New York State Energy Research and Development Authority

Albany Electric Vehicle Feasibility Study

Final Report
June 2012

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New York State
Department of Transportation

Mayor's Office of Energy & Sustainability
City of Albany, NY

Albany Electric Vehicle Feasibility Study

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Energy. Innovation. Solutions.

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Abstract

The City of Albany, New York, in its continued efforts to identify ways to become a more sustainable and livable city, has undertaken a feasibility study to examine ways it and other cities can support and promote the use of Electric Vehicles (EV). This Electric Vehicle Feasibility Study aims to identify what actions must be taken to make a city "EV Ready".

The results of this study, including both policy and charging station location recommendations, provide the City of Albany with the necessary framework to begin its efforts to promote EV use within the city. In addition, the complete Feasibility Study includes information on EV use and demand, existing charging infrastructure, best practices on becoming an EV Ready city, and a checklist for EV readiness.

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Mayor's Office of Energy & Sustainability
City of Albany, NY

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CITY OF ALBANY
Electric Vehicle Feasibility Study

Executive Summary

The City of Albany, New York, in its continued efforts to identify ways to become a more sustainable and livable city, has undertaken a feasibility study to examine ways it can support and promote the use of Electric Vehicles (EV). This Electric Vehicle Feasibility Study, funded by the New York State Department of Transportation (NYSDOT) and the New York State Energy Research and Development Authority (NYSERDA), aims to identify what actions must be taken to make a city "EV Ready".

A key result of this study is a set of recommendations for policy initiatives that the City of Albany may consider implementing in order to support EV use. The chart below summarizes these recommendations.

POLICY	RECOMMENDED ACTION
Zoning	• Revise existing zoning code to include a Specific Use Regulation for EV charging stations. • Create standards for siting, ADA accessibility, and procedures for incorporating structures in historic preservation and business improvement districts modeled after Chapter 270; Public Pay Telephones.
Building Code	• Establish requirements that all newly constructed residential buildings include a 220 volt outlet in associated garages. • Establish requirements that any new commercial building of at least 5,000 square feet include the wiring necessary to accommodate EV charging infrastructure.

POLICY	RECOMMENDED ACTION
Permitting	• Provide an expedited permitting and inspection process for those seeking to install a residential or public EV charging station. • Provide reduced permitting fees or waive fees completely to promote the use of EVs and the installation of the necessary infrastructure. • Provide training for all City of Albany Building and Code Inspectors.
Signage	• Establish a standard design for future EV signs. • Establish minimum standards for visibility.
Parking	• Strictly enforce parking regulations. • Establish a fine schedule for illegal parking.
Lead by Example	• Install EV charging stations at the City's Department of General Services Garage. • Incorporate EVs into the City's existing fleet of vehicles.
Installation	• Identify and lease preferred public locations for EV charging installation. • Release a Request for Proposals for EV charging stations and installations and enter into a contract that provides the greatest benefit to both the City and the EV user.

In addition to these policy recommendations, a key outcome of this study was the identification of optimal locations where Level II EV charging would be most useful, prominent and supported by existing electrical infrastructure in Albany. Objective evaluation criteria were developed to identify these locations. The evaluation criteria for Level II charging stations were split into two stages. Additionally, a separate set of criteria was developed to identify areas or locations for potential DC Fast Charging infrastructure. Listed below are the top 15 locations selected. These locations are considered relatively low in difficulty to connect to the grid and are on public sidewalks or other public property owned by the City, State, or non-profit educational institutions.

Streets

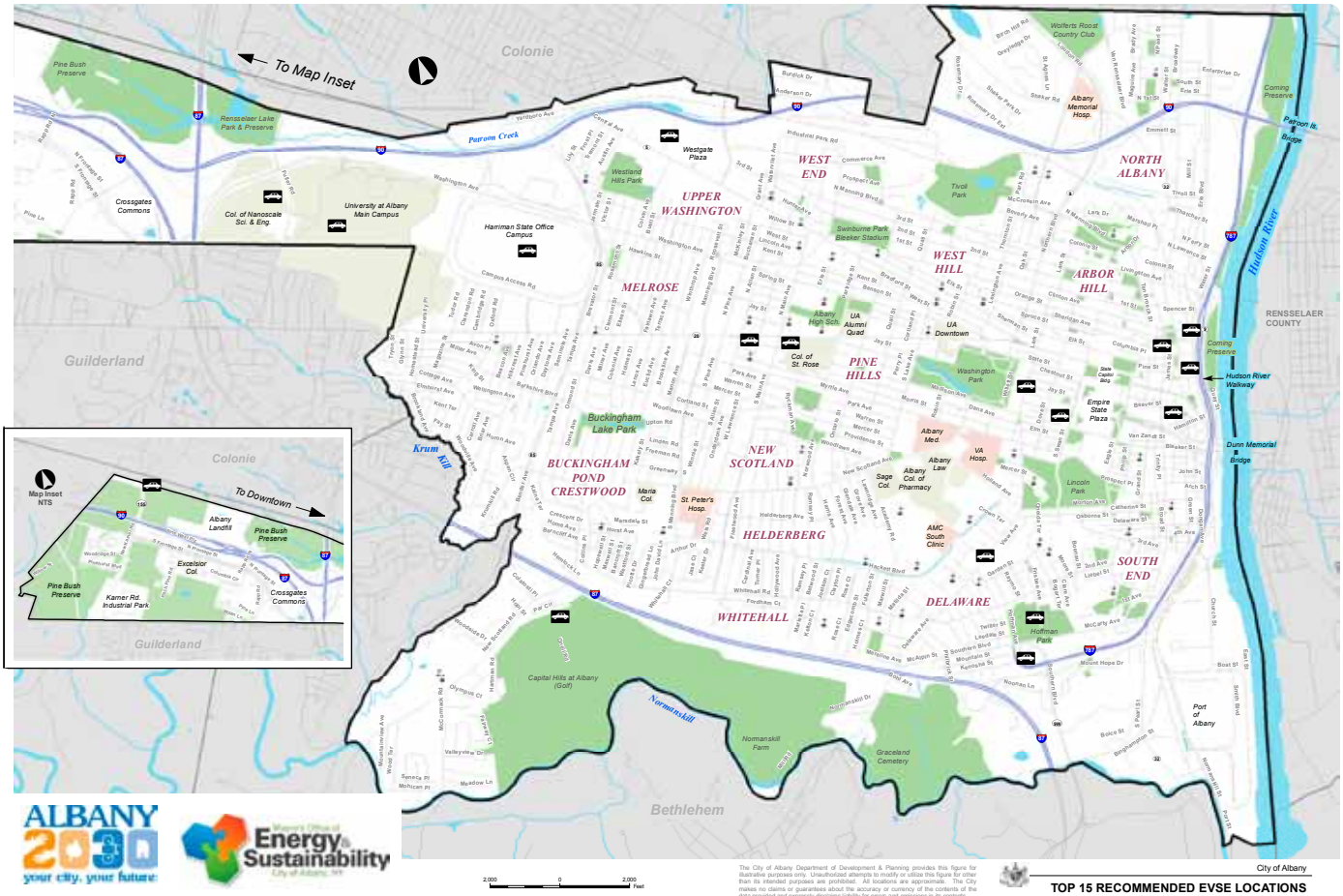
- Delaware Avenue in front of The Spectrum Theater
- Russell Road (Russell Road is a City-owned roadway with on-street parking and is adjacent to Westgate Plaza, a dance studio, and County office buildings.)
- Lark Street between Madison and Washington Avenue

Institutions/Properties/Buildings/Lots

- Robinson Square Parking Lot at Robinson and Swan Streets
- McCarty Avenue New York State Office of General Services Employee Park and Ride lot (This parking lot has 669 designated spaces for State employees.)
- College of St. Rose parking lots
- The church owned parking lot in front of the Hampton Inn that serves Pearl Street, Palace Theatre and Capital Repertory customers

- UAlbany Campus faculty lots and/or visitor lots
- UAlbany NanoTech Complex
- Harriman State Office Campus (This location is home to multiple State agencies and their fleets and the installation of charging stations could encourage the conversion of existing vehicles to EVs.)
- Pine Bush Preserve Discovery Center
- Capital Hills Golf Course
- Madison Avenue between Western Avenue, Allen Street, and Main Street
- Albany parking garages (The three main Albany parking garages—Columbia Garage, Quackenbush Garage, and Green/Hudson Garage—combined have over 2,650 public parking spaces.)
- Hoffman Park at North end of Hoffman Avenue

Figure 1: Recommended Locations in Albany for EVSE Siting



This Feasibility Study includes information on EV use and demand, existing charging infrastructure, best practices on becoming an EV Ready city, and a checklist for EV readiness. This checklist allows municipalities to assess what actions need to be taken to become "EV Ready."

A CHECKLIST FOR EV READINESS	
✓	Revise existing building code to remove barriers to installation of EV infrastructure
✓	Update zoning to allow for EV charging stations in all major zoning categories (differentiating between Levels I, II, and DC by zoning category)
✓	Include standards in building code and permitting language for siting within historic and other specialty districts
✓	Integrate EV charging infrastructure considerations into design review process for new developments, including buildings, and especially for sidewalks, streets, and parking areas
✓	Develop policy for siting EV charging infrastructure within residential districts where residences typically do not have garages
✓	Expedite permitting for EV charging stations
✓	Adopt standard design and visibility requirements for EV charging station signage
✓	Adopt standard policies on ownership and installation of EV charging stations on public property
✓	Work with local utility EARLY to determine capacity for increase in demand from EVs and to determine connection costs and processes
✓	Adopt a fine schedule for parking violations within EV designated parking spaces
✓	Establish fees associated with use of equipment on government property
✓	Adopt a policy/strategy for incorporating EVs into municipal fleet
✓	Form a stakeholder group within the community – businesses, institutions, local utilities, interested consumers, fleet operators to evaluate demand and create strategies for EV uptake
✓	Create an education and marketing program to educate the community about EVs, infrastructure, and available incentives
✓	Consider provision of free/discounted tolls, parking, HOV lanes, and other driving incentives, including free or reduced price charging at certain times or locations
✓	Work with taxi fleets, rental car companies, and car-sharing programs to integrate EVs and charging infrastructure
✓	Work with colleges, technical schools, and other education providers to develop EV workforce training courses and programs
✓	Coordinate with fire, EMS, police, and other emergency responders to provide EV-specific training offered by the Fire Protection Research Foundation

Mayor's Office of Energy & Sustainability
City of Albany, NY

CITY OF ALBANY
Electric Vehicle Feasibility Study

Overview and Background

To promote the use of electric vehicles (EVs) in the Capital Region, the City of Albany has conducted an EV Feasibility Study to identify opportunities and best practices for making Albany "EV Ready". Becoming an EV Ready City is just one of the many strategies being implemented as part of the City of Albany's climate and sustainability efforts. Mayor Gerald D. Jennings made a commitment to sustainability in 2005 by signing onto the US Mayors' Climate Protection Agreement, and more recently through the creation of the Mayor's Office of Energy & Sustainability. Given the significant impact that the transportation sector has on greenhouse gas (GHG) emissions[1], the transition to EVs will be an important climate mitigation strategy for the city and was identified as a key transportation strategy in the City's Albany 2030 Comprehensive Plan.

