



ChargeNY

New York State Electric Vehicle Charging Station Quarterly Report

Report Period April through June 2016

Final Report

New York State Energy Research and Development Authority

September 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 April through June 2016

Final Report

Prepared for:

New York State Energy Research and Development Authority

Albany, NY

Adam Ruder
Project Manager

Prepared by:

Energetics Incorporated

Clinton, NY

and

Idaho National Laboratory

Boise, ID

September 2016

Notice

This report was prepared by Energetics Incorporated and Idaho National Laboratory (hereafter “contractor”) in the course of performing work contracted for and sponsored by the New York State Energy Research and Development Authority (hereafter “NYSERDA”). The opinions expressed in this report do not necessarily reflect those of NYSERDA or the State of New York, and reference to any specific product, service, process, or method does not constitute an implied or expressed recommendation or endorsement of it. Further, NYSERDA, the State of New York, and the contractor make no warranties or representations, expressed or implied, as to the fitness for particular purpose or merchantability of any product, apparatus, or service, or the usefulness, completeness, or accuracy of any processes, methods, or other information contained, described, disclosed, or referred to in this report. NYSERDA, the State of New York, and the contractor make no representation that the use of any product, apparatus, process, method, or other information will not infringe privately owned rights and will assume no liability for any loss, injury, or damage resulting from, or occurring in connection with, the use of information contained, described, disclosed, or referred to in this report.

NYSERDA makes every effort to provide accurate information about copyright owners and related matters in the reports we publish. Contractors are responsible for determining and satisfying copyright or other use restrictions regarding the content of reports that they write, in compliance with NYSERDA’s policies and federal law. If you are the copyright owner and believe a NYSERDA report has not properly attributed your work to you or has used it without permission, please email print@nyserda.ny.gov.

Information contained in this document, such as web page addresses, are current at the time of publication.

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 New York State 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 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 almost 700 charging ports (bringing the statewide total to more than 1,400), 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

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 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 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 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.

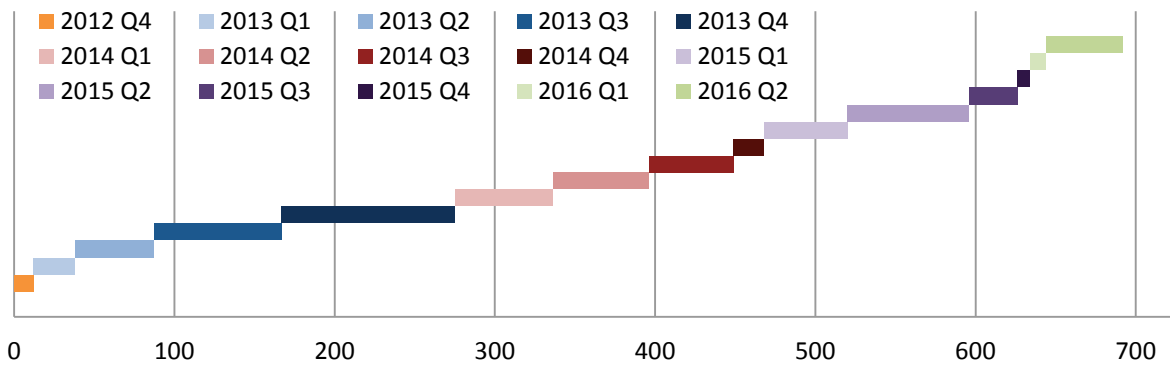
If the average time a vehicle draws power is significantly less than the average time a vehicle is connected, then the EV is occupying the station longer than necessary and should be moved to allow other EVs to charge. Site owners can use all of these metrics to help decide whether installing EVSE is a good investment (directly or indirectly). These results also provide 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 June 2016, the NYSERDA EV Charging Station Program funded the installation of 692 charging ports (506 stations at 299 unique locations). During the last quarter, 48 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 6.9 percent of the time in the past quarter, a five percent 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 Dispersed

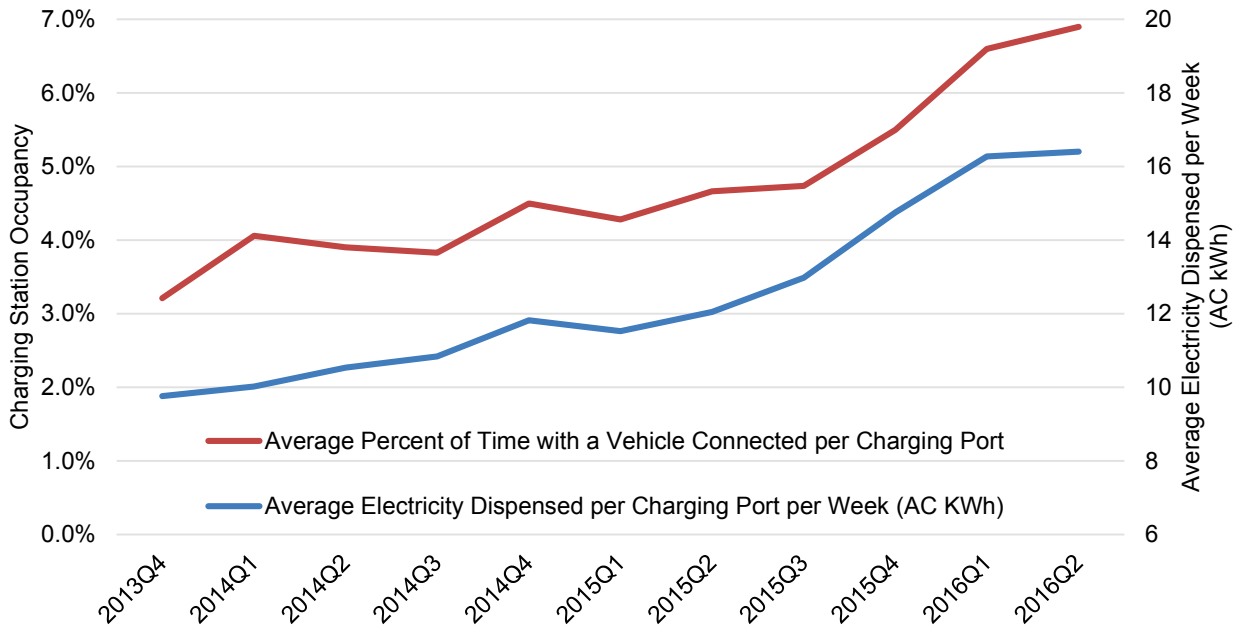


Table 1 and Table 2 show the data results by subset for the percentage of time with a vehicle connected for the average this quarter and change from last quarter (highest results are highlighted in green).

