Greater Buffalo & Niagara

Electric Vehicle Charging Station Plan

Greater Buffalo and Niagara EV Charging Station Plan

PREPARED BY:

CLEAN COMMUNITIES OF WESTERN NEW YORK
A US DOE CLEAN CITIES COALITION

ENERGETICS
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IN COLLABORATION WITH:

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Greater Buffalo and Niagara EV Charging Station Plan

Input to the Greater Buffalo and Niagara EV Charging Station Plan was provided by these sponsors and supporters, along with other key stakeholders in the region. Members of this working group which reviewed, ranked, and provided feedback on all aspects of this plan included:

- Adam Ruder, NYSERDA
- Robyn Marquis, NYSERDA
- Colleen Smith-Lemmon, NYSDOT
- Hal Morse, Greater Buffalo Niagara Regional Transportation Council
- Kelly Dixon, Greater Buffalo Niagara Regional Transportation Council
- Ali Adelman, Wendel Companies
- John Havrilla, Wendel Companies
- Gary Marchiori, Energy Mark
- Cliff Mason, National Fuel
- Bob Reynolds, National Grid
- Craig Jackson, Clean Communities of Western New York

Buffalo Zoo installed an AC Level 2 charging station for visitors.

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List of Acronyms

AC	Alternating Current
BEV	Battery Electric Vehicle
DC	Direct Current
EREV	Extended Range Electric Vehicle
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
HEV	Hybrid Electric Vehicle
ICE	Internal Combustion Engine
kW	KiloWatts
kWh	KiloWatt Hours
MPG	Miles Per Gallon
MPO	Metropolitan Planning Organization
MSRP	Manufacturer Suggested Retail Price
NYC	New York City
NYS	New York State
NYSDOT	New York State Department of Transportation
NYSERDA	New York State Energy Research and Development Authority
SAE	Society of Automotive Engineers
SUNY	State University of New York
PHEV	Plug-in Hybrid Electric Vehicle
VAC	Volts of Alternating Current
ZEV	Zero Emission Vehicle

EV drivers can charge while visiting or working at Buffalo State University.

Greater Buffalo and Niagara EV Charging Station Plan

Executive Summary

This EV Charging Station Plan assesses Greater Buffalo and Niagara Region's current support for electric vehicles (EVs), often referred to as its EV-readiness. The Plan also provides recommendations to create a more comprehensive charging network that supports EV drivers and addresses any implementation barriers.

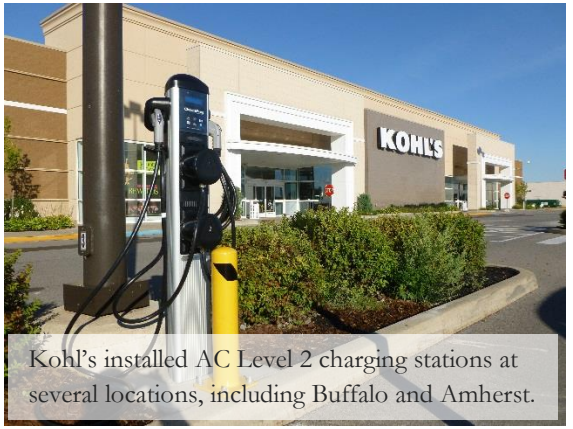
EVs can save money and reduce air pollution in New York State. Compared to gasoline-powered cars, EVs are more energy efficient and cost 50-70% less to operate per mile. A large portion of New York's electricity grid is powered by clean low-carbon energy sources (not oil or coal), allowing EVs to reduce greenhouse gas emissions and pollutants that cause smog and acid rain. New York State has prioritized EV market development support through its ChargeNY initiative.

A number of plug-in hybrid electric vehicle (PHEV) and battery electric vehicle (BEV) models are available in New York State due to its participation in California's zero emission vehicle (ZEV) mandate. The ZEV mandate requires all major car manufacturers to sell increasing percentages of ZEVs.

Both PHEVs and BEVs displace petroleum fuel by charging their batteries from the electrical grid. BEVs typically have a larger battery pack for more electric miles (~60-100), but have no option when the battery is depleted. PHEVs have a less electric range (~10-50), but also have a small gasoline engine that can power the vehicle if needed.

EVs replenish their batteries by connecting to charging stations at home, work, or at public locations. Various charging levels provide different rates of charge from 20 minutes to 12 hours, with faster chargers being considerably more expensive to install and operate. The station installation costs can also vary from site to site. Ideal locations are where the parking space is close to the electrical panel and the existing service is sufficient to sustain the additional electrical load.

At the end of 2015, there were 706 EVs registered in the Greater Buffalo and Niagara Region. 111 were BEVs and 595 were PHEVs. These represent a very small but growing fraction of all registered vehicles. Currently there are 36 public charging station locations in the region, 6 private station locations, and one DC fast charging station location.



Kohl's installed AC Level 2 charging stations at several locations, including Buffalo and Amherst.

To help create a more comprehensive charging network that supports current and future EV drivers, *five additional charging station installations are recommended at key locations in the Greater Buffalo and Niagara Region*:

- Amherst
- Williamsville
- Niagara Falls
- North Buffalo
- Orchard Park

Some other locations that could also be considered for installing more charging stations were Cheektowaga, West Seneca, Lewiston, South Buffalo, and Youngstown.

Six barriers were identified to be critical issues limiting the expanded use of EVs in the Greater Buffalo and Niagara Region. Municipalities, counties, and the region as a whole should lead or support initiatives that follow these recommended potential solutions and strategies.

EV Building Regulations need to be reviewed by the targeted municipal planning and building departments. Lack of regulations may lead to unnecessary road blocks in completing new installations. Permitting and siting requirements should be defined prior to new installations to avoid future issues that may result in needing to relocate a charging station.

DC Fast Charging Infrastructure is required to facilitate longer EV travel distances, including inter-regional trips. They should be placed in larger cities where there is a concentrated population of EV drivers so the stations can also be used by local residents. The planning of fast charging stations should be coordinated at a state level and attempt to align with regular routes for government or private fleets of EVs. Logical fast charger locations to consider in the Greater Buffalo and Niagara Region include Niagara Falls, Buffalo, Williamsville, Amherst, Orchard Park, and travel stops along I-90.

EV Buyer and Driver Education is needed through large scale awareness efforts that are coordinated with EV manufacturers and local dealerships. These efforts should be directed towards key demographics of potential EV buyers rather than a broad audience. EV projects involving students in college or younger could be effective, as well as efforts that draw a connection between EVs and ongoing electricity generation initiatives (e.g., solar power installations). A dedicated webpage for promoting EVs should be developed, since online resources are excellent for providing information.

Collaboration with the Electric Utility is need for EV initiatives to be successful. Electric utilities can share valuable information on the source of electricity used to charge EVs and the impact it has on the environment and local jobs. They are also logical candidates to lead by example in regards to EV adoption. Consultation or guidelines issued by the electric utility specifically for EV owners would help them make more informed decisions on their EV purchases.

Anticipated Charging Station Occupancy should be examined for new charging locations to assure that the installation will benefit EV drivers. It is critical to monitor and manage charging station use so a single EV does not prevent others from using the station after they have completed a charge. Proper signage reminds EV drivers of time limits and networked charging stations can notify the driver when charge cycle is complete or impose fees for longer than necessary parking.

Proper Site Planning helps ensure new construction projects consider installing charging stations or provide preparations for installing them in the future. Prime examples are projects at universities, medical campuses, and technology parks where employees would likely consider EVs. Architects and planners must understand when charging stations are a good option so developers can negotiate an incentive for including an installation.

More EVs will be utilized by Greater Buffalo and Niagara region residents in the near future because they provide benefits for the entire community. Gradually expanding the charging network in the region and supporting the recommended strategies to help our communities become more EV-ready will prepare us for the future. Even today, attracting EV drivers from other areas of the state can complement the efforts to promote tourism in the Greater Buffalo and Niagara region. EVs also attract highly educated and technology savvy individuals who can help drive our emerging technology industries.

The *key next steps to implementing this EV Charging Station Plan* are:

1) Holding meetings with key stakeholders in the recommended locations to prepare for, and encourage, new charging stations.
2) Working with municipal planning and building departments to establish siting guidelines for new installations.
3) Work with EV dealerships to educate them on availability of charging infrastructure and EV vehicle rebates.
4) Support EV vehicle and infrastructure rebate/incentive program.
5) Identify additional key sites where charging station benefit EV drivers.

Overview

For a new technology such as the electric vehicle (EV), which requires coordinated construction of infrastructure and widespread education and outreach, careful planning is essential. Public EV charging stations are important for EV drivers to have the ability and confidence to use their vehicle throughout New York State (NYS), both to travel within and between metropolitan areas.

Incorporating EV charging station planning into broader local and regional planning processes can help ease the adoption of the new technology. EV charging station planning is complex because of the different factors considered by drivers when planning trips, including the different types and speeds of EV charging stations. Educating decision makers and key stakeholders is critical.

A number of initiatives have recently been undertaken to support EV readiness nationally (through the Department of Energy Clean Cities EV readiness grants), within NYS (chiefly through efforts by NYSERDA), and even locally in some cases. This EV Charging Station Plan, along with the process to create it, is one of the first opportunities to discuss and document EV charging infrastructure at the regional level.

OBJECTIVE

The objective of this Greater Buffalo and Niagara Region EV Charging Station Plan is to recommend strategies for supporting current and future EV drivers travelling within the region and between NYS regions. Since EVs have a more limited range than conventional internal combustion engine (ICE) vehicles that use petroleum fuels, the most critical area of support is providing charging opportunities to EV drivers.

Therefore, this Plan identifies gaps where public infrastructure is not currently available in the region to support EV drivers and recommends charging station installations in key locations to establish a comprehensive charging network. In addition to more charging stations, this Greater Buffalo and Niagara Region EV Charging Station Plan also outlines critical implementation barriers for charging station installations or EV adoption and recommends strategies for addressing them.

Plan Authors and Contributors

Clean Communities of Western New York and Energetics Incorporated led the development effort for this Greater Buffalo and Niagara Region EV Charging Station Plan. Clean Communities of Western New York is one of 90 local DOE-sponsored Clean Cities Coalitions that develops public/private partnerships to promote alternative fuels and vehicles, fuel blends, fuel economy, hybrid vehicles and idle reduction awareness. Energetics is a technical consulting firm with more than 30 years of experience supporting alternative fuel vehicle development and deployment efforts for the U.S. Department of Energy, NYSERDA, and other entities.

NYSERDA and the New York State Department of Transportation (NYSDOT) sponsored the project to develop this plan, which also created four other plans for the other regions along the Interstate 90 corridor. The Greater Buffalo and Niagara Region EV Charging Station Plan was also supported by the Greater Buffalo-Niagara Regional Transportation Council, the designated Metropolitan Planning Organization (MPO) for the area.

Plan Components

This Greater Buffalo and Niagara Region EV Charging Station Plan presents **background** information on the current technology used by EVs and EV charging stations. This information provided our working group members, along with

the readers of this report, with a general understanding of what EV models are available, who is buying EVs in NYS, which types of charging stations are on the market, and how charging stations are being used.

The next section of this Plan details the **existing EV charging infrastructure** in the Greater Buffalo and Niagara Region, along with the current EV owners. Maps in this section clearly show areas that lack EV infrastructure; places where there are no public charging stations and an EV driver passing through the area would not have a feasible option to charge if they need one.

Based on input from the working group, this Greater Buffalo and Niagara Region EV Charging Station Plan presents the **recommended locations for installing new public charging stations** in this region to establish a more comprehensive charging network that will support current and future EV drivers. Potential venues for AC Level 2 charging station installations in these recommended locations are listed and meetings with those venues and other relevant stakeholders in that location should be held to discuss the best option for pursuing a charging station installation. Coordinating this will allow these locations to capitalize on the existing NYS tax credit for charging stations or other potential funding which may become available.

Potential locations for the placement of direct current (DC) fast chargers are also presented as discussed among the working group members. These stations allow EV drivers to charge in durations similar to fueling a conventional ICE vehicle. This enables EV drivers to travel between NYS regions while providing more convenient charging for EV drivers in the immediate area surrounding that DC fast charger.

The final section of this Greater Buffalo and Niagara Region EV Charging Station Plan discusses barriers that are currently limiting the use of EVs in this region's communities. **Recommendations are provided that will help Greater Buffalo and Niagara Region communities become more supportive of EVs and EV charging infrastructure**. Since we can all benefit from better air quality due to fewer exhaust emissions and importing less petroleum products, it is in our best interest to encourage EV adoption.

Charging stations at multi-family dwellings, like Country Club manor in Williamsville can provide residents an opportunity to use an EV since they may not have a garage where they would be able to install their own.

Greater Buffalo and Niagara EV Charging Station Plan

Background

Electric Vehicles

Hybrid electric vehicles (HEVs) supplement the internal combustion engine with electrical power produced by an on-board electric motor. The electrical system acts as a generator when a driver applies the brakes, converting kinetic energy into electrical energy that is stored in a small battery pack. Gasoline or diesel is still the primary fuel.

Electric vehicles (EVs) take the HEV concept further, using a larger on-board battery for extended electric-only range. The driver charges the battery by plugging the vehicle into a charging outlet. When running on electricity, EVs are able to completely offset the use of gasoline, eliminating all tailpipe emissions.

Two different types of EVs are available: plug-in hybrid electric vehicles (PHEV) and battery electric vehicles (BEV). A PHEV is an HEV with a larger battery that plugs in to charge, but it keeps a gasoline or diesel engine as a backup. Some variations are called extended range EVs, or EREVs. After the battery energy is exhausted, the engine starts and the vehicle acts like a normal HEV until it is charged again from the grid.

BEVs fully remove the gasoline or diesel powertrain and replace it with an electric powertrain consisting of an electric motor, power electronics, and a battery pack. BEVs have a longer all-electric range than PHEVs, but do not have a fuel backup when the battery is depleted.

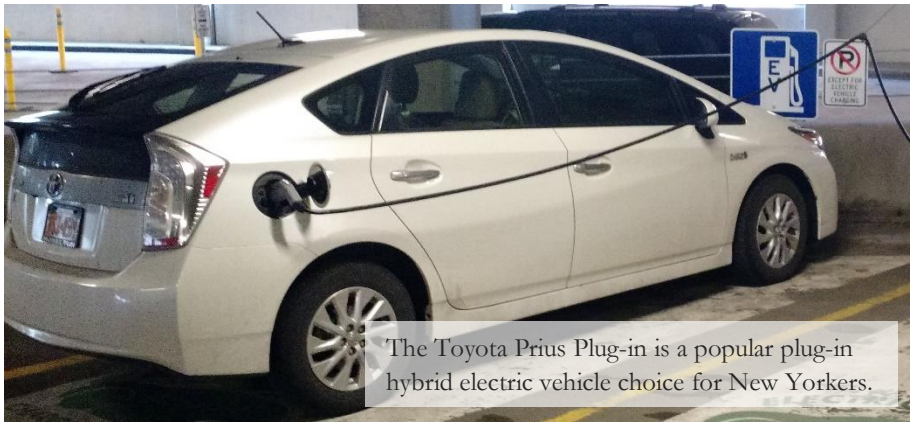
Using electricity as a vehicle fuel is currently less expensive per mile than gasoline, and can be even more cost effective if the EV driver takes advantage of off-peak electricity rates.

Current BEVs can travel between 60 and 265 miles on a single charge and take at least 30 minutes to recharge the battery. A gasoline vehicle will be able to travel 300-500 miles on a single tank and can fuel in less than five minutes.

This "range anxiety" can often be solved with careful planning (including being sure to plug in every night and knowing where charging stations are along your route), or through the purchase of a PHEV to have a gasoline engine in reserve. PHEVs have ranges similar to gasoline vehicles, but typically only run on electricity for the first 10 to 50 miles.

Cold and hot ambient temperature conditions will impact the realized driving range due to added power requirements to heat or cool the interior. There is also a decrease in performance of the EV batteries. While manufacturers continue to improve the vehicle's performance for adverse climates, a decrease in electric mileage by up to 50% on the coldest days and 20% on the hottest may occur. Pre-conditioning the EV while it is still plugged-in is a good strategy for minimizing the decline in range.

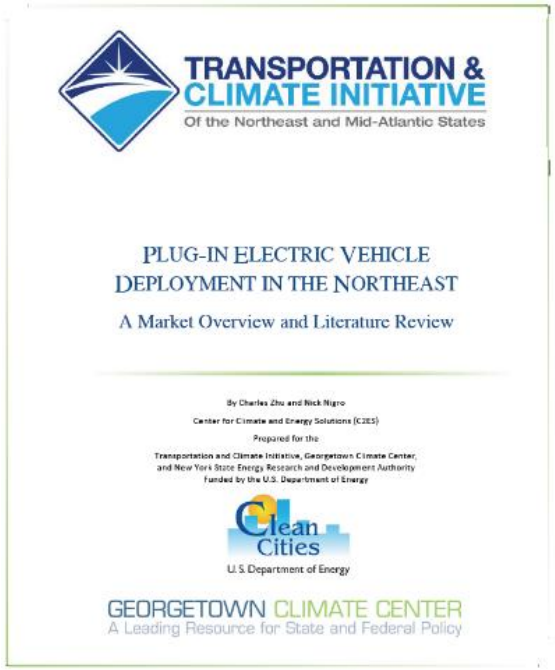
EV models available for purchase in New York State are listed in Appendix A.



