



ChargeNY

New York State Electric Vehicle Charging Station Quarterly Report

Report Period July through September 2016

Final Report



New York State Energy Research and Development Authority

December 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.

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Report Period July through September 2016

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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 ChargeNY initiative, which has a set goal of a statewide network of 3,000 public and workplace charging stations to supporting 40,000 plug-in vehicles by 2018. Since the program's inception in 2013, the State has supported the installation of over 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. The purpose for these quarterly data reports is to share charging station usage data and analysis with the public.

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. The analysis includes only EVSEs with at least one charging event during the past quarter and 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 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 they are in EV dedicated parking spaces. However, the vehicles only draw power until the battery pack is at capacity. 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 considering installing charging stations can use this data and analysis for sites similar to theirs to understand 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 average time a vehicle connects to the charger is the duration drivers stay at the host location and will indicate the electrical energy requirements from the station.

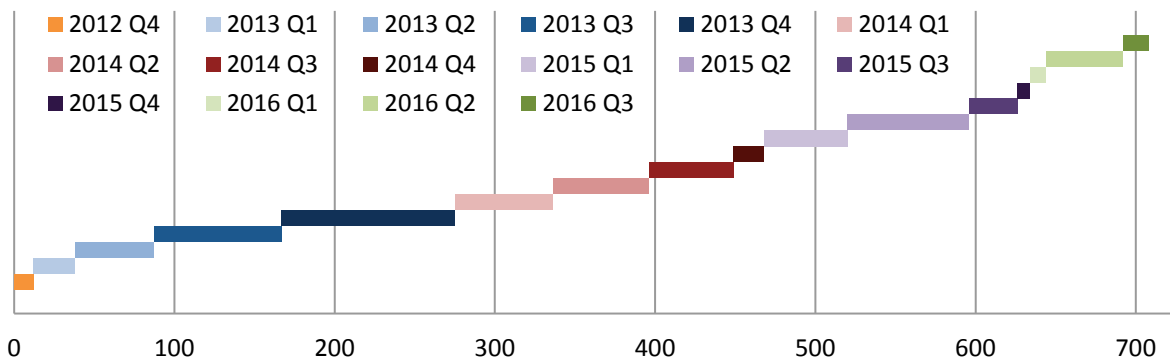
If the average time a vehicle draws power is significantly less than the average time a vehicle is connected, then the EV is occupying the station longer than necessary and should move to allow other EVs to charge. Site owners can use all of these metrics to help decide whether installing EVSE is a smart 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 length of time a vehicle is connected, length of time a vehicle is drawing power, and 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 2016, the NYSERDA EV Charging Station Program funded the installation of 708 charging ports (506 stations at 299 unique locations). During the last quarter, 16 new charging ports were installed.

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



On average, charging stations had an EV plugged in 6.4 percent of the time in the past quarter, a seven percent 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 program.

Figure 2. Change in Station Occupancy and Electricity Dispersed

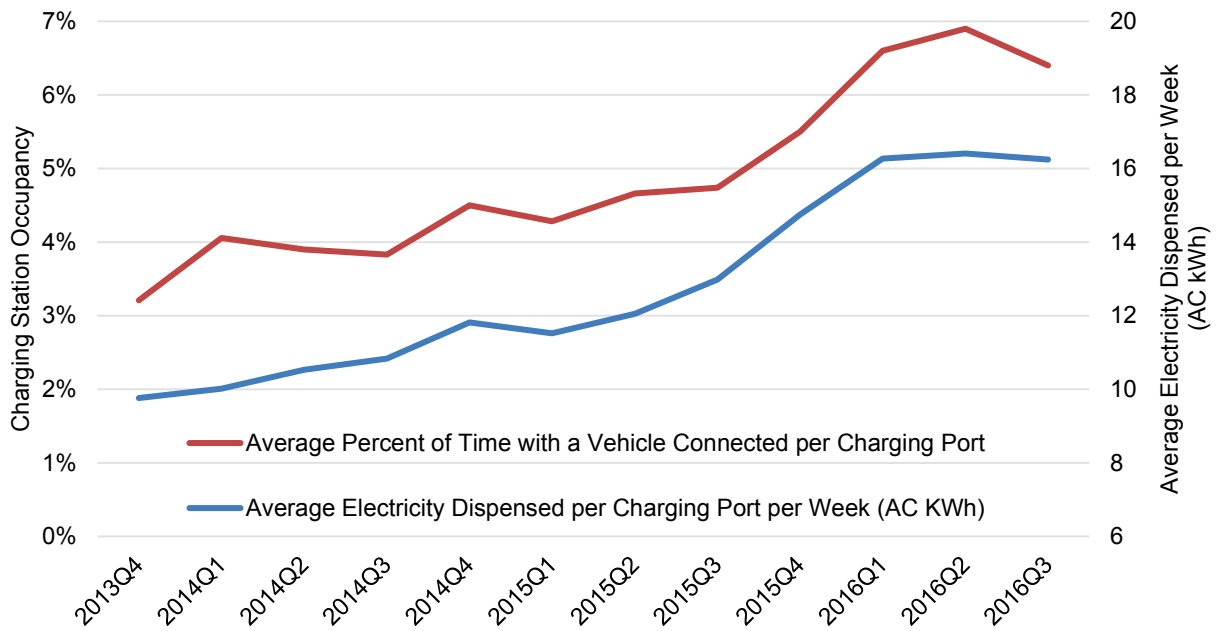


Table 1 and Table 2 show the data results by subset for the percentage of time with a vehicle connected for the average this quarter and change from last quarter (highest results are highlighted in green).