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

Access Type	2016 Q2 Average	Change from 2016 Q1	Payment	2016 Q2 Average	Change from 2016 Q1	Land Use	2016 Q2 Average	Change from 2016 Q1
Limited	9.4%	2%	Free	7.2%	3%	Urban	8.4%	-1%
Public	5.4%	6%	For Fee	4.2%	20%	Suburban	6.5%	12%
						Rural	2.6%	-28%

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

Region	2016 Q2 Average	Change from 2016 Q1	Venue	2016 Q2 Average	Change from 2016 Q1
Long Island	11.0%	-9%	Multi-Family	13.9%	8%
Finger Lakes	9.9%	-1%	University/Medical	10.7%	-12%
Hudson Valley	9.6%	50%	Parking (non-NYC)	9.5%	16%
New York City	6.3%	-2%	Transit	7.4%	64%
Capital District	5.6%	-10%	Parking (NYC)	5.1%	6%
Western NY	3.7%	-8%	Workplace	4.9%	4%
North Country	2.6%	18%	Leisure Destination	3.0%	-6%
Southern Tier	2.6%	18%	Retail Location	2.9%	12%
Central NY	2.2%	-12%	Hotel	1.4%	-7%
Mohawk Valley	0.6%	-33%			

The charging pattern for these NYSEERDA program stations primarily reflects use by EV drivers during working hours. The highest utilization occurs during weekdays between 9 a.m. and 4 p.m. Cumulative peak charging demand occurs at 9 a.m. when many of these EVs connect at the beginning of the workday, but quickly tapers off (most EVs appear to only require a short charging time before reaching full battery capacity). A second, smaller peak in charging demand appears in the early afternoon, potentially when a second worker with an EV gains access to the charging station after the first one is moved mid-way through the day, or a second charge on the first vehicle after using the EV for errands or during lunch time.

Limited access stations are occupied significantly more than public access stations (9.4 percent for limited vs. 5.4 percent for public), because EVs remain plugged into limited access stations (7.3 hours per charge event on average) more than twice as long as public access stations (3.5 hours per charge event). However, the shorter connection times at public access stations allow for more charging events (2.6 charging events started per public access port per week vs. 2.1 for limited access stations) and both types of stations result in the same average percent of time with a vehicle drawing power per charging port at 2.9 percent.

Almost 90 percent of the NYSERDA program stations reporting usage this past quarter did not impose a fee for use. The free stations experience a higher percentage of time occupied and dispensing power, with more than twice as many charging events started per charging port per week (2.6 for free stations vs. 1.2 for stations with a fee). However, EV drivers that use the stations with a fee draw power for a longer period of time which indicates that they were likely relying on this station for a charge when they parked at these locations.

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 electric vehicles and Tesla models in particular which have larger battery packs. 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 (5.8 hours) for EVs to stay connected to charging stations in this setting. The ability for EVs to more easily find and move to another parking space in suburban and rural settings might factor into their shorter connection times per charge event (4.2 hours for suburban settings and 3.6 for rural settings). This also helps free up the station to be used by other EVs and charging stations in suburban settings experienced more charging events started per charging port per week (2.6) than for the urban-based charging stations (2.4).

Charging stations in the Hudson Valley have experienced a second consecutive quarterly increase of 50 percent or greater for the average percent of time with a vehicle connected per charging port to currently stand at 9.6 percent. This is still slightly below Long Island and the Finger Lakes Region (including Rochester) which reported at 11.0 percent and 9.9 percent respectively (although both of these regions saw a decrease in utilization between the first and second quarter of 2016).

Over the past five quarters, the charging station occupancy percentage at transit locations has increased significantly over the previous quarter (the quarterly percentage increases were greater than 50 percent except between the second and third quarters of 2015 when it was 36 percent). The growing popularity for charging EVs at transit locations has boosted them above charging stations used at workplaces and in New York City garages. Charging stations at transit locations are now the fourth most utilized venue (in terms of the percentage of time with a vehicle connected) behind multifamily dwellings, university/medical campuses, and parking lots or garages outside of New York City.

4 Analysis of EV Registrations in New York State

The following graphs show the results of EV registration data analysis as of July 31, 2016 from the NYS Department of Motor Vehicles over time, by model and by location.

