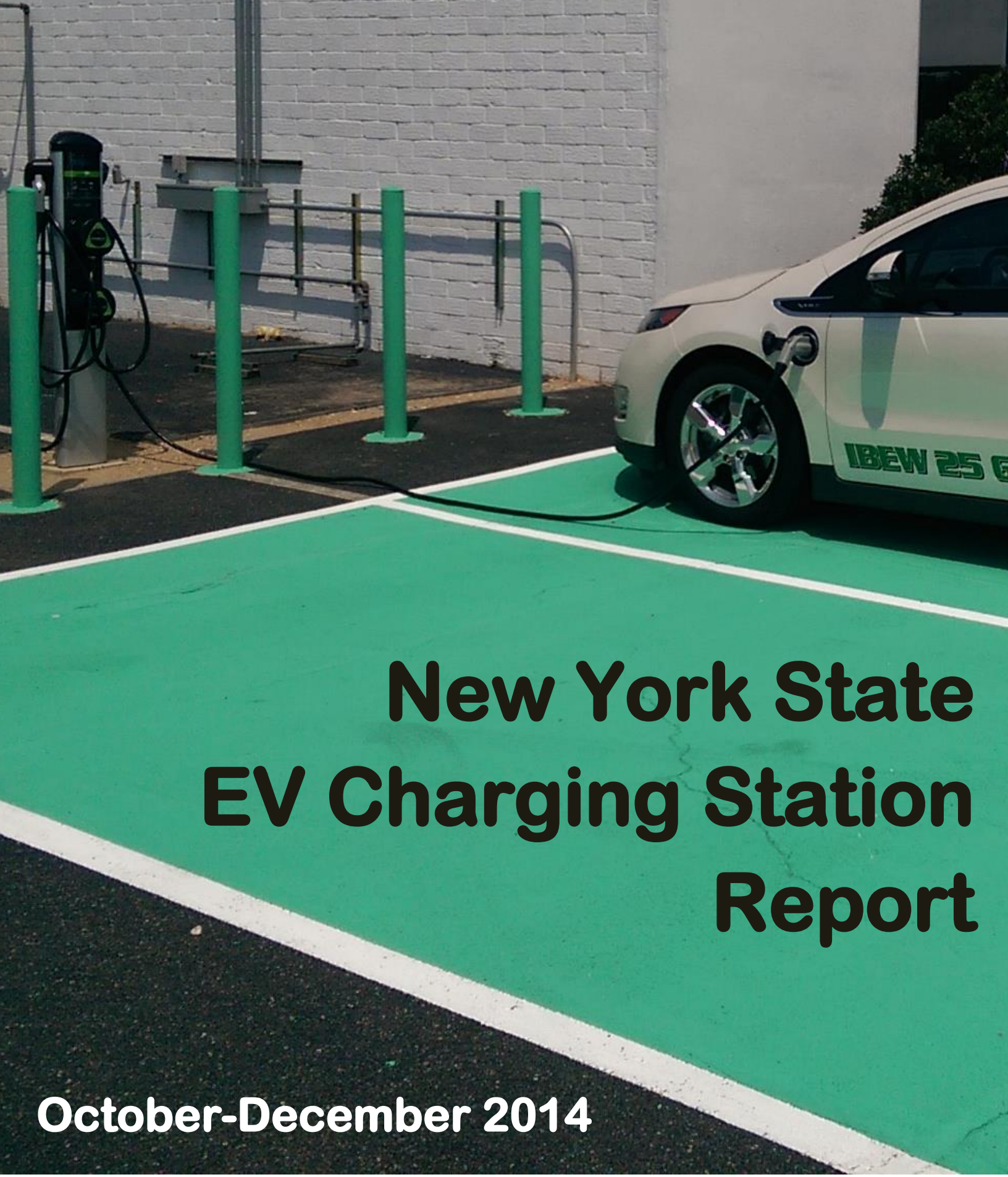

New York State EV Charging Station Report

October-December 2014

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New York State Electric Vehicle Charging Station Report

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 state. These installations support New York Governor Andrew Cuomo's Charge NY initiative, which is focused on making New York ready for EVs by 2018. The initiative has the goal of creating 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. The NYSERDA-funded 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. Charging station usage data and analysis are shared with the public through these quarterly data reports. By doing so, NYSERDA is paving the way for future private sector charging station investment.

About This Report:

The accompanying data pages summarize 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 NYSEDA program. The first data analysis page provides an overview that 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. This means that a charging station with two charging connections (a dual port station) was counted as two ports.

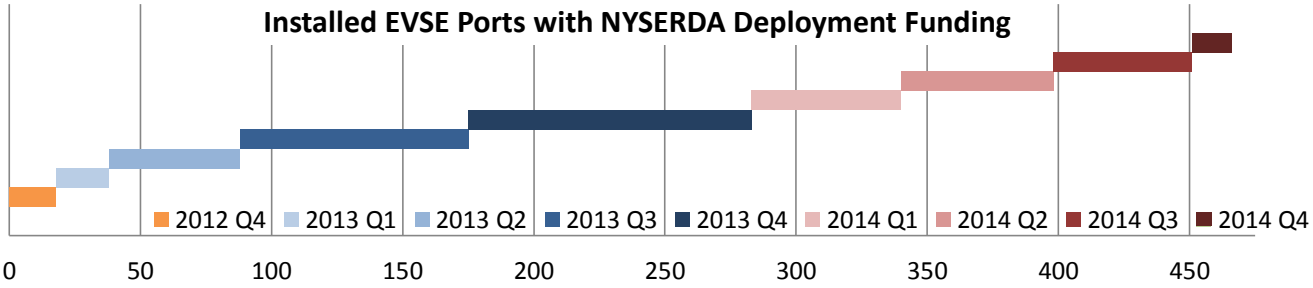
On the first page, the EVSE access types are defined as follows. ***Public EVSE*** are available to any EV. ***Private EVSE*** are exclusively for a company's fleet vehicles' use. ***Limited EVSE*** are installed specifically for, but may not necessarily be restricted to, a select group (e.g., employees, apartment building tenants, or hotel guests). EVs are likely ***connected*** to a charging station the entire time they are in EV dedicated parking spaces. However, the vehicles only ***draw power*** until the battery pack is finished charging. The ***Charging Demand*** plot shows the total electrical power used by all active NYSERDA-funded stations at different times of day. This indicates the total electrical grid impact from EVs charging at NYSERDA-funded public stations. It is important to note that this does not reflect all EV charging in New York State. Public charging stations not funded by the NYSERDA project and home charging were not included in this analysis.