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

| Access Type | 2016 Q3 Average | Change from 2016 Q2 | Payment | 2016 Q3 Average | Change from 2016 Q2 | Land Use | 2016 Q3 Average | Change from 2016 Q2 |
|-------------|-----------------|---------------------|---------|-----------------|---------------------|----------|-----------------|---------------------|
| Limited | 8.5% | -10% | Free | 6.6% | -8% | Urban | 7.7% | -8% |
| Public | 5.2% | -4% | For Fee | 4.8% | 14% | Suburban | 6.0% | -8% |
| | | | | | | Rural | 2.5% | -4% |

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

| Region | 2016 Q3 Average | Change from 2016 Q2 | Venue | 2016 Q3 Average | Change from 2016 Q2 |
|------------------|-----------------|---------------------|---------------------|-----------------|---------------------|
| Long Island | 10.0% | -9% | Multi-Family | 10.7% | -23% |
| Finger Lakes | 10.0% | 1% | Parking (non-NYC) | 10.0% | 5% |
| Hudson Valley | 8.2% | -15% | University/Medical | 9.3% | -13% |
| New York City | 6.0% | -5% | Transit | 6.3% | -15% |
| Capital District | 4.7% | -16% | Parking (NYC) | 5.6% | 10% |
| Western NY | 3.7% | 0% | Workplace | 4.5% | -8% |
| Southern Tier | 3.5% | 35% | Leisure Destination | 3.1% | 3% |
| Central NY | 2.5% | 14% | Retail Location | 2.6% | -10% |
| North Country | 2.3% | -12% | Hotel | 1.9% | 36% |

For the first time since the start of the NYSEERDA program, the average charging station occupancy decreased. This is likely because few new stations were installed in past 12 months. Of the 70 ports installed between October 2015 and September 2016 through this program, over half were part of two deployments: charging stations at Charter Communications locations limited to employees and company vehicles, and charging stations at Brooklyn Navy Yard, another location with restricted access. The number of EVs and charging stations in the State have each been relatively stable recently; the leveling off of charging station usage may indicate that the overall use of the network may have reached an expected level for the current number of EVs in the State.

The decline in charging station occupancy from July to September as compared to previous quarters may be due to changing work patterns during the summer. The difference in charging availability, as well as charging demand, between weekdays and weekends shows that the majority of these charging stations are used during work hours from Monday to Friday. Therefore, vacations or a change in work schedule may have an impact on overall charging use. This factor is particularly relevant at universities, traditionally one of the highest utilized venues for charging stations, which have fewer employees working over the summer. It is possible that this data is influenced by seasonal variations in charging behaviors rather than awareness of these new stations that has driven the increase in usage to this point. Increased use of charging stations at leisure destinations and hotels also reflects typical summertime behaviors, while workplace and transit-adjacent stations saw less use.

While there was a noticeable decrease in charging station occupancy, the average electricity dispensed per charging station only declined slightly. An increase in the use of stations that charged a fee and longer charging times at other stations offset declines in other market segments. Charging stations with a fee experienced a 14 percent increase in the average percent of time an EV was connected (from 4.2 percent in Q2 of 2016 to 4.8 percent in Q3), as well as a longer average percent of time an EV drew power from the charging station (from 1.8 percent in Q2 of 2016 to 2.1 percent in Q3). This resulted in an increase of 1.7 AC kWh for the average electricity consumed per charging port per week. Charging stations in New York City (many of which impose a fee for charging) experienced lower occupancy in Q3 of 2016 as compared to Q2, but a higher average percentage of time that an EV drew power and an increase from 11.7 AC kWh average per charge event to 13.9 AC kWh. In other words, EVs occupied charging stations for a shorter amount of time, but charged for a larger percentage of connected time, resulting in more electricity consumed.

4 Analysis of EV Registrations in New York State

The following graphs show the results of EV registration data analysis as of October 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