Figure 3. Total Registered EVs in New York State

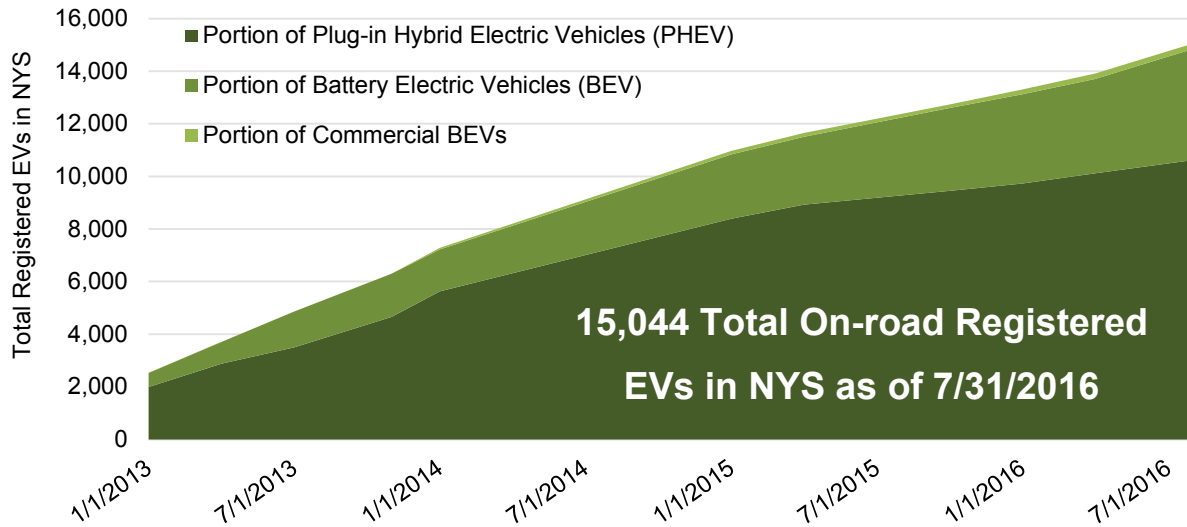


Figure 4. Battery Electric Vehicles in New York State

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

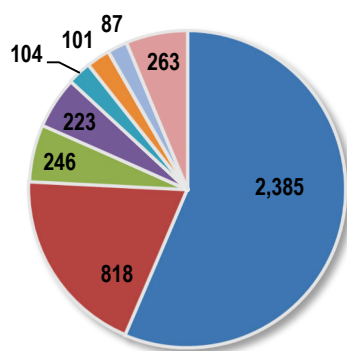
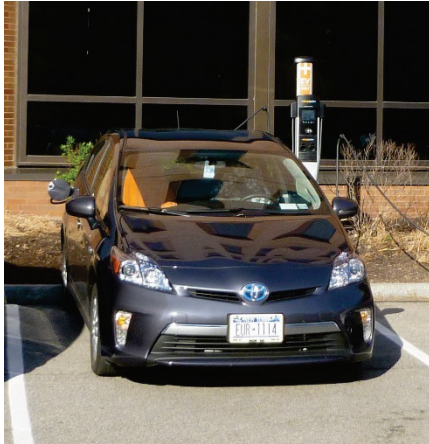


Figure 5. Plug-in Hybrid Electric Vehicles in New York State



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

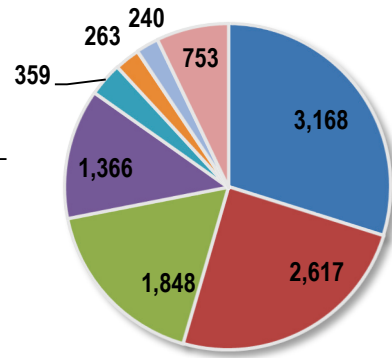
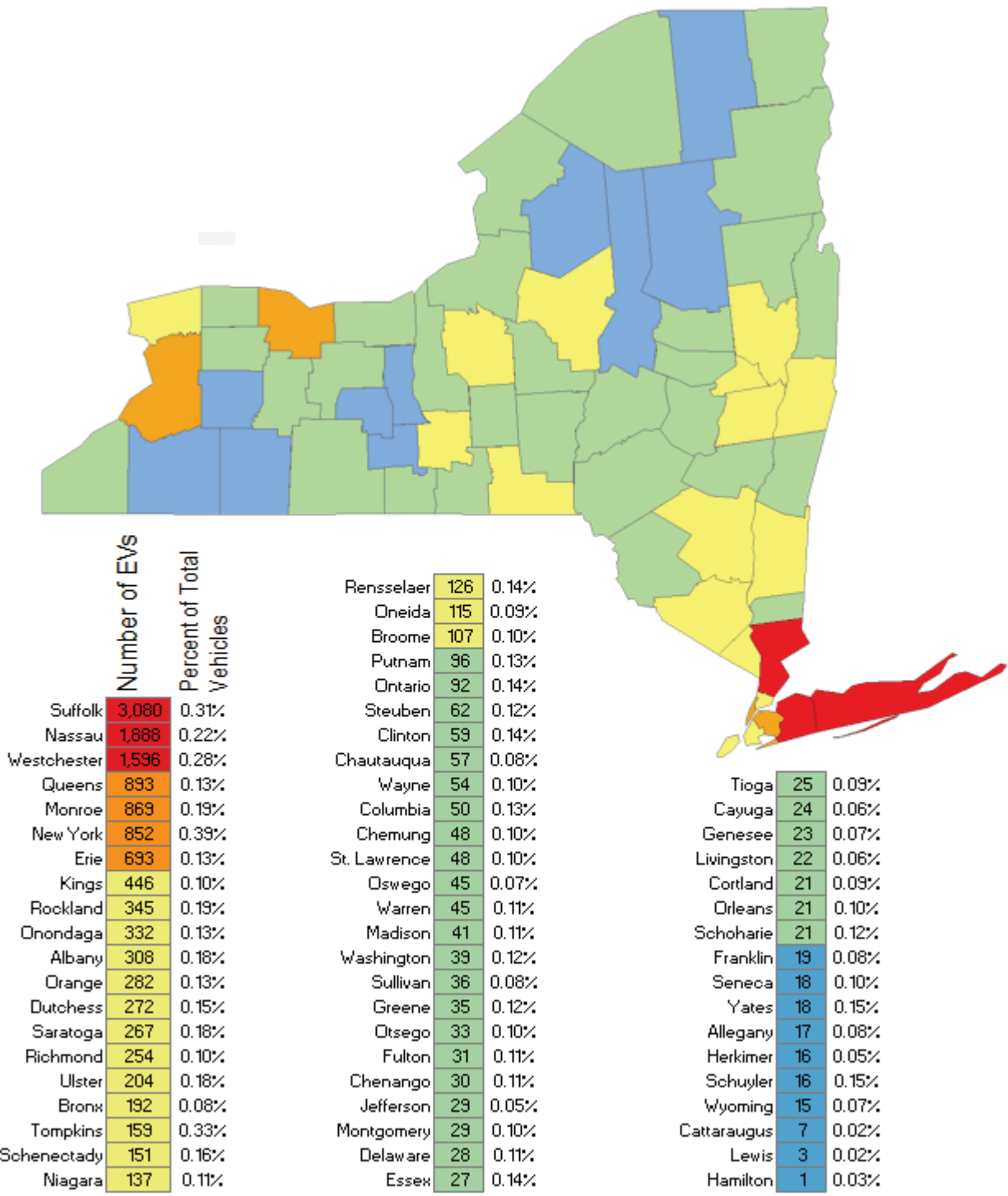


