



**TRANSPORTATION &
CLIMATE INITIATIVE**
Of the Northeast and Mid-Atlantic States



GEORGETOWN CLIMATE CENTER

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

ELECTRIC VEHICLE SUPPLY EQUIPMENT SUPPORT STUDY

Prepared for:

New York State Energy Research and
Development Authority
and
Transportation and Climate Initiative

Prepared by:

WXY Architecture + Urban Design
and
Energetics Incorporated

November 2012



GEORGETOWN CLIMATE CENTER

W X Y architecture + urban design

NOTICE

This material is based upon work supported by the U.S. Department of Energy under Award Number #DE-EE0005586.

This report was prepared as an account of work sponsored by an agency of the United States Government, the New York State Energy Research and Development Authority (NYSERDA) and the state of New York. Neither the United States Government, the state of New York nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process or service by trade name, trademark, manufacturer or otherwise does not necessarily constitute or imply its endorsement, recommendation or favoring by the United States Government, the state of New York or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Information and documents published under the name of the Transportation and Climate Initiative (TCI) represent work produced in support of the TCI or its projects. TCI materials do not necessarily reflect the positions of individual jurisdictions or agencies unless explicitly stated.

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 sector. Jurisdictions participating in this TCI project are Connecticut, Delaware, DC, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont. Clean Cities Coalitions from the Northeast and Mid-Atlantic regions are working with the TCI states on this project through the Northeast Electric Vehicle Network.

This document was commissioned by TCI, and was developed as part of the Electric Vehicle Supply Equipment (EVSE) Support project awarded under NYSERDA Program Opportunity Notice (PON) 2392 to Energetics Incorporated. The research, interviews and analysis in this report were performed by WXY Architecture + Urban Design (Project team Adam Lubinsky, Jennifer Gardner and Paul Salama), with support from Energetics Incorporated.

.

CONTENTS

Acknowledgements	iv
List of Abbreviations	v
Executive Summary	vi
Creating Electric-Vehicle-Ready Cities and Towns:.....	1
A Guide to Electric Vehicle Planning and Policy Tools	1
Policy and Planning Tools for EV Readiness	4
Tool 1: ZONING.....	7
Tool 2: PARKING.....	12
Tool 3: CODES.....	16
Tool 4: PERMITTING.....	19
Tool 5: PARTNERSHIPS AND PROCUREMENT	24
Summary	29
Appendix A: Overview of Electric Vehicle Supply Equipment Charging Levels.....	34
Appendix B: Gaps and Opportunities	35
Appendix C: Zoning.....	38
Appendix D: Parking	42
Appendix E: Codes	43
Appendix F: Permitting.....	48

ACKNOWLEDGEMENTS

Thank you to the following individuals for their experience and insight into planning, regulating and deploying electric vehicle charging infrastructure:

Meg Andrews, Environmental Planning Manager, Maryland Department of Transportation (MDOT), and Member of the Maryland Electric Vehicle Infrastructure Council

Bruce Bentley, Energy Innovation Center, Green Mountain Power

Joseph Berman, Environmental Certification Specialist, Golub Corporation/Price Chopper

Denis Clements, Electrical Program Chief, Oregon Building Codes Division

Albert Dahlberg, Coordinator, Project Get Ready Rhode Island

Mark W. Earley, P.E., Chief Electrical Engineer, National Fire Protection Association

Omoniyi Giwa, Senior Borough Programme Officer, Transport for London

Ken Frank, Research Scientist, New Jersey Department of Environmental Protection

Jim Jensen, Senior Bioenergy and Alternative Fuels Specialist, Washington State University Energy Program

Ari Kahn, Electric Vehicle Policy Analyst, New York City Office of Long-Term Planning and Sustainability

Brian Kiley, Edgewood Electric

Larry McAuliffe, Sustainability Manager, New York Metropolitan Transportation Council

James McCabe, Senior Director of Standards Facilitation, American National Standards Institute

Patti Miller-Crowley, Washington State Department of Commerce, and Member of the State EV Taskforce

John Murach, Director of Business Planning and Corporate Performance, Baltimore Gas and Electric Company

Beth Neaman, External Engagement, Advance Technology Group, PEV Readiness Program, Southern California Edison

Michael Pfeiffer, Deputy Senior Vice President, Technical Services, International Codes Council

Joan Rohlfs, Environmental Resources Program Director, Metropolitan Washington Council of Governments

Steve Russell, Alternative Fuel and Vehicle Coordinator, Massachusetts Department of Energy Resources

Greg Seher, Project Analyst, Atlantic County Utilities Authority

Malcolm Shield, Climate Programs Engineer, City of Vancouver Sustainability Group

Howard Slatkin, Director of Sustainability/Deputy Director of Strategic Planning, New York City Department of City Planning

Kristen Weiss, State Legislative Analyst, MDOT

Additional thanks to the **Georgetown Climate Center**, particularly **Cassandra Powers** of the **Transportation and Climate Initiative (TCI)** for her guidance and coordinating efforts without which this report and review process would not have been possible, as well as to the **Clean Cities Coordinators**, the **TCI Clean Vehicles and Fuels Workgroup**, **Gustavo Collantes**, President, Logios and **Mark Stout**, President, Mark L. Stout Consulting, for their collective review and feedback.

LIST OF ABBREVIATIONS

AB	Assembly Bill (California)
ADA	Americans with Disabilities Act
AFV	Alternative Fuel Vehicle
BC	British Columbia
BCD	Building Code Division (Oregon)
CNG	Compressed Natural Gas
COG	Council of Governments
DC	Direct Current
EV	Electric Vehicle
EVIC	Electric Vehicle Infrastructure Council (Maryland)
EVITP	Electric Vehicle Infrastructure Training Program
EVSE	Electric Vehicle Supply Equipment
GHG	Greenhouse Gas
IBC	International Building Code
LEED	Leadership in Energy and Environmental Design
MDOT	Maryland Department of Transportation
MPO	Metropolitan Planning Organization
MWCOG	Metropolitan Washington Council of Governments
NEC	National Electrical Code
NGO	Nongovernmental Organization
NYCDCP	New York City Department of City Planning
NYSERDA	New York State Energy Research and Development Authority
ODOT	Oregon Department of Transportation
OEM	Original Equipment Manufacturer
PSRC	Puget Sound Regional Council
RFP	Request for Proposal
SCE	Southern California Edison
SEC	Seattle Electrical Code
TCI	Transportation and Climate Initiative
V	Volt

EXECUTIVE SUMMARY

Battery and plug-in hybrid electric vehicles (EVs) are becoming an important part of the transportation landscape. EVs offer clear environmental, economic, and energy benefits to communities of all sizes, and as consumers become aware of these benefits, EV purchases will rise.

Anticipated growth in the EV sector creates a need to facilitate and encourage the development of a consistent and accessible network of EV charging infrastructure (known as electric vehicle supply equipment, EVSE), including at home, on public streets, and in commercial settings. While the full extent of EV charging demand is not yet known, communities can take proactive steps to encourage infrastructure development.

This guide is meant for local governments to use as a resource to help their communities become EV-Ready. The report takes an in-depth look at five policy tools that can enable EV readiness: zoning and parking ordinances, codes, permitting, and building interagency or business partnership. An overview of each of these tools is provided, and best practices are explored.

Key Findings

Zoning

- Zoning is a necessary part of EV readiness, but it has inherent limitations.
- Defining EVs and EVSE as a permissible use in zoning regulations is a first step on which decision makers can build future regulations.
- By setting development standards through zoning ordinances, municipalities can use this tool to shape the scope of EVSE deployment.
- Incentivizing zoning, such as the exchange of development bonuses for the inclusion of EVSE pre-wiring or infrastructure in new development, is a potential method to increase EVSE deployment, but it remains largely untested.

Parking

- Regulation of EVSE through parking ordinances can set the scope and enforcement requirements for parking with state or local laws.
- Parking ordinances can be effective tools in encouraging EVSE in a wide range of installation scenarios, including public and private space as well as new and existing construction.
- Parking ordinances work hand-in-hand with parking management (whether public or private) to enforce regulations on the use of parking spaces, including EV charging-only spots.
- Opportunities exist for private parking management and for developing EV parking incentives, such as preferred parking, which may encourage EV purchases.

Codes

- No changes to the national model codes are currently necessary to ensure user or installation safety for level 1 and level 2 charging.
- Codes can be used to provide consistent and flexible options to regulate for EVSE. This can include setting development standards, such as requirements for a certain number or percentage of EVSE-designated parking stalls.
- Code changes will require buy-in from the development community, but precedents indicate costs will not increase dramatically.
- Municipalities that are able to adopt their own codes benefit from a highly flexible state code—one that provides different standards for different situations.

Permitting

- Several municipalities have found their existing permitting sufficient through defining EVSE installations as “minor” work.
- Most permitting expediting efforts have focused on a “standard” single-family home installation, but future efforts should seek to facilitate more complex installations and installations in multifamily and commercial settings.
- Reducing permitting fees for EVSE should start by eliminating unnecessary administrative and inspection steps.
- Fee standardization benefits consumers and is useful to electricians quoting prices.

Partnership and Procurement

- Having a diverse set of partners in EV-readiness planning is important because it can strengthen the EV markets. Expertise and dissemination of information are necessary for new technologies to catch on. This is often best accomplished by working with public, private and non-governmental organizations dedicated to EVs.
- Creative business partnerships will be crucial to the future of EVSE deployment. Many businesses may be attracted to hosting EVSE because of branding opportunities. Nurturing business partnerships may reveal new business models that promote EVs and benefit the business community.
- Private-sector innovation and investment will continue to shape the EV market.
- The public sector can encourage this development and reduce public expense by establishing procurement programs and policies for equipment and services.

These tools comprise potential approaches at the local level that can work alone or in combination to implement EV-ready policies. For the region, bridging local boundaries to create a coordinated infrastructure network poses the next challenge to meeting the needs of the growing EV sector.

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

The delivery of a vehicle charging network and electric vehicle supply equipment (EVSE)¹ required by the growing number of electric vehicles (EVs) in the Northeast and Mid-Atlantic states² will need to be supported by government and planning organizations, in collaboration with the private sector.

This guide will demonstrate, using examples and ideas from cities and states already making themselves more EV-ready, what policy tools can be utilized to make sure that EVSE is allowed; encouraged through voluntary actions, incentives and easy and affordable administrative processes and, where possible, required in new construction.

The guide considers key regulatory areas—zoning, parking, codes and permitting—and the creation of opportunities for both the public- and private-sectors to work together and lead EV-ready initiatives. As these tools are readily available to local jurisdictions, this guide analyzes each regulatory area in detail to determine how they can be effectively used for EV-ready planning. Identifying the actionable policy and planning levers for local jurisdictions and offering precedents will help the Northeast and Mid-Atlantic states to encourage EV use and to achieve a level of regional cohesion for EV charging.

Why Take Action?

EVs offer clear environmental, economic and energy benefits to communities of all sizes. Action to encourage greater EV usage through a more EV-ready environment can bring the following benefits:

¹ EVSE is commonly referred to as a charging station; both terms are used in this guide.

² See the companion study, *Assessment of EVSE and EV Deployment*, for more detailed information on the current status of EVs and EVSE in the Northeast and Mid-Atlantic United States.

- Reduction of petroleum consumption
- Reduction of air pollution that can cause cancer and other serious health effects including cardiovascular and respiratory problems such as asthma, especially in children and the elderly³
- Reduction of greenhouse gas (GHG) emissions that contribute to global warming, in line with local, state and federal goals
- Improvements to soil and water quality through the reduction of pollutants in stormwater runoff⁴
- Anticipated economic development benefits in the form of business and job growth in the EV and transportation equipment industries, reduced losses associated with carbon emissions⁵ and potential property value increases due to air quality improvements⁶ and sound minimization
- Improvements to the status of national energy independence and fuel cost savings to individuals and jurisdictions

While the full extent of EV charging demand is not yet fully determined, there is a clear need for EV

³ “Particulate Matter: Health,” U.S. Environmental Protection Agency, updated June 15, 2012, <http://www.epa.gov/pm/health.html>.

⁴ Federal Highway Administration, “FHWA Environmental Technology Brief: Is Highway Runoff a Serious Problem,” updated July 19, 2012, <http://www.fhwa.dot.gov/publications/research/infrastructure/structures/98079/runoff.cfm>.

⁵ Interagency Working Group on Social Cost of Carbon, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866* (Washington, DC: U.S. Environmental Protection Agency, February 2010), <http://www.epa.gov/oms/climate/regulations/scc-tds.pdf>.

⁶ Kenneth Y. Chay and Michael Greenstone, “Does Air Quality Matter? Evidence from the Housing Market,” *Journal of Political Economy* 113, no. 2 (April 2005) 376–424.

infrastructure. The development of a consistent, accessible charging network would enable EV owners and communities to accomplish the following:

- Charge at home, at work and in commercial and public locations
- Extend vehicle range
- Better integrate EVs into regional transportation networks
- Encourage more widespread EV adoption

What is the Purpose of the Guide?

The EVSE Resource Guide highlights best practices and new actionable ideas from across the Transportation and Climate Initiative (TCI) region, North America and beyond. Best practices are typically defined as those methods or approaches that have consistently generated the desired results. Relying on best practices for EV and EVSE deployment planning presents an interesting problem: the approaches are often too new to be sure of their effectiveness. As a result, each town, city or metropolitan area should closely consider, based on applicability, many of the examples and potential solutions offered by the guide. Because of the chicken-and-egg nature of planning this type of decentralized transportation infrastructure, jurisdictions must take the lead in clearing regulatory pathways to make room for the adoption of EVs and deployment of the necessary infrastructure in order to ensure the possibility of market uptake of EVs. The primary focus is to identify opportunities for local action in the TCI region.⁷

The purpose of this guide is to provide discussion and guidance to practitioners from government and the private sector regarding the limitations

⁷ TCI is a collaboration of the transportation, energy and environment agencies from the 11 Northeast and Mid-Atlantic states and Washington, D.C., focused on reducing GHG emissions from the transportation sector. The following states have jurisdictions participating in this TCI project: Connecticut, Delaware, DC, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont. They will be referred to throughout this report as the TCI region. TCI states work closely with 16 of the region's Clean Cities Coalitions through the Northeast Electric Vehicle Network.

and opportunities associated with local planning and administrative processes that relate to EVSE deployment, using these tools as a framework for local action.

The guide will demonstrate pathways to EV readiness. For the purposes of this document, EV readiness can be interpreted at minimum as the removal of barriers to easy, safe and cost-effective EVSE installation. At maximum, local jurisdictions can use the tools available in order to influence the scale and character of EVSE deployment, including working with regional entities such as local Clean Cities Coalitions, Councils of Government (COGs) and Metropolitan Planning Organizations (MPOs).

Who Should Use the Guide?

This guide will identify and describe the most relevant tools to local governments and provide guidance to practitioners at all levels of state and local government wishing to take action to encourage EVSE deployment. It will help public and private installers of EVSE, developers and other private-sector actors understand the context of proposals to install EVSE. It will help regional planning organizations working to incorporate EV-ready planning into transportation planning priorities. Finally, it will help private stakeholders understand how their efforts might be bolstered through policy changes.

You will find the guide useful if you are a policy maker who develops, enacts or enforces strategic plans, regulations and legislation or an industry stakeholder or member of an interest group from the private sector.

Unlike location-specific EV-ready plans, the guide takes a wider approach by offering a menu of best practices from across the country and abroad that can be applied to the specific local needs and conditions of the TCI region. Variations such as geography, demographics, administrative structures and presence of existing markets for EVs and EVSE preclude a sweeping regional approach at this stage of EV planning.⁸ Further, the integration of EVSE into the built environment will require engagement from policy makers at

⁸ These demographic and market differences are explored in more detail in the companion report, *Assessment of Current EVSE and EV Deployment*.

different jurisdictional scales. The guide aims to engage the range of levers available to state and local governments and the constituent organizations that use the tools highlighted here—zoning, parking, codes, permitting and inspection and partnerships and procurement.

Resource Guide Structure

The next section provides an overview of each of these tools for local jurisdictions, describes the goals of EV-ready planning and introduces a summary analysis of each tool’s relative strengths and weaknesses in different types of applications.

Each subsequent section presents a more in-depth look at the five planning tools and their applicability to EVSE:

Tool 1: Zoning (page 7)

Tool 2: Parking (page 12)

Tool 3: Codes (page 16)

Tool 4: Permitting and Inspection (page 19)

Tool 5: Partnership and Procurement (page 24)

Each section introduces a different tool and its potential relevance to planning for EVSE deployment, and includes key examples from the TCI region and elsewhere as an overview of best practices. Each section ends with a discussion of present limitations of the respective tool that point to opportunities and considerations for future planning.

Finally, the report concludes with key findings, areas for ongoing study and recommended next steps.