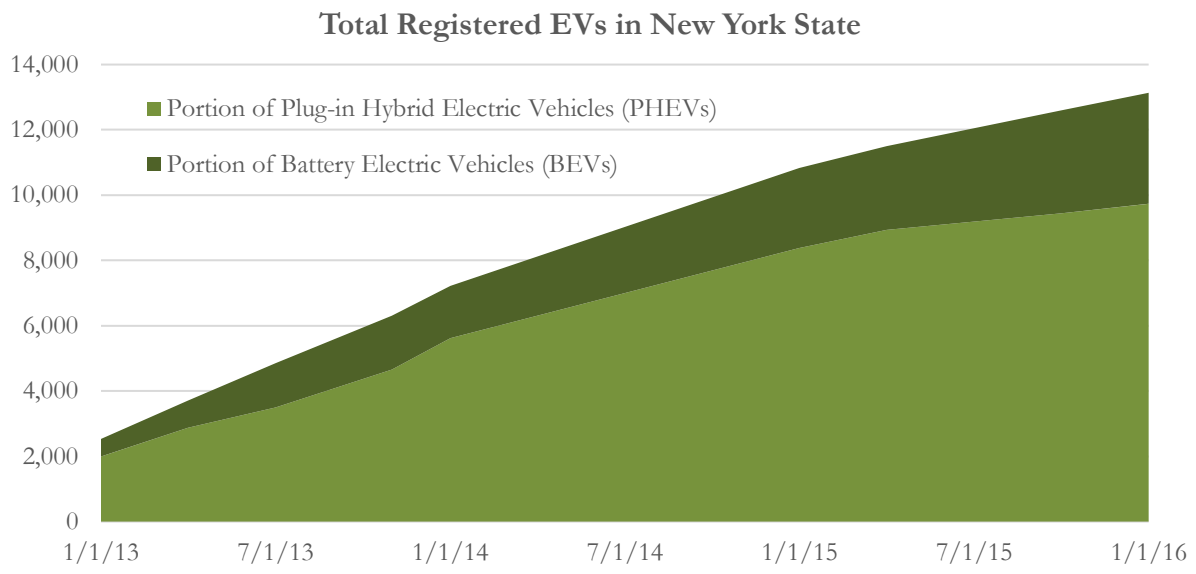
The Toyota Prius Plug-in is a popular plug-in hybrid electric vehicle choice for New Yorkers.

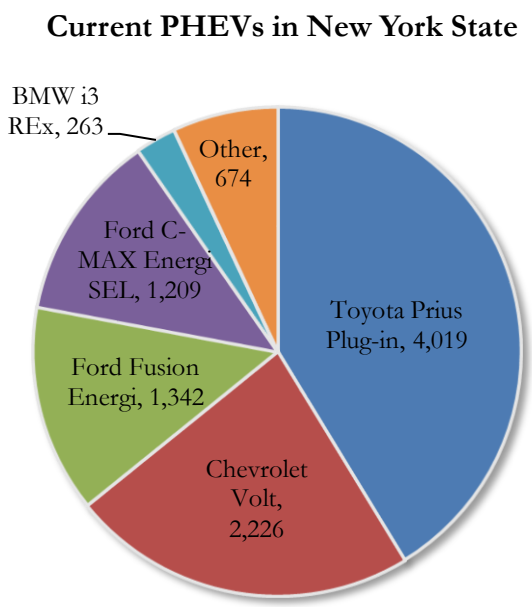
Greater Buffalo and Niagara EV Charging Station Plan

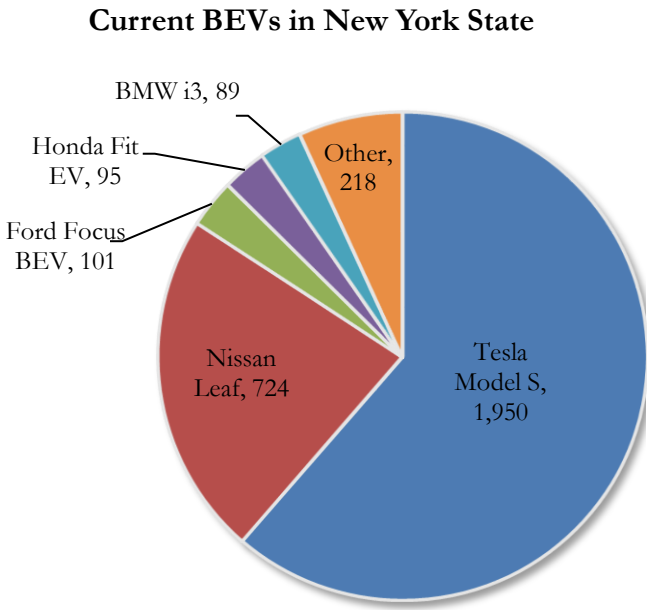
The *Literature review of EV use in the Northeast* provides an overview of EV deployment in the Northeast as of 2012. The document is intended to serve as a resource for consumers and policymakers who seek to better understand the nature of and challenges facing EV deployment in the Northeast.



EV ownership in New York State has been increasing rapidly in the past couple of years. There are close to three times more PHEVs registered in New York State than BEVs, but a variety of models are being offered and purchased for both technologies. EVs still only account for 0.16% of all registered vehicles.







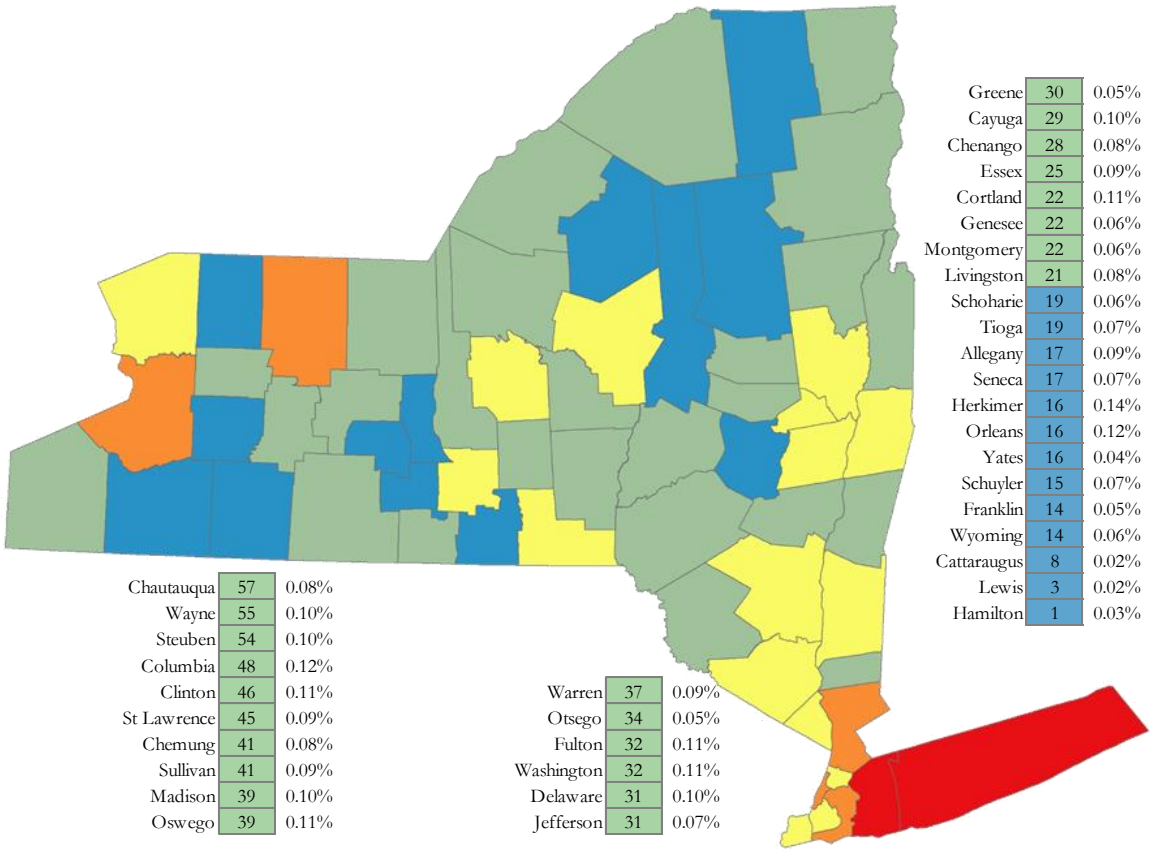
Greater Buffalo and Niagara EV Charging Station Plan

Different parts of New York State have seen greater adoption of EVs.

BEVs and PHEVs by County

(NYS Department of Motor Vehicle data as of 1/1/2016)

	Number of EVs	Percent of Total Vehicles
Suffolk	2,750	0.28%
Nassau	1,635	0.18%
Westchester	1,376	0.22%
Monroe	808	0.17%
Queens	668	0.12%
New York	650	0.06%
Erie	640	0.18%
Onondaga	353	0.13%
Kings	350	0.16%
Rockland	318	0.06%
Albany	286	0.15%
Saratoga	276	0.17%
Orange	252	0.11%
Dutchess	235	0.12%
Richmond	202	0.08%
Ulster	181	0.16%
Bronx	171	0.15%
Schenectady	146	0.26%
Tompkins	131	0.13%
Oneida	129	0.10%
Niagara	125	0.09%
Rensselaer	123	0.09%
Broome	103	0.04%
Ontario	92	0.14%
Putnam	84	0.11%

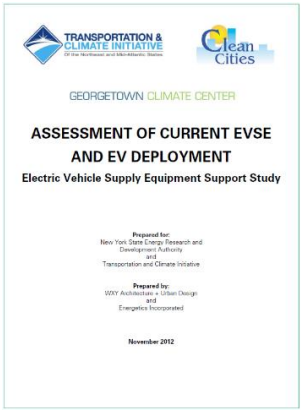


Chautauqua	57	0.08%
Wayne	55	0.10%
Steuben	54	0.10%
Columbia	48	0.12%
Clinton	46	0.11%
St Lawrence	45	0.09%
Chemung	41	0.08%
Sullivan	41	0.09%
Madison	39	0.10%
Oswego	39	0.11%

Warren	37	0.09%
Otsego	34	0.05%
Fulton	32	0.11%
Washington	32	0.11%
Delaware	31	0.10%
Jefferson	31	0.07%

Greene	30	0.05%
Cayuga	29	0.10%
Chenango	28	0.08%
Essex	25	0.09%
Cortland	22	0.11%
Genesee	22	0.06%
Montgomery	22	0.06%
Livingston	21	0.08%
Schoharie	19	0.06%
Tioga	19	0.07%
Allegany	17	0.09%
Seneca	17	0.07%
Herkimer	16	0.14%
Orleans	16	0.12%
Yates	16	0.04%
Schuyler	15	0.07%
Franklin	14	0.05%
Wyoming	14	0.06%
Cattaraugus	8	0.02%
Lewis	3	0.02%
Hamilton	1	0.03%

The Assessment of Current Charging Station and EV Deployment for the Northeast found that:



- Communities with EV ownership are significantly less dense than communities without EVs, with nearly all EV ownership located outside of urban cores. Whether driven by more straightforward EV charging infrastructure installation, more suitable automotive trips or other factors, these communities contain more single-fam ily homes and fewer multifamily structures than communities with no EV ownership.
- Communities with EV ownership tend to be more educated and wealthier than communities without EVs. Greater incidence of EV ownership correlates with higher income and more graduate degree attainment.
- Greater access to EV dealerships and EV charging stations relates to greater numbers of EVs in communities.

EV Charging Infrastructure

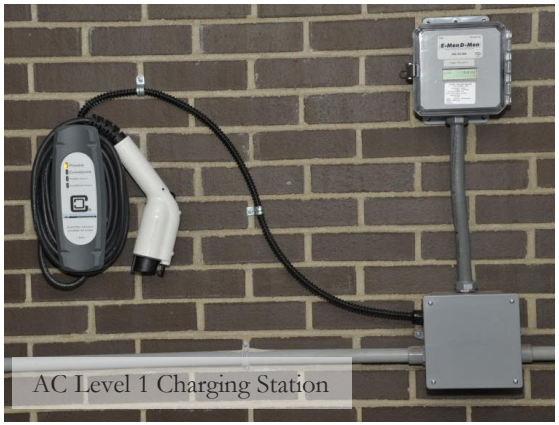
EV drivers have various options available to plug in and charge their batteries at charging stations, which are also referred to as electric vehicle supply equipment (EVSE). For the majority of users, a home charger can fulfill almost all of their charging needs. Public charging stations are used to recharge EVs while drivers are at work, shopping, or at other destinations, and help expand the functionality of electrification technology for many owners.

For many EV owners, the vehicle they select will accommodate their normal daily driving needs without needing to charge during the day. However, if that owner needs to run extensive errands one day, wants to take their EV to a recreational destination in the evening or on weekends, or is pushing the limits of their EV's battery range in the winter when it operates less efficiently, they will want to find an opportunity to get an additional charge during the day.

For some EV owners, installing a charger at their primary residence may be challenging (e.g. if they are renting or have an older house with insufficient electrical capacity to add more load) and will need charging infrastructure at their workplace or a public venue to feasibly use an EV.

Charging stations are classified by their approximate charge rates and the form of power delivered (alternating current [AC] or direct current [DC]). Charging times for each specific vehicle vary depending on power electronics, state of charge, battery capacity, and level of charging station used.

AC Level 1 Charging is limited to 120 volts of alternating current (VAC) and uses a typical household three-prong plug. All current EVs are sold with AC Level 1 capabilities and only need a dedicated 20 amp outlet to charge. AC Level 1 stations charge slowly, and are generally used in home or workplace charging applications where EVs will be parked for long periods of time. AC Level 1 charging adds 2 to 5 miles of electric range per hour of charging time. Usually, a portable AC Level 1 charger is included in the initial vehicle purchase price. Hardware cost: Up to $1,000.



AC Level 1 Charging Station

AC Level 2 Charging provides electrical energy at either 240 VAC (typical for residential applications) or 208 VAC (typical in commercial and industrial applications). This level of charging is viable for both residential and public charging locations. Unlike AC Level 1 charging, AC Level 2 charging requires additional hardware that can be mounted on the wall, to a pole, or as a stand-alone pedestal. It must be hard-wired to the electrical source. The increased charging rate and affordability of AC Level 2 charging stations make them the most popular choice for all EV charging applications. It provides up to 7.2 kilowatts (kW) for residential and up to 19.2 kW for commercial, which typically results in 10 to 20 miles of range added per hour of charging time. Hardware cost: $450-$5,000.

AC Level 2 Charging Station

DC Fast Charging utilizes direct-current (DC) energy transfer and a 480 VAC input to provide extremely rapid recharges at heavily used public charging locations. The type of station is generally cost prohibitive for home applications. However, depending on the EV, DC fast charge stations can provide an 80% recharge in as little as 20 minutes. This option is only available on certain EVs. Hardware cost: $7,000-$40,000.

Tesla's Supercharger Network offers DC fast charge for free, but is only available for Tesla owners. The network currently covers many major travel corridors across North America. Each Supercharger offers 120 kW charging (about 140 miles of range in 20 minutes).

Tesla DC Fast Charge Stations

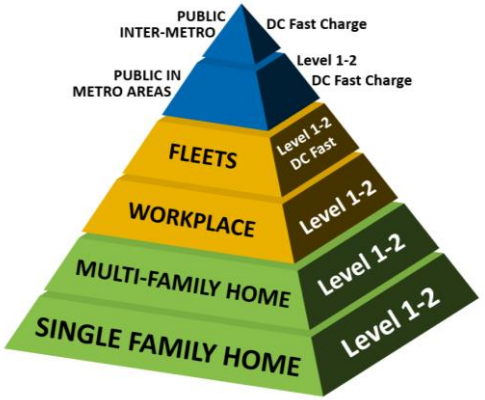
Connectors, or plugs, for AC Level 1 and Level 2 charging stations have been standardized to allow owners of all EV models to utilize the same charging infrastructure. The industry standard for AC Level 1 and AC Level 2 charging is the Society of Automotive Engineers (SAE) J1772 connector, which provides significant safety and shock-proof design elements.

Up until 2013, the Japanese CHAdeMO connector was the only DC fast charge standard connector, available on both the Nissan Leaf and Mitsubishi i-Miev. In early 2013, the SAE J1772 connector standard was expanded to include DC fast charge with the SAE J1772 Combo connector, which is available on the Chevrolet Spark, Volkswagon e-Golf, and BMW i3.


SAE J1772 Combo connector (AC Level 1 and Level 2 connector would include the top circular plug components)

Tesla uses a different proprietary connector, but includes a SAE J1772 compliant adapter cable with each vehicle sold and offers adapters for CHAdeMO and SAE J1772 Combo connections for an additional price.

AC Level 1 charging stations are most suitable for residential overnight charging. However, because of their low cost and lower power draw from the grid, AC Level 1 can also be an effective option for locations where EVs are parked all day long, especially PHEVs that have smaller battery packs. This includes workplaces, commuter lots, or long term parking at airports. Many AC Level 2 charging stations are designed to be more durable for an outdoor setting and work well for public venues where an EV may be parked for 2-6 hours.