EVs and associated infrastructure are one solution for addressing localized air pollution and GHG emissions, as well as making Albany more resilient to rising fuel prices. In addition to lowering GHG emissions, EVs also reduce localized criteria air pollutants that contribute to respiratory illnesses such as asthma, reducing the health risks to Albany residents.

This EV Feasibility Study begins with an overview of the current state of EVs and EV infrastructure, including technology, policy on both the national and state levels, and current and potential demand for EVs. It continues with a discussion of the role for EVs and EV infrastructure in Albany, how to get Albany EV Ready, and provide some recommendations for zoning, policy, and EV infrastructure development. Finally, this study offers best practice recommendations and a Checklist for EV Readiness, which can be used by Albany as well as other municipalities to support and prepare for large-scale EV proliferation.

1 According to the City's 2009 Greenhouse Gas Inventory, the transportation sector accounted for 21% of community-level GHGs.

Intended Outcomes of the Study

The intended outcomes of this EV Feasibility Study include the following:

- Assessment of current opportunities for the City of Albany to support the proliferation of EVs throughout the Capital District
- Identification of criteria for strategic placement of charging infrastructure
- Identification of policies and regulations for EV-friendly zoning, infrastructure, and technology
- A thorough review of best practices and their applicability to Albany
- Recommendations for optimal locations for siting charging stations in Albany
- Recommendations on incorporating EVs into the City's municipal fleet

Current State of Electric Vehicles and Electric Vehicle Infrastructure

With an estimated one million EVs being delivered to the U.S. car market by 2015[2], automakers, businesses, and municipalities are quickly trying to identify potential EV buyers who would require charging facilities. Over 20 EV models have been announced for introduction in the next few years, including traditional commuter cars, light duty trucks, and exotic sports cars. A report released by the U.S. Department of Energy (DOE) in February 2011 estimated production of the Chevrolet Volt and Nissan Leaf, two of the most successful EVs on the market, to be greater than 100,000 units per year for each model by 2015. Numbers for 2011 indicate that production has been coming up short on reaching their targeted production, but both manufacturers have plans to ramp up production and sales in 2012.

Types of Electric Vehicles

There are a wide variety of electric vehicles entering the market, which operate based upon different combinations of power systems and engine/motor types. The most popular type of EV on American roads today is the **Hybrid Electric Vehicle (HEV).** HEVs primarily use an internal combustion engine (ICE) to power the vehicle. The engine also charges a battery pack that powers a set of electric motors. These are used to assist or completely replace the internal combustion engine for short periods of time at low speeds. Electricity for the batteries also can be generated during braking (called regenerative braking). Of the different HEVs available, the most popular model is the Toyota Prius. Most automobile manufacturers have been rolling out new models to challenge Toyota's dominance, such as the Honda Insight, Ford Fusion Hybrid, and the Lincoln MKZ Hybrid.

Chevrolet's 2012 Volt, an example of a PHEV

Plug-in Hybrid Electric Vehicles (PHEVs) have similar drivetrain configurations to HEVs and share many of the same advantages. PHEVs plug into an external power source to recharge the battery packs. PHEVs can run entirely on electricity for short trips on a full charge,

2 2011. One Million Vehicles by 2015: February 2011 Status Report. U.S. Department of Energy. http://www1.eere.energy.gov/vehiclesandfuels/pdfs/1_million_electric_vehicles_rpt.pdf

Tesla, an example of an all-electric (BEV) sports car

greatly increasing fuel economy. Using electricity for powering vehicles is significantly less expensive than gasoline. Conversion kits are available for HEVs such as the Toyota Prius and the Ford Escape Hybrid, but the Chevrolet Volt is the first mass-produced PHEV available on the market. The Volt is a unique PHEV in that its gasoline generator does not drive the vehicle at all until the driver has taken the vehicle beyond its electric range.

Battery electric vehicles (BEVs) are powered exclusively off an on-board battery pack. BEVs have a shorter total range than HEVs and PHEVs. Once depleted, BEVs would have to recharge at an EV charging station or swap out the battery pack, depending upon the vehicle charging model in use. BEVs have no gasoline costs and are particularly suitable for average commuting trips. The Nissan Leaf for example, is the leading BEV currently available and has a range of just over 70 miles. Several high-end fully electric and PHEV sports cars are also available from Tesla and Fisker.

Neighborhood electric vehicles (NEVs) operate exclusively off an on-board battery which can be charged by plugging into any 110V outlet. Global Electric Motorcars (GEM) makes the most popular line of NEVs. While street legal, most NEVs are designated as low-speed vehicles, maxing out at approximately 25 MPH and are meant for short distances typically less than 30 miles. These features generally make them best suited for use within local governments, the recreation and hospitality industries (amusement parks, resorts, etc.), security patrol, property management, and grounds keeping.

EV Charging Systems and infrastructure

A General Electric Level II Charging Station

There are three levels of electric vehicle charging systems in use in North America. **Level I** charging uses a standard 120V household outlet. **Level II** is a 240V system that requires the installation of a special charging station that can be wall mounted, pole mounted, or in-ground, and operates on a dedicated circuit similar to a clothes dryer. Level II systems are governed by a new national standard connection called J-1772 that all automakers and EV charging system manufacturers use. Overcoming this charging connection standardization barrier was a major milestone in the EV industry and critical to mass-scale EV adoption. The J-1772 specifies a standard plug interface, and other aspects of charging station design and safety requirements.

DC Fast Charging systems (sometimes referred to as Level III) are expensive, require complex technical electrical installations and are not yet designed under a national standard like Levels I and II. DC Fast Charging stations effectively replicate the traditional gas pump experience, and allow the driver to re-charge their EV more quickly than Level I or II chargers. Due to high costs, electricity access, and installation requirements, DC Fast Chargers will likely be initially placed at highway rest areas for emergencies or at fleet depots to support longer distance EV driving.

A breakdown of typical voltages, output, and cost for each type of charging system is shown below. It is important to note that the costs indicated are for the equipment and initial installation and do not account for any annual maintenance or upgrade costs. Different systems will have different maintenance requirements. When considering installing a charging station, it is important to talk to the Electric Vehicle Supply Equipment (EVSE) provider and account for maintenance costs (around the equipment, such as snow and ice clearing, as well as maintaining the equipment itself) and how those costs will be covered.

Table 1: Charging Station Length to Charge and Cost

LEVEL	VOLTAGE (V)	MAXIMUM OUTPUT CURRENT (A)	ESTIMATED TIME TO CHARGE	COST PER CHARGING STATION
I	120	12	8-12 hrs	Cost of household outlet
II	208/240	32	4-8 hrs	$1k-$3k + installation
DC Fast (III)	450-700	200-550	5-30 min	$25,000 - $40,000+

EVSE, or charging stations/pedestals, are installed in locations wherever there is a need for EV charging. This includes homes, public locations, workplaces, retail, and other locations where there is an expectation that the EV can and will be parked for several hours and will have time to charge.

A number of EVSE manufacturers have partnerships with EV manufacturers to provide charging stations for consumers, including General Electric, Coulomb, ECOtality, Clipper Creek, and others. A list of some of these providers and their products can be found in Appendix B.

Current Policy

In 2008, President Obama put forth a goal of putting one million electric vehicles on the road by 2015[3]. To drive demand for EVs, the Obama Administration adopted a three-part strategy that includes maintaining and improving tax incentives to make EVs more affordable, continuing to invest in EV research and development, and encouraging communities to invest in EV infrastructure through competitive grants.

On the state level, the Transportation and Climate Initiative (TCI), a regional collaboration of Northeast and Mid-Atlantic states, including New York, aims to "stimulate sustainable economic development and improve the environment by supporting innovative technologies and smart planning, and through finding greater efficiencies within the transportation sector."[4] One action of the TCI was to launch the Northeast Electric Vehicle Network. Through this effort, states have developed partnerships with utilities, the private sector, the Clean Cities Coalition, and others to promote the expansion of EVs and EV infrastructure both locally and regionally.

Also on the state level, the New York State Energy Research and Development Authority (NYSERDA) recently received a one million dollar grant from the U.S. Department of Energy to promote electric vehicle use. The money is now funding the state's Electric Vehicle Supply Equipment (EVSE) Demonstration and Support Program. This program is meant to accelerate vehicle electrification and advance the use of innovative technologies. It is anticipated that funds from this program will lead to the installation of multiple charging stations within Albany.

3 2011. One Million Vehicles by 2015: February 2011 Status Report. U.S. Department of Energy. http://www1.eere.energy.gov/vehiclesandfuels/pdfs/1_million_electric_vehicles_rpt.pdf

4 2011. Transportation and Climate Initiative of the Northeast and Mid-Atlantic States. Georgetown Climate Center http://www.georgetownclimate.org/sites/default/files/TCI%20brochure.pdf

The City of Albany is in an important position to become a leader in local and regional promotion of EVs and EV infrastructure. In addition to being the State Capital, it is also a central transportation hub for the region, and the City has already made a strong commitment to sustainability through the creation of the Mayor's Office of Energy and Sustainability. EVs will be a significant part of Albany's efforts to address energy and GHG emissions from the transportation sector.

Driving Patterns and Charging Demand

It is anticipated that in the early stages of EV market penetration, the majority of charging will take place at home. The second location, and the most likely location to shift charging away from homes, would be the workplace. Parking facilities near office buildings, manufacturing facilities, and in busy downtown centers will be prime candidates for EV charging infrastructure. While retail establishments are unlikely to be popular charging points for consumers, retail establishments are also workplaces and, as such, should be considered, especially those that attract consumers for longer periods of time (such as malls, movie theaters, etc).

Range anxiety may be a factor in purchasing decisions for potential EV drivers. Most EV drivers change their driving behavior and become efficient trip planners with an acute understanding of their "range budget," or the remaining distance they are able to travel on a single charge. Most EV drivers will choose to charge at their origin (home) or destination (work), while a small percentage stop along a trip to plug in at charging stations.

Analyses of charging demand have assumed that the utilization rate of each charging station will increase over time as use of and comfort with EVs increases. This implies that initial charging stations will be built in numbers beyond demand and will be underutilized, but intentionally so as to promote the adoption of EVs through changed public perception. If public perception is changed such that drivers can feel confident that charging infrastructure is available to them, they will be more likely to drive EVs. Eventually the ratio of public charging stations to EVs would decrease and fewer charging stations will be needed for every additional EV. The Electrification Coalition, a not-for-profit group of industry leaders committed to increasing the use of EVs in the U.S., uses the ratios in the following chart to estimate charging demand.

Table 2: Public Charging Station Demand Ratios

PUBLIC CHARGER RATIOS	2010	2020	2030
Expected Public Chargers per Vehicle	2.0	1.5	1.0
Maximum Public Chargers per Vehicle	2.5	2.0	1.5
Minimum Public Chargers per Vehicle	1.5	1.0	0.5

Using public charging station demand ratios to create a charging station location plan, especially public charging systems, requires the mapping of potential charging points. The Site Evaluation and Recommendations section of this study provides further information for potential charging locations within Albany.

Albany Institute of History and Art (Washington Avenue)

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CITY OF ALBANY
Electric Vehicle Feasibility Study

Why Electric Vehicles in Albany?

