



**NYSDERDA**

# New York State Electric Vehicle Charging Station Quarterly Report

Report Period October through December 2015

**Final Report**



New York State Energy Research and Development Authority

February 2016

## **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.

# **New York State Electric Vehicle Charging Station Quarterly Report**

**Report Period October through December 2015**

*Final Report*

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February 2016

## Notice

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# 1 Introduction

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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 the New York State. These installations support Governor Andrew M. Cuomo's ChargeNY 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 has supported the installation of over 600 charging ports (bringing the statewide total to more than 1,200), revised regulations to clarify charging station ownership rules, and supported research and demonstration projects on new EV technologies and policies.

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

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The NYSERDA Electric Vehicle Charging Infrastructure Report in Appendix A summarizes the usage of EVSE that were 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 NYSERDA 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 may not necessarily be 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 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 New York State. Public charging stations that were 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 requirements provided by 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 with a vehicle drawing power is significantly less than the average time a vehicle is connected, then the EV is occupying the station longer than necessary, and should be moved to allow other EVs to charge. Site owners can use all of these metrics to help decide whether installing EVSE is a good investment (directly or indirectly). These results also provide insights into whether or not to charge EV drivers for using the station, and if charging, the most appropriate fee structure to use (fees can be set by session, time, or energy consumed).

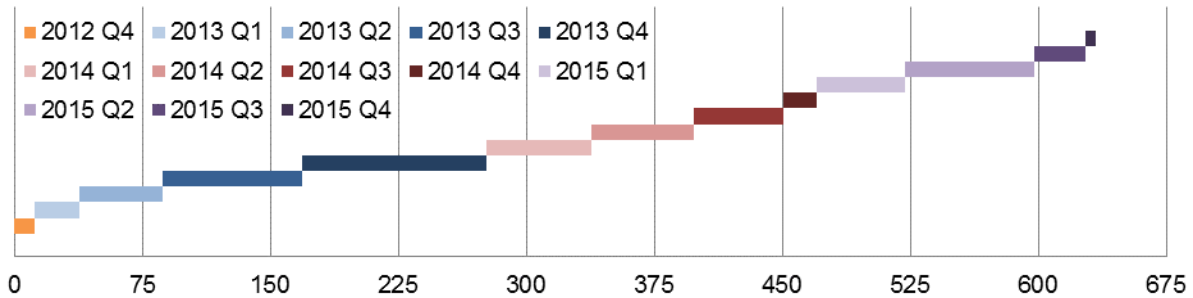
The three line charts on the last five pages of Appendix A display the **differences in length of time a vehicle is connected, differences in length of time a vehicle is drawing power, and differences in energy consumed** to show variations in charging behavior within the EVSE groups (e.g., a large portion 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 September 2015, the NYSERDA EV Charging Station Program funded the installation of 634 charging ports, 6 of which were installed during the last quarter.

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



On average, an electric vehicle was connected to these charging stations 5.5% of the time in the past quarter, a 17% increase from the previous quarter. Table 1 and Table 2 show the data results by subset for the percentage of time with a vehicle connected for the average this quarter and change from last quarter (highest results are highlighted in green).

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

Access Type	2015 Q4 Average	Change from 2015 Q3	Payment	2015 Q4 Average	Change from 2015 Q3	Land Use	2015 Q4 Average	Change from 2015 Q3
Limited	7.1%	18%	Free	6.0%	20%	Urban	7.6%	29%
Public	4.7%	18%	For Fee	2.5%	-4%	Suburban	4.6%	10%
						Rural	3.3%	50%

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

Region	2015 Q4 Average	Change from 2015 Q3	Venue	2015 Q4 Average	Change from 2015 Q3
Long Island	9.4%	38%	University/Medical	10.2%	38%
Finger Lakes	7.8%	-1%	Multi-Family	7.2%	-10%
New York City	6.3%	50%	Parking (non-NYC)	7.0%	6%
Capital District	5.3%	2%	Parking (NYC)	5.1%	31%
Hudson Valley	4.2%	0%	Workplace	4.3%	-2%
Western NY	3.9%	30%	Transit	2.9%	53%
Central NY	2.3%	35%	Leisure Destination	2.6%	-24%
North Country	2.3%	21%	Retail Location	2.4%	9%
			Hotel	1.0%	-29%

The highest utilization of charging ports occurs during weekdays from 9 a.m. to 4 p.m., which suggests that most EV drivers are plugging in to these stations while at work. The collective electricity demand for all charging stations installed through the NYSERDA EV Charging Station Program has a significant peak at the beginning of this period (9 a.m.) when those EVs need to charge their batteries, but it falls off quite quickly, indicating that only a few hours of charging at level 2 are needed to fully recharge the vehicle's battery after the morning commute.

Limited access stations are occupied much longer per charge event than public access stations (6.1 hours per charging event as compared to 3.5), but the average length of time a vehicle actually draws power from the charging port is fairly similar (2.3 hours per charge event for limited access stations as compared to 1.8 hours for public access stations).

Free charging stations experience three times as many charging events per week as "for fee" stations, which leads to a higher percentage of time a vehicle is plugged in at these stations. However, EVs that do connect to a station with a fee stay connected longer and draw more electricity per charge event.

In regards to the average percentage of time a vehicle is connected or drawing power per charging port, charging stations in urban setting see the highest amount of time in use, followed by those in suburban settings, then those in rural settings. However, both urban and rural settings experience a wider range in length for charging stations, while the majority of charging events in suburban settings are short durations.

