vehicle Connected per Charging Event



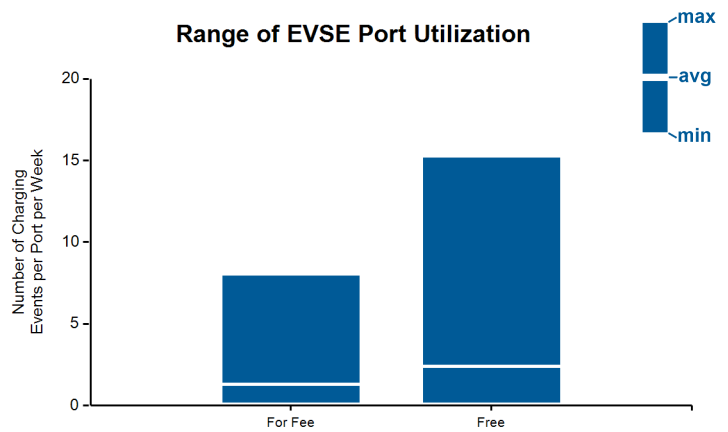
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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.

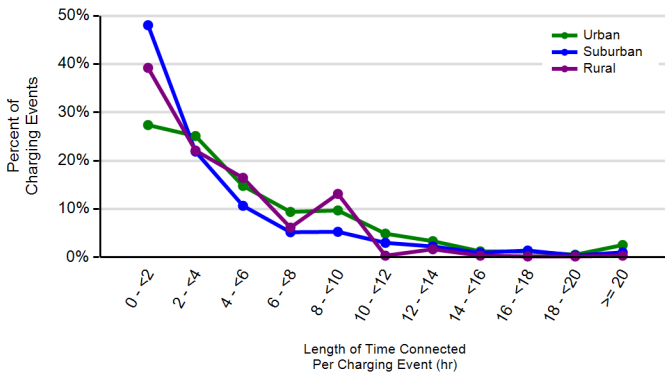
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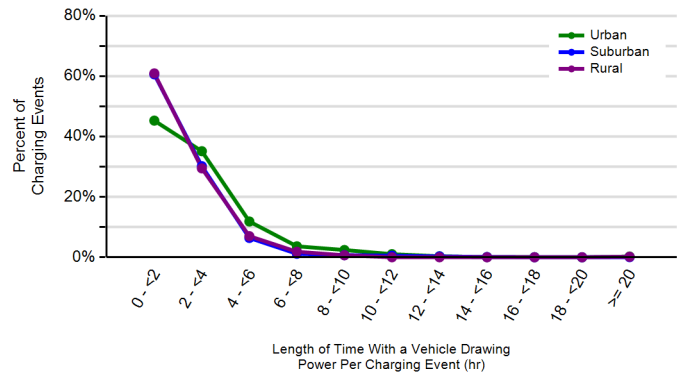
EVSE Usage - By Land Use Type

	Urban	Suburban	Rural
Number of charging ports ¹	195	307	42
Number of charging events ²	5,810	9,728	602
Charging energy consumed (AC MWh)	60.8	64.0	4.4
Average percent of time with a vehicle connected per charging port	7.6%	6.0%	2.5%
Average percent of time with a vehicle drawing power per charging port	3.8%	2.8%	1.3%
Average number of charging events started per charging port per week	2.3	2.4	1.1
Average electricity consumed per charging port per week (AC kWh)	23.9	15.9	8.0
Average length of time with vehicle connected per charging event (hr)	5.6	4.2	3.8
Average length of time with vehicle drawing power per charging event (hr)	2.8	2.0	2.0
Average electricity consumed per charging event (AC kWh)	10.5	6.6	7.3