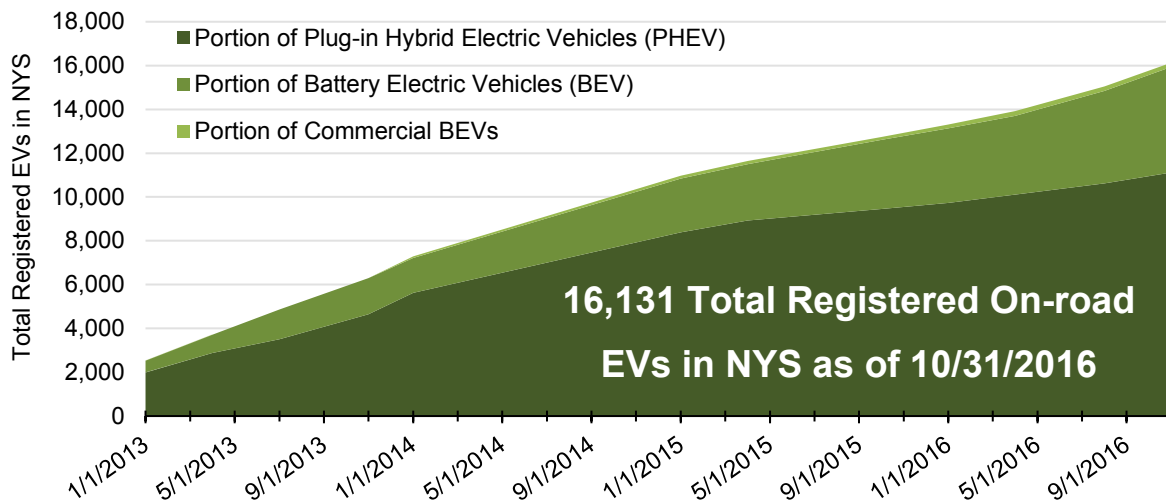


Figure 4. Battery Electric Vehicles in New York State

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

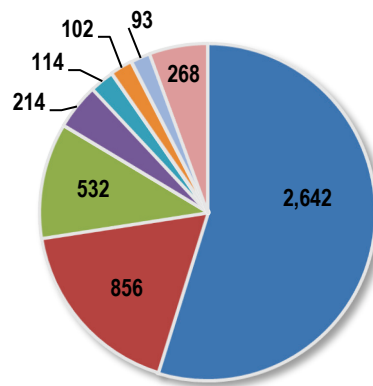


Figure 5. Plug-in Hybrid Electric Vehicles in New York State

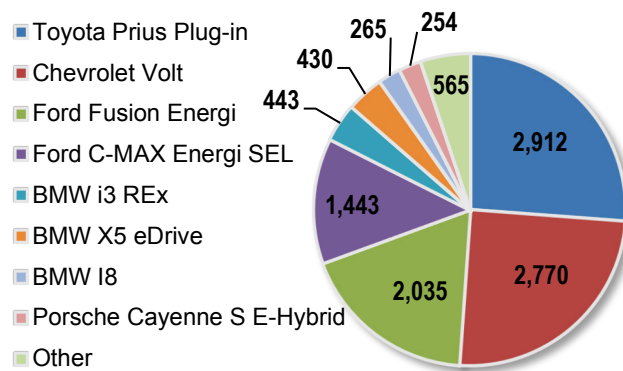
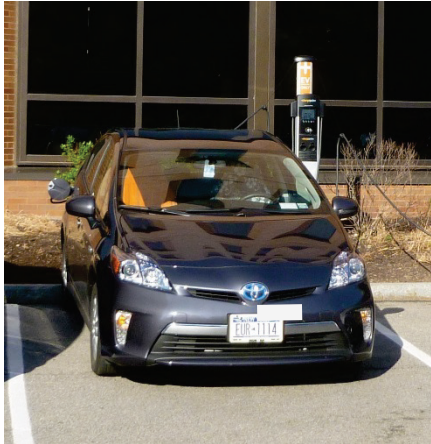
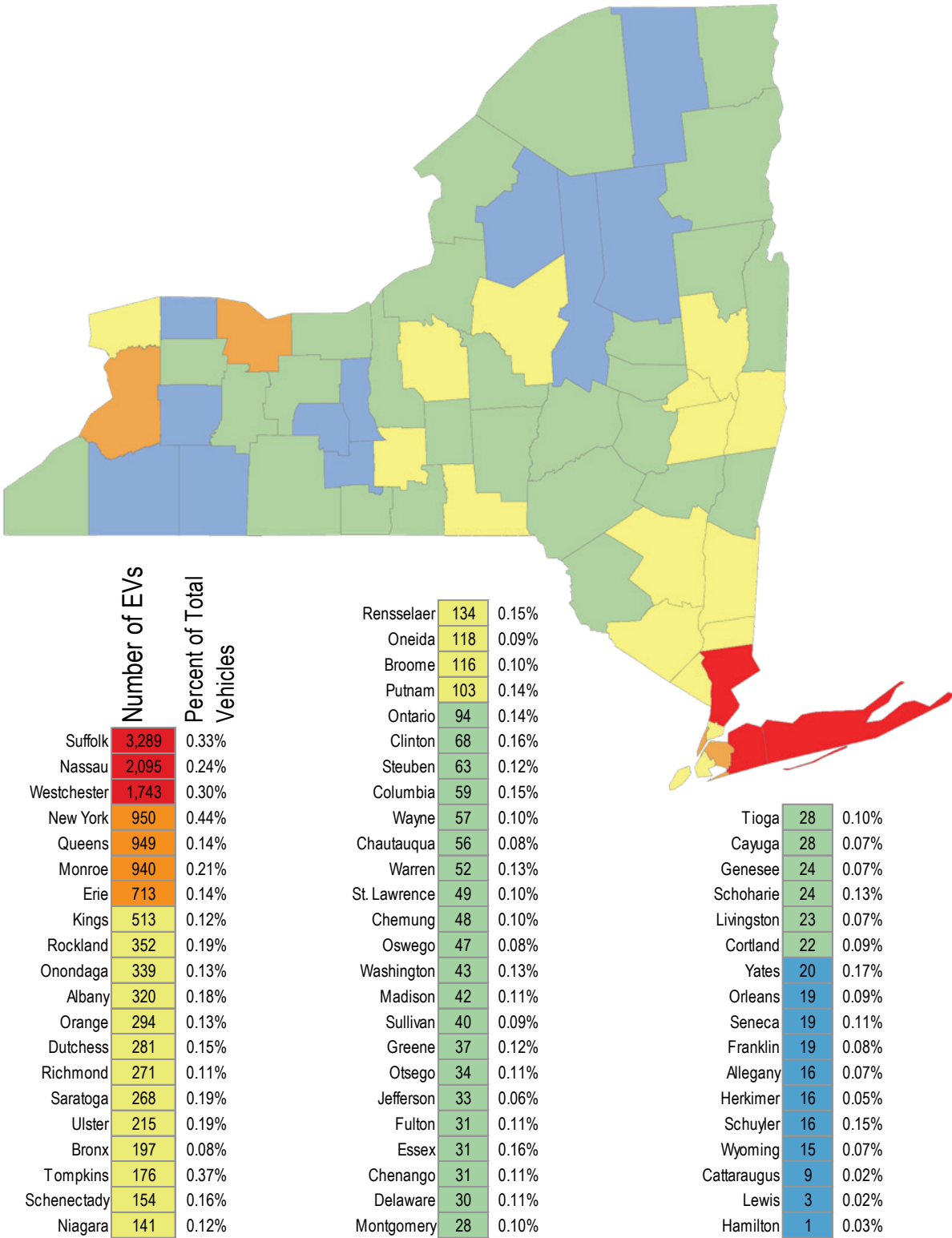


Figure 6. Number and Percentage of EVs among All Registered Vehicles in each NYS County



As of 11/1/2016

Appendix A: NYSERDA Electric Vehicle Charging Infrastructure Report

NYSERDA Electric Vehicle Charging Infrastructure Report

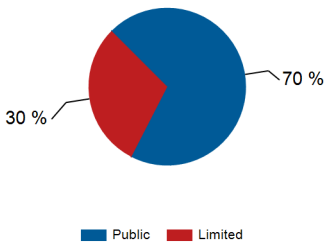
Report period: July 2016 through September 2016