The remaining five data analysis pages include the same table and charts for various charging station subsets including: ***access type***, ***required payment***, ***land use type***, ***region***, and ***venue*** (the last four subsets exclude private EVSE because their use is specific to the particular host site's operations). 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 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 events 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.

Data Trends and Significant Changes from the Past Quarter:

Between December 2012 and December 2014, the NYSERDA EV Charging Station Program funded the installation of 466 charging ports, 15 of which were installed this past quarter.



The following table lists the station types with the highest average percentage of time with a vehicle connected this quarter.

Highest Average Percentage of Time with a Vehicle Connected This Quarter									
Access Type		**Payment**		**Land Use**		**Region**		**Venue**	
Private	46.1%	Free	4.9%	Urban	7.3%	Finger Lakes	7.6%	Parking (non-NYC)	8.2%

This following table shows the station types with the greatest increased usage since last quarter.

Greatest Increase in Average Percentage of Time with a Vehicle Connected Since Last Quarter									
Access Type		**Payment**		**Land Use**		**Region**		**Venue**	
Private	+24%	For Fee	+30%	Urban	+30%	Hudson Valley	+113%	Parking (non-NYC)	+78%

Fewer charging ports were used in the fourth quarter of 2014 as compared to the third quarter, but charging ports that were used were used at a higher rate than last quarter (8.0% as compared to 6.8% last quarter). All access types— public, limited, and private—saw increases in the percentage of time with a vehicle connected.

There are three regions averaging 2.5 or more charging events per port per week— Rochester/Finger Lakes (2.9), Western NY (2.6), and the Capital District (2.5). Other than Long Island which averaged 1.7, all other regions are averaging less than 1 charging event per port per week.

EVs remain at a New York City parking garage charging stations an average of 4.8 hours after they have been fully charged. At workplaces EVs are parked at charging stations 4.6 hours longer than needed to receive a full charge, on average. Except for retail locations that experience very short (1.2 hours on average) EV connection times, EVs are only charging about half of the time they are connected to the charging stations we tracked.

Data Comparisons to Other Published EVSE Reports:

Evaluating Electric Vehicle Charging Impacts and Customer Charging Behaviors – Experiences from Six Smart Grid Investment Grant Projects[1] was published by the U.S. Department of Energy's Electricity Delivery & Energy Reliability Office as an outcome from funding provided through the American Recovery and Reinvestment Act of 2009. While specific project objectives varied, the utilities leading the Smart Grid Investment Grant (SGIG) projects evaluated the technical performance of the charging systems, the potential grid impacts of charging during peak periods, and the potential need for distribution system upgrades and capacity additions to meet expected electricity demand growth from rising adoption of plug-in electric vehicles.

Duke Energy (which recently merged with Progress Energy) provides electric service to customers in the Southeast and Midwest. Duke's "Plug-IN" project includes 47 commercial stations in Indiana, which were funded through a federal grant separate from the SGIG program. Duke Energy reported over 84% of charging sessions at public retail locations lasted less than 2 hours, while only 45% of sessions at office and municipal locations lasted under two hours. New York EVSE installations in the NYSERDA program during 2014 showed similar results with 85% of charging sessions at public retail locations lasted less than 2 hours and 54% of charging sessions lasted under two hours at workplaces and parking lots or garages throughout the state. This supports their conclusion that different utilization and charge profiles are expected at different venues.

Progress Energy serves more than 3 million customers in North and South Carolina and Florida. In 2012, Progress Energy merged with Duke Energy. Through SGIG funding, Progress Energy installed public charging stations at 46 locations in North and South Carolina and 68 locations in Florida. Figure 1 shows the energy use and percentage of all charge events by the duration of charging sessions at Progress Energy commercial stations and NYSERDA-funded public and limited stations. One-third of the charge events at Progress Energy commercial stations were longer than 4 hours whereas only 9% of NYSERDA public and limited station usage was of this duration. The energy usage curve for Progress Energy commercial stations was fairly consistent for these various charge event durations, but NYSERDA data showed a steeper curve with a considerable rise for charge events over 4 hours. This indicates that the EVs using the NYSERDA stations typically drew more energy (a higher number of vehicles with onboard chargers greater than the lowest 3.3 kW rating and larger battery packs). Also, while only a small portion of the total sessions, the NYSERDA charge events longer than 4 hours were likely a lot longer in duration to provide the much higher average energy draw per event. This is likely from the stations at multi-family dwellings and parking garages in New York City that serve as an EV's primary parking location (the Progress Energy project may not have many installations at such venues).

