



ZERO EMISSION VEHICLE MUNICIPAL HANDBOOK

A Land Use Guide for Cities and Towns

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Executive Summary

The purchase and use of zero emission vehicles and high efficiency vehicles in the United States has increased rapidly over the past 15 years. From a market that was nearly non-existent in 2000, sales of high fuel efficiency vehicles have increased substantially, and in the last five years, Rhode Island has seen the number of Zero Emission Vehicles (ZEVs) grow to 691. These vehicles have access to 75 public charging stations in addition to home charging, which is much more popular. This handbook focuses on ZEVs, which are cars powered by one of several types of technology that produce no tailpipe emissions. Not only do many major automakers now offer plug in hybrid models for many cars, new companies have begun to make large and growing profits selling stylish and powerful battery electric vehicles for this growing market segment.

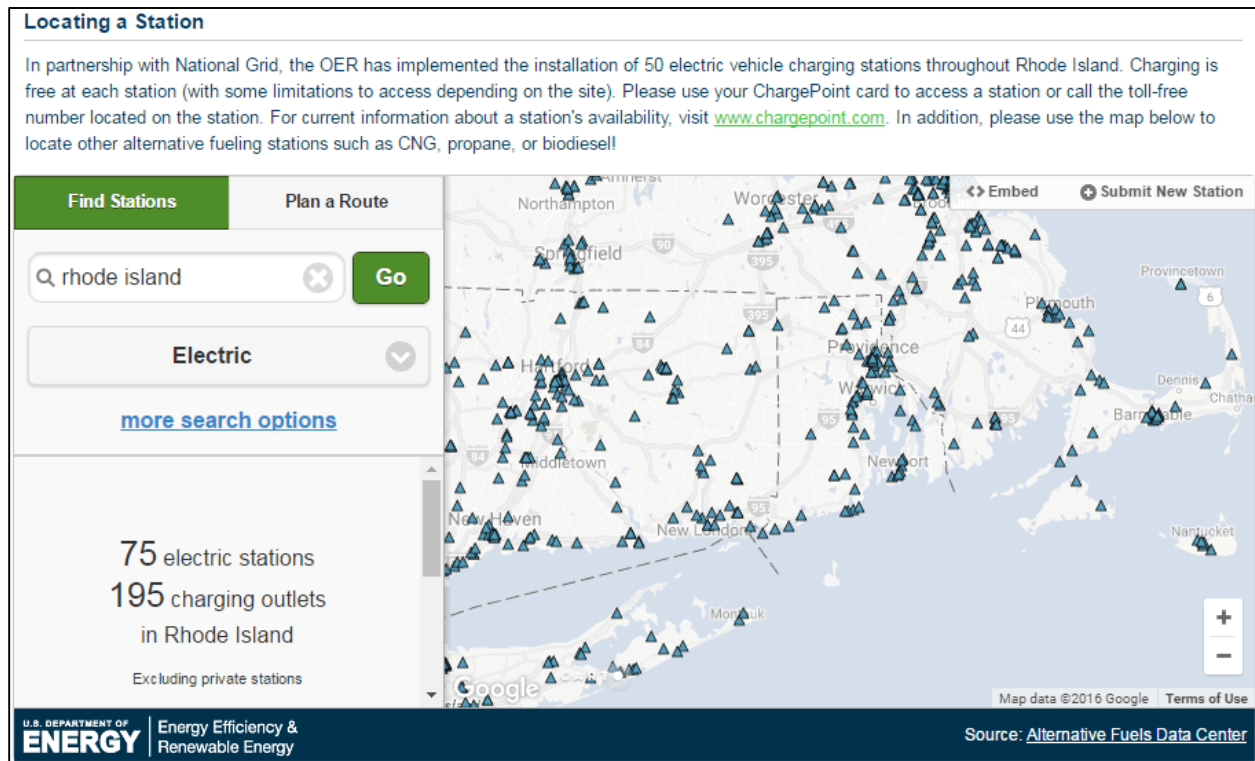
Rhode Island's cities and towns are uniquely positioned to plan for the continuing expansion of the Zero Emission Vehicle market. Though issues like building codes and utility regulation require state level action, the cities and towns of Rhode Island will have a disproportionate impact on the market uptake of ZEVs simply because local governments control parking and land use. Since many ZEVs need to plug in to the electrical grid to refuel, and because parking spaces are the most convenient places to charge, the design of parking is a crucial issue. Through the use of local ordinances and direct municipal land ownership, local cities and towns can help to create incentives to encourage the construction of charging infrastructure, the lack of which is currently an important disincentive to ZEV ownership.

In addition to discussions of the hows and whys of ZEV readiness in local ordinances, Appendix I provides model ordinances that a municipality might seek to implement in order to create ZEV readiness. Appendix II includes a reference section, which provides municipal planners additional resources for their research.

This handbook provides a variety of policy options that can be used together to provide drivers and land owners with the incentives they need to continue the expansion of Rhode Island's charging infrastructure. By removing obstacles and setting standards for parking design, land use, and driver behavior, the cities and towns of Rhode Island can begin to enjoy the economic and environmental benefits of ZEV use.

Introduction

Zero Emission Vehicles (ZEVs) can be defined as “Vehicles which produce no emissions from the on-board source of power.”¹ As of January 2015, 691 electric vehicles have been registered in Rhode Island. Overall, 13 manufacturers with at least 16 models are represented, giving Rhode Islanders a diverse selection of vehicles to choose from. With at least 6 more models slated to hit roadways within the next two years, it is expected that the demand for ZEVs will continue to climb.

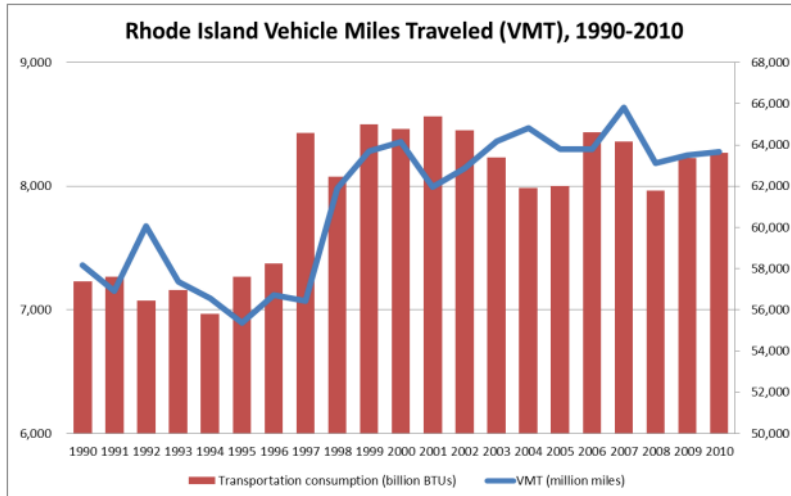


Source: OER

Figure 1: Current EV Charging Stations

These changes have the potential to provide great benefits for the State of Rhode Island. Economically, ZEV deployment would help Rhode Islanders achieve greater energy independence and save money. According to Rhode Island’s Office of Energy Resources, “annually, approximately \$1.4 billion is spent on transportation-related energy costs, consuming 64 trillion BTUs of energy and releasing 4.5 million tons of CO₂ into the atmosphere.” This is money that is removed from the state’s economy and from the residents of the cities and towns of Rhode Island. As the residents of Rhode Island continue to adopt the use of ZEVs, and drive down the purchase price, more and more of the money currently being spent on transportation will remain in state.

¹ California Air Resources Board



Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics

Figure 2: Rhode Island Vehicle Miles Traveled 1990-2010

for its size, a relatively low lying topography, and a coastally oriented settlement pattern, Rhode Island may see more than seven feet of sea level rise by 2100 according to current estimates. Given the large numbers of Rhode Islanders that live near high volume road ways and along the coast, it is very much in the best interest of the state to attempt to attain the environmental benefits offered by the widespread adoption of ZEVs.

While the growth of the ZEV market promises great environmental and fuel reduction benefits, attaining the widespread adoption of ZEVs presents some challenges for the current policy environment. ZEVs, by definition, rely on alternative new sources of power at the vehicular level. The most mature technology is seen in Plug in Electric Vehicles, referred to in this paper as Electric Vehicles (EVs), which use on board batteries to store power taken from the electrical grid. Due to the time required for fueling these vehicles, parking facilities are the most convenient location for charging infrastructure. Unfortunately, most current parking facilities do not have charging capacity. This lack has been one of the major factors reducing the desirability of ZEV ownership, resulting in fewer ZEVs on the road. In the past, the lack of ZEVs on the roads has in turn prevented the provision of charging infrastructure by the private sector.

As a result, the ZEVs in the State of Rhode Island are being serviced by a public charging infrastructure that has largely been built using government grants. By 2015, 75 charging stations had been installed using a combination of federal, state, and private grants. Rhode Islanders have charged up over 13,000 times at these chargers in less than two years. This shows that there is indeed a growing market for ZEV charging infrastructure, and private companies are beginning to make investments in this area. Still, more needs to be done to turn this market into an economically self-sufficient industry.

While federal, regional, and state sources clearly have an important role to play in this process, it is the local land use and zoning regulations that will be the most direct point of contact between society, drivers, and private developers. The cities and towns of Rhode Island are thus faced with both the challenge and opportunity of accommodating and encouraging new infrastructure as the ZEV market continues to grow. The primary purpose of this handbook is to aid the cities and towns of Rhode Island in understanding and meeting the challenges, and opportunities, of ZEV readiness.

From an environmental standpoint, ZEVs promise to improve air quality and reduce greenhouse gas emissions. While Rhode Island as a whole is currently considered to be in attainment of its goals under federal air quality standards, this is not necessarily the case in the areas immediately around high-volume roadways. In addition, Rhode Island is a state uniquely vulnerable to sea level rise caused in part by climate change related to the emissions of greenhouse gasses. With a very long coastline

Background

The State of Rhode Island has engaged in a number of regional initiatives to curb greenhouse gas emissions. Notably, on October 24, 2013 the governors of California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont signed a Memorandum of Understanding (MOU) with the stated goal of reducing greenhouse gas and smog-causing emissions and fostering energy independence by transforming the transportation sector.²

The MOU encourages states to undertake joint implementation of actions and programs, and to create individual state programs to address barriers in ZEV deployment and build a robust ZEV market. More concretely, the MOU states have agreed to a combined goal of 3.3 million ZEVs on the roads by 2025. Since the MOU signing, state regulators, the auto industry, infrastructure developers, and other stakeholders have shared information and best practices to help move this effort forward.

To meet these goals Rhode Island has engaged in a number of efforts. The Office of Energy Resources (RIOER) has developed the Rhode Island State Energy Plan (RISEP), to lay out the state's overall energy goals, and this in turn has become an element of the Rhode Island Statewide Planning Program (RISPP) State Guide Plan, with which all municipal comprehensive plans must be in conformity. RIOER has also led the working group that has published the Zero Emission Vehicle Action Plan. RISPP was a participant in the creation of the ZEV Action Plan and this handbook fulfills its commitments to that process.

What is a ZEV?