Charging station at the Holiday Inn Express

There are multiple factors that make EV use suitable for residents of Albany as well as the entire Capital Region. There are currently five locations in the Capital District with public EV charging infrastructure, including the Holiday Inn Express in downtown Albany, the NYSERDA office in Guilderland, a ShopRite in Niskayuna, the Saratoga Technology and Energy Park in Malta, and the HVCC Tec-Smart facility, also in Malta. Factors such as energy prices, types of housing stock, commute times and population demographics make EV use an appropriate and beneficial choice for residents and justify an increased investment in EV infrastructure throughout the Capital District.

Energy Prices

Gasoline and electricity prices are factors affecting the suitability of EVs. An EV will be most valuable to someone living in an area with high gasoline prices and low electricity prices. High electricity prices (such as in Hawaii) reduce the value of owning an EV compared to an internal combustion engine vehicle. This is why time-of-use electricity rates for residential customers are an important factor for greater EV adoption rates. High gasoline prices increase the value of owning an EV. The west coast, especially California, typically has the highest gasoline prices at the pump, while the East Coast or Midwest typically has the second most costly prices for gasoline in the country. New York often ranks among the highest states in gasoline costs in the Northeast.

Housing Stock

EV charging equipment setup and installation is easiest for those in single family houses with enclosed garages, where the charging station can be easily connected to the home electrical system. These installations will help drive initial EV adoption momentum. For those in multi-family units or in dense areas where each parcel does not have a driveway, residential off-street parking facilities will be the easiest locations to install, manage and use EV charging stations. The prevalence of both single family and multi-family garage availability will be key initial drivers for EV charging momentum. In Albany, there is a large variety of residential housing types, with single family houses and driveways being more prevalent in the western side of the city. Often larger apartment and condo buildings have dedicated surface lots. There are large sections of the city especially surrounding Washington Park that do not have access to off-street residential parking facilities, but are near to commercial or institutional parking facilities ideal for shared parking and EV charging station installations. For all these reasons, Albany's housing stock is well-positioned to make a switch to EV use.

Commute

The latest "Commuting in America" report by the Transportation Research Board shows that the average work trip length increases with metro area population size, with a national average of 12 miles.[1] The Capital Region Census Combined Statistical Area (CSA) has a population of about 1.1 million people, with a shorter average work trip length than many larger CSAs. The one-way commuting distances within Albany are less than 10 miles. The commuting distance from the closest suburbs into downtown Albany is approximately 10 miles or less including Colonie, Bethlehem, Guilderland, Loudonville, and East Greenbush. Commuting distance between downtown Albany and Troy is about 7 miles, Schenectady and Clifton Park, about 20 miles, Saratoga about 35 miles. Even when doubled for round-trip mileage, these commute trips fall within the 35-50 mile electric range of the Chevrolet Volt and/or the 73-100 mile range of the Nissan Leaf.

Social and Environmental Factors

EV consumer demand will be driven by a number of factors including cost of ownership, gas savings, environmental sensitivity, status and image considerations, wealth, price premium, awareness of benefits, educational attainment and more. These factors can be measured many ways including unhealthy air quality days, income, education levels, and hybrid vehicle ownership. In 2011, according to the American Lung Association's annual State of the Air report[2], the Capital Region (Albany CSA) ranked 67 out of 277 metro areas nationally for the number of high ozone days (~6 days) and 97 out of 277 metro areas for 24-hour particle pollution (~1 day). Median household income for Albany is about $39,000, below that of Albany County at about $54,000. A study by Deloitte indicated that EV buyers trend toward having incomes over $50,000 with an education of bachelor's degree or higher. Within the city of Albany and Albany County 37 percent of the population has a bachelor's degree or

1 Commuting in America III: The Third National Report on Commuting Patterns and Trends. NCHRP Report 550. **http://onlinepubs.trb.org/onlinepubs/nchrp/CIAIII.pdf**

2 American Lung Association: State of the Air 2011. **http://www.stateoftheair.org/2011/states/new-york/albany-36001.html**

higher, better than the state average of 32 percent and national average of 28 percent.[3] These statistics would indicate that there are definitely portions of the city of Albany's and especially the county's populations that would likely have interest in EV ownership. A desire to improve local air quality could additionally drive demand.

A Commitment to Sustainability

As mentioned earlier, the City of Albany, under the leadership of Mayor Jennings, has made a strong commitment to being a leader for sustainability in New York. Electric vehicle proliferation will contribute to improved sustainability. While there are emissions associated with the production of electricity at power plants, the use of electric vehicles will reduce emissions by reducing the combustion of gasoline and diesel fuel. When an electric vehicle is running off of its battery, the vehicle is not producing any emissions, thus reducing the mobile source pollution that can contribute to decreased air quality in urban or high-traffic areas. Greenhouse gas emissions are also lower per electric vehicle mile traveled than per gasoline vehicle mile traveled due to the fact that electricity generation, especially for this region, is much cleaner than gasoline combustion from an emissions standpoint. For example, the Nissan Leaf requires 34 kWh per 100 miles. The emissions generated from production of this 34 kWh of electricity in the Albany region totals 10.64 kg of CO_2 equivalent. Driving a gasoline-fueled vehicle the same distance will produce 39 kg of CO_2 equivalent,[4] nearly four times the emissions of the electric vehicle. Continued increases in renewable sources in upstate New York's electric generation mix will reduce the emissions associated with electricity production even further.

3 US Census Bureau. State and County QuickFacts **http://quickfacts.census.gov/qfd/states/36000.html**

4 Assumes national average fuel economy of 22.6mpg for passenger vehicle (according to the Bureau of Transportation Statistics). Electric emissions factors from eGRID, NPCC Upstate NY region. Motor gasoline emissions from the Climate Registry:
http://www.theclimateregistry.org/downloads/2009/05/2011-Emission-Factors.pdf

Mayor's Office of Energy & Sustainability
City of Albany, NY

CITY OF ALBANY
Electric Vehicle Feasibility Study

Getting Albany EV Ready

Since 2009 and with funding from the American Recovery and Reinvestment Act, a select group of cities from around the country initiated aggressive action to create more EV ready communities. President Obama has driven this effort by identifying a goal of getting one million electric vehicles on the road by 2015. In most cases, what municipalities are discovering through their efforts is that there are no specific regulations or ordinances disallowing the use of electric vehicle supply equipment (EVSE). However, there are rarely clear municipal processes accommodating them. In an effort to get ahead of the curve on mass-scale EV proliferation, a municipality may want to review and revise as needed their local policies, zoning, building codes and permitting process to create an "EV Ready Community." In addition, streetscape design, signage and an effective charging policy should be developed. A comprehensive understanding of potential EV buyers should also be considered in order to anticipate future demand trends.

Zoning

Zoning, permitting, and inspection processes are critical factors in the development of an EV infrastructure network. For example, zoning regulations must allow for the construction of charging stations in multiple zoning categories, especially in residential areas. Building codes can also accelerate EV adoption by requiring buildings to meet specifications for accommodating EV charging. Residents who buy EVs will need to charge the vehicles shortly after purchase, so an expedited and streamlined permitting process for charging stations may be necessary. Through proper zoning, permitting, and other regulatory processes, communities can increase their readiness for EVs dramatically.

Like most cities, Albany does not have any language within their existing code for the accommodation of EV charging infrastructure for either public or private uses. The City, in order to remove any existing barriers for installation of charging stations, will need to revise their existing zoning code to support the installation of EV charging infrastructure. Existing barriers such as setback requirements or inadequate language or definitions of EVs and EV infrastructure can hinder the installation process substantially. This review should result in amendments to existing code as well as an additional section of City Code specifically dedicated to the policies of installing and managing EV charging infrastructure.

This installation and management section of the City Code can be modeled after Chapter 270; Public Pay Telephones. Chapter 270 already addresses the issues that will be encountered when seeking to install an EV charging station. These issues include procedures for siting, ADA accessibility, as well as procedures for incorporating structures into historic preservation and business improvement districts.

To further promote the installation of EV Charging Stations and to remove any barriers, the City should include an EV charging station section in Chapter 375 Article XIV Specific Use Regulations. The City of Albany, as was done with Solar Energy Equipment, can specifically allow for the installation and use of EV charging stations within all Zoning Districts throughout the city. For more specific zoning code recommendations, please refer to the Checklist for EV Readiness and the Summary of Best Practices Section of this document.

The City should also use its existing permitting and building code procedures as a way to promote and educate the public on the use of EVs within the city. Revision to the permitting process and building code could entice a developer to install EV charging equipment for the benefit of expedited permitting. In addition, adding a requirement to include the wiring necessary to support the future installation of EV charging equipment may encourage developers to add the equipment immediately at the time of construction. The table below illustrates these opportunities.

Table 3: Municipal Tools to Incentivize EV Use

TOOL	OPPORTUNITY
Building Code	• Within the City of Albany's Building Code, establish a requirement that all newly constructed residential buildings include a 220 volt outlet in associated garages. • Require that any new commercial building of at least 5,000 square feet includes the wiring necessary to accommodate an EV charging station.
Permitting	• Provide an expedited permitting and inspection process for those seeking to install a residential or public EV charging station. • Offer a reduced permitting fee or waive the fee completely to promote the use of EVs and the installation of the necessary infrastructure. • Use the permitting process as a way to train and educate inspectors and licensed electricians on the best practices associated with EV charging installations. At the time of application for a permit, make available to electrical contractors the Charging Station Installation Handbook for Contractors and Inspectors from Advanced Energy and the City of Raleigh, NC.

Parking and Streetscape

Parking and streetscape design could affect the desirability of EVs in a number of ways. The availability of preferential parking for EVs and whether this is accompanied by free charging stations are aspects that may influence a potential EV buyer's decision. Reserved parking for EVs could be an incentive, all other factors being equal, in urban areas where parking is at a premium. However, it is necessary to consider that, while it could be an incentive to drivers, free public charging has negative implications for pollution and GHG production by encouraging EV owners to charge their vehicles during peak hours during the day instead of charging their EV at home during the nighttime when the electric grid has excess capacity. Additionally, a vehicle parked in a charging station for an extended period of time could prevent other EVs from utilizing the charging station, requiring the possibly unnecessary installation of additional charging stations to accommodate perceived demand. Thus, whether reserved parking or free charging is provided and the time and duration for which these amenities are provided are important factors to consider. EV-only parking adjacent to either free or paid charging stations must be enforced aggressively, such that EV owners can plan trips with a reasonable level of certainty that charging will be possible at known points. Many communities, such as New Haven, Connecticut and Salem, Oregon have implemented parking restrictions, installed meters at charging stations (so that EV drivers pay for electricity use) and committed to enforcing parking restrictions to address these issues.

To ensure the proper use of EV designated parking spaces Albany will need to strictly enforce the parking regulations as well as potentially increase the fines paid for illegally parking. The City could propose that those parking illegally in an EV designated parking spot pay fines equal to those assessed for cars parked illegally in a handicapped designated spot. These penalties incur fines of $150.00 per violation as opposed to a $35.00 fine for a more common "no parking" violation. The increases in the penalties may ensure that charging stations are available to those who need them but will also allow the City to generate additional revenue from these reserved parking spots.