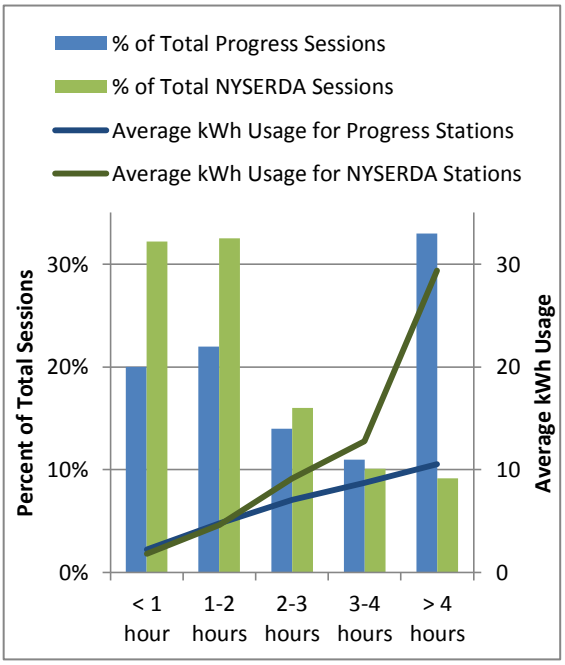


Figure 1: Energy Use and EVSE Comparison Between Progress Energy and NYSERDA Stations

[1] U.S. Department of Energy, *Evaluating Electric Vehicle Charging Impacts and Customer Charging Behaviors – Experiences from Six Smart Grid Investment Grant Projects*, December 2014, http://energy.gov/sites/prod/files/2014/12/f19/SGIG-EvaluatingEVcharging-Dec2014.pdf

Progress Energy found that the vast majority of charging sessions occurred between 9:00 am and 7:00 pm. Commercial and public stations used mostly during business hours increase the likelihood for overlap with typical peak time periods for utilities. This is shown in Figure 2 along with a second plot in Figure 3 for the NYSERDA data. The NYSERDA data has a defined peak in charging activity during in the middle of the day for weekdays, although the highest amount of charging is early afternoon (1-2 pm) whereas the Progress Energy charging usage peaks in the late morning (10 am - 12 pm). While the Progress Energy charging usage data also shows a peak on weekends, this is less defined for the NYSERDA stations that show fairly constant use all throughout the afternoon on weekends. The lowest period of use for Progress Energy stations occurs from midnight to 6 am, but NYSERDA stations are used least from 5-6 am on weekdays and 7-8 am on weekends.

