



Capital District Electric Vehicle Charging Station Plan



Capital District EV Charging Station Plan

PREPARED BY:



IN COLLABORATION WITH:



WITH SUPPORT FROM:



NYSERDA

Department of
Transportation

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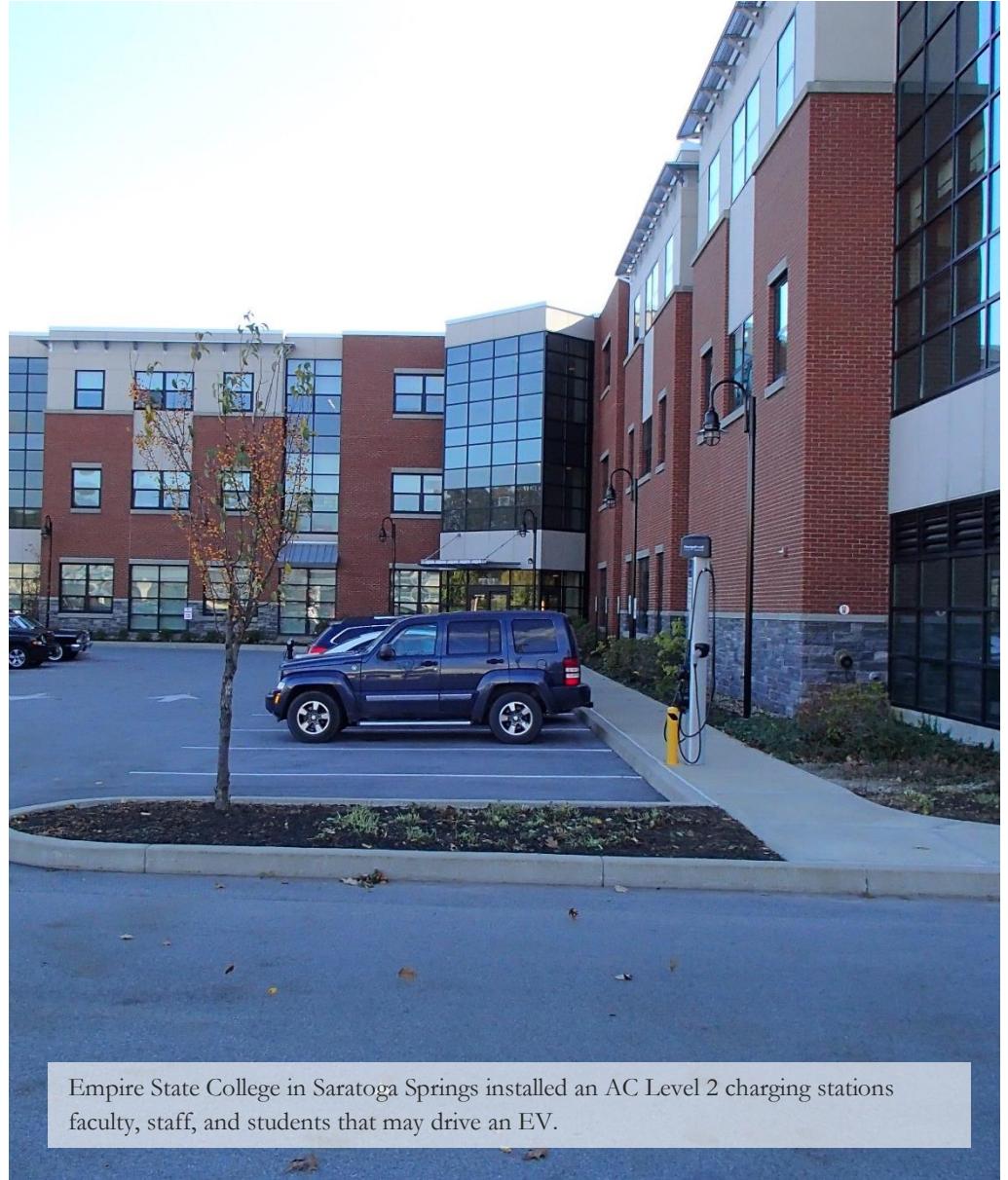
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Input to the Capital District EV Charging Station Plan was provided by these sponsors and supporters, along with other key stakeholders in the region. Members of this working group which reviewed, ranked, and provided feedback on all aspects of this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

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- Mike Lyons, Town of Colonie
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- Nathan Putnam, New York State Department of Conservation
- Sam Wells, Capital District Transit Authority
- Thomas Ashley, Greenlots.com



Empire State College in Saratoga Springs installed an AC Level 2 charging stations for faculty, staff, and students that may drive an EV.



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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



AC Level 2 charging stations have been installed at many hotels throughout the region, including Homewood Suites in Colonie, for employees and guests.



Capital District EV Charging Station Plan

Executive Summary

This EV Charging Station Plan assesses the Capital District'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 energy sources, 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 831 EVs registered in the Capital District. 223 were BEVs and 608 were PHEVs. These represent a very small but growing fraction of all registered vehicles. Currently there are 69 locations with public charging station in the region with 39 in Albany County, 7 in Schenectady County, 15 in Saratoga County, and 8 in Rensselaer County.

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

- Albany
- Saratoga Springs
- Schenectady
- Troy
- Colonie

Some other locations that could also be considered for installing more charging stations were Clifton Park, Malta, Bethlehem, Guilderland, and Niskayuna.





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

Support and better promotion of EVs by car dealerships is needed to drive adoption. Providing training and information to dealers to help talk about EVs to potential buyers could make dealers feel more comfortable with the vehicles. Also, a local incentive to a dealer for every EV sold could motivate dealerships to market EVs better.

Fast charging stations will be needed 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 on fast charging stations should be coordinated at a state level and attempt to align with regular routes for government or private fleets of EVs.

Educating potential EV owners through large scale awareness efforts that are coordinated with EV manufacturers and local dealerships is needed. 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.

Making EV-readiness part of local planning and roadway construction processes addresses the challenge of installing charging in an urban setting. As roads are reconstructed and streetscapes are redesigned, EV infrastructure must be considered and coordinated to create more EV-friendly areas in our downtowns. Local planning departments should define EV infrastructure in their zoning codes and adopt appropriate design guidelines to ensure future on-street EV charging stations are ADA compliant, do not pose a safety risk to others, and enhance neighborhood character rather than diminish it.

Certain new construction projects should consider installing charging stations or providing 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 be a good option so developers can negotiate an incentive for including an installation.

General education on EVs for elected officials through presentations and publications should be provided. Key elements of this outreach would be hands-on experiences to see and drive EVs. It is also important to draw connections between EVs and other local initiatives such as renewable electricity generation projects or even tourism.

More EVs will be utilized by Capital District residents in the near future because they provide benefits for the entire community. While current EV adoption rates may be too low to pursue any charging station requirements or regulations, 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. 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) Assess each city or town's EV-Readiness
- 2) Holding meetings with key stakeholders in the recommended locations for additional charging stations to prepare for, and encourage, new installations
- 3) Identify opportunities to leverage resources or coordinate partnerships between stakeholders to install charging stations
- 4) Explore funding/grant opportunities availability



Capital District EV Charging Station Plan

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 local planning initiatives. 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 Capital District 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 Capital District 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

Capital District Clean Communities and Energetics Incorporated led the development effort for this Capital District EV Charging Station Plan. Capital District Clean Communities Coalition was established in 1999 to advance the Capital Region's economic, environmental, and energy security by

promoting the use of alternative fuels, advanced vehicle technologies and policies that reduce petroleum consumption in transportation. 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 Capital District EV Charging Station Plan was also supported by the Capital District Transportation Committee (CDTC), the designated Metropolitan Planning Organization (MPO) for the region.

Plan Components

This Capital District 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 Capital District, 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 Capital District 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 Capital District 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 Capital District 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. Ninety-six percent of commuters in the Capital District have a round-trip commute less than 60 miles, which is within the range of an EV that is charged overnight at home. Because New York's power grid is one of the cleanest in the nation, switching passenger cars from gasoline to electric will reduce emissions by 75% per mile. The CDTC's New Visions 2040 Plan supports investments in EVSE because of these significant air quality benefits.



Charging stations at Universities or Colleges, including this one at SUNY Albany, are often used by professors or staff, who have an income and education level typical of EV drivers.



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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 a 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.

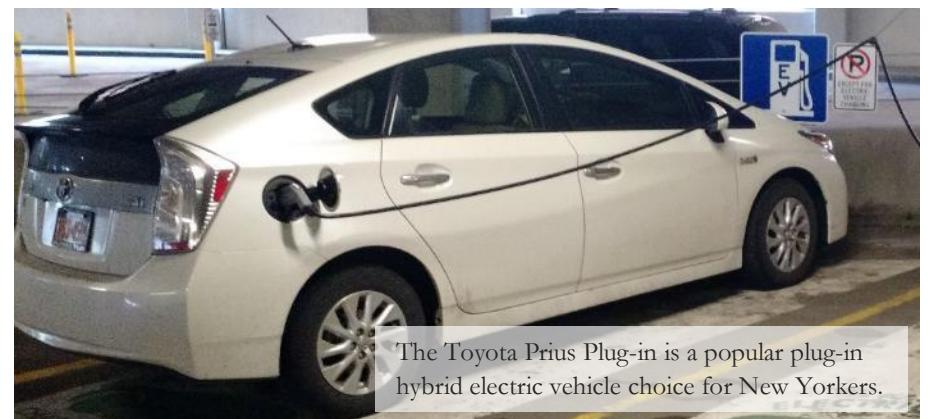
Current BEVs can travel between 60 and 265 miles on a single charge and take at least 30 minutes to recharge the battery. A gasoline vehicle will be able to travel 300-500 miles on a single tank and can fuel in less than five minutes.

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.

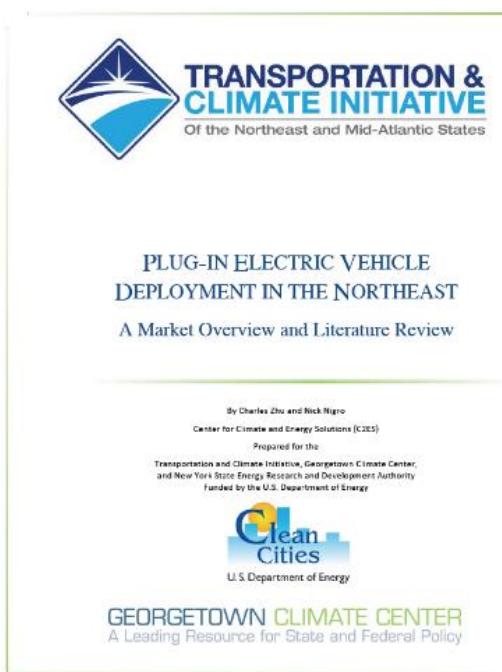


The Toyota Prius Plug-in is a popular plug-in hybrid electric vehicle choice for New Yorkers.

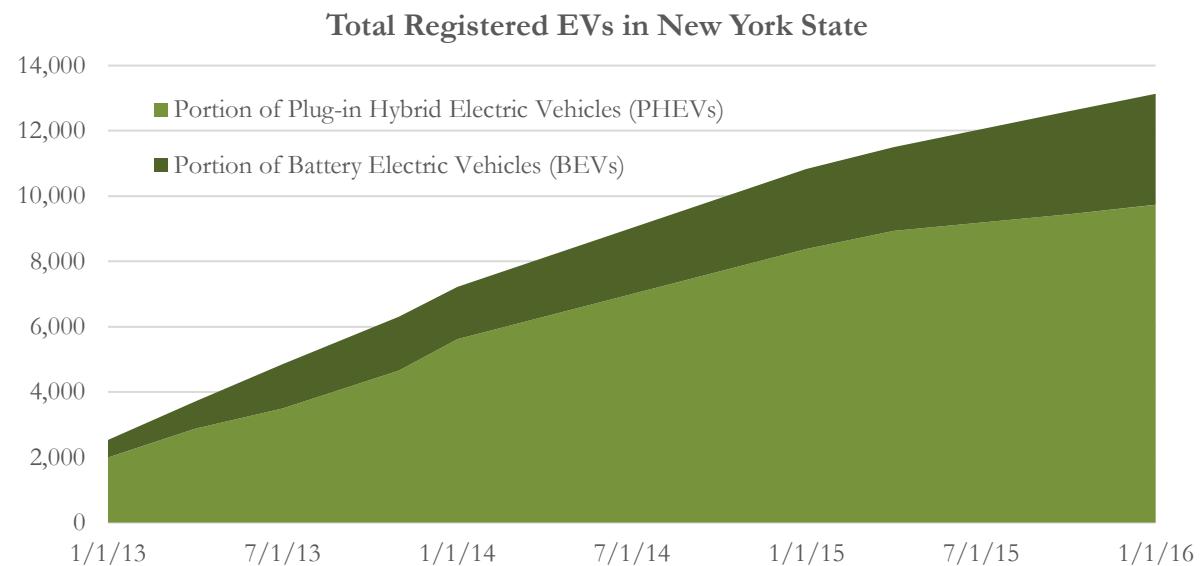


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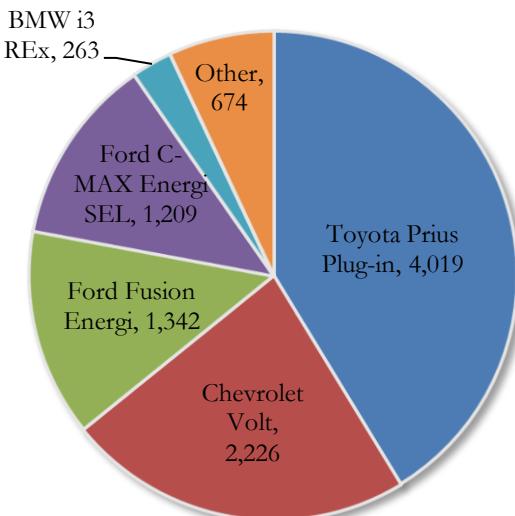
The [Plug-In Electric Vehicle Deployment in the Northeast: A Market Overview and Literature Review](#) provides an overview of EV deployment in the Northeast as of 2012. The document is intended to serve as a resource for consumers and policymakers who seek to better understand the nature of and challenges facing EV deployment in the Northeast.