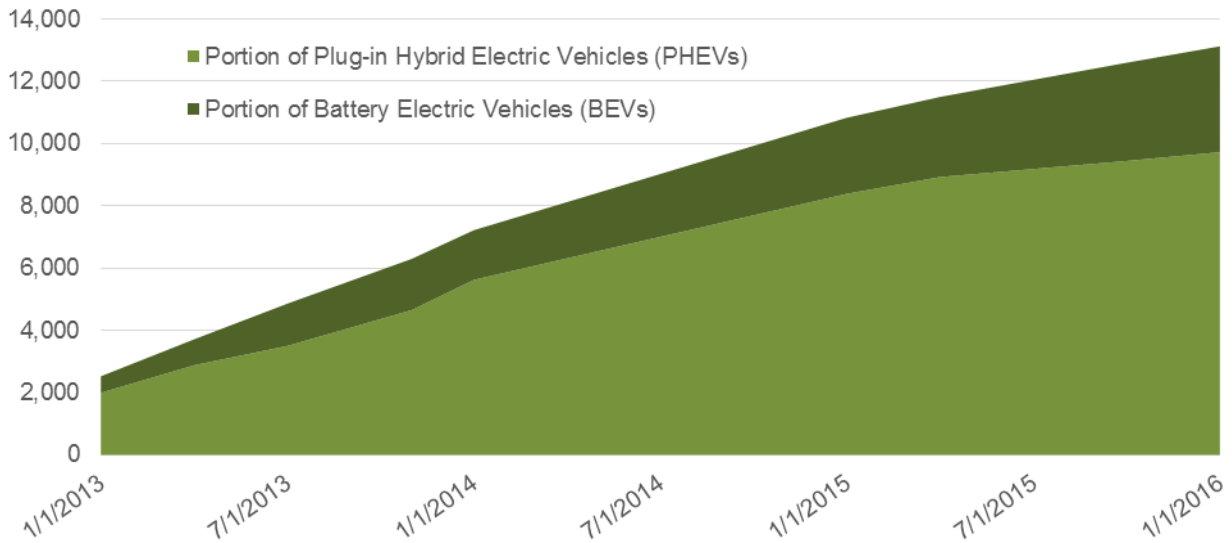
Charging stations in Long Island experienced a significant increase in their occupancy rate since the previous quarter to beat out the Finger Lakes Region (which includes Rochester) for the first time since these analyses started for the NYSERDA EV Charging Station Program. This high occupancy rate is due to a longer average time that a vehicle is plugged in per charge event. The Finger Lakes Region, Capital District, and Western New York stations have more charge events per week than those in Long Island, but the average duration of each event is much shorter.

Charging stations at universities or medical campuses have the highest occupancy rate due to a high average of charging events per week (3.1) and a longer average length of time each vehicle is connected per charge event (5.6 hours). Retail locations have a high average of charging events per week (3.5), but much shorter connection durations (1.2 hours). On the other hand, EVs stayed plugged in to stations at New York City garages and multi-family locations longer than at universities or medical campuses (10.9 and 10.7 hours respectfully), but their average number of charge events per week is much lower (0.8 and 1.1) so their overall occupancy also lower.

# 4 Analysis of EV Registrations in New York State

The figures in this section show the results of analyzing EV registration data from the New York State Department of Motor Vehicles as of December 31, 2015 over time, by model, and by location.

**Figure 2. Total Registered EVs in New York State**



**Figure 3. Battery Electric Vehicles in New York State**

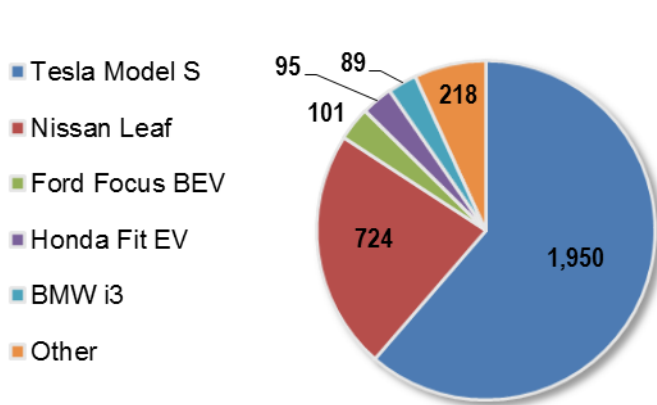
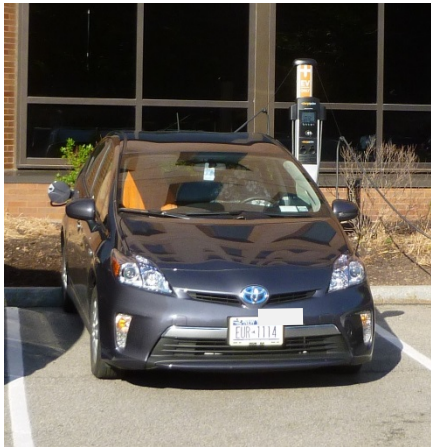
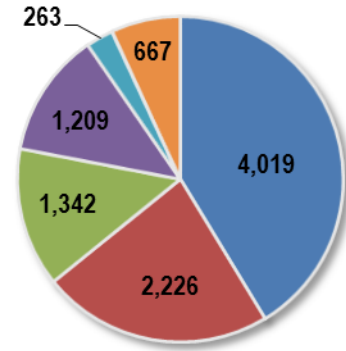