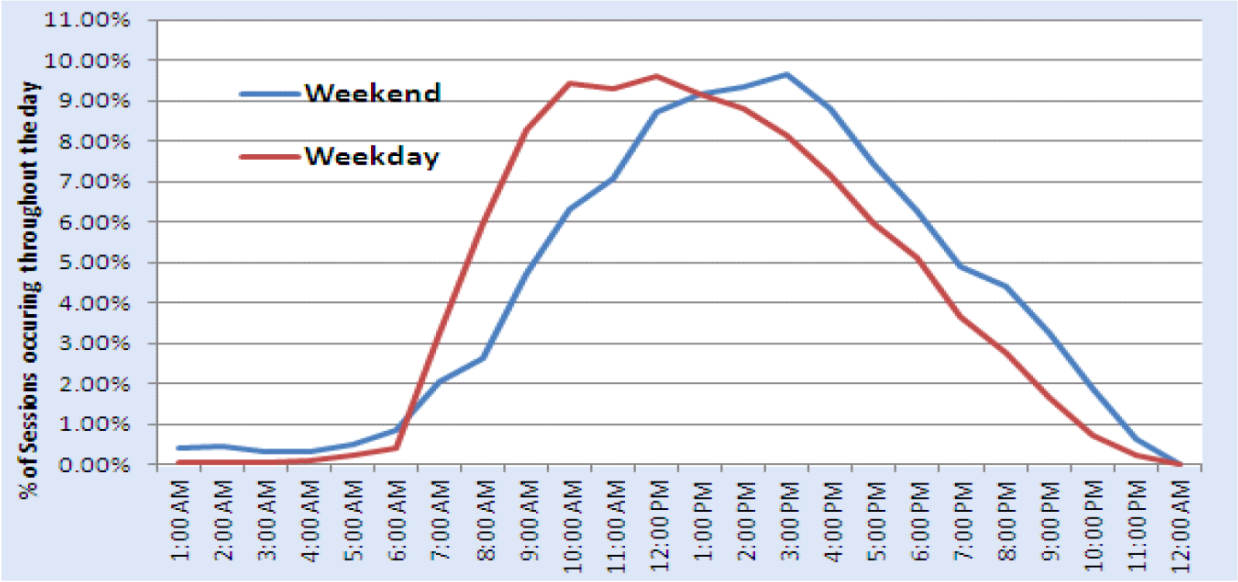


Figure 2: Progress Energy Commercial Charging Station Daily Use Pattern

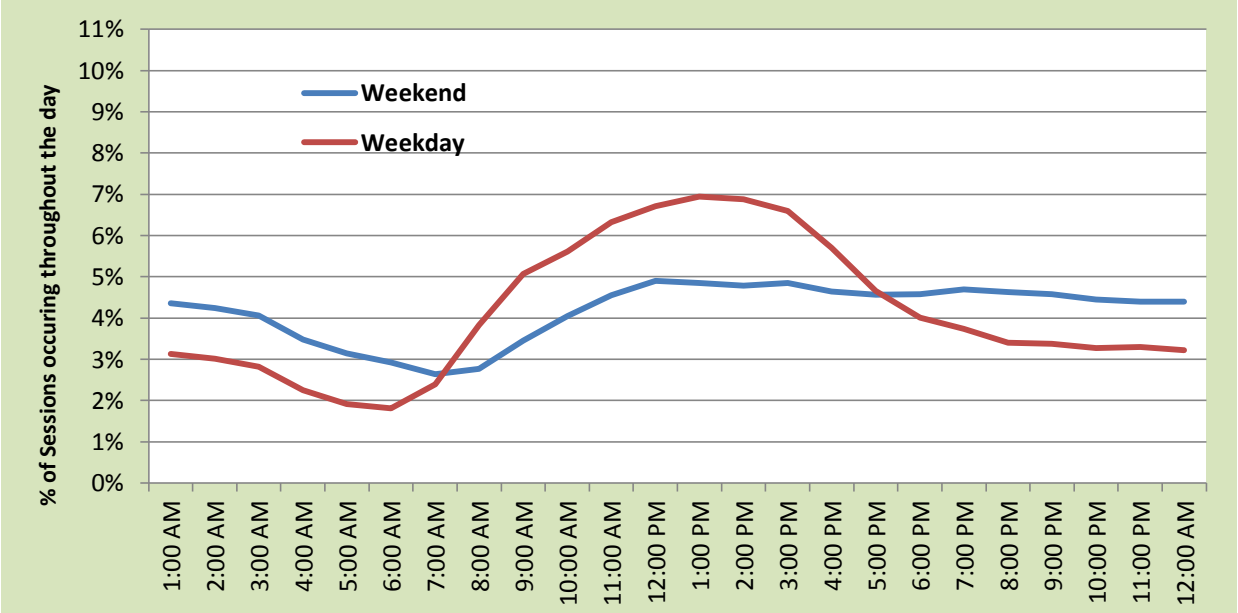


Figure 3: NYSERDA Public and Limited Charging Station Daily Use Pattern

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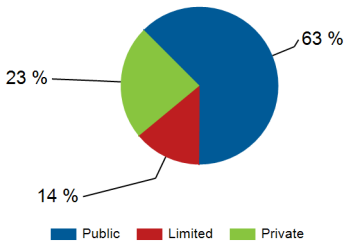
New York State

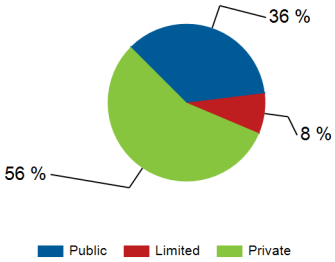
EVSE Usage - By Access Type

	Public	Limited[3]	Private	Total
Number of charging ports[1]	237	89	27	353
Number of charging events[2]	6,143	1,366	2,305	9,814
Electricity consumed (AC MWh)	40.06	9.36	63.28	112.70
Percent of time with a vehicle connected	4.7%	2.8%	46.1%	7.5%
Percent of time with a vehicle drawing power	2.3%	1.5%	42.8%	5.3%

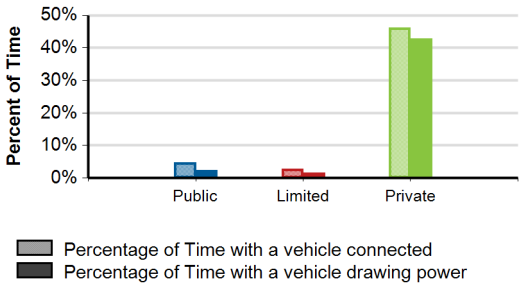
Number of Charging Events



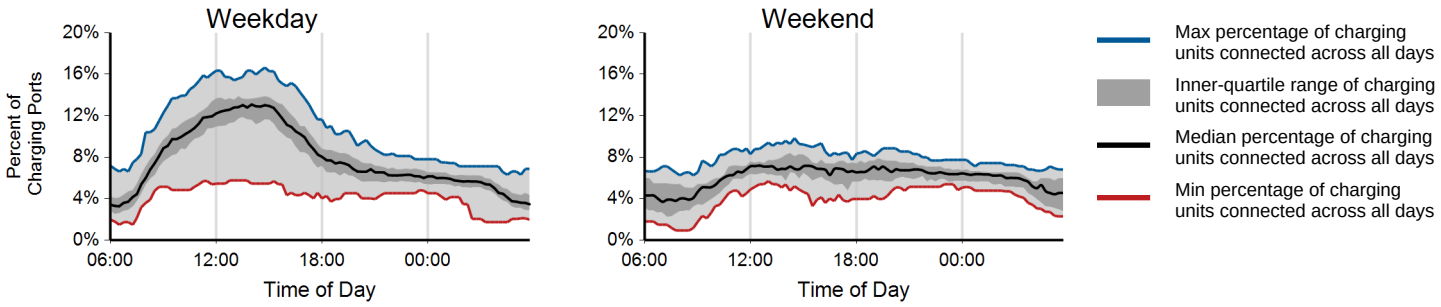
Electricity Consumed



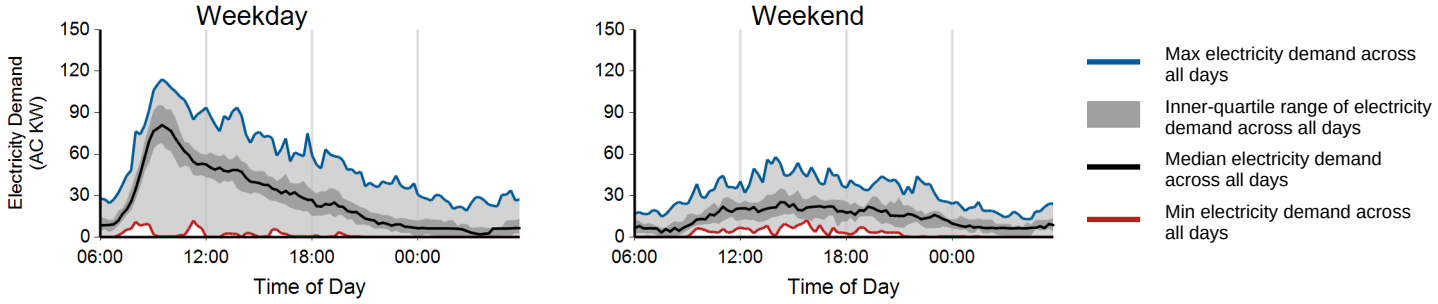
Charging Unit Utilization



Charging Availability: Range of Percentage of All Charging Ports with a Vehicle Connected versus Time of Day[4]