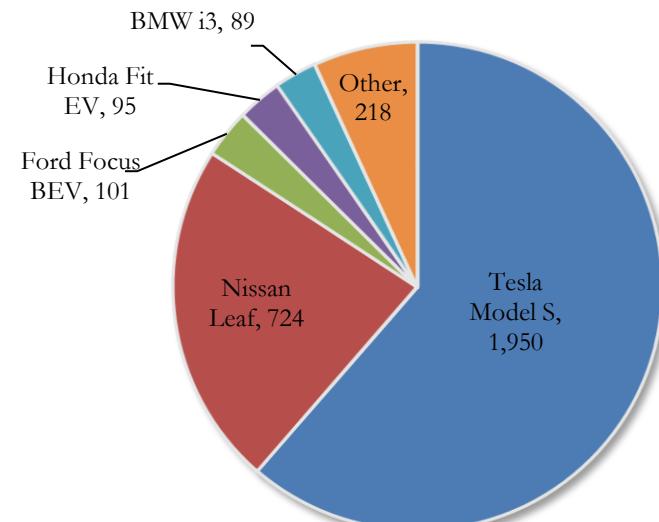
EV ownership in New York State has been increasing rapidly in the past couple of years. There are close to three times more PHEVs registered in New York State than BEVs, but a variety of models are being offered and purchased for both technologies. EVs still only account for 0.16% of all registered vehicles.



Current PHEVs in New York State



Current BEVs in New York State

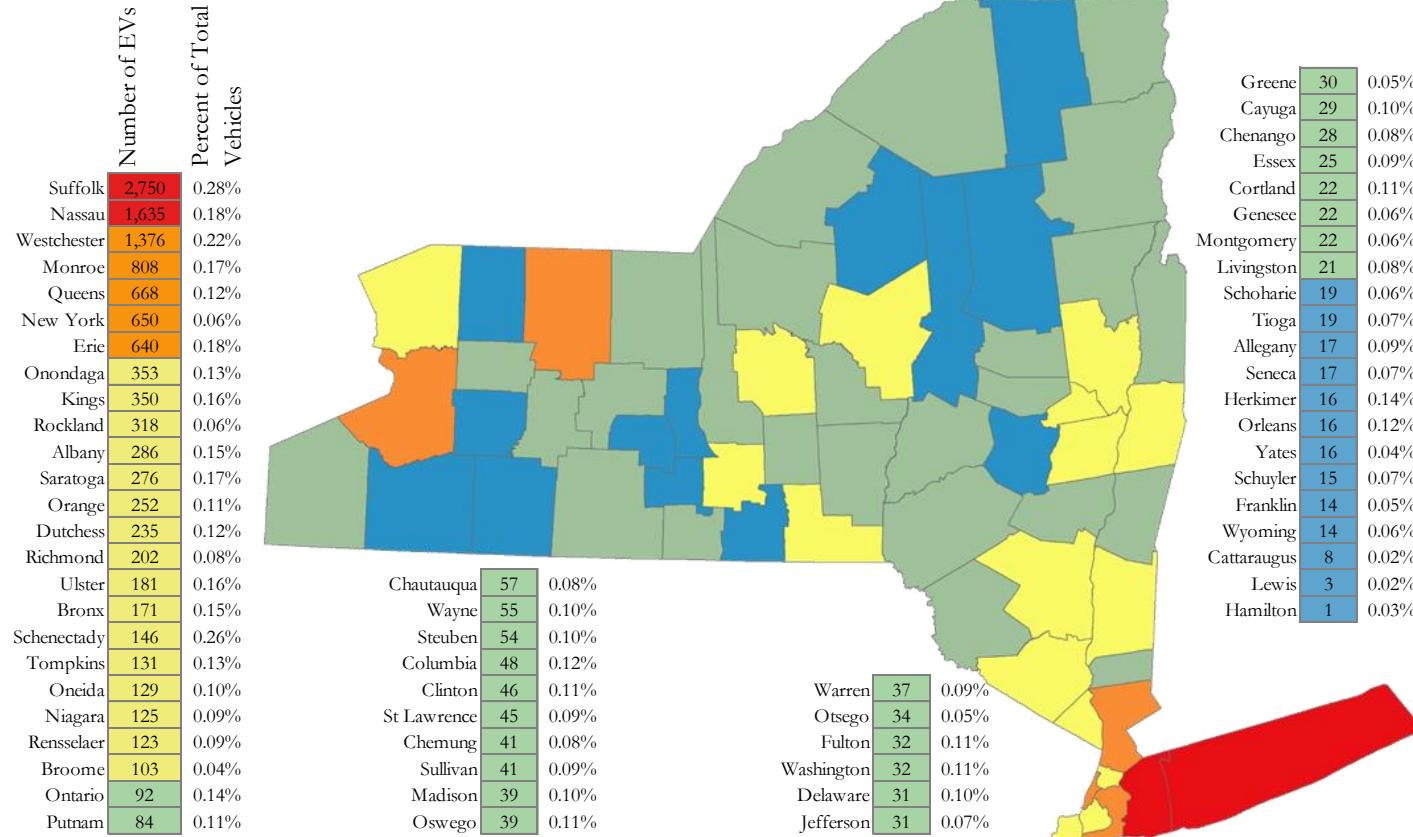


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Different parts of New York State have seen greater adoption of EVs.

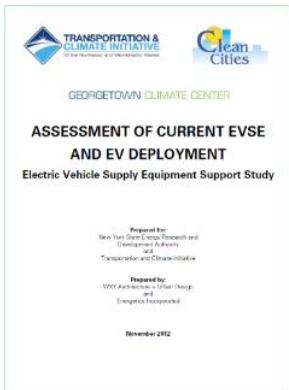
BEVs and PHEVs by County

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



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 family 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 especially in dense urban areas without private garages and older infrastructure) 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 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.





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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. This 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).

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.

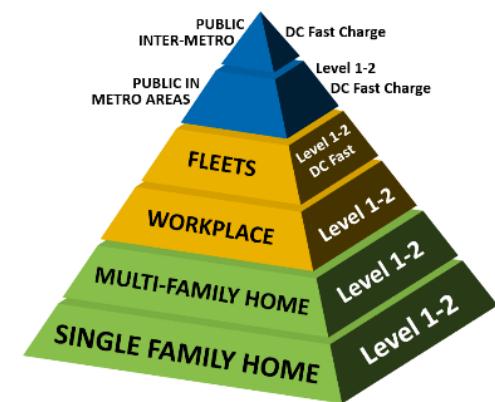
Up until 2013, the Japanese CHAdeMO connector was the only DC fast charge standard connector, available on both the Nissan Leaf and Mitsubishi i-Miev. In early 2013, the SAE J1772 connector standard was expanded to include DC fast charge with the SAE J1772 Combo connector, which is available on the Chevrolet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

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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. Networked stations can usually be located through mobile applications.

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

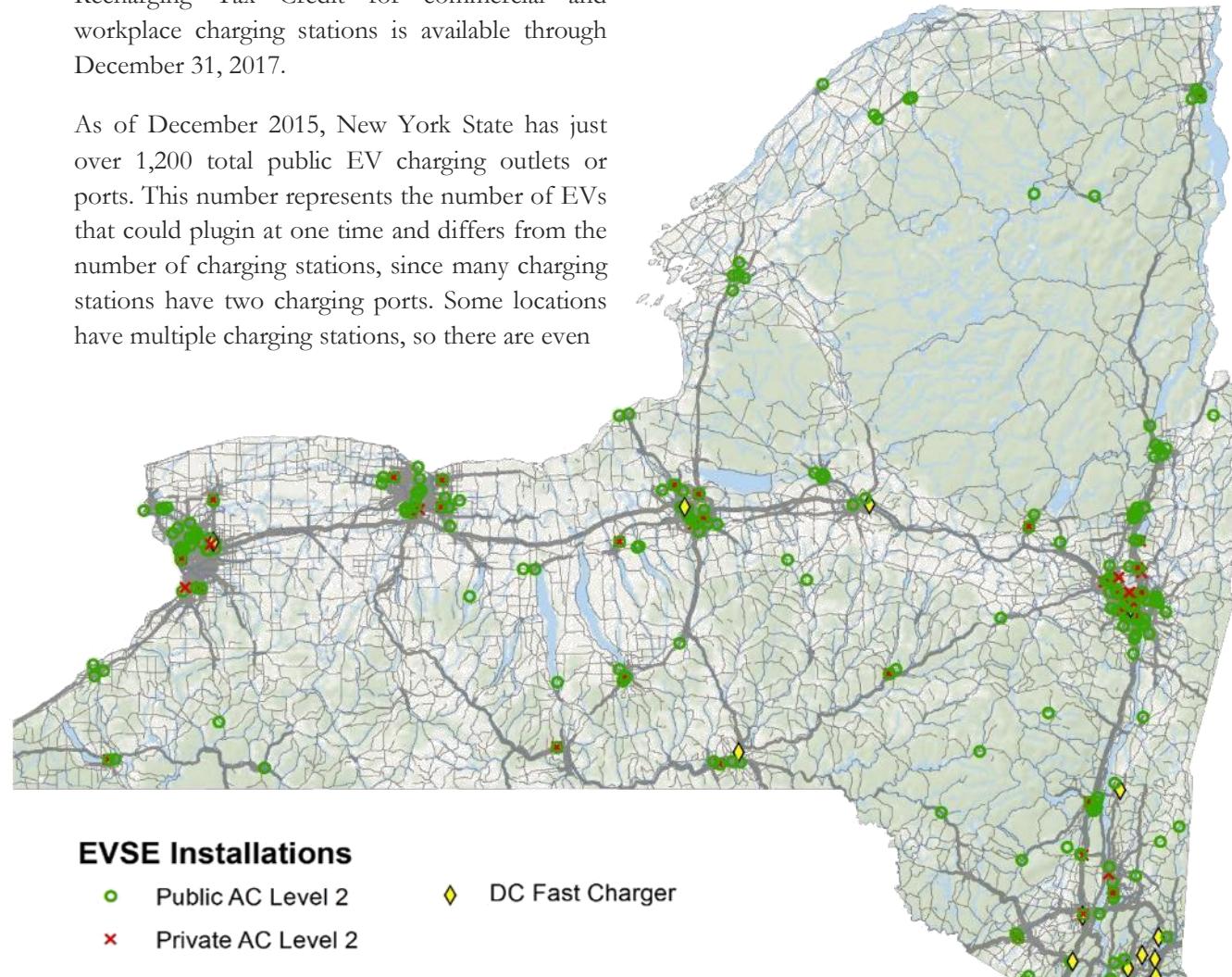
providers are considering offering the option to lease charging stations as well.

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.

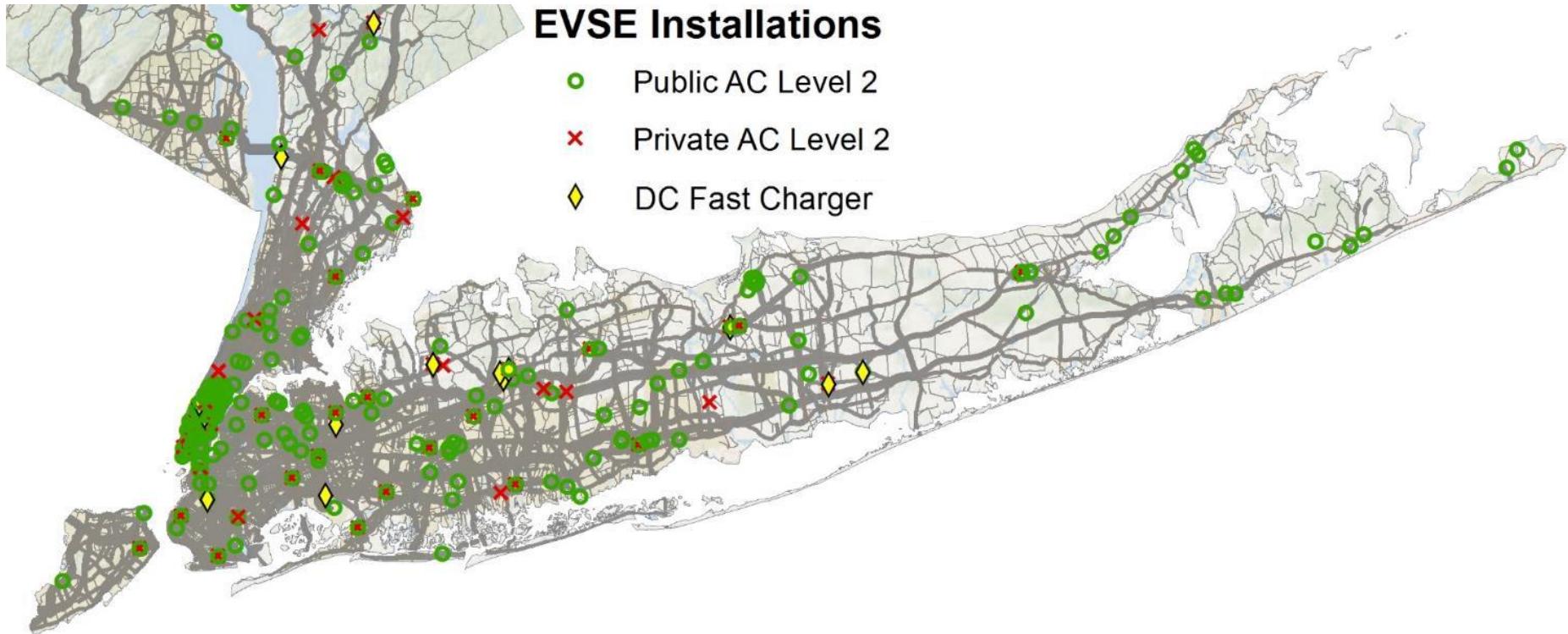
As of December 2015, New York State has just over 1,200 total public EV charging outlets or ports. This number represents the number of EVs that could plugin at one time and differs from the number of charging stations, since many charging stations have two charging ports. Some locations have multiple 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](#).