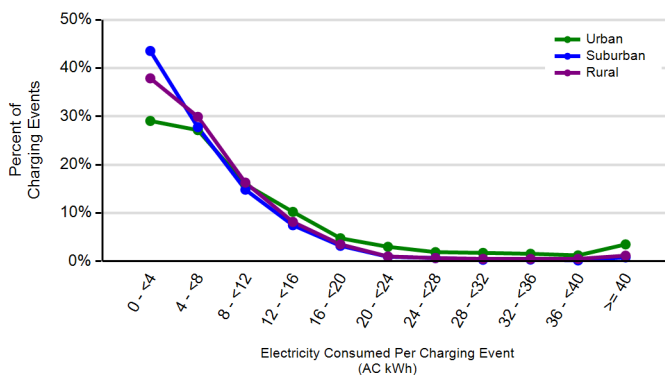
Distribution of Length of Time with a Vehicle Connected per Charging Event



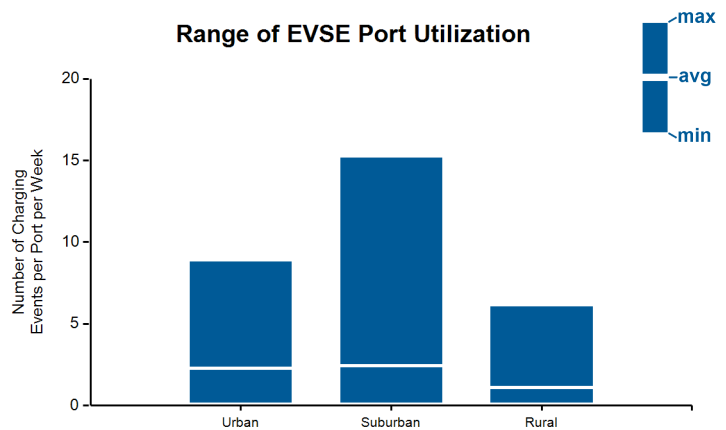
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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.

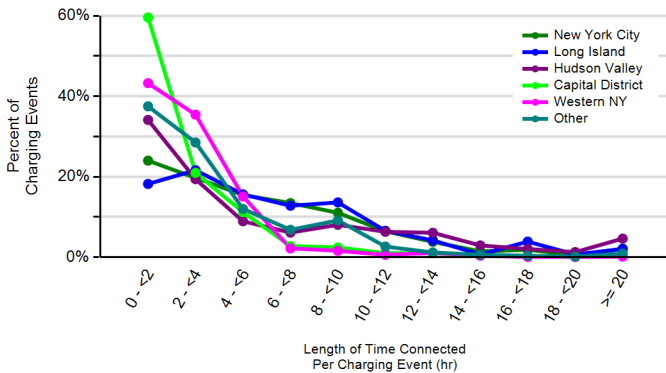
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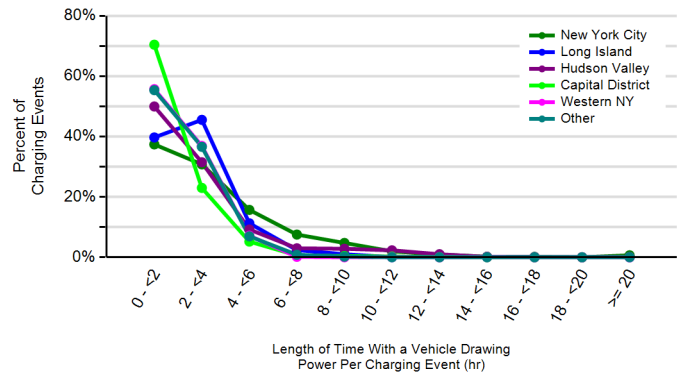
EVSE Usage - By Region