DC Fast Chargers require a significant investment and draw considerable power, but they are necesary for inter-regional travel by EVs that wish to use major highways and go farther than the distance available from one battery charge. DC Fast Chargers may also be effective in urban areas with a high population of EVs because they provide convenience over AC Level 2 charging (much shorter time) and they don't require a large number of parking spaces that would be needed to charge a lot of EVs using AC Level 2 chargers.

Higher charging station power draw can lead to increased electrical costs for the facility, but some applications may be able to take advantage of lower off-peak electrical rates with a time-of-use

schedule if the EV charging will occur during off-peak times (night).

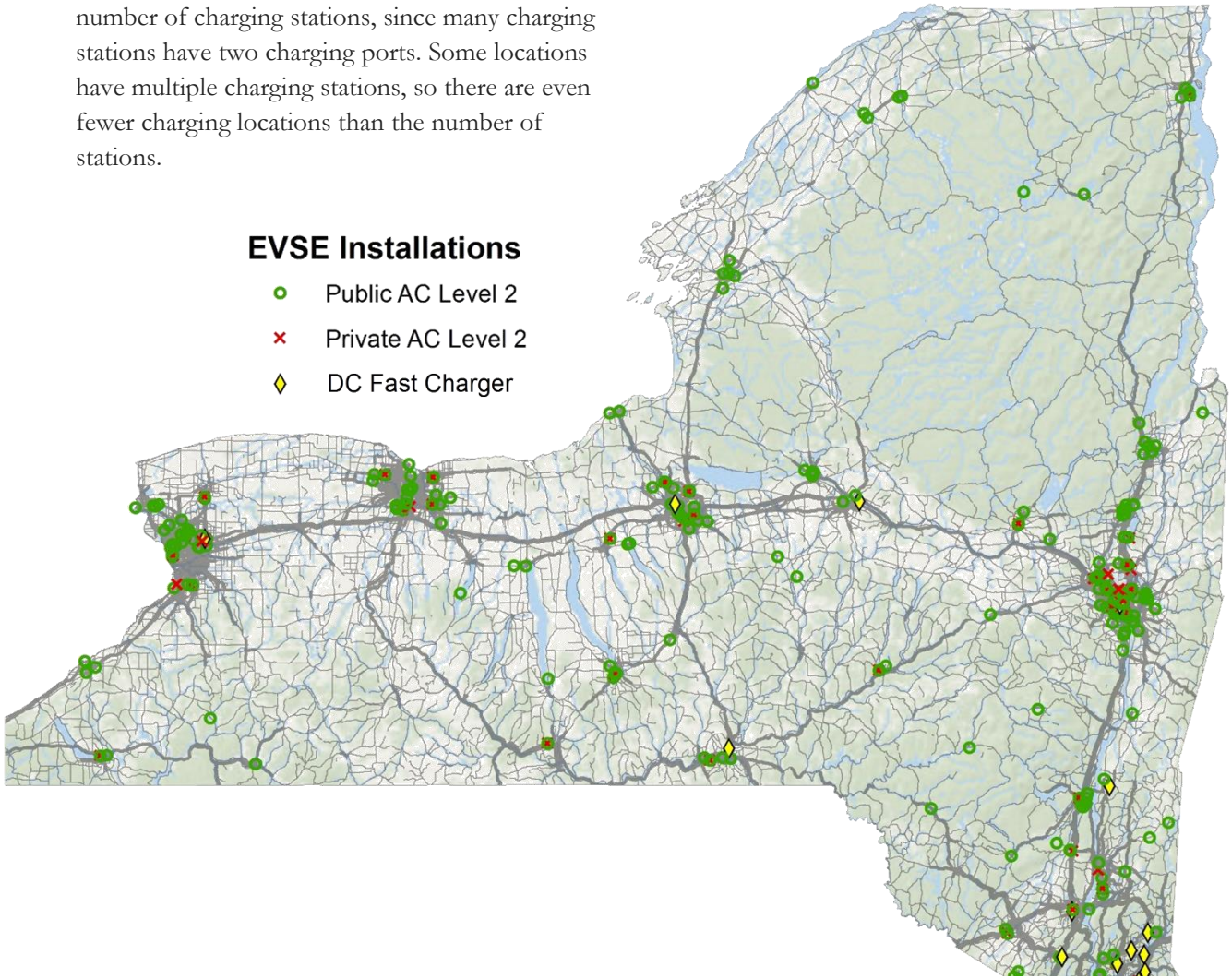
Most AC Level 2 and DC Fast Chargers come with an option to purchase a *subscription to a charging network* that can collect payments from users and limits use of the station to charging network members. There is often no fee for EV drivers to become a member, and there is also an option to activate the station using a toll-free number for anyone that does not have a network card. In addition to listing the station on its network maps for EV drivers, the network will track station usage so you know when and how long it is being used. Network subscriptions typically cost the station owner about $20 to $30 per month per charging outlet.

Different *ownership options* exist for charging stations with the most common model of a charging station host owning it. However, third-party charging station service providers may pay for the installation, operate the station, and share some of the profits with the host site. Some charging station manufacturers, third-party charging station service providers, or charging station network providers are considering offering the option to lease charging stations as well.

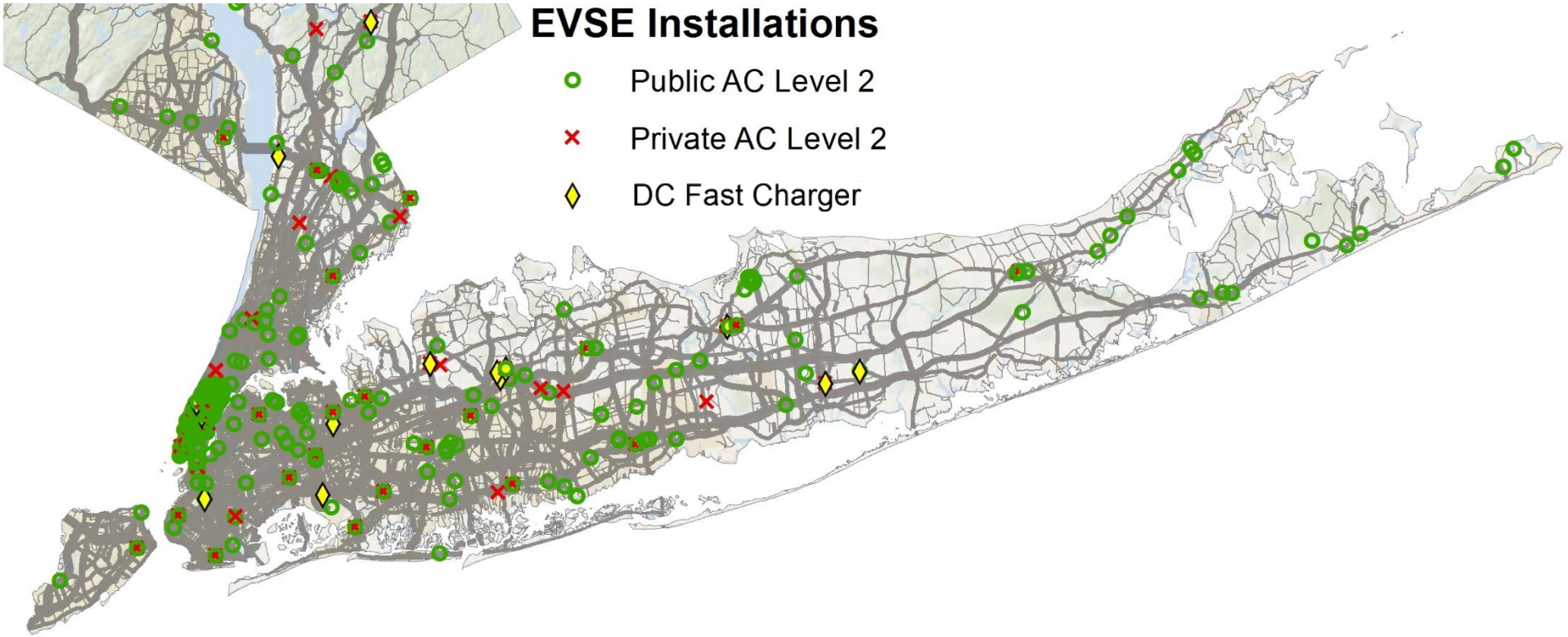
As of 2013, *New York State provides an income tax credit* for 50% of the cost, up to $5,000, for the purchase and installation of alternative fuel vehicle refueling and electric vehicle recharging stations. The New York State Alternative Fuel Vehicle Recharging Tax Credit for commercial and workplace charging stations is available through December 31, 2017.

As of December 2015, New York State has just over 1,200 total public EV charging outlets or ports. This number represents the number of EVs that could plug in at one time and differs from the number of charging stations, since many charging stations have two charging ports. Some locations have multiple charging stations, so there are even fewer charging locations than the number of stations.

NYSERDA has funded 634 new EV charging port installations since 2012 which has significantly increased the public EV charging infrastructure in the state. The U.S. Department of Energy maintains an interactive map of alternative fuel station locations.



Greater Buffalo and Niagara EV Charging Station Plan



For a *cost-effective and successful charging station installation*, one must factor in how much use can be expected and how much benefit EV drivers can get from charging while parked at that location. Offering charging can help businesses increase visits, keep customers for longer durations, and serve as a good perk for employees or residents. EV drivers often seek out charging locations as they go about their everyday routines at, for example, restaurants, stores, and entertainment venues.

For public installations, consider the time an EV driver would typically spend parked at that location, because short durations may offer fewer benefits to EV drivers. Other important factors include, but are not limited to: patterns of travel in an area; an area's demographics, which may be correlated with characteristics typical of EV owners; and the nature of a potential EV charging station location, whether it is public property, private businesses such as retail companies, multifamily housing or other institutions. Building leases or third-party operated parking can complicate charging station installations and all parties should work out arrangements to clarify ownership, operation, and revenue in advance.

Installing *EV charging stations at workplaces* can be very successful at the right business and have benefits for employers and their employees alike. EV charging stations can attract and retain desirable employees. EV drivers are typically tech-savvy and highly educated, qualities many employers seek in prospective employees.

Charging stations visibly demonstrate an organization's commitment to sustainable energy consumption and complement other environmentally friendly initiatives. Some workplace charging locations are able to serve

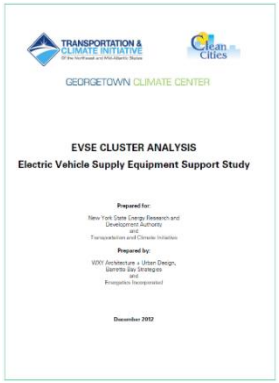
employees and visitors, as well as the general public. Two key examples are:

- Colleges or Universities
- Medical Campuses

Other examples of public venues that have successful charging station installations include:

- Regional transit (commuter lots)
- Downtown multi-purpose parking lots or garages
- Retail destinations (malls or outlets with multiple stores)
- Popular year-round leisure destinations

The Charging Station Cluster Analysis walks through the location types where EV charging infrastructure might be installed and informs decision-makers and prospective EV charging station hosts of which factors make a good EV charging location. Targeting locations for EV charging infrastructure rollout through this cluster approach can help create a system of EV charging in the critical early stages of EV adoption.



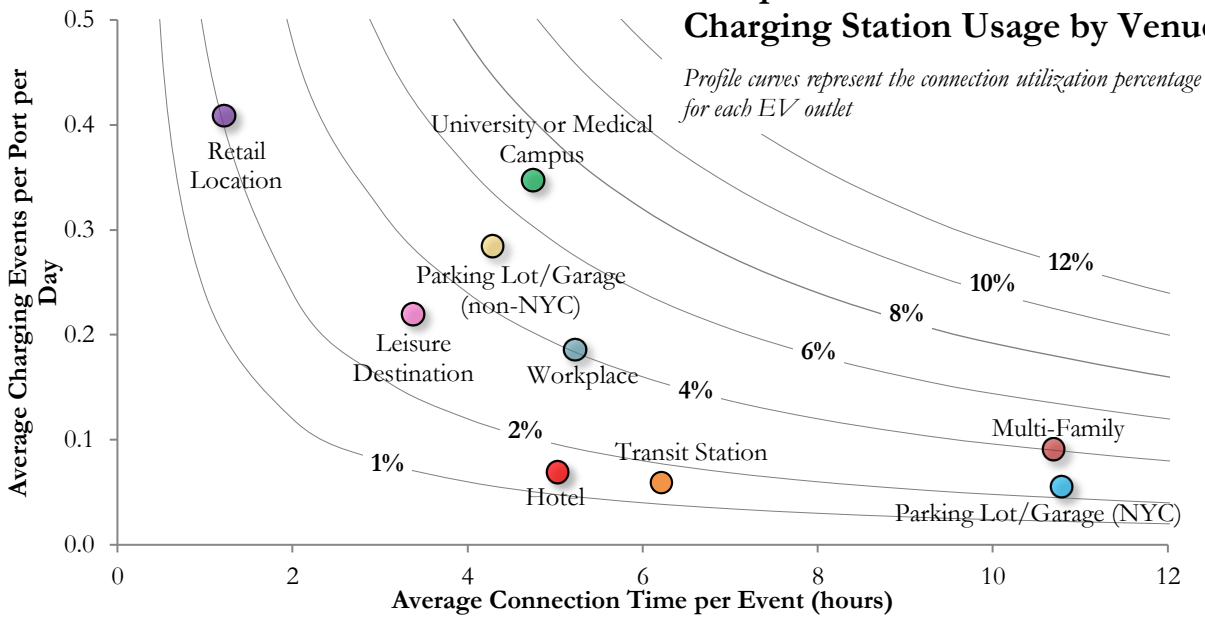
In 2012 and 2013, NYSERDA awarded $8 million to 14 organizations through its Charging Station Demonstration Program to install AC Level 2 EV infrastructure, from Long Island to Buffalo. These installations, which will be about 700 charging outlets in total, represent a wide range of business models and approaches to providing public charging infrastructure.

Charging station data is regularly collected and analyzed. The following results are from 2015.

- EV charging stations the Rochester/Finger Lakes region were occupied most (a vehicle was plugged into a port an average of 7.2% of the time respectively), followed by Long Island (5.6% of the time) and the Capital District (4.2% of the time).
- EV charging stations that charged a fee for use (most are NYC parking garages) followed this same trend: few charge events per day, but high energy dispensed per charge event.
- EV charging stations in New York City (NYC) parking garages, multi-family dwellings, and hotels averaged few charge events per day, but dispensed the highest amounts of energy per charge event.
- The average plug-in time per charge event differed for various location types. Shortest, by far, were the retail locations (1.2 hours), followed by leisure destinations (3.4 hours), non-NYC parking lot/garages (4.3 hours), university or medical centers (4.7 hours), hotels (5.0 hours), workplaces (5.2), and transit stations (6.2 hours). NYC parking garages and multi-family dwellings showed the longest plug-in times per charge event, with an average of 10.8 and 10.7 hours respectively.

Comparison of Public NYS EV Charging Station Usage by Venue

Profile curves represent the connection utilization percentage for each EV outlet

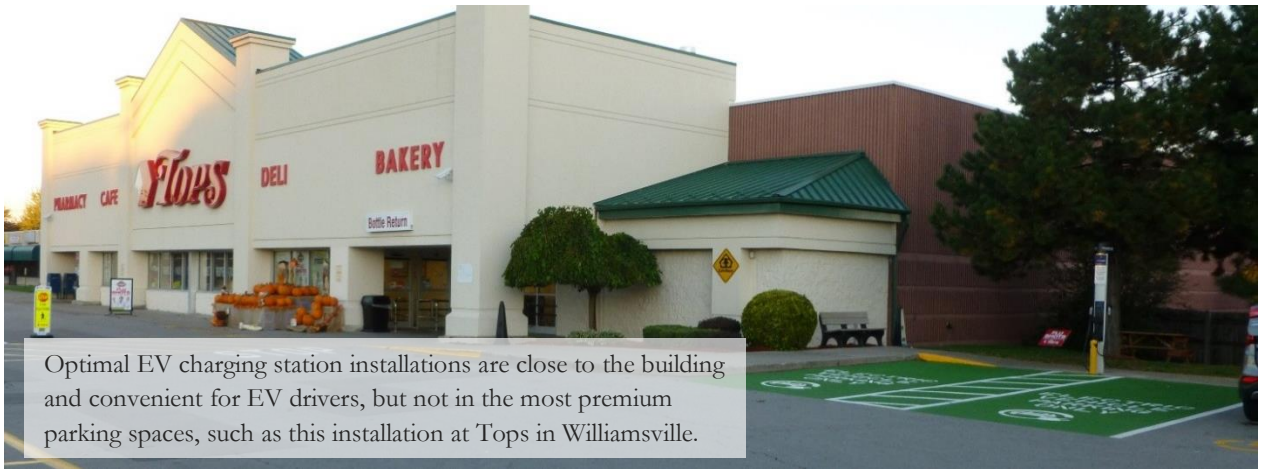


In addition to the EV charging station's location, *where it is placed onsite and how it is installed will also impact the ease of use for EV drivers and station cost effectiveness*. Charging station installation costs can exceed the cost of the hardware itself and are influenced by a number of factors that should be considered when determining if a site is good and where to install the charging station on the property.