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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. Workplace charging can also provide the opportunity to integrate EVs into an organization's fleet.

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

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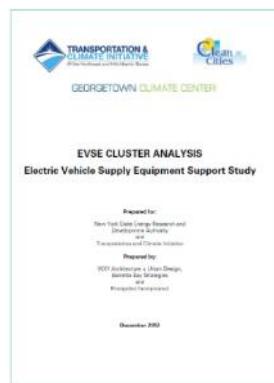
employees and visitors, as well as the general public. Two key examples are:

- 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.

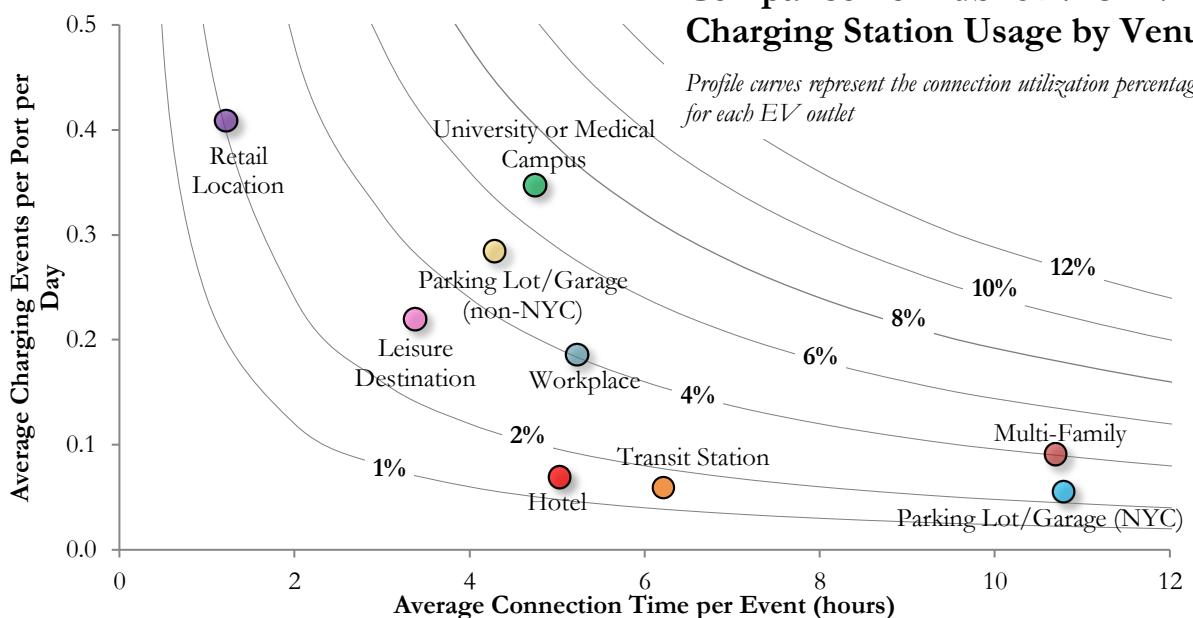
Charging station data is regularly collected and analyzed. The following results are from 2015.

- EV charging stations in 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





Capital District Electric Vehicle Charging Station Plan

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.



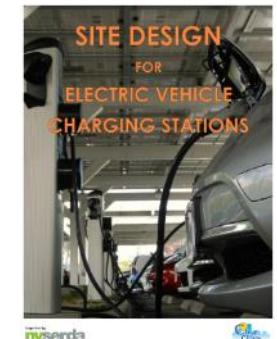
[Siting and Design Guidelines for Charging Stations](#) identify and diagram key siting and design issues that are relevant to local governments as well as developers, homeowners, businesses, utility providers, and other organizations interested in best practices for EV charging infrastructure implementation.

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

Effective signage and pavement markings 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.





Capital District EV Charging Station Plan

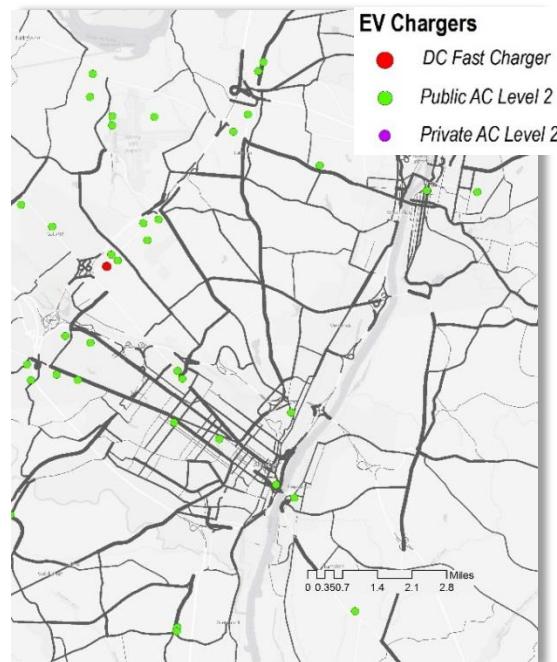


Current EV Landscape

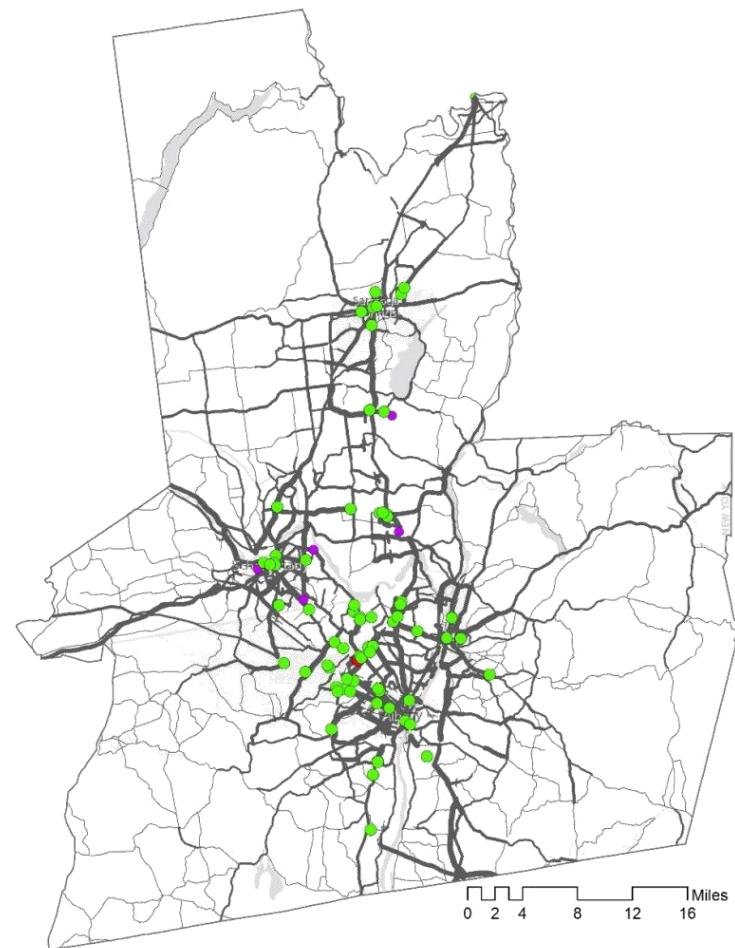
Currently, there are 69 public EV Level 2 charging station locations in the Capital District, including:

- Price Chopper (12 retail locations plus headquarters in Schenectady)
- Shoprite
- Century House
- Holiday Inn (Albany)
- Quality Inn
- Hampton Inn (5 locations)
- Kohl's (3 locations)
- Vent Fitness (3 locations)
- Chili's (3 locations)
- Albany Airport
- Saratoga Auto Museum
- Schenectady Museum of Innovation and Science
- Empire State College
- Rensselaer Polytechnic Institute
- Skidmore College
- Schenectady Community College
- University at Albany, Uptown & Downtown
- Union College
- Uncle Sam Parking Garage (Troy)
- Freedom Square Parking Lot (Troy)

Some workplaces and dealerships have installed private charging stations, while Tesla put in DC fast charging stations at Colonie Center. The Capital District has several areas in the region where there are gaps in the EV charging network as shown in the map to the right with the existing stations.



Albany area



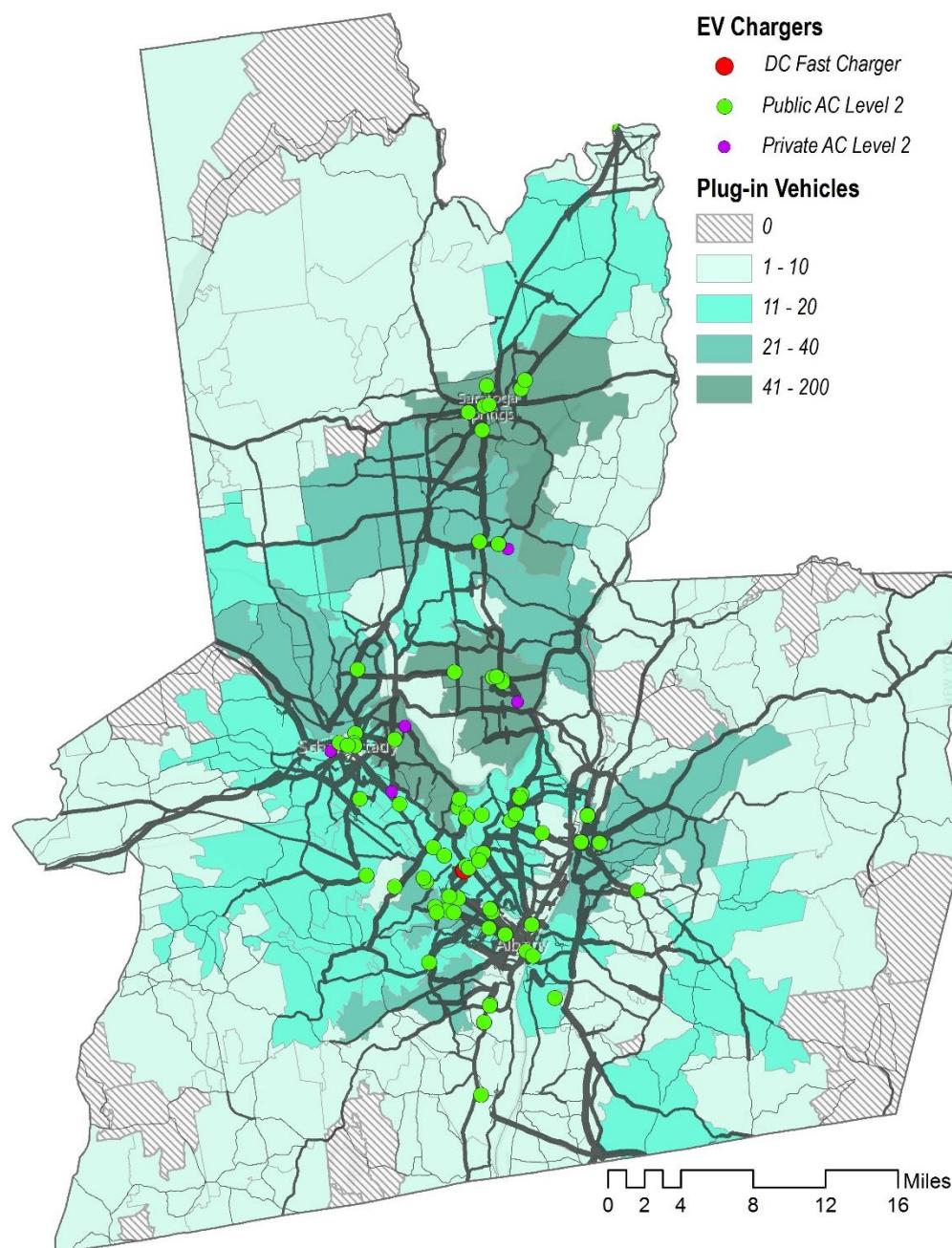
Capital District Electric Vehicle Charging Station Plan

The map of the Capital District 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:

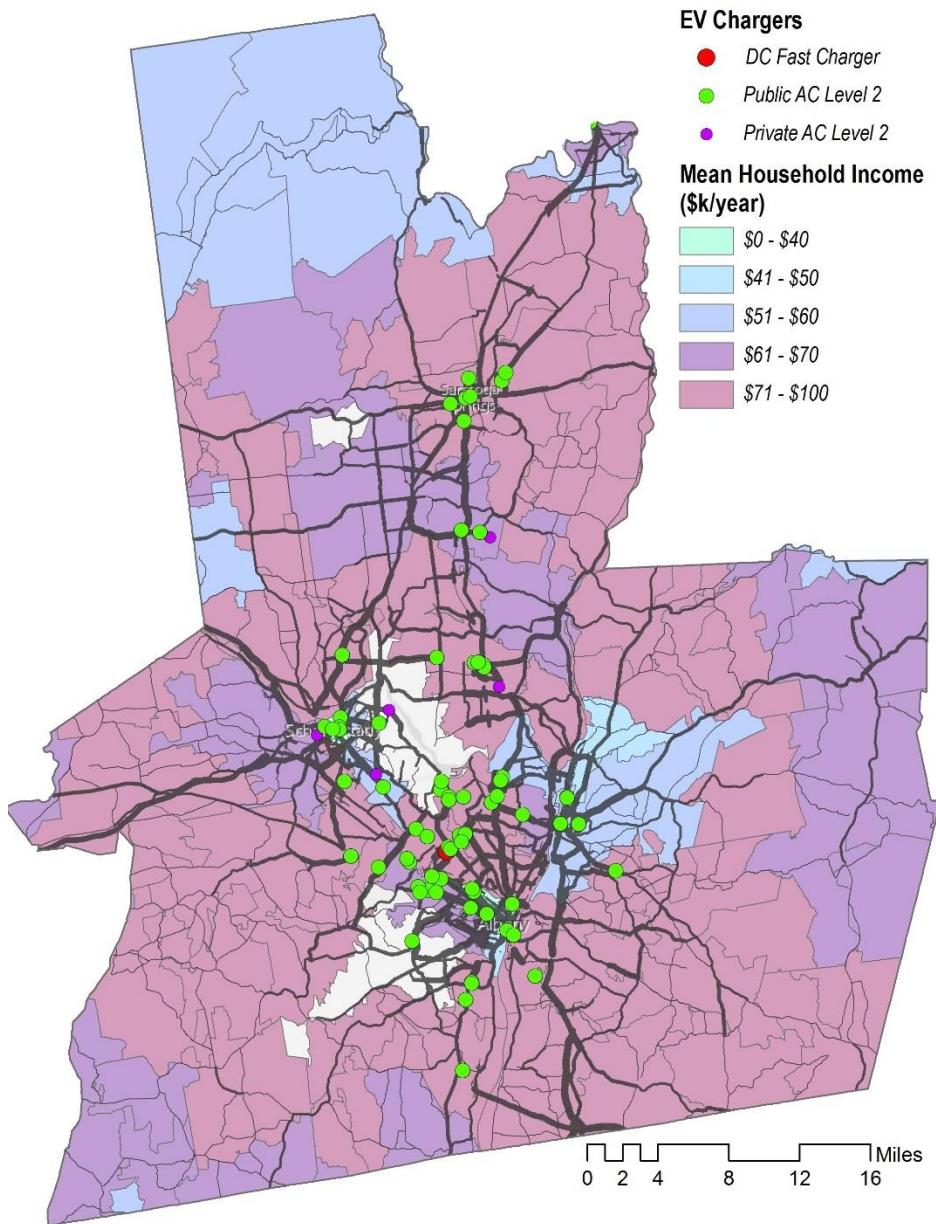
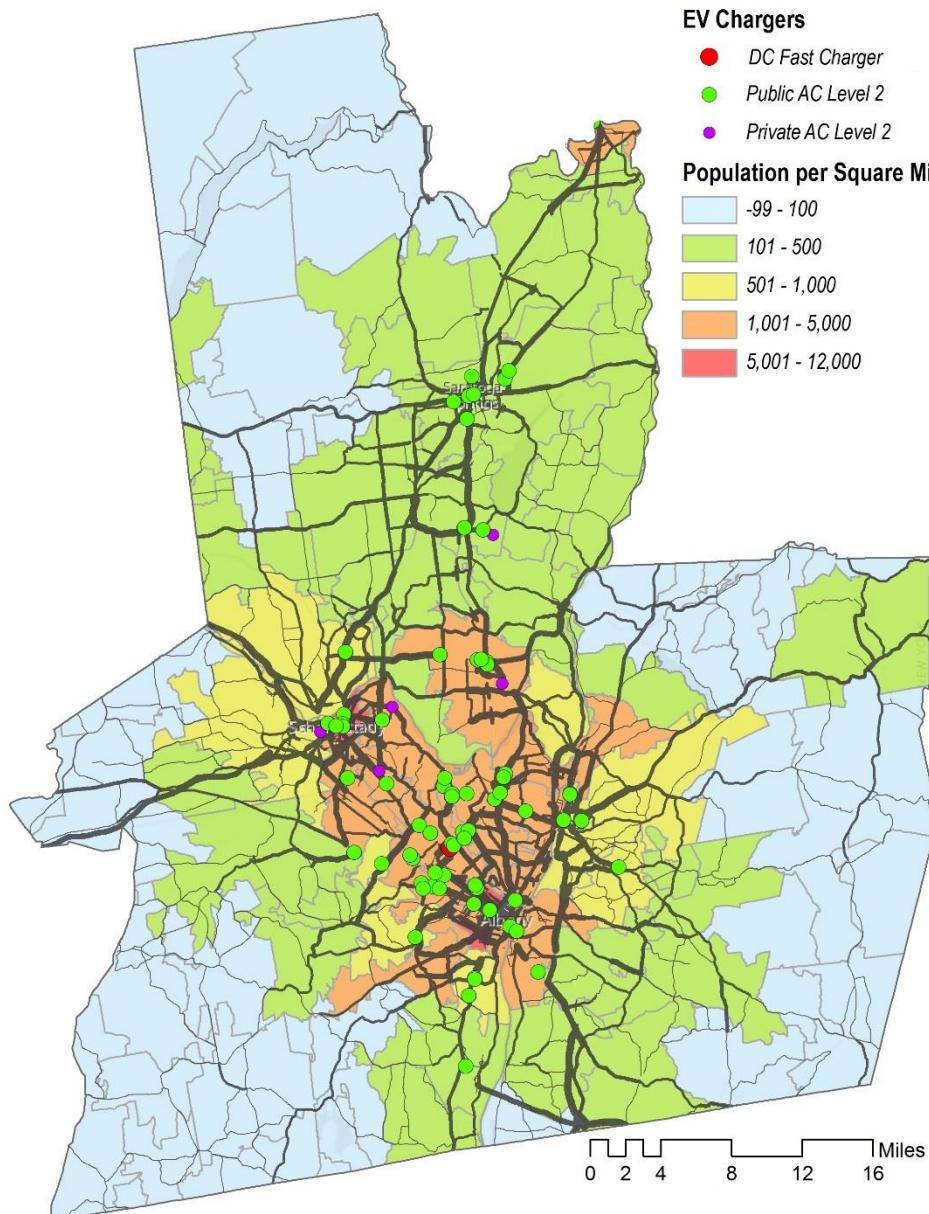
- 12866 (Saratoga Springs): 72 EVs
- 12065 (Clifton Park): 63 EVs
- 12309 (Schenectady): 53 EVs
- 12054 (Delmar): 37 EVs
- 12203 (Albany): 36 EVs

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 Capital District maps showing population and income per household on the following page, EV ownership is more closely tied to income rather than population.



Capital District Electric Vehicle Charging Station Plan



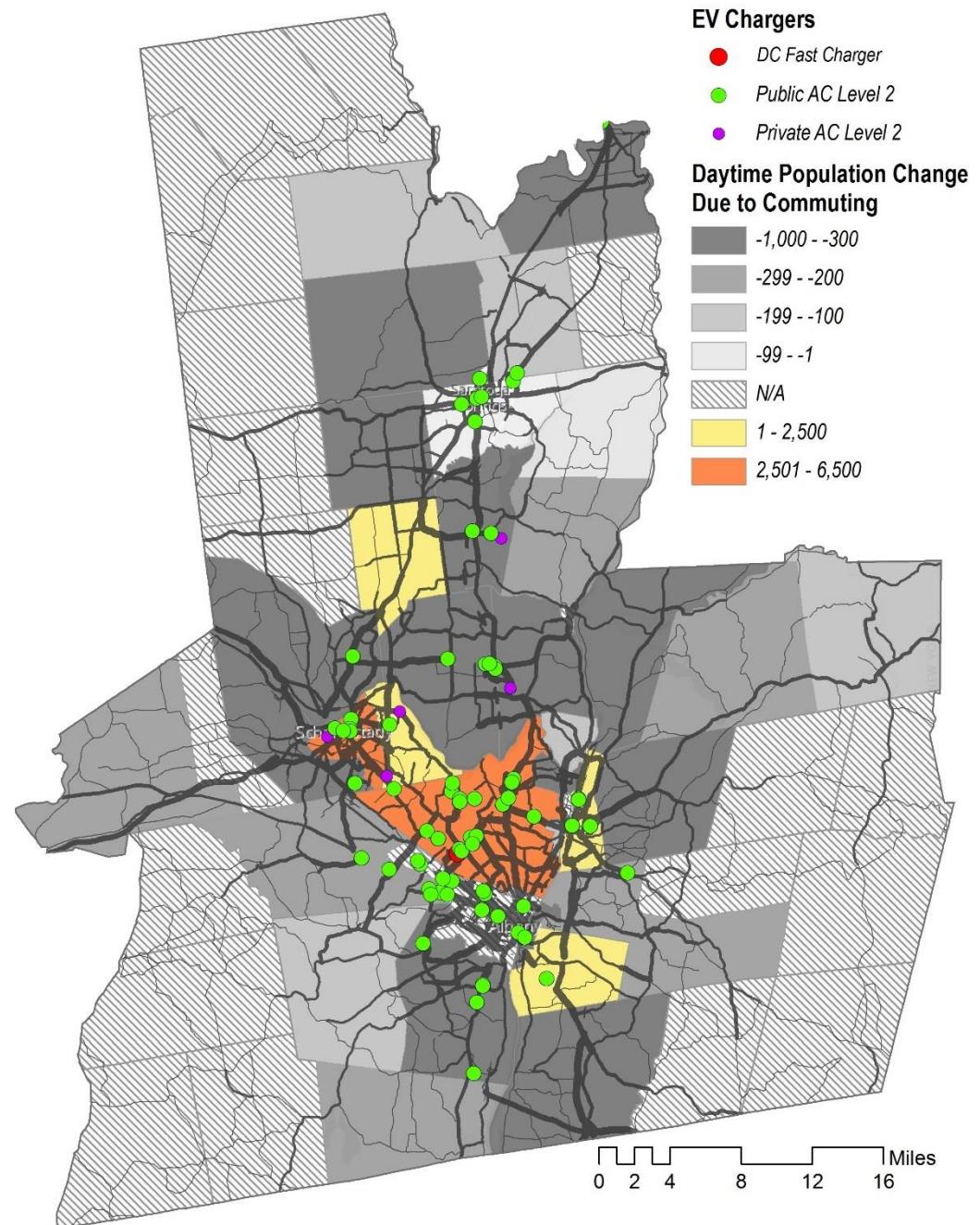


Capital District Electric Vehicle Charging Station Plan

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 in more residential areas where EV owners would charge at home overnight.



This AC Level 2 Charging Station at Rosenblum Properties in Albany can be used by employees or visitors that drive an EV.





Capital District EV Charging Station Plan



Recommendations for Additional EV Infrastructure

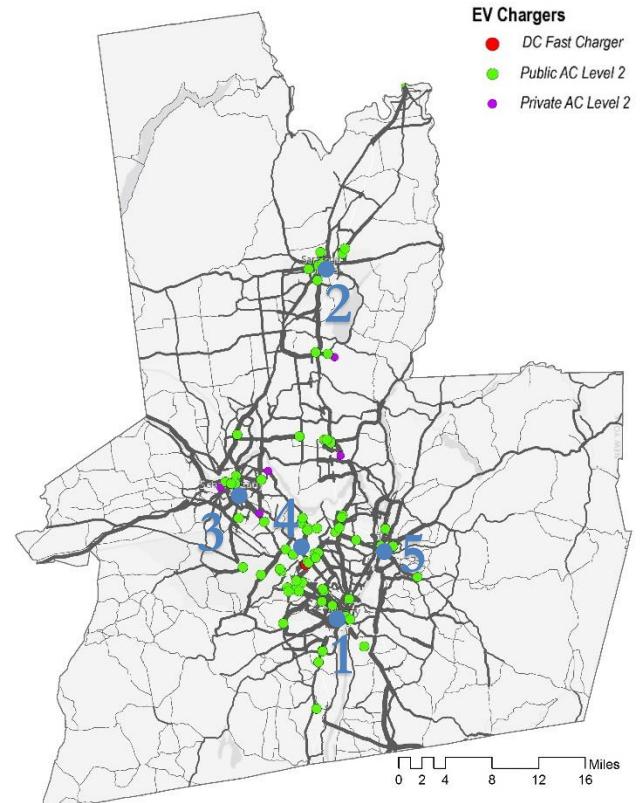
While the electric vehicle charging network has expanded, it does not yet operate as a comprehensive network that would allow an EV driver to easily travel throughout the region. As illustrated in the map at right, there are both gaps in the network and insufficient or misplaced EVSE. There are numerous areas where an EV driver passing through the area would not have a feasible option to charge. Other areas have several Level 2 charging stations, but they are not located where most current and potential EV-owners park. For example, there are 9 Level 2 charging stations in the City of Albany, which experiences the biggest daytime population growth in the region. Only one of these 9 stations is Downtown, and it is located at the Holiday Inn, rather than at a public lot. Charging stations in the Parking Authority or NYS-owned lots would be more accessible to more people.