POLICY AND PLANNING TOOLS FOR EV READINESS

Local and state governments have important tools at their disposal that can be used to more successfully and seamlessly integrate EVSE into the planning and administration of states, cities and towns. Each jurisdiction will need to determine the most appropriate lead agencies and offices based on its own needs and assessments of costs and benefits. This section will identify the role of each type of administrative or planning tool and introduce a discussion of EV readiness at the state or local level that will be considered in greater detail in the pages that follow.

EV readiness in policy and regulation will involve incentivizing or requiring EVSE infrastructure deployment, eliminating procedural barriers, considering potential for financial incentives or mandating pre-wiring for EVSE installation.

A key strategy for capturing the many benefits of EVs will be the development of policies and programs that aim to deploy EVSE infrastructure to meet today's charging needs and prepare cities, towns and regional corridors for growing EV use. Simply put, EV readiness can be achieved through zoning that requires EVSE parking in the private realm, parking ordinances that enable EVSE in the public realm, building or electrical codes that require wiring in parking and set new standards for safety and permitting that streamlines the administrative process.

Despite differences across the region, there are a handful of factors that need to be in place to successfully advance policy, legislation and ordinances relevant to EV infrastructure. EV-ready planning includes creating and implementing solutions to one or more of the following barrier-reducing actions:

- Ensuring that new construction is EVSE ready⁹

⁹ "EVSE-ready" new construction can include a range of possible options for municipalities. From the literature and case studies these include: requirements to install EVSEs, requirements to pre-wire (lay conduit) for a certain percentage or number of parking stalls in new construction for future EVSE installation, requirements

- Clearing administrative pathways for residential service upgrades and EVSE retrofit
- Providing safe, consistent and accessible EVSE installations and implementing good site planning and design
- Ensuring that new construction can support higher electricity demand, with the potential of adding future vehicle battery charging capacity and eventually energy storage devices
- Enabling dedicated parking spaces for EVs in both public and private realms, with clear protocols for the usage and operation of the spaces and EVSE
- Aligning EVSE deployment with policy and environmental mandates to achieve emissions reductions, air quality improvements, transportation technology advances and energy independence

There is no one-size-fits-all policy approach to increasing EV readiness. Each state or local jurisdiction needs to evaluate the objectives behind any potential new policy, code revision or other change and follow a path that best suits the jurisdiction.

for reserved space in the electrical closet for future electrical service capacity and requirements providing regulations that do not inhibit voluntary installation.

Table 1: EV Planning and Policy Tool Summary

ZONING	<p>Determines where and how EVSE is allowed, incentivized or required</p> <ul style="list-style-type: none"> • Zoning establishes allowable uses through the municipal zoning code • Zoning can consider the deployment of EVSE within the larger context of planning and land use • Incentive zoning, such as the exchange of development bonuses for the inclusion of EVSE pre-wiring or infrastructure in new development, is a potential area for EVSE deployment, but it remains largely untested • By setting development standards through zoning ordinances, municipalities can use this tool to shape the scope (how many and where) of EVSE deployment
PARKING	<p>Sets the scope and enforcement requirements for parking with state or local laws</p> <ul style="list-style-type: none"> • Parking ordinances apply to publicly accessible EVSE, including on-street parking and municipal lots and garages, and are therefore an important part of infrastructure development • Similar to zoning, parking ordinances provide a way to require a certain number or percentage of spaces and to restrict the use of charging stalls to EVs • Because parking ordinances apply to the public realm, parking tools can be effective in encouraging EVSE in a wide range of installation scenarios, including public and private space as well as new and existing construction • Opportunities exist for private parking management • Opportunities exist for developing EV parking incentives, such as preferred parking, which may encourage EV purchases
CODES	<p>Ensure safe EVSE installations and specify the scope of EVSE-ready construction</p> <ul style="list-style-type: none"> • Changes to the building and electrical codes are not necessary from a safety standpoint, but codes can help make places EV-ready • State and local codes may need to change to meet certain requirements, such as emissions reduction goals. This is an ideal opportunity to incorporate EVSE • Municipalities that are able to adopt their own codes benefit from a highly flexible state code—one that provides different standards for different situations • Building and electrical codes present different EV-ready opportunities
PERMITTING AND INSPECTION	<p>Streamlines the administrative process so that it is uncomplicated, fast and affordable</p> <ul style="list-style-type: none"> • Updating and streamlining permitting eases implementation of EVSE and reduces fees to the consumer as well as costs to the municipality over the long term • Permitting is a local administrative process. As a result, the process varies across the TCI region, as evidenced by wide variations in permit fees • While the prime inspection venue is provided by cities and state offices, third-party inspection firms offer opportunities for partnership and inspector training throughout the TCI region
PARTNERSHIP AND PROCUREMENT	<p>Works closely with private or quasi-public partners to implement infrastructure in the public realm</p> <ul style="list-style-type: none"> • Partnerships include working groups, which can unite government agencies with private industry and experts • Regional planning organizations such as MPOs and COGs are important for building consensus and getting the word out • Local U.S. Department of Energy Clean Cities chapters can offer additional funding and information on EVs • Governments can procure EVs for municipal and state fleets to increase awareness and meet sustainability goals • The role of the private sector can be just as, if not more, important in preparing the region for more comprehensive EVSE deployment

Limitations to the Tools

There are limitations placed on government policy makers when it comes to promoting EVs and EVSE deployment through the regulatory and administrative tools typically available to the public sector. The applicability of mechanisms such as codes, permitting, zoning, ordinances and partnerships at the state and local levels will of course be determined by jurisdiction of the agency, office, firm or other entity leading the planning effort. As a result, the degree of EV readiness will depend on the menu of tools each policy maker has at his or her disposal, the time and funding available, the degree of cooperation within the local or state government and the ability to partner with businesses or other private-sector organizations.

Evidence indicates that overregulation in the early stages of the EV market will have a negative effect on the EV industry.¹⁰ Developing business models need space to grow and innovate, and some policy makers in the TCI region have noted that their own state's regulations have been influenced by the understanding that it is too early in the development of the industry to limit EVSE to certain business models.¹¹ Additionally, the behavior and etiquette of EV drivers around charging stations have yet to be determined. This includes a full understanding of the real demand on publicly accessible charging in particular as charging and battery technology evolves. Overregulation also has a negative impact on the development community. By requiring EVSE or EVSE pre-wiring too early or in the wrong instances, officials may place a burden on developers who do not yet see real financial benefits to EV charging. In light of these considerations, government officials are reluctant to regulate emerging markets with a heavy hand. Given the overall recognition that EVs are a developing technology, with a developing market to match, the lack of municipal experience with respect to consumer preference and user

behavior including driving patterns and etiquette will limit the degree to which local governments will willingly interfere by overregulating EVSE deployment. This approach expects consumers, private industry, utilities, original equipment manufacturers (OEMs) and service networks to drive the development of this new sector.

¹⁰ Stephen Brown, David Pyke, and Paul Steenhof, "Electric Vehicles: The Role and Importance of Standards in an Emerging Market," *Energy Policy* 38, no. 7. (July 2010): 3797–3806, <http://www.sciencedirect.com/science/article/pii/S0301421510001631>.

¹¹ Meg Andrews and Kristen Weiss, phone interview, September 18, 2012.

TOOL 1: ZONING

Zoning is a form of local ordinance that governs the use of property within local jurisdictions. Zoning for EVSE will need to consider the existing methods and technologies available for EV charging, and potentially think ahead to proactively address developing technologies and installation scenarios.¹² Zoning ordinances are enacted locally, occasionally in order to comply with state mandates.¹³ Zoning regulates land uses and sets parameters for different types and intensities of land uses, as well as the requirements asked of developers. As a result, zoning establishes expectations of developers by specifying what types of uses are allowed and the character of new development. In this way, zoning changes impact future construction, with the exception of changes to permissible uses, which allow EVSE as accessory uses in existing development.

As a tool for local governments in infrastructure planning, zoning ordinances are used to indicate where EVSE is allowed or prohibited.¹⁴ Zoning is a long-term tool, not a shortcut to accelerating infrastructure deployment. Because of the long-term nature of zoning changes and the development process, jurisdictions should prioritize zoning changes that may be necessary to allow EVSE in appropriate locations in order to achieve timely results.

¹² Different types of EVSE may have different zoning implications. Levels 1 and 2 charging, illustrated in Appendix A: Overview of Electric Vehicle Supply Equipment Charging Levels, will be the dominant case to consider for zoning today. Level 3 charging is still in development, and will likely be useful in roadside or commercial applications that will require different zoning considerations from levels 1 and 2 residential and commercial applications. Future technology and business models will shape the ways in which EVSE best fits into zoning districts.

¹³ As in the case of Washington State’s mandate that local jurisdictions allow EVSE.

¹⁴ In general, zoning ordinances regulate the use of land, setting standards for specific primary and secondary uses, building area and height, lot coverage and street setbacks. Other requirements dictated by zoning include residential density, parking spaces required, open space, signage, the nature of a building’s street frontage.

Zoning is seen as one of the bigger “question marks” in planning for EVs and EVSE. The connection between zoning ordinances and EV readiness is not as clear-cut as the other tools described in this guide. Zoning is a “blunt tool”: it alone will not facilitate EVSE deployment, but the potential for it to prohibit or preclude EVSE is a factor every town should consider. Zoning is an important step toward EV readiness, but additional measures are needed. Localities should review local zoning ordinances to ensure that EV charging stations are permitted under existing regulations. Changes to zoning may also assist localities in incentivizing or requiring EVSE or characteristics of EVSE deployment.

There are several examples of EV-specific zoning ordinances that have been tested to date. A 2010 EV-readiness study by the Puget Sound Regional Council (PSRC) found that no city in the United States had adopted any comprehensive building or zoning ordinance that addressed EV charging at that time; it was far more likely for a place to have pursued parking ordinances as a form of regulation.¹⁵ Similarly, in 2011, TCI was not aware of any jurisdiction in the Mid-Atlantic or Northeast regions that had adopted zoning ordinances addressing EVSE.¹⁶ However, several large and small municipalities—from New York City to Methuen, Massachusetts—were taking steps to introduce EV-specific zoning regulations.

¹⁵ Puget Sound Regional Council, *Electric Vehicle Infrastructure: A Guide for Local Governments in Washington State* (Olympia, WA: Washington Department of Commerce, July 2010), http://psrc.org/assets/4326/EVI_full_appendices.pdf.

¹⁶ Cassandra Powers, TCI.

What can Zoning Accomplish?

Zoning actions should include the following to support EVSE and EV readiness in the TCI region:

- Ensure the zoning resolution or ordinance permits EVSE in logical locations
- Establish clear definitions for EVs and EVSE, as well as the use groups¹⁷ for EVs and EVSE
- Consider relevant comprehensive planning frameworks
- Set out high-level criteria for design, accessibility and parking enforcement
- Consider impacts of EVs on GHG and other emissions with respect to environmental review processes

Zoning should function to support any applicable plans that may be in place. A comprehensive plan or EV agenda could be used to indicate where EV charging stations should be allowed, concentrated, and required. In general, zoning ordinances should account for projected development over a long period of time and guide EVSE deployment. Currently, investment and grant funding has provided opportunities for cities, counties and states to prepare EV-readiness plans, and zoning should be a consideration when planning for and locating EVSE.

Compliance with Federal and State Legislation

Requirements to create plans, such as for transportation, energy efficiency or reducing GHG emissions, often come from federal and state governments. For example, federal transportation funding for MPOs is often linked to a long-term plan. Some existing state legislation defines EVs and EVSE, and in some cases it indicates the scope of EVSE deployment.

States considering the requirements of EVs and EVSE have determined that an early step is to clarify what, exactly, these new technologies are and where and how many might be needed. Local jurisdictions planning for EVs will need to comply with or exceed any applicable state requirements. In addition to EVSE-specific rules, states may also establish environmental requirements. GHG or air quality emissions targets are especially relevant and local governments should be aware of how

¹⁷ Use groups refers to a designated group of land uses that are considered to be allowed as-of-right.

opportunities in their jurisdictions fit into the bigger picture of environmental planning.

The Role of Zoning in EVSE Deployment

Planners and other officials can use zoning to allow, incentivize or require EVSE either throughout a municipality's zoning districts or in specific areas. The remainder of this section discusses examples of each approach.

Allow EVSE

Defining EVSE in the local city planning and land use context is a good first step that a handful of jurisdictions have taken to ensure that EVSE installations are allowed. By incorporating language specific to EVSE and/or battery swap stations in the local zoning ordinance, local planning offices can help clear barriers to installation by answering a simple question in the zoning text: What is EVSE?

New York City's Department of City Planning reviewed EV charging and battery swap stations and determined that a distinction was needed to create clarity in the zoning text to ensure vehicle battery charging was codified as a use distinct from gasoline filling stations. In the New York City Zoning Resolution, this pointed to a need to include battery charging in a distinct use group.¹⁸ The city's "Zone Green" zoning text amendments, enacted by the New York City Council in April 2012 defines "electric vehicle charging in conjunction with parking facilities" as an accessory use in the New York City Zoning Resolution. It places EV charging stations and battery swap facilities in a use group for "Auto Service Establishments." This includes such facilities as automobile glass and mirror shops and tire sales establishments but not petroleum fuel filling stations, which allows EVSE in any drive-in property/use in a commercial district. For New York City, this designation supported city efforts to deploy infrastructure without being overly prescriptive.

New York City provides an instructive example, but the type of zoning district and use group categories will differ from place to place. Local resolutions will account for permissible uses, based on zoning districts (e.g., residential,

¹⁸ Howard Slatkin, interview, August 29, 2012.

commercial and industrial), special districts and potentially on the level of charge.¹⁹ Including clear definitions and provisions for where EVSE is allowable as-of-right (or by right)²⁰ will limit barriers associated with development review. These definitions will allow the developer to avoid the costs of seeking special approvals for changes such as by rezoning, special permit or variance, all of which require a public review process.

In the Region: Methuen, Massachusetts in 2011 adopted an addendum to the city zoning resolution that specifies permissible use of levels 1 and 2 charging stations in single-family and multifamily zones.

- Levels 1 and 2 are permitted as accessory uses to parking facilities in all areas.
- Level 3 or DC fast charge is permitted as a principal use in commercial or industrial zones or as a conditional use in general.

See <http://www.cityofmethuen.net> for more information.

State legislation can require local jurisdictions to adopt zoning provisions for EVSE, such as Washington State's requirement that EVSE and battery swap stations be designated as permissible uses in certain types of zoning districts throughout the state. Washington State offers an example of a targeted approach to infrastructure location, requiring local jurisdictions within a buffer zone surrounding the state's primary transportation corridor and population centers to adopt zoning ordinances allowing EVSE and battery swap stations. Jurisdictions in Washington must develop regulations to allow the use of EVSE and battery swapping stations in all areas except for critical areas or those areas

¹⁹ Please refer to Appendix A: Overview of Electric Vehicle Supply Equipment Charging Levels for an overview of charge levels, and to the Siting and Design Guidelines prepared in conjunction with this toolkit for a discussion of site-specific concerns and constraints.

²⁰ As-of-right or by-right development is development conducted in accordance with existing zoning, and which does not require additional review, variance, approval or planning permits from the local authority. Note: electrical installation permits are a separate tool and process.

zoned for residential or resource use.²¹ The regulatory framework stems from research and state-level legislation spearheaded by the Washington Department of Commerce and allows localities to adopt the appropriate changes to zoning in order to be in compliance. Examples of jurisdictions' various responses to this mandate are instructive because they reflect the value of zoning as a local tool.

Incentivize EVSE

Incentive zoning provides a bonus, such as in the form of additional floor area, in exchange for the provision of a public amenity or community improvements. In New York City, for example, bonuses are provided for public plazas, cultural venues, subway improvements, theater preservation, and grocery stores in particular areas and affordable housing units.²²

In the case of EVSE, a developer incentive would be exchanged for EVSE pre-wiring or charging station installation. Typical developer incentives include an increase in allowable floor area or a reduction of required parking. EVSE is the public benefit, and the incentive would be the increased density, reduced parking or other incentive to encourage the inclusion of EVSE in new construction. Zoning ordinances could define priority areas where EVSE may be required and/or supported by programmatic incentives to install EVSE. The nature of the incentive would be outlined in the zoning ordinance as well.

Zoning incentives are an interesting but largely untested area of local regulation for EVSE. Several ideas gleaned from stakeholders are included below; however, in general it should be noted that a lack of clarity in this area is to be expected at this point in the development of the EV market. Jurisdictions and private industry have not completely decided on the value of EVSE or charging station units to the public; Methuen, MA in fact disincentivizes EVSE by counting electric

²¹ Patti Miller-Crawley, phone interview, July 18, 2012. See also the Western Washington Clean Cities Coalition and Washington State Plug-In Electric Vehicle Task Force's "Plug-in Electric Vehicle Readiness Plan for the State of Washington" (September 2010) at <http://www.electricdrive.wa.gov>.