The largest factor can be the currently available electrical service. All new charging station installations should have a load analysis performed on the facility's electrical demand to determine if there is capacity to add EV charging stations. Upgrading electrical service would add significant cost to the installation. A longer distance between the electrical panel and the EV charging station means increased installation costs because it increases the amount of necessary trenching (and repair), conduit, and wire.

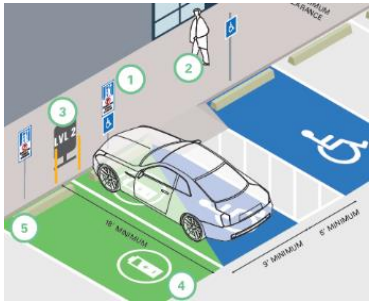
Although it is desirable to minimize the distance between the electrical panel and EV charging station as much as possible, you also need to consider the impact of placing the station at that location on the property. For example, placing charging station parking spaces in the back of a building might discourage their use, but other customers may be upset if a charging station is installed in prime parking spaces that often remain vacant because there are few EV drivers.

Other considerations have less impact on installation costs, but can impact how effective the station is at benefiting EV drivers and other clients. Be sure to think about the path of the charging cord when in use (so it is not a tripping hazard), parking lot management practices (will the charging station get in the way of pavement cleaning or snow plowing, or is it a space where snow is piled in the winter or where equipment might be stored), and signage (for EV drivers to easily find the station).

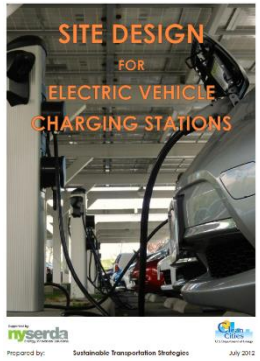


Optimal EV charging station installations are close to the building and convenient for EV drivers, but not in the most premium parking spaces, such as this installation at Tops in Williamsville.

Siting and Design Guidelines for Charging Stations identify and diagram key siting and design issues that are relevant to local governments as well as developers, homeowners, businesses, utility providers, and other organizations interested in best practices for EV charging infrastructure implementation.



Site Design for Electric Vehicle Charging Stations highlights best practices for designing EV parking spaces, and provides several illustrated design scenarios.



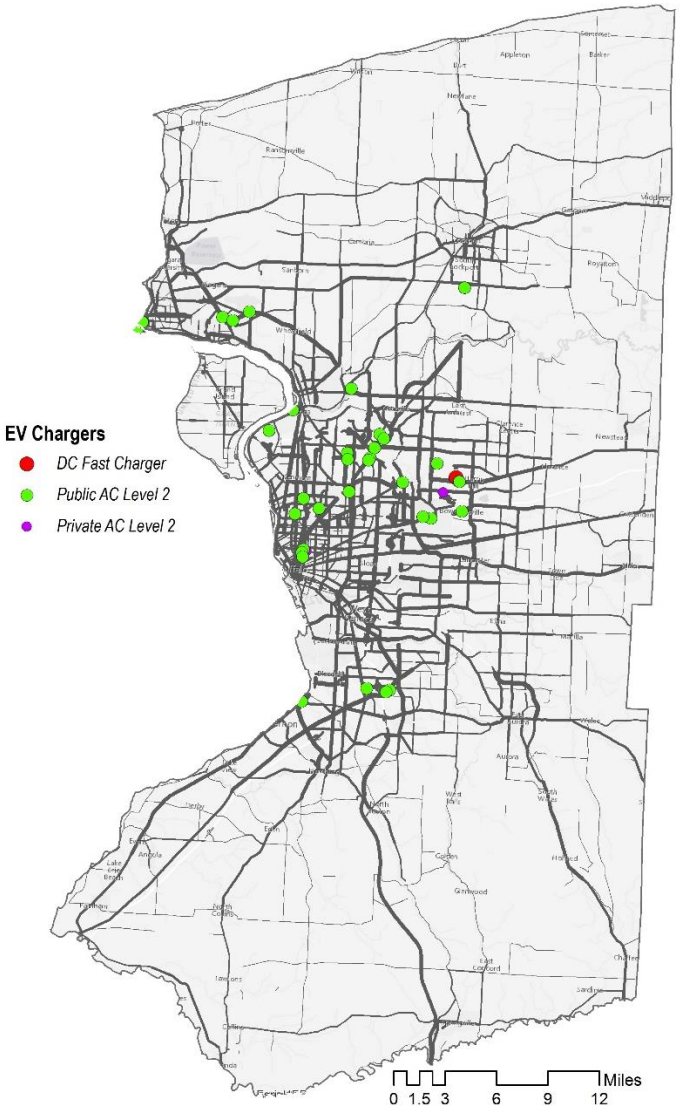
Effective signage helps EV drivers navigate to charging station spaces and helps to prevent those spaces from being occupied by a non-EV. The Charging Station Signage Overview covers general service (guidance), regulatory (enforceable), and special (information/trailblazer) signage. Another effective strategy for distinguishing the EV charging space is to paint the entire space green or mark the pavement with an EV charging symbol.

Current EV Landscape

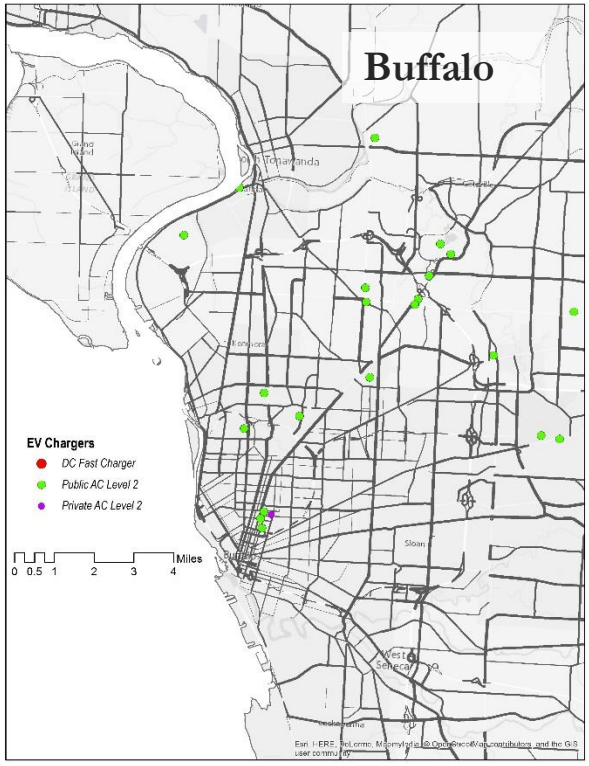
Currently, there are 36 public EV Level 2 charging station locations in the Greater Buffalo and Niagara Region, including:

- Buffalo Airport
- Buffalo Zoo
- Niagara Falls Airport
- Niagara Falls Parking Lots
- Town of Tonowanda
- SmartHomeBuffalo
- University at Buffalo (Bissel, Bonner, and Diefendorf Hall)
- Buffalo State College
- Buffalo Niagara Medical Campus
- Chili's (Amherst, Niagara Falls)
- Comfort Inn (Buffalo)
- Country Club Manor (Williamsville)
- JATC/IBEW (Niagara Falls, Orchard Park)
- Kohls (Amherst, Buffalo)
- NFTA (Hamburg)
- Riverview Solar
- Tops (Williamsville)
- Townplace (Cheektowaga)

Tesla DC fast charging stations are at Shops at Main on Transit Road in Buffalo.



The Greater Buffalo and Niagara Region has several areas where there are gaps in the EV charging network as shown in these maps with the existing stations.



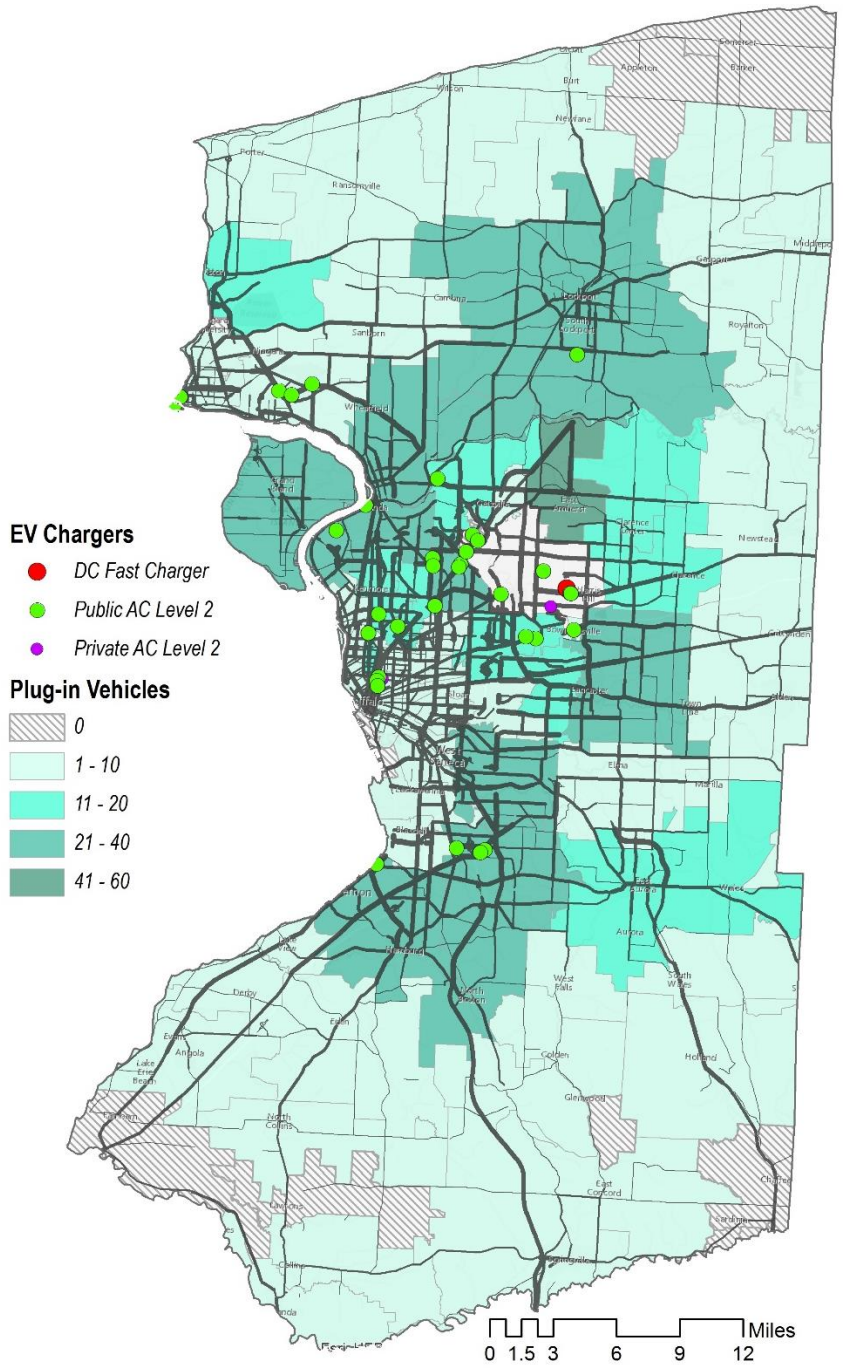
Greater Buffalo and Niagara EV Charging Station Plan

The map of the Greater Buffalo and Niagara Region to the right shows EV ownership (both PHEVs and BEVs) by zip code as of December 31, 2015. The zip codes with the most PEV owners are:

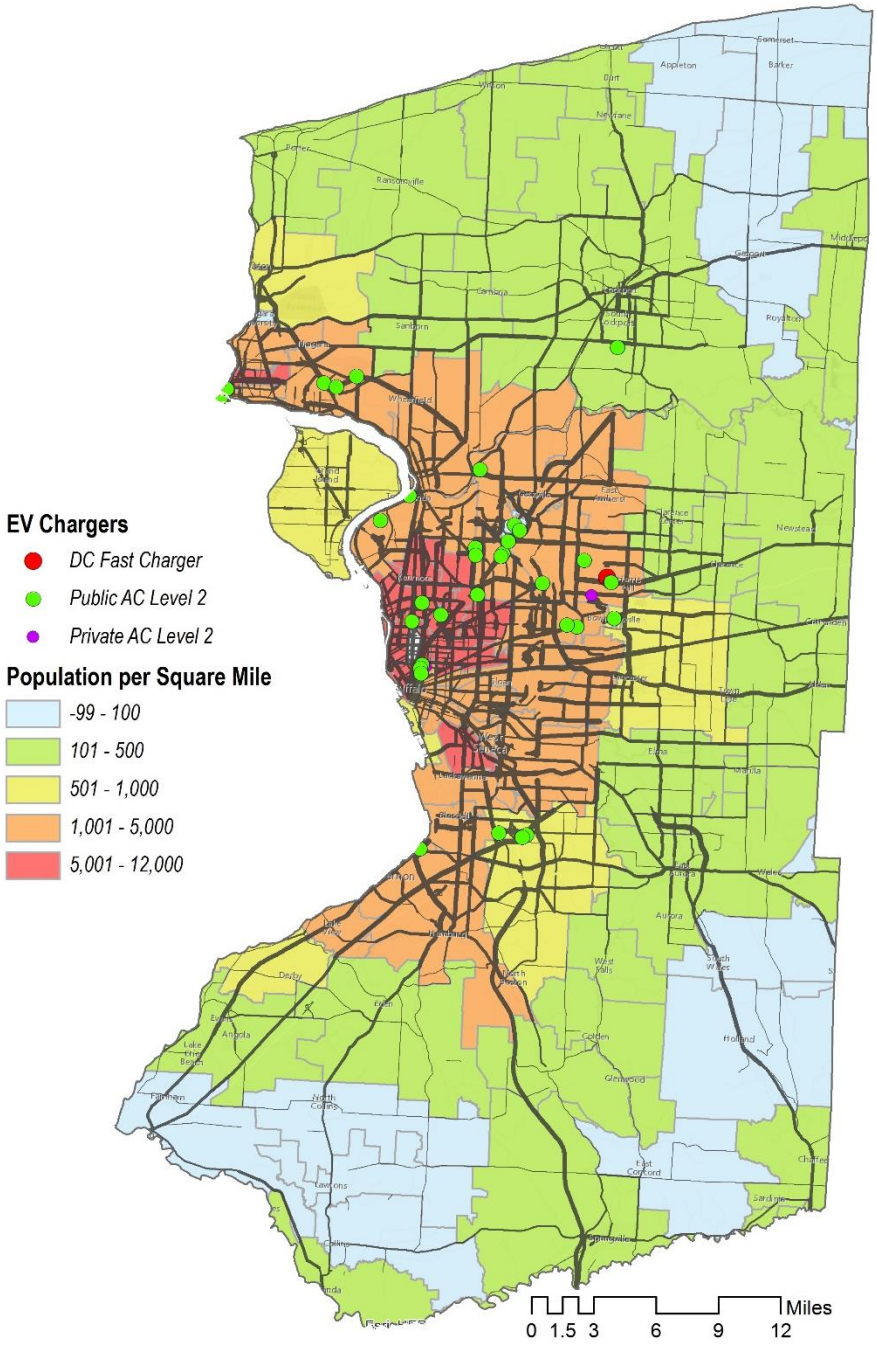
- 14221 (Buffalo): 71 EVs
- 14051 (East Amherst): 41 EVs
- 14094 (Lockport): 36 EVs
- 14075 (Hamburg): 34 EVs
- 14127 (Orchard Park): 32 EVs

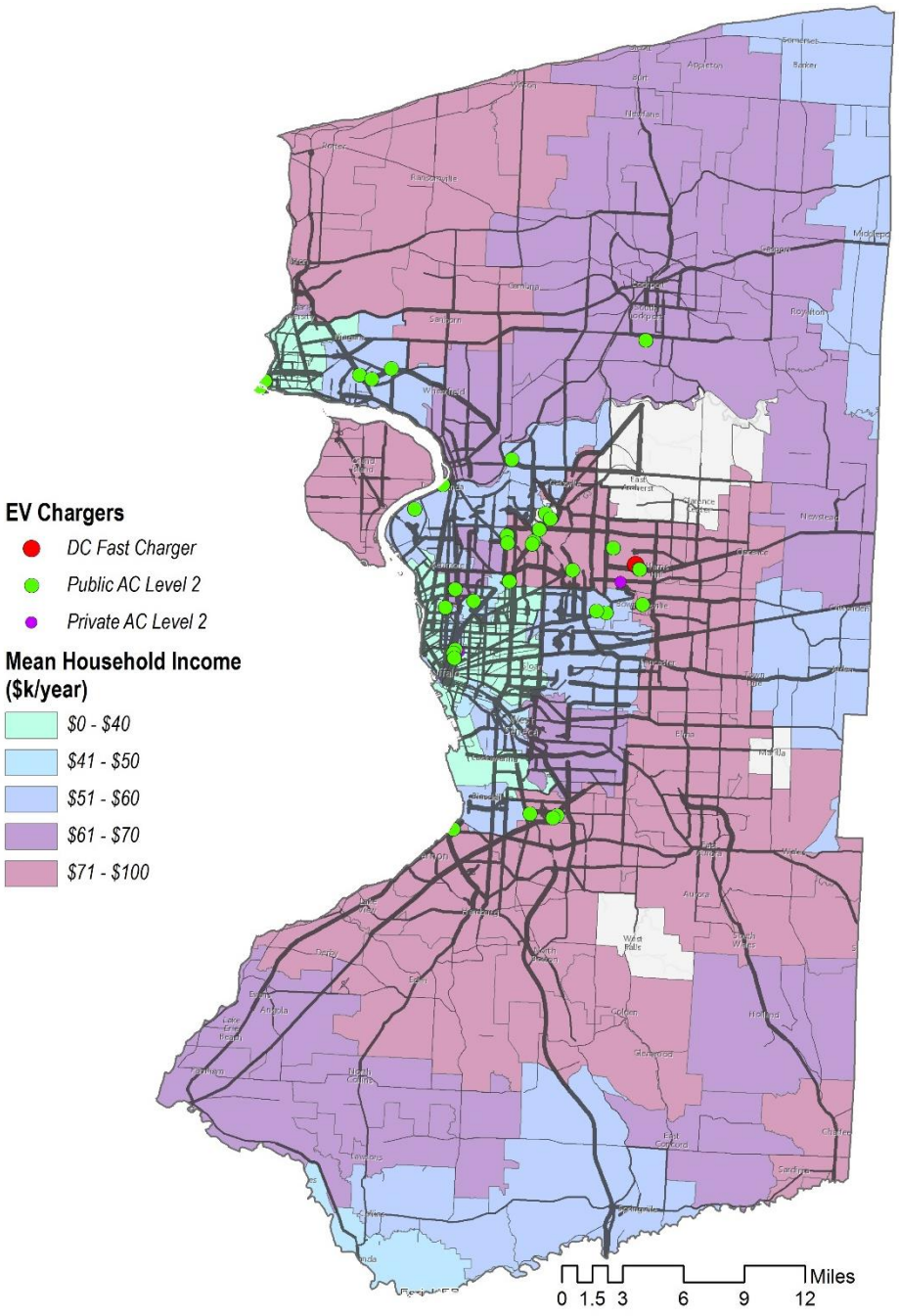
Existing public EV charging locations are also included for reference. There is a correlation between the public EV charging station locations and EV ownership, but it is not clear whether the charging stations encourage EV ownership or EV ownership encourages the installation of public EV charging stations.