Some municipalities and organizations in the Capital District have taken the initiative to install EV charging stations which has made those locations very supportive of EV drivers. Continuing to expand the public charging network

is needed to support existing and potential EV-owners, along with EV drivers that visit our region.

Five communities have been identified as “key locations” for expanding the electric vehicle charging network. These communities include the Cities of Albany, Saratoga Springs, Schenectady, Troy, and the Town of Colonie. These were ranked as the highest priority based on proximity to high volume roads, population and population shifts that occur as activity and employment centers, and existing electric vehicle infrastructure.

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. Albany	4. Troy
2. Saratoga Springs	5. Colonie
3. Schenectady	



Albany

The City of Albany is the New York State Capital and economic and cultural center of the Capital District. The City is located at the crossroads of two of the Region's busiest highways, Interstate 90 and Interstate 87, and along the Hudson River. It is the largest of 8 cities in the Capital District and serves as the Albany County seat.

Overview

As the Capital of New York State, Albany is an employment center and major activity generator. It is the home to a number of universities and colleges, hospitals, large businesses, non-profit organizations, and services. But its largest employer is state government. It experiences the greatest daytime population shift, increasing its population by almost 70% each day.

Albany has experienced growth in the high-technology industry, with great strides in the nanotechnology sector. It is the home to the State University of New York (SUNY) Polytechnic Institute, or the Colleges of Nanoscale Science and Engineering. There are also a number of museums and cultural attractions in the City that attract visitors from outside of the Region.

The City is made up of a number of diverse neighborhoods. The Downtown neighborhood serves as the core business district and location of NYS government buildings and offices. There are ongoing development projects downtown that are anticipated to attract new residents and visitors.

These projects include the rehabilitation of a historic hotel, a new convention center, a transit center, apartments and condominiums. There are also regular festivals and farmers markets. And lastly, Downtown Albany is where many of the Capital District Transportation Authority's (CDTA) major transit routes, including the Region's first bus rapid transit route, begin and end.

While the first EV charging station in the region was installed at the Holiday Inn in Downtown, there are currently no EV charging stations in any of the public or private commuter lots and garages. Given the high number of commuters and relatively short commutes to Downtown from surrounding towns, this is an ideal location to expand EV infrastructure.

The Mid-town neighborhoods of Pine Hills, Park South, University Heights, and the UAlbany Uptown Campus Area are home to hospitals, universities, and colleges. New York State Route 5, or Central Ave, is a major travel route in Albany and serves as its main commercial corridor. It connects the City with the most populated town in Albany County, the Town of Colonie. Most of the existing EV charging stations are located in these neighborhoods but use is mostly limited to patrons of specific businesses and students, faculty, or staff of the University at Albany.

Another area of the City experiencing significant development is the Park South and University Heights neighborhood. Albany Medical Center, located between neighborhoods, has expanded its

facilities and invested in newly constructed parking garages, offices, and residential spaces. This area attracts visitors and employees of Albany Medical Center as well as students of Albany Law School, Albany School of Pharmacy, and Albany Medical College. This has also been identified as a key location and opportunity for the expansion of EV infrastructure.

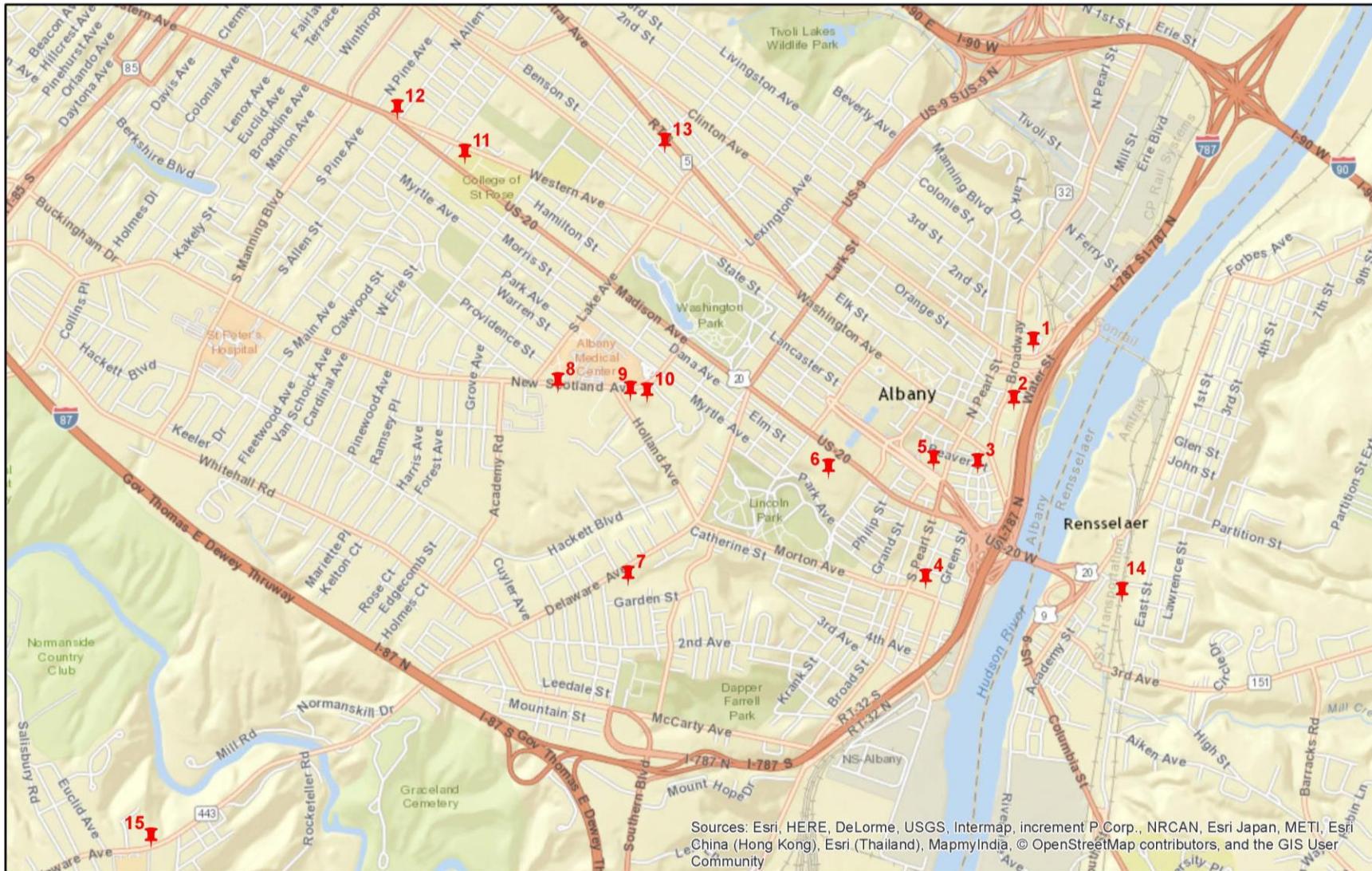
Demographics

The 2014 American Community Survey estimates the City of Albany's population to be 98,566, which is up just less than 1% from the 2010 Census figures. Of all the Capital District municipalities, Albany experiences the greatest increase in daytime population with an additional 65,577 people coming into the City each day. Relative to other cities and towns in the Capital District, Albany is dense, with a population per square mile of 4,791. The median household income is \$40,287.

EV Factors

Records indicate 92 EVs registered in zip codes in the City of Albany and 160 in the surrounding area. There are currently 18 EV charging stations in the City, most of which are not accessible to the majority of residents and commuters. Being an older city, Albany has a lot of dense neighborhoods with attached housing and no garages or driveways. This is a barrier for potential EV-owners living in these neighborhoods. Identifying locations for convenient publicly accessible charging stations is important for Albany to overcome this barrier. This will include on-street EV charging station locations and establishing design standards and regulations.

Capital District Electric Vehicle Charging Station Plan



1 Quackenbush Lot	5 Times Union Center	9 Hilton Garden Inn @ Albany Medical Center	12 "The Point"
2 Riverfront Garage	6 NYS Museum	10 Albany Medical Center Parking Garages	13 WAMC Parking Lot
3 Green/Hudson Garage	7 Spectrum 8 Theater	11 St. Rose College Parking Lot	14 Albany/Rensselaer Amtrak Station
4 DMV	8 Sage College		15 Delaware Ave Park & Ride Lot





Saratoga Springs

The City of Saratoga Springs is located north of Albany in Saratoga County. The City is in close proximity to Interstate 87 and NYS Route 9, or Broadway, which runs north-south through the City and serves as the center of its downtown. Saratoga Springs has been a popular resort destination for over 200 years.

Overview

Saratoga Springs earned its name from the mineral springs in the area. These mineral springs have made the City a popular resort destination for over 200 years. It is home to the historic Saratoga Race Track, Saratoga Spa State Park, the Casino and Harness Race Track, museums, and performing arts venues. In addition to being a tourist destination, Saratoga Springs is also home to a number of restaurants, shops, Saratoga Hospital, and Skidmore College.

The City has experienced significant growth and development in the last decade, which has transformed much of the Downtown. Development has reduced the amount of surface parking lots but has provided the opportunity for new parking garages and structures. The Market Center Apartments garage, which includes a Price Chopper supermarket, currently has a Level 2 EV charging station. Because it is in such close proximity to downtown, Saratoga Springs has become a popular evening and weekend destination for local EV-drivers who appreciate being able to

plug-in while dining, shopping, or exploring the City's parks and museums.

The museums, restaurants, shops, State Park, and Casino are year-round attractions. However, the City sees its population triple in the summer with the New York City Ballet, Philadelphia Orchestra, and then the 40-day race season at the Saratoga Race Track. This makes the city a popular vacation destination that attracts visitors from all over the world.

Saratoga is also home to the Saratoga Auto Museum. The Auto Museum is relatively new, opening in 2002, and serving as an educational resource on the past, present, and future of the automobile. The Museum was one of the first locations in the City to install an EV charging station. It often hosts EV events on its front lawn as well as a number of Tesla test drive events.

The City is mostly broken up into the three distinct neighborhoods. The East Side neighborhood is home to the Casino, Race Track, Congress Park, a popular weekly Farmers Market and a number of schools. The West Side is a denser neighborhood with a mix of single and multi-family homes. It is known as the "Art District" because of the number of art galleries, restaurants, and locally-owned shops. It is also home to Saratoga Hospital, the YMCA, Saratoga High School, and a number of office buildings. The North Broadway is a historic neighborhood with mansions and sprawling lawns and leads to Skidmore College.

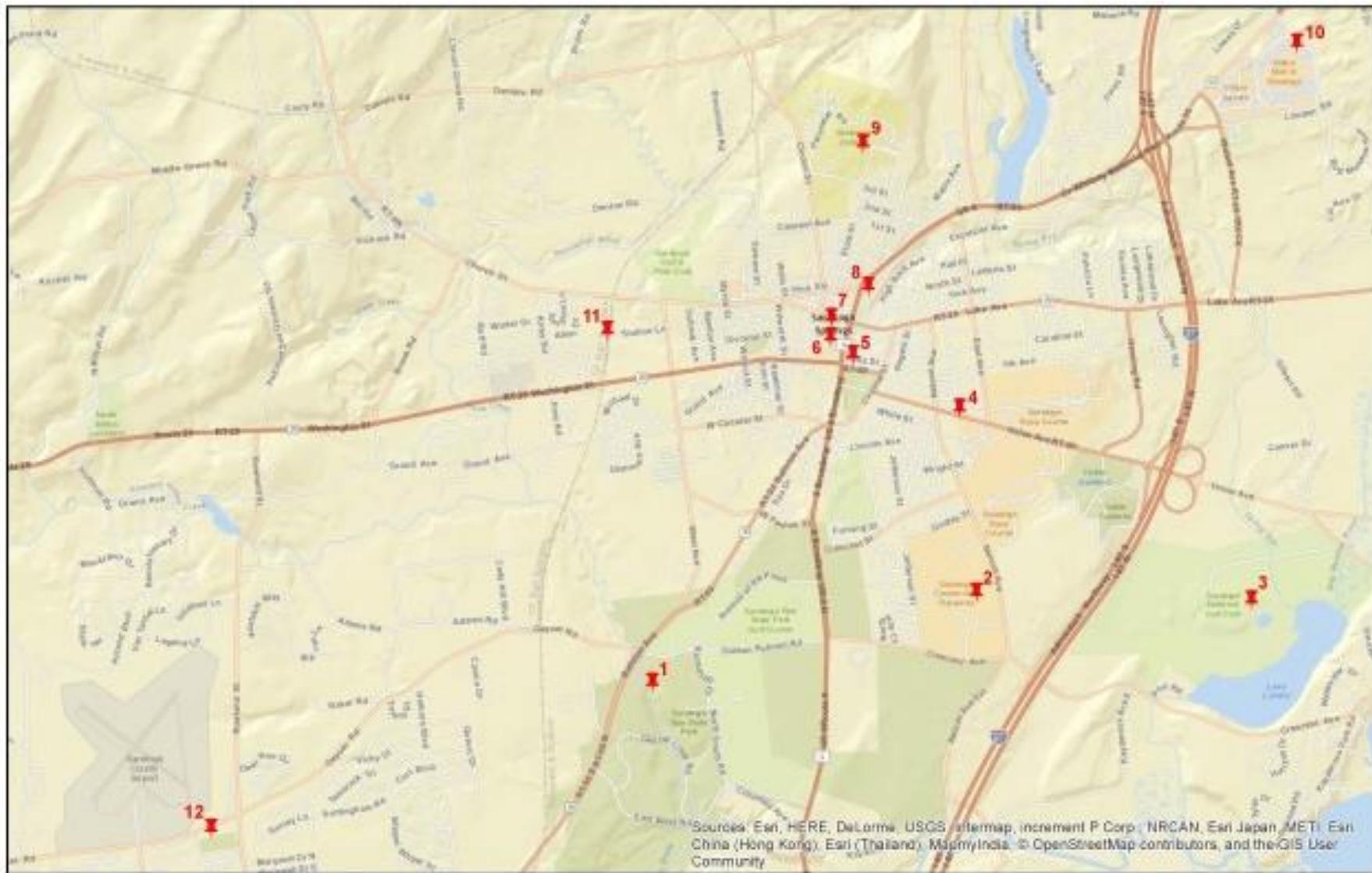
Demographics

The City of Saratoga Springs has a population of just over 27,000, this is an estimated increase of 3.3% from 2010. As mentioned earlier, the City has experienced significant development, mostly as a result of its popularity as a tourist destination. In the summer, the City's population increases by 40,000. Saratoga Springs has one of the highest median incomes in the Capital Region at \$66,713.