Charging Demand: Range of Aggregate Electricity Demand versus Time of Day[4] 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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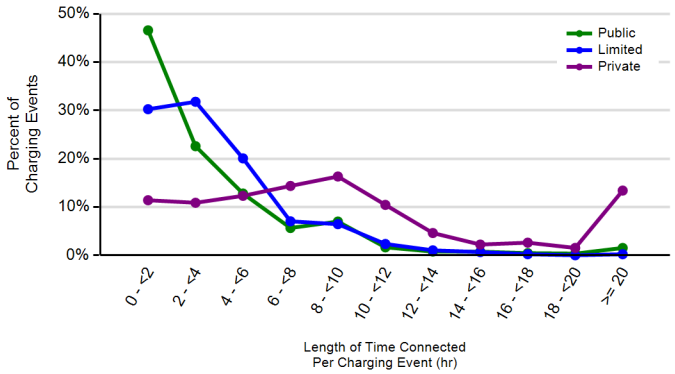
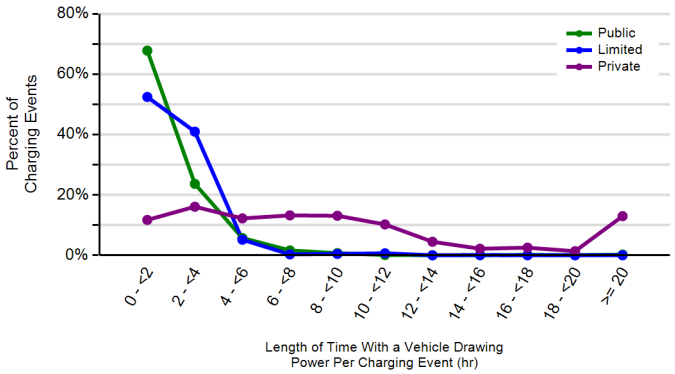
EVSE Usage - By Access Type

	Public	Limited[3]	Private
Number of charging ports[1]	237	89	27
Number of charging events[2]	6,143	1,366	2,305
Charging energy consumed (AC MWh)	40.1	9.4	63.3
Average percent of time with a vehicle connected per charging port	4.7%	2.8%	46.1%
Average percent of time with a vehicle drawing power per charging port	2.3%	1.5%	42.8%
Average number of charging events started per charging port per week	2.0	1.2	6.5
Average electricity consumed per charging port per week (AC KWh)	13.1	8.4	178.3
Average length of time with vehicle connected per charging event (hr)	4.0	3.9	11.9
Average length of time with vehicle drawing power per charging event (hr)	1.9	2.0	11.1
Average electricity consumed per charging event (AC kWh)	6.5	6.9	27.5

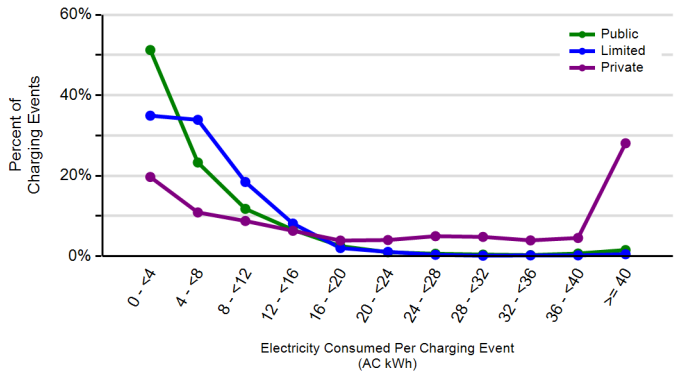
Distribution of Length of Time with a Vehicle Connected per Charging Event



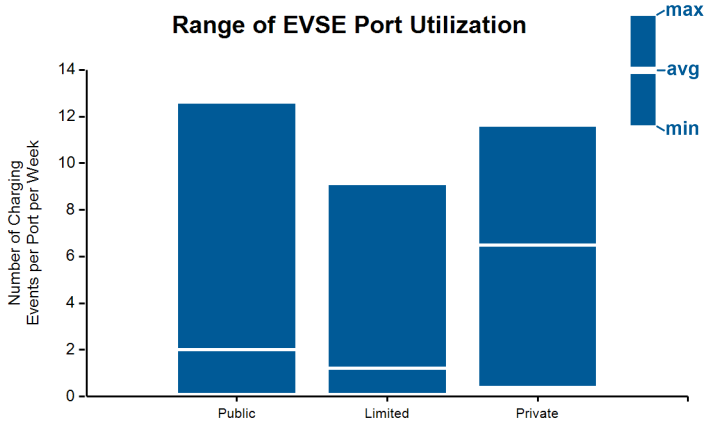
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



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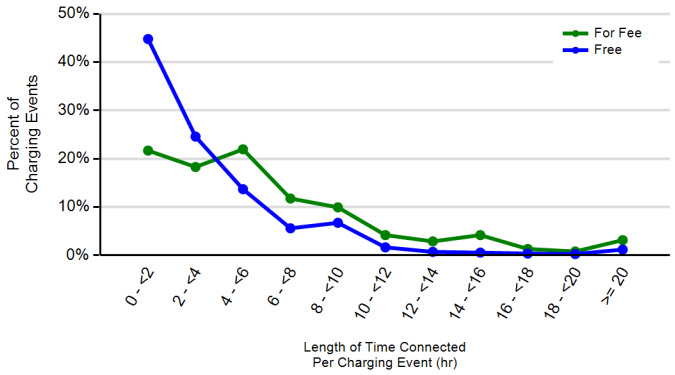
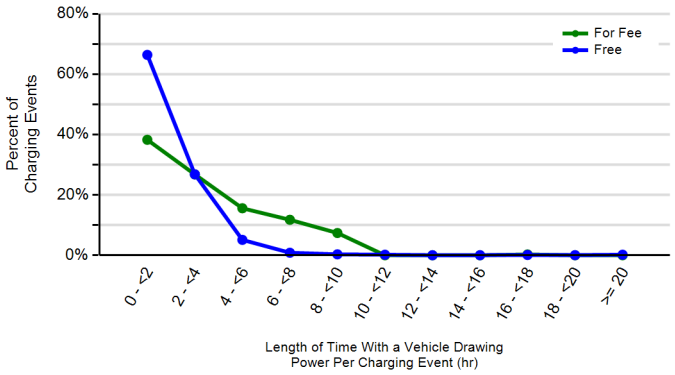
EVSE Usage - By Required Payment[3]