New York State

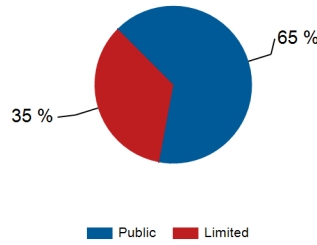
EVSE Usage - By Access Type

| | Public | Limited ³ | Total |
|--|--------|----------------------|--------|
| Number of charging ports ¹ | 341 | 195 | 536 |
| Number of charging events ² | 10,990 | 4,697 | 15,687 |
| Electricity consumed (AC MWh) | 73.06 | 38.60 | 111.67 |
| Percent of time with a vehicle connected | 5.2% | 8.5% | 6.4% |
| Percent of time with a vehicle drawing power | 2.9% | 2.8% | 2.8% |

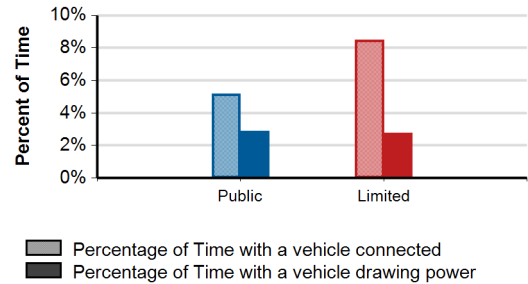
Number of Charging Events



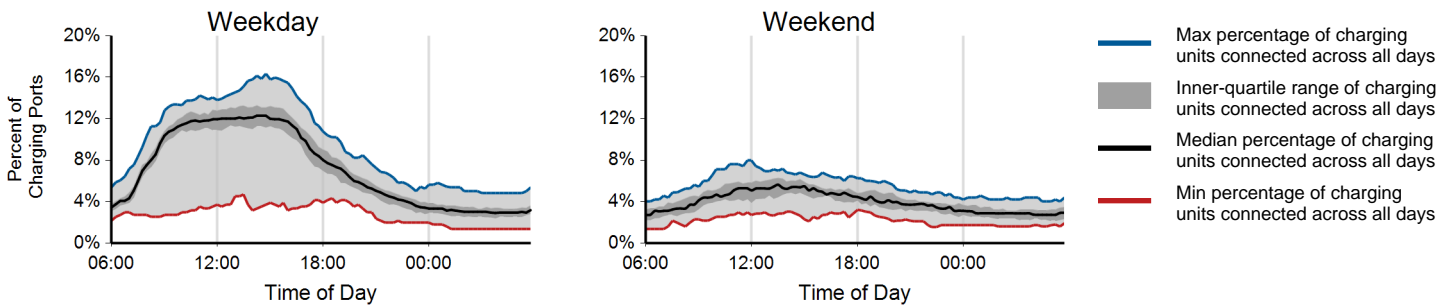
Electricity Consumed



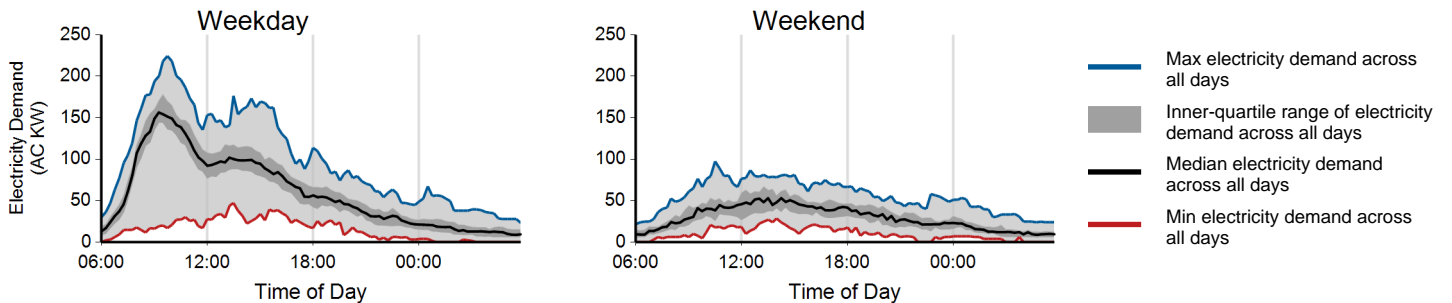
Charging Unit Utilization



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.

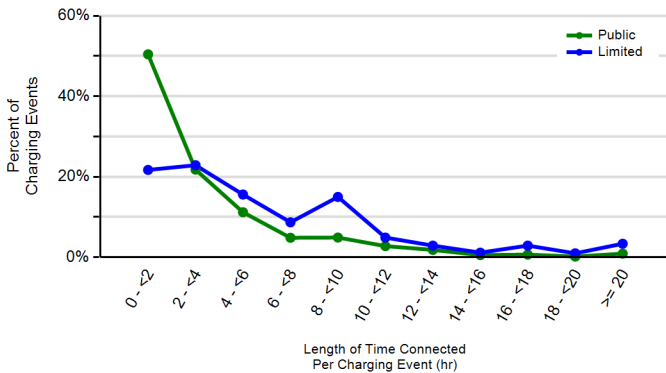
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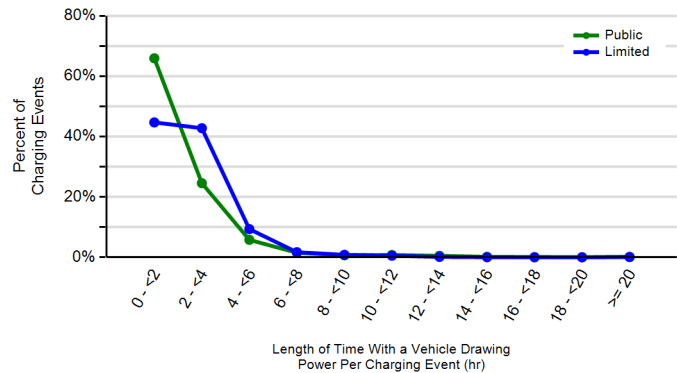
EVSE Usage - By Access Type

| | Public | Limited ³ |
|---|--------|----------------------|
| Number of charging ports ¹ | 341 | 195 |
| Number of charging events ² | 10,990 | 4,697 |
| Charging energy consumed (AC MWh) | 73.1 | 38.6 |
| Average percent of time with a vehicle connected per charging port | 5.2% | 8.5% |
| Average percent of time with a vehicle drawing power per charging port | 2.9% | 2.8% |
| Average number of charging events started per charging port per week | 2.5 | 1.9 |
| Average electricity consumed per charging port per week (AC kWh) | 16.5 | 15.8 |
| Average length of time with vehicle connected per charging event (hr) | 3.5 | 7.4 |
| Average length of time with vehicle drawing power per charging event (hr) | 2.0 | 2.4 |
| Average electricity consumed per charging event (AC kWh) | 6.6 | 8.2 |