EV Factors

There are 72 EVs in Saratoga Springs with 71 in the surrounding area. There are 7 publicly-accessible EV charging stations in the City. Three of those charging stations are within close proximity to Broadway, Saratoga Springs downtown spine.





- 1 Saratoga Spa State Park
- 2 Saratoga Casino & Raceway
- 3 Saratoga National Golf Club
- 4 National Museum of Racing & Hall of Fame
- 5 Putnam St Parking Deck
- 6 Woodlawn Ave Parking Garage
- 7 Woodlawn Ave Parking Lot
- 8 Future Center City Garage
- 9 Skidmore College
- 10 Wilton Mall/Exit 15 Park & Ride Lot
- 11 Saratoga Amtrak Station
- 12 Milton Town Hall Park & Ride Lot



Schenectady

The City of Schenectady is located about 20 miles west of Albany on the south side of the Mohawk River. It is located along Interstates 90 and 890 and where New York State Routes 7 and 5 converge. The City is also accessible by Amtrak, with a station right in its downtown. It is the second largest city in the Capital Region and the Schenectady County seat.

Overview

Schenectady was a manufacturing center known as “The City that Lights and Hauls the World,” because of its two prominent businesses – General Electric (GE) and the American Locomotive Company (ALCO). Like most Industrial Cities, Schenectady’s population began to decline after the Great Depression. The closure of the GE plant in 1969 marked a significant loss of population, which the City has never been able to recover.

Despite some setbacks, Schenectady has attracted new business including Golub Corp, the Price Chopper Supermarkets headquarters, the New York Lottery, and MVP Healthcare. They are also home to some high-tech industries like Quirky and Trans Finder, Schenectady County Community College, Union College and Graduate School, Ellis Hospital, and Proctors Theater.

Schenectady’s downtown is a regional destination, with Proctors Theater and a number of popular bars and restaurants. It is also in the midst of working with developers to remediate the former ALCO site on the Mohawk River to build a casino. Like other Capital Region cities, Schenectady has a lot of dense, older neighborhoods with few driveways.

The City of Schenectady recently purchased plug-in vehicles and installed a Level 2 charging station. The station is available for public use but will also serve the Codes Department plug-in vehicles.

Demographics

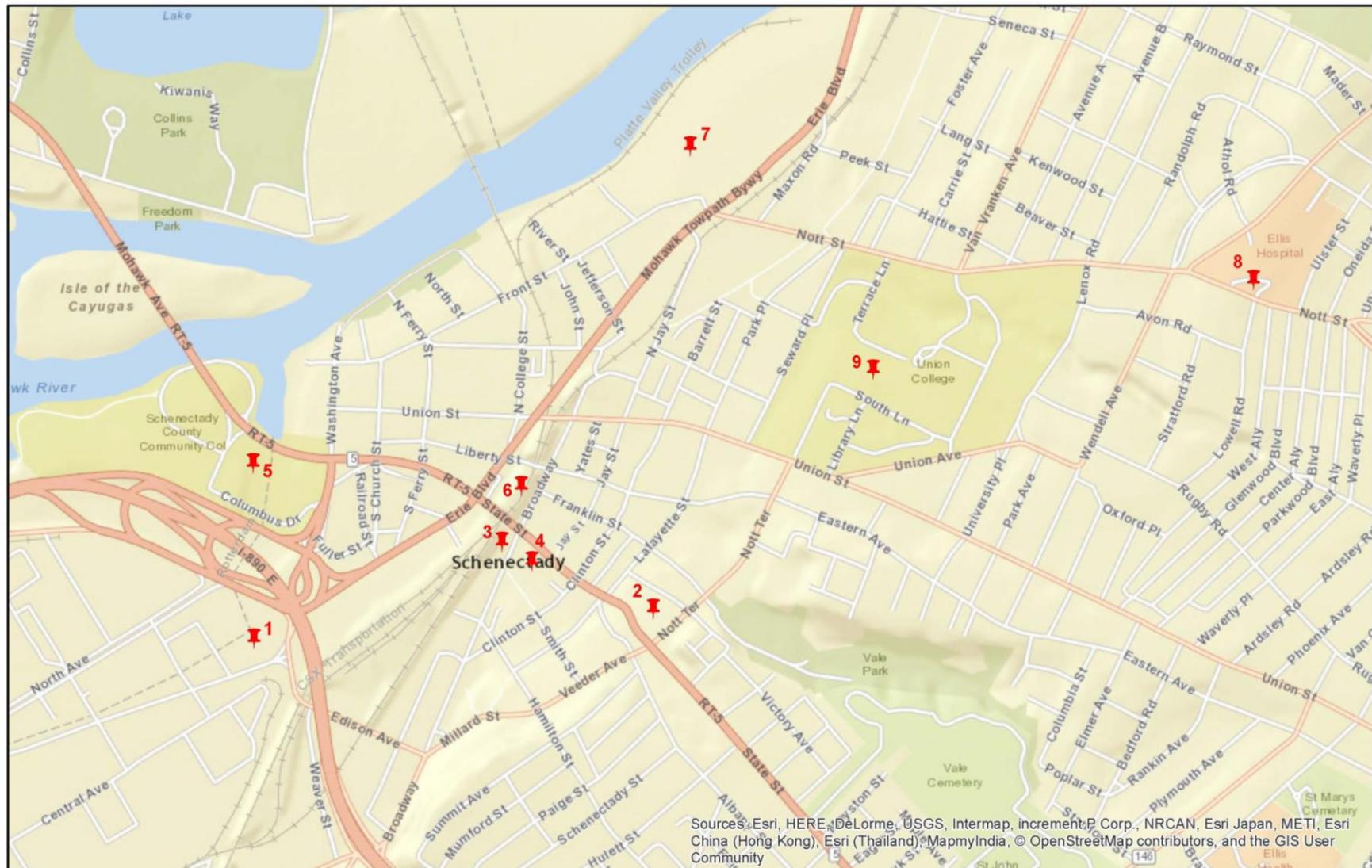
The 2010 Census was the first since 1950 that Schenectady did not lose population. However, the 2014 Census estimates Schenectady’s population at 65,936, a slight (0.3%) decrease from 2010 Census figures. The median household income in Schenectady is \$38,381.

EV Factors

15 EVs in Schenectady with 126 in the surrounding area. There are 8 EV charging stations in the City of Schenectady. Two stations are in the City’s downtown and 3 of the stations are located on college campuses.



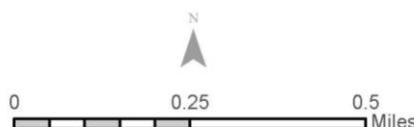
Capital District Electric Vehicle Charging Station Plan



- 1 GE Energy
- 2 MVP Healthcare
- 3 Broadway Parking Garage

- 4 Proctors Theater
- 5 Schenectady County Community College
- 6 Schenectady Amtrak Station

- 7 Future Casino Site
- 8 Ellis Hospital
- 9 Union College





Troy

The City of Troy is just 8 miles northeast of Albany and 30 miles south of Saratoga Springs. It is on the eastern bank of the Hudson River. The major transportation routes serving Troy include Interstate 787 and New York State Routes 2, 4, and 7, a major route to Vermont. Troy is the seat of Rensselaer County.

Overview

Troy is often referred to as “Collar City” due to its history in textile production. Like other Capital Region cities, Troy suffered from the decline of the industrial era and migration of jobs to the suburbs. However, in recent years Troy has enjoyed a surge in redevelopment and new businesses.

The City is home to Hudson Valley Community College, Sage College, and Rensselaer Polytechnic Institute (RPI). It has two hospitals, St. Mary’s and Samaritan, as well as large public parks and cemeteries. The downtown neighborhood is flat and runs along the Hudson River. It is dense and occupied by various bars, restaurants, shops, and a mix of single-family and multi-family homes with few driveways. East of downtown is a steep hill that separates it from the RPI campus and various less dense neighborhoods.

The City is a destination for its nightlife and entertainment. Troy Music Hall attracts various performances and the Tri-City Valley Cats minor league baseball team plays at Joe Bruno Stadium at the City’s southern tip. Due to the large number of

colleges and universities, there is a large student population living throughout the city. The Troy Waterfront Farmers Market is the most popular farmers market in the Capital Region and a common weekend destination. The “summer market” is located on River Street in downtown every Saturday and the “winter market” is in the Troy Atrium downtown.

Demographics

The population of Troy is 49,910 and the median household income is \$38,991. Like other cities, Troy has been losing population since 1950 but saw a slight uptick in the 2010 Census.

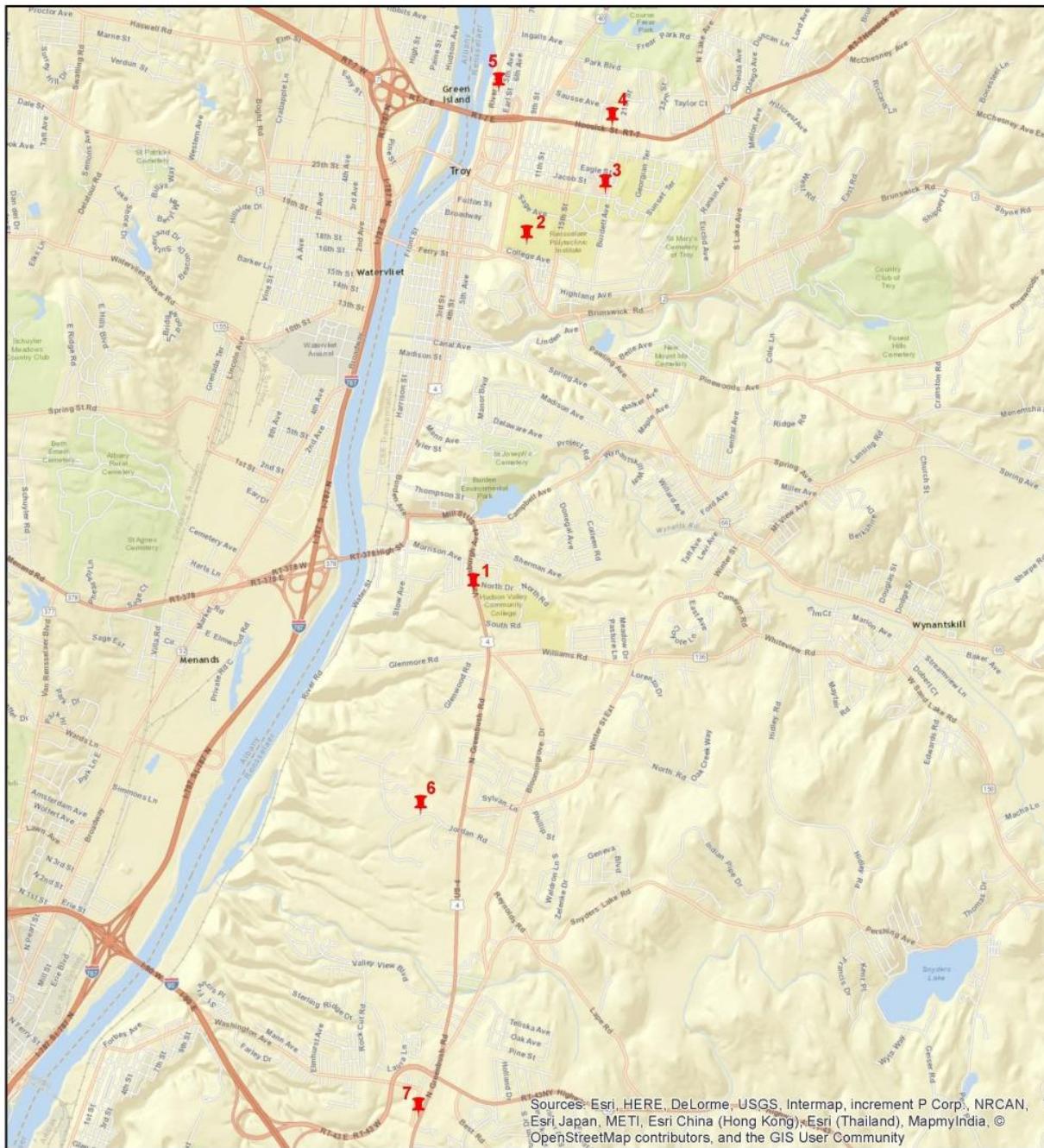
EV Factors

31 EVs in Troy with 61 in the surrounding area. There are 5 charging stations in the City, 1 of which is located in a public parking lot downtown.