Figure 6. Number and Percentage of EVs among All Registered Vehicles in each New York State County



As of 8/1/2016

Appendix A: NYSERDA Electric Vehicle Charging Infrastructure Report

NYSERDA Electric Vehicle Charging Infrastructure Report

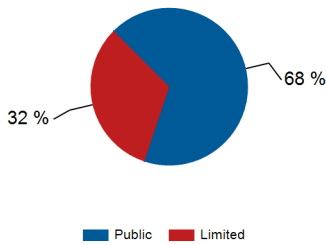
Report period: April 2016 through June 2016

New York State

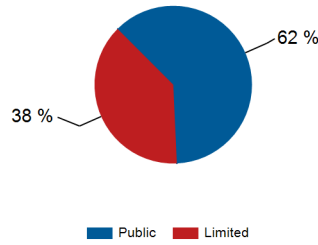
EVSE Usage - By Access Type

	Public	Limited ³	Total
Number of charging ports ¹	321	189	510
Number of charging events ²	10,776	5,157	15,933
Electricity consumed (AC MWh)	66.31	41.04	107.35
Percent of time with a vehicle connected	5.4%	9.4%	6.9%
Percent of time with a vehicle drawing power	2.9%	2.9%	2.9%

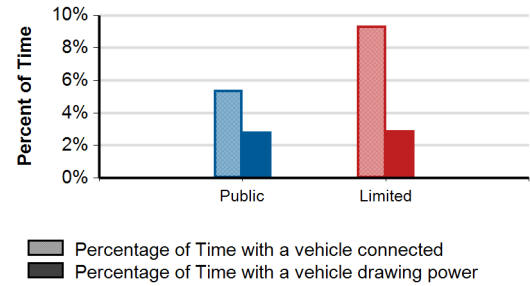
Number of Charging Events



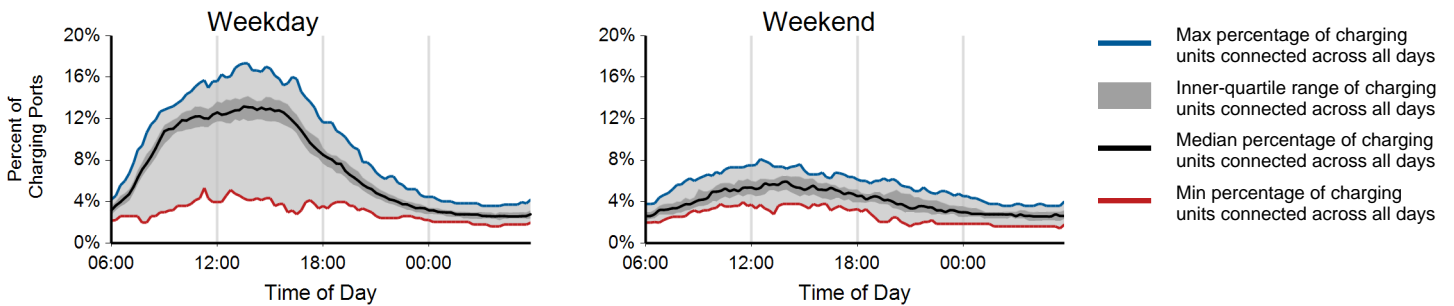
Electricity Consumed



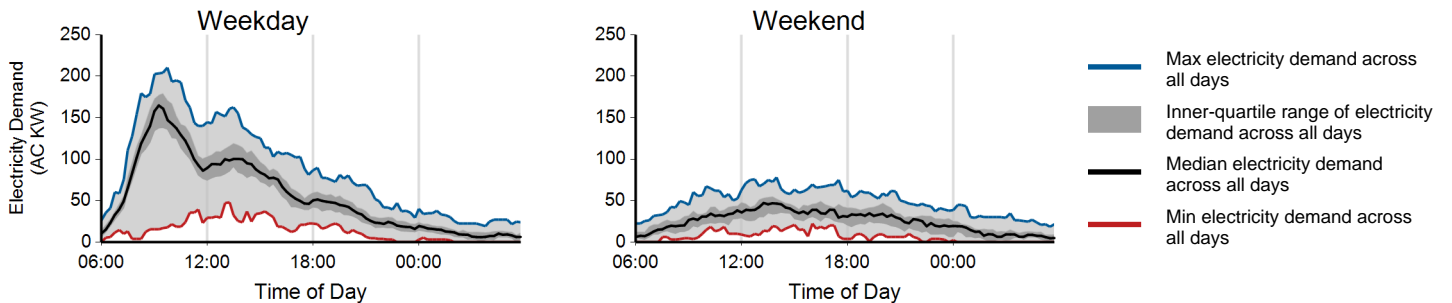
Charging Unit Utilization



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.