There are a number of technologies currently in use, and in development, to help reduce the emissions of cars. The industry has created terms to help identify and group these technologies together, but it should be recognized that, with the technologies changing all the time, these terms are not absolute. This handbook is focused on one of these general technological groupings, the Zero

Emission Vehicles (ZEV). A ZEV is one of the technology types that produce no tailpipe emissions. They are not absolutely pollution free, as the power that runs them has to come from somewhere, but on the level of the vehicle itself there are no harmful airborne emissions. Two technology types that currently meet this criteria include: Electric Vehicles (EVs), and Fuel Cell Electric Vehicles (FCEVs).



Source: OER

Figure 3: A Prototype Fuel Cell Electric Vehicle, a type of ZEV powered by hydrogen.

² This document may be viewed online at the NESCAUM website:

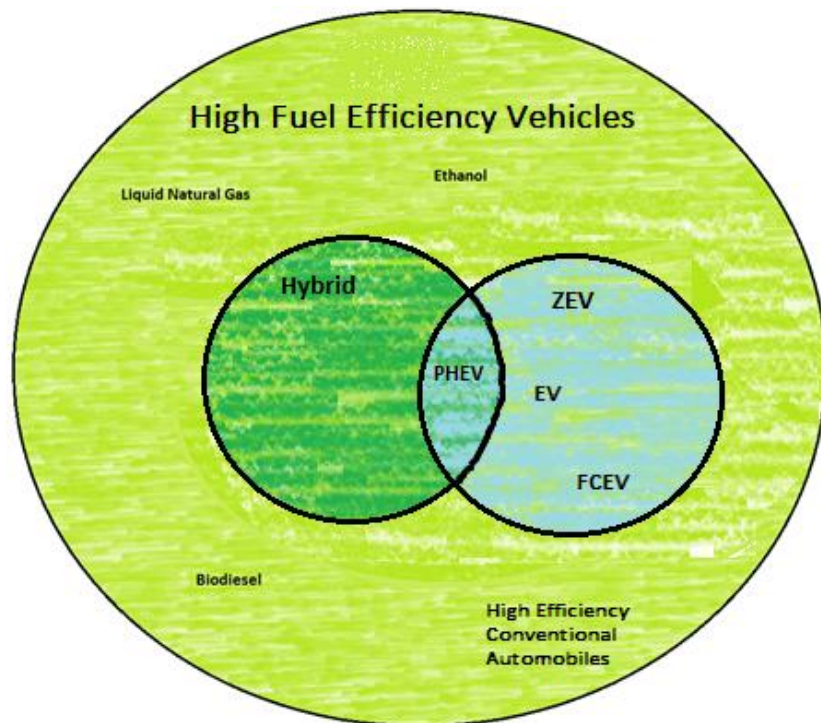
<http://www.nescaum.org/documents/zev-mou-8-governors-signed-20131024.pdf/>

Electric Vehicles (EVs)

EVs are powered by plugging the vehicle into the electrical grid. The electricity is stored in batteries and powers an electrical motor. This group of technologies includes Plug in Hybrid Electric Vehicles (PHEVs).³ Getting power from the electrical grid to the EV's batteries can take a varying amount of time, although new technologies are speeding up the process. For now, charging an EV can take anywhere from a few minutes to twenty-four hours. How long any one charging session will last depends on the "level" of charger used, how depleted the vehicle's batteries were, the type of charging technology used, and the size of the batteries.

Fuel Cell Electric Vehicles (FCEVs).

FCEVs contain an electrical motor, but rather than being powered primarily by stored electricity, the vehicle contains a plastic membrane, called a fuel cell, which allows stored hydrogen to react with airborne oxygen in a controlled chemical reaction. The fuel cell harvests the energy from the reaction, and the electricity runs the electric motor. The only direct byproduct is water. FCEV technology shows a lot of promise, particularly because fueling the vehicle with hydrogen at a fueling station could replicate current driver behaviors. Unlike the long charge times currently required for EVs, FCEV vehicles can be fueled at a fueling station in as little as five minutes. As a result, the current gas station infrastructure could be adapted to serve this technology, and drivers would not have to adapt to the idea of fueling their vehicle at home.



High Fuel Efficiency Vehicles

There are a wide variety of other technologies that also

offer improvements over conventional automobiles, which can generally be grouped together as high fuel efficiency vehicles. These vehicles generally burn some sort of fuel for either direct mechanical power, like a conventional automobile, or for electric power, as is the case with hybrids. Either through increased engine efficiency or through cleaner burning fuels, these technologies present significant

Figure 4: High Fuel Efficiency Vehicle Types.

³ PHEVs are primarily powered by stored electricity, and can be charged by connecting to the grid, but also contain gasoline engines that serve to recharge the on-board batteries in situations where the vehicle is in danger of running out of power. Because most Americans drive less than the battery range of PHEVs in an average day, and because the substantial deployment of charging infrastructure would make it even less likely that the gasoline engine would be required, PHEVs are considered functionally the same as EVs in most situations.

improvements over conventional automobiles. Generally, wide adoption of high fuel efficiency vehicles would allow consumers to achieve large emissions reductions while still using a modified version of the current fueling infrastructure. The fact that there are still some direct emissions means that high fuel efficiency vehicles, while a net positive over conventional technologies, are not as desirable as ZEVs. Many municipalities seek to incentivize the entire high fuel efficiency market, rather than focusing only on ZEVs, when instituting priority parking programs. For the purposes of this handbook, high fuel efficiency vehicles can be considered those vehicle models that are LEED Qualified according to American Council for an Energy-Efficient Economy (ACEEE),⁴ or which holds a SmartWay Certification from the US Environmental Protection Agency (USEPA).⁵

Components of ZEV Parking Infrastructure

Though there are many areas where local governments could impact the deployment of ZEV technologies, the land use regulations of the local parking infrastructure has potentially the largest impact on consumers. This potential is due to the technological requirements of EV vehicles and because parking presents the opportunity to incentivize ZEV deployment at little or no cost to the public. This infrastructure can be created in both public and private spaces.

ZEV parking infrastructure can be broken down into two types that serve different functions. ‘Charging Stations’ are parking spaces provided with a source of power that will allow an EV to charge their batteries. The primary purpose of these parking spaces is to provide power to the vehicle and alleviate range anxiety. By contrast ‘Priority Parking Spaces’ are normal parking spaces located in an advantageous position and intended for use only by EVs or other vehicle classes. The main purpose of priority parking spaces is to give drivers an incentive to drive vehicles that benefit the public at large. These two types of infrastructure can also interact to magnify the incentives created.

Public Vs Private Parking Infrastructure

An issue that often confuses discussions of parking and land use is the role of private property in the creation of parking infrastructure. There is not a clear delineation of authority over the creation and management of these spaces, and this makes it hard for members of the public, or even members of governmental bodies, to understand what role local government plays in managing parking policy. As we will see, there is a clear role for government to play, and the way authority over parking is shared creates opportunities for governments seeking to create ZEV friendly parking policies.

In most places in Rhode Island, the vast majority of parking occurs on privately held land. Though these spaces are often treated as public space by members of the public, a tendency exacerbated by the presence of regulatory traffic signs, they are in fact private property and are governed as such. Simply put, on private property all traffic and on-site parking regulation is overseen by the land owner. Public authorities cannot generally intervene on issues relating to traffic and parking regulation unless invited by the land owner. So, if a driver were to improperly park in a privately owned lot, they would only be prosecuted if the owner of the store had the vehicle removed.

⁴ A list of these models is maintained by the ACEEE affiliate organization, Greenercars.org. As of 2016, the list can be found online at <http://www.greenercars.org/news/list-leed-qualified-cars>

⁵ The USEPA maintains a list for each model year at <http://www.fueleconomy.gov/feg/download.shtml>

Despite the importance of private infrastructure in the parking landscape, municipal ordinances set much of the form and context of parking regulation. This is done in three ways: through land use regulations, by defining specifically what actions constitute a crime, and by conditioning the public to treat those actions as criminal via enforcement in publicly owned facilities.

Land use regulations set much of the form and signage present in privately owned parking lots. Such ordinances often stipulate the amount of parking, the form that the parking lot must take, the amount of parking set aside for disabled patrons, and the required types of signage in the parking lot. Developers work with municipal staff to get to a final design that is acceptable to the public. Ultimately it is in the best interests of both the land owner and the public to have parking areas with smoothly flowing traffic that are not a threat to public safety. To ensure this happens, the municipal government helps to determine what signs and regulations are represented to the public in private parking lots, while the actual construction and enforcement of those regulations is carried out by the land owner.

As a result a land owner can choose to enforce or not enforce these regulations, so long as the built form of the lot conforms to local ordinances. Conversely, the land owner can choose to enforce



Figure 5: An example of regulations established by a landowner and not by ordinance

additional regulations, for example by creating reserved parking spaces for individuals or groups not legally protected. So long as these rules do not violate local, state, or national law by being discriminatory, the land owner is fully within their rights to have an offending vehicle towed, for the same reason a business owner can refuse service to those inappropriately dressed. While appropriate behavior may be in the eye of the beholder, the land owner is allowed to determine such standards on his or her property.

The establishment of guidelines for behavior in parking lots is an important public benefit. Municipal ordinances relating to signage design, enforcement, and consequences, help both members of the public and land owners by creating a

non-arbitrary system of enforceable behaviors. Because municipalities establish ordinances that specify what parking and traffic behavioral regulations have the force of law, the public knows to stop at stop signs and not park in handicapped spaces, and they are less likely to blame the land owner for involving the police in instances where these norms are violated. Other regulations, such as those reserving spaces, are often respected by the public because they are perceived as an extension of other parking laws.

An important part of establishing these norms involves the use of public parking. Truly public parking refers to those parking spaces that are on property owned and operated directly by the municipality.

Usually this refers to street parking spaces but can also apply to publicly owned lots. The regulations in such areas are directly enforced by the police, and as such the behaviors expected in such areas become the norms that the public expects to follow in all other parking areas. Usually the regulations employed in such areas are directly set by municipal ordinance. This gives the managers of such parking infrastructure reduced flexibility, but also helps set very clear rules for the public.

To summarize, parking norms are created as a result of municipal ordinances and regulations, both in terms of what constitutes an offense and in terms of the creation of social norms via direct enforcement of regulations on public parking spaces. These norms carry over to private parking spaces, where the basic regulations required are instituted by land use ordinances but enforcement is left to the land owners. Most of the parking in the United States takes place in private parking lots, and so the majority of this hand book is directed at altering infrastructure and behavior in private lots. Though direct construction and enforcement in these lots is not in the hands of the municipality, ordinances can change land use patterns over time, alter the stated enforceable offenses, and alter social norms by changing enforcement in public lots. This creates numerous opportunities for municipalities to alter behaviors and catalyze the creation of ZEV parking infrastructure without the direct expenditure of public funds.

Charging Stations

All EVs require an external source of electrical power to charge their batteries. Parking spaces supplied with the equipment necessary to connect an EV to the electrical grid are called “Charging Stations.” Though in some sense such spaces are fueling stations, the function and use of a charging station differs considerably from that of a conventional fueling station. From the point of view of the consumer, the biggest difference between the facilities is the time required to charge an EV at a charging station, which is considerably longer than the amount of time it takes to put gas in a conventional automobile. Though the length of time required for any individual fueling stop varies based on a number of factors, the biggest single factor affecting charging time of an EV is the ‘level’ of charger used for charging. The “level” of a charger relates to the amount of voltage the charger puts into the vehicle based on standards developed by the Society of Automotive Engineers.⁶

- **Level 1 Charging: 2 to 5 miles of range per hour of charging time**

Level 1 chargers are 120 volt chargers with the same power output as a standard home wall outlet. Most modern vehicles will allow a driver to simply plug a standard extension cord from the vehicle into a wall outlet, or else an adapter will be provided with the vehicle. It is generally recommended that the outlet in question be on a dedicated circuit, and some older models require a more substantial piece of equipment be



Source: USDOE

Figure 6: Most EVs can be charged at a standard wall outlet, but not quickly.