²² Department of City Planning, "Zoning Glossary," City of New York, accessed November 9, 2012, <http://www.nyc.gov/html/dcp/html/zone/glossary.shtml>.

vehicle charging spaces as half of a space for minimum parking calculations.²³

A number of questions remain as to how incentive zoning could be applied to EVSE. First, it is not yet clear that EVSE will be viewed as a significant enough public benefit to justify an exchange for additional floor area. Further, even if EVSE impacts can be effectively monetized or determined to be significantly publicly beneficial, uncertainties exist regarding whether EVSE charging stations or spaces can be considered exchangeable with floor area or parking reductions.

Require EVSE

There are two ways that zoning can create requirements for the installation of EVSE. First, zoning can require the scope of future EVSE deployment through zoning text amendments that specify where and how many parking stalls in future development will include EV-ready wiring or charging stations. Second, zoning resolutions can set standards for EVSE design and use where they are permitted. Examples of both approaches to using zoning tools to require EVSE come from other countries or other applications. As a result, it is important to consider the way that visionary planning ideas might translate to the growing EV markets in U.S. cities.

A strong example of requiring EVSE through zoning changes comes from a place without zoning: London, United Kingdom. The Plan for London, the city's long-range development plan, requires EVSE installation by mandating it in new construction.²⁴ London's plan requires all new development to include 20% of parking stalls to be not only allocated to EVs, but also equipped with charging stations in order to encourage the uptake of EVs.²⁵ This approach has not yet been

²³ See Appendix C: Zoning for the full text of Methuen, MA's Addendum to Comprehensive Zoning Ordinance - Electric Vehicle Provisions

²⁴ "London's Transport," *The London Plan* (2011) chapter 6, <http://www.london.gov.uk/sites/default/files/LP2011%20Chapter%206.pdf>.

²⁵ Omoniyi Giwa, Senior Borough Programme Officer, Transport for London. interview August 12, 2012. London's development strategy is only one part of a comprehensive plan to bring EVs to the city through deployment of 25,000 EVSE by 2015. See also: <http://www.london.gov.uk/sites/default/files/uploads/eletric-vehicles-plan.pdf>.

tested in the United States through zoning; however, building codes and parking regulations, discussed later in this guide, have set similar requirements using different tools.

Zoning can also be used to require certain characteristics of installed EVSE by setting development standards.²⁶ There are a number of examples of existing resolutions that highlight how zoning can be used to set standards for EVSE design, including the following:

- EVSE charging stations are reserved for EV parking only, except when located as an accessory to single-family residential uses²⁷
- Signage: ensuring its appropriate use and enforcement is the responsibility of the local jurisdiction²⁸
- Accessibility: zoning can specify that the design and location of EVSE conform with Americans with Disabilities Act (ADA) or barrier-free accessibility requirements²⁹

²⁶ Department of City Planning, *Article 1 General Provisions: Chapter 4 0 Sidewalk Café Regulations* (New York: The City of New York, July 26, 2012), <http://www.nyc.gov/html/dcp/pdf/zone/art01c04.pdf>.

²⁷ "Chapter 17.63: Electric Vehicles Charging Stations," *The Chelan Municipal Code* (Chelan, WA: Code Publishing Company, September 27, 2012), <http://www.codepublishing.com/WA/chelan/html/Chelan17/Chelan1763.html>.

²⁸ Meg Andrews, Maryland State Department of Transportation, interview August 18, 2012.

²⁹ "Chapter 17.63: Electric Vehicles Charging Stations," *The Chelan Municipal Code* (Chelan, WA: Code Publishing Company, September 27, 2012), <http://www.codepublishing.com/WA/chelan/html/Chelan17/Chelan1763.html>.

Limitations

Zoning is a primary local tool for implementing EVSE, but it may also be the one with the most limitations for EV readiness in the immediate future, except for defining areas of permitted use.

Reluctance to Require EVSE through Zoning

Experts and municipal stakeholders have expressed hesitation concerning overregulation.³⁰ Regulation can take many forms, but the overall desire is to ensure that industry growth and innovation is not stifled in order to encourage EV adoption, while also ensuring that no individual or industry is overburdened with requirements intended to support the growth of the EV sector. These ideas apply to zoning because of the limitations and requirements that zoning can be used to place on property owners. In New York City, city planning officials expressed reluctance to create land use requirements that would pressure landlords into the business of owning and operating EVSE.

In many municipalities, the role of zoning is often highly responsive to the development community. Where it is perceived that zoning changes would not be well received by developers or landlords due to added development or maintenance costs related to EVSE installation, zoning may not be the most ideal approach for EV-ready planning. According to Howard Slatkin of the New York City Department of City Planning (NYCDCP), “zoning cannot be used to compel people into a particular business model.”³¹

Public Review Process

To this point, zoning changes must undergo review that takes the development community into account through the public process. Zoning changes require some form of public review process and will be subject to local public input as well as general political will. Any zoning proposal involving EVs and EVSE must pass a public review.

Planning Departments Do Not Enforce or Inspect

As described by NYCDCP, zoning incentives for this type of use are more difficult to enforce. It is hard for the city to tell whether an indoor or underground garage is meeting the requirements for the zoning incentive after development benefits are received. There is obviously no recourse by which to take back the benefit to the developer associated with the incentive.

³⁰ Please reference *EVSE Codes for the Built Environment*, the companion report discussing the regulatory role of codes and standards in the EV infrastructure domain.

³¹ Howard Slatkin, interview, August 29, 2012.

TOOL 2: PARKING

Parking ordinances will apply to publicly accessible charging stations. EVSE in the public realm, such as on-street locations, municipal lots and even privately operated garages will make up an important part of the necessary charging infrastructure for EVs. Parking regulation and enforcement is typically a shared responsibility in municipalities, requiring participation of departments of transportation, law enforcement, public works, permitting and other key players in the management of transportation and traffic. These stakeholders also include neighborhood associations, parking garage managers and others who by law or voluntarily participate in this area of regulation.

The municipal code can utilize parking ordinances and management as a tool to address a number of aspects of EV charging infrastructure: the scope of EVSE pre-wiring or installation from a transportation and logistics perspective; on-street EV charging and parking and how best to manage user rotation, access and violations.

Parking ordinances will operate in close association with management plans for parking lot or garage operators that open to the public. Given the existing subsidies for businesses and private operators and the lack of extensive municipal funding to support EVSE installation, parking managers may take a lead role in making decisions about the way EVSE is made available to the public.

In general, EV charging has become almost synonymous with parking regulation—EVs will need to park in order to charge. A discussion of how parking management contributes to EVSE deployment will engage the following key ideas:

- Incorporation of EVSE in the public right of way
- Safety and accessibility
- User rotation or “linger time” and etiquette
- Violations of posted parking rules and enforcement
- Site design
- Monetization and business models

State Regulations for Scope and Enforcement

Parking regulations impact the scope of EVSE readiness in a given place and can specify how many and where EVSE charging stations are required or encouraged.

Hawaii: Plug-In Electric Vehicle Parking Requirement

In Hawaii, all parking facilities that are available for use by the general public and include at least 100 parking spaces must designate at least 1 parking space specifically for electric vehicles by July 1, 2012, provided that no parking spaces required by the ADA Accessibility Guidelines are reduced or displaced. Spaces must be clearly marked and equipped with EVSE. Owners of multiple parking lots may designate and install EVSE in fewer parking spaces than required in one parking lot, as long as the total number of aggregate spaces for all parking lots is met. Penalties apply for non-EVs that park in spaces designated for EVs.³²

Local Parking Ordinances

Some local jurisdictions have in fact chosen to regulate use more directly; that is, to use the municipal code to establish parking ordinances that prohibit parking in an EV-charging space except for EVs utilizing the charger.

Lacey, Washington

The city of Lacey, Washington, enacted EV infrastructure requirements that restrict the use of specially designated charging stalls as EV charging

³² “Senate Bill 2747 SD1 HD2,” Hawaii State Legislator, accessed November 9, 2012, http://www.capitol.hawaii.gov/measure_indiv.aspx?billtype=SB&billnumber=2747; Department of Business, Economic Development and Tourism, *Hawaii State Energy Office EV Ready Fact Sheet* (Honolulu: Hi, State of Hawaii, March 2012), http://energy.hawaii.gov/wp-content/uploads/2011/09/DBEDT-EV-Fact-Sheet-MAR-2012_final.pdf.

only.³³ This local law adds parking enforcement to the zoning regulations required by the Washington State.³⁴

On-Street Parking

On-street EVSE will require cooperation of the owners of the electrical infrastructure at the installation site—generally the city or the owner of the adjacent building.

Zoning regulations typically do not apply to the public right-of-way, which would fall under a city's department of transportation or other similar agency's purview. In New York City, rules can dictate requirements for accessory parking and public parking, with an "increasingly important gray area in between."³⁵ The issue is that density of development and use generates a need for highly flexible parking. The "gray area" includes on-street parking. In some areas of New York City, more than 50% of residents with cars park on the street. There are important ongoing questions as to how parking ordinances and management can not only maintain order for publicly accessible stations, but also provide home charging solutions for EV drivers who do not have easy access to an outlet or charging station.

Parking Management

There is a need to establish a clear process and determine which agencies will handle the logistics of EVSE charging spaces in the public realm—and in publicly accessible lots and garages.³⁶

Local jurisdictions are primarily responsible for implementing parking and incentive structures most appropriate for local markets. This responsibility includes both enforcing regulations and working with private-sector partners such as garage operators who will enforce regulations on their property. Parking management thus refers to both enforcement in public areas and operations

³³ City of Lacey, *Ordinance No. 1351* (Lacey, WA: City of Lacey, August 16, 2010), <http://www.mrsc.org/ords/l32o1351.pdf>.

³⁴ Syracuse, NY is another municipality that has taken similar steps.

³⁵ Howard Slatkin, interview, August 29, 2012.

³⁶ Mary Doswell, Dominion Resources "What Municipalities Need to Know," presentation, February 4, 2011.

of private entities providing EVSE charging and parking.

Enforcement: EV Parking Regulation

In California, an individual may not stop, stand or park a motor vehicle, or otherwise block access to parking, in a stall or space designated for the exclusive purpose of charging an EV unless the vehicle displays a valid state-issued zero-emission vehicle decal and is connected for electric charging purposes.³⁷

By contrast, after analysis of proposed, similar legislation, some states have determined that in areas where EV markets are not yet strong it is too early to regulate enforcement of EV parking at the state level.

Similar to all traffic statutes, statutes prohibiting parking by non-EVs or non-charging EVs can be enforced in any publicly accessible lot or garage in most municipalities, if such a statute is approved in a jurisdiction. An example from the TCI region that attempted to regulate parking in this way is a bill that was proposed in Maryland that would have made it illegal for a non-EV to park in an EV-designated space. While the bill was being discussed, the concern was raised that an ordinance that restricts parking may deter use at that lot. Upon review by the EV Council in the state, the resolution was determined premature at this point. An important takeaway from Maryland's experience is that there is likely already law on the books that allows a car parked illegally for any reason, based on the signage at a particular location, to be towed.³⁸

Accessibility

It will be necessary to create spaces and routes that are safe and accessible to drivers, who will spend more time than usual maneuvering around a parking space in order to connect and disconnect. Planning for accessibility must at minimum limit tripping hazards and other liability concerns, and should also consider ways to meet ADA compliance standards.

³⁷ California Department of Motor Vehicles, "V C Section 22511 Off-Street Parking: Electric Vehicle," CA.gov, accessed November 9, 2012, <http://www.dmv.ca.gov/pubs/vctop/d11/vc22511.htm>.

³⁸ Meg Andrews and Kristen Weiss, Maryland State Department of Transportation, interview, August 18, 2012.

Private-Sector Participation in Local Parking Options

Parking enforcement for designated EV-charging-only spaces is also a developing function of the private sector, both in cooperation with the public sector and with other private businesses, including EVSE network providers. Retail operators and parking lot managers are particularly well positioned to utilize private parking lots and garages to pilot EV-only parking. Public-private partnerships have manifested in a handful of arrangements. In London, for example, the NCP parking garage company has agreed to enforce EV-only parking based on the citywide initiative laid out in the Plan for London.³⁹ In a more local example of voluntary parking management agreements, experience with other types of designated spaces was considered. In the northeast United States, the supermarket chain Price Chopper has instituted EV-only parking with charging stations that include a marketing-oriented solar-canopy design. The company has based its site design on customer experiences associated with other types of designated parking, such as the store's "New Mom" parking spaces, which are located near store entrances.⁴⁰

Parking as Incentive for Host and User

The management of parking spaces will involve the motivation of the EVSE host: green branding, customer amenity and Leadership in Energy and Environmental Design (LEED) certification are just a few reasons that will determine where and how a parking operator, public or private, will locate the EVSE within the lot or garage.

Parking location can be an important EV user incentive. Accessible and visible charging stations can be amenities to customers.⁴¹

³⁹ The London Plan website, <http://www.london.gov.uk/thelondonplan/>; Ominiya Giwa, Transport for London, interview.

⁴⁰ Joseph Berman, LEED AP, Price Chopper Environmental Certification Specialist, interview, July 25, 2012.

⁴¹ Many stakeholders indicate that choosing spaces near building entrances for EVSE may result in non-EV owner resentment. In addition, locating EVSE-only spaces near front building entrances often results in higher installation costs since the main electric power line to a commercial building is most often in the rear of the building and must be extended at considerable additional costs.

New York State Energy Research and Development Authority Funds Public-Private Pilots

A few examples of the possibilities for public-private partnerships and private-sector participation in providing publicly accessible EVSE come from New York State, where the New York State Energy Research and Development Authority (NYSERDA) has recently announced recipients of \$4.4 million in EV and EVSE grants throughout the state. Among these programs, several pilot projects target parking management:

- Beam Charging LLC will install 28 charging stations, each in a separate public parking garage in New York City, and will gather data to study how such stations are used.
- Car Charging Group Inc. will install charging stations at 15 high-traffic locations in New York City, targeting apartment dwellers. The garages will be those used primarily for monthly parking.
- Access Technology Integration Inc. will install charging stations with innovative reservation and payment systems at seven locations in and around Albany, including a variety of installation contexts, such as hospitals, transportation hubs, universities and retail.

Source: "Governor Cuomo Announces Deployment of 325 Electric Vehicle Charging Stations Across New York State." [governor.ny.gov](http://www.governor.ny.gov), June 6, 2012, <http://www.governor.ny.gov/press/06062012Charging-Stations>.

Limitations

Premature Regulation

Overall, case studies have shown a reluctance to regulate prematurely. This is particularly clear for parking restrictions. For parking restrictions, in states with relatively few EVs, state-level legislation is seen as a draconian approach to regulation that may eliminate the ability of local governments to address the appropriate degree of EV readiness and the cost-benefit relationship of enforcement. Even in areas with many EVs, the use and enforcement of signed parking space restrictions may ultimately be more of a parking management issue than one of even a local ordinance.⁴² In many cases, the use of EV spaces can be managed with signage, regardless of the location.⁴³

Host-Operator Agreements

Different ownership and management structures will determine how difficult EVSE installation and maintenance will be, whether on the street or in lots and garages. Business models of the various charging networks or EVSE OEMs will place different requirements on those navigating the owner-manager relationships.

⁴² Example locations include, London and Maryland.

⁴³ Meg Andrews and Kristen Weiss, Maryland State Department of Transportation, interview, August 18, 2012.

TOOL 3: CODES

Codes govern the structural aspect of EVSE installation; codes for EVSE include building and electrical codes as well as those that regulate the communications aspects of EVs and EVSE at the network scale. However, this guide refers to building and electrical codes that set standards for safety and scope of EVSE deployment within the built environment.

These codes are developed at the national or international level in an advisory capacity and are known as model codes. Model codes are adopted by states and local jurisdictions through the legislative process. These include the National Electrical Code (NEC) and the International Building Code (IBC). States and localities generally have latitude to adopt their own building and electrical codes and administrative permitting processes, but typically some form of the NEC and IBC applies in each state.

A number of states have adopted amended codes specific to EVSE. The scope of best practices for EV readiness includes codes in two important ways: (1) establishing minimum requirements for EV-ready parking stalls (either pre-wired or with charging station installed), and (2) addressing permitting or other administrative processes.

Change is Not Necessary, but it Helps Achieve EV Readiness

While there are no barriers to EVSE installation embedded in the existing national model building and electrical codes, there is room within the codes as adopted by the states to more clearly encourage EV readiness.

- Despite differences between jurisdictions, the structural codes themselves cover existing safety concerns related to existing automotive and charging technology and permit or facilitate conditions under which EVSE can be installed.
- Neither level 1 nor level 2 charging requires significant electrical work so long as the existing circuitry supports the electrical load and connection.