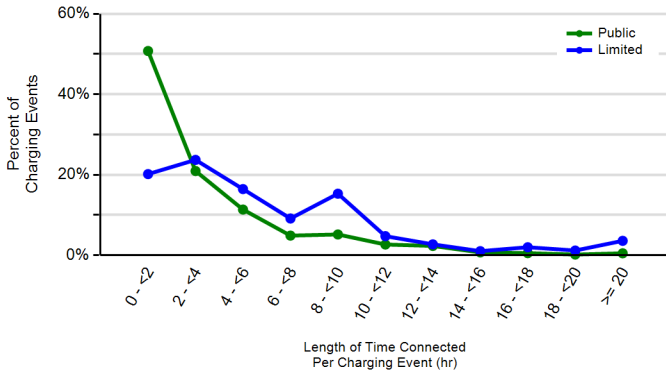
NYSERDA Electric Vehicle Charging Infrastructure Report

Report period: April 2016 through June 2016

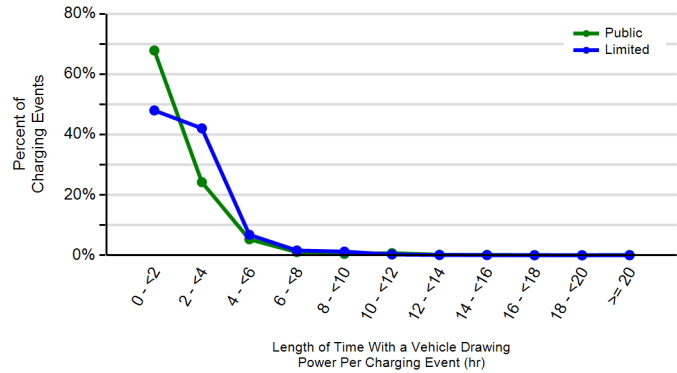
EVSE Usage - By Access Type

	Public	Limited ³
Number of charging ports ¹	321	189
Number of charging events ²	10,776	5,157
Charging energy consumed (AC MWh)	66.3	41.0
Average percent of time with a vehicle connected per charging port	5.4%	9.4%
Average percent of time with a vehicle drawing power per charging port	2.9%	2.9%
Average number of charging events started per charging port per week	2.6	2.1
Average electricity consumed per charging port per week (AC kWh)	16.0	17.1
Average length of time with vehicle connected per charging event (hr)	3.5	7.3
Average length of time with vehicle drawing power per charging event (hr)	1.8	2.3
Average electricity consumed per charging event (AC kWh)	6.2	8.0

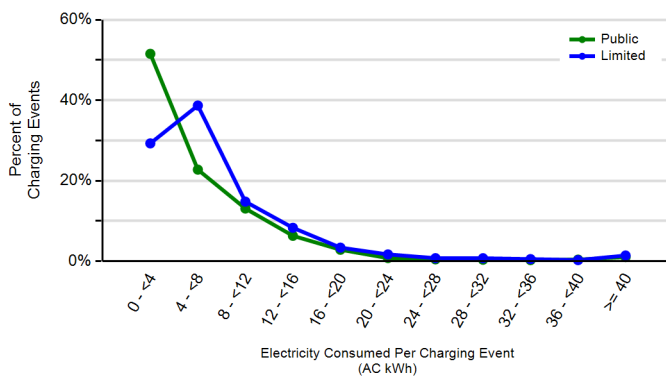
Distribution of Length of Time with a Vehicle Connected per Charging Event



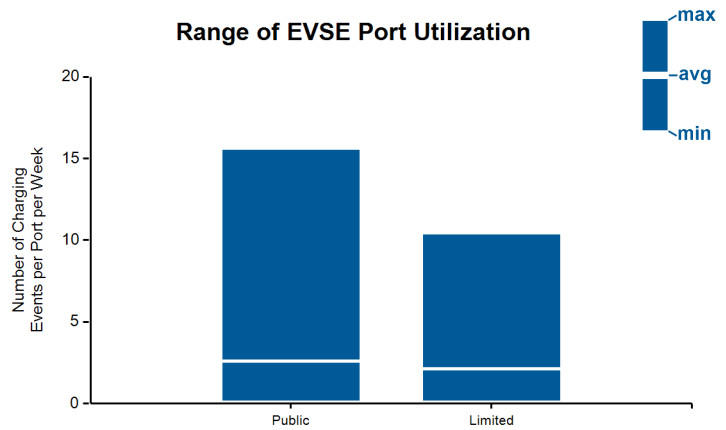
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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.

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.

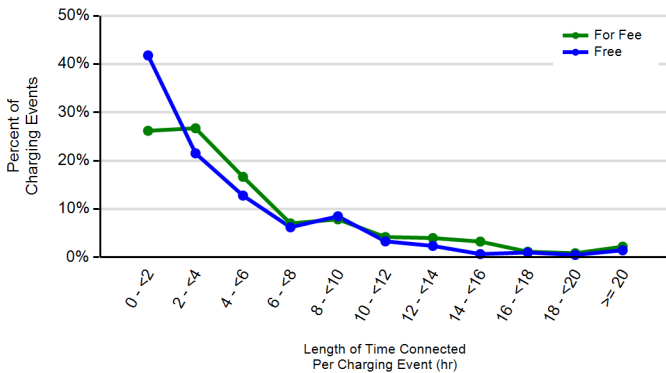
NYSERDA Electric Vehicle Charging Infrastructure Report

Report period: April 2016 through June 2016

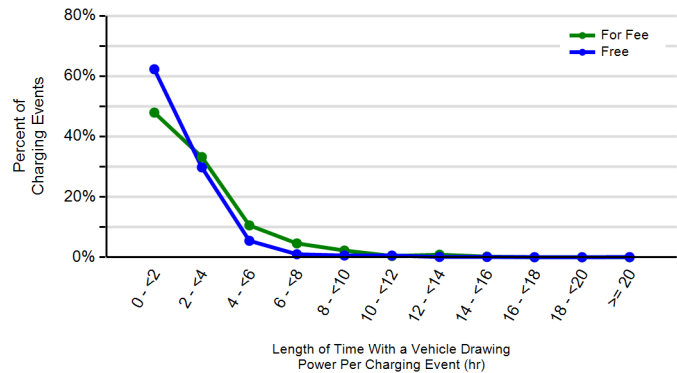
EVSE Usage - By Required Payment

	For Fee	Free
Number of charging ports ¹	64	446
Number of charging events ²	955	14,978
Charging energy consumed (AC MWh)	10.1	97.3
Average percent of time with a vehicle connected per charging port	4.2%	7.2%
Average percent of time with a vehicle drawing power per charging port	1.8%	3.0%
Average number of charging events started per charging port per week	1.2	2.6
Average electricity consumed per charging port per week (AC kWh)	12.6	16.9
Average length of time with vehicle connected per charging event (hr)	5.9	4.7
Average length of time with vehicle drawing power per charging event (hr)	2.6	1.9
Average electricity consumed per charging event (AC kWh)	10.6	6.5