	For Fee	Free
Number of charging ports[1]	51	275
Number of charging events[2]	383	7,126
Charging energy consumed (AC MWh)	6.8	42.7
Average percent of time with a vehicle connected per charging port	2.6%	4.5%
Average percent of time with a vehicle drawing power per charging port	1.2%	2.3%
Average number of charging events started per charging port per week	0.6	2.0
Average electricity consumed per charging port per week (AC KWh)	10.9	12.0
Average length of time with vehicle connected per charging event (hr)	7.0	3.8
Average length of time with vehicle drawing power per charging event (hr)	3.4	1.9
Average electricity consumed per charging event (AC kWh)	17.7	6.0

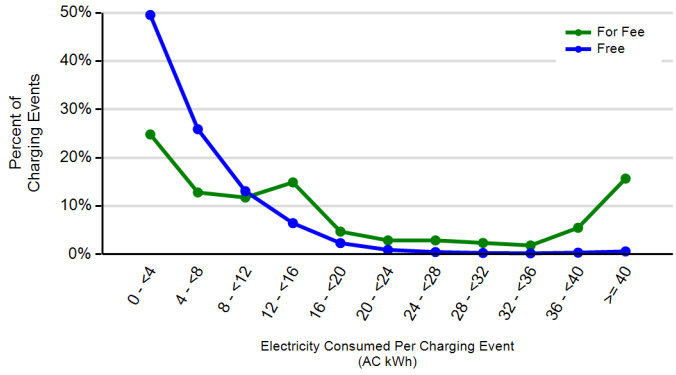
Distribution of Length of Time with a Vehicle Connected per Charging Event



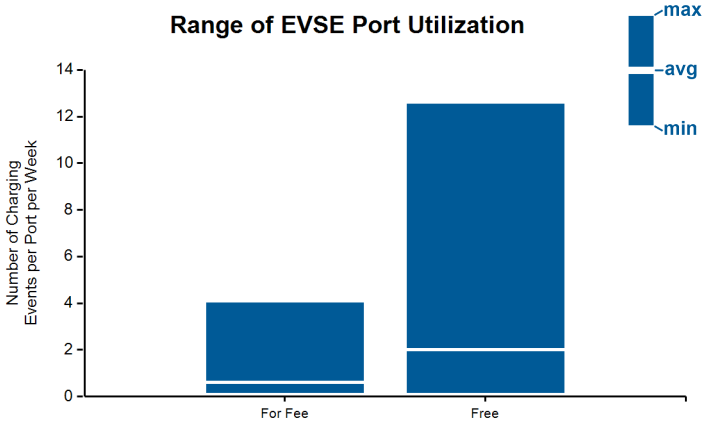
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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.

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[3] Only includes data from EVSE providing Public or Limited access.

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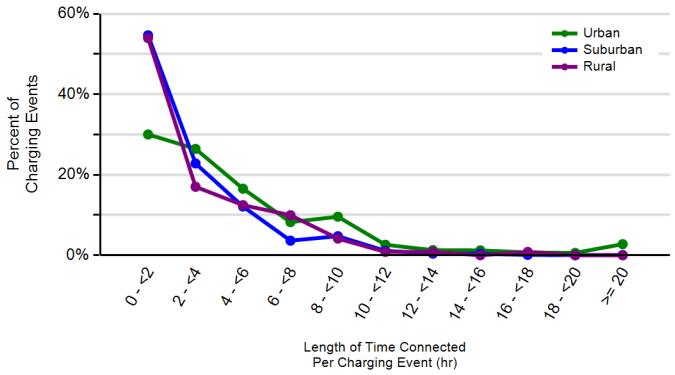
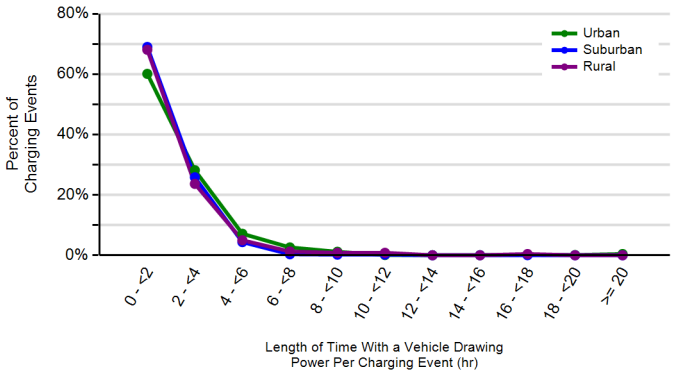
EVSE Usage - By Land Use Type[3]

	Urban	Suburban	Rural
Number of charging ports[1]	126	172	28
Number of charging events[2]	3,362	3,906	241
Charging energy consumed (AC MWh)	26.9	20.8	1.7
Average percent of time with a vehicle connected per charging port	6.9%	2.8%	1.2%
Average percent of time with a vehicle drawing power per charging port	3.0%	1.7%	0.7%
Average number of charging events started per charging port per week	2.1	1.8	0.7
Average electricity consumed per charging port per week (AC KWh)	16.8	9.4	4.8
Average length of time with vehicle connected per charging event (hr)	5.5	2.7	3.0
Average length of time with vehicle drawing power per charging event (hr)	2.4	1.6	1.8
Average electricity consumed per charging event (AC kWh)	8.0	5.3	7.2

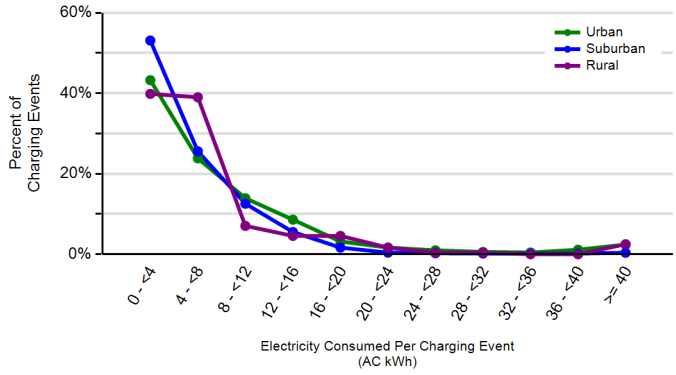
Distribution of Length of Time with a Vehicle Connected per Charging Event