- Each installation presents unique wiring and construction challenges that can drive up cost, but those challenges are typically accounted for by the existing structural codes and standards.

State or local code changes may be required in order to comply with environmental, transportation or clean energy target legislation established at the federal or state level. The building code can include scoping requirements, enabling jurisdictions to self-tailor regulations through a selection of the most appropriate mandatory and optional provisions. Because codes amendments are one of several interrelated strategies to encourage EVSE deployment, in considering changes it is important to consider what codes can accomplish:

- Codes can specify scoping requirements that set numerical or percentage-based goals or limits for certain features in new construction (e.g., percentage of required parking to be built and wired to be EVSE-ready).
- Codes can provide for new permitting or inspection protocols and encourage the reduction of associated administrative costs.
- Codes are revised regularly and will be adapted at the national level to meet new structural or fire safety concerns, such as those related to new and emerging technologies.

Variations across the TCI region will mean that states will make different choices. States such as New Jersey, for example, with a relatively evenly distributed, dense population and centrally located transportation corridors may find scoping requirements in the building code to be a good solution. By contrast, Maine's lack of population density and residential concentration around key urban centers may suggest a different approach.

Building Codes and Scope of Infrastructure Deployment⁴⁴

Municipal Code Changes

A number of municipalities have the ability to adapt and adopt their own local building and electrical codes, making this a useful local tool in those locations. Vancouver took advantage of its unique ability among Canadian cities to modify its building codes in order to require a substantial percentage of parking stalls in new construction to be made EV ready. Vancouver became the first North American city to require EVSE connection in all new development. This was achieved by modifying the city’s building by-laws to require EVSE-ready wiring in new single-family and multifamily residential construction. Twenty percent of multifamily new construction and 100% of single-family new construction must be built EVSE ready, according to the new by-laws. New code updates for 2012 will increase the residential service request to 220 volts (V) to accommodate uniform level 2 charging and will introduce a 10% EVSE-ready parking requirement to new commercial construction.

High-Level Flexibility through Voluntary State Building Code Appendices

Building codes as adopted by the states can offer additional options for voluntary compliance at the local level. California has implemented CALGreen, which sets a high bar as the nation’s first mandatory green building code. The code’s overall goals deal directly with the state’s mandate to reduce GHG emissions, and an EV-ready policy included in the code recognizes the ability of regulation in one high-emissions area (buildings) can impact and incentivize greener consumer behavior in another (transportation). The state’s approach to phasing in the code’s mandatory provisions sheds light on the ways in which other jurisdictions might adopt similar code amendments, and the inclusion of “tiers” of compliance in the voluntary appendices makes it possible for the adopting jurisdiction to choose the level of deployment and enforcement most appropriate for the local market and community.

⁴⁴ For a complete discussion of code-specific issues for EVSE and sample code language, please refer to *EVSE Codes for the Built Environment*, a companion to this guide.

Adopted Code Language: CALGreen Green Construction Code⁴⁵

CALGreen’s 2010 edition contains mandatory measures for nonresidential construction that require 8% of total parking spaces to be designated for low-emission, fuel-efficient, or carpool vehicles and voluntary measures that raise requirements to 10% (tier 1) and 12% (tier 2). Further, electric vehicle supply wiring is required for EV charging stations, for between one and four parking spaces, depending on the lot or garage capacity.⁴⁶ Appendix E: Codes contains more EV-relevant code from CALGreen, including voluntary measures from tiers 1 and 2.

Table 5.106.5.2

Total Number Of Parking Spaces	Number Of Required Spaces
0–9	0
10–25	1
26–50	3
51–75	6
76–100	8
101–150	11
151–200	16
201 and over	At least 8% of total

Using the State Electrical Code to Ease the EVSE Installation and Permitting Process

Targeting the structural codes presented unique opportunities and challenges for the state of Oregon. The state’s building codes are different from most other states; codes adopted at the state level set both the minimum requirements for construction statewide and the maximum requirements that local jurisdictions can enforce.⁴⁷ State-level building code changes would establish

⁴⁵ California Building Standards Commission, *2010 California Green Building Standards Code* (Sacramento, CA: California Building Standards Commission, January 1, 2011), www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf.

⁴⁶ CALGreen Nonresidential Voluntary Measures A5.106.5.3 requires one 120 volt alternating current 20 amp and one 208/240 V 40 amp, grounded alternating current outlets or panel capacity and a conduit installed for future outlets.

⁴⁷ The scope of this research did not include a close examination of the legislative structures in each TCI region state. Oregon’s model of setting the minimum and maximum code standards may not apply.

a uniform policy for all new construction across the entire state. The state had established a working group, which concluded that while building code changes would reduce the construction costs associated with retrofitting buildings to be EVSE ready in the future, the increased costs for developers at the present would be premature.⁴⁸

In this light, finding a way of guaranteeing a positive user experience, reducing the administrative costs and ensuring a path for emerging technology and its safe installation without adapting the scope or structural aspects of the building code was a challenge to the state in its approach to the supporting EVSE. The solution was to ask the state Building Codes Division (BCD) to develop a home EVSE installation process that could be completed within just a few days of purchase. The inclusion of EVSE in the state's minor label program is described in the next section, on permitting.

Municipal Electrical Codes Respond to Local Conditions

In Seattle, Washington, the 2008 edition of the city's adopted version of the electrical code identified and added some notable changes specific to EVs, with the purpose of making it easier to install home and commercial EVSE. The Seattle Electrical Code (SEC) includes article 625.27, addressing required space for physical equipment and space planning in order to install future conduit, panel and disconnect for EVSE. In addition, provisions in the SEC deal with outlet load calculations for residential EVSE, as well as feeder and conduit specifications for multifamily residential occupancies. Seattle's electrical code modifications speak to the potential to utilize a jurisdiction's electrical codes to meet localized market demands and projections; the city was planning ahead in the 2008 code edition to account for EVSE installation once the first Nissan LEAF vehicles hit the Seattle market in 2010.⁴⁹ Article 625.27 of the SEC may offer best practice

⁴⁸ Multnomah County Oregon, *Report of the Alternative Fuel Vehicle Infrastructure Working Group* (Portland, OR: Multnomah County, January 2010), http://www.psrc.org/assets/3751/W_OregonReport_2010.pdf.

⁴⁹ City of Seattle, "Plug-In Electric Vehicles – Frequently Asked Questions," (Seattle, WA: City of Seattle, n.d.), https://www.seattle.gov/environment/documents/Electric%20Vehicles%20FAQ_Update_070511.pdf.

guidance to local jurisdictions seeking to plan in advance for EVs, and it may also inform the National Fire Protection Association's next revision of the national model electrical code. The full SEC is available online.⁵⁰

Limitations

The most obvious limitation in using codes to enhance EV readiness is the fact that the current national codes do not require or incentivize EVSE. Codes experts recommend an approach that utilizes voluntary appendices, such as California's Green Building Code. Including optional but consistent choices for EVSE in state building codes would be a best practice for consideration in the TCI region. However, the slow revision process (3-year cycles) may pose an additional limit to this goal.

For the development and construction community, there is a need to keep costs low enough to be easily absorbed into overall project costs. However, inclusion of EVSE readiness in the building phase can be more cost effective than retrofit and increase the value of individual units as well as the community at large.

Codes may impose additional costs in staff time and training on local governments as well. Acknowledging the high costs associated with a major code revision, this guide does not at this time recommend changes to the local code revision cycle that would require states or municipalities to update their codes more regularly.

Application and enforcement of codes occurs at the local level through the permitting and inspection process and will require additional cooperation among inspection and enforcement agencies.

⁵⁰ Department of Planning and Development, *2008 Seattle Electrical Code Quick Reference*, Ordinance 122970 (Seattle, WA: City of Seattle, June 5, 2009), http://www.seattle.gov/dpd/static/2008%20QR%20complete_LatestReleased_DPDP016577.pdf.

TOOL 4: PERMITTING

EV advocates and automakers alike have pushed for simplifying and streamlining jurisdictions' electrical permitting processes for EVSE installation, recognizing that local procedural variations add time, cost and uncertainty. These issues can potentially deter EV purchases. Thus, the use of the permitting tool will include changes to a jurisdiction's administrative process that streamline filing, application approvals and inspection to make EVSE installation faster, easier and more affordable to homeowners and business owners.

Electrical permitting is the local enforcement of the electrical code, which, as mentioned in the previous section, is enacted to establish standards to protect both the public and property. Most electrical work in homes and businesses requires a permit and generally must be performed by an electrician licensed in the relevant state and municipality. Throughout most of the TCI region, the permitting process is administered by local jurisdictions, each with distinct forms, fees, electrical code definitions, installer requirements and inspection operations. A number of different approaches to EV readiness in permitting have been tried across the country; key examples are detailed in this section.

Most EV-ready permitting efforts focus on "standard" EVSE installation cases, which occur in private garages of single-family homes and involve electrical work requiring at most upgraded circuit breakers and new electrical lines and outlets to accommodate level 1 or 2 chargers.⁵¹ This focus captures most EV charging needs—nearly all EV owners primarily charge at home, and more than 90% of those owners park and charge in a private garage. However, efforts to improve

⁵¹ Office of Energy Efficiency and Renewable Energy, "Oregon Deploys Plug-In Vehicles and Charging Infrastructure," U.S. Department of Energy, April 25, 2011, <http://www.afdc.energy.gov/case/1000?print>. Oregon's Building Codes Division further defines standard EVSE installations as those within sight of the electrical panel supplying the charging unit, having a branch circuit that does not exceed 40 amps/240 volts and are not located in a damp place.

the permitting process should be expanded to other contexts if the goal is to develop the EV market beyond the simplest use case. This is especially true in the TCI region, which has both the oldest housing stock and the highest percentage of households not living in single-family homes with garages in the United States.⁵²

While the EVSE installation process includes several components affected by local permitting procedures, the focus of this section is on the three main parts of the administrative permitting process: permit filing, installation and inspection.

Filing a Permit

Different permitting solutions have been attempted across the country, varying in complexity, and their suitability depends heavily on context. For finding which permitting solutions is appropriate, it is important to first look at the existing processes to see if they can accommodate EVSE easily, do not present undue burdens on installers and generally are sufficiently speedy and reasonably priced. Otherwise a quick, low-cost process should be sought, which removes unnecessary steps such as anything requiring multiple trips to permitting offices or installation locations.⁵³ A particularly forward-thinking example of process streamlining can be found in Vancouver, Canada, where the municipality decided EVSE installation work is safe and minor enough as to not require any permit filing.⁵⁴ Others would caution against this approach, in case homeowners who install their

⁵² Please reference the companion report, *Assessment of EVSE and EV Deployment*,

⁵³ California Plug-in Electric Vehicle Collaborative, *Streamlining the Permitting and Inspection Process for Plug-In Electric Vehicle Home Charger Installations*, Version 2 (Sacramento, CA: California Plug-In Electric Vehicle Collaborative, July 2012) http://www.c-5.org/images/cms/files/PEVC_Permitting_Inspection_Report.pdf?PHPSESSID=ce8dac464280d6a3eeb839c29b5ed308.

⁵⁴ Malcolm Shield, interview, May 1, 2012.

own EVSE do not properly calculate the capacity of their electrical panels.⁵⁵

Streamlined permitting practices should exist in municipalities. While implementing a uniform practice across the region or within states is not a necessity,⁵⁶ securing a permit to install a charging station should be easy for EV owners in every city and town.

Permitting Costs

Permitting fees and requirements are the greatest source of variation in EVSE installation and are a visible and potentially prohibitive factor for EV ownership.

EVSE permitting fees vary widely. National survey data from the EVSE installer firm SPX found fees ranging from \$0 to \$624.⁵⁷ Generally, these fees cover municipalities' administrative and inspection costs, though it is possible to find neighboring municipalities with similar processes, yet vastly different fees. The method for determining and assessing these fees varies as well. In a jurisdiction near Philadelphia, for example, fees were calculated as a percentage of the total job cost, meaning that permit fees would rise along with EVSE labor and capital costs⁵⁸—not an ideal proposition for individuals or businesses. Fee standardization is desirable for electricians providing quotes to potential customers.

⁵⁵ Brian Kiley, interview, August 27, 2012. Refer to *EVSE Codes for the Built Environment*, a companion report produced with this study, for more information on the National Electrical Code and the issues associated with the International Residential Code, which regulates many single-family dwellings in the TCI region and across the United States.

⁵⁶ Recommendations to change the permitting process should recognize the multi-tiered additional costs associated with such changes—from developing and printing forms and labels to updating computer systems and training inspectors on new regulations.

⁵⁷ California Plug-in Electric Vehicle Collaborative, *Streamlining the Permitting and Inspection Process for Plug-In Electric Vehicle Home Charger Installations*, Version 2 (Sacramento, CA: California Plug-In Electric Vehicle Collaborative, July 2012) http://www.c-5.org/images/cms/files/PEVC_Permitting_Inspection_Report.pdf?PHPSESSID=ce8dac464280d6a3eeb839c29b5ed308.

⁵⁸ Tony Bandiero, Director, Greater Philadelphia Clean Cities.

Burdensome and unnecessary permitting requirements should be eliminated because these demand more time of the electrician, thereby adding to installation costs.

Existing Minor Work Processes

The easiest way to accommodate EVSE installations in existing permitting processes is to define EVSE as appliances, and thereby make it subject to the same permitting requirements. On the whole these installations are similar, even though EVSE's lengthy, sustained electrical draw does not compare to other household appliances. Being categorized as an appliance allows EVSE installations to fall under "minor" electrical work, which is usually subject to the least burdensome permitting processes.

This is often the best solution for simplicity and continuity, and several jurisdictions have taken this route:

- New Jersey defines certain types of straightforward electrical work as "minor work," and a review of the state's electrical code determined that residential EVSE installations qualify. Minor work requires only verbal notification to the local code office prior to installation, followed by submission of the permit application within five days of the verbal notification.⁵⁹
- Oregon modified its electrical code to include EVSE installations in the minor label program. This statewide process speeds simple EVSE installations by enabling licensed electricians to pre-purchase permitting minor installation "labels" online and inspecting only 1 out of 10 EVSE installations.⁶⁰
- Raleigh, North Carolina, has similarly extended its "walk-through" process to EVSE, where an employee of the city's inspection center takes the installer through permitting process, typically in under an hour.⁶¹

⁵⁹ Ken Frank, NJDEP, interview, August 19, 2012.

⁶⁰ Dennis Clements, written correspondence, July 27, 2012.

⁶¹ Office of Energy Efficiency and Renewable Energy, "Raleigh, North Carolina's Plug-In Vehicle Activities and Processes," U.S. Department of Energy, April 28, 2011, <http://www.afdc.energy.gov/case/1001>.

- New Hampshire allows the homeowner to do the electrical work on his single-family residence without a permit—an example of the requirements set by the International Residential Code.

Permitting Template

Where the existing permitting procedures do not properly facilitate EVSE installations, municipalities can use a separate permit specific to EVSE. Having such a permit suggests a jurisdiction has researched the EVSE installation process in general. It should also be noted that in addition to the variance in application fees, the permitting form itself is the most apparent administrative difference between municipalities. Standardizing that form at the metropolitan area, state or even regional level is one of the simplest ways to eliminate errors and confusion for filers, who may be homeowners or electricians who work across jurisdictional boundaries. The Alternative Fuels Data Center at the U.S. Department of Energy has created such an EVSE-specific permitting template.⁶²

Online Permitting

Several municipalities utilize online permitting processes, which require large initial investment but generally provide shorter turnaround times and lower administrative costs than paper-based forms. Cities such as Houston, San Francisco and Los Angeles go even further, offering automatic or instantaneous permitting for standard EVSE installs.⁶³ These online permits are often paired with rapid inspection-by-date guarantees, as discussed below. On the East Coast, a handful of Virginia jurisdictions have instituted online or same-day fax permitting procedures for EVSE.⁶⁴

⁶² Office of Energy Efficiency and Renewable Energy, "Permit for Charging Equipment Installation," U.S. Department of Energy, accessed November 13, 2012, http://www.afdc.energy.gov/pdfs/EV_charging_template.pdf.

⁶³ Office of Energy Efficiency and Renewable Energy, "Houston's Plug-IN Vehicle Activities and Processes," U.S. Department of Energy, April 18, 2011, <http://www.afdc.energy.gov/case/1003>.

⁶⁴ "VA Local EVSE Permitting Contacts," Virginia Clean Cities, accessed November 13, 2012, http://www.virginiaev.org/?page_id=17.

Minor Label Programs: Oregon Case Study

In 2008, Oregon's BCD adopted statewide permit and inspection protocols through a rule that establishes the types and number of permits and inspections required to install EVSE. One of the central aspects of Oregon's code change is the inclusion of EVSE in the state's minor label program. Oregon's statewide process speeds simple EVSE installations by enabling licensed electricians to pre-purchase permitting minor installation "labels" online and inspecting only 1 out of 10 EVSE installations.