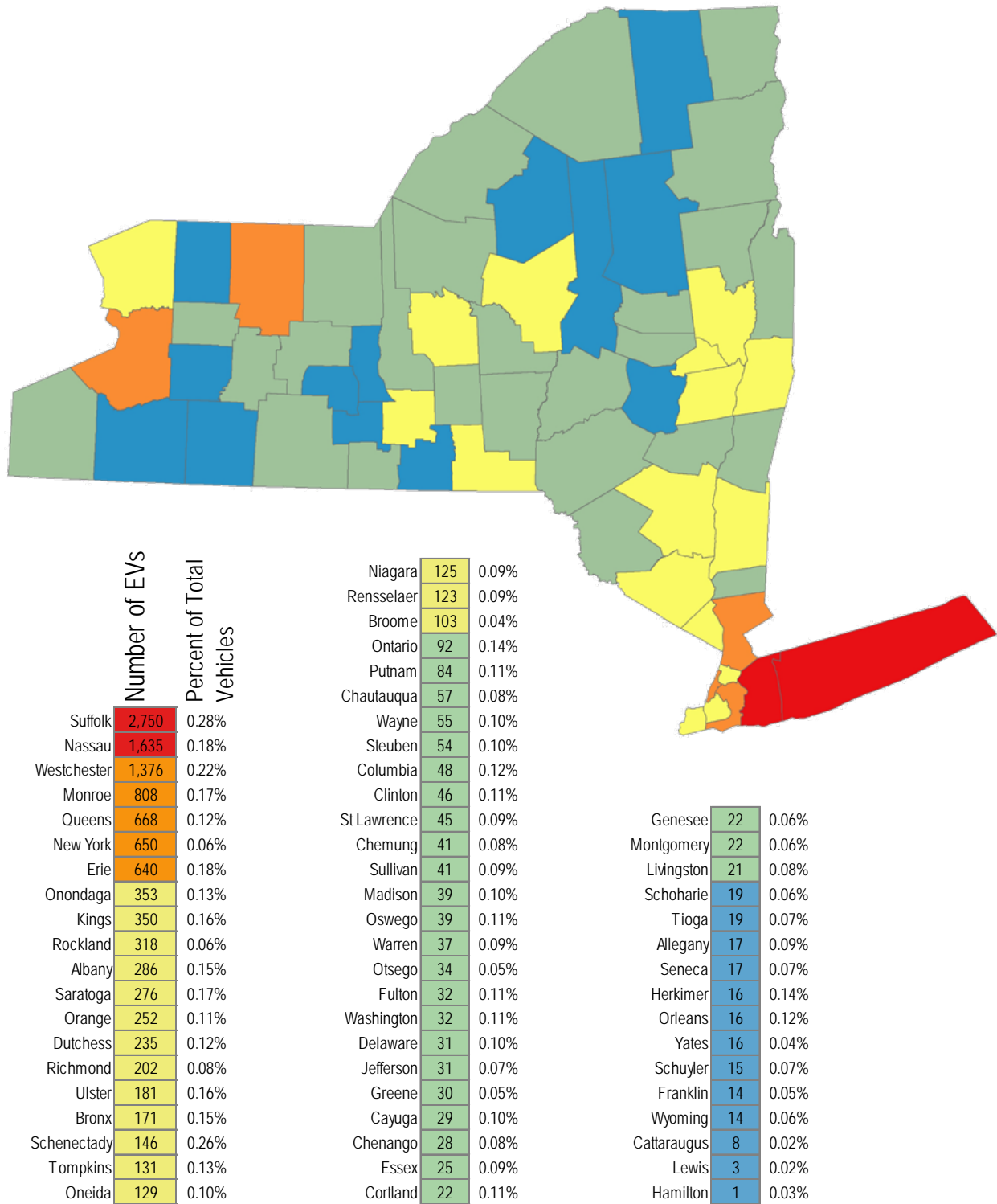
Figure 4. Plug-in Hybrid Electric Vehicles in New York State



- Toyota Prius Plug-in
- Chevrolet Volt
- Ford Fusion Energi
- Ford C-MAX Energi SEL
- BMW i3 REx
- Other



**Figure 5. Number and Percentage of EVs per New York State County**



# **Appendix A: NYSERDA Electric Vehicle Charging Infrastructure Report**

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# NYSERDA Electric Vehicle Charging Infrastructure Report

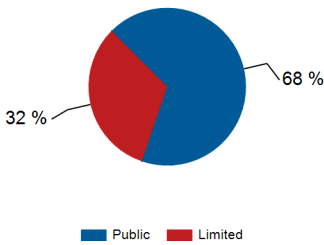
Report period: October 2015 through December 2015

New York State

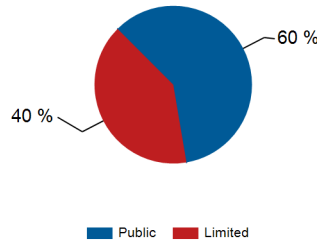
## EVSE Usage - By Access Type

	Public	Limited <sup>3</sup>	Total
Number of charging ports <sup>1</sup>	320	171	491
Number of charging events <sup>2</sup>	9,299	4,426	13,725
Electricity consumed (AC MWh)	56.23	37.78	94.01
Percent of time with a vehicle connected	4.7%	7.1%	5.5%
Percent of time with a vehicle drawing power	2.4%	2.7%	2.5%