Signage

In April 2011 the Federal Highway Administration (FHWA) granted interim approval for optional use of an alternative EV charging sign to be installed on the nation's roads for directional signage. The new signs will be included in the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD). Prior to the FHWA adopting the new signage, state and local governments were allowed free reign over EV fueling directional signs. As a result, there was no set standard and a number of competing designs were created.

In order to avoid confusing EV drivers, the City of Albany should act early to adopt a standard for all EV signage. Using existing street sign design standards, the City should establish the design for future EV signs as well as establish minimum standards for visibility. This will allow the City of Albany to control the branding of the initiative and will avoid confusion and frustration among drivers looking for charging locations. If desired, the City of Albany can manufacture and produce the standard signs and can provide them to a vendor at the time of final inspection by City Code Enforcement. The cost of the signs can be charged to the operator of the EV Charging Station, included in the permitting fees or waived to promote the use of EVs in Albany. If an external entity provides an EV charging station, the sign for the charging

station should include that entity's name, though Albany's sign code may require updating to allow for this, since it could be conceived of as a form of advertising, not allowed under current sign code. See the Best Practices for an EV Ready Community Section of this report for recommendations around signage for EVs. It should be noted that the examples shown here of possible EV signs have not been fully approved for use at this time.

Demand Management

The existing EV charging stations in the Capital Region do not limit the amount of time that a customer can use the parking spot and/or charging station. However, as the popularity of EVs increases, the establishment of time limits will be necessary. The City of Albany should establish a standard time limit for charging and an associated penalty for exceeding that time period. For example, the City of Santa Rosa, CA has put four hour time limits on some of its public EV charging stations. These standards would be required for any charging station installed on City owned property or property leased from the City.

Similar standards will also be needed for EV charging infrastructure located on commercial properties. Businesses and institutions will individually need to establish a standard time period for charging and a penalty for violation. It will be necessary for this information to be posted at each charging station to inform the driver of the limitations.

The establishment of these limits and penalties are important to ensure that charging stations are available for use when needed and are not simply being dominated by one or two users.

Charging Policy and Permitting

While most EV charging will occur when the vehicle is parked at home, public charging stations allow drivers to extend the range of their trips and provide charging opportunities for residents who only have access to on-street parking. Additionally, in the short-term, public charging stations will have a significant impact on the overall perception and awareness of EVs.

The most prevalent question that arises when considering public charging stations is who should pay for the electricity and what system should be employed to facilitate the financial transactions between the EV charging station and the driver. The price structure used to determine the cost of charging at public metering stations can influence the behavior patterns of EV drivers. The price must be high enough to deter excess use of sub-optimal daytime charging, yet low enough so as not to discourage EV purchases at all.

Noting that most states make it illegal for any entities besides utilities to charge for kilowatt-hours, non-utility EV charging station owners can only charge for the parking spot either by time, a one-time flat connection fee, or through a monthly subscription for segments of time. If the municipalities chose to own the charging station they will have to take into account the cost of the electricity as well as the lost revenue from losing a non-EV metered parking spot when determining the pricing standards.

Table 4: Models for Public EV Installation and Operation

MODEL	DESCRIPTION
EVSE Provider	• EVSE (Electric Vehicle Supply Equipment) provider installs the charging stations on space leased from a municipality. The utility meters usage, and sends bills directly to the EVSE provider. The EVSE provider owns, operates, and collects payment from use of the charging stations.
Municipality or Business Ownership	• The municipality or business owns the EVSE equipment, although the EVSE provider may operate and maintain the equipment and collect payments from use.
Utility Ownership	• A public utility company would install, own, and maintain the EVSE hardware. Costs would be included in the base rate all customers pay, similar to how utility companies finance new substations or utility poles. Charging stations would still use the same pay-for-use systems available from non-utility providers.

The City of Albany has a variety of options for their involvement in the installation and management of EV charging infrastructure. Options range from the owning and operating of charging stations to the leasing of City land or a row for the installation of infrastructure to be used by EV drivers.

Another option available to other municipalities, but not to Albany, that is worth noting is for charging stations to be installed and directly tied to a streetlight. Again, this would not work within Albany as most standalone city streetlights that are not mounted on National Grid poles are not metered; they are paid for by the City under a special contract with National Grid. Therefore the City of Albany cannot use these to connect to an EV charging station at this time. Streetlights would need to be individually metered to allow for their use as a charging station connection.

Understanding the current financial constraints facing the City of Albany as well as the infrastructure investment and maintenance costs associated with EV charging infrastructure, the City should look at partnering with a private company for the installation and maintenance of charging stations.

EV infrastructure is an opportunity to generate revenue for City projects and operations. Using the list of recommended EVSE sites developed by this study the City should look to lease City property for the installation and operation of public EV charging stations. The lease revenue generated from this process could offset the revenue lost from removing non-EV parking meters and also create a funding stream to be used to support other sustainability projects throughout the city. Albany could release a Request for Proposals which includes the identified public locations for EV charging station installation and could enter into a contract with the proposer that provides the greatest benefit to both the City and EV users. Any potential lease should be structured in such a way that the City receives minimum set revenue for each space leased but can increase its revenue based on the usage of the space.

Working with the Local Utility

Any EV charging station installed in Albany would have to be done in cooperation with National Grid, the local utility provider. Due to this, the City of Albany will need to develop an internal policy for notifying National Grid when a permit application is received for EV charging station installation. In addition, this would include the design standards process established by National Grid that any on-street installation is subject to. It is estimated that from construction to connection and activation the entire process for installing an EV charging station will take 10 weeks to complete through the National Grid design process.

nationalgrid

National Grid EV Charging Station Siting Criteria

Public Access – To ease range anxiety, stations must be readily accessible to the public, preferably 24 hrs/day. Certain sites cannot allow this for security reasons, but to be eligible, sites must offer the station to the public at least 10 hrs/day.

Nearby local attractions – Charging can take a typical PEV between 3-8 hours for a full charge. Because of this fact, it is frowned upon to install a charging station in an empty parking lot or isolated area. Charging stations should be sited at or within walking distance to one or more of the following:

- Restaurant or Café
- Library
- Retail Store/Shopping Mall
- Downtown/Town Center
- Sports Arena
- Gym or Fitness Facility

1-3 Hour Turnover – Because PEV drivers rarely park at commuter or all-day parking areas with less than ½ of a full charge they rarely need to be plugged in for more than 2-3 hours. If they are parked somewhere where their vehicle doesn't move for 6-10 hours then they are occupying a station that could be used by another driver. With this in mind, National Grid tries to avoid siting in parking areas with a 6-10 hour turn-over and focus on places with a shorter (1-3 hour) turn-over.

208v or 240v power nearby and no pavement cutting needed – Ideal sites would have 208 volt or 240 volt power within 40 feet of the charging station with little construction required to access it.

Enthusiastic Customer Partner – Finally, the most important thing that leads to successful installations is an enthusiastic customer partner.

The City typically charges fees for permitting and other costs associated with breaking the sidewalk to National Grid. National Grid will require the customer pay for any such restoration fees. If the City is working with a company on the installation of charging stations, they should consider streamlining this process and eliminating these City-imposed fees for installations on City property.

National Grid has been active in its consideration of EV charging infrastructure and has established its own criteria for siting of EV charging stations.

Leading by Example – Electric vehicles in Albany's municipal fleet

Corporations and municipalities are increasingly turning to EVs to replace older and less efficient vehicles in their fleets. Large fleet owners are especially suitable for EVs due to the cost savings associated with operating many EVs. Often the upfront cost of charging stations prevents operators from making the switch. These costs can be minimized if enough vehicles use the new charging infrastructure instead of traditional fuels. Over the lifetime of a vehicle, the overall fuel cost will be substantially lower than an equivalent gasoline or diesel powered vehicle since the electric cost to drive the vehicle one mile will be lower than the gasoline cost for the same distance in Albany. In addition, maintenance costs are also lower on average, further increasing the potential savings. New York City has successfully incorporated over 400 EVs into their municipal fleet making them the largest municipal EV fleet in the country. Users of these EVs in New York City include the Department of Citywide Administrative Services, the Department of Correction, the Department of Environmental Protection, Department of Parks and Recreation, Department of Sanitation, Department of Transportation, New York City Fire Department, the New York City Police Department, and Taxi and Limousine Commission.

The City of Albany could install charging infrastructure within the Department of General Services garage where most of the City owned fleet vehicles are parked and maintained. EVs could be charged during operational downtimes or during the overnight hours, greatly simplifying the process of using public charging stations throughout the city. With the infrastructure in place, the City could lead by example and incorporate various EVs into its fleet. Because numerous types of EVs are being manufactured now, including passenger vehicles as well as light- and heavy-duty trucks, EVs are well-suited for most types of municipal fleet needs. Opportunities for passenger vehicles used for administrative tasks could be available for use as well as all-electric heavy-duty vehicles for City maintenance and operation staff. Improved battery life and range or an overall increase in availability of charging stations will be necessary for most public safety vehicles to begin using EVs.

Mayor's Office of Energy & Sustainability
City of Albany, NY

CITY OF ALBANY
Electric Vehicle Feasibility Study

EVSE Site Evaluation and Recommendations

Criteria and Methodology

Level II Charging Stations

The primary purpose of this Feasibility Study is to identify optimal initial locations where Level II EV charging would be most useful, prominent, and supported by existing electrical infrastructure in Albany. Objective evaluation criteria were developed to identify these optimal locations. The evaluation criteria for Level II charging stations were split into two stages, described below. Additionally, a separate set of criteria was developed to identify areas or locations for potential DC Fast Charging infrastructure that will be most closely associated with highway charging.

Criteria Development - Stage One

The first stage was the identification of general "opportunity zones" to target for Level II charging in Albany using GIS mapping. The criteria identified locations most convenient and with the highest probability of covering the expected future penetration of EVs (high residential or workplace density, preferably both). **Maps 1 and 2** from this stage, found in Appendix A, show the following:

- Sites with a minimum household density exceeding 2,500 households per square mile (average household density in the city of Albany is 2,118 as of the 2000 census)
- Sites with government institutions and businesses of 250 or more employees

The evaluation then focused on narrowing this further by identifying high visibility, high traffic areas for both cars and pedestrians. **Map 3** from this stage, found in Appendix A, shows the following criteria:

- Near or on a roadway with a minimum functional classification of "major collector"[1]
- Near or at major vehicle trip generators[2]
- Major commercial or employment districts

Map 4 in Appendix A shows these criteria with circles identifying areas where all or most of the criteria from stage one overlap.

Criteria Development - Stage Two

The second stage of the evaluation used another set of criteria to identify specific locations for public, Level II charging within each of the general opportunity zones identified in the first stage. This step was done directly with the assistance of National Grid, providing general information on ease or difficulty of installations on certain streets, areas, or properties around the city. The following are the four criteria used in this stage:

- Location with adequate electrical infrastructure for Level II charging, where the electrical infrastructure could be tapped cost effectively.[3]
- Sidewalk locations, with enough width to place a charging pedestal at the curb and maintain an ADA accessible path.[4] Sidewalks with overhead electrical wires/poles are a lower cost to connect.
- High-use parking facilities with 50 spaces or more.
- A location with typically long dwell times for cars (See "A Guide for Future Investments" Section).