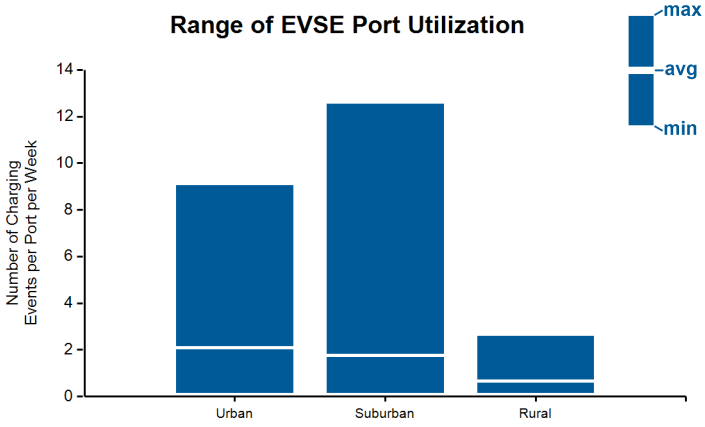
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



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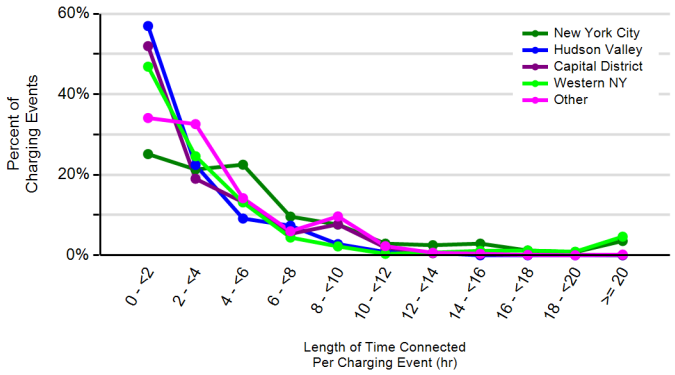
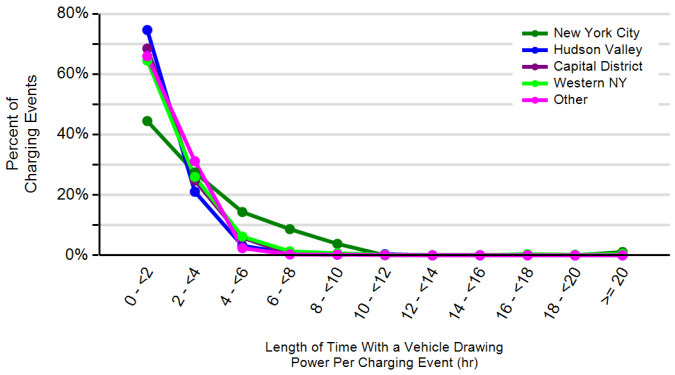
EVSE Usage - By Region[3]

	New York City	Long Island	Hudson Valley	Capital District	Syracuse/Central NY	Rochester/Finger Lakes	North Country	Western NY	Other[4]
Number of charging ports[1]	60	29	35	88	13	28	16	43	14
Number of charging events[2]	760	605	504	2,778	163	1,052	127	1,362	158
Charging energy consumed (AC MWh)	10.6	3.8	2.7	15.6	1.0	5.5	0.7	8.5	1.0
Average percent of time with a vehicle connected per charging port	4.3%	3.3%	1.7%	4.3%	2.1%	7.6%	1.3%	6.9%	1.0%
Average percent of time with a vehicle drawing power per charging port	2.2%	1.9%	1.1%	2.3%	1.2%	3.0%	0.7%	3.0%	0.8%
Average number of charging events started per charging port per week	1.0	1.7	1.2	2.4	1.0	2.9	0.6	2.4	0.9
Average electricity consumed per charging port per week (AC KWh)	14.1	10.8	6.3	13.5	6.3	14.9	3.5	15.0	5.5
Average length of time with vehicle connected per charging event (hr)	7.2	3.2	2.5	3.0	3.6	4.5	3.3	4.8	1.5
Average length of time with vehicle drawing power per charging event (hr)	3.7	1.8	1.5	1.6	2.0	1.8	1.7	2.1	2.0
Average electricity consumed per charging event (AC kWh)	14.0	6.3	5.3	5.6	6.4	5.2	5.5	6.2	6.4

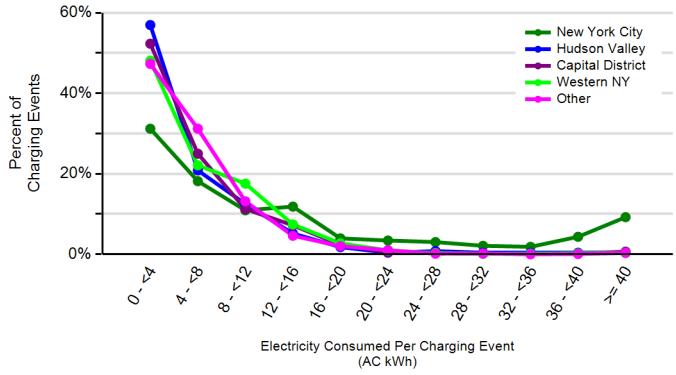
Distribution of Length of Time with a Vehicle Connected per Charging Event[5]



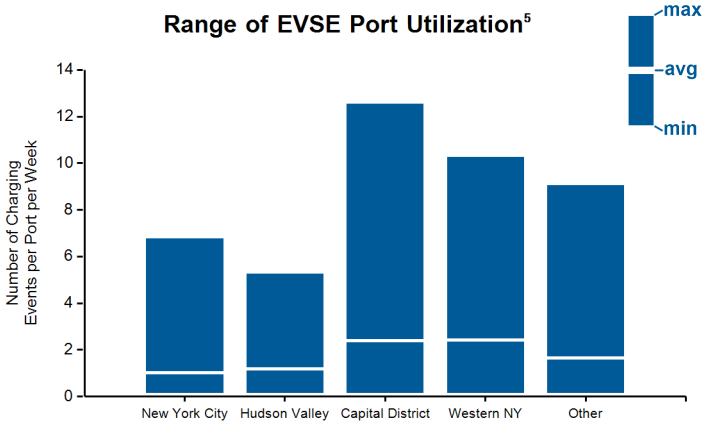
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event[5]



Distribution of AC Energy Consumed per Charging Event[5]



Range of EVSE Port Utilization[5]



[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] Only includes data from EVSE providing Public or Limited access.