The electrical minor label program allows electrical contractors to use labels in lieu of individual permits for limited, simple installations, repair and maintenance. In examining EVSE, BCD determined that the installation of a simple 40 amp circuit in a residential setting could also fall into this same scope of minor label work. The program defines standard EVSE installations as those within sight of the electrical panel supplying the charging unit, having a branch circuit that does not exceed 40 amps/240 V and not located in a damp place. Under this program, just 1 in 10 of an electrician's completed jobs is inspected by BCD. An additional benefit of the program addresses some concerns raised by the electrical safety community concerning the lack of control over residential installation by homeowners: only licensed professionals are permitted to purchase minor labels.

The inclusion of EVSE in the state's minor label program can be considered a best practice that reduces the cost to the state in terms of inspections and to the EV owner, making the installation of at-home charging infrastructure that much more accessible. Each minor label permit costs \$14, compared to permitting costs that still reach up to \$700 in some areas of the Los Angeles region. The Oregon code amendment emphasizes the potential for states or local jurisdictions to amend the code to create a more pro-EVSE regulatory environment.

Sources: Dennis Clements, correspondence, July 27, 2012; Office of Energy Efficiency and Renewable Energy, "Oregon Deploys Plug-In Vehicles and Charging Infrastructure," U.S. Department of Energy, April 25, 2012, <http://www.afdc.energy.gov/case/1000?print>.

Cary, North Carolina, has instituted an online permitting process specific to EVSE.⁶⁵

Installation

The permitting discussion so far has focused on standard EVSE installations, but more complex installations are of course possible. The type of installation will impact the extent of the expedited permitting available, as well as the inspection required.⁶⁶

Level 1

The simplest installation scenario is connecting an EVSE to an existing 110/120 V outlet, for level 1 EVSE. In those cases permitting is not usually required, though municipalities often recommend filing a permit anyway.

Level 2

Level 2 EVSE installations are generally more complex, especially in older building stock that demands upgraded circuitry and panels to support not only the 240 V outlets required but also the “bandwidth” or local circuit capacity. Regardless of existing electrical capacity, level 2 chargers are stand-alone or wall-mounted appliances that must be hard-wired to the system. Although the device itself is no more complex than a household clothes dryer, the installation requires more expertise than plugging into a wall outlet.

Direct Current Fast Charge

Not yet in wide application, direct current (DC) fast charging stations will likely continue to be installed in primarily commercial locations. As a result of the type of high power, dedicated panels and hard-wired installation for a device that performs internal alternating current/DC current conversion, DC fast charging will likely not be a candidate for expedited permitting processes.

⁶⁵ Inspections and Permit Department, “Residential Electric Vehicle Supply Equipment Permitting and Inspections Guide” (Cary, NC: Town of Cary, March 2012), <http://www.townofcary.org/Assets/Inspections+and+Permits+Department/PDFs/Res+Electric+Vehicle+Guide+3-12.pdf>.

⁶⁶ For more detail on installation scenarios see the companion report, *Siting and Design Guidelines for Electric Vehicle Supply Equipment*.

Other Concerns

At the time of EVSE installation, the homeowner or building owner may want to set up additional capacity, either in the form of additional conduit or panels for future EVSE installation, or maybe more commonly, in the form of sub-, interval-, or smart-metering systems that enable the user to record power usage or setup. This installation, which may or may not be covered by the utility in a given jurisdiction, can cause the work to be considered major.

Training Electricians

Though not generally part of the permitting process, it would be beneficial for electricians performing EVSE installations to be familiar with the hardware and aware of the unique electrical load requirements of EVs when calculating electric panel capacity. It is also important to make sure electricians are aware of alternatives to making expensive panel upgrades and that they are not adding cost to customers by requiring such upgrades. This is especially important in the older building stock of the Northeast.⁶⁷

Training as many electricians as possible in EVSE installations will benefit customers by providing more competition among licensed electricians experienced with EVSE;⁶⁸ evidence has shown that OEM-approved installers can charge up to 75% more and may take longer to complete the installation than their independent competitors.⁶⁹ Installer training can help to address basic how-to issues and to familiarize electricians with a variety of EVSE devices and best practices for different installation scenarios.

Inspection

Inspection is the last step in the permitting process. Ensuring that any uncertainties or time requirements are minimized is an important part of expediting the permitting process, and several municipalities guarantee inspections within a

⁶⁷ Steve Russell, interview, September 19, 2012.

⁶⁸ Josie Garthwaite, “Wanted Fair Costs for Electric Car Home Charger Installations,” [plugincars.com](http://www.plugincars.com/wanted-fair-costs-home-charger-installations-106724.html), January 27, 2011, <http://www.plugincars.com/wanted-fair-costs-home-charger-installations-106724.html>. SPX, the preferred installer for Chevy Volts for the EV Project.

⁶⁹ Steve Russell of MA DOER said, Aerovironment’s, which provided EVSE in Massachusetts, recommended installers cost more and took months longer to install than community electricians.

certain time frame, even on the same day.⁷⁰ Los Angeles, for example, provides a 24-hour guarantee but allows usage of the EVSE prior to inspection.

The need for training and professional development has been identified as a key barrier to expedited inspection. Programs such as Clean Cities' Electric Vehicle Infrastructure Training Program (EVITP) address other components of inspection, making sure the inspectors are familiar with EVSE equipment and requirements. EVITP facilitators have generally found that inspectors are well informed, or at least know of an informed party to contact in case any questions arise. Further, though permits and processes are local, inspectors often work for a number of municipalities, with third-party inspection agencies working across state lines.⁷¹ These inspectors have found that installation issues are not unique to EVSE and are the same as those of any other electrical appliance.⁷² An effort in Massachusetts has focused on inspector training and EVSE awareness, and the program has included traveling workshops with licensing departments around the state conducted through the state's Clean Cities Coalition and Department of Transportation.⁷³ In Pennsylvania, inspection companies are actually required by law to be private (or third-party) entities. In such a case, it would be beneficial to ensure that private firms and inspectors are included in any outreach.

Limitations

The expedited permitting processes discussed in this section are only applicable to single-family homes, or what is most often considered the "standard" installation. As the EV market matures and less optimal EVSE installation contexts are encountered, municipalities will have to develop and pilot permitting practices for multi-family buildings, offices and commercial lots. Many of these contexts are similar to the standard installation, potentially requiring minimal service upgrades, and often in close proximity to the electric panel.

Standardization of permitting in commercial fleet scenarios could have a large impact. A high degree of cost uncertainty exists for commercial fleet EVSE permitting, installations which rely heavily on grant funding. One fleet manager suggested that EVSE installations at his facilities cost \$25,000 each. Any savings found in the installation process would allow funding for additional EVSE and realization of the benefits from fleet conversions.

⁷⁰ Under a pilot program for single-family residential EVSE, if the permit is filed by 12:00 pm Houston's Code Enforcement Group will complete an inspection that same day.

⁷¹ Middle Department Inspection Agency <http://www.mdia.net/> (n.d.)

⁷² John Murach, Director of Business Planning and Corporate Performance, Baltimore Gas & Electric, interview, September 20, 2012.

⁷³ Steve Russell, Massachusetts Department of Environmental Resources and Clean Cities Coordinator, interview, September 19, 2012.

TOOL 5: PARTNERSHIPS AND PROCUREMENT

Successful local plans for EVSE rollout have been multifaceted in scope; in order to achieve statewide and local impacts, it is useful for EV proponents in government and the private sector to have a forum for cooperation that can react to specific state and local conditions. According to one nongovernmental organization (NGO) stakeholder, Albert Dahlberg, Founder of Project Get Ready Rhode Island, EV infrastructure deployment will require the coordinated support of at least two of the following: public-sector leadership, utility leadership and nonprofit leadership. The authority to regulate or enforce different aspects of EV readiness and EVSE deployment will lie within different state and local agencies in a combination of actors that will differ from state to state. For example, while NYSERDA leads EV activities in New York, the Department of Commerce leads EV planning in Washington State. In both cases, permitting, codes and zoning all reside under the purview of other departments and at different levels of government. Thus, the reduction of barriers to EVSE deployment will come from collaborative efforts, such as through large-scale and multi-agency coalitions and working groups as well as public-private partnerships and utility participation; all of these types of efforts have recently contributed to a broad-based understanding of intersections between local and regional goals in model jurisdictions.

The role of the private sector can be just as important in preparing the region for comprehensive EVSE deployment. Federal and state funding can be allocated to private infrastructure developers (e.g., ECOTality's EV Project) to gather data, test business models and pilot high-visibility EV charging projects. In addition, as discussed below, the process of vetting vehicles and technology products for procurement by state and local fleets and infrastructure projects is another form of partnership that will accelerate the public sector's ability to act as an early adopter of EVs.

Public-Private Partnerships

Due to the decentralized nature of EVSE deployment, it is critical to note that the expansion of a network of EV charging infrastructure will be heavily dependent on partnerships of all kinds. These include traditional public-private partnerships between government agencies and private businesses as well as partnerships with employers, multi-dwelling unit residential landlords and homeowners' associations. These partnerships will need to occur at multiple jurisdictional scales. Planning for the region will include collaboration regarding both site-by-site installations and among organizations and agencies that can help to bridge boundaries.

An established best practice, whether through legislative act or other means of coordination, is the creation of a working group or council responsible for the analysis of EV and EVSE feasibility, costs and public benefits.⁷⁴

The Maryland Electric Vehicle Infrastructure Council (EVIC) promotes the use of EVs in the state. It is staffed by the Maryland Department of Transportation, with support from the Maryland Energy Administration and the Maryland Public Service Commission, and is composed of members representing other state agencies, the state legislature, the Governor's appointees, public and private utilities, professional associations and industry.⁷⁵ Maryland's EVIC was enacted through state legislation, and its responsibilities include development of a statewide action plan, assistance in developing and coordinating statewide standards for permitting and installation of EVSE, recommendation of a statewide infrastructure plan and incentives and development of targeted

⁷⁴ See *EVSE Codes for the Built Environment Document* for more details.

⁷⁵ Department of Transportation, "Maryland Electric Vehicle Council," State of Maryland, accessed November 13, 2012, http://www.mdot.maryland.gov/Office%20of%20Planning%20and%20Capital%20Programming/Electric_Vehicle/Documents/EVC_Fac_Sheet_Final.pdf.

fleet policies.⁷⁶ Creation of state-level, interagency and cooperative working groups, such as EVIC, requires enabling or charter legislation for effective establishment.⁷⁷

Another approach to generating regional participation is illustrated by Washington State's legislation requiring the local regional planning organization, the PSRC, to seek federal or private funding in order to plan for EV infrastructure deployment, with priority given to projects that include the development of model ordinances and local government guidance.⁷⁸

In London, United Kingdom, the transportation planning agency Transport for London is leading a consortium of public and private partners involved in an initiative called "Plugged-In Places." The agency-led consortium was awarded approximately \$15 million to support EVSE deployment throughout the city, a portion of which is used to provide matching funds for publicly accessible charging stations.⁷⁹

Regional Planning: MPOs and COGs

MPOs and COGs have also taken coordinating and leadership roles within the TCI region. Larry McAuliffe, Sustainability Manager at the New York Metropolitan Transportation Council, notes that such regional planning organizations are often working to coordinate activities of agencies and authorities that are already quite strong on their

⁷⁶ See the "Maryland Electric Vehicle Infrastructure Council" (SB176/HB167, 2011 Session).

⁷⁷ "Maryland Electric Vehicle Infrastructure Council," Senate Bill No. 176, Chapter 400, (May 19, 20221) http://www.mdot.maryland.gov/Office%20of%20Planning%20and%20Capital%20Programming/Electric_Vehicle/Documents/Senate_Bill_176.pdf.

⁷⁸ Washington State Legislature, "RCW 47.80.090, Regional Transportation Planning Organizations – Electric Vehicle Infrastructure," Access Washington, accessed November 13, 2012, <http://apps.leg.wa.gov/rcw/default.aspx?cite=47.80.090>; Washington State Legislature, "HB 1481 – 2009-10," Access Washington, accessed November 13, 2012, <http://apps.leg.wa.gov/billinfo/summary.aspx?bill=1481&year=2009>.

⁷⁹ Source London homepage, accessed November 13, 2012, <https://www.sourcelondon.net/>; Omoniyi Giwa, Senior Borough Programme Officer, Transport for London, interview, September 12, 2012.

EV Working Groups in the TCI Region and Beyond

Connecticut

Former Governor M. Jodi Rell mandated the formation of the Connecticut Electric Vehicle Infrastructure Council to produce a report of recommendations per Executive Order 34. Senate Bill 1168, which includes several recommendations for enabling and incentivizing EV adoption, was the result of the Council's report, though has yet to be voted on.

Rhode Island

At a smaller scale, Project Get Ready Rhode Island has led EV-ready planning efforts in the state by utilizing its role in the nonprofit sector to coordinate interested parties in government and to push forward a relationship with National Grid, the only electrical utility in the state.

Vancouver

The British Columbia (BC) Electric Vehicle Working Group united interests and expertise from local and provincial governments, utility and energy resources and academia in an effort to create a comprehensive EV-ready and infrastructure deployment strategy. The BC EV Working Group was composed of 10–12 carefully selected institutional members representing different levels and agencies within the provincial and city governments, NGOs, an electrical utility and academia. In its bimonthly meetings, the working group sought to understand the large-scale questions in the context of what small steps could be taken.

London

In London, what is effectively a government-government partnership employs heavy lifting at the city level, allowing for system-wide consistency in the Transport for London Source Network as well as freedom among local borough governments in the implementation and management of EVSE.

Sources: Office of Energy Efficiency and Renewable Energy, "Expired, Repealed, and Archived Connecticut Incentives and Laws," U.S. Department of Energy, August 31, 2012, http://www.afdc.energy.gov/laws/laws_expired/CT; Albert Dahlberg, Director, Project Get Ready Rhode Island, interview, September 19, 2012; Malcolm Shield, interview, July 18, 2012; Omoniyi Giwa, Senior Borough Programme Officer, Transport for London, interview, September 12, 2012.

own, and many of which are already cooperating.⁸⁰

There are often funding opportunities available to MPOs for transportation planning and compliance with GHG goals. However, the funding available to such organizations may come with specific directives, and often MPOs are unable to pursue programming that does not contribute to an environmental bottom line.

Both MPOs and COGs collect and disseminate information with members. This role makes these regional planning organizations an ideal vehicle for developing partnerships across different levels of government, thereby connecting with the needs of municipalities—another key need identified by jurisdictions. For example, the Washington, DC, area Metropolitan Washington Council of Governments (MWCOG) formed a working group around EVs in order to meet the needs of early acting member groups. Fairfax County, Virginia, is one local government that started to plan for EV readiness, but wanted to ensure that it was not out of step with other actors in the region and sought guidance from MWCOG.⁸¹

This level of organization represents an important outreach opportunity across the region. According to MWCOG Environmental Resources Director Joan Rohlfs, “You can’t view a local government as a single actor. That’s a mistake. We deal with a number of different committees and professionals who work with any given place. [There are] always people to connect with on EVs in municipalities [...] the transportation director [may be] interested, even if the county administrator is not.”

Utility Participation and Local Leadership

Local utility companies can play an important role. In an example from outside the TCI region, Southern California Edison’s (SCE’s) approach to EV readiness is intensive and demonstrates potential for utility participation in other localities. The utility, serving much of the Los Angeles mega region, recognizes the necessity of proactive

approaches to increased EV ownership and the expansion of fast charging facilities.

Some of SCE’s concerns include homeowners purchasing and self-installing EVSE from retailers such as Home Depot, and the reality that EV early adopters are likely already heavy electricity users. SCE also recognizes the contexts specific to its service area, including the need to upgrade EV charging facilities constructed in the previous century, as well as climate and building stock variation. The energy supply for many area homes may only be 40 amps—insufficient for level 2 EVSE.

SCE’s mission is to provide safe and reliable electrical service, and this mission drives SCE’s involvement in the EV infrastructure space. Uniform messaging on EVs and EVSE is a primary goal; as such, SCE has developed outreach programs and pursued comprehensive stakeholder outreach to achieve it.

SCE actively monitors EVSE deployment through several partnerships: with auto manufacturers and dealers to obtain data on EV orders, with EVSE service providers that sell or lease charging stations and via municipalities’ notification systems indicating EVSE installation permits or electrical service upgrades. The utility itself scrutinizes spikes in energy use and encourages owner notification with special EV rates on time-of-use meters.⁸²

Finally, SCE leads and partners in energy-related research, most recently with the University of California, Los Angeles and the University of California, Santa Barbara. SCE also aids in the dissemination of reports through transportation and regional planning organizations.