The result of this two stage process was a full list of potential charging station sites across the city, broken down by potential streets and potential properties or buildings. The full list is included in Appendix A. The short list of 15 sites was then selected from the full list, pulling one or more ideal locations out of the zones originally identified. These 15 sites represent those locations that are considered relatively low in difficulty to connect to the grid, are on public sidewalks, other public property,[5] or non-profit educational institution property.

1 Major Collectors are designed to collect traffic from local roadways, while providing a balance between regional mobility and local access, and are typically characterized by higher design speeds and higher volumes than other collector roadways.

2 A major vehicle trip generator was defined as any individual land use expected to generate at least 1,000 gross daily vehicle trips, determining a minimum size for each land use type that would be likely to generate 1,000 daily trips. Vehicle trip generation is not actual trip data, but instead potential for trip generation based on size and land use type.

3 In Downtown Albany, most electrical infrastructure is underground, so it can be costly to tap into those wires that run under the streets. Similarly, if the electric lines are not near the location under consideration, it will be costly to run the electricity to the site. Costs can be minimized if siting a station near a National Grid pole (non-underground network). Costs are also minimized if sub-metering on existing service instead of initiating a new separate service.

4 The Public Rights-of-Way Design Guide recommends a minimum of 5 feet for an accessible passable area for residential and commercial sidewalks, with an additional recommendation of up to 10 feet to allow for comfortable shared space in central business districts.
http://www.access-board.gov/prowac/guide/PROWGuide.htm#3_2_1

5 Even if the City or State does not choose to purchase/own charging equipment, the sites could still be viable locations through third-party leasing arrangements.

The full list and evaluation criteria should not be considered final but should be viewed with flexibility for changes in future trends. A general list of EV charging location types (i.e. hotels, movie theaters, etc.) was developed to guide the aforementioned evaluation process, and should guide the City and potential developers in expansion of the charging station network in the future, (See "A Guide for Future Investments" section).

DC Fast Charging Stations

DC Fast Charging will be relevant for long-distance and highway travel and for commercial fleets in the future. Complexities for this type of charging include its expense, installation requirements, the potential need for an attendant, and concerns about impacts to battery life from regular fast charging. DC Fast Charging should be viewed as a range-extender for going longer distances, or a quick charge for fleets that need short downtimes. Unlike Level II charging, there is no standard for DC Fast Charging and there are multiple systems proposed for use. Installation of DC Fast Charging equipment is not recommended until a standard has been established.

DC Fast Charging Criteria

The criteria used for identifying opportunity zones for DC Fast Charging are as follows:

- Areas of city within 3-5 minute driving distance of each major highway exit off of I-787, I-90, and I-87 (shown on **Map 5**) and,
- Areas within a walkable commercial district or locations that represent a substantial destination
- Property that can accept the size of a DC Fast Charge unit (typically about 52" W x 98" H x 15" D)
- Sufficient electrical capacity for DC Fast Charging equipment (480 volt 3-Phase AC input)
- Site that has an attendant who could be trained to use the equipment, if necessary

Map 5, found in Appendix A, highlights areas of the city within 3-5 minute driving distance of each major highway exit on the interstate system. Most of the city can be reached within an estimated 5 minutes of a highway exit (in perfect traffic conditions), while a three minute distance is more concentrated along I-787 and near the Everett Road, Harriman State Office Campus, University of Albany, and Fuller Road/Washington Avenue Extension exits off of interstate 90. Commercial districts or destinations have been circled on the map, and represent an economic opportunity for Albany as EV owners waiting for a fast charge could potentially use the 30 minutes of charging time consuming products or services in these commercial destinations.

Current DC Fast Charging systems are the size of a typical gas pump, often require an attendant, and have substantial electrical capacity needs. There are few locations in Albany that fit this description other than highway travel plazas, gas stations, and fleet operations facilities (UPS, FedEx, Taxis, etc). There is one gas station in a major walkable commercial district within a 3 minute driving distance – the Mobil station at the corner of Lark Street and Madison Avenue that could potentially house a DC Fast Charging system. There are other gas stations and also car dealerships in non-walking friendly commercial districts close to highway exits such as near Everett Road and Central Avenue. Crossgates Mall in Guilderland could be considered an ideal DC Fast Charging location because it has a dedicated exit off of I-87, and is a self contained walkable commercial district.

There are 27 travel plazas on the New York State Thruway, all of which would be candidates for DC Fast Charging, though none are within Albany city limits. The largest company fleets in the area known to be testing EVs and that also have short downtimes are FedEx and UPS; these facilities are near the airport in Colonie. Other fleets exist in Albany, owned by New York State, the City of Albany, and taxi companies, but none would be expected to have a significant enough fleet of fully-electric EVs with short downtimes to justify the investment in DC Fast Charging at the present time.

Recommendations

Top 15 Recommended EVSE Sites

This list of the top recommended sites was determined from a larger list (provided in Appendix C), pulling one or more ideal locations out of the zones originally identified on the full list of potential sites. This list represents those locations that are considered relatively low in difficulty to connect to the grid, are on public sidewalks, other public property, or non-profit educational institution property. These are organized by estimated cost and difficulty to install and connect to the grid according to a preliminary review by National Grid.

Streets

- Delaware Avenue in front of The Spectrum Theater
- Russell Road (Russell road is a City-owned roadway with on-street parking and is adjacent to Westgate Plaza, a dance studio and County office buildings.)
- Lark Street between Madison and Washington Avenue

Institutions/Properties/Buildings/Lots

- Robinson Square Parking Lot at Robinson and Swan Streets
- McCarty Avenue New York State Office of General Services Employee Park and Ride lot (This parking lot has 669 designated spaces for State employees.)
- College of St. Rose parking lots

Robinson Square Parking Lot

- The church owned parking lot in front of the Hampton Inn that serves Pearl Street, Palace Theatre, and Capital Repertory customers
- UAlbany Campus faculty lots and/or visitor lots
- UAlbany NanoTech Complex
- Harriman State Office Campus (This location is home to multiple State agencies and their fleets and the installation of charging stations could encourage the conversion of existing vehicles to EVs.)
- Pine Bush Preserve Discovery Center
- Capital Hills Golf Course
- Madison Avenue between Western Avenue, Allen Street, and Main Street
- Albany parking garages (The three main Albany parking garages—Columbia Garage, Quackenbush Garage, and Green/Hudson Garage—combined have over 2,650 public parking spaces.)
- Hoffman Park at corner of Hoffman & McCarty

Primary Backup Options

Primary backup options were chosen based on similar criteria, but not restricted to public and non-profit educational properties. These sites, also from the full list, should be considered as backup options if any of the top 15 sites are determined to be unfeasible for any reason.

Streets

- Madison Avenue Between Eagle and Swan Streets at the NYS Museum
- Swan Street between Madison and Washington Avenue
- State Street along Washington Park from Western Avenue to Lark Street
- Washington Avenue in front of Albany Institute of History and Art

above:
Albany Parking Authority Green & Hudson Garage

right:
Delaware Avenue

Institutions/Properties/Buildings/Lots

- Wadsworth Center of the NYS Department of Health (major research institution)
- City Hall
- Trinity Church Parking Lot on Lark Street
- Hotel Albany Garage
- OGS parking garages (These include the Empire State Plaza Main and East Garages, Madison Visitor, Elk Street, 110 State, Sheridan Hollow Garage, DEC garage)
- Any hotel along Washington Avenue across from the UAlbany and Harriman Campuses
- Patroon Creek office campus and new apartment complex
- WAMC Park and Ride lot
- NYS Thruway Authority HQ
- 17 Chapel Condos
- Albany Heritage Area Visitors Center and Planetarium / The Pump Station Parking Lot (This lot is adjacent to the Quackenbush Lot owned by the Albany Parking Authority and has 198 spaces.)

above: Quackenbush Garage

right: Trinity Church parking lot on Lark Street

Mayor's Office of Energy & Sustainability
City of Albany, NY

CITY OF ALBANY
Electric Vehicle Feasibility Study

Best Practices for an EV Ready Community

The City of Albany, as the Capital of New York, understands and embraces its role as a leader in the state on sustainability issues and initiatives. As Albany takes steps to become an EV Ready Community, it understands that to be successful it cannot act alone. The information below will lay the foundation for Albany and municipalities across New York to be prepared to support and promote the use of EVs.

EV Ready Checklist

Table 5: A Checklist for EV Readiness

✓	Revise existing building code to remove barriers to installation of EV infrastructure
✓	Expedite permitting for EV charging stations
✓	Update zoning to allow for EV charging stations in all major zoning categories (differentiating between Levels I, II, and DC by zoning category)
✓	Include standards in building code and permitting language for siting within Historic and other specialty districts
✓	Develop policy for siting EV charging infrastructure within residential districts where residences typically do not have garages.
✓	Integrate EV charging infrastructure considerations into design review process for new developments, including buildings, and especially for sidewalks, streets, and parking areas
✓	Adopt standard design and visibility requirements for EV charging station signage
✓	Adopt standard policies on ownership and installation of EV charging stations on public property
✓	Work with local utility EARLY to determine capacity for increase in demand from EVs and to determine connection costs and processes
✓	Adopt a fine schedule for parking violations within EV designated parking spaces
✓	Establish fees associated with use of equipment on government property
✓	Adopt a policy/strategy for incorporating EVs into municipal fleet
✓	Form a stakeholder group within the community – businesses, institutions, local utilities, interested consumers, fleet operators to evaluate demand and create strategies for EV uptake
✓	Create an education and marketing program to educate the community about EVs, infrastructure, and available incentives
✓	Consider provision of free/discounted tolls, parking, HOV lanes, and other driving incentives, including free or reduced price parking at certain times or locations
✓	Work with taxi fleets, rental car companies, and car-sharing programs to integrate EVs and charging infrastructure
✓	Work with colleges, technical schools, and other education providers to develop EV workforce training courses and programs
✓	Coordinate with fire, EMS, police, and other emergency responders to provide EV-specific training offered by the Fire Protection Research Foundation

Summary of Best Practices

The following table provides a summary of best practices, including those outlined in the Checklist for EV Readiness and additional practices communities will want to consider when working to promote EVs and become EV Ready.