⁶ This same group has largely standardized plug design to ensure that most EVs are able to charge at most chargers, though some work remains to be done on this issue.

installed, but in most situations these modifications can be done with limited electrical experience and equipment. If a parking area is not provided with any kind of outlet, installation costs can be more substantial. As a general rule of thumb, the further from the circuit breaker, the higher the cost of the installation. Much of this cost can be avoided if the installation of the circuit is done while the structure is being built. Because Level 1 charging involves a fairly low transfer of electricity, this category of charging is usually the easiest to implement, but takes the longest to recharge the vehicle's battery. Level 1 is a good solution for home charging and for workplace charging with longer dwell times.

- **Level 2 Charging: 10 to 30 miles of range per hour of charging time**



Source: RIOER

Figure 7: Level 2 Charger located at Brown University

Level 2 chargers deliver voltages of up to 240 volts, double the power output of a standard home wall outlet. Residential chargers generally cost around \$600.00 per unit, not including installation, while commercial chargers can cost up to \$6,000.00 due to the need for more advanced information based technologies. Level 2 chargers require a special, dedicated circuit and some specialized knowledge and equipment to install. Since 240 volts is roughly the same power level used by a standard home clothes drying machine, the installation is within the expertise of any professional electrician. As with Level 1 chargers, installation costs can vary widely based largely on the circumstances of the installation.

Level 2 chargers are very versatile. Though not necessarily appropriate for a driver attempting to refuel on a long road trip, the relatively faster charge time makes a Level 2 charger useful for some commercial properties while still being affordable enough to be within reach of residential application.

- **Level 3/DC Fast Charging: Fully charges most vehicles in 30 minutes or less**

Currently providing around 480 volts, fast chargers provide large amounts of charge very quickly. Though still not as convenient as pumping gas, fast charging happens quickly enough for a driver to fully charge a vehicle while utilizing a rest stop without inconvenience. The tradeoff is that fast chargers are very expensive. While some units start as low as \$7,000.00 (with \$10,000.00 per unit being a more reasonable median cost), they require highly sophisticated technology whose installation requires the services of highly trained professionals. As a result, as much as two thirds of the cost of adding a DC fast charger may lie in the labor, permitting, and installation costs, rather than the equipment itself.



Source: pluginamerica.org

Figure 8: Fast chargers are fast but expensive to install.

Due to the above factors, fast chargers are generally inappropriate for home use. For commercial uses, particularly at highway business locations and at large retail establishments, DC fast charging is ideal. As technology advances newer and faster chargers are being developed, and a fourth level of charging may be added in the next few years. For now, all these technologies are included in the term “DC Fast Chargers.” At one time these technologies were described as “Level 3,” but that is no longer the preferred term.

The relatively longer charging times required by EV technology mean it is most convenient to charge this type of vehicle while it is parked rather than pausing on a trip. Several surveys of ZEV users in California have shown that the majority of charging is done at home or at the workplace. This pattern of charging represents a fundamental reversal from the way most drivers are used to fueling their vehicles, and requires a different kind of infrastructure to be added to the urban environment. The lack of this infrastructure has been one of the primary contributing factors to the slow growth of the EV market, due to a concept known as “range anxiety.”

Range anxiety is the stress caused when a driver is worried that they will be stranded due to running out of fuel. Though it is experienced by drivers of conventional vehicles, the short duration of fueling and the ubiquity of gas stations in urban areas does much to alleviate the fear. For drivers of ZEVs this fear is magnified and acute due to the relative absence of appropriate fueling infrastructure. Most public places do not carry the alternative fuels used by many ZEV technologies, while most parking lots are not outfitted with consumable electrical power. Even when outlets are available, the long charge times for EVs from a standard outlet could mean that a driver who loses charge and is unable to find a higher level charger could potentially spend an entire day refueling.



Source: U.S. DOE

Figure 9: Public Charging Stations

From a logical standpoint these are not fatal issues. Most vehicles do not drive further in a day than the standard range of a current EV, meaning that most drivers will not run out of charge in an average day’s driving. Since most vehicles spend far longer parked than they do on the road, and even Level 1 charging will fully charge most vehicles in a night’s charging, a driver that charges at home and at work will be unlikely to ever run out of charge. Still, drivers are used to having easy access to gas stations, and having to plan out their charging adds complexity to travel that many do not relish. Numerous studies, from inside and outside the auto industry, have shown this to be the biggest single concern voiced by consumers considering the purchase of an EV. This creates a self-defeating cycle where infrastructure is not built, so consumers do not buy the vehicles they want, so there is no perceived demand for infrastructure.

This cycle has already begun to break. The success of EVs in California and internationally has shown that there is a market for EVs when infrastructure is provided, and so a variety of federal, state, local, and nongovernmental actors have begun efforts to create a basic national infrastructure. There are already 75 publicly accessible charging stations in Rhode Island that have begun servicing the 691 EVs on the road as of 2015, and the number of EVs is growing. As the number of EV users continues to grow it will become easier for private industry to justify the creation of new infrastructure, but local

governments still have a clear role to play in the process of creating regulations to promote visible, attractive, and functional public charging infrastructure to help reassure consumers.

Priority Parking Programs

Priority parking programs seek to incentivize the use of lower emission vehicles through the deployment of incentives. These programs do not provide any physical infrastructure beyond a standard parking space, but they give advantages to drivers of vehicles with reduced emissions by reserving choice spots. Because the types of vehicles involved are established by fiat rather than by the physical requirement for a piece of infrastructure, such programs allow municipalities a great amount of flexibility. Most priority parking programs currently target the larger group of high fuel efficiency technologies rather than the relatively smaller ZEV market. This allows communities to incentivize pollution reductions while still allowing a more substantial portion of the driving public to take advantage of the benefits. As ZEVs come to represent larger and larger portions of the market, the number of communities targeting ZEVs alone may start to rise as well.



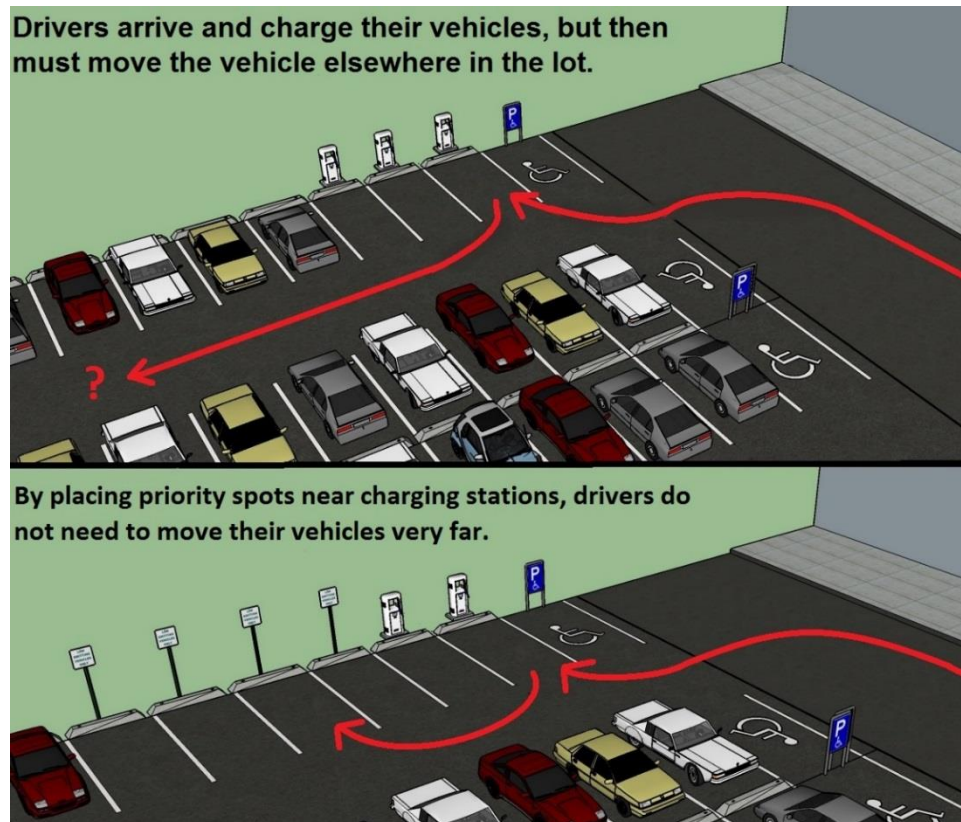
Source: Yuba College, California

Figure 10: Sign for a high fuel efficiency parking space.

The incentive deployed by these programs is also fairly flexible. Non-monetary incentives consist of prized parking spaces reserved for high fuel efficiency vehicles or ZEVs. In addition to making the trip to and from the vehicle more convenient, such programs also showcase high fuel efficiency vehicles and ZEVs as a desirable or admirable vehicle to own. Monetary incentives can also be deployed by communities that charge for parking by providing discounted or free parking to drivers of high fuel efficiency vehicles or ZEVs.

Policy Interactions

Though charging stations may seem to be the only really required piece of ZEV infrastructure, charging stations and priority parking programs are complementary concepts. Though charging stations do



have the ability to act as a non-monetary incentive, charging stations are relatively expensive compared to a normal parking space, which limits the number that can be created. Additionally, charging stations should be used only by vehicles actively charging, to allow the maximum number of EVs to be fueled. This will undermine their value as a parking incentive. A driver may be happy about getting a spot at a charging station close to the door on a busy shopping day, but when that driver has to leave the store twenty minutes later to move the vehicle out of the charging station, this happiness may be dampened. Having priority parking spaces located nearby will mean that the driver is not forced to move their vehicle all the way to the back of the lot. Having one or two charging stations next to a larger number of priority parking spaces might be preferable from a driver's perspective to having a larger number of chargers, and would likely be much cheaper for the developer.

Achieving Readiness for ZEVs in Land Use and Parking Policy

The creation of charging and priority parking infrastructures would make great strides to encourage the drivers in Rhode Island to adopt ZEV technologies. Though the direct installation of this infrastructure is laudable, the cities and towns of Rhode Island cannot do this on their own; ultimately private industry is going to need to want to deploy this infrastructure. This handbook was created to help municipalities and developers to install this infrastructure by establishing appropriate ordinances. The steps of this process can be broken into four parts: Barrier Elimination, Parking Design Standard Setting, Land Use Standard Setting, and Behavioral Standard Setting. The design of public parking infrastructure will play a role in the realization of these efforts.

Barrier Elimination

In most municipalities there are few obstacles to implementing ZEV parking infrastructure. Nonetheless, a careful analysis of regulations to find and eliminate disincentives to ZEV infrastructure is the first step toward encouraging ZEV uptake and breaking the range anxiety cycle.

One of the biggest barriers to ZEV infrastructure installation is often the variety of permit requirements property owners must go through in order to undertake this relatively minor construction project. Some of this is simply the result of the internal processes of a municipality, and so corrective steps can be taken without relying on an ordinance. The creation of special, streamlined permits for charger installation can help ensure that the health safety and welfare of the public is protected while still making the creation of ZEV infrastructure much easier.