Procurement Policies Link Government Fleets to Private Innovation, Public Benefit

Procurement policies can be utilized either to require that government (1) purchase a certain percentage of EVs (or EV-related services) or (2) consider such a purchase as a part of any

⁸⁰ Larry McAuliffe, Sustainability Manager, NYMTC, interview, September 17, 2012.

⁸¹ Joan Rohlfs, Environmental Resources Program Director, MWCOG, interview September 18, 2012.

⁸² Beth Neaman, Southern California Edison, interview, August 2, 2012.

procurement process.⁸³ At minimum, state and local governments should be encouraged to adopt low-emission vehicles by including EV models and EVSE products on state purchasing lists.⁸⁴ EVs purchased for Government fleets have been recognized as trendsetters in the EV market, and jurisdictions interested in promoting EV readiness should consider incorporating EVs and plug-in hybrid electric vehicles into local and state fleets whenever possible. Several states and local jurisdictions have taken steps to require that public-sector fleets meet certain environmental standards. Procurement policy is an area where the federal government can also play a role; many local government fleets purchase vehicles from U.S. General Services Administration schedules.

Alternative Fuel and Advanced Vehicle Acquisition Requirements

In Delaware all new light-duty vehicles that state agencies, departments and offices purchase must be hybrid electric, alternative fuel, fuel-efficient or low-emission vehicles, unless such a purchase compromises health, safety or law enforcement needs. In addition, the state must develop procedures for diesel fleet vehicles to use biodiesel fuel blends of the highest percent content that is practical.⁸⁵

In Vermont, the Department of Buildings and General Services is required to consider alternative fuel vehicles (AFVs) when purchasing vehicles for state use, as per Vermont Statutes Title 29.⁸⁶

Public-Private Partnerships

Many EV-ready municipalities have begun partnering with industry to develop and vet new design ideas and models for future government procurement. Such partnerships can involve product design and procurement as well as services and can be a part of innovative strategies

or fit within existing request for proposal (RFP) or bidding processes.

Innovative Partnership Programs Channel Funding

Oregon demonstrates policy and practice integration across state and local levels. The Oregon Department of Transportation (ODOT) and the state's Office of Innovative Partnerships and Alternative Funding have worked with industry and government partners on EV projects and pilots, including ECOTality's EV Project, the facilitation of the West Coast Green Highway and administering a Tiger II EV infrastructure grant.

In September 2010, ODOT received \$700,000 in federal stimulus funding to install up to eight DC fast charging stations in southern Oregon. In October of the same year, ODOT was awarded an additional \$2 million from the TIGER II program in order to enable the state to build necessary infrastructure to support and expand the range of existing EVs.⁸⁷ The stations "will be placed no more than 50 miles apart on highways outside of metro areas to create a continuous network."⁸⁸

Limitations

Short-Staffed Planning Organizations

An important but overlooked limitation on the regional planning process is the difficulty of ensuring staff time sufficient to cover initiatives and program development. The MWCOG has, at the height of the activity of its EV Infrastructure Planning Work Group, been able to devote a significant number of staff hours among five staff members to developing the research, recommendations and data required to put forth a draft plan. Because of the structure of the organization, funding for this preliminary research

⁸³ Often such policies focus on low- or zero-emission vehicles, including EVs.

⁸⁴ Albert Dahlberg; Ken Frank NJDOT, interview, September 19, 2012.

⁸⁵ Executive Order 18, 2010. Office of Energy Efficiency and Renewable Energy, "Alternative Fuel and Advanced Vehicle Data Acquisition," U.S. Department of Energy, updated, November 8, 2012, <http://www.afdc.energy.gov/laws/law/DE/8665>.

⁸⁶ "Title 29: Public Property and Supplies," The Vermont Statutes Online, accessed November 13, 2012, <http://www.leg.state.vt.us/statutes/chapters.cfm?Title=29>.

⁸⁷ Washington State was awarded a similar grant of more than \$1.3 million, <http://westcoastgreenhighway.com/projects.htm>.

⁸⁸ Federal Highway Administration, "U.S. Transportation Secretary LaHood Announces Agreement for Electric Vehicle Charging Stations in Northwest Oregon," U.S. Department of Transportation, April 8, 2011, <http://www.fhwa.dot.gov/pressroom/fhwa1114.htm>.

project was possible through MWCOG membership.⁸⁹

Limitations to Procurement

Even areas that require statewide compliance with AFV acquisition requirements may face issues at the local level. Local governments may need additional support in gathering data, reviewing vehicle model or product choices and finding staff time to vet vehicles or charging stations. These are all challenges that can impede local decision making and timelines.

To aid local jurisdictions in the procurement process, states can perform the following actions:

- Provide a model RFP
- Develop a vehicle model list
- Negotiate a master price agreement

Of course, funding represents a significant hurdle to every local government. Ensuring that the types of programs described in this section continue to expand to new jurisdictions is an issue of available grant or subsidy funding. To paraphrase frequent responses from public-sector stakeholders during the research process: *we would do it if we had the money.*

In addition to administrative and funding limitations, the supply of EV models may simply not be growing fast enough, particularly in the fleet sector. It may not be possible at present for localities to convert to EVs if there is not an appropriate vehicle model available.

However, these limitations to procurement may find at least a partial solution in public-private and business-to-business partnerships and agreements that can help local jurisdictions connect to existing and developing EV sector resources.

⁸⁹ Joan Rohlf, Environmental Resources Program Director, MWCOG, interview September 18, 2012.

SUMMARY

The document has highlighted important opportunities and challenges associated with five planning and policy tools for regulating and administering EVSE deployment and installation in local jurisdictions. As described in key examples, EV deployment can be encouraged through zoning, codes, parking, permitting or partnerships, and each policy tool has its own set of opportunities and limitations. The use of these policy and planning tools lays the groundwork for the deployment of EVSE.

Key Findings

Zoning

Defining EVSE as an allowable use in a municipality's zoning districts is a good first step for EV readiness. Cities and towns in the TCI region are beginning to use zoning ordinances to ensure that EVSE is defined as an allowable use in residential and commercial zoning districts.

The use of the zoning tool to establish EV readiness has inherent limitations because it has not yet been widely tested as a practice. For example, zoning could also be appropriate and useful when development standards are needed to shape the scope and qualities of future EVSE deployment by requiring those characteristics in future development. However, zoning text amendments of this nature are rare in the United States. Furthermore, zoning has not yet been tested in its ability to incentivize EVSE deployment, such as through developer incentives.

Parking

As with zoning, parking ordinances can regulate EVSE installation by setting requirements for the number of parking spaces provided by new construction. Parking ordinances also have an enforcement component that can be used to restrict designated EVSE charging spaces in lots, in garages or on the street. Parking regulations can be implemented by localities or states; for example, Hawaii requires at least 1 EVSE charging space per 100 in every newly constructed lot or garage throughout the state. Parking ordinances apply to publicly accessible EVSE, including on-

street parking and municipal lots and garages, and are therefore an important part of infrastructure development and management.

Parking management is a potentially fruitful area for public-private partnerships, and in this context it will be important for localities to work with private parking management firms to ensure regulations are amenable. In public and private scenarios, determining how enforcement (e.g., towing or ticketing) will occur will be an ongoing issue, one that TCI region municipalities have the opportunity to help creatively solve.

Codes

Building and electrical codes ensure that EVSE installations are safe and can be used to specify the scope of EVSE-ready construction. Changes to building and electrical codes are not necessary from a safety standpoint, but codes can help make places EV ready. Local jurisdictions may need to adapt state and local codes in order to meet certain requirements, such as emissions reduction goals. This is an ideal opportunity to incorporate EVSE into new construction. As a result, code changes will require buy-in from the development community, but precedents from cities such as Vancouver indicate that costs will not increase dramatically.

Municipalities that adopt or amend a state code benefit from a highly flexible code that provides different standards for different situations. In general, building and electrical codes present different EV-ready opportunities.

Permitting

For permitting, the goal is streamlining the administrative process so that it is uncomplicated, fast and affordable. Efforts to update and streamline permitting should first target reducing and standardizing fees to the consumer. In the TCI region, several municipalities have determined their existing permitting to be sufficient by defining EVSE installations as "minor" work. Most efforts to expedite permitting have focused on a "standard" single-family home installation, but future efforts should seek to facilitate more complex installations and installations in multifamily and commercial settings. Finally, while

the primary inspection authority is provided by city and state offices, third-party inspection firms offer opportunities for partnership and inspector training throughout the TCI region.

Partnership and Procurement

Diverse partnerships in EV-readiness planning strengthen the EV planning process. Developing expertise and disseminating information is necessary for new technologies to catch on. This shift is often best accomplished by working with organizations dedicated to EVs. In the TCI region, the Northeast EV Network is in a unique position to guide future partnerships at the regional scale, while municipalities will take the lead in generating local interest; both will likely work closely with the EV industry. Indeed, creative business partnerships may be crucial to the future of EVSE deployment. Many businesses will be attracted by branding opportunities. Nurturing business partnerships may reveal new business models that promote EVs and benefit the business community, and private-sector innovation will continue to shape the EV market. Finally, the public sector can take an active role and encourage partnership and private business development through procurement policies that include EVs, EVSE charging stations and support services.

Policy and Planning Tools in Summary

The tools that have been included in this document represent only a starting point in an evolving area for public policy, planning and administration. The matrix on the following page summarizes each of these tools and its respective abilities to influence or regulate EV adoption and EVSE deployment. The relative ability of a tool to achieve local EV readiness has much to do with where the tool is implemented, such as at the local or state level. A tool's potential is measured

based on how adept it is at allowing, incentivizing or requiring EVSE in various contexts and installation scenarios. The best contexts are highlighted for each tool, and the summary matrix focuses on macro issues such as deployment of EVSE in the public or private realm, the tool's ability to include provisions for EVSE in new or existing development or deploy EVSE across different land use categories or ensure EVSE deployment in some of the more challenging installation contexts such as multi-family dwellings.

Another category of "impacts" are those that relate to policy. Jurisdictions planning for EVSE should consider using the tools most appropriate for achieving local goals. Examples of policy impacts include incentivizing EV ownership, reducing GHG emissions, improving public safety or health, regulating EVSE in the public realm and improving accessibility, among others.

The last three summary categories address implementation, likely partnerships and agency actors as well as suggest potential opportunities in these areas for each tool.

Implementation summarizes relationships, required processes and strategies behind implementing EV-ready planning using each tool.

Agency Oversight suggests likely municipal or state agencies and offices that would have responsibility for EV-ready planning using each tool.

Partnership Opportunity describes for each tool the type of public-private or public-public partnerships that have been shown to advance EV readiness.

Finally, the matrix suggests case studies that were sources for the material in this guide, as well as places that readers should look to for further EV-ready planning precedents.

EVSE Planning and Policy Tools Summary

CRITERIA	ZONING	PARKING	CODES	PERMITTING
JURISDICTIONAL SCALE				
<i>Municipal</i>	●	●	○	●
<i>State</i>	○		●	●
TOOL POTENTIAL				
<i>Allow</i>	●			
<i>Incentivize</i>		●		●
<i>Require</i>	●	●	●	
EVSE CONTEXTS				
<i>Public Realm</i>		●	●	●
<i>Private Development</i>	●		●	
<i>New Development</i>	●		●	●
<i>Existing Development</i>	○	●		●
<i>Land Use</i>	- Residential - Industrial - Commercial	- Parking - Transportation - Commercial	- Residential - Industrial - Commercial - Parking - Transportation	All But Publicly Owned
<i>Key Installation Scenarios</i>	- Multi-Family - Retail - Fleets	- On-Street - Municipal Central Business Districts	- Multi-Family Residential	- Single- and Multi-Family Residential
TOOL STRENGTHS	- Specifies Allowable Uses - Sets Development Standards - Updates Existing Rules - Works With Comprehensive Plans	- Is Enforceable - Promotes On-Street EVSE - Influences Accessibility and Design	- Sets Development Standards - Is Enforced - Creates Minimum Parking Requirements	- Reduces Fees to Consumer - Supports Public Safety - Is Enforced - Eases Implementation
TOOL LIMITATIONS	- Is Not Yet Tested as Incentive - Can Be Difficult to Enforce, Inspect - Imposes Developer Costs	- Relies on Developing Business Models - Can Cause Lost Opportunity Costs - May Result in Lost Parking for Non-EVs	- Have Slow Revision Process - Impose Developer Costs - National Model Code Does Not Incentivize or Require EVSE	- Is Not Yet Tested as Commercial Incentive - Adds Costs Due to Professional Training - Cannot be Used to Require EVSE
IMPACTS	- Encourages EVSE in Multiple Land Uses - Raises Visibility - Can Influence Good Design	- Adds to User Accessibility, Both ADA and Availability of EVSE - Raises Visibility - Enables EVSE in Public Realm	- Can Require EVSE or Wiring in New Development - Can Create Streamlined Permitting Processes - Help Meet Emissions Reductions Goals	- Implements Public Safety Standards - Reduces Installation Timelines - Reduces Permitting Fees
IMPLEMENTATION	- Agency Initiative - Public Review Process - Private Development	- Agency Cooperation for Enforcement and Ticketing - Host-Operator Agreements - Private Management	- State and Local Agency Oversight - Flexible Voluntary Code Appendices	- Permit Templates - Site Assessment - Inspection - Utility Reporting - Technology Updates - Professional Training
AGENCY OVERSIGHT	- Department of Planning or Zoning - Department of Buildings - Planning Commission or Board	- Department of Transportation - Public Works Department	- Department of Commerce or Building Codes Division - Environmental Compliance - Department of Buildings or Construction - Utility Regulation	- Department of Buildings or Construction
PARTNERSHIP OPPORTUNITY	- Municipal Working Groups - Development Community - Comprehensive Planning Organizations	- Private Garage Operators - Local Businesses - Charging Networks and OEMs	- Regional Planning/Working Groups - Electrical Utilities and Industry - State and Local Agencies - Code-Setting Bodies	- Interagency Cooperation - Inspection Contractors - Standards and Professional Organizations, Unions
CASE STUDIES	- Washington State Municipalities - Vancouver, Canada - New York, NY - London, United Kingdom	- Hawaii - California - Maryland - London, United Kingdom - Tokyo, Japan	- Oregon - California - Vancouver, Canada - Seattle, WA	- Oregon - New Jersey - Maryland - Raleigh, NC - Houston, TX

Estimated Relative Effectiveness { ○ Somewhat Effective
● Effective

Moving EV-Ready Planning Forward

This guide has identified EV-ready planning and policy tools available for public-sector action. However, the role of the private sector can be just as important in preparing the region for more comprehensive EVSE deployment—something to remember when organizing partnerships and working groups or when considering charging station or fleet models for procurement. Partnerships that successfully link government agencies, industry and interest groups as well as connect ideas and resources will create maximum-impact plans.

Of course, no one-size-fits-all planning approach will successfully incorporate EVSE into local jurisdictions, because each state or local government will present distinct opportunities and challenges. Presenting the tools' opportunities as well as limitations is intended to help establish realistic plans and move forward on local goals.

In addition to the options and criteria outlined in this guide, the research that informed production of this guide found that places moving forward on EV-ready policy and plans have almost all been home to an EV champion. Whether that champion is an individual or an agency, planning for a new type of infrastructure with no precedent takes a visionary approach. Further, the ability to invest time and resources, build relationships and spearhead public outreach are all key characteristics of that champion. In short, EV-ready municipalities are those that have recognized the opportunities associated with EVs and as a result have begun to address the challenges and barriers to their widespread adoption using the tools at their disposal.

This guide to policy and planning tools has approached EV readiness from the local perspective. For the region, translating local policy, law and practice into a connected, cohesive and coordinated infrastructure network poses the next challenge to TCI stakeholders. Activating these tools through a larger policy vision at the city, state and regional levels will more effectively enable high-level cohesion and widespread reduction to EVSE barriers. Policy provides incentive to encourage local spending and staff time in service of meeting state and regional goals and requirements.

The TCI region has a need to identify larger-scale opportunities to create boundary-crossing solutions in the EV sector. The decentralized nature of the EV charging infrastructure network is challenging, as is the dynamism of EV- and EVSE-related technology. Crafting a cohesive and substantive regional approach for EVSE deployment will depend on stakeholder agreement on what EVSE is; where it can go; how much it should cost to install; how its use will be encouraged or enforced and what parties will be involved in funding, planning and administering the process. These are all questions that relate to the different tools available to cities and towns: zoning, parking, codes, permitting and inspection, partnerships and procurement. At present, the varying degrees of interest in embracing EVSE planning among local and regional actors means that there is risk of a patchwork approach to infrastructure deployment based on ad hoc solutions.