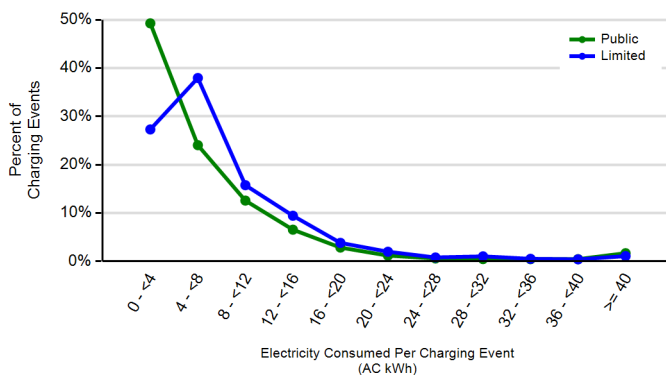
Distribution of Length of Time with a Vehicle Connected per Charging Event



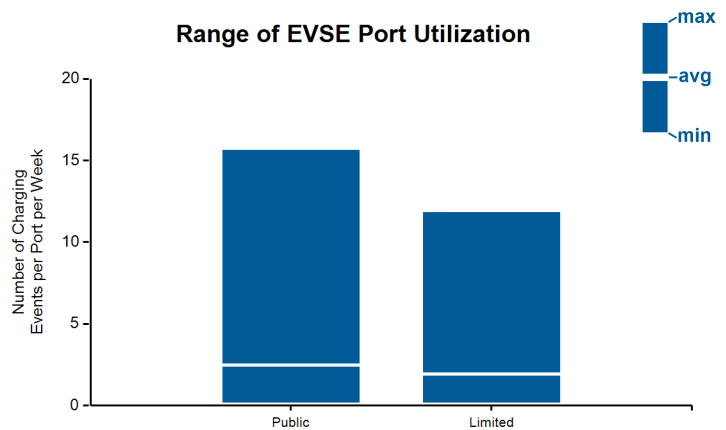
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



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.

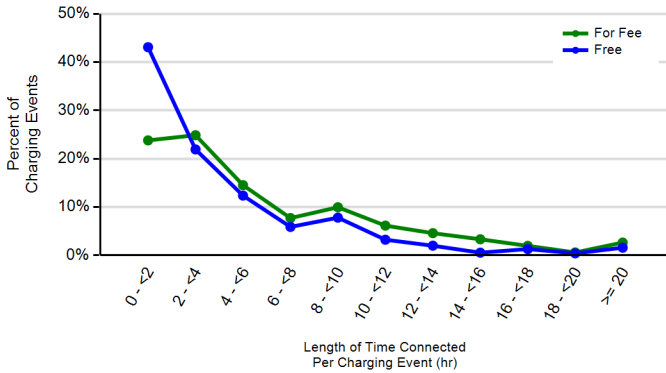
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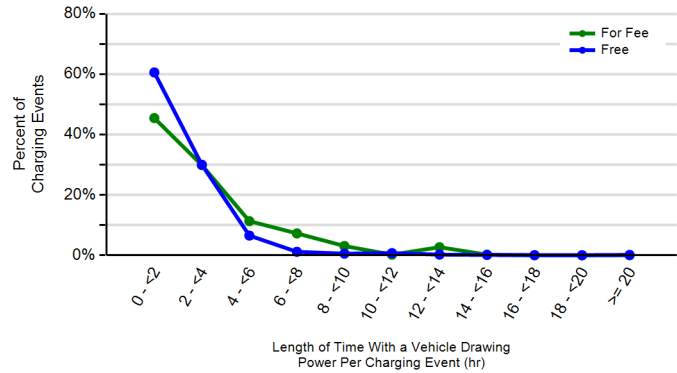
EVSE Usage - By Required Payment

| | For Fee | Free |
|---|---------|--------|
| Number of charging ports ¹ | 67 | 469 |
| Number of charging events ² | 1,026 | 14,661 |
| Charging energy consumed (AC MWh) | 12.4 | 99.3 |
| Average percent of time with a vehicle connected per charging port | 4.8% | 6.6% |
| Average percent of time with a vehicle drawing power per charging port | 2.1% | 3.0% |
| Average number of charging events started per charging port per week | 1.2 | 2.4 |
| Average electricity consumed per charging port per week (AC kWh) | 14.3 | 16.5 |
| Average length of time with vehicle connected per charging event (hr) | 6.8 | 4.5 |
| Average length of time with vehicle drawing power per charging event (hr) | 3.0 | 2.0 |
| Average electricity consumed per charging event (AC kWh) | 12.1 | 6.8 |

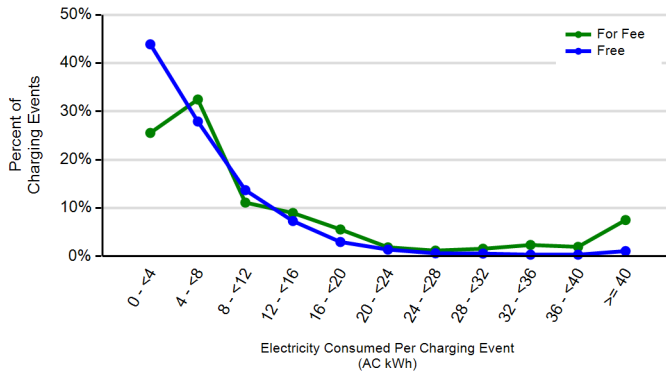
Distribution of Length of Time with a Vehicle Connected per Charging Event