	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	97	73	103	113	22	41	10	26	48	11
Number of charging events ²	1,983	2,312	2,480	4,729	397	2,003	97	533	1,304	302
Charging energy consumed (AC MWh)	28.9	22.1	22.1	25.6	2.1	14.6	0.6	2.8	8.5	1.9
Average percent of time with a vehicle connected per charging port	5.8%	10.6%	8.1%	4.6%	2.8%	10.3%	1.2%	1.9%	3.5%	2.7%
Average percent of time with a vehicle drawing power per charging port	3.4%	3.6%	3.0%	3.0%	1.4%	4.8%	0.8%	1.5%	2.5%	2.2%
Average number of charging events started per charging port per week	1.6	2.4	1.8	3.2	1.4	3.7	0.7	1.6	2.1	2.2
Average electricity consumed per charging port per week (AC kWh)	23.0	23.1	16.3	17.3	7.2	27.1	4.9	8.2	13.4	13.6
Average length of time with vehicle connected per charging event (hr)	6.1	7.3	7.5	2.4	3.4	4.7	2.7	2.1	2.8	2.1
Average length of time with vehicle drawing power per charging event (hr)	3.6	2.5	2.8	1.6	1.7	2.2	1.9	1.6	2.0	1.7
Average electricity consumed per charging event (AC kWh)	14.6	9.6	8.9	5.4	5.3	7.3	6.6	5.2	6.5	6.2

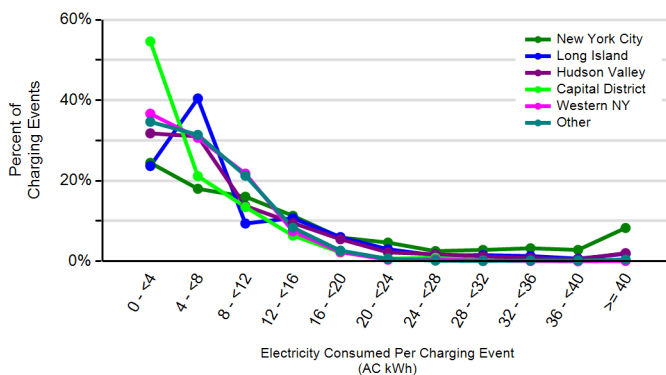
Distribution of Length of Time with a Vehicle Connected per Charging Event⁴



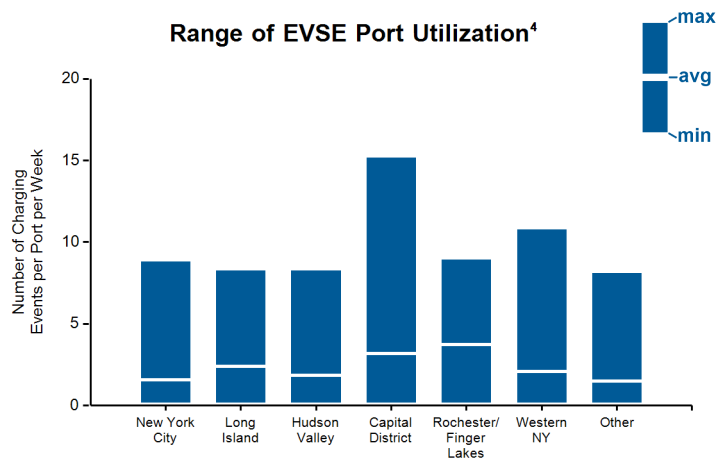
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event⁴



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'.

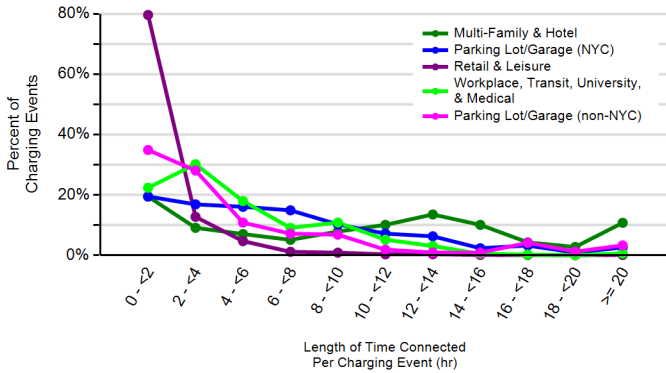
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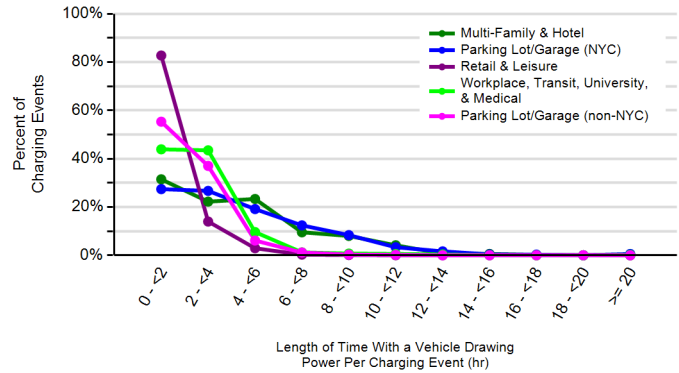
EVSE Usage - By Venue