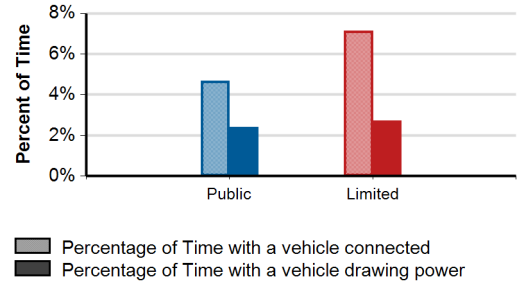
Number of Charging Events



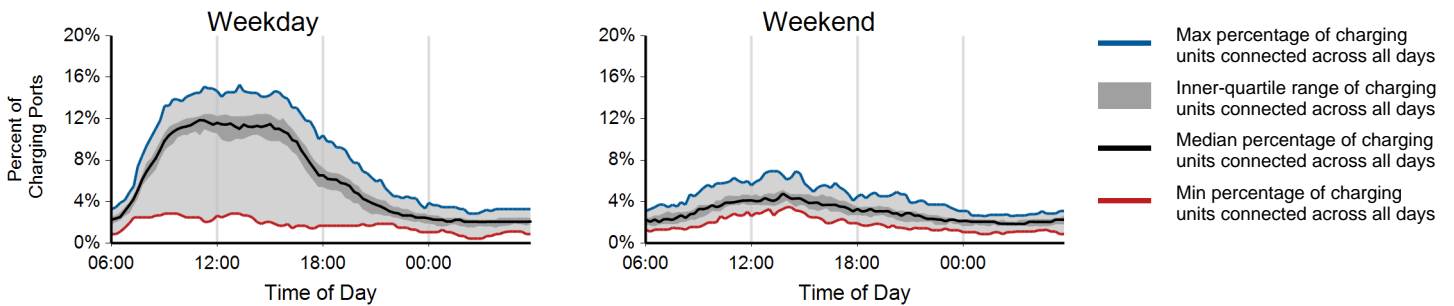
Electricity Consumed



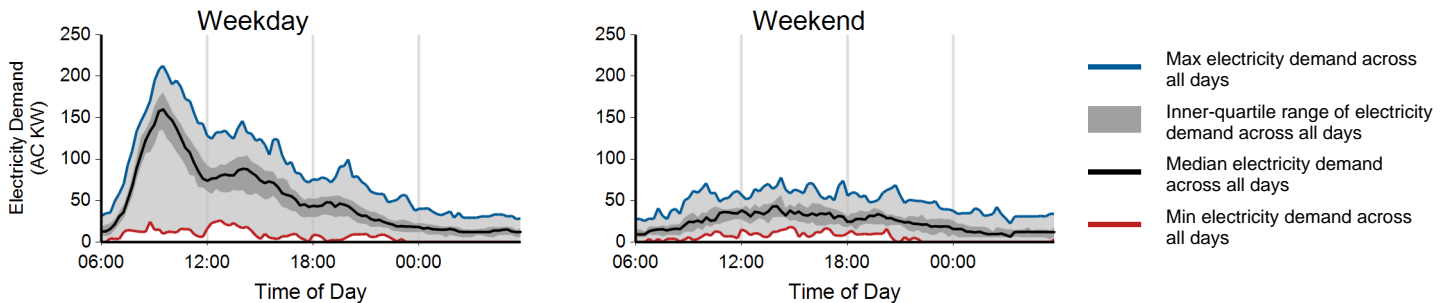
Charging Unit Utilization



## Charging Availability: Range of Percentage of All Charging Ports with a Vehicle Connected versus Time of Day<sup>4</sup>



## Charging Demand: Range of Aggregate Electricity Demand versus Time of Day<sup>4</sup> for All Charging Ports



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

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

<sup>3</sup> 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.

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

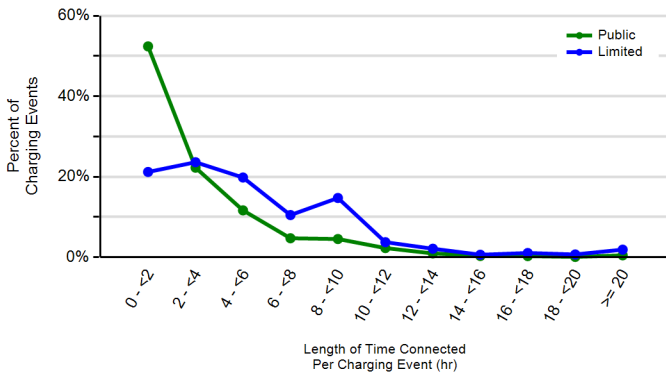
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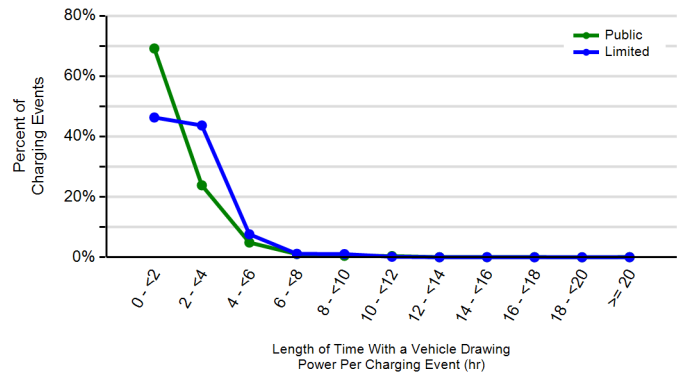
## EVSE Usage - By Access Type

	Public	Limited <sup>3</sup>
Number of charging ports <sup>1</sup>	320	171
Number of charging events <sup>2</sup>	9,299	4,426
Charging energy consumed (AC MWh)	56.2	37.8
Average percent of time with a vehicle connected per charging port	4.7%	7.1%
Average percent of time with a vehicle drawing power per charging port	2.4%	2.7%
Average number of charging events started per charging port per week	2.3	2.0
Average electricity consumed per charging port per week (AC kWh)	13.6	16.9
Average length of time with vehicle connected per charging event (hr)	3.5	6.1
Average length of time with vehicle drawing power per charging event (hr)	1.8	2.3
Average electricity consumed per charging event (AC kWh)	6.0	8.5