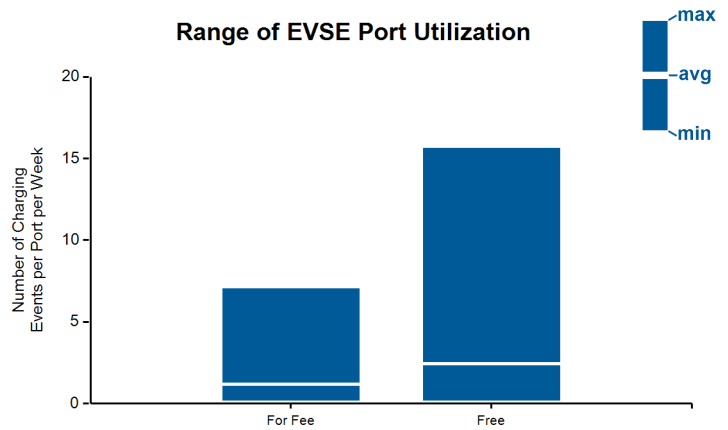
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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.

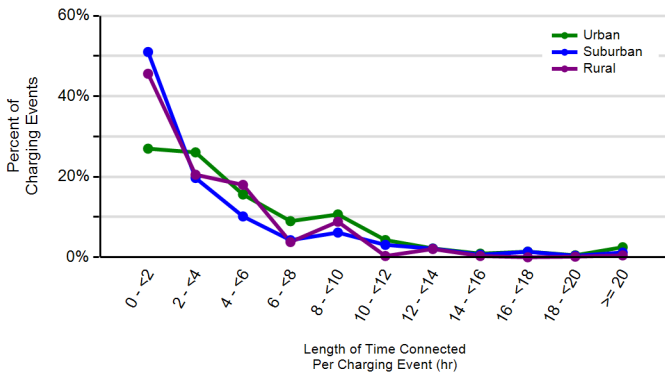
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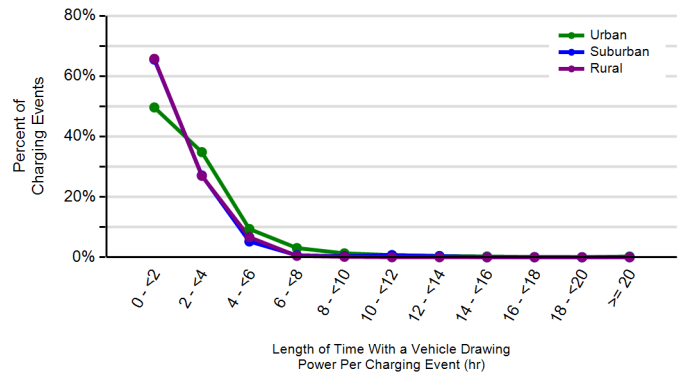
EVSE Usage - By Land Use Type

| | Urban | Suburban | Rural |
|---|-------|----------|-------|
| Number of charging ports ¹ | 200 | 297 | 39 |
| Number of charging events ² | 5,853 | 9,200 | 634 |
| Charging energy consumed (AC MWh) | 54.7 | 53.2 | 3.8 |
| Average percent of time with a vehicle connected per charging port | 7.7% | 6.0% | 2.5% |
| Average percent of time with a vehicle drawing power per charging port | 3.6% | 2.5% | 1.2% |
| Average number of charging events started per charging port per week | 2.3 | 2.4 | 1.3 |
| Average electricity consumed per charging port per week (AC kWh) | 21.5 | 13.9 | 7.5 |
| Average length of time with vehicle connected per charging event (hr) | 5.6 | 4.2 | 3.3 |
| Average length of time with vehicle drawing power per charging event (hr) | 2.6 | 1.8 | 1.6 |
| Average electricity consumed per charging event (AC kWh) | 9.3 | 5.8 | 6.0 |

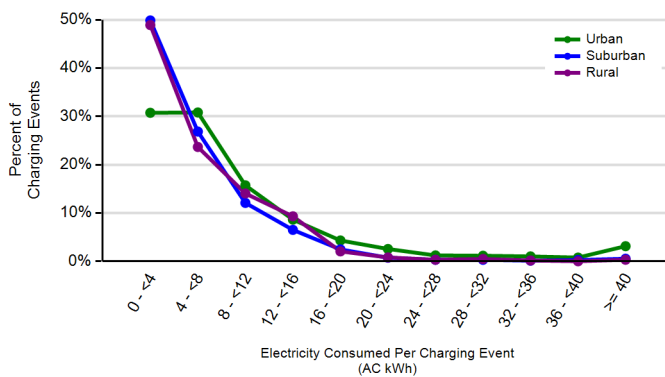
Distribution of Length of Time with a Vehicle Connected per Charging Event



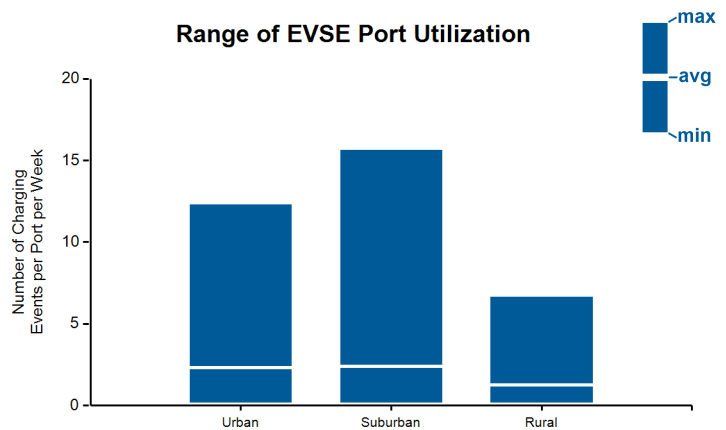
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



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.