At least some of the obstacles faced by property owners seeking to install ZEV infrastructure can come from the ordinances, or the ways those ordinances are interpreted. Some property owners have faced situations where chargers were being interpreted strictly as fueling stations, and thus saw all chargers banned from residential zones. Other property owners seeking to install chargers have been asked to build the type of infrastructure one would see in a gas station, such as extreme lighting and fire suppression apparatus, despite the fact that the charger was not open to the public and contained no explosive fuels.

BARRIER ELIMINATION KEY POINTS

Streamlined permitting for charger installation.

Clarify that chargers are not gas stations.

Ensure that charging stalls count towards total parking space requirements.

As a result, one of the first steps a city or town seeking to be ZEV ready should undertake is clarifying the status of ZEV infrastructure within the regulations. Often this can be done internally, by clarifying to staff that chargers are distinct from gasoline fueling facilities, but many municipalities have made it a point to spell this out.

Ordinance 17.63.030 of the City of Chelan, Washington presents an excellent example of the issues a planner might want to address at this stage.

17.63.030 Where permitted.

A. Level 1 and 2 electric vehicle charging stations are a permitted use in all zoning districts.

B. [DC fast] charging stations are a permitted use in the Warehouse and Industrial (W-I), Highway Service Commercial (C-HS), and Public Lands and Facilities (P) zoning districts, but require a conditional use permit in Downtown Mixed Use (DMU), Tourist Accommodation (T-A), Special Use District (SUD) and Waterfront Commercial (C-W) zoning districts.

In this case, Level 1 and 2 chargers are allowed in a blanket statement in all zones. Other municipalities limit this use to only those chargers intended for private use to avoid lighting and access conflicts. DC fast chargers are much more restricted, as befits their complexity, expense, and potential use as a more conventional public fueling station.

One final common disincentive to the construction of charging infrastructure relates to parking requirements for new developments. As a result of their use as a fueling station, some municipalities have refused to count charging stations or priority parking spaces towards the minimum parking requirement for a property. As a result, developers are forced to build an extra conventional parking space for each charging space they construct, adding significantly to the cost of each charging space. To avoid this, ZEV ready municipalities have clarified their zoning ordinances to permit the inclusion of charging stations towards the total constructed parking on a property. This is a fairly simple fix, and again the City of Chelan, Washington, provides a good example:

17.63.050 Minimum parking requirements.

Electric vehicle charging stations located within parking lots or garages may be included in the calculation of the minimum required parking spaces required pursuant to the Development Standards, Section 9.

Parking Design Standard Setting

ZEV technology is new and often not fully understood. The creation of standards of design can encourage developers and members of the public by providing clear guidelines. These guidelines should describe the elements of design and construction necessary to ensure the health, safety, and welfare of those using or constructing ZEV infrastructure, while leaving room for new innovation.

Standards for the Charger

Though charger technology is in a constant state of innovation, some basic elements are likely to be important for the entire life of the technology, and so some guidelines can be suggested. Kane County, Illinois, Ordinance 1.3.01.B.1. covers the basics:

e. Charging Station Equipment. Charging station outlets and connector devices shall be no less than 36 inches and no higher than 48 inches from the ground or pavement surface where mounted, and shall contain a retraction device and/or a place to hang permanent cords and connectors a sufficient and safe distance above the ground or pavement surface. Equipment mounted on pedestals, lighting posts, bollards,

or other devices shall be designated and located as to not impede pedestrian travel or create trip hazards on sidewalks.

f. Charging Station Equipment Protection. Adequate charging station equipment protection, such as concrete-filled steel bollards, shall be used. Non-mountable curbing may be used in lieu of bollards, if the charging station is setback a minimum of 24 inches from the face of the curb.

In general, ordinances should require the charger screens and cables to be located at a convenient height for public use and be so constructed that, when properly used, the cables are not dragging on the ground where they can be damaged. The charger itself should ideally be protected from the usual minor damage that can occur to objects around parking spaces. There are a variety of public charger construction options that meet the needs of the public, and so the ordinances should be written to allow for a variety of types while still ensuring the basic requirements of usability and durability.

Signage is another key issue for charger site design. There is potentially a large amount of information the public would want to know about a charger, and it is important to avoid overwhelming a potential user. Kane County, Illinois, again summarizes the basics:

- a. Signage. Each charging station space shall be posted with signage indicating the charging station space is only for use by electric vehicles for charging purposes. Days and hours of operations shall be included if time limits or tow away provisions are to be enforced.
 - b. Maintenance. Charging station equipment shall be maintained in all respects. A phone number or other contact information shall be provided on the charging station equipment for reporting purposes when the equipment is not functioning or other equipment problems are encountered
- [...]
- g. Usage Fees. An owner of a charging station is not prohibited from collecting a fee for the use of a charging station, in accordance with applicable State and Federal regulations. Fees shall be prominently displayed on the charging station.

As does the City of Chelan, Washington:

B. Signage. Each electric vehicle charging station shall be posted with signage indicating the space is only for electric vehicle charging purposes. Signage shall include items contained in subsection F of this section. Way finding signs conveniently located to guide motorists to the charging stations are permitted with approval of the planning department.

F. Notification. The following information shall be posted at all electric vehicle charging stations:

1. Voltage and amperage levels;
2. Hour of operations if time limits or tow-away provisions are to be enforced by the property owner;
3. Usage fees;
4. Safety information;
5. Contact information for reporting when the equipment is not operating or other problems.



Source: Kane County, IL.

Figure 12: Examples of Signage Design

Kane County, Illinois, then, would have a typical public charging station posted with two official signs: One indicating that the parking space is for EV use only, and one indicating the length of time a driver may park in the space. The station is also required to have pricing information, and a phone number for reporting problems located somewhere on the charger. Whether this is physically on the charger itself or on a third sign is left vague. The City of Chelan addressed many of the same concerns (with the addition of safety and amperage notification), but draws a distinction between signage and notification. The information on the signs will be intended for passing motorists, while other notifications are intended only for the user of the charger. For example, a passing motorist not driving an EV would want to know that it is illegal to park their vehicle in that space. The phone number for reporting maintenance issues would be inappropriate for a similar kind of signage, but would be important information for the user of the charger. On the other hand, there is grey area here. Would a passing motorist want to know the charging fee rates? Possibly, but not necessarily, and so it is left up to the land owner to determine what is best.

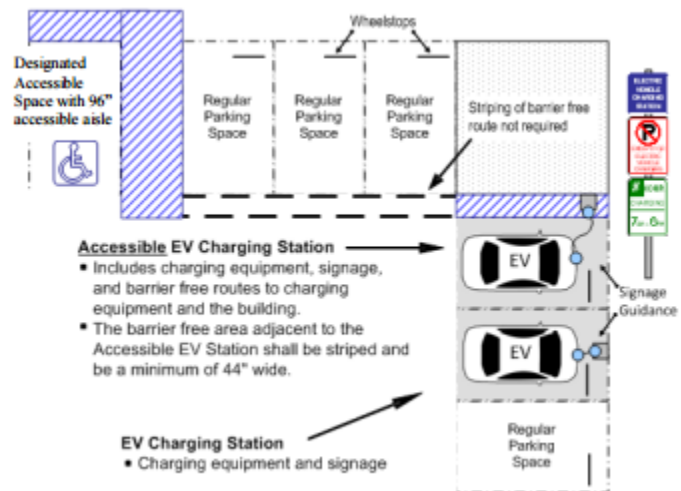
Standards for Space Design

Most aspects of space design are relatively straight forward. For both charger spaces and ZEV priority parking spaces, the physical size of the parking space should be the same as that of standard parking spaces. Whatever size regulations work for a standard automobile will work for ZEVs. Similarly, the lighting provided in a lot with chargers and priority parking spaces should be the same as that provided for standard parking lots in the municipal ordinance. The types of lighting required for gasoline fueling stations are inappropriate for charging spaces, and enforcement of such standards would create an unnecessary conflict between ZEV infrastructure and other uses. Municipalities with ordinances encouraging low-light pollution site design may want to encourage the placement of chargers near lighting features if those chargers are going to be open to the public at night.

Standards for Lot Design

The location of charging and ZEV priority parking spaces within a parking lot can have a lot of grey areas, and planning staff should carefully consider their choices when creating site designs. In general, the preference in site design guidelines is for charging spaces to be located near the building entrance, as seen in the ordinance of Chelan, Washington:

2. Accessible charging stations shall be located in proximity to the buildings or facility entrances and shall be connected to a barrier-free accessible route of travel.



Source: Kane County, IL

Figure 13: An example of stall and lot design

This allows the charging stations to provide a non-monetary incentive to EV drivers, who benefit from more desirable parking spaces.

However, municipalities that are creating a ZEV priority parking program may want to consider whether such issues apply. Since a charging space's core function is to charge EVs, while the core function of a priority parking space is to provide a non-monetary incentive, planners may decide to maximize the

incentive power of the priority spaces by placing them closest to the building's door, while loosening standards for charger placement.

There are several additional reasons not to be overly strict about charger placement within a lot. Placing chargers further back in the lot may reduce the number of illegal parking infractions that take place in the spaces. Such infractions reduce the efficiency of the space by preventing potential users from accessing the charging equipment, costing the land lord money in the form of charging fees and increasing the possibility of range anxiety. Placing charging spaces in a less desirable location may prevent such issues.

Another good reason not to insist on the location of charging spaces in the immediate proximity of the door is the practicalities of charger construction and power. Chargers do not always get their power from the building that they are servicing, instead taking power directly from more high capacity power lines in the street. Allowing developers to reduce the cost of installation would encourage infrastructure development. Some developers may even want to maximize the value of their investment by powering it with a solar panel structure. Such structures can help draw attention to the presence of the charging facility, contribute to the positive public relations of the developer, reduce the costs of powering the charging stations, reduce reliance on fossil fuels, and even reduce the heat island effect of the parking lot. Due to such structure's reliance on direct sunlight it is usually inappropriate to place them directly next to a building, as the building's shadow might impede their proper functioning. As such, developers interested in using such technologies would have good reason to place their charging stations away from the building entrance.

In general, charging stations should be placed near entrances, but not closer than priority parking spaces, and ordinances should make allowances for various methods of powering the chargers. These guidelines are complicated by the need to respect ADA standards

ADA Compliance

Per federal and state law, handicapped accessible facilities should always be available to allow those with mobility challenges to enjoy the same transportation infrastructure benefits as their neighbors. As the benefits of owning ZEV vehicles become more manifest it is similarly incumbent on planners to incorporate accessibility requirements into design guidelines, though it is not yet a strict legal requirement.

The first and easiest factor to take into account is that handicapped parking spaces should be the closest spaces to the door, regardless of the presence of charging spaces or ZEV priority parking facilities. Ordinances developed in accordance with the previous section should be clear that they do not override the precedence currently given to handicapped parking facilities in federal, state, and local law. To put that another way, charging spaces



Fashion Island Shopping Mall, Newport Beach, CA.
Photo by LightMoves.

Figure 14: An ADA Accessible Charging Stall

and ZEV priority parking should in turn be located just beyond the handicapped parking spaces.