The Market Block in downtown Troy

Capital District Electric Vehicle Charging Station Plan



- 1** Hudson Valley Community College
- 2** RPI
- 3** Samaritan Hospital
- 4** Hilton Graden Inn
- 5** Urban Grow Center
- 6** RPI Tech Park
- 7** Defreestville Park & Ride Lot



0 0.25 0.5 0.75 1 1.25 1.5 Miles



Colonie

The Town of Colonie is the most populous suburb of Albany County. It is located between the Cities of Albany and Schenectady connected by New York State Route 5. Interstate 87, or the Adirondack Northway, runs through the center of the Town. New York State Routes 9 and 7 are also major transportation corridors. Its northern border lays along the Mohawk River.

Overview

Colonie is the largest Town in the Capital District and Upstate New York in both population and size and includes the Villages of Colonie and Menands. The Town has been the center of growth in the Capital District since 1950. Located at the heart of the Tech Valley, Colonie offers a mix of urban, suburban and rural communities.

The daytime population doubles each day as people from throughout the Capital District and afar come to work and do business in the large office and health parks of Corporate Woods, British American, Executive Woods, Century Hill and the Wolf Road corridor or stay in one of the many hotels. It is a popular shopping destination due to the large number of retail establishments including Colonie Center, Latham Farms, Northway Mall, Shoppes at Latham Circle, Newton Plaza, Colonie Plaza and many more strip and big box type of retailers.

With the adoption of the Town's Land Use Law, significant land use practices have been employed

along these major corridors which include opportunities for the expansion of EV infrastructure.

The Central Avenue *NYS Route 5) east-west corridor continues to be a significant component of the Capital District's transportation and land use system anchored by the region's two largest urban centers, Albany and Schenectady, with direct access to Interstate 87. A significant concentration of jobs and long standing homes are present within a half mile of the 16 mile corridor between Schenectady and Albany boasting 15% of the Capital District's households and 30% of the jobs. Public investments continue to be a vital component to maintain Central Avenue as a major east-west corridor as demonstrated by the CDTA with the introduction of the first BusPlus BRT service in the Capital District in 2011 on its highest volume route. The Railroad Avenue Industrial Park is uniquely positioned between the College of Nanoscale Science and Engineering and Central Avenue with an array of industrial, incubator, and entrepreneurial start-ups and spinoff companies. While this corridor contains the greatest number of EV chargers, their addition along this corridor would greatly benefit the commuter.

The Troy Schenectady Road (NYS Routes 2 & &) east-west corridor serves a range of functions, from providing mobility between the urban centers of Schenectady and Troy from Interstate 87, to offering accessibility to the region's only commercial airport and various businesses and neighborhoods. The corridor attracts visitors and

employees and would be an ideal corridor to expand EV infrastructure.

The Loudon Road (NYS Route 9) north-south corridor continues to experience significant business and housing development. This corridor parallels Interstate 87 connecting the urban centers of Albany and Saratoga. The campus of Siena College which has 3,500 undergraduate and graduate students is also located in this corridor. This corridor attracts employees and students and with the lack of EV charging stations would greatly benefit with the expansion of EV infrastructure.

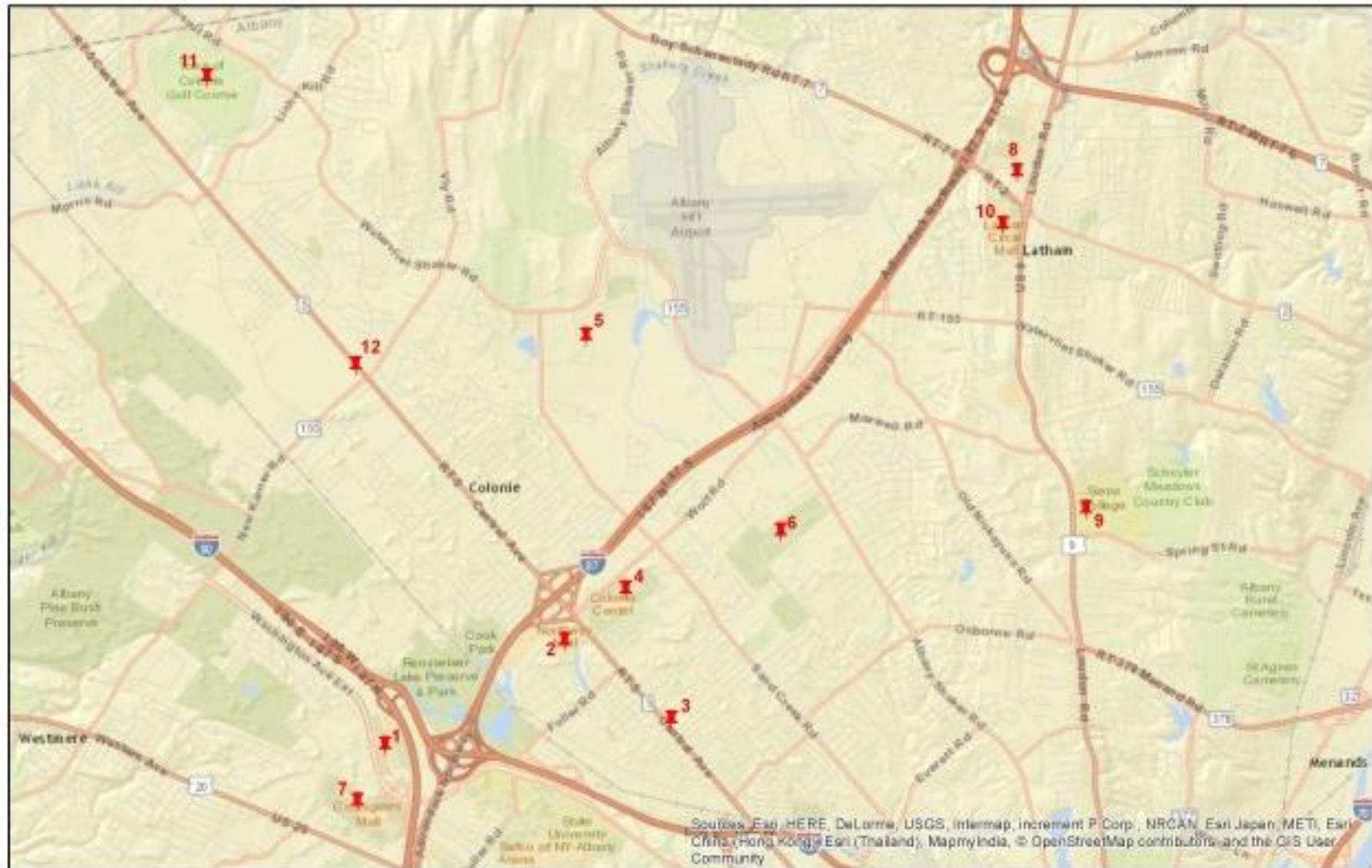
Demographics

The Town's estimated population in 2014 was 83,015, which is bigger than most of the Region's cities. The median household income was \$72,642.

EV Factors

Most recent DMV data shows 15 EVs registered in Colonie with 134 in the surrounding area. There are 6 EV charging stations in the Town, including a Tesla Supercharger at Colonie Center. Most of the stations are located at the many car dealerships and hotels located within the Town, but more and more retailers are installing stations as well.

Capital District Electric Vehicle Charging Station Plan



1 Crossgates Commons	4 Colonie Center	7 Crossgates Mall	10 Shoppes at Latham Circle
2 Northway Mall	5 ITT Tech	8 Latham Farms	11 Colonie Golf Course
3 Bryant & Stratton College	6 The Crossings	9 Siena College	12 Price Chopper Plaza



Capital District Electric Vehicle Charging Station Plan

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.

Clifton Park is 20 mile north of Albany and 20 miles south of Saratoga Springs. It is mainly a bedroom community with a lot of residents commuting to Albany via Interstate 87. It has a population of just over 37,000 and is steadily growing. In recent years there have been efforts to develop more mixed use commercial and multi-family housing in the Town's center. As the Town continues to develop it could benefit from requiring new buildings to be EV-Ready.

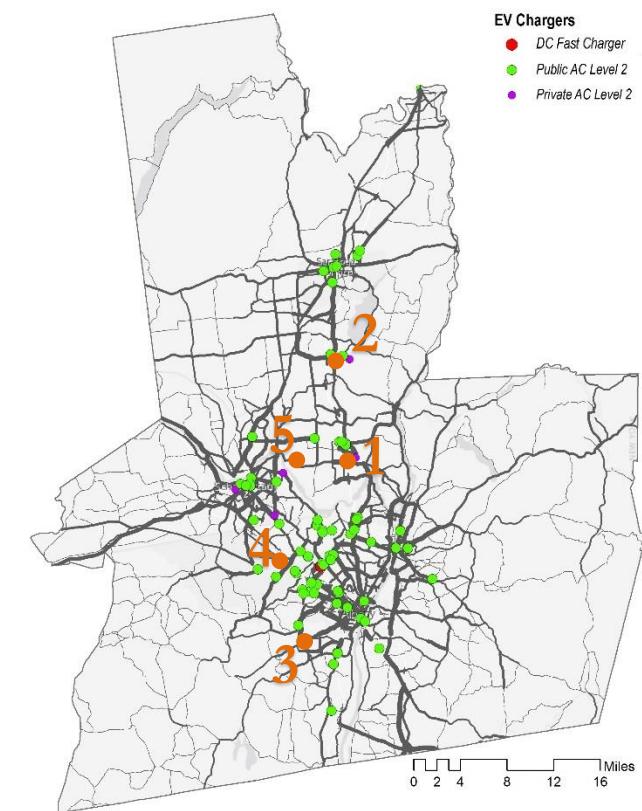
Malta is just under 30 miles north of Albany and about 10 miles south of Saratoga Springs. It is home to the Luther Forest Technology Park which is occupied by Global Foundries, IBM, and other high-tech industries. Global Foundries alone employs over 3,000 people. As a result of the Tech Park Malta has experienced a significant amount of new development along its "Main Street" New York State Route 67, which has transformed the suburb. The population of the Town is just under 15,000. Again, as the Town develops it could benefit from requiring new buildings to be EV-Ready. As the home to a number of high-tech industries, providing EV charging is just one amenity that could be leveraged to attract talented workers.

Bethlehem is just 8 miles south of Albany and includes the hamlets of Delmar, Elsmere, Slingerlands, Glenmont, Selkirk, South and North Bethlehem. Delmar, Elsmere and Slingerlands are older streetcar suburbs whereas the other hamlets are less dense and still growing. Its population is almost 35,000, much of which commutes to Albany for work. Delmar's "Four Corners" is a dense, walkable area, which is a popular destination for residents. There are a few Town-owned parking lots nearby that would be good charging station hosts. A number of large, big box type of retail is located along US Route 9W in Glenmont, making it another good host for charging stations.

Guilderland is located 12 miles west of Albany and 10 miles south of Schenectady. It is a suburban town with a population of almost 36,000. New York State Route 20, a major route going all the way to Buffalo, cuts through the Town and is occupied by various retail and restaurants. The Town is home to the Region's largest shopping mall, Crossgates Mall. Crossgates is 1.7 million square feet with over 250 stores, restaurants, and an 18-screen IMAX movie theater. It is owned by Pyramid Management Group. Another popular retail destination shared by Guilderland and the City of Albany is Stuyvesant Plaza which is homes to coffee shops, restaurants, and various clothing and gift shops.

Niskayuna is barely 3 miles east of Schenectady. It also shares borders with the Town of Colonie and

its northern border is the Mohawk River. It has a population of about 22,000. It is home to GE Energy, GE Global Research Center, SI Group, and Knolls Atomic Laboratory.