While it is not the goal of this guide to propose in-depth recommendations, an important next step to enable consistent application of the planning and policy tools highlighted here is to create a detailed profile of the TCI region's regulatory framework, including a review of legal requirements such as environmental legislation and benchmarks, transportation plans and existing applications of the tools, including the many pilot programs in place throughout the region. Developing a baseline assessment of the regulatory environment specific to EVSE in the region can help stakeholders strategize around common goals and share applicable best practices.

Further, connecting planners, administrators, inspectors, other municipal employees and EV-industry professionals in the region's metropolitan area sub-regions (specifically Washington, DC-Baltimore, Philadelphia, New York-New Jersey and Boston) through ongoing work will be important. Holding an annual conference and publishing a dedicated website are two recommendations that would help to establish the TCI Northeast Electric Vehicle Network as a recognizable presence and an ongoing forum for EV advocacy and development. Taking the TCI Northeast Electric Vehicle Network's activities further, establishing additional grant-funded opportunities to promote a working group with participants from Clean Cities Coalitions is one highly viable approach.

In these and any future initiatives aimed at promoting EVs in the Northeast and Mid-Atlantic, the TCI Northeast Electric Vehicle Network is uniquely poised to act as a leader, connecting government, EV advocacy and industry stakeholders to develop long-term strategy across the region. Other organizations that can contribute directly to policy-making efforts, especially for long-term planning and outreach include, among others, the following:

- COGs
- MPOs
- Regional planning nonprofits
- Public authorities (such as the Port Authority of New York-New Jersey)
- Clean Cities Coalitions

Multi-city and -state actors such as those above with means and motivation would be well positioned to play a transformative role in accelerating and broadening EVSE deployment. EV-ready planning in cities and towns across the TCI region will be most successful when done in support of state and regional policy priorities that target the primary benefits of EVs: reduction of the consumption of natural resources; reduction of air pollution that can cause cancer and other serious health effects; reduction of GHG emissions; improvements to soil and water quality and anticipated economic development benefits.

At the state and regional levels, a vision for accomplishing each of these goals should clearly articulate the role of EVs and the importance of developing an EV battery charging infrastructure network. In cities and towns across the TCI region, EV-ready planning will make that vision possible.

APPENDIX A: OVERVIEW OF ELECTRIC VEHICLE SUPPLY EQUIPMENT CHARGING LEVELS

LEVELS OF CHARGE: DIAGRAMS AND ATTRIBUTES

LEVEL 1




**8–20+
HOURS
CHARGE
TIME**

ATTRIBUTES:

- A standard outlet can potentially fully recharge an EV battery in 8–12 hours, though larger batteries, such as on the Tesla Model S, would require between 1 and 2 days
- This level is often sufficient for overnight, home charging
- Standard outlets can also provide an option for “peace of mind” charging using onboard equipment on the go
- Uses standard J1772 coupler
- In-vehicle power conversion

LEVEL 2




**4–8
HOURS
CHARGE
TIME**

ATTRIBUTES:

- Free-standing or hanging charging station units mediate the connection between power outlets and vehicles
- Requires installation of charging equipment and often a dedicated 20–80 amp circuit, and may require utility upgrades
- Well-suited for inside and outside locations, where cars park for only several hours at a time, or when homeowners seek added flexibility of use and a faster recharge
- The public charging network will comprise primarily level 2 charging stations
- Public context requires additional design features, such as payment and provider network interfaces or reservation systems
- Uses standard J1772 coupler
- In-vehicle power conversion, charging speed limited by the onboard charger

DC FAST CHARGE




**30
MINUTES
CHARGE
TIME**

ATTRIBUTES

- Free-standing units, often higher profile
- Enable rapid charging of EV battery to 80% capacity in as little as 30 minutes
- Electrical conversion occurs in EVSE unit itself
- Relatively high cost compared to level 2 chargers, but new units on the market are more competitively priced
- Draws large amounts of electrical current, requires utility upgrades and dedicated circuits
- Beneficial in heavy-use transit corridors or public fueling stations
- Standard J1772 coupler approved in October 2012

APPENDIX B: GAPS AND OPPORTUNITIES

This section highlights additional opportunities that exist for jurisdictions that wish to become electric vehicle (EV) ready. These are opportunities to address central challenges that rose to the top during this process. However, it is important to note that while these gaps affect municipal planning and municipal-level actors, such as local power authorities, decision making in many of these categories is the responsibility of the states.

First, there are important regulatory gaps that should be addressed. These fall into three primary categories:

- Utility Regulation, Reporting and Access to Information
- Limitations on the Use of Public Property
- Local Program Incentives

Second, incentives for electric vehicle supply equipment (EVSE) deployment have not been addressed in this guide. This appendix concludes with a brief overview of these opportunities.

Utility Performance, Regulation and Reporting

Resale of Electricity: NIPSCO's IN-Charge Electric Vehicle Program, Indiana⁹⁰ Reduces Electricity Cost

Resulting from a 2011 settlement with the U.S. Environmental Protection Agency, Indiana's second-largest electricity provider, NIPSCO, agreed to offer several programs aimed at reducing air emissions or preserving lands potentially impacted by air emissions. These programs resolved allegations that NIPSCO violated the Clean Air Act. In April 2012, one of these, the IN-Charge Electric Vehicle Program, began offering financial incentives for EV purchase and use, including an aggressive time-dependent incentive.

⁹⁰ "Nipsco In-Charge Electric Vehicle Program – At Home," Nipsco, October 11, 2012, http://www.nipsco.com/Libraries/Our_Services/NIPSCO_EV_FAQ_FINAL.sflb.ashx.

Administered by the EVSE operator 350Green, the program first offers a credit of up to \$1,650 to purchase and install residential EVSE, then, in order to facilitate time-of-use billing, it provides a free dedicated meter. Finally, enrollees receive free EV charging during off-peak hours (10 p.m.–6 a.m.) until January 31, 2015. The program is limited to 250 customers or until funding is exhausted (approximately \$413,000).

Owner/Operators of EVSE are not Electricity Suppliers or Electrical Utilities

Some jurisdictions have identified as a potential barrier to EVSE installation the regulatory designations that apply to EVSE and the premises on which EV charging stations are installed. Ensuring that individual homeowners or business operators are not classified as a utility provider is one relevant step.

The **Maryland Electric Vehicle Infrastructure Council** (EVIC) identified the need to make a clear distinction between EVSE and electricity suppliers—i.e., utilities—a priority; without such a distinction in the state's law, it was unclear whether or not EVSE owner/operators would be subject to the same extensive regulations and tariffs as energy suppliers.⁹¹ EVIC recognized (1) the short-term issue of the excessive cost and market-dampening effect of regulating each EVSE operator through the public service commission in the state and (2) the long-term issue of regulating the resale of electricity. This long-term issue is relevant in many states across the TCI region and nation, but it was considered by EVIC as secondary to letting the young EV market develop. Acting first on the short-term issue of definitions, Maryland House Bill 1280 and Senate Bill 997 (2012)⁹² amended the state's public utilities article and eliminated the short-term barrier by exempting EVSE operators from regulation as electricity suppliers. Similarly, California's

⁹¹ Meg Andrews and Kristen Weiss, Maryland Department of Transportation, interview, September 18, 2012.

⁹² *Public Utilities - Electric Vehicle Users and Charging Stations - Exclusions* Maryland Senate Bill No. 997, Maryland House Bill No. 1280, 2012.

Assembly Bill (AB) 631, passed in 2011, stipulates that an entity providing electricity as fuel for light-duty EVs will not be regulated as a public utility. California already had a precedent for the bill regarding compressed natural gas (CNG) provision. As in the case of the CNG bill, AB 631 followed an earlier decision by the California Public Utilities Commission and extended that decision into law.⁹³

Plug-In Electric Vehicle Information Disclosure

Access to vehicle registration records has been a barrier for the study of EVs and markets, but it also has been identified as a significant service issue for utilities and electricity providers. Representing several electricity suppliers in New England, Northeast Utilities considers notification to be a fundamental component of an optimized EV infrastructure, saying “[We] can accommodate [EVSE] if we know when and where.”⁹⁴

The inability for utilities and government departments outside motor vehicle registration offices to easily (or at all) access information regarding the registration and location of EVs is a problem for utilities. It is also a problem for EV planning efforts in general; matching demand to service, right-sizing regulations, developing metrics to determine the success of EV-related pilots and programs and understanding when trend thresholds have been reached. Solutions could be developed either at the federal level or by the individual states.

Regulation of utilities includes utility notification of EVSE installation and the larger issue of the limitations on the resale of electricity. States such as Maryland and Colorado have addressed reporting through legislation; utilities such as Greater Philadelphia’s PECO have also developed companion initiatives in other places that offer monetary bonuses to residential and business

customers who report an EV purchase or EVSE installation in their home or business.⁹⁵

Notification should occur as early as possible. Having the dealership or DMV notify utilities would give them time to make any needed upgrades. In Atlanta,⁹⁶ utility notification occurs through the permitting process giving the municipality the ability to delay approval until utilities are able to upgrade their infrastructure to handle the load. Clean Cities stakeholders believe that the permitting process may be too late because by the time a permit is filed the EV may have already been purchased and the EV owner begun using level 1 charging at home.

Overall, grid reliability is a state-regulated issue that drills down to the local level: the utilities’ need to know and plan for increased loads on local transformers. In many locations, access to the motor vehicle registration databases is highly restricted due to privacy concerns.⁹⁷

In **Maryland**, utility members of the EV Council noted the need to react to the observation that EVs were clustering in certain neighborhoods.⁹⁸ House Bill 1279 and Senate Bill 998 allow the state Motor Vehicle Association to transmit to the utility critical data including the type of electric vehicle and street address of registration, with appropriate privacy provisions.⁹⁹ The decision to legislate at a time when there are roughly 700 EVs on the road in the state indicates that concentrated EV charging is a real utility concern that is not premature.

⁹³ “California Legislature Fuels the Future of Electric Vehicles,” TriplePundit, June 13, 2011, <http://www.triplepundit.com/2011/06/california-legislature-fueling-future-electric-vehicles/>.

⁹⁴ Watson Collins, “Plug-In Electric Vehicles: Putting the Fundamentals in Place,” presentation, May 6, 2011, <http://www.ncsl.org/documents/energy/WCollins-511.pdf>.

⁹⁵ “Your Resource for Everything EV,” Peco, accessed November 14, 2012, <https://www.peco.com/Environment/GreenVehicles/ElectricVehicles/Pages/RegisterYourVehicle.aspx>.

⁹⁶ “Permitting Process for Electrical Vehicle Supply Equipment (EVSE) in a Single Family Residence Setting,” City of Atlanta, accessed November 13, 2012, <http://www.atlantaga.gov/modules/showdocument.aspx?documentid=538>.

⁹⁷ Maryland, Rhode Island and New Jersey are examples in the TCI region cited by interviewees for this project.

⁹⁸ Meg Andrews and Kristen Weiss, Maryland Department of Transportation, interview, September 18, 2012.

⁹⁹ *Motor Vehicle Administration - Plug-in Vehicles - Disclosure of Personal Information*, Maryland Senate Bill No. 998, Maryland House Bill No. 1279, 2012.

Similar in scope to Maryland's bills, California's Senate Bill 859 allows the state's DMV to disclose an EV owner's address and vehicle type to an electrical corporation or local publicly-owned utility if that information is used exclusively to identify where the EV is registered. The bill also allows such data to be acquired by automakers, dealerships and individuals for statistical research or reporting purposes.¹⁰⁰

Limitations on Use of Government Property

EVSE for publicly-owned land, such as national and state parks, highway concessions/public rest areas and municipal installations presents permit-free installation opportunities, but laws limiting the use of government property include restrictions on the resale of electricity as described above, as well as on commercial uses that may impact the ability of charging networks or EVSE operators to install or operate in certain areas.

Incentives

As touched upon in the policy tools, a wide array of potential incentives are possible for municipalities, jurisdictions, and private entities. See the report *Assessment of EVSE and EV Deployment* for a list of existing incentives at the state-level.

Other Local Ordinances and Program Incentives

- In addition to parking regulation, local ordinances, including some supporting program incentives, form the basis of local jurisdictions' EV-ready actions
- EVSE-equipped loading zones or green loading zone designation
- Preferential parking in municipal garages and surface lots
- Metered parking incentives

Non-Financial Public-Sector Incentives and Programs

- High-occupancy vehicle lane access
- No emissions testing for battery EVs
- Reduced vehicle registration fees

- Toll or congestion pricing exemption
- Preferential loading zones
- Night-time/off-peak delivery incentives for commercial vehicles
- Grace periods for electric delivery vehicles
- Use of noise regulations

Financial Incentives

- EV sales tax exemption
- EV/EVSE tax credits and rebates
- Reduced registration fees
- Reduced inspection fees

Market-Based and Other Private-Sector Approaches

- Queuing incentives for EV-equipped vendors at loading docks
- Reduced vehicle insurance rates for EVs
- Marketing and branding campaigns for early adopter firms, fleets and locations
- Preferential pricing for EVs in private garages¹⁰¹
- Reframing EVSE and associated infrastructure as advertising platform
- Original equipment manufacturer incentives, such as memoranda of understanding to bring vehicles to local markets

¹⁰⁰ "An Act to Amend Section 1808.23 of the Vehicle Code, Relating to Vehicles," California Senate Bill No. 859, Chapter 346, September 26, 2011, http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0851-0900/sb_859_bill_20110926_chaptered.pdf.

¹⁰¹ The Rudin Management Company, Inc. has such a program: <http://www.rudin.com>.

APPENDIX C: ZONING

Sample Zoning Amendments

As discussed in Tool 1: ZONING, there are three methods to include EVSE planning in zoning: allowance, incentive, and requirement. Below are example texts of EVSE allowance and requirement, as well as zoning text incentivizing car-sharing.

Allow Use

The full EV-relevant edits included in New York City's zone green are shown below in context (*italics ours*):

Article I: Chapter 2: 12-10: DEFINITIONS

"An #accessory use# includes: [...]

(19) An ambulance outpost operated by or under contract with a government agency or a public benefit corporation and located either on the same #zoning lot# as, or on a #zoning lot# adjacent to, a #zoning lot# occupied by a fire or police station.;

(20) Electric vehicle charging in connection with parking facilities;

(21) Solar energy systems."

32-16: Use Group 7

"D. Auto Service Establishments

Automobile glass and mirror shops [PRC-B1]

Automobile seat cover or convertible top establishments, selling or installation [PRC-B1]

Electric vehicle charging stations and automotive battery swapping facilities [PRC-B1]

Tire sales establishments, including installation services [PRC-B1]"¹⁰²

¹⁰² "Zone Green Text Amendment (N 120132 ZRY)," City of New York, Enacted April 30, 2012 http://www.nyc.gov/html/dcp/pdf/greenbuildings/adopted_text_amendment.pdf

In the state of Washington, legislation requires EVSE to be allowed in each of the zonings of specific local jurisdictions, providing sample language for fully- and partially-planning jurisdictions.¹⁰³ The city of Woodinville, an example of a fully-planned jurisdiction, enacted a local ordinance adding the following definitions to its zoning text:

"21.06.200 Electric vehicle charging station.

Electric vehicle charging station: a public or private parking space that is served by battery charging station equipment that has as its primary purpose the transfer of electric energy (by conductive or inductive means) to a battery or other energy storage device in an electric vehicle. An electric vehicle charging station equipped with Level 1 or Level 2 charging equipment is permitted outright as an accessory use to any principal use.

21.06.201 Electric vehicle charging station — public.

Electric vehicle charging station — public: an electric vehicle charging station that is (1) publicly owned and publicly available (e.g., Park & Ride parking, public library parking lot, on-street parking) or (2) privately owned and publicly available (e.g., shopping center parking, nonreserved parking in multi-family parking lots).

21.06.202 Electric vehicle charging station — restricted.

Electric vehicle charging station — restricted: an electric vehicle charging station that is (1) privately owned and restricted access (e.g., single-family home, executive parking, designated employee parking) or (2) publicly owned and restricted (e.g., fleet parking with no access to the general public).

21.06.203 Electric vehicle infrastructure.

¹⁰³ For more on the legislation see: http://psrc.org/assets/4328/EVI_report_Sec1_Ordinance.pdf

Electric vehicle infrastructure: structures, machinery, and equipment necessary and integral to support an electric vehicle, including battery charging stations, rapid charging stations, and battery exchange stations.”¹⁰⁴

The full text of Methuen’s Addendum to Comprehensive Zoning Ordinance - Electric Vehicle Provisions can be found below:

“Section V-T Electric Vehicle Charging Stations and Electric Vehicle Battery Exchange Stations:

Reference should be made to the most recent addition of the Massachusetts Electrical Code

1) Definitions

- a) **Battery charging station** means an electrical component assembly or cluster of component assemblies designed specifically to charge batteries within electric vehicles, which meet or exceed any standards, codes, and regulations set forth.
- b) **Battery electric vehicle (BEV)** means any vehicle that operates exclusively on electrical energy from an off-board source that is stored in the vehicle’s batteries, and produces zero tailpipe emissions or pollution when stationary or operating.
- c) **Battery exchange station** means a fully automated facility that will enable an electric vehicle with a swappable battery to enter a drive lane and exchange the depleted battery with a fully charged battery through a fully automated process, which meet or exceed any standards, codes, and regulations set forth.
- d) **Charging levels** means the standardized indicators of electrical force, or voltage, at which an electric vehicle’s battery is recharged. Levels 1, 2, and 3 are the most common EV charging levels, and include the following specifications:
 - i) Level 1 is considered slow charging.