Accessibility standards should also be taken into account in site design standards for charging and ZEV priority parking facilities, as seen in the ordinance for Kane County, Illinois:

C. Accessible Charging Stations. It is strongly encouraged, but not required, that a minimum of one (1) accessible charging station be provided. Accessible charging stations should be located in close proximity to the building or facility entrance and shall be connected to a barrier-free accessible route of travel to and from the building or facility. It is not necessary to designate the accessible charging station exclusively for the use of disabled persons. Below are two options for providing for accessible electric vehicle charging stations [referenced image is figure 13].

These issues have not yet been tested in court, but it would be a best practice to ensure that at least one charging space is handicapped accessible. As described in the Kane County ordinance, this requires clear areas to one side of a parking space and an accessible route to the building entrance. A fuller description of the current design standards for accessible parking spaces can be found in Chapter 5, section 502, of the 2010 ADA Standards for Accessible Design, published by the Justice Department.⁷ It will probably not be possible in current conditions to count the provided handicapped compliant charging space towards a land owner's required number of handicapped spaces, as it would be inappropriate to limit parking at the space to the very small number of handicapped drivers of EVs. As a result it is not currently advisable to mark accessible charging stalls as "handicapped only." It is likely that as the market for EVs grows, this situation will change, so the careful composition of ordinances to allow the future designation of handicapped charging spaces would be a good idea for the forward thinking planner. A best practice would be to set aside the same portion of charging stations to be handicapped charging stations as normal parking spaces, but only in facilities with large numbers of charging spaces.

Site Design Standards

Though many site design standards are universally applicable, the different types of land use that exist in any community will require slightly different standards. This section will discuss these differences, and when these differences should be written into the zoning ordinances.

Residential

The vast majority of charging is currently done at home using inexpensive, Level 1 chargers. As vehicle batteries become larger, an increasing number of private users are investing in the convenience of a Level 2 charger. Though both types of



Figure 15: Most charging will take place at home.

charger fit easily into residential facilities, the fact that most charging happens in this context means that small improvements to residential ordinances will have large benefits in terms of the ease with

⁷ Available online at: <https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards.pdf>

which the consumer can adapt to EV technology. Planners should consider a variety of housing types and densities with a variety of parking facilities, but some key features should be taken into account in all residential zones.

Charging Level

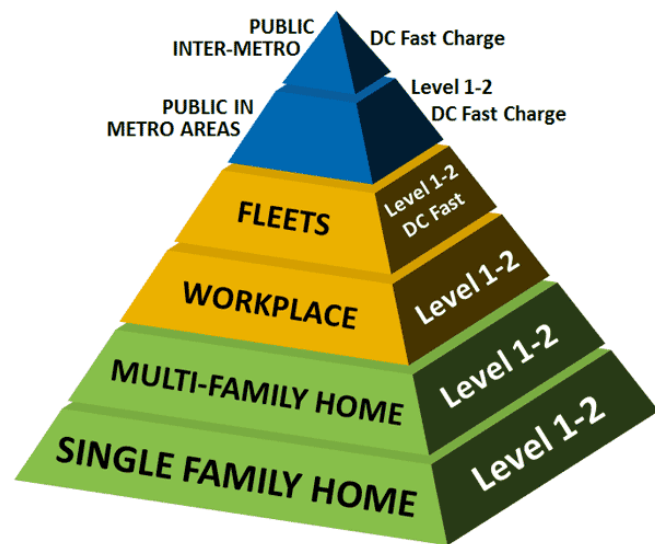
In most residential developments provision need only be made for Level 1 or 2 charging. This holds true for any development where the unit will have a dedicated parking space, either through the provision of a garage or parking structure or in the form of assigned parking. Developments with communal parking lots may need to function more like a commercial development, with higher level chargers and time limits on charger use. In any case, Level 1 or 2 charging should be a by right use, and DC fast charging should be discouraged except in high density zones.

Access

Where practical, access should be limited to private residents in residential zones. This will ensure residents have access when desired, and prevent the development of traffic to commercial fueling facilities in residential neighborhoods. Such an eventuality could create unnecessary conflicts between charging infrastructure and local residents. This provision may not be necessary in multifamily zones, and would likely be counterproductive in mixed use or downtown zones. Municipal officials must use their professional judgement to balance the benefits of public access with the potential for use conflicts. As a general rule, if a location already has high traffic and medium term parking, public access is unlikely to create conflicts.

Minimum Provisions

Developers should not generally be asked to provide a physical charger in a residential development, with the possible exception of high density developments with communal parking. In most cases this would be an unnecessary imposition on the developer. Instead, regulations should be written to make newly developed properties ZEV ready. Parking structures and garages should be built with dedicated circuits already in place, so that residents or land lords will not have to undertake major renovations to install them later. In many cases this kind of retrofit can be as much as five times more expensive to install later than it would have been if installed during the initial construction of the structure. As such, the cost to the developer of a new property is minimal, would likely increase the value of the property even for users without electric vehicles, and would save future users of the property significant frustration and expense.



Source: New York State Energy Research and Development Authority

Figure 16: There are a number of broad guidelines for what land use is appropriate for what level of charging.

Non Residential

While home charging is the most common, public charging facilities are the most visible, and will do the most to calm range anxiety issues. As ZEV adoption increases, market forces will organically encourage construction of ZEV infrastructure. Nonetheless thought should be given early to what level of charging is appropriate for the types of land use in any given city or town.

Charging Level

Lower levels of charging are appropriate for different land use types based on the expected behavior of its users. Facilities such as hotels might be able to utilize Level 1 chargers, but most office, industrial, and warehousing land uses will require Level 2 facilities at a minimum. In these instances the lower level chargers are sufficient because the employees of the facilities are likely to be parked for several hours while they are at work, and so higher level charging, which would require the employee to leave work and move their vehicle after it had finished charging, would be inappropriate. By contrast, commercial, retail, entertainment, and highway business facilities would require high level facilities. Drivers will want their vehicle to be charged when they are done shopping, and so shorter charge times will better reflect the common usage of these facilities. Additionally, higher level chargers tend to come with more attractive aesthetic features, which will help raise public awareness. Zoning ordinances should take these issues into consideration when determining by-right uses for charging infrastructure.

Access

In general, the non-retail facilities described will probably not be publicly accessible. These facilities may be supplied by employers as a free benefit to employees, in which case their use by the public would increase costs. In addition, non-retail businesses might view the use of these facilities by the general



Source: RIOER

Figure 17: Level 2 Public Charging Station

public as a security concern, since this would involve access to the property by people unconnected to the business. Retail facilities are, by contrast, open to the public by definition. For such land uses restrictions on access would be frowned upon, as such restrictions would increase issues of range anxiety. For these areas ordinance language encouraging information sharing on one of the national charging networks would, in fact, be appropriate to help encourage patronage.

Minimum Provisions

Developers should not be asked to provide physical chargers, but instead should meet basic ZEV readiness steps. Public lots should be designed with ZEV infrastructure in mind. This would include the provision of electric infrastructure in parking lots appropriate to the charging level optimal for that zone's use, in conjunction with parking spaces capable of permitting the appropriate level of charging station accessibility. For example, industrial zones should provide an outdoor electrical line near at least one parking spot capable of serving as a handicapped accessible space.

Behavioral Standard Setting

Setting and enforcing behavioral standards ensures that such pieces of infrastructure that have already been created are properly utilized by members of the public. Such efficient use of resources will help break the cycle of range anxiety and help business leaders see the profit potential of ZEV infrastructure. In order to ensure such an outcome, different behavioral standards will be required for the different infrastructure types discussed in this handbook.

Charging Station

Charging stations occupy a unique legal space somewhere between a fueling station and a parking space. As has already been discussed in the section on zoning standards, charging spaces should be considered parking spaces from the perspective of zoning codes in order to avoid their being onerous to developers, but for the purposes of behavioral standard setting charging spaces should be understood as a fuel source. From the point of view of the driver they are possibly the only nearby way to ensure that their vehicle functions. From the point of view of the owner of the charging facility the charger is a money making asset, essentially a business albeit an automated one. Misuse of such facilities denies the driver access to a needed resource and denies the facility owner an opportunity to make back their capital and turn a profit.

Enforcement of these types of standards has been one of the most common steps taken by municipalities undertaking ZEV readiness policies. Here is an example from Raleigh, NC Ordinance Sec. 11-2174. (c):

The City Council may designate certain parking spaces on City streets at or near electric charging stations for use only by electric vehicles. An electric vehicle is one that operates, either partially or exclusively, on electrical energy from the grid, or an off grid source, that is stored on board for motive purpose. An electric charging station is equipment that has as its primary purpose the transfer of electric energy to a battery or other energy storage device on an electric vehicle.

Spaces designated as reserved for electric vehicles shall be clearly marked as such. When a space has been so marked no person shall park or stand any nonelectric vehicle in that space. If an electric vehicle is parked in such a designated space but is not attached to the charging station it is in violation of this ordinance. Any nonelectric vehicle so parked is subject to civil fine or removal. The fine for violation of this ordinance is fifty dollars (\$50.00) and shall be collected in the same manner and with the same penalties for late payment as other on street parking violations. Any vehicle parked in such a space must make the appropriate payment for the space and observe the time limit for the underlying parking zone.

Here is an example from Georgetown, TX Ordinance Sec. 10.16.090. - Electric vehicle charging stations.

A. No person shall stop, stand or park any vehicle in areas designated for electric vehicle charging for any purpose except charging of an electric vehicle.

B. Signage. Each electric vehicle charging station shall be designated with a sign stating "Parking Restricted Charging Only."

This example is from the California statewide enabling legislation:

22511.1. (a) A person shall not park or leave standing a vehicle in a space or space designated pursuant to Section 22511 unless the vehicle is connected for electric charging purposes.

(b) A person shall not obstruct, block, or otherwise bar access to parking spaces or spaces described in subdivision (a) except as provided in subdivision (a).

These examples touch the basic behavioral guideline that should be established for efficient charger usage: spaces are for actively charging EVs only. This can be broken down into two related issues: only EVs may park at charger spaces, and they should only park there for as long as it takes to complete a charge. The first point is the most straightforward: drivers of EVs need the charging facility to make use of their vehicle, and only EV drivers will pay the facility owner for their service. All others are, in a sense, trespassing and disrupting a business. Ensuring that the vehicle parked at a space is an EV has historically presented several jurisdictions with challenges, but the current best practice is that if a vehicle is plugged into a charger then it is assumed to be an EV. As such, vehicles must be plugged into the charger to legally use the space.

The second point, that the users of the charging space should only use the space for as long as it takes to charge, is again straightforward in its rationale: If a vehicle is charged after only a few minutes, but continues to occupy the charging space for an indefinite period of time, it prevents others from utilizing the facility and, in effect, costs the facility owner money. Crafting a legal framework for this point requires going into more depth than the first point. Making these standards overly strict would scare users away from EV technology, and the fact that it can take several hours to charge an EV means that it would be infeasible to ask a driver to wait by their vehicle while it charges and move it immediately afterwards. Therefore, rather than basing enforcement on a state of active charging, conventional parking duration signs should be used to ensure turnover of parking spaces. Time intervals should be set based on the maximum charge times possible. Given the ever expanding battery capacity of EVs, this can be something of a moving target, so ordinances would ideally allow the standard setting agency some leeway in the times assigned. That said, given current technologies, times can be allotted that give ample time for the driver to charge their vehicle given the level of charger installed.