When compared to the Greater Buffalo and Niagara Region maps showing population and income per household on the following page, EV ownership is more closely tied to income rather than population.



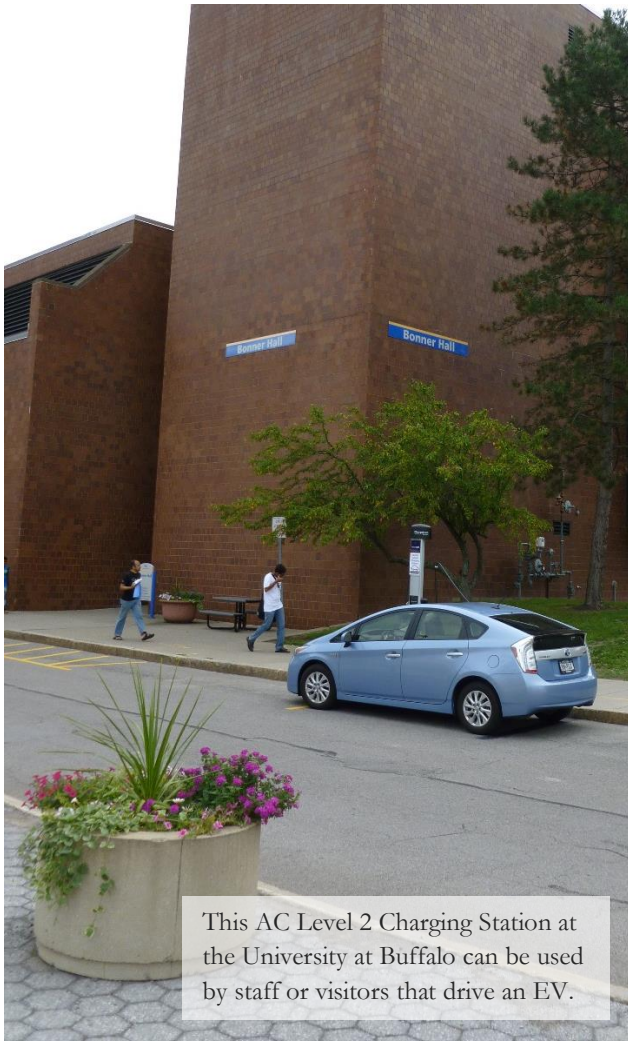
Greater Buffalo and Niagara EV Charging Station Plan



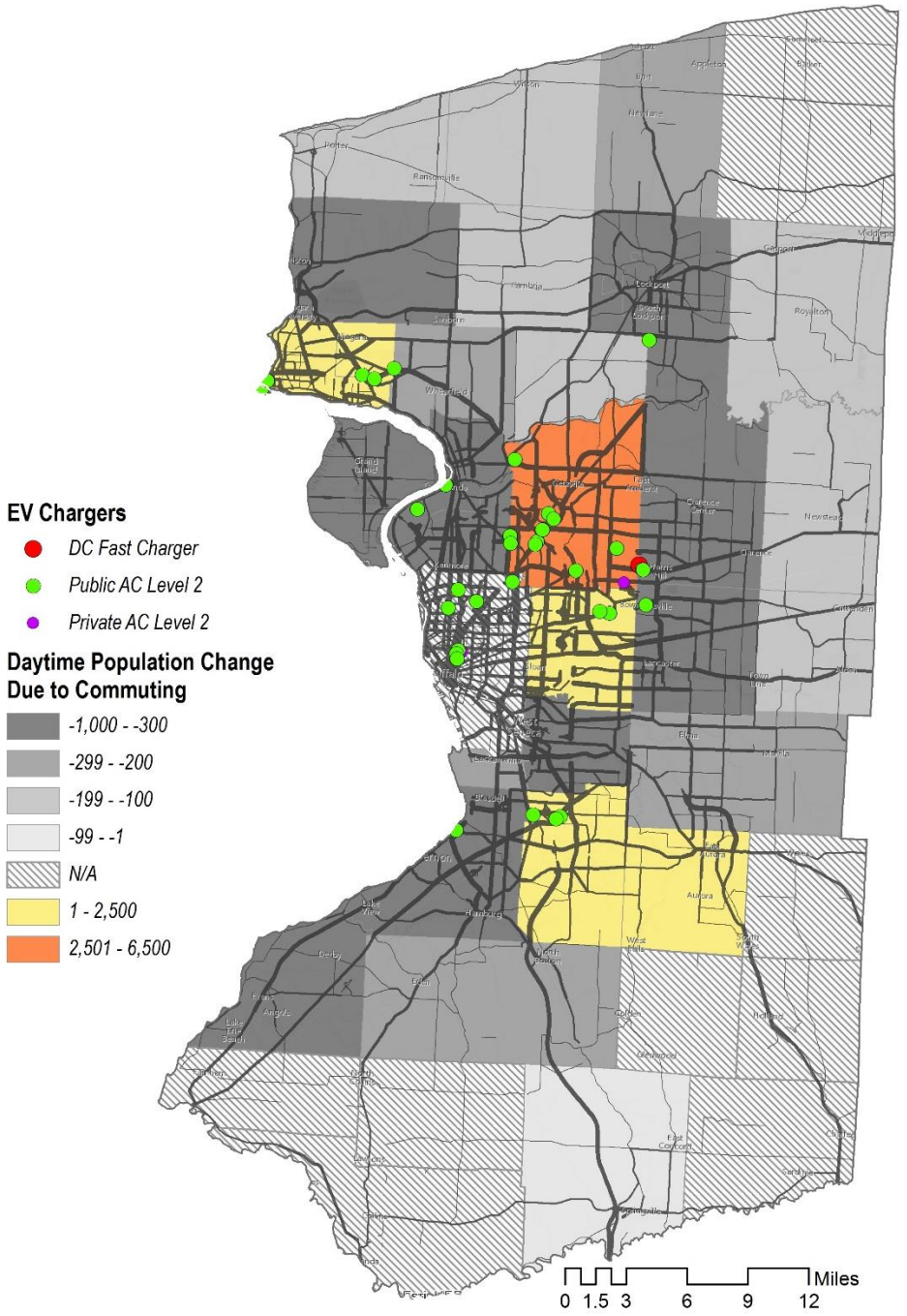


Greater Buffalo and Niagara EV Charging Station Plan

This map shows the daytime population change during weekdays. Workplace or public chargers are likely needed more in areas that experience an influx of people each day, rather than other areas that are more residential and EV owners would charge at their home overnight.



This AC Level 2 Charging Station at the University at Buffalo can be used by staff or visitors that drive an EV.



Greater Buffalo and Niagara EV Charging Station Plan

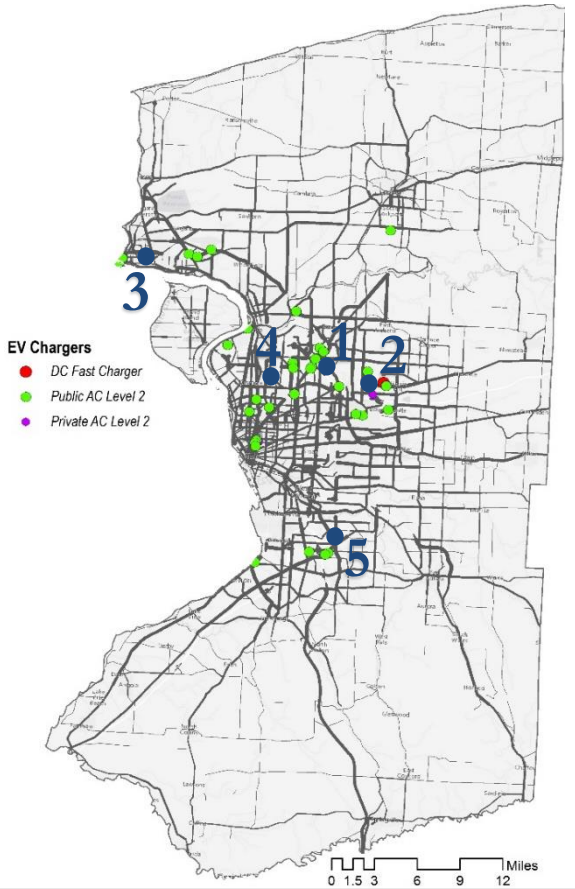
Recommendations for Additional EV Infrastructure

The Greater Buffalo and Niagara Region does not currently have a comprehensive network of charging stations that would allow an EV driver to easily travel throughout the region. There are numerous areas where an EV driver passing through the area would not have a feasible option to charge.

Some municipalities and organizations in the Greater Buffalo and Niagara Region have taken the initiative to install EV charging stations which has made those locations very supportive of EV drivers. However, most of the existing public charging stations in this region have experienced very minimal use which has made it hard to justify further investments in infrastructure.

In the Greater Buffalo and Niagara Region, commutes are longer and must accommodate some severe winter conditions which doesn't particularly favor EV ownership (at least BEV models that rely entirely on electric power). However, continuing to expand the public charging network is needed to support residents that could use EVs, along with EV drivers that visit our region. Five additional charging station installations are recommended at key locations throughout the Greater Buffalo and Niagara region to help create a more comprehensive network to support current and future EV drivers. Two locations are major tourism destinations (Buffalo and Niagara Falls) that could serve EV drivers within the Greater Buffalo and Niagara Region and beyond. The remaining three recommended locations (Amherst, Williamsville, and Orchard Park) currently have some charging stations in their municipality, but they are not ideally located for commuters or visitors. Installing new charging stations in the downtown districts of these towns could potentially serve EV drivers that are employed nearby or those that visit for entertainment during evening or weekends.

Overviews of the five recommended locations are provided on the following pages with some potential sites where the actual installation could go. Holding key stakeholder meetings at these locations will enable the municipalities to capitalize on the available tax credit or other funding that might support new installations.



● Suggested Locations for More EV Infrastructure

1. Amherst
2. Williamsville
3. Niagara Falls
4. North Buffalo
5. Orchard Park

Amherst is a town in Erie County. The largest and most populous suburb of Buffalo, the town of Amherst encompasses most of the village of Williamsville as well as the hamlets of Eggertsville, Getzville, Snyder, Swormville, and East Amherst. The town is in the northern part of the county and borders a section of the Erie Canal.

Amherst Town Hall

Overview

On April 10, 1818, the Town of Amherst was officially created by an Act of the NYS Senate. This new town was named for Sir Jeffrey Amherst, an English lord who was Commander-in-Chief of the British troops in America from 1758-1763, before the American Revolution. King George III rewarded Lord Amherst by giving him 20,000 acres in New York, but Lord Amherst never visited his new lands. Timothy S. Hopkins was elected the first Supervisor of the Town of Amherst in 1819.

Other communities grew in Amherst. Except for Williamsville, which became an incorporated village in 1850, these communities, known as hamlets, have no formal boundaries but were often designated by their post offices. Snyder was named Snyderville as Michael Snyder was this hamlet's first postmaster and also operated a store at the corner of Harlem Road and Main Street. Eggertsville was named for Christian Eggert, the first postmaster of this settlement. Getzville, located in the northern part of the town, received its name from Joseph Getz, owner of a cooper shop, mill and postmaster. Swormsville commemorates Adam Schworm, a prominent landowner and businessman. East Amherst was originally called Transit Station and Millersport was Mill Port because it was located along the important early water transportation route of Tonawanda Creek.

Today, there are only a few farms in the Town of Amherst, mostly in the northern section of the town near Tonawanda Creek. Farmland has been used to build many new houses. The completion of the University at Buffalo campus in Amherst, along with the construction of major access roads such as the 1-290 (Youngman Expressway) and 1-990 (Lockport Expressway) made it easier for people to live in Amherst and commute to jobs in Buffalo and other nearby communities. Rapid growth in population created the need for more houses, highways, shopping centers, schools, and recreational facilities.

Demographics

As of the 2010 census, there were 122,366 people living in Town of Amherst. The population density was 2,300 people per square mile. The average income per capita is approximately $27,647 annually. Over half of the residents (51.7%) aged 25 and over have obtained a Bachelor's degree or higher, including 26.7% who earned a Graduate or professional degree.

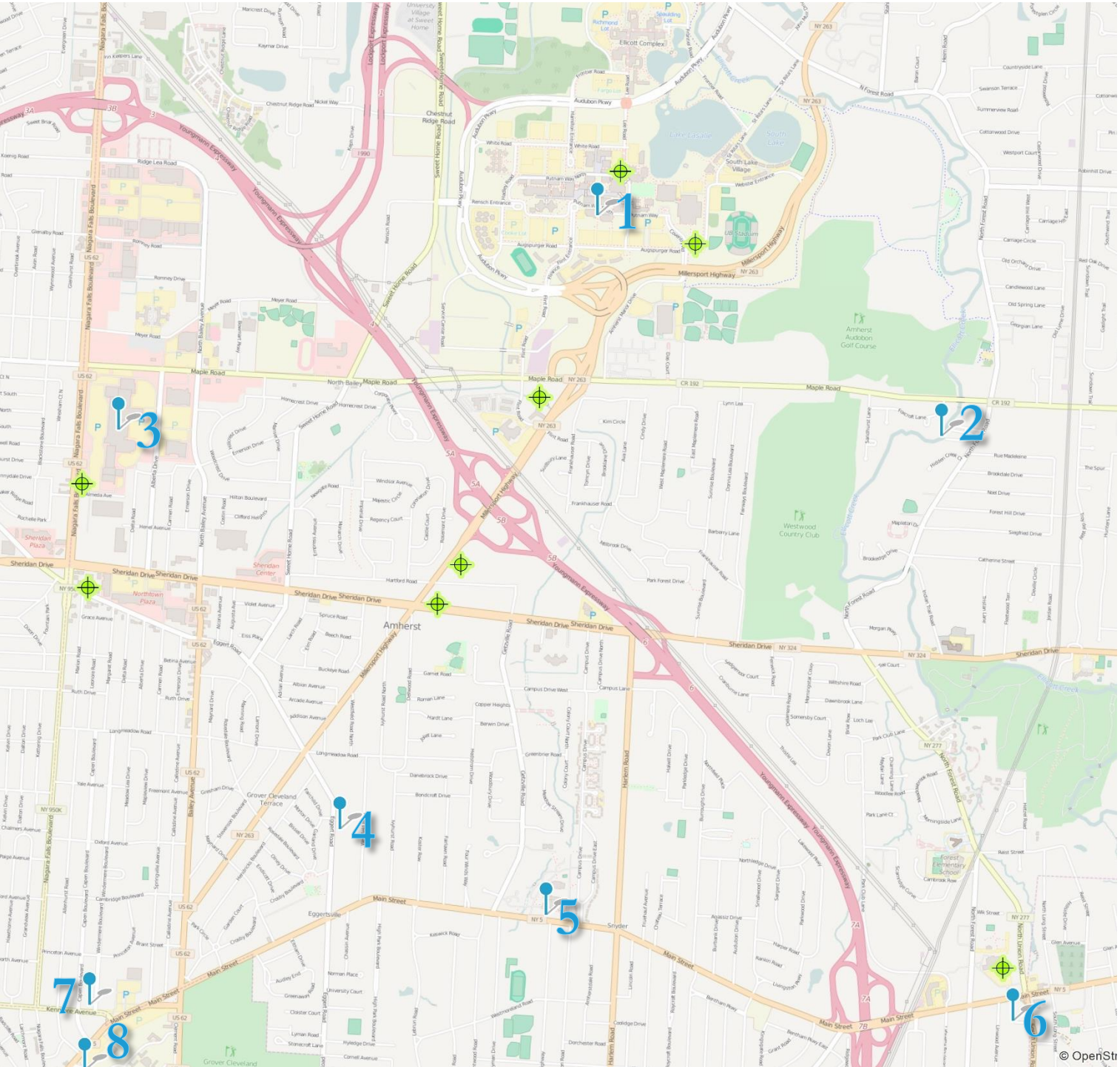
EV Factors

As of 2015, there were approximately 139 EVs owned by residents of Amherst, with an additional 237 EVs in neighboring towns.