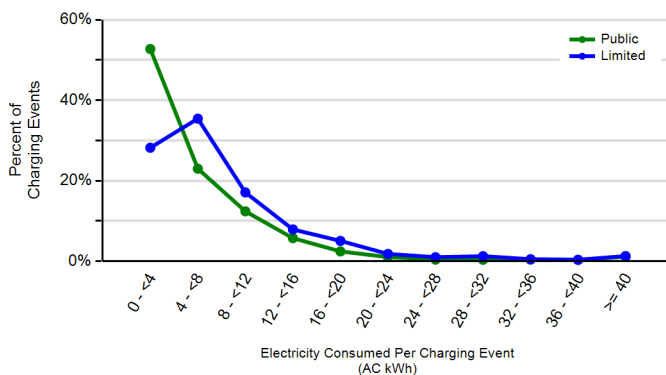
**Distribution of Length of Time with a Vehicle Connected per Charging Event**



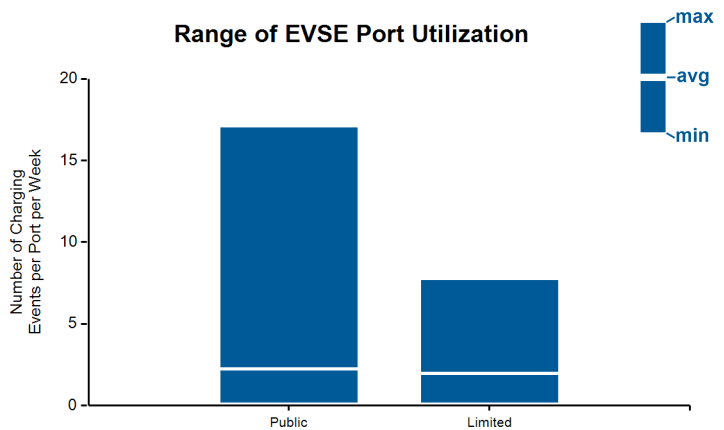
**Distribution of Length of Time with a Vehicle Drawing Power per Charging Event**



**Distribution of AC Energy Consumed per Charging Event**



**Range of EVSE Port Utilization**



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

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

<sup>3</sup> 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.



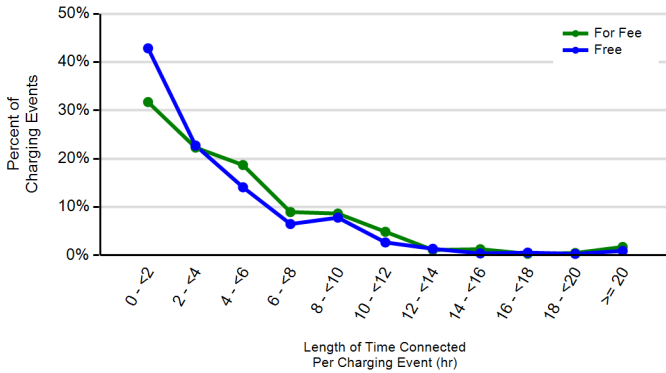
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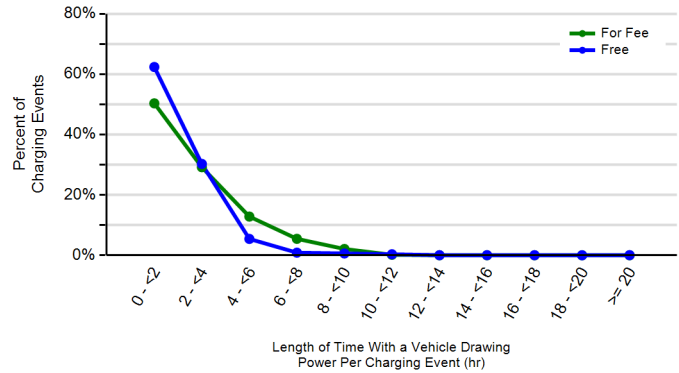
## EVSE Usage - By Required Payment

	For Fee	Free
Number of charging ports <sup>1</sup>	66	425
Number of charging events <sup>2</sup>	637	13,088
Charging energy consumed (AC MWh)	7.2	86.8
Average percent of time with a vehicle connected per charging port	2.5%	6.0%
Average percent of time with a vehicle drawing power per charging port	1.1%	2.7%
Average number of charging events started per charging port per week	0.8	2.4
Average electricity consumed per charging port per week (AC KWh)	8.5	15.8
Average length of time with vehicle connected per charging event (hr)	5.7	4.3
Average length of time with vehicle drawing power per charging event (hr)	2.5	1.9
Average electricity consumed per charging event (AC kWh)	11.3	6.6

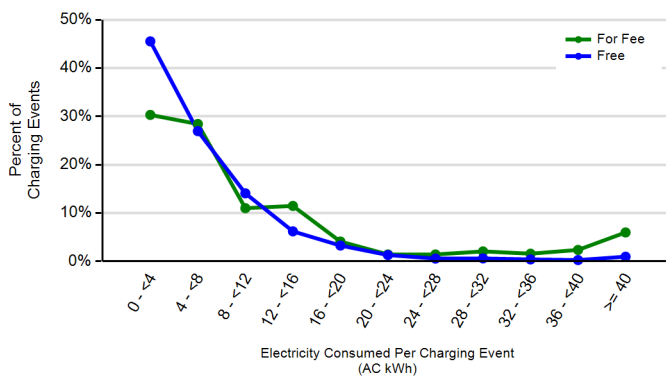
**Distribution of Length of Time with a Vehicle Connected per Charging Event**