	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	90	68	86	77	19	31	112	23	38
Number of charging events ²	2,871	1,115	3,978	1,638	492	233	4,664	539	610
Charging energy consumed (AC MWh)	19.5	22.2	14.4	13.0	7.9	2.9	40.1	4.2	4.9
Average percent of time with a vehicle connected per charging port	9.3%	5.2%	2.6%	4.6%	16.1%	2.2%	9.3%	3.2%	4.8%
Average percent of time with a vehicle drawing power per charging port	3.0%	3.3%	2.2%	2.5%	5.0%	1.3%	4.6%	2.1%	2.4%
Average number of charging events started per charging port per week	2.4	1.3	3.6	1.6	2.0	0.6	3.2	1.8	1.2
Average electricity consumed per charging port per week (AC kWh)	16.6	24.9	12.9	13.0	31.8	7.1	27.3	13.9	9.8
Average length of time with vehicle connected per charging event (hr)	6.4	7.0	1.2	4.7	13.8	6.3	4.9	3.0	6.7
Average length of time with vehicle drawing power per charging event (hr)	2.0	4.5	1.0	2.6	4.2	3.9	2.4	2.0	3.3
Average electricity consumed per charging event (AC kWh)	6.8	19.9	3.6	7.9	16.1	12.4	8.6	7.8	8.0

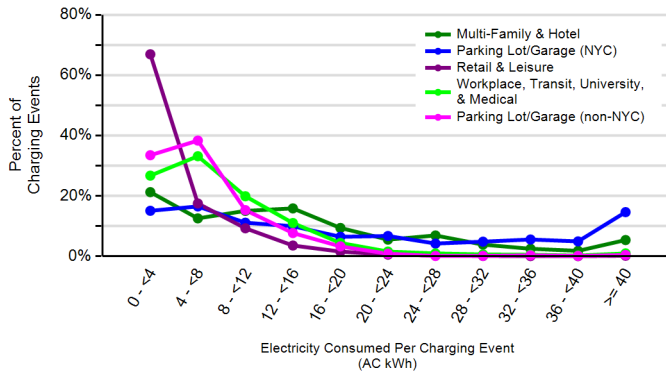
Distribution of Length of Time with a Vehicle Connected per Charging Event



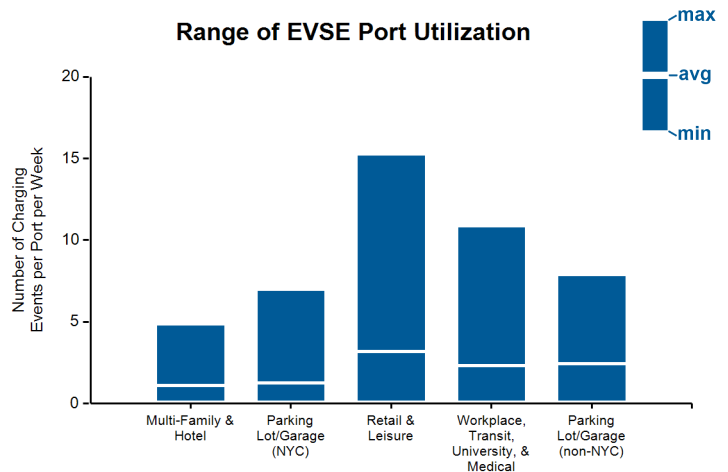
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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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