Beyond use restrictions and time limits, planners should consider how the use of the charging space will interact with other extant parking regulations. In general, charging spaces should be subject to all the other extant parking regulations. In a private or municipally owned lot parking spaces are usually only intended to function during normal business hours, and this may need to be made explicit on the charger for security reasons. When planning street parking, planners should generally not plan for chargers in locations with shorter parking durations than is appropriate for that charging level, or in no parking

Parking Duration

The legal parking time limit at a charging station should, in general, be based on the maximum amount of time a car could spend charging at that station. Drivers should be able to fully charge their vehicles without worrying about the time limit, but the time limit is necessary to remind the drivers to move to a conventional or priority parking space when the charging is concluded.

The table below is based on the amount of time it would take a driver to sufficiently charge a car for a drive of 100 miles. This number was chosen specifically because no cars currently on the market allow vehicles to reach 100 miles on a single charge, and so no driver will ever be left over the time limit and without a sufficient charge. This said, new models are getting closer to achieving the 100 mile threshold with every generation of EV, so the listed times should be taken as guidelines based on current conditions at the time of publication. Ideally, ordinances created to set charge time duration statutes would build some flexibility into the statute to allow the future upgrade of these ordinances to reflect changing conditions.

Charger Level	Parking Time Limit
Level 1	24 hours
Level 2	9 hours
Level 3	1 hour

Other factors are likely be important for private landowners setting time limits. For example, the length of the working day at an office may be more important than charge time. Private land owners should be allowed to set the time limits based on their own needs.

zones. Municipal officials may want to consider whether parking spaces should be subject to parking meters in addition to the money paid for charging the vehicle.

The enforcement mechanism for these ordinances varies by the municipality. In most municipalities the vast majority of parking enforcement is left to private property owners, who can call the police and request that a vehicle be towed if it is violating posted signage. Some municipalities have interpreted this to mean that any posted signage is legally enforceable by a property owner. The logical conclusion of this interpretation is that, since the municipality is the property owner for public parking, simply creating the signage should make it enforceable. While this position is legally defensible, it is often not entirely clear to members of the public, and so many municipalities choose to spell out their charging station regulations in an ordinance.

ZEV Priority Parking

There have been a number of attempts to create priority parking programs from state, local, and non-governmental sources. Most famously, California attempted to create a priority parking system based on the purchase by drivers of a decal from the California Environmental Protection Agency. This program was ended due to widespread confusion by law enforcement, municipal officials, and the public, but a similar program was successfully begun in Nashville, TN:

12.44.075 - Free metered parking for clean technology vehicles.

A. For purposes of this ordinance, "clean technology vehicle" means a vehicle rated by the U.S. Environmental Protection Agency with a minimum Environmental Performance Score for both Greenhouse Gas and Air Pollution of 7, and a total combined score of 16 or higher. A vehicle's Environmental Performance Score can be determined by inputting the vehicle's information into the Green Vehicle Guide located at <http://www.epa.gov/greenvehicles>.

B. Notwithstanding the provisions of Section 12.44.040, no parking payment shall be required for a clean technology vehicle parked in a parking metered space located within the boundaries of the Downtown Central Business Improvement District, as designated by Section 2.177.010 of the Metropolitan Code, for a duration not to exceed the posted time limit on the meter if the vehicle is displaying a valid sticker issued by the Davidson County Clerk designating the vehicle as a clean technology vehicle. The county clerk shall determine the proper place on the vehicle to which the sticker is to be affixed so as to maximize visibility for the benefit of the parking patrol officers.

A similar program was begun by Bellevue College, Washington State, which has quasi-governmental power over parking on their campus:

Low emissions fuel efficient (LEFE) permits.

Only vehicles displaying a valid student or staff/faculty parking permit and a low emissions fuel efficient permit issued by the college may use LEFE spaces. Permits will only be issued to vehicles certified as LEFE by the Environmental Protection Agency (EPA).

The City of Charlotte, NC, has established a priority parking program without any establishing ordinance, based on the language of their pre-existing parking ordinance:

Section 14-216 (a) – (a)(1) Illegal parking.

(a) It shall be unlawful to stop, stand, or park a vehicle: 1) On a street or on any public property owned or leased by the city in violation of an official traffic control device when such traffic control device gives notice of restrictions or prohibitions on parking.

Finally, it should be noted that some private companies have started creating priority parking signage on their properties. For the most part these programs are not enforced by legal action or municipal ordinance, but by the behavior of their customers.

These various programs indicate the wide variety of potential components a priority parking program can contain: the type of vehicle incentivized, the regulatory mechanism, and the type of incentive given. These are all interrelated points and the municipal government should give thought to the issues and capabilities at their disposal.

The type of vehicle incentivized is potentially a wide ranging category. Though this handbook was created to incentivize ZEVs, many municipalities prefer to incentivize all high fuel efficiency vehicles. This can include everything from hybrids to certain kinds of biodiesel. This allows for larger numbers of drivers to potentially take advantage of the priority program, but often encounters enforcement issues.

The enforcement mechanism for the priority parking program essentially means the way the police or private land owners will ensure that the right drivers are taking advantage of the facilities provided. Many programs are simply enforced by the good behavior of drivers, but for more ambitious programs something more may be required. The crux of the problem of enforcement is that it is unreasonable to expect police officers to keep track of all the models of EVs, ZEVs, or high fuel efficiency vehicles that are released every year. The issue is helped by the fact that a number of organizations, such as the United States Environmental Protection Agency, maintain databases of commercially available models of EVs, ZEVs, or high fuel efficiency vehicles, but it is still unreasonable to expect a busy police officer to sift through this data while engaged in a parking enforcement patrol. This explains the popularity of decal-based programs, despite the difficulties sometimes faced by such programs early on. While a police officer cannot be expected to make judgement calls about what vehicles fit into a given program, a municipal or state official with access to one of these databases can make such a judgement. Once a decal is issued, police officers in the field are only required to note the presence or non-presence of such a decal.

The level of incentive chosen depends greatly on the conditions of the municipality in question. In general, a priority parking program should be focused on creating a location incentive, allowing drivers special access to preferred parking, but this need not always be the case. Nashville's program simply exempts drivers from paying for parking meters. This type of program may be preferable in dense downtown areas, where drivers cannot be expected to all be going to the same place. Such financial incentives may help offset consumer irritation at being asked to pay for a decal, which has been a major stumbling block in the way of many decal programs.

Though a lot of variation is possible, most organizations engaged in the creation of a priority parking program either choose to base their programs on good driver behavior or on decals. Good driver programs require little or no preparation or legislation by the municipality. Since the program is essentially unenforced, the creating organization often does not even define what kind of vehicles qualify, simply focusing on providing a location incentive to those drivers who decide that they qualify. Decal programs require much more preparation and marketing, both internal and external to the establishing organization, but allow the organization better control over the types of vehicles included, the scale of the incentive to drivers, and more established and transparent enforcement.

It should be noted that municipalities with both EV charging facilities and a priority parking program should assign penalties for violation relative to the severity of the offence. The obstruction of a charging facility should be considered a much more severe infraction, while the penalties for the violation of a priority parking program should be relatively minor. The former is theoretically an act of trespassing and prevents drivers from accessing required “fuel.” The latter is simply a minor traffic violation. The creation of proportional penalties will help the public acclimate to the new legal environment.

Public Parking Facilities

When creating policies and ordinances it is important, for legal, economic, and ethical reasons, not to impose a heavy burden on land owners and private citizens. But when the land owner is the city or town, this note of caution is no longer relevant. In public spaces, the municipality can pursue the full implementation of infrastructure considered desirable, subject only to the municipal budget and the dictates of good planning practice.

This potentially has several key benefits. This infrastructure can of course serve to directly provide charging facilities and help reduce range anxiety. This may be particularly important for agencies attempting to incorporate ZEVs into their fleet. Should the municipality choose to charge for this service, such charging facilities may become a new source of revenue. More broadly, a properly designed public lot can help developers and members of the public become used to, and appreciate, the deployment of ZEV infrastructure. This can be especially important in terms of setting behavioral standards.

To implement this infrastructure, the site design and charger standards discussed in this paper can be expanded to call for direct construction of charging and priority parking facilities by municipal property managers. For more information about the type and quantity of facilities ideally created, please see Table 2 in Appendix I. Ideally, this policy would be part of a comprehensive effort to plan the provision of ZEV infrastructure at municipal facilities in order to ensure the efficient deployment of municipal resources.

When embarking on such a planning effort it is important to remember some key points. As discussed in the section on land use standards, the level of charging should be tailored to the activity of the property. Chargers located at facilities with relatively rapid parking turnover, such as libraries or licensing offices, may choose to implement higher levels of charging. Government offices without much visitation by members of the driving public, such as schools, may only desire lower level charging. Parking facilities located near public transportation will probably require lower levels of charging, but more chargers to accommodate the very long dwell times at each charger. In all cases, it would be preferable to provide charging facilities in areas that are accessible to the public and not confined to government employees. Many of the benefits discussed above will clearly not be achieved if the public is prevented from using the provided facilities.

There are two exceptions. First, cities and towns may choose to provide chargers as a benefit or incentive to encourage ZEV use by their employees. If such facilities are included in a lot from which the public is excluded, it may still serve an important function in encouraging ZEV use, though it is recommended that employees not be charged for using the charger in this case. The second exception is in the case of facilities intended for fleet vehicles, which should be provided with dedicated chargers and priority spaces. Fleet managers in particular, and fleet users in general, should be given training on how to use ZEVs and the proper techniques for efficiently using the provided charging facilities.

The downside to the creation of publically owned parking facilities is that they are potentially expensive investments. There are a number of programs from the state and federal governments that may help defray these costs. The Charge Up! Program, run by RIOER, offers incentives to state agencies and municipalities interested in installing chargers at publically-accessible facilities, and supports the purchase or lease of electric vehicles (EVs) for integration into public sector fleets. On the federal level there are a large number of programs that can potentially be used to defer the costs of ZEV infrastructure construction, most notably the Improved Energy Technology Loans. Under this program the US Department of Energy will provide loan guarantees for eligible projects that reduce air pollution and greenhouse gases, and support early commercial use of advanced technologies. Please see the Stay Connected section of Appendix II for more information on other programs.

Conclusions

Rhode Island's cities and towns are uniquely positioned to benefit from, and overcome the obstacles to, the continuing expansion of the Zero Emission Vehicle market. Though issues like building codes and utility regulation require state level action, the cities and towns of Rhode Island can make great strides towards the market uptake of ZEVs through the use of their control over subdivision, zoning, parking regulations, and through their own directly owned land. This handbook provides a variety of policy options that can be used together to provide drivers and land owners with the incentives they need to continue the expansion of Rhode Island's charging infrastructure. By removing obstacles and setting standards for parking design, land use, and driver behavior, the cities and towns of Rhode Island can begin to enjoy the economic and environmental benefits of ZEV use.

Next Steps

There are a number of steps a city or town may take in addition to those outlined in this paper. Further research is always a good idea and this handbook contains several important resources for those seeking to gain greater insight and context on the issue of ZEV readiness. Cities and towns may also seek to review their internal procedures and policies for ZEV readiness. Finally, keeping up to date on the changing situation in the world of ZEV technology and regulation is advisable.