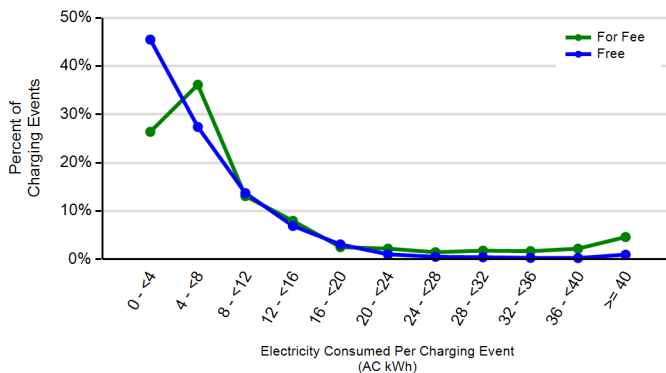
Distribution of Length of Time with a Vehicle Connected per Charging Event



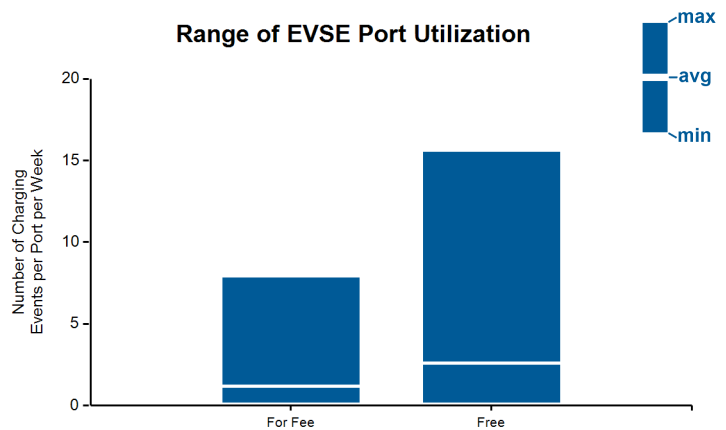
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



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.

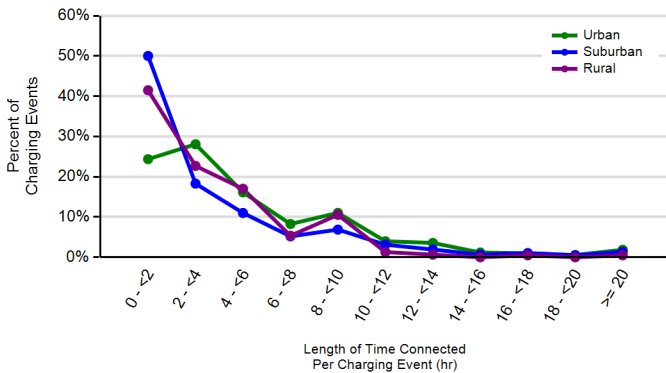
NYSERDA Electric Vehicle Charging Infrastructure Report

Report period: April 2016 through June 2016

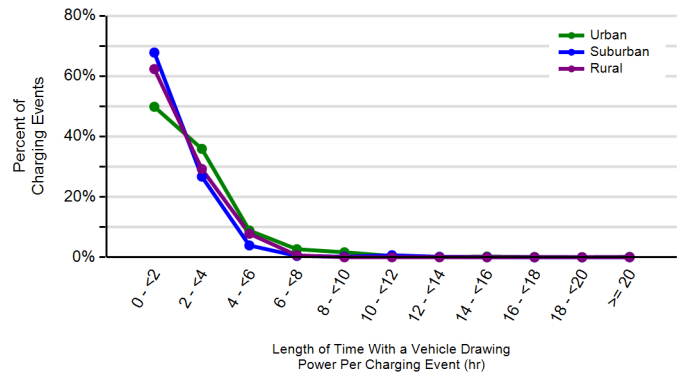
EVSE Usage - By Land Use Type

	Urban	Suburban	Rural
Number of charging ports ¹	176	295	39
Number of charging events ²	5,486	9,830	617
Charging energy consumed (AC MWh)	48.3	55.1	4.0
Average percent of time with a vehicle connected per charging port	8.4%	6.5%	2.6%
Average percent of time with a vehicle drawing power per charging port	3.7%	2.6%	1.3%
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)	21.3	14.5	8.0
Average length of time with vehicle connected per charging event (hr)	5.8	4.2	3.6
Average length of time with vehicle drawing power per charging event (hr)	2.5	1.7	1.8
Average electricity consumed per charging event (AC kWh)	8.8	5.6	6.4

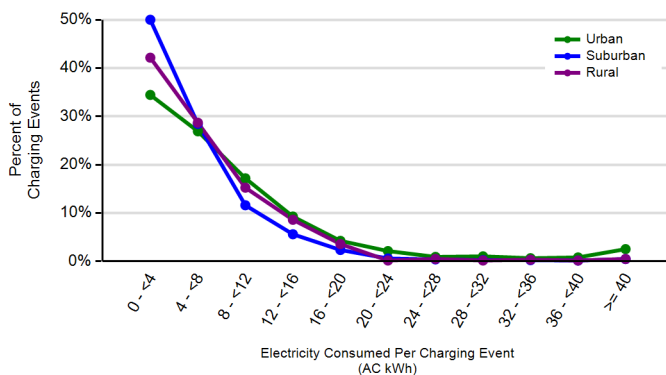
Distribution of Length of Time with a Vehicle Connected per Charging Event



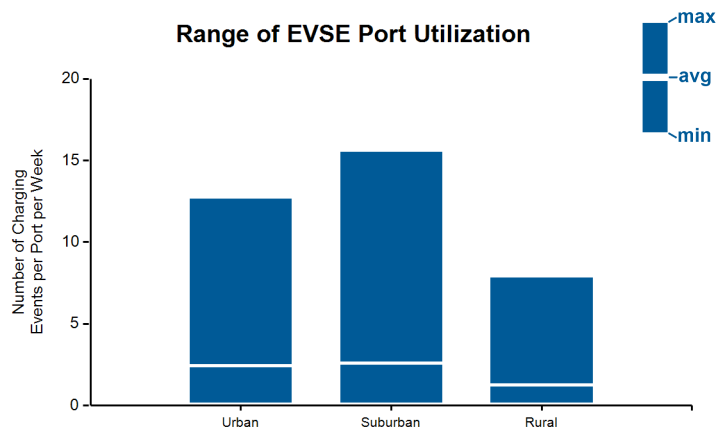
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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.