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

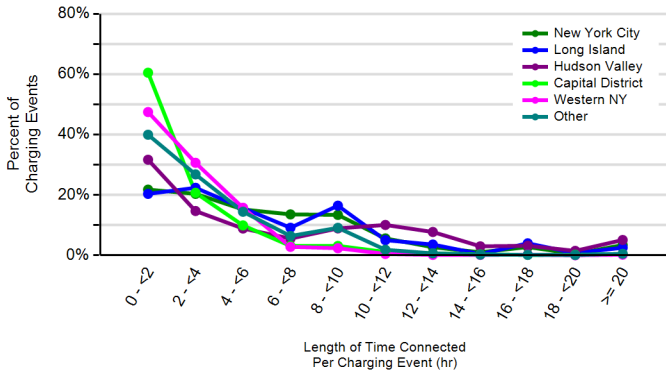
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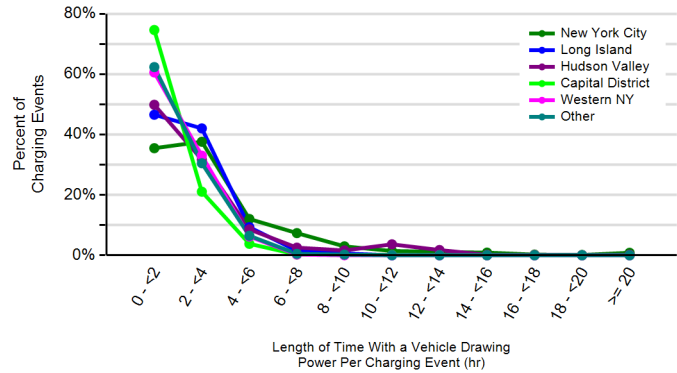
EVSE Usage - By Region

| | New York City | Long Island | Hudson Valley | Capital District | Syracuse/Central NY | Rochester/Finger Lakes | North Country | Western NY | Southern Tier |
|---|---------------|-------------|---------------|------------------|---------------------|------------------------|---------------|------------|---------------|
| Number of charging ports ¹ | 98 | 73 | 101 | 105 | 19 | 41 | 25 | 52 | 13 |
| Number of charging events ² | 1,720 | 1,996 | 2,190 | 4,479 | 368 | 2,199 | 652 | 1,577 | 366 |
| Charging energy consumed (AC MWh) | 23.8 | 16.4 | 18.3 | 21.6 | 1.8 | 14.2 | 3.2 | 9.7 | 2.0 |
| Average percent of time with a vehicle connected per charging port | 6.0% | 10.0% | 8.2% | 4.7% | 2.5% | 10.0% | 2.3% | 3.7% | 3.5% |
| Average percent of time with a vehicle drawing power per charging port | 3.2% | 2.8% | 2.8% | 2.8% | 1.4% | 4.8% | 1.7% | 2.5% | 2.0% |
| Average number of charging events started per charging port per week | 1.4 | 2.1 | 1.7 | 3.3 | 1.5 | 4.1 | 2.0 | 2.3 | 2.1 |
| Average electricity consumed per charging port per week (AC kWh) | 19.6 | 17.5 | 14.2 | 15.9 | 7.3 | 26.4 | 9.9 | 14.2 | 11.7 |
| Average length of time with vehicle connected per charging event (hr) | 7.1 | 7.9 | 8.1 | 2.4 | 2.8 | 4.1 | 1.9 | 2.7 | 2.7 |
| Average length of time with vehicle drawing power per charging event (hr) | 3.8 | 2.2 | 2.8 | 1.4 | 1.5 | 2.0 | 1.4 | 1.9 | 1.6 |
| Average electricity consumed per charging event (AC kWh) | 13.9 | 8.2 | 8.4 | 4.8 | 4.9 | 6.5 | 4.8 | 6.1 | 5.5 |

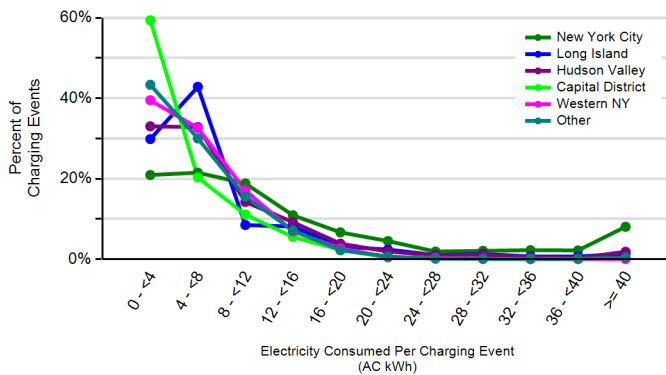
Distribution of Length of Time with a Vehicle Connected per Charging Event⁴



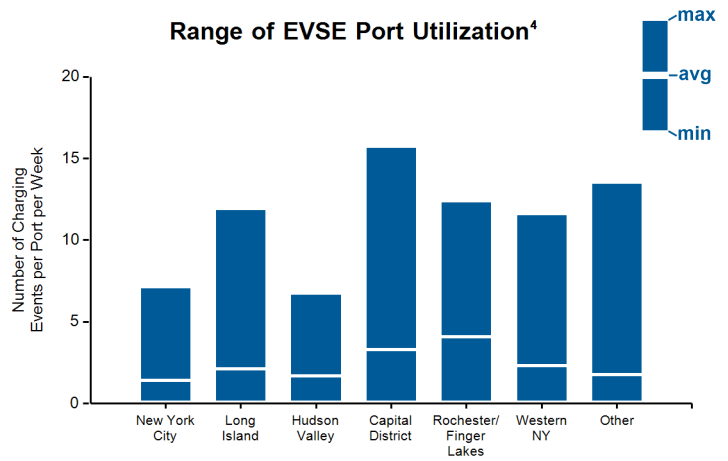
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event⁴



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'.