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

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

NYSERDA Electric Vehicle Charging Infrastructure Report

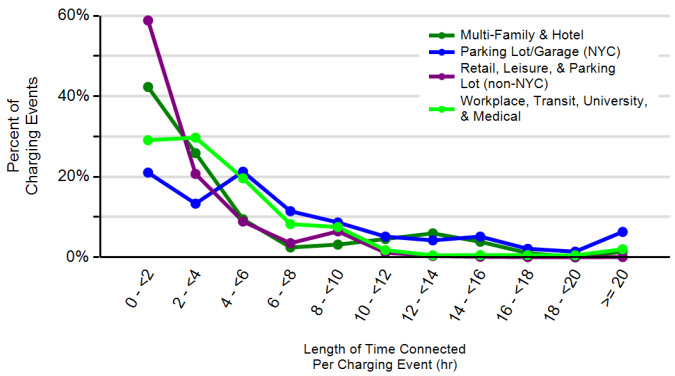
nyserda Energy. Innovation. Solutions.

Report period: October 2014 through December 2014

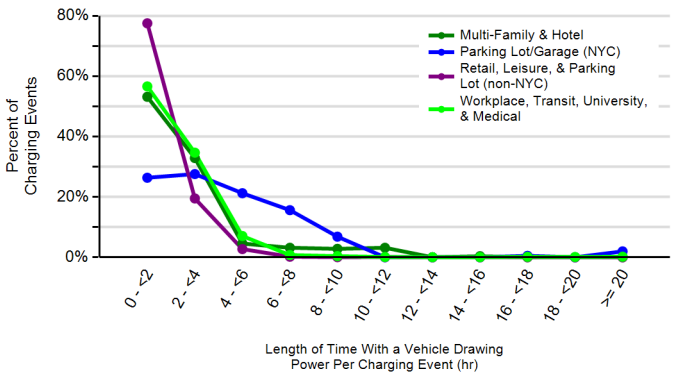
EVSE Usage - By Venue[3]

	Parking Lot/Garage (non-NYC)	Parking Lot/Garage (NYC)	Retail Location	Workplace	Hotel	University or Medical Campus	Leisure Destination	Transit Station
Number of charging ports[1]	40	51	55	53	30	61	16	16
Number of charging events[2]	1,501	428	1,839	976	260	2,121	312	46
Charging energy consumed (AC MWh)	8.1	8.8	6.8	6.7	2.4	14.6	1.7	0.2
Average percent of time with a vehicle connected per charging port	6.8%	4.0%	1.9%	5.9%	1.8%	6.2%	3.1%	0.3%
Average percent of time with a vehicle drawing power per charging port	3.0%	2.1%	1.6%	2.1%	1.0%	3.3%	1.6%	0.2%
Average number of charging events started per charging port per week	2.9	0.7	2.5	1.4	0.7	2.8	1.5	0.2
Average electricity consumed per charging port per week (AC KWh)	15.5	13.8	9.4	9.7	6.3	19.1	8.0	1.0
Average length of time with vehicle connected per charging event (hr)	3.9	10.0	1.2	6.9	4.6	3.8	3.5	1.8
Average length of time with vehicle drawing power per charging event (hr)	1.7	5.2	1.1	2.4	2.6	2.0	1.8	1.3
Average electricity consumed per charging event (AC kWh)	5.4	20.6	3.7	6.8	9.4	6.9	5.4	4.1

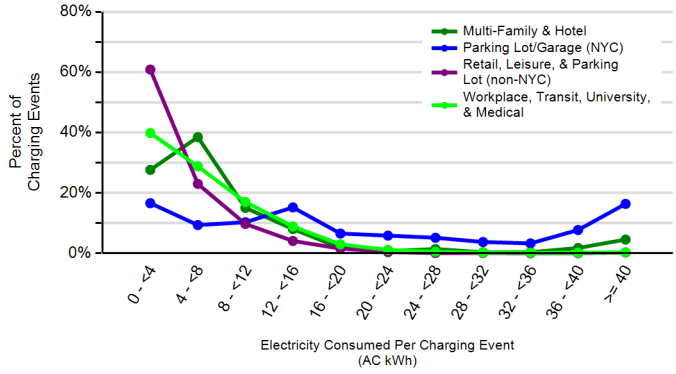
Distribution of Length of Time with a Vehicle Connected per Charging Event



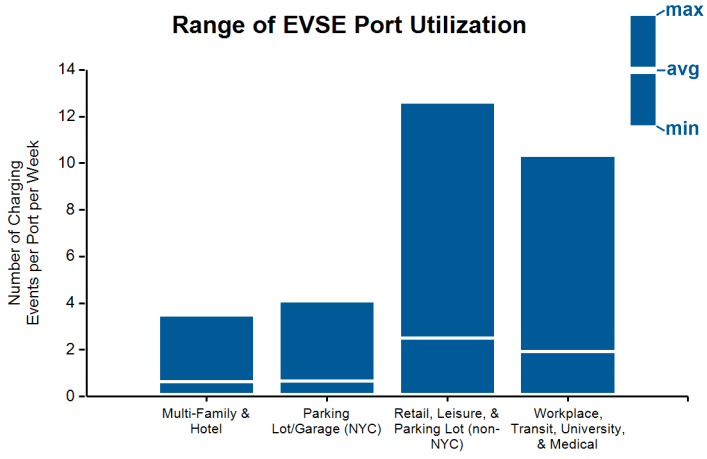
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



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