The large number of workplaces, universities, and colleges throughout the town creates an opportunity to provide charging for residents driving EVs. Additionally, local residents may become more familiar with the technology with the addition of the stations and, due to the higher income rates, purchase EVs for the environmental and energy benefits.


University at Buffalo North Campus

Greater Buffalo and Niagara EV Charging Station Plan



1 University at Buffalo North Campus

2 Amherst Town Hall

3 Boulevard Mall

4 Millard Fillmore Suburban Hospital

5 Daemen College

6 Park-n-Ride at Main St. & Union

7 University at Buffalo South Campus

8 NFTA Lot on UB South Campus

Existing EV Charging Station

Williamsville is a village of the Town of Amherst. The Village of Williamsville is well known for its central location in the Buffalo and Niagara region and boasts a rich historic past.

Overview

The Village of Williamsville was incorporated in 1850 and is one of over 550 incorporated Villages chartered by the State of New York. It encompasses an irregular square mile, most of which lies within the Town of Amherst with its southeast corner in the Town of Cheektowaga.

Williamsville was the first and largest settlement in the Town of Amherst. The village was settled first because of its location on the main road to Buffalo and because it was next to Ellicott Creek (first known as Eleven Mile Creek). The waterfalls on Ellicott Creek were used to power mills for sawing wood into lumber, wheat into flour, and corn into cornmeal. These mills were very important to the early settlers. Williamsville derived its name from one of the first settlers, Jonas Williams, who came in 1805 and owned two mills on opposite banks of Ellicott Creek. The settlement was called Williams Mills until after the War of 1812. In 1811, Jonas Williams purchased the mill on Spring Street which today is known as the Williamsville Water Mill.

Demographics

As of the 2010 census, there were 5,300 people living in the Village of Williamsville. The population density was 4,206 people per square mile. The average income per capita is approximately $27,177 annually. In the village, the population is age diverse with 19.6% under the age of 19, 5.8% from 20 to 24, 26.6% from 25 to 44, 28.2% from 45 to 64, and 23.4% who were 65 years of age or older. The median age range was 45–49 years.

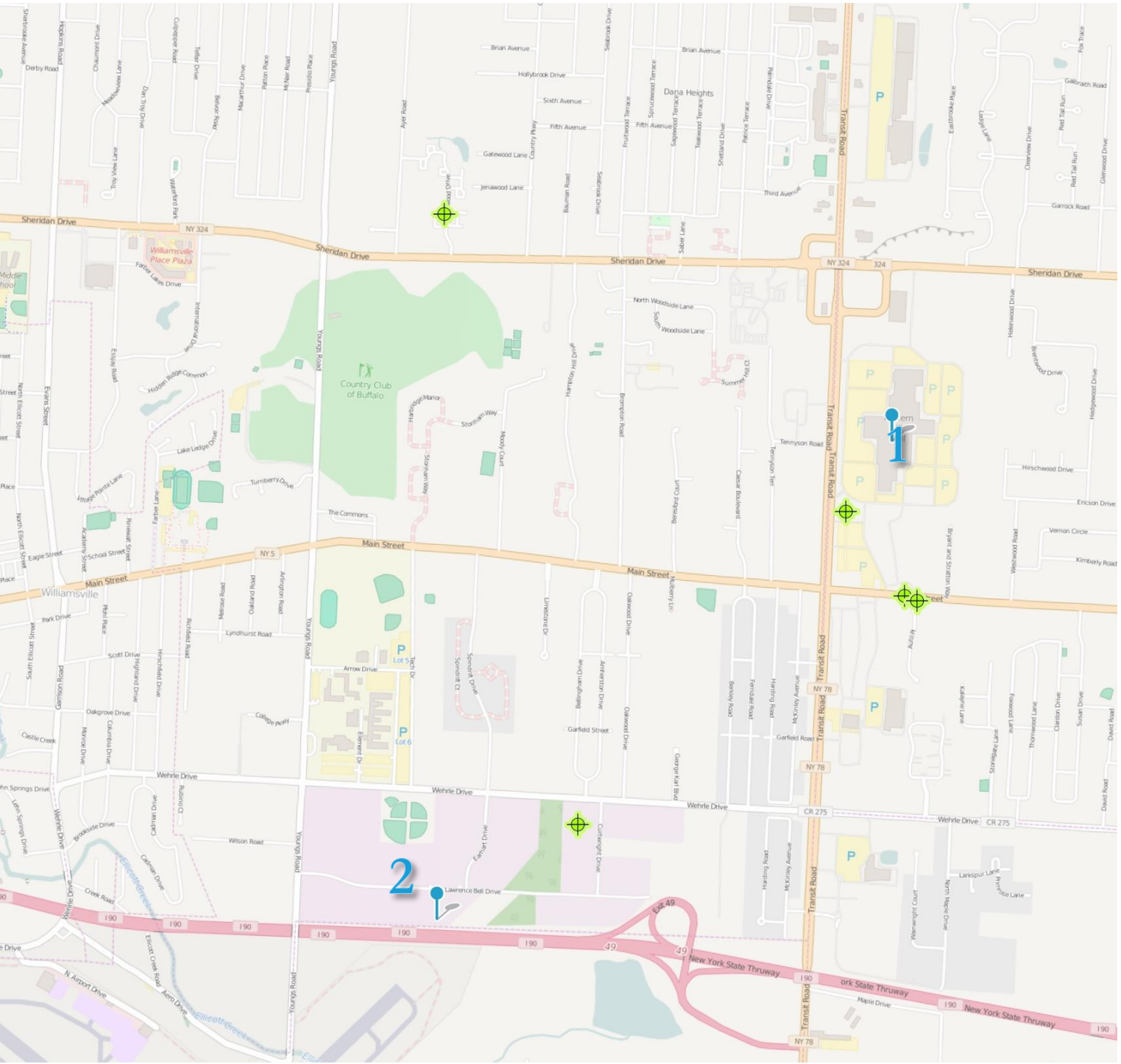
EV Factors

As of 2015, there were 16 known EV owners in Williamsville with 157 in the surrounding area.

There is currently five publically accessible charging location in the Village of Williamsville or nearby. One of which is located at the Tops Friendly Market grocery store. Williamsville has a developing small business district down the Main Street corridor. This corridor is an excellent location to host new EVSE locations. The visual exposure and charging experience will go a long way to helping educate travelers and shoppers on the availability of EV charging that would support an expanding EV population in the area.

Williamsville Water Mill

Greater Buffalo and Niagara EV Charging Station Plan



1 Eastern Hills

2 Exit 49 Park and Ride

Existing EV Charging Station

Niagara Falls a city in Niagara County. It is adjacent to the Niagara River, across from the city of Niagara Falls, Ontario, and named after the famed Niagara Falls which they share. The city is within the Buffalo–Niagara Falls Metropolitan Statistical Area as well as the Western New York region.

Overview

While the city was formerly occupied by Native Americans, Europeans who migrated to the Niagara Falls in the mid-17th century began to open businesses and develop infrastructure. Later in the 18th and 19th centuries, scientists and businessmen began harnessing the power of the Niagara River for electricity and the city began to attract manufacturers and other businesses that were drawn by the promise of inexpensive hydroelectric power. After the 1960s, however, the city and region witnessed an economic decline consistent with the rest of the Rust Belt as industries left the city and affluent families relocated to nearby suburbs. Globalization has played a large role in the decline of manufacturing in the city.

Despite the decline in heavy industry, Niagara Falls State Park and the downtown area closest to the falls continue to thrive on tourism. The population, however, has continued to decline from a peak of 102,394 in the 1960s due to the loss of manufacturing jobs in the area.

Local and state government officials have vowed to embrace the physical and cultural advantages that the region naturally possesses, such as the Niagara Gorge, wine trails, historical landmarks, Little Italy, and of course Niagara Falls itself. These marketing efforts have attempted to move focus away from the city's industrial past to embrace a tourism-based economy. In late 2001, the State of New York established the USA Niagara Development Corporation, a subsidiary to the State's economic development agency, to focus specifically on facilitating development in the downtown area.

Demographics

As of the 2010 census, there were 50,193 people living in the City of Niagara Falls. The population density was 2,988 people per square mile. The average income per capita is approximately $20,327 annually.

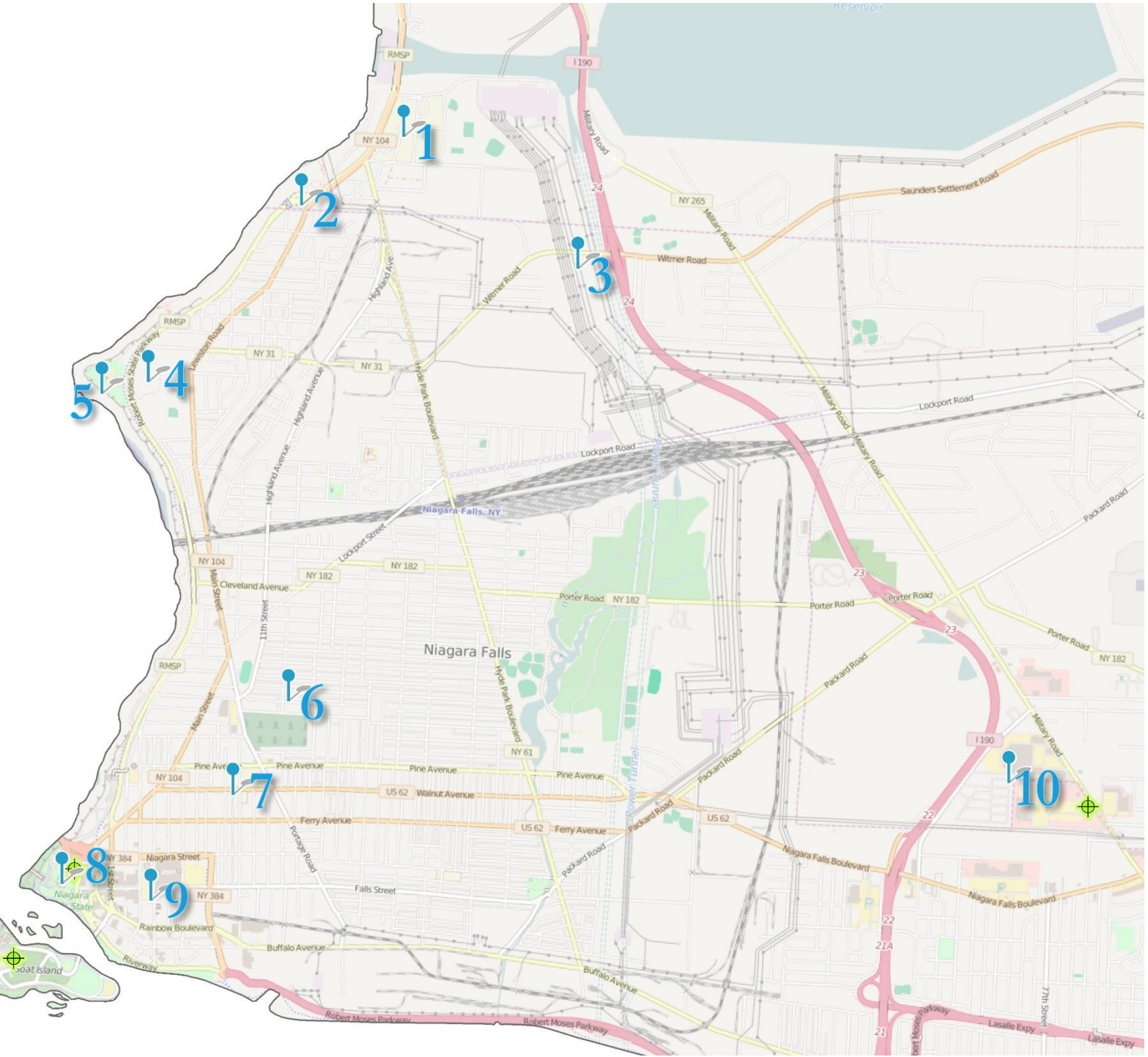
Within the city, the age of the population was spread out with 22% under the age of 18, 10.1% from 18 to 24, 24.2% from 25 to 44, 28.2% from 45 to 64, and 15.5% who were 65 years of age or older. The median age was 39 years.

EV Factors

As of 2015, there were seventeen EVs owned by residents of Niagara Falls, with an additional 43 EVs owned by individuals that live in bordering areas. Currently, there are chargers located at the Niagara Falls state Park and the Niagara Falls International Airport. Additional stations sited throughout the city, major tourist areas around the falls, and additional sites within the Niagara Falls State Park system will benefit tourists who visit the scenic location and spend several hours enjoying the view and experience of the Falls.

Niagara Falls

Greater Buffalo and Niagara EV Charging Station Plan



1. Niagara University
2. Devil's Hole State Park
3. Reservoir State Park
4. De Veaux Woods State Park
5. Whirlpool State Park
6. Niagara Falls State Park
7. Niagara Falls Medical Center
8. Niagara Falls
9. Seneca Niagara Casino
10. Niagara Fashion Outlet Mall

Existing EV Charging Station

North Buffalo

North Buffalo stretches from the City's border with Kenmore to several neighborhoods to the south with Delaware Park forming the southern border. At its western boundary is Elmwood Avenue. The eastern border is Main Street. The topography of North Buffalo is flat. Cornelius Creek once flowed through North Buffalo, along a path roughly following Hertel Avenue. Cornelius Creek is now one of the many buried creeks in Buffalo and is incorporated into the city's storm sewer system.

Overview

North Buffalo is heavily populated with Italian-Americans, as evidenced by the Hertel Avenue strip which has many Italian restaurants, bakeries, and stores. This area along Hertel Avenue is now locally known as Little Italy. Many Italians in North Buffalo migrated from the West Side in the 1970s and 1980s, when Puerto Ricans first began to settle in traditionally Italian-American neighborhoods west of Richmond Avenue. The Italian Village Festival, now called the Italian Heritage Festival, moved from Connecticut Street on the West Side to Hertel Avenue in North Buffalo in 1988.

From the 1950s until the late 1970s, North Buffalo was the historic center of Buffalo's Jewish community. Jews first settled in North Buffalo in the 1920s, with Jewish developers building a sizable number of single-family houses and two-flats in the North Park/Hertel Avenue area. The growth of the neighborhood's Jewish population rapidly accelerated in the 1950s, when urban renewal in the Lower East Side, and racial transition exacerbated by blockbusting in the Hamlin Park neighborhood, displaced the formerly large Jewish population of those communities. Although the majority of Jews in the Buffalo area now live in suburban Amherst and Williamsville, many remain in North Buffalo; particularly secular and Orthodox Jews. The neighborhood is home to several Orthodox synagogues and schools, and institutions such as the Schvitz.

Because of its pedestrian-oriented environment (proximity to downtown Buffalo, the University at Buffalo, and suburban office parks) and high-quality 1920s-era housing stock, North Buffalo is experiencing an influx of young professional homebuyers.

Like most former industrial cities of the Great Lakes region, Buffalo is recovering from an economic depression from suburbanization and the loss of its industrial base. The city's population peaked in 1950, when it was the 15th largest city in the United States, and its population has been spreading out to the suburbs since then. The demographic change and the impact of such change on the industrial cities of the region, including Buffalo, was significant. Based on the 2006 census estimate, Buffalo's population was equivalent to its population in the year 1890, reversing 120 years of demographic change. On the other hand, the populations of suburbs such as Amherst, Clarence, Orchard Park, and Cheektowaga have increased proportionally as automobile-centric lifestyles developed.