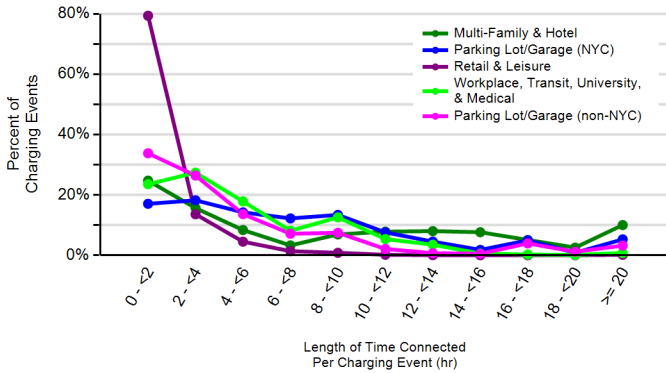
NYSERDA Electric Vehicle Charging Infrastructure Report

Report period: July 2016 through September 2016

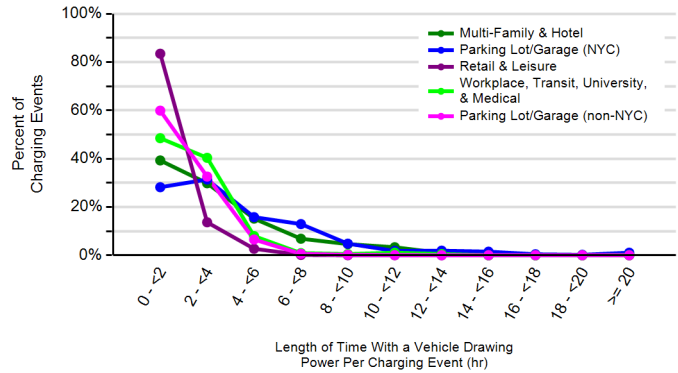
EVSE Usage - By Venue

| | 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 | 86 | 70 | 81 | 74 | 18 | 32 | 113 | 25 | 37 |
| Number of charging events ² | 2,999 | 950 | 4,049 | 1,507 | 312 | 238 | 4,350 | 638 | 644 |
| Charging energy consumed (AC MWh) | 19.3 | 18.2 | 13.4 | 10.9 | 4.6 | 2.7 | 33.6 | 3.9 | 5.2 |
| Average percent of time with a vehicle connected per charging port | 10.0% | 5.6% | 2.6% | 4.5% | 10.7% | 1.9% | 9.3% | 3.1% | 6.3% |
| Average percent of time with a vehicle drawing power per charging port | 3.2% | 3.0% | 2.2% | 2.3% | 3.1% | 1.0% | 4.0% | 2.1% | 2.9% |
| Average number of charging events started per charging port per week | 2.7 | 1.1 | 3.8 | 1.7 | 1.4 | 0.6 | 3.0 | 1.9 | 1.3 |
| Average electricity consumed per charging port per week (AC kWh) | 17.6 | 20.2 | 12.6 | 12.0 | 19.8 | 6.9 | 22.9 | 11.8 | 10.8 |
| Average length of time with vehicle connected per charging event (hr) | 6.1 | 8.9 | 1.2 | 4.5 | 13.3 | 5.2 | 5.3 | 2.7 | 8.0 |
| Average length of time with vehicle drawing power per charging event (hr) | 1.9 | 4.7 | 1.0 | 2.3 | 3.9 | 2.7 | 2.3 | 1.8 | 3.7 |
| Average electricity consumed per charging event (AC kWh) | 6.4 | 19.1 | 3.3 | 7.2 | 14.6 | 11.5 | 7.7 | 6.1 | 8.1 |

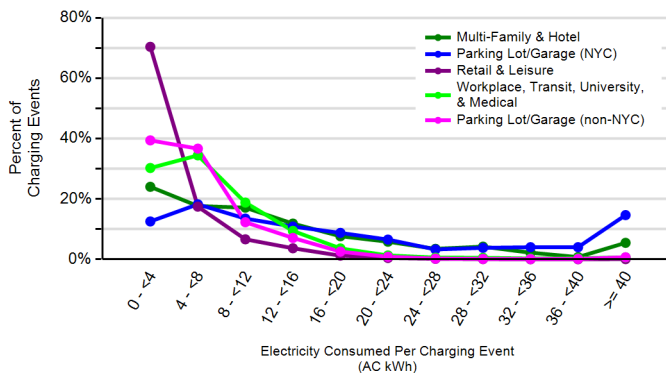
Distribution of Length of Time with a Vehicle Connected per Charging Event



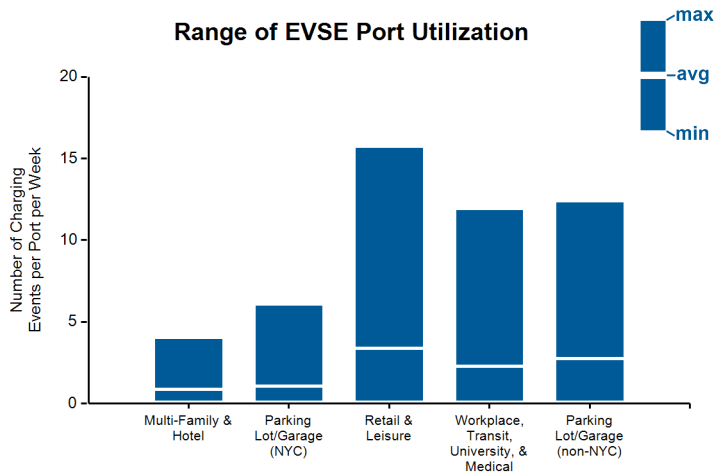
Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



Distribution of AC Energy Consumed per Charging Event



Range of EVSE Port Utilization



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

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

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