This handbook is intended as a guide and reference for municipalities just starting to work on issues relating to ZEVs. It is not a definitive work on the subject either in terms of its own limited scope or in terms of the wider world of ZEV readiness. The reference section of this handbook contains a variety of resources for those seeking greater insight and context on ZEV readiness. Those looking for further information on the topics directly covered in the body of this handbook would be well served by examining the Bibliography section of this handbook, which contains references to the publications and ordinances that informed the conclusions of this handbook. The Stay Connected section of Appendix II contains links to publications and organizations that provide useful information on ZEV readiness.

There are a number of steps a municipality may choose to take in order to create a comprehensive ZEV policy beyond those connected to municipal ordinances. Many municipalities have begun their ZEV policy process with a review of their internal permitting processes, and have found that, though charging infrastructure is minimally offensive, current regulations require lengthy permitting processes even for private residents. Clarifying the place of charging infrastructure in internal policy and creating a streamlined approval process for clean technology projects can often be done without legislation and removes one of the biggest hurdles for those contemplating the addition of ZEV infrastructure. As an

example, the City of San Diego, CA, has made the goal of 24 hour approval of charging projects official policy. Reviews of such internal policies are a key next step for implementing ZEV readiness.

The creation or revision of municipal ordinances may be an important step in implementing ZEV readiness. This handbook has focused on presenting the breadth of places where ordinances and policies might be created in ways that would encourage ZEV readiness, as well as examining how those policies might interact. Implementing these policies in the form of positive ordinances will depend greatly on the circumstances of the individual municipality, and a cautious approach should always be taken to avoid overburdening the rights of property owners. Readers are encouraged to refer to the Model Ordinances in Appendix I.

Once the low hanging fruit of internal policy and ordinance reviews have been completed, the municipality may wish to engage in the direct creation of incentive programs. Such programs would offer funding or tax incentives to residents or developers who create ZEV infrastructure. Such programs are a topic well beyond the scope of this handbook, but a number of such programs exist in various places around the country. Some information about the state of this kind of incentive program will be available in the Stay Connected section of Appendix II.

Finally, it is important to stay aware of larger developments. These can take the form of regulatory changes and technological changes. State level policy decisions may open new opportunities for the municipality, while possibly also necessitating further alterations to the municipal code. There are ongoing efforts to clarify the legal status of the retail sale of electricity for EV charging that could have major implications on the way charging infrastructure will be built out. Similar efforts are being made to review the state level building code for ZEV implications. If the city or town remains vague in the ordinance language used in relation to these issues it is unlikely to run afoul of future developments, but remaining up to date on regulatory discussions occurring at the state, regional and national levels is a good way to avoid wasted effort and identify new opportunities.

Similarly, technological change remains a constant in the world of ZEV readiness. Manufacturers of EVs are working hard to constantly expand the distance their vehicles can travel on a single charge, while charger manufacturers are also working to reduce the dwell time required at a charger. FCEV manufacturers are constantly innovating and as their technology matures it will likely bring its own set of unique challenges. A good way to keep up to date on such evolving issues is to regularly check in with the organizations referenced in the Stay Connected section of Appendix II.

Appendix I: Model Ordinance

Many of the policies suggested in this document are potentially interconnected and require careful balancing. This section aims to assist municipalities to identify the set of policies that best suit their needs by laying out all the policies that are currently considered feasible in Rhode Island, and organizing them into policy scenarios that could be implemented as a package. This is not an exhaustive list of the policies or policy scenarios that could be implemented, but instead represents a starting point that a municipality could use when crafting legislation.

Model Parking Ordinance:

Definition

High Fuel Efficiency Vehicle: A vehicle whose model is LEED Qualified according to American Council for an Energy-Efficient Economy, or which holds a Smartway Certification from the US Environmental Protection Agency (USEPA).⁸

Electric Vehicle (EV): An electric vehicle is one that operates, either partially or exclusively, on electrical energy from the grid, or an off grid source, that is stored on board for motive purpose.

Electric Vehicle Charging Station: An electric charging station is equipment that has as its primary purpose the transfer of electric energy to a battery or other energy storage device on a plug-in electric vehicle.

High Fuel Efficiency Vehicle Priority Parking Space: A parking space designated for use by a high fuel efficiency vehicle.

Use and Designation of Electric Vehicle Charging Station

- (A) Spaces equipped with an electric vehicle charging station shall be reserved for EVs and shall be clearly marked as such.
- (B) No person shall park or stand any nonelectric vehicle in a space equipped with an electric vehicle charging station. If an electric vehicle is parked in such a designated space but is not attached to the charging station, it is in violation of this ordinance.
- (C) Any vehicle improperly parked in a space equipped with an electric vehicle charging station is subject to civil fine or removal. The fine for violation of this ordinance is \$[appropriate amount] and shall be collected in the same manner and with the same penalties for late payment as other on street parking violations.
- (D) All vehicles utilizing a space equipped with an electric vehicle charging station must obey all parking ordinances otherwise applicable to such a space.
- (E) All vehicles utilizing an electric vehicle charging station must pay for the services rendered by the owner of the electric vehicle charging station, assuming said owner desires payment.

⁸ Either or both listings are valid

Use and Designation of a High Fuel Efficiency Parking Space⁹

- (A) High Fuel Efficiency Parking Spaces are reserved for use of a high fuel efficiency vehicle, as determined by the presence of a high fuel efficiency vehicle parking decal issued by [appropriate agency].
 - a. [Appropriate agency] shall have the authority and responsibility for issuing high fuel efficiency vehicle parking decals for qualifying motor vehicles based on the [yearly lists of SmartWay Vehicles maintained by the USEPA].¹⁰ The clean technology vehicle stickers shall only be available for private passenger vehicles. Each sticker shall be valid for a period of [duration]. The [appropriate agency] shall be entitled to collect an annual fee of [low amount, eg: ten] dollars from the applicant for each high fuel efficiency vehicle decal issued. All fees collected for the high fuel efficiency vehicle decal shall be deposited in the [appropriate fund] of the [municipality] to assist in offsetting administrative costs. Information on the proper display of the high fuel efficiency vehicle parking decal shall be decided on by discussion between the [enforcement agency] and the [issuing agency], and each successful applicant will be given this information at the time of the issuing of the high fuel efficiency vehicle parking decal by the [issuing agency]
 - b. High fuel efficiency vehicle parking spaces may be used by emergency service vehicles and vehicles with disabled placards.
- (B) All high fuel efficiency vehicle parking spaces must be clearly marked as such, per guidelines in [zoning ordinance].
- (C) The [appropriate agency] may designate a number of spaces on [municipality] owned parking lots as high fuel efficiency vehicle parking spaces, per standards laid out in [zoning ordinance].
- (D) Property owners with more than 10 parking spaces may designate high fuel efficiency vehicle parking spaces in accordance with the guidelines set out in [zoning ordinance].
- (E) Any vehicle utilizing a high fuel efficiency vehicle parking space that is not properly displaying the high fuel efficiency vehicle parking decal is subject to civil fine. The fine for violation of this

⁹ Should the municipality prefer to engage in a High Fuel Efficiency Vehicle priority parking program without the use of a decal program this section would read as follows:

- (A) High fuel efficiency vehicle parking spaces are reserved for use of high fuel efficiency vehicles.
- (B) High fuel efficiency vehicle parking spaces may be used by emergency service vehicles and vehicles with disabled placards.
- (C) All high fuel efficiency vehicle parking spaces must be clearly marked as such, per guidelines in [zoning ordinance].
- (D) The [appropriate agency] may designate a number of spaces on [municipality] owned parking lots as high fuel efficiency vehicle parking spaces, per standards laid out in [zoning ordinance].
- (E) Property owners with more than 10 parking spaces may designate high fuel efficiency vehicle parking spaces in accordance with the guidelines set out in [zoning ordinance].
- (F) Any vehicle utilizing a high fuel efficiency vehicle parking spaces inappropriately is subject to civil fine. The fine for violation of this ordinance is \$[appropriate amount] and shall be collected in the same manner and with the same penalties for late payment as other on street parking violations.
- (G) All vehicles utilizing a high fuel efficiency vehicle parking spaces must obey all parking ordinances otherwise applicable to such a space.

¹⁰ Alternatively or in conjunction: List of LEED-Qualified Cars maintained by the American Council for an Energy-Efficient Economy

ordinance is \$[appropriate amount] and shall be collected in the same manner and with the same penalties for late payment as other on street parking violations.

- (F) All vehicles utilizing a high fuel efficiency vehicle parking spaces must obey all parking ordinances otherwise applicable to such a space.

Model Zoning Ordinance:

Definition

Electric Vehicle Charging Station: An electric vehicle charging station is public or private equipment that has as its primary purpose the transfer of electric energy to a battery or other energy storage device on an electric vehicle and is classified based on the following levels:

- (A) Level 1 is considered slow charging and operates on a fifteen to twenty amp breaker on a one hundred twenty volt AC circuit.
- (B) Level 2 is considered medium charging and operated on a forty to one hundred amp breaker on a two hundred eight or two hundred forty volt AC circuit.
- (C) DC fast charging is considered fast or rapid charging and operated on a sixty amp or higher breaker on a four hundred eighty volt or higher three phase circuit with special grounding equipment. DC fast charging stations can also be referred to as rapid charging stations that are typically characterized by industrial grade electrical outlets that allow for faster recharging of electric vehicles.

High Fuel Efficiency Vehicle Priority Parking Space: A parking space designated for use by high fuel efficiency vehicles, per [parking ordinance pertaining to parking areas].

Accessible Electric Vehicle Charging Stations: Electric vehicle charging stations designed to permit use by persons with disabilities, as defined by Section 502 of the Americans with Disabilities Act Design Standards, but not restricted to vehicles with handicapped placards.

Standards for Electric Vehicle Charging Stations

Electric vehicle charging stations utilizing parking spaces located in a public parking lot or parking garage, in on-street parking spaces, or in any other parking arrangement not associated with single family residences or assigned tenant parking, shall comply with the following standards. Due to the fact that the technology associated with electric vehicles, batteries and electric vehicle charging stations is relatively new and is anticipated to change, and that there is a lack of municipal experience on consumer and community preferences and attitudes with regard to electric vehicles, the [planning director] may authorize variations from these standards, so long as the intent and goal of the standards and this chapter are addressed.

- (A) Electric vehicle charging stations shall be reserved for parking and charging of electric vehicles only, per regulations in [parking ordinance].
- (B) Each electric vehicle charging station shall be posted with signage indicating the space is only for electric vehicle charging purposes. Signage shall include items contained in subsection (E)b. and (E)f. of this section. Way finding signs conveniently located to guide motorists to the charging

stations are permitted, so long as they do not violate any provisions of [municipal signage ordinances].¹¹

(C) Adequate site lighting shall be provided, in compliance with [local lighting ordinance].

(D) Equipment for electric vehicle charging stations shall comply with the following standards:

- a. Equipment mounted on pedestals, lighting posts, bollards, or other devices for on-street charging stations, shall be designed and located as to not impede pedestrian travel or create trip hazards within the right-of-way. Equipment located along a designated barrier free route must not impede the accessibility of disabled persons.
- b. Charging outlets and connectors shall be no less than thirty-six inches, or no higher than forty-eight inches, from the top of the surface where mounted, and shall contain a retraction device or a place to hang cords and connectors above the ground surface.
- c. Equipment shall be protected by wheel stops or concrete-filled bollards when mounted on poles or when otherwise vulnerable to collision.