Demographics

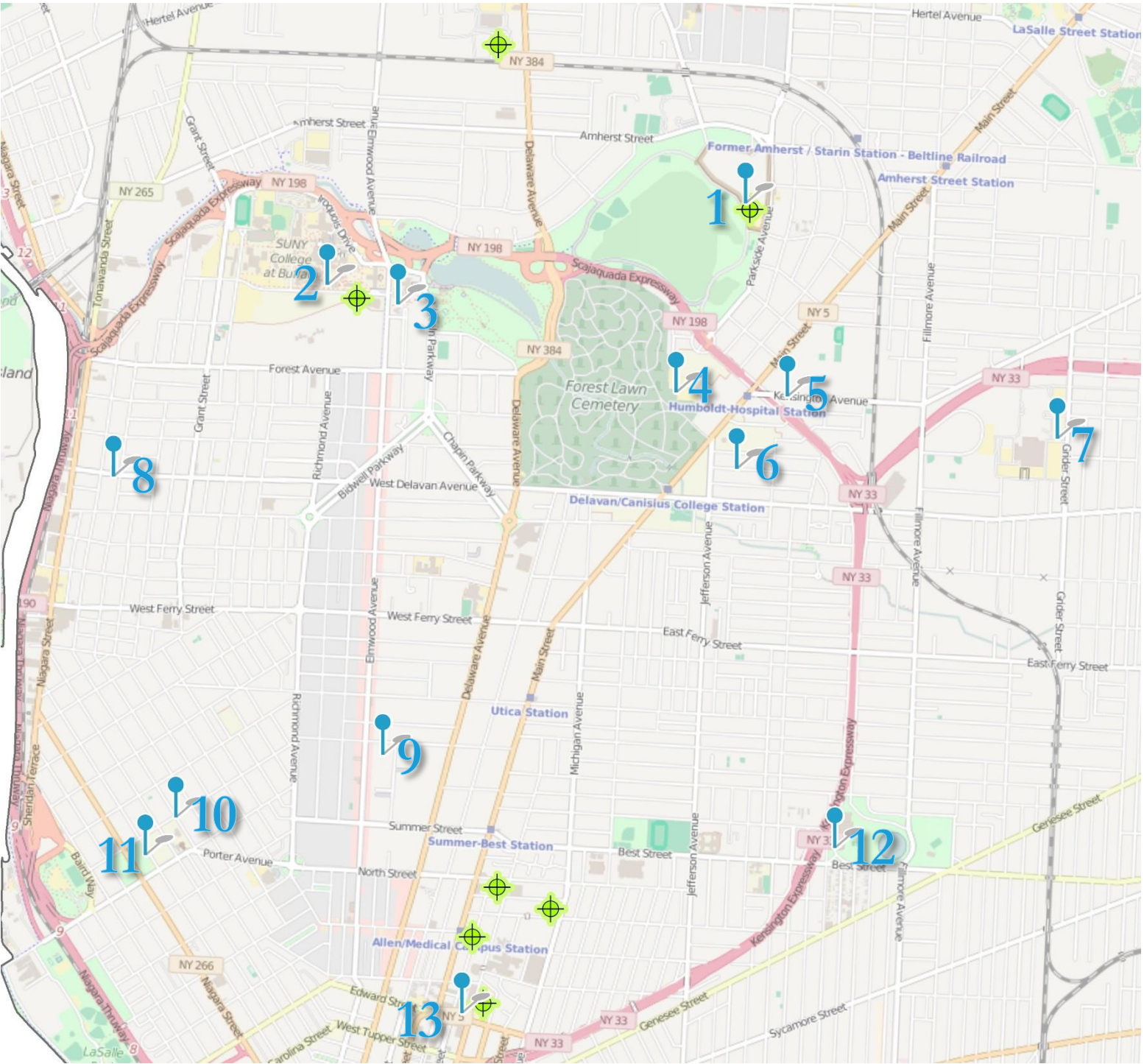
As of the census of 2010, there were 261,310 people living in the City of Buffalo. The population density was 6,436 people per square mile. The average income per capita is approximately $14,991 annually.

EV Factors

As of 2015, there were approximately 100 EVs owned by residents of North Buffalo, with an additional 120 EVs owned by individuals that live in bordering areas.

Buffalo Skyline

Greater Buffalo and Niagara EV Charging Station Plan



1. Buffalo Zoo
2. Buffalo State College
3. Albright Knox
4. Medaille College
5. Sister's Hospital
6. Cansius College
7. Erie County Medical Center
8. Turner Ramp at 1 Perkins Drive
9. Women and Children's Hospital
10. Front Park
11. D'Youville College
12. Buffalo Science Museaum
13. Buffalo Niagara Medical Campus

Existing EV Charging Station

Orchard Park is a small community located south of the City of Buffalo. Orchard Park is best known as an upper middle class suburb. Ralph Wilson Stadium, home of the Buffalo Bills, is located here, drawing in fans from Canada, all of New York, and bordering states.

Overview

In 1803, Didymus C. Kinney and wife Phebe (Hartwell) purchased land and built a cabin in the southwest corner of the township, which has since been turned into a museum. The following year, a migration of Quaker settlers began.

The town was separated from the town of Hamburg in 1850 and first named "Ellicott", after Joseph Ellicott, an agent of the Holland Land Company. Within months, the name was changed to the town of "East Hamburg". Around 1934, the town was renamed "Orchard Park" after its principal settlement.

In the early 1900s, a large fire burned down most of the central part of the village of Orchard Park around South Buffalo Street.

Within Orchard Park, the Buffalo, Rochester, and Pittsburgh Railroad Station and the Johnson-Jolls Complex are listed on the National Register of Historic Places.

Demographics

As of the 2010 census, there were 28,272 people living in the Town of Orchard Park. The population density was 718 people per square mile. The average income per capita is approximately $38,260 annually.

The age distribution within Orchard Park is 25.2% under the age of 18, 5.7% from 18 to 24, 25.6% from 25 to 44, 26.8% from 45 to 64, and 16.6% who were 65 years of age or older. The median age was 41 years.

EV Factors

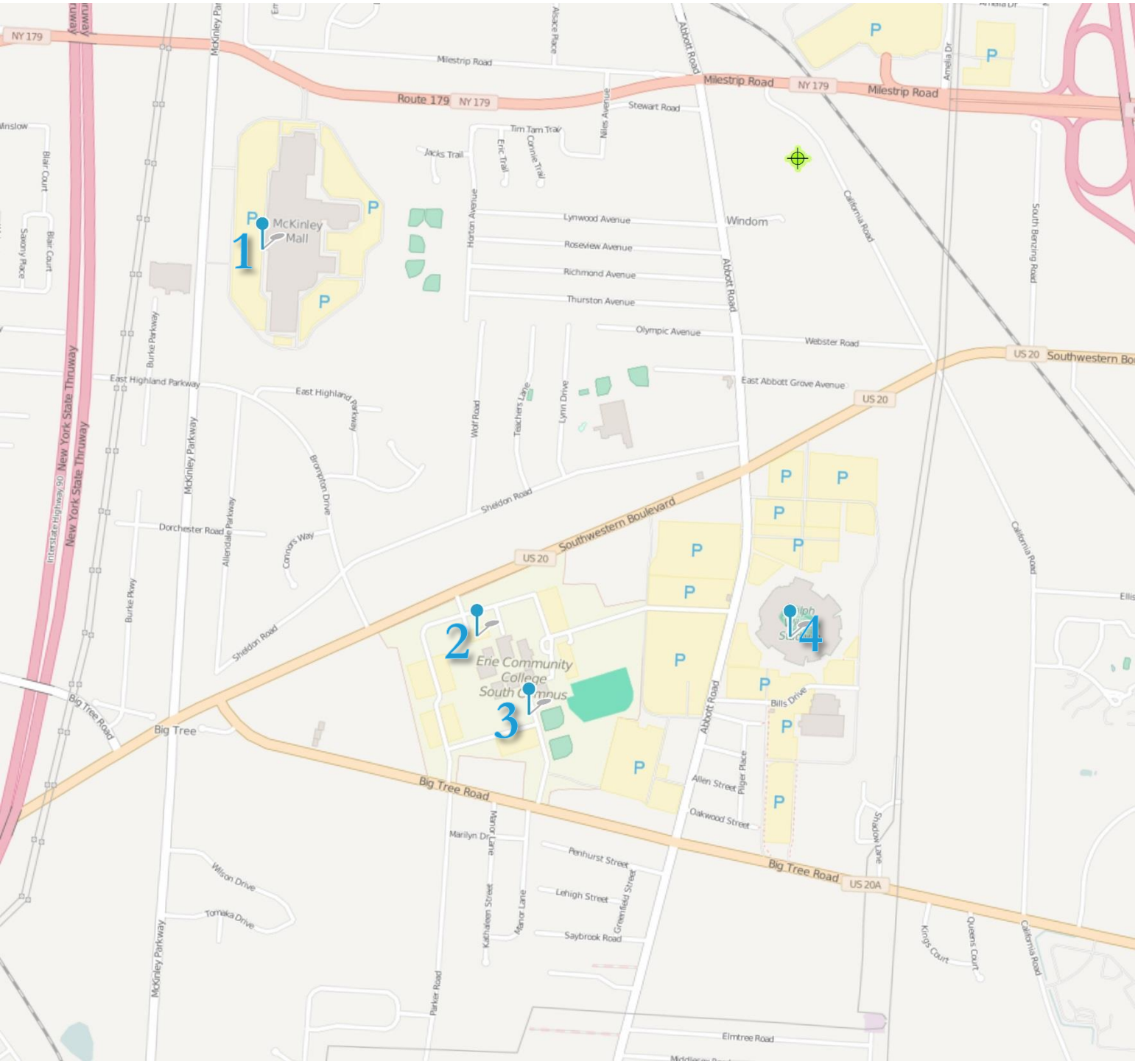
As of 2015, there were approximately 32 EVs owned by residents of Orchard Park, with an additional 99 EVs owned by individuals that live in bordering areas.

EV charging locations at the Ralph Wilson Stadium would be a good fit for commuters heading to NFL games and other events held at the stadium. Orchard Park is also home to many light manufacturing companies where EV charging stations would be well situated for employees to charge during working hours.

Other priority EV charging station locations include Erie Community College South Campus and the McKinley mall. Both locations have thousands of commuters that utilize these facilities for extended periods and would be excellent candidates for AC level 2 stations.

Ralph Wilson Stadium

Greater Buffalo and Niagara EV Charging Station Plan



1 McKinley Mall

2 Erie County Community College South Park and Ride Lot

3 Erie County Community College South Campus

4 Ralph Wilson Stadium

Existing EV Charging Station

Other Potential Level 2 Charging Station Installation Locations

Five additional locations have good potential for installing charging stations. As EV use expands in this region, these locations should be considered.

Cheektowaga is a town in Erie County. As of the 2010 census, it had a population of 88,226. The town is in the north-central part of the county. It is the second largest suburb of Buffalo, after the town of Amherst. The town of Cheektowaga contains the village of Sloan and half of the village of Depew. The town is home to the Buffalo Niagara International Airport, Erie County's principal airport.

West Seneca is also a town in Erie County with a population was 44,711 at the 2010 census. West Seneca is a centrally located interior town of the county, and a suburb of Buffalo. West Seneca, Orchard Park, and Hamburg form a cluster of middle-class suburban towns.

Lewiston is a town in Niagara County formed in 1818. The population was 16,262 at the 2010 census. In 2015, the Town of Lewiston was ranked the most affluent community in Niagara County and the eighth overall in Western NY.

South Buffalo is a neighborhood that makes up the southern third portion of the City. Traditionally known for its large Irish-American community, this community also has a strong presence of various other nationalities. The once heavily industrialized district was home to many steel mills, automotive parts manufacturers, petroleum refineries, foundries, and machine shops. However, due to increasing deindustrialization and rising unemployment the area, South Buffalo has experienced growing problems with poverty, population decline, as is the region as a whole.

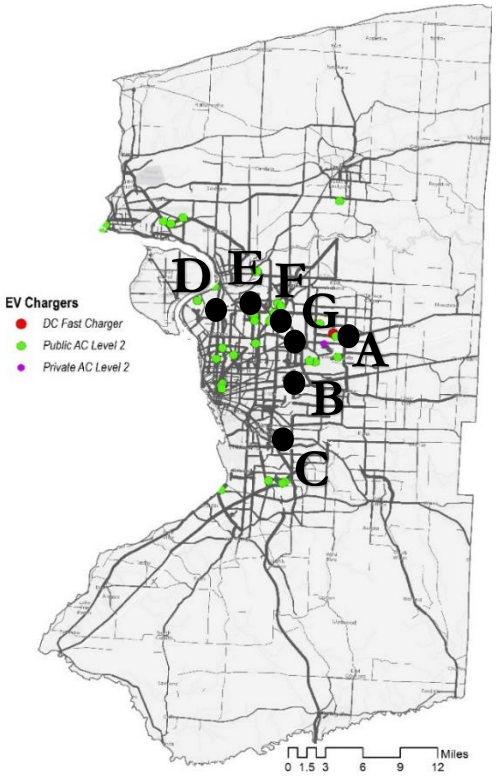
South Buffalo, as officially designated by the Buffalo City Council, is bordered by the town of West Seneca on the east, the City of Lackawanna on the south, Lake Erie on its western edge, and the Buffalo River serves as its northern border. NYS Route 16 (Seneca Street), Abbott Road, and South Park Avenue are the major streets serving South Buffalo.

Youngstown is a village in Niagara County. The population was 2,063 at the 2013 census. It is home to Old Fort Niagara, a National Historic Landmark and New York State Historic Site that welcomes more than 100,000 visitors every year. Old Fort Niagara offers a collection of original military architecture and fortifications from the 18th and 19th Centuries, as well as living history events and programs, historical exhibits and collections, archaeology, and education.

DC Fast Charging Infrastructure

AC Level 2 charging stations are useful for extending the daily use of EVs, but they are not practical for enabling inter-regional travel. DC fast chargers, which can provide an 80% change in about 20 minutes, are needed to further extend the use of EVs throughout NYS. Strategically placing DC fast chargers in the Greater Buffalo and Niagara Region along major Interstates could support transient, as well as local, EV drivers.

Major shopping centers, transportation hubs, or tourist destinations adjacent to highways exits that are convenient for EV traveler will also serve the visitors and locals in that area. Recommended locations for DC fast charging stations along I-90 are at Exit 49: Depew / Lockport [A], Exit 51: Buffalo Airport in Cheektowaga [B], and Exit 56: Milestrip Road in Orchard Park [C]. Potential options along I-290 are at Exit 2: Colvin Blvd. in Tonawanda [D], Exit 3: Niagara Falls Blvd. in Amherst [E], Exit 6: Sheridan Drive in Amherst [F], and Exit 7: Main Street in Williamsville [G].



Recommendations for Community EV Readiness

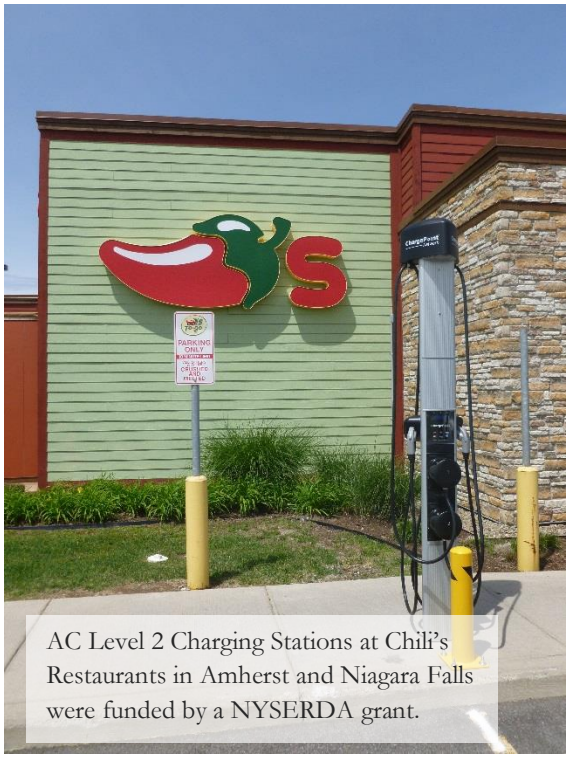
Although gasoline-powered vehicles will be around for many years, a shift in the transportation industry toward electrification will change how people drive and fuel vehicles. EVs can be very beneficial to communities and their residents. Unlike gasoline-powered vehicles, EVs are quiet, emit no direct air pollution, and do not require imported fuel that must be transported with the risk of spills or leaks.

To enjoy these benefits and support residents who make the investment in cleaner cars, communities can promote the use of EVs by becoming EV-ready. Municipalities can prepare for EVs and the infrastructure that is used to charge them with the following best practices guides for amending local rules and regulations to be EV-friendly.

Understanding which level and how many charging stations are feasible for different settings based on expected EV use is critical. The type and number of EVs in a community will help shape how many and what kind of charging station an EV owner might need. The different types of charging stations will charge EV batteries at different rates. The type of EV charging infrastructure at each site should correspond with the amount of time a vehicle might be parked there while the driver is shopping, working, or enjoying entertainment. As a municipality, zoning laws must permit the installation of each charging station type in an appropriate setting.

Zoning and parking ordinances have a wide impact on how and where public charging stations are installed and used. Zoning rules can help determine what types of land uses are appropriate for AC Level 1, AC Level 2, and DC fast charging stations and how they should be sited. Parking rules dictate who is allowed to park in parking spaces adjacent to charging stations, and whether cars parked there illegally can be fined or towed. One of the most frustrating situations for an EV driver in need of a charge is to pull up to a charging station, only to find it is occupied by a conventional vehicle.