EV READINESS CATEGORY	BEST PRACTICE
Siting	• Install EVSE in popular public locations • Work with hotels, large employers, universities, and institutions to install EVSE • Establish priority zones for focusing EV infrastructure investment • Work with electric utility to determine suitability of streetlights or utility poles for connecting charging stations • Avoid, when possible, locations requiring connections to underground electrical networks • Ensure adequate lighting is provided around EVSE to minimize safety concerns.
Zoning, Permitting, and Building Codes	• Allow Level I and Level II charging stations in zoning code • Allow DC Fast Charging stations in commercial and industrial areas and as a conditional use in residential areas in zoning code • Allow battery swapping stations in code as a principal use in certain zones • Require that any new commercial building of at least 5,000 square feet includes the wiring necessary to accommodate an EV charging station • Adopt EV and EVSE related definitions in zoning code • Require EV charging station conduit to reach a percentage of spaces in new parking structures and surface lots over a certain number of spaces • Require a 240v outlet and an EV charging station in new lower density home construction that includes a driveway • Require a minimum percentage of parking spaces in new multi-unit residential buildings to include EV charging stations and/or conduit to accommodate them in the future • Adopt the DOE National Model EV Permit for issuing EVSE permits, customize it for local needs, and determine the appropriate permit fee • Integrate notification of the utility as part of the permitting process • Create an expedited online or in-person electrical permit and inspection process that takes no longer than 24 hours to obtain a permit, and no longer than 48 hours to obtain an inspection after installation is complete • Provide City inspectors and make available to electrical contractors the Charging Station Installation Handbook for Contractors and Inspectors from Advanced Energy and the City of Raleigh, NC • Consider creating a public charging station request process

EV READINESS CATEGORY	BEST PRACTICE
Education and Outreach	• Send emergency responders to the Electric Vehicle Safety Training given by the National Fire Protection Association both online and in person • Work with local auto dealerships to educate them on the process, rebates available, etc; hand out information cards for dealerships to give EV buyers • Require auto dealership to notify utility when EV/charging equipment has been sold to a consumer so that utility can monitor changes in load • Hold a daytime EV information forum for parking garage/lot owners, developers, condo associations, building management companies; hold an evening session for residential owners • Educate electrical contractors on permitting and inspection requirements; send copies of the Charging Station Installation Handbook • Work with the utility to include EV education in utility bills and mailings to customers • Set up an EV education website on the municipal website educating the public on the benefits of EVs and including resources that prospective consumers will need, and surveys to gauge interest levels • Work with local community colleges, trade schools, and public high schools to establish EV and EVSE training programs for the electrical and automotive trades • Coordinate with the local Clean Cities Coalition and local transit authority while setting up programs and seeking funding • Work with local radio stations on the development of public service announcements on the environmental benefits of EVs
Streetscape, Signage, Parking	• Update streetscape design standards to include provisions for EV charging stations, with preference for EV charging at spots closest to the corner of a block and near a streetlight for better access, safety, and visibility • Update off-street parking design guidance to include EVSE needs and design considerations • Update shared parking ordinance if necessary for EV charging to maximize use of EV charging station investments • Standardize signage for EV charging stations/parking, including pavement coloring (avoid blue to avoid confusion with handicapped signage/markings) as well as avoid other markings or colors that may conflict with the recommendations in the NATCO Urban Bikeway Design Guide or the MUTCD. • Develop city EV marketing and branding of station location signage (both at charge point and along roadways directing people to EV stations out of plain sight) • For sidewalk installations, require only equipment with self contained retractable cords • In parking and streetscape standards, specify that cable must not run across ADA pathways, and stations must not violate ADA sidewalk width • Update parking regulations to define active charging, allow for overnight charging, and allow for enforcement of normal time limits during the day. Enforcement will require the development of standard procedures for removal and towing of a plugged-in vehicle that is in violation

A Guide for Future Investments

Long charging times must be taken into account when siting EV charging infrastructure. Among the mass-market EVs with a Level II charge capability: a Chevy Volt takes approximately four hours to fully charge; a Nissan Leaf seven hours; and the Ford Focus Electric three hours (unconfirmed). While most vehicles will not likely be charging from a fully depleted state, multiple hours are still required, unless the vehicle is simply being topped off. Places with consistently short vehicle dwell times of generally less than an hour (i.e. fast food or pharmacies) will have a lower value for EV charging than venues with longer vehicle dwell times (i.e. offices, universities, theatres). A list of these location types with typically longer dwell times is provided below to help identify optimal locations for the City of Albany to encourage siting of future charging stations, and where developers should focus their efforts going forward. These are generic types of sites for consideration beyond the specific site recommendations provided earlier in this study. Many of these locations are located on private property, and would require the City to coordinate with private landholders to incorporate EV charging stations. The City could partner with these entities and encourage them to make commitments. These locations were chosen based on the following criteria:

- **Duration of stay** - Charging stations should be located in places where people park their vehicles for at least two hours.
- **Population density and frequency of visits (turnover)** - Stations should be sited in locations where people live, work, or frequently visit.

Future Types of Locations for Charging Station Consideration

Beyond the specific sites recommended within this Feasibility Study, other locations could serve as useful EV charging station locations and will be worth considering as Albany and other communities continue to expand their EV infrastructure.

Residential

- Residences, apartment and condo buildings
- Hotels (a temporary “residence”)

Workplace

- City, State, and privately operated parking garages and lots
- College and university campuses
- Office buildings
- Technology , manufacturing and office campuses
- Park and Ride sites
- Hospitals and medical campuses

Public

- Shopping malls
- Beaches and pools
- Performing arts centers
- Airport, train, bus and transit stations
- Sporting event facilities
- Gyms and health clubs
- Parks and recreational facilities
- Libraries
- Museums
- Movie theaters
- Convention centers
- Supermarkets
- Municipal and federal buildings and courthouses
- Baseball fields
- Golf courses

Fleet

- Auto repair shops and sales centers servicing electric vehicles
- Municipal fleet maintenance and parking facilities
- Rental car, taxi, livery, and corporate fleet maintenance and parking facilities

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Appendix A:
Maps of Recommended EVSE Sites

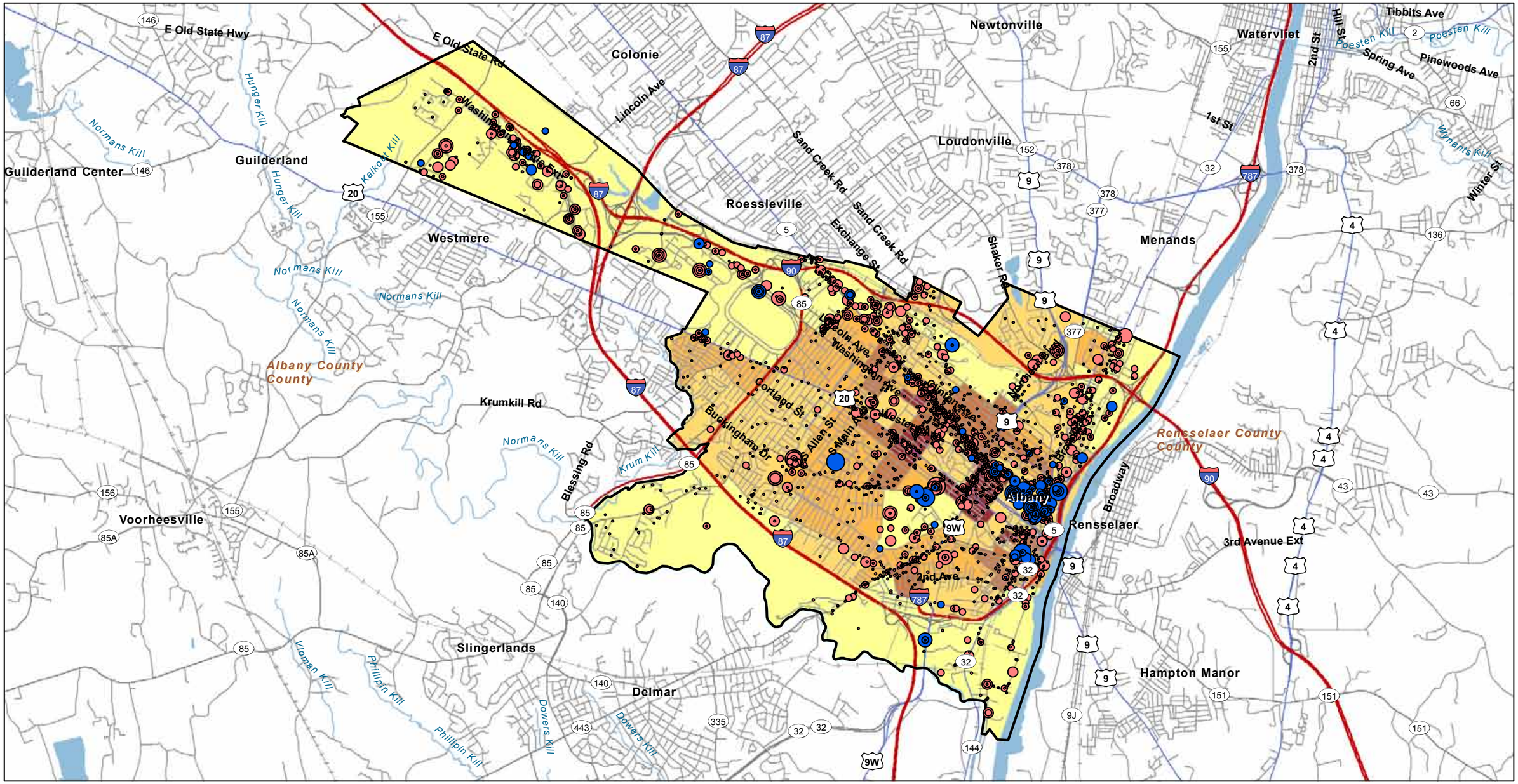
Map 1: Households and Employment Centers – Separate