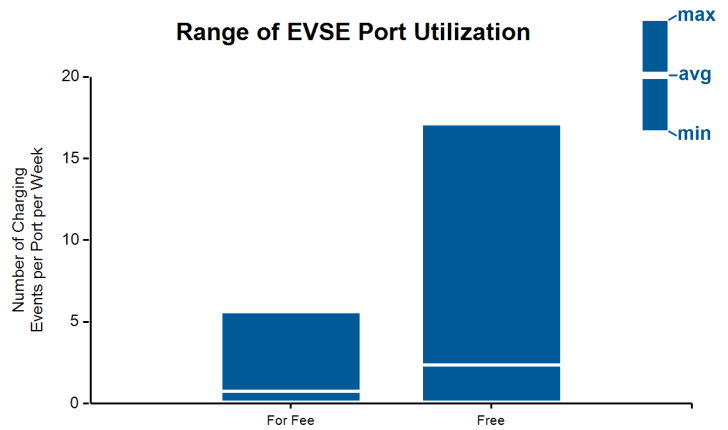
**Distribution of Length of Time with a Vehicle Drawing Power per Charging Event**



**Distribution of AC Energy Consumed per Charging Event**



**Range of EVSE Port Utilization**



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

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

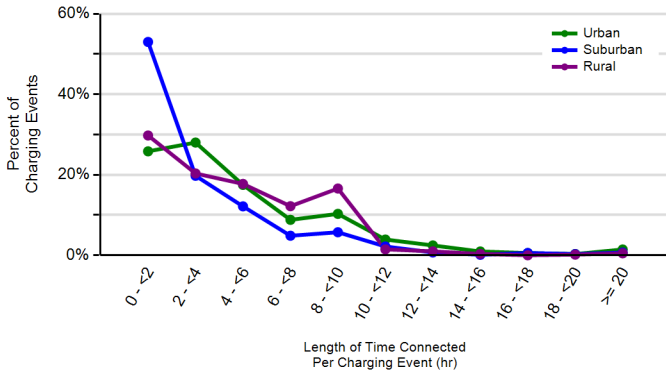
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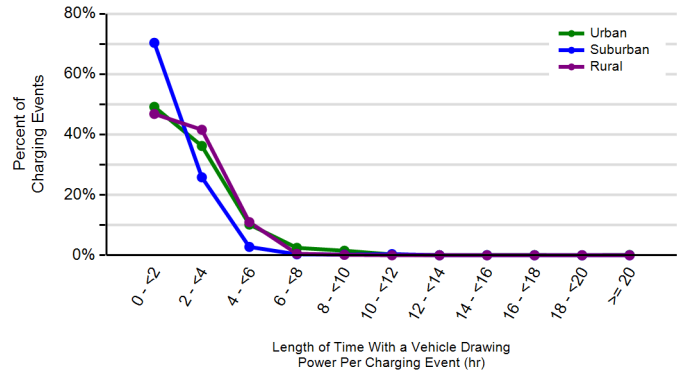
## EVSE Usage - By Land Use Type

	Urban	Suburban	Rural
Number of charging ports <sup>1</sup>	172	280	39
Number of charging events <sup>2</sup>	4,861	8,249	615
Charging energy consumed (AC MWh)	45.9	43.5	4.7
Average percent of time with a vehicle connected per charging port	7.6%	4.6%	3.3%
Average percent of time with a vehicle drawing power per charging port	3.3%	2.1%	1.6%
Average number of charging events started per charging port per week	2.2	2.3	1.2
Average electricity consumed per charging port per week (AC kWh)	20.5	12.0	9.3
Average length of time with vehicle connected per charging event (hr)	5.8	3.4	4.5
Average length of time with vehicle drawing power per charging event (hr)	2.6	1.6	2.3
Average electricity consumed per charging event (AC kWh)	9.4	5.3	7.6

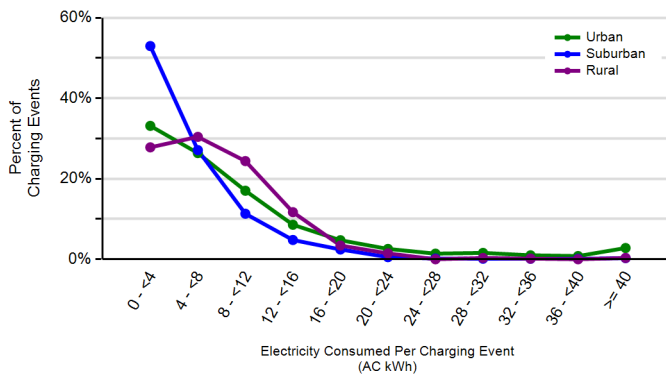
**Distribution of Length of Time with a Vehicle Connected per Charging Event**



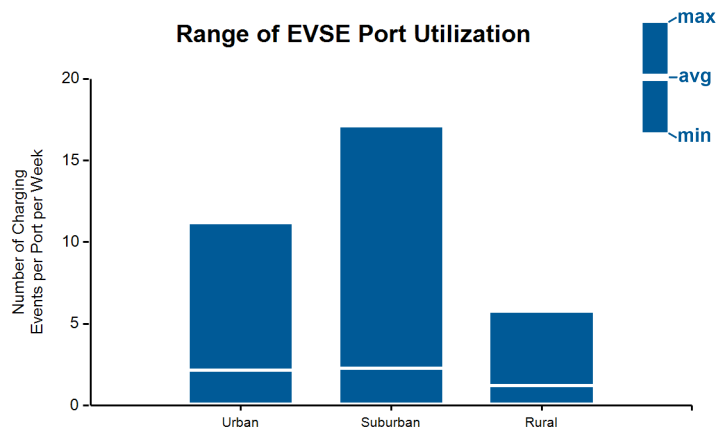
**Distribution of Length of Time with a Vehicle Drawing Power per Charging Event**