- Additional Potential Locations for More EV Infrastructure
 - 1. Clifton Park
 - 2. Malta
 - 3. Bethlehem
 - 4. Guilderland
 - 5. Niskayuna

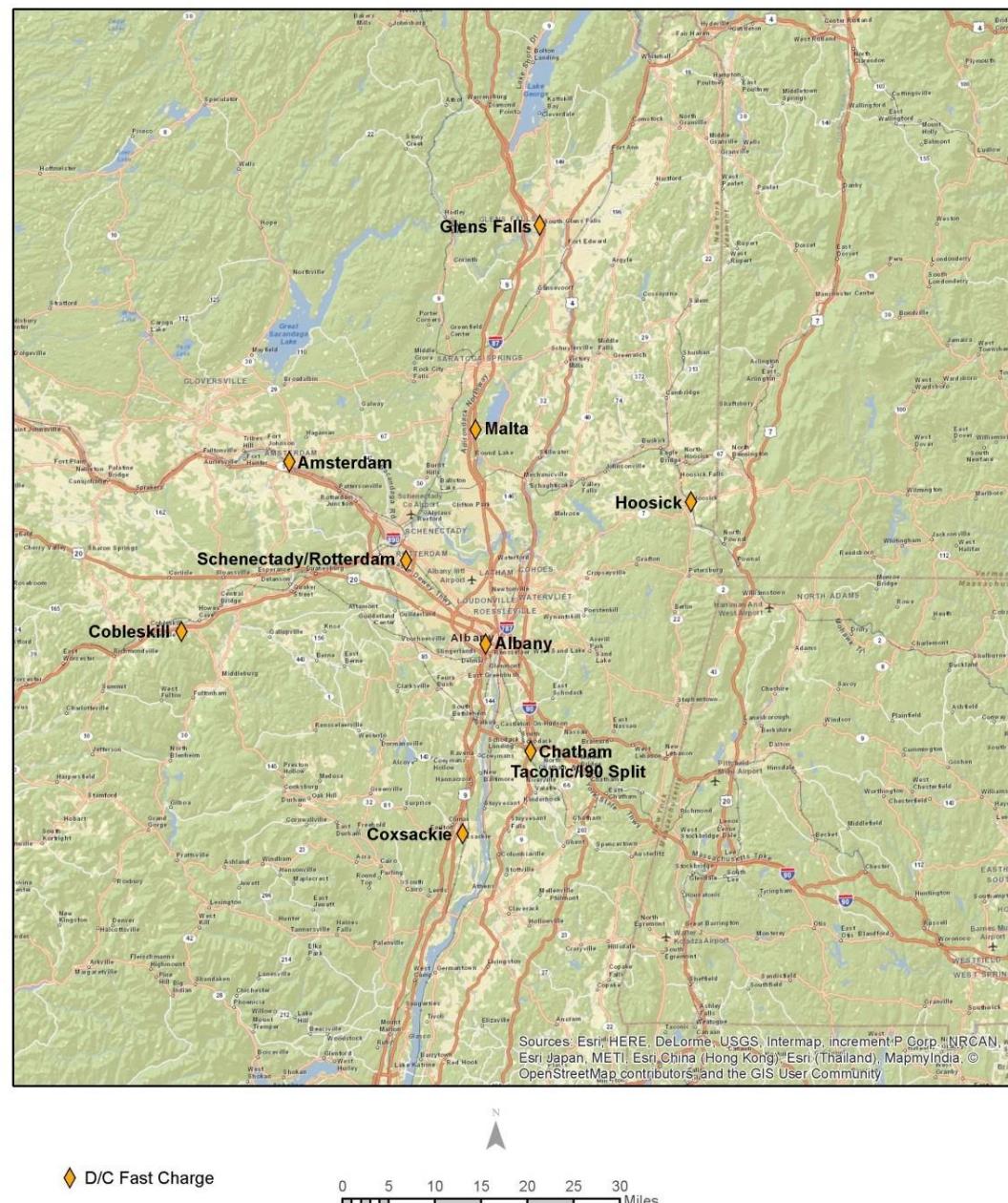
Capital District Electric Vehicle Charging Station Plan

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% charge in about 20 minutes, are needed to further extend the use of EVs throughout NYS. Strategically placing DC fast chargers in the Capital District along major routes could support transient EV drivers as well as local EV drivers.

The Capital District EV Charging Station Plan Working Group recommends that DC fast chargers are installed 25-50 miles from each other along major transportation routes. The following locations have been identified as preferred DC fast charge locations: Albany, Schenectady/Rotterdam, Chatham, Coxsackie, Malta/Saratoga Springs, Glens Falls, Cobleskill.

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. Furthermore, the potential for EV Tourism should be explored in the Capital Region. Fast charging stations should also be located along Scenic Byways, beer or wine trails, or at popular natural area attractions.





Capital District EV Charging Station Plan



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.



GEORGETOWN CLIMATE CENTER



CREATING EV-READY TOWNS AND CITIES: A GUIDE TO PLANNING AND POLICY TOOLS

ELECTRIC VEHICLE SUPPLY EQUIPMENT SUPPORT STUDY

Prepared for:
New York State Energy Research and
Development Authority
and
Transportation and Climate Initiative

Prepared by:
WXY Architecture + Urban Design
and
Energetics Incorporated

November 2012

Simple and consistent EV charging station *permitting processes* can make installing EV infrastructure much easier. Current national

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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

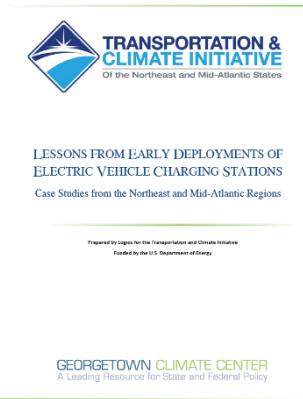
application forms. While residential installations were the focus on this investigation, the results and findings also apply to commercial charging station installations.



[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.

Six barriers were determined to be critical issues limiting the expanded use of EVs in the Capital District. For each, potential solutions and strategies for addressing these are presented and it is strongly recommended that municipalities, counties, and the region as a whole lead or support initiatives that follow these recommendations.

Dealership Support

Support and better promotion of EVs by car dealerships is needed to drive adoption. Currently, local dealerships have not provided a lot of endorsement of EVs, despite support and enthusiasm at the corporate level. A lack of information about the vehicles is the main cause of the issue. *Providing training and information* to dealers to help talk about EVs to potential buyers

could make dealers feel more comfortable with the vehicles. Also, a *local incentive to a dealer* for every EV sold could motivate dealerships to market EVs better.

DC Fast Charging Infrastructure

Fast charging stations will be needed to facilitate longer EV travel distances, including inter-regional trips. 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 needed.

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 and towns 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 Capital District would only be beneficial if they align with DC fast charge station placement in the neighboring regions.

Locating fast charging infrastructure 25-50 miles apart, along major travel routes, will significantly increase an EV's range and potential to travel. Furthermore, the potential for EV Tourism should be explored in the Capital Region



Hampton Inn hotels in Albany, Schenectady, and Clifton Park installed charging station for any guests that drive an EV.

Educating Potential EV Owners

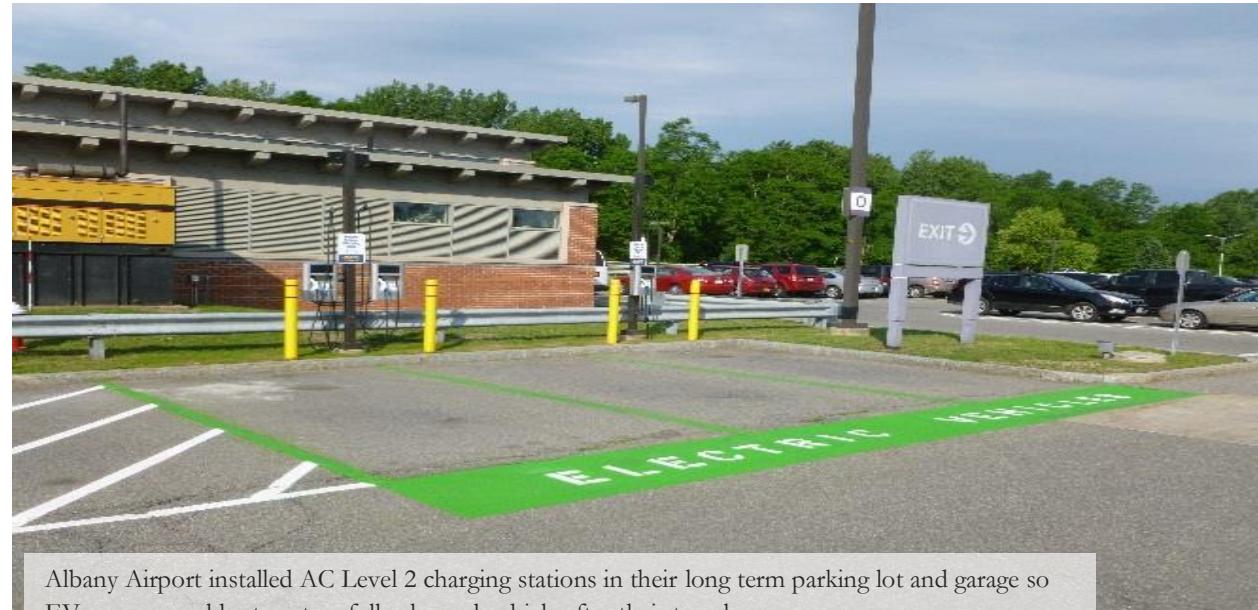
Currently, many people looking to purchase a new vehicle are not knowledgeable about EVs or whether EV technology would be appropriate for them. Anyone interested in EVs would likely have to do their own research and investigation because there is little EV information available or promoted at local 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 statewide), focusing on the most likely consumers. Whenever possible these efforts should be *coordinated with the EV manufacturers and local dealerships*, which should have an interest in promoting their cars, to leverage existing advertising budgets.

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. An 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).

Installing Chargers in an Urban Setting

The challenge of installing charging in an urban setting can be addressed by *making EV-readiness part of local planning and roadway construction*



Albany Airport installed AC Level 2 charging stations in their long term parking lot and garage so EV owners could return to a fully charged vehicle after their travels.

processes. Currently, urban areas lack the necessary utilities to install on-street EV charging due to the age of most Northeast cities. However, as roads are reconstructed and streetscapes are redesigned, EV infrastructure must be considered and coordinated to create more EV-friendly areas in our downtowns. Local planning departments should *define EV infrastructure in their zoning codes and adopt appropriate design guidelines* to ensure future on-street EV charging stations are ADA compliant, do not pose a safety risk to others, and enhance neighborhood character rather than diminish it.

Site Planning

As previously mentioned, requiring all new construction projects to install EV charging stations or even the conduit in preparation for

future installations is likely premature for Capital District 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*

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option to incorporate is important. Discussing EV readiness in site planning will likely enable cost effective charging station installations to expand the charging network in the Capital District.

Once the importance of EV readiness is understood by architects and planning boards, developers could be given an *incentive for installing charging stations* which could allow compromises on other aspects of the new construction design.

Educating Elected Officials

EV adoption in the Capital District is still very limited. There is currently little need and no desire for passing policies that require EV charging infrastructure in new construction projects or make it illegal for conventional ICE vehicles to park in EV charging station spaces. There are much higher priorities for our communities and these are not

currently the critical issues that are limiting EV adoption.

However, like many residents of the Capital District, most elected officials are not even properly educated on EV technology or the benefits they can provide to our communities. *General education on EVs through presentations and publications* should be provided in coordination with their existing meetings and conferences. The development of this Plan served as an initial introduction to EVs for the elected officials that were involved in this project.

Key elements of this outreach to elected officials would be *hands-on experiences* where they have the chance to see and ideally drive EVs. It is also important to *draw connections between EVs and other*

local initiatives such as renewable electricity generation projects or even tourism.

Next Steps

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

- 1) Assess each city or town's EV-Readiness
- 2) Holding meetings with key stakeholders in the recommended locations for additional charging stations to prepare for, and encourage, new installations
- 3) Identify opportunities to leverage resources or coordinate partnerships between stakeholders to install charging stations
- 4) Explore funding/grant opportunities availability





Capital District EV Charging Station Plan



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

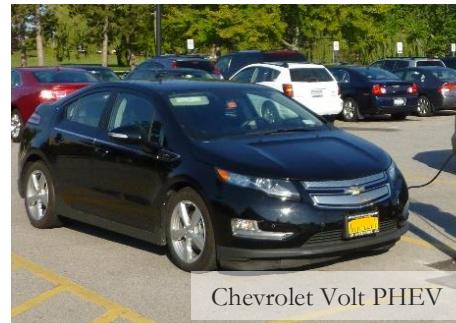
Starting MSRP: \$62,100
Federal Tax Credit: \$4,168
MPG Equivalent: 59
Electric Range (miles): 13

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 Fusion SE Energi

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



Ford Fusion SE Energi 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

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



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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



Ford Focus BEV

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

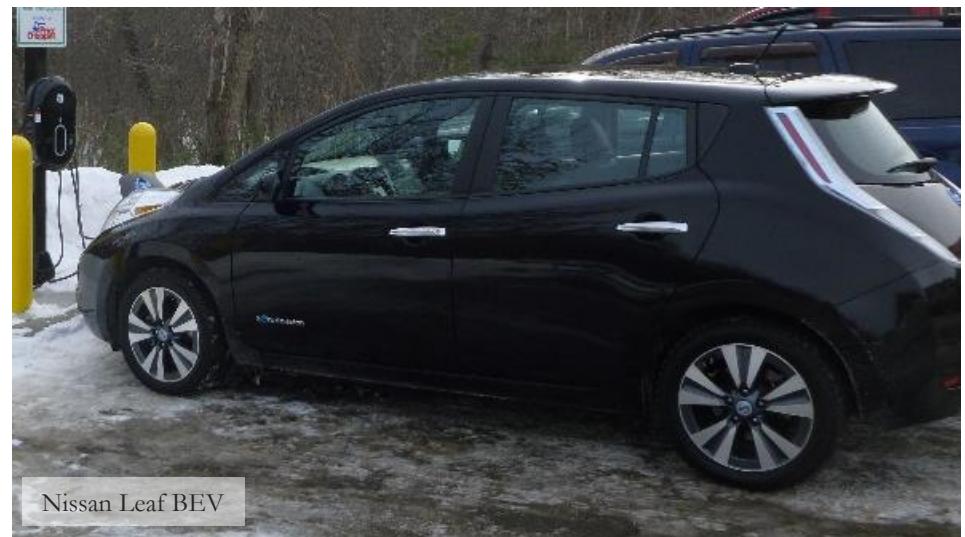
Starting MSRP: \$28,995
Federal Tax Credit: \$7,500
MPG Equivalent: 116
Electric Range (miles): 83



Smart Electric Drive BEV



Tesla Model S BEV



Nissan Leaf BEV