Map 2: Households and Employment Centers – Combined

Map 3: Land Uses, Trip Generators, Functional Class Roads

Map 4: Trip Generators, Functional Class Roads, Hot Spots

Map 5: Areas Near Highway Exits – DC Fast Charging



Source: ESRI, New York State Department of Transportation, U.S Census 2010

Gov Institutions by Employee Size

- 1 - 10
- 20 - 50
- 100 - 250
- 500
- 1000

Business by Employee Size

- 1 - 10
- 11 - 50
- 51 - 250
- 251 - 1000
- 1001 - 5000

Block Groups selection

2010 Total Households / Land Area in Square Miles

- 0 - 1,000
- 1,001 - 2,500
- 2,501 - 5,000
- 5,001 - 10,000
- 10,010 - 20,000

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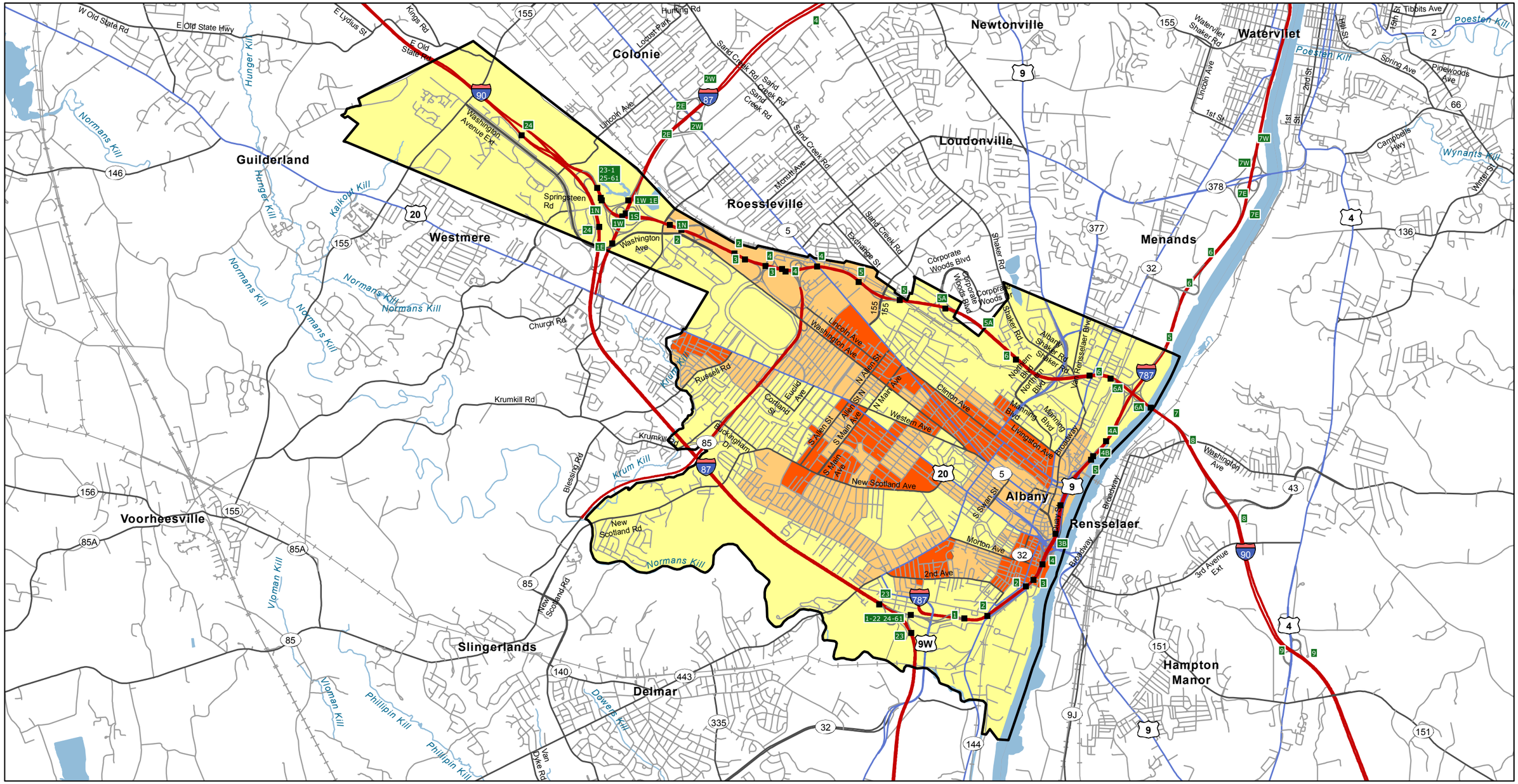
Figure 1

Business Employee Distribution
and Household Density
by Census Block Group

Albany, New York



Source: ESRI, New York State Department of Transportation, U.S. Census 2010

- Exits
- Household density >= 2,500 and business density >= 250 employees
- Household density >= 2,500 or business density >= 250 employees
- Household density < 2,500 and business density < 250 employees

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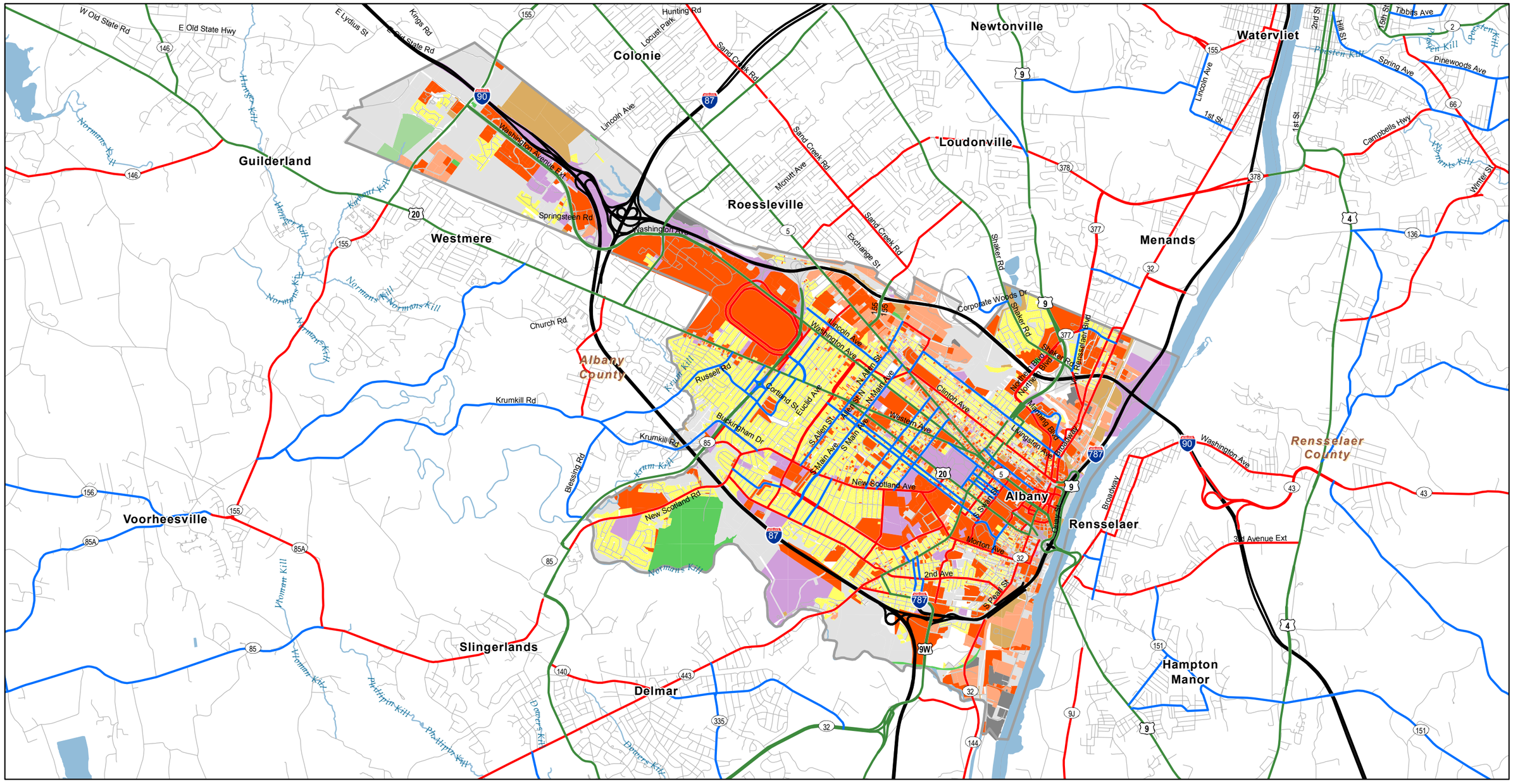
Figure 2

Business Employee Density
and Household Density
Combined - by Census Block Group

Albany, New York



Source: ESRI, New York State Department of Transportation

Major Roads

- Interstate
- Principal Arterial
- Collector
- Minor Arterial
- Significant Trip Generators

Land Use by Parcel

- Commercial
- Community Facilities
- Forest & Open Space
- Industrial
- Infrastructure
- Recreation & Entertainment
- Residential
- Vacant Land

0 0.5 1 1.5 2 Miles

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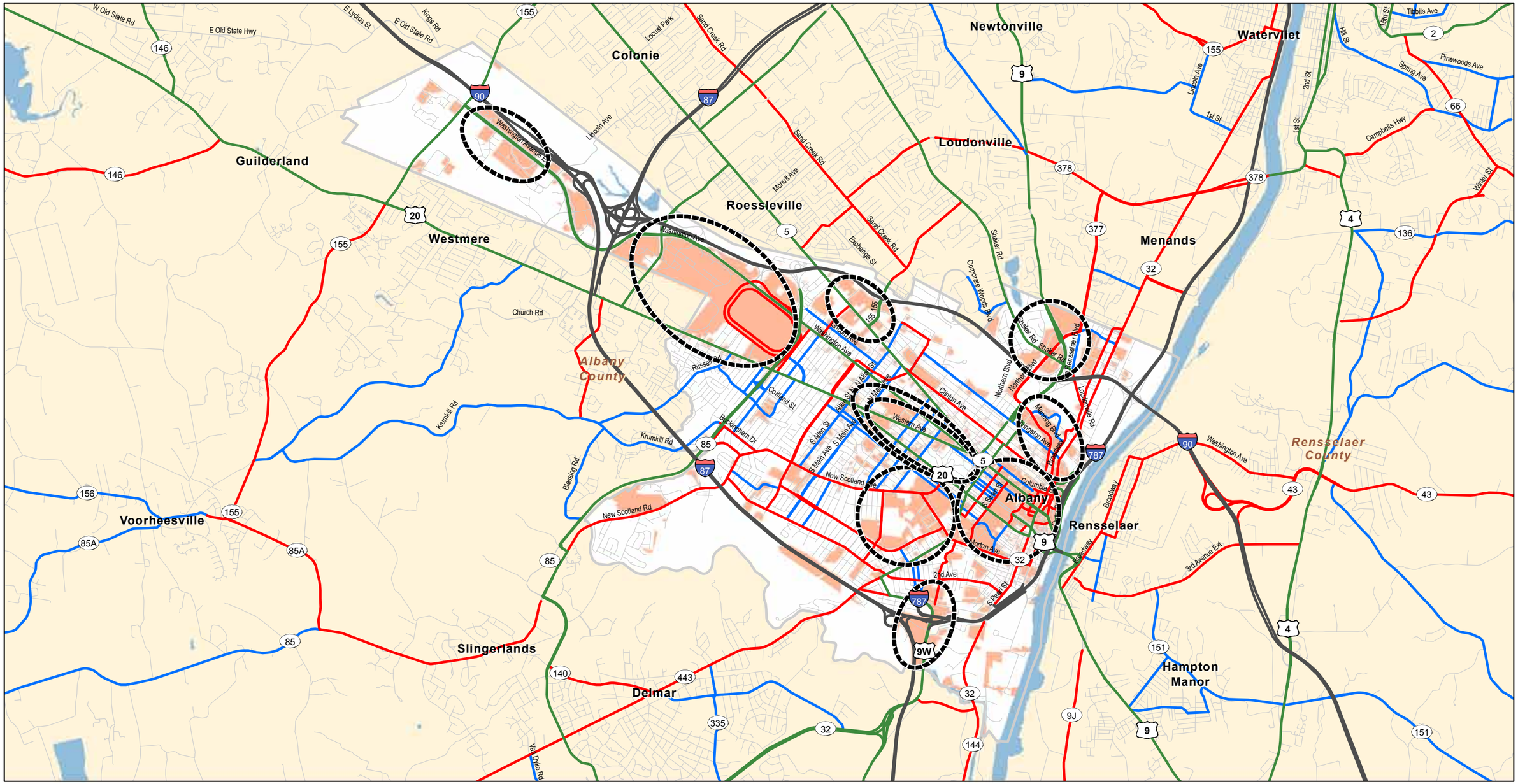
Figure 3