**Distribution of AC Energy Consumed per Charging Event**



**Range of EVSE Port Utilization**



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

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

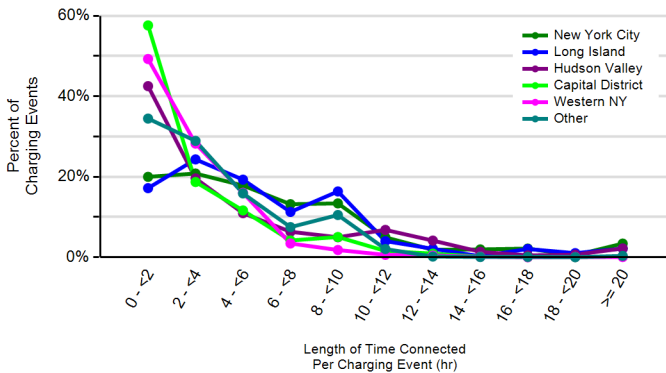
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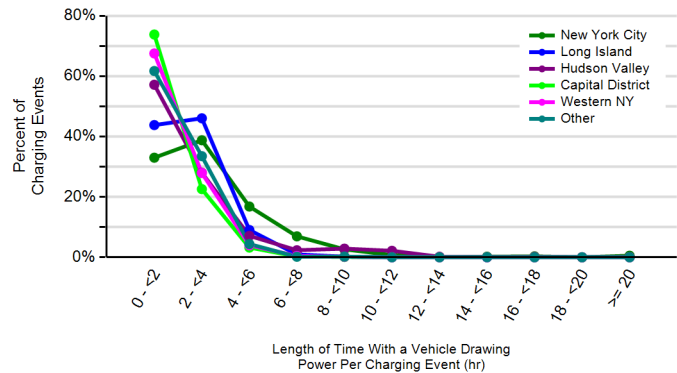
## EVSE Usage - By Region

	New York City	Long Island	Hudson Valley	Capital District	Syracuse/Central NY	Rochester/Finger Lakes	North Country	Western NY	Other <sup>3</sup>
Number of charging ports <sup>1</sup>	77	67	88	105	21	42	23	52	16
Number of charging events <sup>2</sup>	971	1,945	1,689	4,626	300	1,819	469	1,661	245
Charging energy consumed (AC MWh)	13.6	16.3	16.3	22.0	1.7	10.4	2.6	9.4	1.7
Average percent of time with a vehicle connected per charging port	6.3%	9.4%	4.2%	5.3%	2.3%	7.8%	2.3%	3.9%	2.8%
Average percent of time with a vehicle drawing power per charging port	2.3%	3.0%	2.2%	2.8%	1.2%	3.5%	1.5%	2.5%	1.5%
Average number of charging events started per charging port per week	1.0	2.2	1.5	3.4	1.2	3.3	1.6	2.5	1.3
Average electricity consumed per charging port per week (AC kWh)	13.4	18.7	14.3	16.0	6.7	18.9	9.0	14.0	8.7
Average length of time with vehicle connected per charging event (hr)	11.0	7.1	4.8	2.6	3.4	4.0	2.4	2.7	2.1
Average length of time with vehicle drawing power per charging event (hr)	4.1	2.2	2.4	1.4	1.7	1.8	1.5	1.7	3.8
Average electricity consumed per charging event (AC kWh)	14.0	8.4	9.6	4.8	5.8	5.7	5.5	5.7	6.9

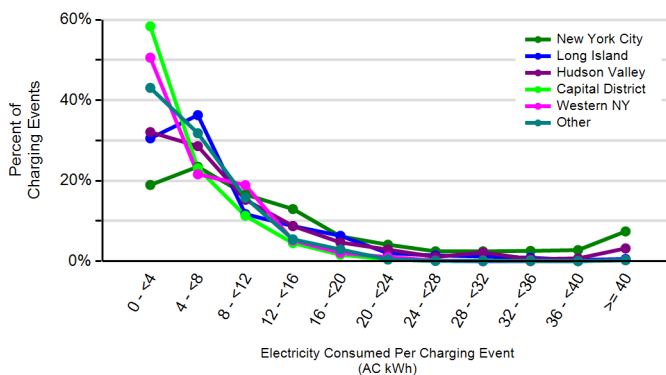
Distribution of Length of Time with a Vehicle Connected per Charging Event<sup>4</sup>



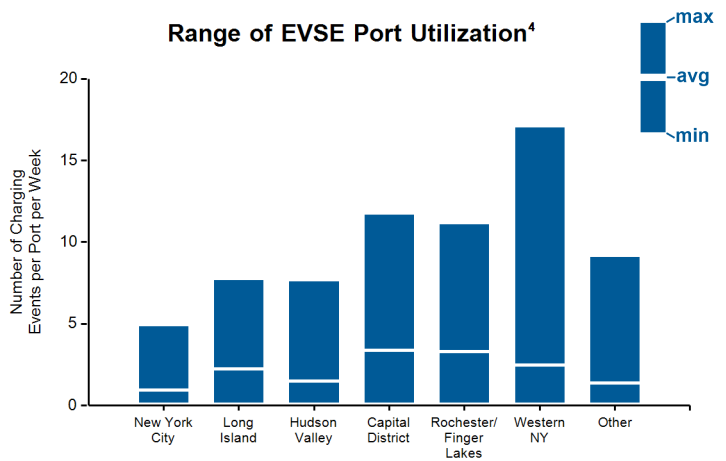
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event<sup>4</sup>