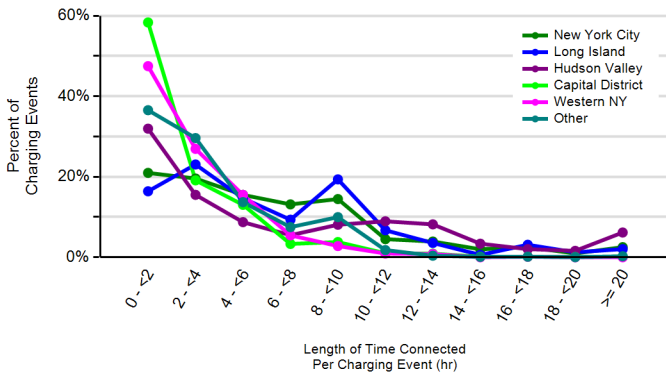
NYSERDA Electric Vehicle Charging Infrastructure Report

Report period: April 2016 through June 2016

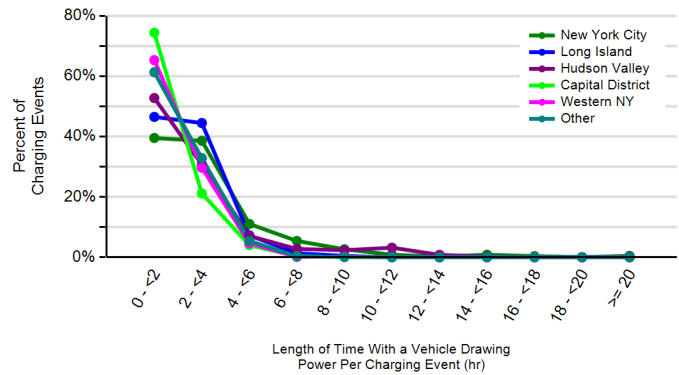
EVSE Usage - By Region

	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	77	66	97	106	22	43	10	23	54	12
Number of charging events ²	1,355	2,026	2,373	5,128	346	2,291	66	582	1,504	262
Charging energy consumed (AC MWh)	15.9	16.1	20.6	25.1	2.0	14.3	0.3	2.8	8.7	1.4
Average percent of time with a vehicle connected per charging port	6.3%	11.0%	9.6%	5.6%	2.2%	9.9%	0.6%	2.6%	3.7%	2.6%
Average percent of time with a vehicle drawing power per charging port	2.7%	3.1%	3.1%	3.1%	1.2%	4.7%	0.4%	1.7%	2.3%	1.6%
Average number of charging events started per charging port per week	1.4	2.4	1.9	3.7	1.2	4.1	0.5	2.0	2.1	1.7
Average electricity consumed per charging port per week (AC kWh)	16.3	18.9	16.7	18.2	7.0	25.6	2.5	9.8	12.5	9.5
Average length of time with vehicle connected per charging event (hr)	7.6	7.7	8.4	2.6	3.1	4.0	2.0	2.1	2.9	2.5
Average length of time with vehicle drawing power per charging event (hr)	3.3	2.2	2.7	1.4	1.7	1.9	1.4	1.4	1.8	1.6
Average electricity consumed per charging event (AC kWh)	11.7	7.9	8.7	4.9	5.8	6.3	5.0	4.8	5.8	5.5

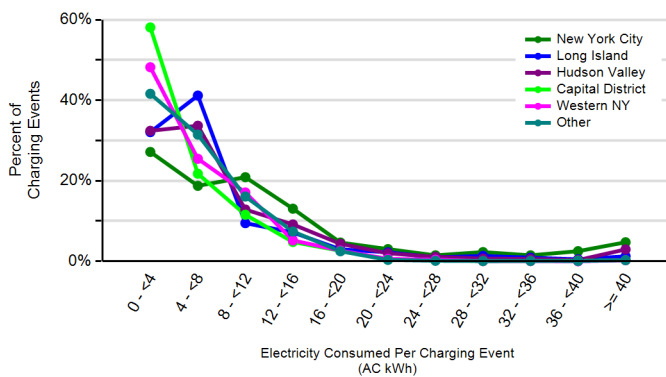
Distribution of Length of Time with a Vehicle Connected per Charging Event⁴



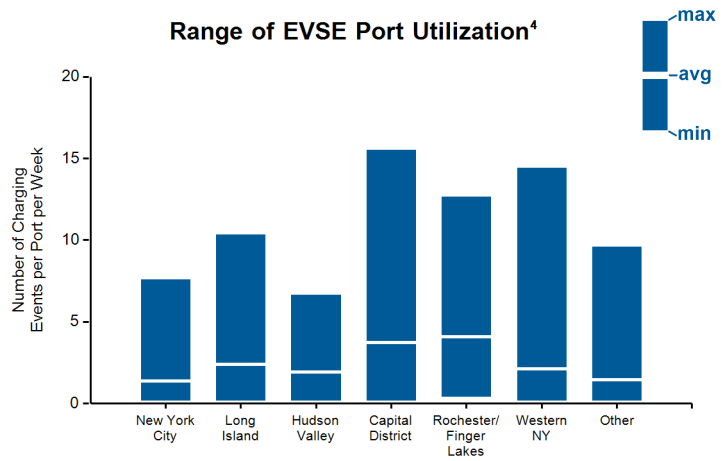
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event⁴



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'.