Examples of zoning and parking policies from across the country can be found in the Planning Policy Tool Guide, which also addresses local permitting practices and building codes. This guide highlights best practices and introduces policy options for public officials and private-sector leaders to prepare their communities, jurisdictions, states, or organizations for EVs.



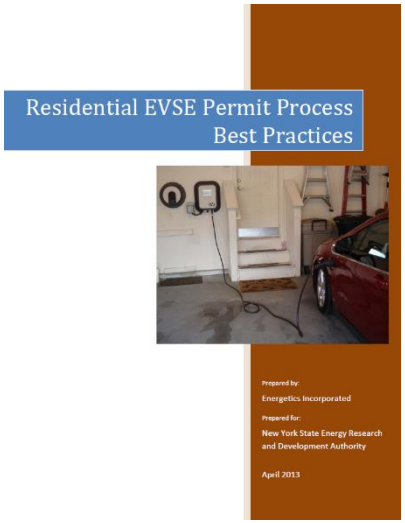
AC Level 2 Charging Stations at Chili's Restaurants in Amherst and Niagara Falls were funded by a NYSERDA grant.

Simple and consistent EV charging station *permitting processes* can make installing EV infrastructure much easier. Current national building and electrical codes neither inhibit nor

facilitate the implementation of EV charging stations. But at a municipal level, the adoption of certain provisions in local codes has successfully encouraged EV-readiness in some jurisdictions.

EV Ready Codes for the Built Environment provides current codes for charging stations and what code provisions could be incorporated into local code to encourage a basic or advanced level of EV-readiness. It highlights best practices from around the world to make recommendations for jurisdictions in the Northeast and mid-Atlantic.

How charging station installation work is classified within a jurisdiction can impact the time and cost of the permitting process. An overview on Permit Process Streamlining reviews best practices for charging station permitting and presents sample application forms. While residential installations were the focus on this investigation, the results and findings also apply to commercial charging station installations.



NYSERDA has funding available for communities to amend their permitting, zoning, and parking ordinances so they are more EV-friendly, along with other opportunities available to support EV and charging station use. Through the Cleaner, Greener Communities program (Phase 2, Category 1), up to $5,000 per municipality is available.

Lessons from Early Installations of Charging Equipment documents EV charging infrastructure installations in the Northeast and Mid-Atlantic, and uncovers some of the related challenges and opportunities.

- In general, preparing the charging sites as part of a new development is more cost effective than incorporating EV charging infrastructure into an existing structure. The cost of electric system upgrades also tends to increase with the age of the building.
- Installations in public spaces, such as sidewalk right of way, can be administratively burdensome and formalizing clear procedures for permitting and approval will help expedite installations.
- Standardization of signs, both regulatory (on-site) and directional (wayfinding) will not only improve communication to drivers but also reduce the burden on site owners and designers.
- Site owners, current and prospective, often struggle with the question of return on investment on EV charging equipment.
- Cords without a management system are often left spread about on the ground and may potentially become a hazard for users or the equipment.
- The Northeast and Mid-Atlantic regions have not yet formally adopted guidelines or recommendations on the definition of ADA-accessible charging space and the minimum number of charging stations that need to meet that definition.
- A careful evaluation of the possible spaces where the EV charging equipment could be located and their impact on the economics of the installation should be part of the planning process before a commitment to installing the equipment is made.
- Public-private partnerships to fund the installation of charging stations help the host construct a more attractive economic case to install the equipment, while enabling government to pursue their community goals.
- Before entering into agreements to install charging stations, prospective hosts should make sure they understand who will pay for maintenance, electricity, and other ongoing costs after installation.

Barriers and Solutions

Establishing a more comprehensive network of AC Level 2 charging stations, as recommended in the prior section, is one key strategy to encourage more drivers to consider owning an EV. Public charging stations could make EV ownership more feasible for some, while the exposure to this technology from having public charging infrastructure will expose others to EV options.

Public AC Level 2 charging stations may also allow current EV drivers to use their vehicle more, rather than relying on a secondary conventional ICE vehicle for trips that require charging while in route. More electric miles results in cost savings for the EV owner and more environmental benefits for the community.

Five barriers were determined to be critical issues limiting the expanded use of EVs in the Greater Buffalo and Niagara Region. For each, potential solutions and strategies are presented and it is strongly recommended that municipalities, counties, and the region lead or support initiatives that follow these recommendations.

Building Regulations

In some jurisdictions, the cost, length, or complexity of the permitting process prevents charging station installations. NYSERDA currently provides funding to help *streamline the permitting process* through the Cleaner, Greener Communities program (Phase 2, Category 1). More importantly, however, is to clearly *establish protocols for EV charging station permits* (e.g., which form and classification it falls under) so developers can plan for and then complete the permitting process required for new installations.

During the planning and permitting of an EV charging station, the developer, host site, and/or installer will interact with several municipal employees. To facilitate the process and portray itself as an EV supportive community, the *zoning board members, clerks, code enforcers, and inspectors should be knowledgeable of EV technology*. In addition to helping the process go smoother, properly educated municipal employees will ensure that the charging station installation is done properly.

DC Fast Charging Infrastructure

EVs will likely always have a more limited range than conventional ICE vehicles because battery technology does not have as high energy density as petroleum fuels. With advancements, the EV driving range will continue to increase, but regular charging will still be necessary. Restricted to only AC Level 1 or Level 2 charging, EVs will always need an extended period to fully replenish the batteries. This limits EV use to local driving within the region. For greater EV acceptance, faster charging options are required.

DC fast charging infrastructure enables EV drivers to replenish a large portion of their battery capacity in a shorter stop, similarly to fueling a conventional ICE vehicle. Installing these stations along major transportation routes facilitates inter-regional travel by EVs. If DC fast charge stations can also be *placed in larger cities where there is a concentrated population of EV drivers, the stations could be used by local residents* as well.

A few suggested locations for DC fast charge stations were mentioned in the previous section, but optimally placing these is a task that must *look at this issue state-wide*. Installing these at certain locations in the Buffalo / Niagara Region would only be beneficial if they align with DC fast charge station placement in the neighboring regions. Regular utilization is needed to maximize the investment into DC fast charging infrastructure. This is currently challenging with the limited number of EVs in some parts of the state. It would be beneficial to *coordinate DC fast charge station installations with government or private fleets of EVs* that could be regular users of this infrastructure in their daily travels.

EV drivers flying out of Niagara Falls or Buffalo Airports can park and plug into AC Level 2 charging stations.

EV Buyer/Driver Education

Currently, many people looking to purchase a new vehicle are not knowledgeable about EVs or whether EV technology would be appropriate for them. Anyone interested in EVs would likely have to do their own research and investigation because there is limited information available or promoted at local dealerships. It is challenging to find an EV for a test drive and almost impossible to compare multiple EV options side-by-side in person.

EV education and awareness should be coordinated on a large scale (regionally or state-wide), focusing on the most likely consumers. Whenever possible, these efforts should be *coordinated with EV manufacturers and local dealerships*, which should have an interest in promoting EVs, to leverage existing advertising budgets. Other business focused organizations, such as the Buffalo Niagara Partnership and the WNY Sustainable Business Roundtable, hold regular meetings educating stakeholders (including fleet owners and operators) on the benefits of new technologies to reduce their greenhouse gas emissions. These meetings are an opportunity to reach a broad spectrum of potential end users on the benefits of workplace charging infrastructure.

Cost savings should be emphasized more than environmental benefits and promotional efforts should be *directed towards key demographics of potential EV buyers* rather than a broad audience. A better audience to target would be residents drawn to the farmer's markets or other initiatives surrounding sustainability or embracing the natural environment (e.g. hiking).

Students in College or younger should be targeted to pass on what they learn to their parents or to "plant a seed" about EVs in their mind for when they consider a vehicle purchase. Colleges or BOCES would be good partners to become involved in projects or studies related to EVs, some of which might task them with promoting this technology.

When possible, it is also useful to *draw a connection between EVs and electricity generation initiatives* for example solar powered integrated EVSE locations at the Buffalo Niagara Medical Campus demonstrate how charging locations can be located off the electrical grid and are practical in application. Consumers tend to understand technology better when they relate it to something they know or can see the bigger picture and how that benefits them.

Online resources are best for providing information to consumers and webpages often provide as little or as much information as is desired by the consumer. NYSERDA has recently created webpages dedicated to providing EV information, but it might not be the most effective webpage for promoting this technology.

While the NYSERDA pages could be linked to for those wanting more in-depth information, a *dedicated webpage promoting EVs* that can be easily found or linked to from other pages should be developed. One suggested option was leveraging the I♥NY webpage which has a "Travel Tools" section. Alternatively, a generic EV promotion page could be made available for any organization in the state to place on their own site and draw more attention to this topic.

Electric Grid/Utility Support

Electric utilities are the energy supplier for EVs and supporting the transportation industry is a market in which they have not traditionally been involved. While the increased demand from charging stations can be concerning, providing electricity to vehicles is also a growth opportunity for electric utilities.

The electric utilities are involved in EV adoption every time a charging station is installed or a vehicle is drawing power to charge its battery. To date, the utilities in this region have taken a very passive role in EV readiness. *Collaborating and partnering with the electric utilities on EV initiatives* could be very effective at promoting this technology and helping to maximize benefits for both consumers and the utility itself.

Many EV drivers adopt this technology to have a positive impact on the environment and a key factor in that is how the electricity to charge the batteries is generated. This is obvious if the EV owner has their own solar panels, but for most others the source of electricity is unknown. Electricity generation is tracked and published at the state level, but *sharing the electricity sources and its impact on EV use* to current or potential EV owners would be useful.

The electric utilities are logical candidates to *lead by example in regards to EV adoption*. Their fleet, where appropriate, could include EVs and some of their facilities or buildings could host public charging stations.

There are no specific electricity rates for EV owners offered by local electric utilities, but charging at night under time-of-use rate schedules could result in cost savings for the consumer and benefit the utility as well. *Consultation or guidelines issued by the electric utility specifically for EV owners* would help them make better informed decisions on optimizing their EV purchase.

Charging Station Occupancy

Several public AC Level 2 charging stations have been installed throughout the Greater Buffalo and Niagara Region, but many are seeing very infrequent use. However, the few sites that are actively used many times run into parking issues. Due to many EV charging parking spots being located near a building's main entrance the EV parking spot is usually a premier location. There are times when non-EVs park in these spots rendering them unusable to EVs when they require charging.

As some EV charging locations become more utilized they also experience not having enough available parking spots for the vehicles that are attempting to charge at this location. Some businesses who offer free charging to their employees are considering assigning time slots for charging their employees EVs. Employees would be required to adhere to charging only during their time slot and then moving their vehicle so that someone else may charge their EV.

To resolve these issues, it is recommended that *adequate signage and distinct painting of EV charging parking spots* are utilized. This makes it significantly clearer to vehicle operators that these spots are for EVs only.

It would be advantageous to better understand where EV owners drive and during which trips they really need public charging. *Establishing a network of EV drivers* to voice these opinions and provide suggestions into future public charging station installations or EV initiatives would be beneficial.

This network of current EV drivers can also be leveraged to promote EV technology and expose others to electrified transportation options. Such a group could *anchor an event for the National Drive Electric week* which has been promoting EV use through critical awareness activities in many places across the US. With a limited supply of new EVs at local dealerships, this EV driver network may also help showcase the technology in coordination with other regional education and awareness initiatives.

Site Planning

Requiring all new construction projects to install EV charging stations or even the conduit in preparation for future installations is likely premature for municipalities that currently have very few EV owners. However, there are some new construction projects where charging stations or the preparations for them should be considered.

Universities, medical campuses, and technology parks are some examples of logical host sites for charging stations. The demographics of employees at those organizations align with typical EV owners and charging stations have been credited with attracting or retaining highly educated and technology savvy employees.

Ensuring that architects and others involved in the planning process of new construction projects *understand when charging stations might be a good option* to incorporate is important. Discussing EV readiness in site planning will likely enable cost effective charging station installations.

The *key next steps to implementing this EV Charging Station Plan* are:

1) Holding meetings with key stakeholders in the recommended locations to prepare for, and encourage, new charging stations.
2) Working with municipal planning and building departments to establish siting guidelines for new installations.
3) Work with EV dealerships to educate them on availability of charging infrastructure and EV vehicle rebates.
4) Support EV vehicle and infrastructure rebate/incentive program.
5) Identify additional key sites where charging station benefit EV drivers.

Appendix A: EV Models Available in NYS

PHEVs

Audi A3 Sportback e-tron
Starting MSRP: $37,900
Federal Tax Credit: $4,168
MPG Equivalent: 95
Electric Range (miles): 31

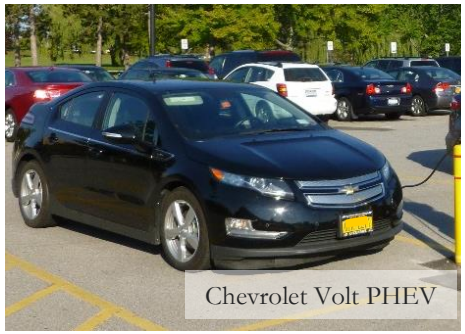
BMW i3 w/ Range Extender
Starting MSRP: $46,250
Federal Tax Credit: $7,500
MPG Equivalent: 117
Electric Range (miles): 81

BMW i8
Starting MSRP: $136,500
Federal Tax Credit: $3,793
MPG Equivalent: 76
Electric Range (miles): 15

BMW X5 xDrive40e
Starting MSRP: $62,100
Federal Tax Credit: $4,168
MPG Equivalent: 59
Electric Range (miles): 13

Cadillac ELR
Starting MSRP: $65,000
Federal Tax Credit: $7,500
MPG Equivalent: 82
Electric Range (miles): 37

Chevrolet Volt
Starting MSRP: $33,170
Federal Tax Credit: $7,500
MPG Equivalent: 106
Electric Range (miles): 53


Chevrolet Volt PHEV

Ford C-Max Energi
Starting MSRP: $31,770
Federal Tax Credit: $4,007
MPG Equivalent: 88
Electric Range (miles): 21


Ford C-Max SE Energi PHEV

Ford Fusion SE Energi
Starting MSRP: $33,900
Federal Tax Credit: $4,007
MPG Equivalent: 88
Electric Range (miles): 21


Ford Fusion SE Energi PHEV

Honda Accord PHEV
Starting MSRP: $39,780
Federal Tax Credit: $3,626
MPG Equivalent: 115
Electric Range (miles): 13

Hyundai Sonata PHEV
Starting MSRP: $34,600
Federal Tax Credit: $4,919
MPG Equivalent: 93
Electric Range (miles): 22

Mercedes-Benz S-Class PHEV
Starting MSRP: $95,650
Federal Tax Credit: $4,168
MPG Equivalent: 58
Electric Range (miles): 20

Porsche Cayenne S E-Hybrid
Starting MSRP: $77,200
Federal Tax Credit: $5,335
MPG Equivalent: 47
Electric Range (miles): 14

Porsche Panamera S E-Hybrid
Starting MSRP: $96,100
Federal Tax Credit: $4,751
MPG Equivalent: 50
Electric Range (miles): 16

Toyota Prius PHEV
Starting MSRP: $29,990
Federal Tax Credit: $2,500
MPG Equivalent: 95
Electric Range (miles): 11


Toyota Prius PHEV

Greater Buffalo and Niagara EV Charging Station Plan

BEVs

BMW i3 BEV
Starting MSRP: $42,400
Federal Tax Credit: $7,500
MPG Equivalent: 124
Electric Range (miles): 81

Chevrolet Bolt
Starting MSRP: N/A
Federal Tax Credit: $7,500
MPG Equivalent: N/A
Electric Range (miles): 200

Ford Focus Electric
Starting MSRP: $29,170
Federal Tax Credit: $7,500
MPG Equivalent: 104
Electric Range (miles): 76

Kia Soul EV
Starting MSRP: $31,950
Federal Tax Credit: $7,500
MPG Equivalent: 112
Electric Range (miles): 105

Mercedes B Class Electric Drive
Starting MSRP: $41,450
Federal Tax Credit: $7,500
MPG Equivalent: 84
Electric Range (miles): 87

Mitsubishi i MiEV
Starting MSRP: $22,995
Federal Tax Credit: $7,500
MPG Equivalent: 112
Electric Range (miles): 62

Nissan Leaf
Starting MSRP: $29,010
Federal Tax Credit: $7,500
MPG Equivalent: 115
Electric Range (miles): 84

Smart Electric Drive
Starting MSRP: $25,000
Federal Tax Credit: $7,500
MPG Equivalent: 107
Electric Range (miles): 68

Tesla Model S
Starting MSRP: $71,070
Federal Tax Credit: $7,500
MPG Equivalent: 95
Electric Range (miles): 265

Tesla Model X
Starting MSRP: $80,000
Federal Tax Credit: $7,500
MPG Equivalent: 89
Electric Range (miles): 230

Volkswagen e-Golf
Starting MSRP: $28,995
Federal Tax Credit: $7,500
MPG Equivalent: 116
Electric Range (miles): 83


Smart Electric Drive BEV


Tesla Model S BEV


Ford Focus BEV


Nissan Leaf BEV