Land Use Tax Code by Parcel
and Significant Trip Generating Parcels

Albany, New York



Source: ESRI, New York State Department of Transportation

Major Roads

- Interstate
- Principal Arterial
- Minor Arterial
- Collector

- Regions of Highest Trip Activity
- Significant Trip Generators by Parcel

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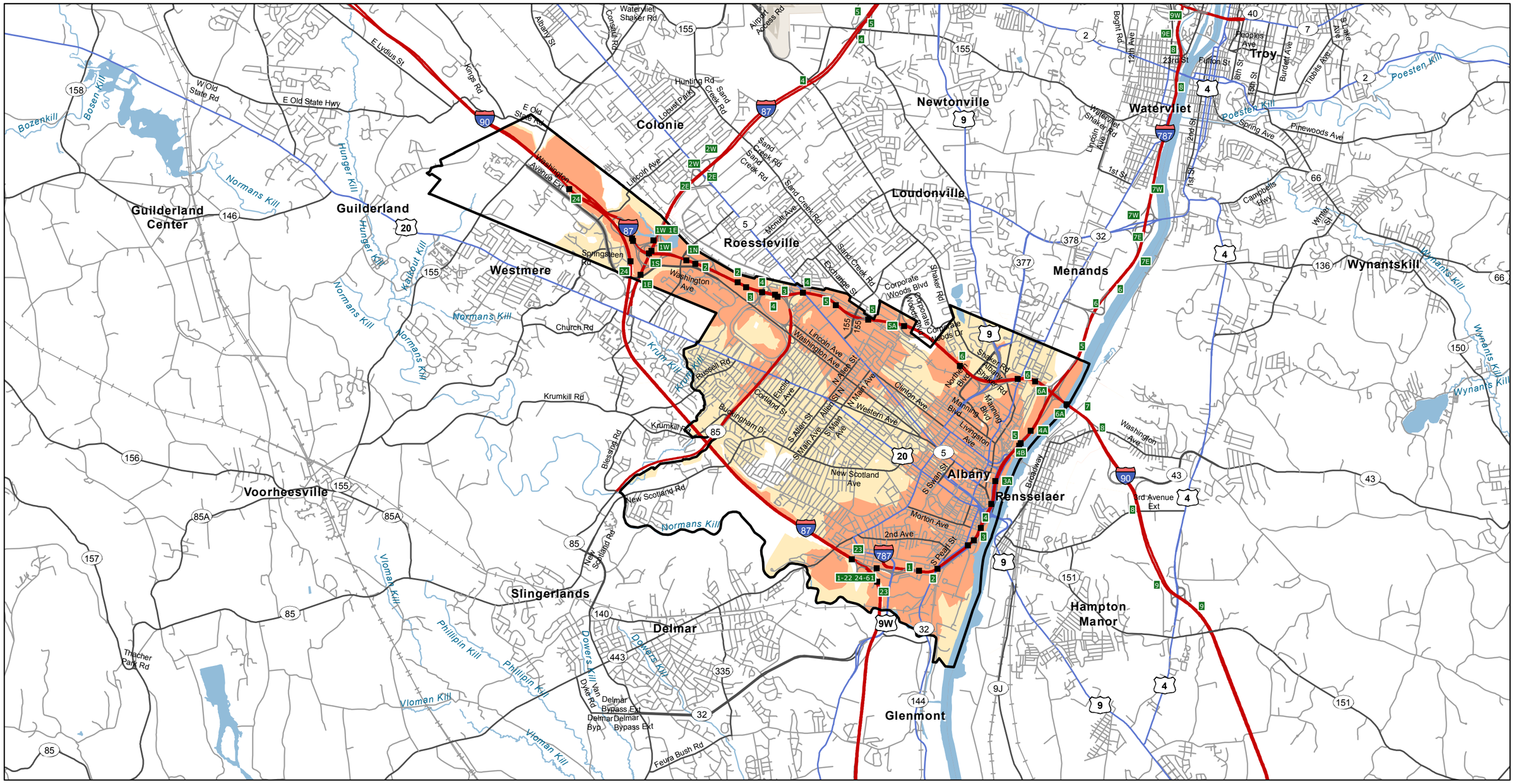
Figure 4

2008 Average Annual Daily Volume (AADT) and Significant Trip Generating Land Use by Parcel

Albany, New York



Source: ESRI, New York State Department of Transportation

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Figure 5

Drive Time Penetration within Albany from Highway Exits

Albany, New York

Appendix B:
List of Charging Station Providers/Products

A number of manufacturers have partnerships with EV manufacturers to provide charging stations for consumers. The following list details just a few of the major charging station providers and their products.

- **GE Wattstation** has a single port Level II station specifically designed to integrate with all of GE's Smart Grid equipment. This allows utility companies to manage the impact of electric vehicles on the grid, and drivers to manage the charging automatically at their home or elsewhere based on variable electricity rates that favor off-peak charging.
- **ECOtality Blink** offers a single port Level II charging station designed for both residential and commercial customers, as well as a commercial-only DC Fast Charging system. ECOtality recently received $114.8 million in DOE funding to install 15,000 Blink charging stations in 18 cities and major metropolitan areas.
- **Coulomb** has a wide range of charging stations, from simple Level I systems up to commercial DC Fast Charging systems. Coulomb operates the ChargePoint Network, a synched up network of more than 6,000 public charging stations with an interactive map and real-time availability data that is accessible via a smart-phone application.
- **Clipper Creek** is a leading supplier of Level I and Level II charging stations that are designed for use by a variety of customers and to be an open canvas for any branding.
- BMW's **DesignWorksUSA** offers the Juice Bar, a 2 or 4 port Level II charger designed specifically for parking garage installations. Because this system offers 4 charging ports on a single unit and can be ordered with no payment interface, the Juice Bar may be an ideal system for valet parking.

A ChargePoint EV Charging Station

- **AeroVironment** is a leading supplier of EV charging stations and equipment nationally and is currently working the Massachusetts Department of Energy Resources to provide charging infrastructure services to cities and towns in the state under its Electric Vehicle Infrastructure grant program.
- **Control Module Industries** is based in Connecticut and produces a wide range of EVSE and fleet management products, including some innovative retractable cord charging solutions that are particularly useful for meeting ADA requirements and for siting in the Northeastern climate.
- Best known for their attempts to popularize battery switching stations, **Better Place** also has a 2 port charging station that can be installed in bollards, wall mounts, or at home.

Appendix C:
Complete List of Recommended EVSE Sites

***Bold = Top 15 Recommended Sites**

A: Downtown/Center Square/Lark/Washington Park East/Mansion/Pastures/Waterfront

Streets

- **Lark Street between Madison and Washington Avenue**
- Pearl Street between State and Clinton Streets (restaurants, downtown visitors, nightlife) (expensive)
- Swan Street between Madison and Washington Avenue (Legislator parking spots) (connect to Empire State Plaza, ESP)[1]
- State Street hill from Capitol to Broadway (including in front of 74 State) (expensive)
- Madison Avenue between Eagle and Swan Streets (connect to ESP)
- Willett Street along Washington Park (expensive)
- Lodge Street on block with County and State courthouses (expensive)

Institutions/Properties/Buildings/Lots

- **Albany parking garages (Columbia Garage 850 spaces, Quackenbush Garage 900 spaces, Green/Hudson Garage 900 spaces)**
- **Robinson Square Parking Lot at Robinson & Swan Streets**
- City Hall
- Hotel Albany Garage
- Federal Building Garage
- Capitol Building
- OGS parking garages (Empire State Plaza Main and East Garage, Madison Visitor, Elk Street, TU Center, 110 State, DEC)
- Trinity Church Parking Lot on Lark Street

B: New Scotland & Delaware: Hospitals/Pharmacy/Law/Medical/Park South

Streets

- **Delaware Avenue in front of The Spectrum**
- New Scotland Avenue in front of Quintessence

Institutions/Properties/Buildings

- New Albany Public Library - Delaware Branch parking lot or on-street space
- The Spectrum parking lots (independent movie theatre and several associated restaurants)
- Albany College of Pharmacy and Health Sciences
- Albany Law School
- Albany Medical College
- Albany Medical Center Hospital
- Albany Med South Clinical Campus on Hackett Boulevard

1 Will require New York State Office of General Services

- Wadsworth Center of the NYS Dept of Health (major research institution)
- Sage College of Albany
- Albany Academy (private primary/secondary school)
- Albany Public High Schools

C: Hoffman Park/FBI/NYS Thruway Authority HQ/NYS OGS Park and Ride

Streets

- McCarty Avenue or Hoffman Avenue in front of City of Albany/St. Rose sports fields (Hoffman Park)

Institutions/Properties/Buildings

- **McCarty Avenue OGS NYS Employee Park and Ride lot (669 spaces)**
- **Hoffman Park at North end of Hoffman Avenue**
- FBI
- NYS Thruway Authority HQ
- NYS Thruway Authority Maintenance, NYS Police, Signage Shop

D: Washington Park West/Madison and Western/UAlbany Downtown Campus/St. Rose

Streets

- **Madison Avenue between Western Avenue/Allen Street and Main Street (restaurants/business district, in front of police station)**
- State Street along Washington Park from Western Avenue to Lark Street
- Madison Avenue in front of Madison Theatre/Tierra Coffee

Institutions/Properties/Buildings

- **College of St. Rose (parking lots)**
- UAlbany Downtown Campus
- Price Chopper
- Inside Washington Park
- WAMC Park and Ride lot (318 Central Avenue)

E: Clinton Avenue & Broadway/Sheridan Hollow/Arbor Hill

Streets

- North Pearl Street in front of Palace Theatre

Institutions/Properties/Buildings

- **Church owned parking lot in front of Hampton Inn that serves Pearl Street, Palace Theatre and Capital Repertory Theatre (Cap Rep) customers**
- 17 Chapel Condos
- Palace Theatre
- Capital Repertory Garage
- Hampton Inn/Yono's Restaurant
- Albany Heritage Area Visitors Center and Planetarium/The Pump Station Parking Lot (Adjacent Quackenbush Lot –Albany Parking Authority 198 spaces)
- Sheridan Hollow Garage – NYS OGS facility

F: Northern Boulevard

Streets

- None

Institutions/Properties/Buildings

- New: Lofts At Bryn Mawr
- Albany Memorial Hospital
- Channel 10 News

G: Central Avenue West/Everett Road/Colvin Avenue

Streets

- **Russell Road (City owned roadway with on-street parking adjacent to Westgate Plaza, dance studio, county office buildings, etc)**

Institutions/Properties/Buildings

- Car Dealerships selling EVs: Armory, DePaula, Orange
- Strip malls: Westgate Plaza/Price Chopper and Hannaford Plaza

H: UAlbany/Harriman

Streets

- None

Institutions/Properties/Buildings

- UAlbany Campus faculty lots and/or visitor lots
- UAlbany NanoTech Complex
- **Harriman State Office Campus (forward thinking people, state fleets, state owned) (National Grid has a central 115 kVa supply)**
- Any hotel along Washington Avenue across from UAlbany/Harriman
- Patroon Creek office campus (SEFCU, Bone & Joint Center) and new apartments.

I: Washington Avenue Extension/Pine Bush

Streets

- None

Institutions/Properties/Buildings

- **Pine Bush Preserve Discovery Center (customer installation)**
- BBL (NYSERDA) corporate campus/Corporate Circle campus
- Townhouses and rental apartments at the end of Washington Avenue Extension

OTHER

- **Capital Hills (golf, walkers, snowshoeing, skiing, dog park)**
- Buckingham Lake Park (walkers in prosperous neighborhood, apartments nearby)
- (For current or future consideration because they are used extensively by city residents who may buy EVs: Stuyvesant Plaza--Guilderland, Colonie Center--Colonie, Crossgates Mall—Guilderland)

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Albany Electric Vehicle Feasibility Study

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