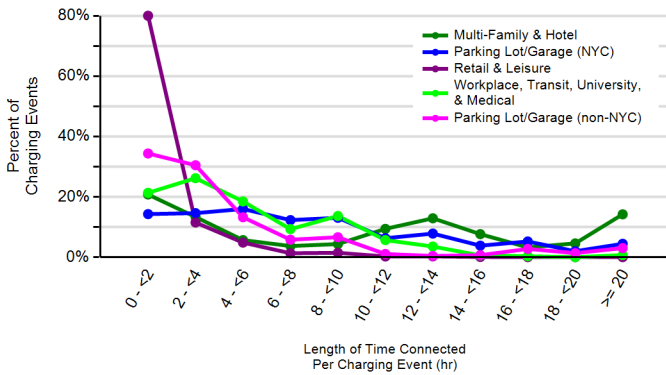
NYSERDA Electric Vehicle Charging Infrastructure Report

Report period: April 2016 through June 2016

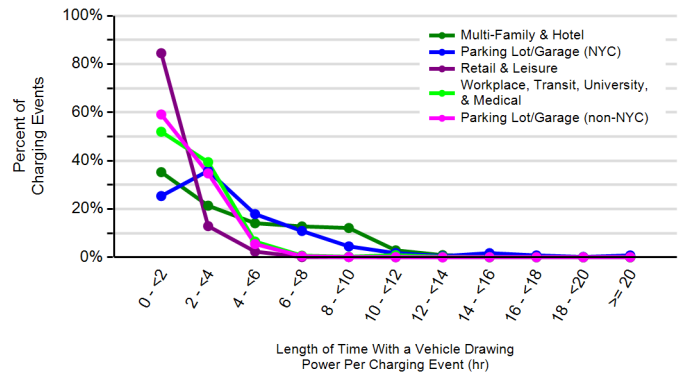
EVSE Usage - By Venue

	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	81	56	82	66	19	28	117	25	36
Number of charging events ²	3,025	650	4,226	1,627	299	158	4,792	482	674
Charging energy consumed (AC MWh)	19.0	11.5	14.7	11.2	5.5	2.0	35.1	2.8	5.6
Average percent of time with a vehicle connected per charging port	9.5%	5.1%	2.9%	4.9%	13.9%	1.4%	10.7%	3.0%	7.4%
Average percent of time with a vehicle drawing power per charging port	3.3%	2.6%	2.4%	2.3%	3.8%	0.8%	4.0%	1.7%	2.9%
Average number of charging events started per charging port per week	2.9	0.9	4.0	1.9	1.3	0.4	3.2	1.5	1.5
Average electricity consumed per charging port per week (AC kWh)	18.2	15.9	13.8	13.2	24.4	5.5	23.3	8.9	12.2
Average length of time with vehicle connected per charging event (hr)	5.5	9.4	1.2	4.3	17.5	5.5	5.7	3.3	8.5
Average length of time with vehicle drawing power per charging event (hr)	1.9	4.8	1.0	2.0	4.8	2.9	2.1	1.8	3.4
Average electricity consumed per charging event (AC kWh)	6.3	17.6	3.5	6.9	18.3	12.7	7.3	5.8	8.3

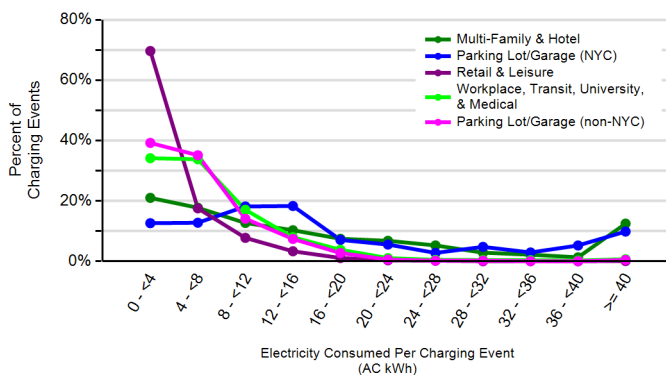
Distribution of Length of Time with a Vehicle Connected per Charging Event



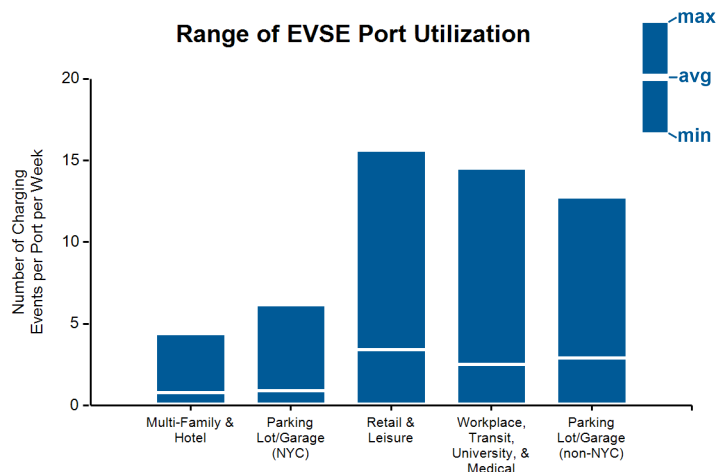
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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.

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York State since 1975.

To learn more about NYSERDA's programs and funding opportunities, visit nyserda.ny.gov or follow us on Twitter, Facebook, YouTube, or Instagram.

**New York State
Energy Research and
Development Authority**

17 Columbia Circle
Albany, NY 12203-6399

toll free: 866-NYSERDA
local: 518-862-1090
fax: 518-862-1091

info@nyserda.ny.gov
nyserda.ny.gov



State of New York

Andrew M. Cuomo, Governor

New York State Energy Research and Development Authority

Richard L. Kauffman, Chair | John B. Rhodes, President and CEO