(E) The following information shall be posted at all electric vehicle charging stations:

- a. Voltage and amperage levels;
- b. Hour of operations if time limits or tow-away provisions are to be enforced by the property owner;
- c. Usage fees;
- d. Safety information;
- e. Contact information for reporting when the equipment is not operating or other problems.
- f. Parking duration limits should be set based on charging level of the equipment, as set out in table 1, but subject to the needs and operating time of a land owner.

Charger Level	Parking Time Limit
Level 1	24 hours
Level 2	9 hours
Level 3	1 hour

Appendix Table 1: Charging Duration by Charger Level

(F) When not in conflict with the previously mentioned requirements, or the requirements set forth in section (G), the design of the parking space associated with the electric vehicle charging station shall conform to the standard guidelines laid out in [zoning or parking ordinance].

(G) Due to the need to provide disabled persons with accessibility, without burdening land owners with the creation of superfluous infrastructure, Accessible Electric Vehicle Charging Stations shall be designed to meet the needs of disabled persons while not being restricted to their use. The design and location of electric vehicle charging stations shall comply with the following barrier-free accessibility requirements:

- a. The design of Accessible Electric Vehicle Charging Stations shall comply with the design guidelines for conventional Charging Stations, as laid out in sections A-F of this ordinance, but shall incorporate accessible stall design guidelines as laid out in [zoning, parking, or handicapped parking enabling ordinance of local code. If such a section does

¹¹ It may be desirable for municipalities with heavily restrictive signage ordinances to add language permitting some wayfinding signage.

not exist, use standards laid out in Section 502 of the Americans with Disabilities Act Design Standards].

- b. Notwithstanding section (G)a. of this ordinance, Accessible Electric Vehicle Charging Stations will not be restricted to holders of handicapped driver placards, and the stall should not incorporate signage restricting use to said group.
- c. Accessible Electric Vehicle Charging Stations shall be provided at the rate of one (1) accessible station for every fifty (50) or fewer conventional charging stations.
- d. Accessible Electric Vehicle Charging Stations shall be located in proximity to the buildings or facility entrances and shall be connected to a barrier-free accessible route of travel.
- e. Flexibility shall be permitted in the siting of Accessible Electric Vehicle Charging Stations to allow cost effective siting of infrastructure, so long as the rights and accessibility of disabled persons are retained, particularly in regards to section (G)d.

Standards for High Fuel Efficiency Vehicle Priority Parking Spaces

- (A) High fuel efficiency vehicle priority parking spaces must be clearly marked as such using a design similar to that in figure 18.
- (B) The design of the high fuel efficiency vehicle priority parking space shall conform to the standard guidelines laid out in [zoning or parking ordinance].
- (C) High fuel efficiency parking spaces shall be located as close to the building entrance as is practical without violating the provisions of [local disabled parking ordinance].



Minimum Parking Requirements

Electric vehicle charging stations and high fuel efficiency vehicle priority parking spaces located within parking lots or garages may be included in the calculation of the minimum parking spaces required pursuant to the [current local zoned parking requirement].

Appendix Figure 18: High Fuel Efficiency Vehicle Parking Space Sign

Where Permitted

- (A) Level 1 and 2 electric vehicle charging stations are an accessory use in all zoning districts except [Local equivalent of mixed use or downtown] zoning district, where they are a conditional use.
 - a. Electric vehicle charging stations are understood to be for private use only in [Local equivalent of Single Family Residential] zoning districts.
 - b. Use of electric vehicle charging stations should be limited to residents only in [Local equivalent of multifamily residential] zoning districts.
- (B) DC fast charging stations are an accessory use in the [Local equivalent of Warehouse and Industrial, Highway Commercial, Hotel, and Public Lands and Facilities] zoning districts.
 - a. DC fast charging stations are a conditional use in [Local equivalent of Retail, Commercial, and Mixed Use or Downtown] zoning district.

Model ZEV Site Design Guidance

[The Municipality] would view favorably the following non-binding steps to improve ZEV readiness:

- (A) Residential. In order to proactively plan for and accommodate the anticipated growth in market demand for electric vehicles, it is strongly encouraged, but not required, that all new one-family and multiple-family homes with garages or other permanent parking structures be constructed to provide a 220-240-volt/40 amp outlet on a dedicated circuit in close proximity to designated vehicle parking to accommodate the potential future hardwire installation of a Level 2 charging station.
- (B) Non-Residential. In order to proactively plan for and accommodate the anticipated future growth in market demand for electric vehicles, it is strongly encouraged, but not required, that all new and expanded non-residential development parking areas provide the electrical capacity necessary to accommodate the future hardwire installation of Level 2 charging stations. It is recommended that a typical parking lot (e.g. 1,000 or less parking spaces) have a minimum ratio of 1% of the total parking spaces located in proximity to such electrical capacity in order to be prepared for such stations.
- (C) Property owners seeking to create ZEV infrastructure immediately may choose to follow the guidelines laid out in table 2, with a ratio of three (3) High fuel efficiency vehicle priority parking spaces for every one (1) Electric vehicle charging station installed, and with a minimum of one (1) Electric vehicle charging station.
 - a. All charging stations in [multifamily residential zones] should be restricted to use by residents only. This provision does not apply to [mixed use or downtown] zones.

Land Use Type	Charging Stations	Priority Spaces	Total
Multi-family residential	2.50%	7.50%	10%
Lodging	0.75%	2.25%	3%
Retail, eating and drinking establishment	0.25%	0.75%	1%
Office, medical	0.75%	2.25%	3%
Industrial	0.25%	0.75%	1%
Institutional, municipal	0.75%	2.25%	3%
Recreational/entertainment/cultural	0.25%	0.75%	1%
Other	0.75%	2.25%	3%

Appendix Figure 19: Optional Percentage of LEV Parking Stalls by Land Use Type

Appendix II: References

The information in this section is provided for those who are seeking more insight and context on the information provided in the body of the handbook. The Bibliography of Ordinances section contains all the ordinances referenced or consulted in this document, with URL links to their location. The Bibliography of Sources section references the sources that informed the recommendations in the handbook more generally. The Stay Connected section provides resources for those interested in keeping informed of the constant changes occurring in the world of ZEV readiness.

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Stay Connected

ZEV readiness is a constantly evolving subject. The technologies used for EV and FCHEV are in a state of ongoing innovation, even as federal and state regulators seek to adjust to the new conditions. The following organizations can help provide information to city and town administrators, elected officials, and members of the public seeking to keep up to date on those aspects of this handbook most subject to change.

Acadia Center

< <http://acadiacenter.org/>>

The Acadia Center works across key sectors of the economy, in state, local, regional and national jurisdictions to promote effective solutions to tackle the problem of climate change. They publish reports, analyses, charts, policy memos, whitepapers, infographics and many other resources for a range of stakeholder audiences, and so their website can provide a wealth of information for those researching ZEV issues.

American Council for an Energy-Efficient Economy (ACEEE)

< <http://aceee.org/>>

< <http://www.greencars.org>>

The American Council for an Energy-Efficient Economy (ACEEE), is a nonprofit, 501(c)(3) organization, that seeks to encourage energy efficiency policies, programs, technologies, investments, and behaviors. Their website contains information about a wide variety of green technologies and policies. A part of this larger organization is GreenerCars.org, which aims to allow drivers to compare the green characteristics of various cars. The site brings together a wide variety of federal data to allow users to compare vehicles across different characteristics, with a user experience that is similar to Consumer Reports or Kelly's Blue Book. Due to the user friendly interface, use of reputable federal data,

and high standard of site maintenance, many municipalities use GreenerCars.org's definitions of greener or low emission vehicles as their legal standard for priority parking or decal programs.

EV Smart Fleets

< <http://evsmartfleets.com/>>

An organization, partnered with Clean Cities, that aims to help state and local governments address barriers to the purchase of ZEVs for their fleets by aggregating purchases through a multi-state aggregated EV solicitation and procurement agreement.

Northeast States for Coordinated Air Use Management (NESCAUM)

< <http://www.nescaum.org/>>

NESCAUM is a 501(c)(3) nonprofit association of air quality agencies in the Northeast. Our Board of Directors consists of the air directors of the six New England states (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont), New Jersey, and New York. Their purpose is to provide scientific, technical, analytical, and policy support to the air quality and climate programs of the eight Northeast states. A policy agreement by NESCAUM was one of the principal events in the creation of this handbook, and their website is a good way to keep abreast of changing regional regulations and initiatives.

Ocean State Clean Cities Coalition

< <http://web.uri.edu/oscc/>>

Ocean State Clean Cities Coalition is a group of stakeholders working together to promote alternative fuels, idle reduction, fuel economy, and emerging vehicle technologies. Ocean State Clean Cities is hosted at the URI Transportation Center, and is part of the wider Clean Cities organization which is sponsored by the USDOE. Ocean State Clean Cities helps to organize and run a variety of ZEV programs around Rhode Island, and their newsletter is a good way to keep on top of ZEV issues in the state.

Rhode Island Office of Energy Resources

<<http://www.energy.ri.gov/>>

<<http://www.rienergy.org/>>

<<http://www.energy.ri.gov/Transportation/ChargeUp/index.php>>

< <http://www.drive.ri.gov/>>

The Rhode Island Office of Energy Resources (OER) works closely with private and public stakeholders to increase the reliability and security of the state's energy supply, reduce energy costs and mitigate against price volatility, and improve environmental quality. OER has spearheaded the ZEV readiness effort in Rhode Island and their websites contain a variety of resources pertaining to the subject, notably the ZEV Action Plan, and a tool for finding the nearest charging station. They also are running two incentive programs to directly promote the use of ZEVs. The Rhode Island Charge Up! Program offers incentives to state agencies and municipalities interested in installing electric vehicle supply equipment (EVSE or charging stations) at publically-accessible facilities, and supports the purchase or lease of electric vehicles (EVs) for integration into public sector fleets. OER also maintains the website for DriveRI, a rebate program for ZEV drivers. As the organization overseeing ZEV readiness implementation, at the state level, their websites should be the first places to check when seeking information about updates to state regulations.

Transportation and Climate Initiative (TCI)

< <http://www.transportationandclimate.org/content/clean-vehicles-and-fuels>>

TCI is a collaboration of the transportation, energy and environment agencies from the 11 Northeast and Mid-Atlantic states and Washington, DC, focused on reducing greenhouse gas emissions from the transportation sectors. TCI seeks 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.

United States Department of Energy: Office of Energy Efficiency & Renewable Energy

< <http://energy.gov/eere/office-energy-efficiency-renewable-energy>>

< <http://www.afdc.energy.gov/>>

< <http://www.afdc.energy.gov/fuels/laws/ELEC>>

The sheer volume of information provided by the United States Department of Energy and its Energy Efficiency & Renewable Energy covers issues far beyond those relevant to users of this handbook. Helpfully, the organization has recently invested significant resources into making their web presence much more user friendly. There are a large number of tools on the web sites intended to help both members of the public and local officials in understanding different aspects of ZEV technology. As the organization ultimately responsible for overseeing ZEV regulation at the federal level, their websites should be the first place to check when seeking information about updates to federal regulations. Amongst the many important resources on this website is a page with a list of all the federal programs that could potentially be used to directly incentivize ZEV projects from federal and state government agencies.