Distribution of AC Energy Consumed per Charging Event<sup>4</sup>



Range of EVSE Port Utilization<sup>4</sup>



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

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

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

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

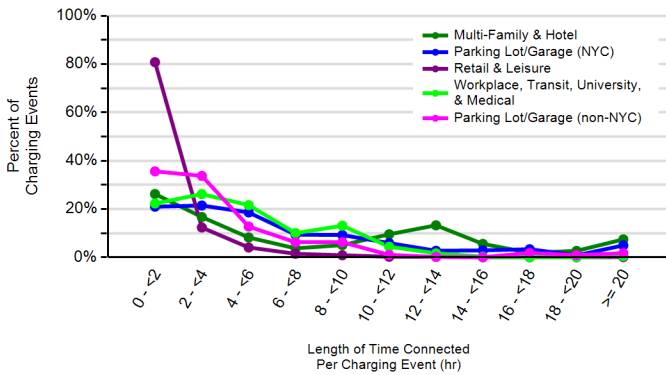
# NYSERDA Electric Vehicle Charging Infrastructure Report

Report period: October 2015 through December 2015

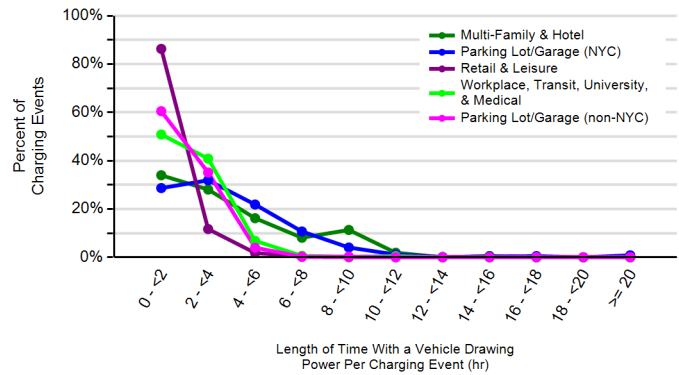
## EVSE Usage - By Venue

	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 <sup>1</sup>	70	61	87	58	16	26	112	21	40
Number of charging events <sup>2</sup>	2,246	630	3,868	1,299	238	140	4,516	317	471
Charging energy consumed (AC MWh)	14.2	11.2	13.4	9.0	5.3	1.6	33.7	2.1	3.4
Average percent of time with a vehicle connected per charging port	7.0%	5.1%	2.4%	4.3%	7.2%	1.0%	10.2%	2.6%	2.9%
Average percent of time with a vehicle drawing power per charging port	2.8%	2.4%	2.0%	2.1%	2.9%	0.7%	4.0%	1.3%	1.4%
Average number of charging events started per charging port per week	2.5	0.8	3.5	1.7	1.1	0.4	3.1	1.2	0.9
Average electricity consumed per charging port per week (AC kWh)	15.8	14.0	12.2	11.8	25.2	4.6	23.0	7.6	6.8
Average length of time with vehicle connected per charging event (hr)	4.7	10.9	1.2	4.2	10.7	4.1	5.6	3.8	5.2
Average length of time with vehicle drawing power per charging event (hr)	1.9	5.1	1.0	2.0	4.3	2.8	2.2	1.8	2.6
Average electricity consumed per charging event (AC kWh)	6.3	17.8	3.5	6.9	22.2	11.3	7.5	6.6	7.3

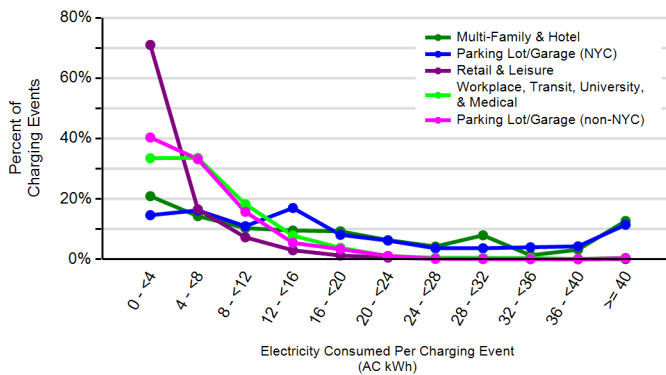
Distribution of Length of Time with a Vehicle Connected per Charging Event



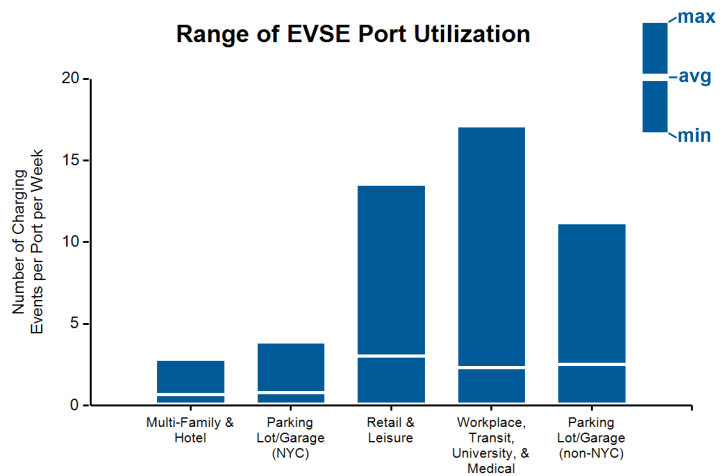
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



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

<sup>2</sup> 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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