- ii) Level 2 is considered medium charging.
- iii) Level 3 is considered fast charging.
- e) **Electric vehicle** means any vehicle that operates, either partially or exclusively, on electrical energy from the grid, or an off-board source, that is stored on-board for motive purpose. “Electric vehicle” includes: (1) a battery electric vehicle; (2) a plug-in hybrid electric vehicle; (3) a neighborhood electric vehicle; and (4) a medium-speed electric vehicle.
- f) **Electric vehicle charging station** means a public or private parking space that is served by battery charging station equipment that has as its primary purpose the transfer of electric energy (by conductive or inductive means) to a battery or other energy storage device in an electric vehicle. An electric vehicle charging station equipped with Level 1 or Level 2 charging equipment is permitted outright as an accessory use to any principal use.
- g) **Electric vehicle infrastructure** means structures, machinery, and equipment necessary and integral to support an electric vehicle, including battery charging stations, rapid charging stations, and battery exchange stations.
- h) **Electric vehicle parking space** means any marked parking space that identifies the use to be exclusively for an electric vehicle.
- i) **Non-electric vehicle** means any vehicle that does not meet the definition of “electric vehicle.”
- j) **Rapid charging station** means an industrial grade electrical outlet that allows for faster recharging of electric vehicle batteries through higher power levels, which meets or exceeds any standards, codes, and regulations set forth

2) Applicability:

- a) **Electric vehicle charging station(s) with a level 1 or 2 charging level** shall be permitted in a single-family or multi-family

¹⁰⁴ “Ordinance No. 523,” City of Woodinville, June 9, 2011, <http://www.ci.woodinville.wa.us/Documents/CityHall/Ordinances/Ordinance%20523.PDF>

zone designed to serve the occupants of the home and in all other zones.

- b) **Electric vehicle charging station(s) with a Level 3 or greater charging level** must be installed in a parking lot at a commercial or municipal destination, or located in a vehicle service station. These stations are expected to have intensive use and will be permitted to have multiple “rapid charging stations” to serve expected demand.
- c) **Battery exchange stations** are permitted in the BN, BH, BL and IL zoning districts with a special permit from the ZBA. This use is specifically prohibited in all residential zones.

3) Process for review:

a) Electric vehicle charging station:

- i) **New residential construction:** If associated with new residential construction, installation of a Level 1 or 2 battery charging station shall be processed in association with the underlying permit(s).
- ii) **Retrofitting single family or multi-family residential:** If retrofitting a single-family home for a battery charging station, an electric permit shall be required.
- iii) **New commercial, industrial construction:** If associated with new construction, installation of a battery charging station shall be processed in association with the underlying permit(s).
- iv) **Retrofitting a commercial site:** If retrofitting an existing commercial site for a battery charging station(s), an electric permit and review of a site plan by the Building Inspector to confirm the proposed locations will be required. Additional permits may be required based upon the location of the proposed station(s).

- b) **Battery Exchange Station (s):** A special permit from the ZBA is required in all zones. Additional permits may be required based upon the location and size of the proposed station(s).

4) Design Criteria: The following criteria shall be applied to the location and design of all electric vehicle charging facilities.

- a) Parking spaces for electric vehicles must not be located in the most convenient spots because this will encourage use by non-electric vehicles.
- b) Design should be appropriate to the location and use. Facilities should be able to be readily identified by electric cars users but blend into the surrounding landscape/architecture for compatibility with the character and use of the site.
- c) Where provided, spaces should be standard size parking stalls but designed in a way that will discourage non-electric car vehicles from using them.
- d) **Number:** No minimum number of electric vehicle charging spaces is required however, No more than 10% of the total number of parking spaces may be designated as electric vehicle charging stations.
- e) **Minimum Parking Requirements:** An electric vehicle charging space may count for ½ of a space in the calculation for minimum parking spaces that are required pursuant to other provisions of the Zoning Ordinance.
- f) **Signage:** Each charging station space shall be posted with signage indicating the space is only for electric vehicle charging purposes. Days and hours of operations shall be included if time limits or tow away provisions are to be enforced by the owner. Information identifying voltage and amperage levels or safety information must be posted.
- g) **Accessibility:** Where Charging Station equipment is provided within an adjacent pedestrian circulation area, such as a sidewalk or accessible route to the building entrance, the charging equipment

must be located so as to not interfere with accessibility requirements. Site plan of existing parking lot layout and proposed charging stations must be reviewed and approved by the Building Inspector.

- h) **Maintenance:** Charging station equipment shall be maintained in all respects, including the functioning of the charging equipment. A phone number or other contact information shall be provided on the charging station equipment for reporting when the equipment is not functioning or other problems are encountered.”¹⁰⁵

Incentivize Use

The City of Vancouver’s zoning regulation for car sharing in new developments offers a reduction in required parking spaces, using a ratio 1:5 for dedicated car-share spaces to parking spaces eliminated. A similar regulation could be implemented to incentivize EV charging stations. The limit on the number of allowable car share spaces increases for every sixty dwellings because the City views this as the minimum number of units to support a car share vehicle. Under this regulation, Section 3.2.2 states:

“The Director of Planning and General Manager of Engineering Services, on conditions that are satisfactory to them, may allow the substitution of shared vehicles and shared vehicle parking spaces for required parking spaces:

- (a) except as set out in subsections (b) and (c), at a 1:5 ratio, to a maximum of one shared vehicle and one shared parking space for each 50 dwelling units up to a maximum of two shared vehicles for each 100 dwelling units, rounded to the nearest whole number, or such greater substitution of shared vehicles and shared vehicle parking spaces at such ratio and for such number of dwelling units as they may consider appropriate with respect to the site;
- (b) for secured market rental housing Downtown, at a 1:5 ratio, with no

¹⁰⁵ “Section V-T Electric Vehicle Charging Stations and Electric Vehicle Battery Exchange Stations,” City of Methuen, May 25, 2012, <http://www.ci.methuen.ma.us/Documents/CD/ELECTVEH.pdf>

- (c) maximum number of shared vehicle parking spaces or shared parking spaces;
- (c) for secured market rental housing not Downtown, at a 1:5 ratio, to a maximum of 4 shared vehicles and 4 shared parking spaces for each 100 dwelling units; and
- (d) for developments with secured market rental housing and other residential uses, at a combination of the ratios set out in subsections (a) and (b) or (a) and (c), as the case may be, as to the Director of Planning and General Manager of Engineering Services seems appropriate.”¹⁰⁶

Required Use

Allowable uses may also include a specificity regarding the level of charge. For example, the city of Chelan, Washington responded to the state’s mandate to make EVSE and battery swap stations allowable uses by including a greater degree of specificity regarding which levels of charge are permissible in the city’s various zoning and special districts, including industrial and warehouse districts:

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

B. Level 3 electric vehicle 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.

C. Battery exchange stations are permitted in the Warehouse and Industrial (W-I), Highway Service Commercial (C-HS), and Public Lands and Facilities (P) zoning districts. (Ord. 1425 § 3 (part), 2011).”¹⁰⁷

¹⁰⁶ “Parking By-law (No. 6059): Section 3,” City of Vancouver, October 5, 2010, <http://former.vancouver.ca/commsvcs/BYLAWSParking/sec03.pdf>

¹⁰⁷ “Chapter 17.63: Electric Vehicle Charging Stations,” Code Publishing Company, September 27, 2012, <http://www.codepublishing.com/WA/chelan/html/Chelan17/Chelan1763.html>

APPENDIX D: PARKING

Sample Parking Ordinance

With text shown below, Hawaii Senate Bill No. 2747 (2012) requires publically-accessible parking lots and garages to have at least one exclusive EV charging space.¹⁰⁸

Adopted Code Language:

Section 2. Section 291-71, Hawaii Revised Statutes, is amended to read as follows:
"291-71 Designation of parking spaces for electric vehicles; charging system.

- a) Places of public accommodation with at least one hundred parking spaces available for use by the general public shall have at least one parking space near the building entrance designated exclusively for electric vehicles and equipped with an electric vehicle charging system by July 1, 2012. Spaces shall be designated, clearly marked, and the exclusive designation enforced. Owners of multiple parking facilities within the State may designate and electrify fewer parking spaces than required in one or more of their owned properties; provided that the scheduled requirement is met for the total number of aggregate spaces on all of their owned properties."

¹⁰⁸ "SB2747 SD1 HD2," Hawaii State Legislature, accessed October 24, 2012, http://www.capitol.hawaii.gov/measure_indiv.aspx?billtype=sb&billnumber=2747

Ownership and Liability in Multi-Family Housing

One relevant solution is found in California's Senate Bill 209, regarding the shared space of communal interest developments—that is community apartment, condominium, or cooperative development. The bill imposes the EV-owner installing an EVSE with the responsibility of maintaining an umbrella liability coverage policy of \$1,000,000, while naming the common interest development as an additional insured party.¹⁰⁹

SB209 has a worthwhile additional provision prohibiting common interest development from unreasonably restricting or prohibiting the installation or use of EVSE.

¹⁰⁹ Office of Energy Efficiency and Renewable Energy, "Electric Vehicle Supply Equipment (EVSE) Policies for Multi-Unit Dwellings," U.S. Department of Energy, accessed October 24, 2012, <http://www.afdc.energy.gov/laws/law/CA/9579>

APPENDIX E: CODES

Sample Building Code Amendments for EVSE

As discussed in Tool 3: CODES, many states and local municipalities have supplemented the national code with language to enhance EV readiness. Below are several examples of text dealing with different contexts and requirements.

Meet Future Increased Capacity Needs: Vancouver Building By-law No. 9936 (2009)

Adopted Code Language:

13.2.1.2 Electrical Room

- (1) The electrical room in a multi-family building, or in the multi-family component of a mixed use building, that in either case includes three or more dwelling units, must include sufficient space for the future installation of electrical equipment necessary to provide a receptacle to accommodate use by electric charging equipment for 100% of the parking stalls that are for use by owners or occupiers of the building or of the residential component of the building.

Require a percentage of parking stalls to be pre-wired for EVSE

A strategy to encourage electric vehicle (EV) readiness through the pre-wiring of garages and parking stalls at time of construction for current or future installation of charging stations. The goal is to provide future capability for dedicated EVSE in single- and multifamily homes, as well as commercial locations.

Single-Family Dwellings: Vancouver Building By-law No. 9691 (2008)

Adopted Code Language:

12.2.2.10. Cable Raceway

- (1) Each dwelling unit shall have a cable raceway leading from the electricity circuit panel to an enclosed outlet box in the garage or carport.

- (2) A raceway not smaller than size 21 shall be provided to accommodate future conductors of a separate branch circuit intended to supply a future receptacle for use with the electric vehicle charging system.
- (3) An outlet box for the receptacle referred to in Sentence (2) and approved for the purpose shall be provided in a parking space or parking stall of a storage garage or carport intended for use with the electric vehicle charging system.
- (4) The raceway described in Sentence (2) shall be installed between the dwelling unit panel board and the outlet box referred to in Sentence (3).

Multifamily Dwellings: Vancouver Building By-law No. 9936 (2009)

In 2008, the Vancouver City Council enacted new regulations in the city's building code that require a portion of the parking stalls in all new multifamily (three or more units) residential construction to accommodate EV charging. The provisions went into effect in April 2011.

Adopted Code Language:

13.2.1.1. Parking Stalls

- (1) Each one of 20% of the parking stalls that are for use by owners or occupiers of dwelling units in a multi-family building that includes three or more dwelling units, or in the multi-family component of a mixed use building that includes three or more dwelling units, must include a receptacle to accommodate use by electric vehicle charging equipment.

Residential: CALGreen, Green Construction Code (Voluntary)¹¹⁰

Adopted Code Language:

A4.106.5.4 Electric vehicle (EV) charging.

Dwellings shall comply with the following requirements for the future installation of electric vehicle supply equipment (EVSE).

A4.106.6.1 One- and two-family dwellings.

Install a listed raceway to accommodate a dedicated branch circuit. The raceway shall not be less than trade size 1. The raceway shall be securely fastened at the main service or subpanel and shall terminate in close proximity to the proposed location of the charging system into a listed cabinet, box or enclosure...

Exception: Other pre-installation methods approved by the local enforcing agency that provide sufficient conductor sizing and service capacity to install Level 1 EVSE.

Note: Utilities and local enforcing agencies may have additional requirements for metering and EVSE installation, and should be consulted during the project design and installation.

A4.106.6.1.1 Labeling requirement. A label stating “EV CAPABLE” shall be posted in a conspicuous place at the service panel or subpanel and next to the raceway termination point.

A4.106.6.2 Multifamily dwellings. At least 3 percent of the total parking spaces, but not less than one, shall be capable of supporting future electric vehicle supply equipment (EVSE)

A4.106.6.2.2 Multiple charging spaces required.

When multiple charging spaces are required, plans shall include the location(s) and type of the EVSE, raceway method(s), wiring schematics and electrical calculations to verify that the electrical system has sufficient capacity to simultaneously charge all the electrical vehicles at all designated EV charging spaces at their full rated amperage. Plan design shall be based upon Level 2 EVSE at its maximum operating ampacity. Only

¹¹⁰ “Revision Record for the State of California – Supplement” in *2010 California Green Building Standards Code*, Title 24, Part 11, July 1, 2012, www.iccsafe.org/cs/codes/Errata/State/CA/5570S1002.pdf.

underground and related underground equipment are required to be installed at the time of construction.

Nonresidential: CALGreen, Green Construction Code (Voluntary)¹¹¹

Adopted Code Language:

A5.106.5.1 Designated parking for fuel-efficient vehicles.

Provide designated parking, by means of permanent marking or a sign, for any combination of low-emitting, fuel-efficient, and carpool/van pool vehicles as shown in Table A5.106.5.1.1 or A5.106.5.1.2:

Table A5.106.5.1.1 Tier 1	
Total Number of Parking Spaces	Number of Required Spaces
0–9	0
10–25	2
26–50	4
51–75	6
76–100	9
101–150	11
151–200	18
201 and over	At least 10% of total

Table A5.106.5.1.2 Tier 2	
Total Number of Parking Spaces	Number of Required Spaces
0–9	1
10–25	2
26–50	5
51–75	7
76–100	9
101–150	13
151–200	19
201 and over	At least 12% of total

A5.106.5.3 Electric vehicle charging. Provide facilities meeting Section 406.7 (Electric Vehicle) of the California Building Code as follows:¹¹²

¹¹¹ “Revision Record for the State of California – Supplement” in *2010 California Green Building Standards Code*, Title 24, Part 11, July 1, 2012, www.iccsafe.org/cs/codes/Errata/State/CA/5570S1002.pdf.

A5.106.5.3.1 Electric vehicle supply wiring. For each space required in Table A5.106.5.3.1, provide one 12- VAC 20 amp and one 208/240 V 40 amp, grounded AC outlets or panel capacity and conduit installed for future outlets.

Table A5.106.5.3.1	
Total Number of Parking Spaces	Number of Required Spaces
0–50	1
51–200	2
201 and over	4

A5.106.5.3.2. Additional Electric Vehicle Supply Wiring. Provide a minimum number of 208/240 V 40 amp, grounded AC outlet(s), that is equal to ten percent, rounded up to the next whole number, of the total number of parking spaces.

Local codes including multi-family and commercial installation scenarios in addition to single-family scenarios

Sunnyvale, California¹¹³
Adopted Code Language:

BUILDING DIVISION REQUIREMENTS

An electrical permit is required for installation of electric vehicle chargers. [...]

New Residential Construction

- Garages/carports attached to individual dwelling units (typically single-family detached and townhouses) shall be pre-wired for a Level 2 electric vehicle charger.
- Shared parking facilities (typically condominiums and apartments) shall have 12.5% of the required spaces pre-wired for Level 2 electric vehicle chargers.

¹¹² The California Building Code sets out definitions of EVs and installation requirements for ventilation and electrical systems. The code can be found here: http://publicecodes.cyberregs.com/st/ca/st/b200v10/st_ca_st_b200v10_4_sec006.htm.

¹¹³ Building and Planning Division, “Electric Vehicle Chargers,” August 2012, <http://sunnyvale.ca.gov/Portals/0/Sunnyvale/CDD/Residential/Electrical%20Car%20Chargers.pdf>

Non-Residential and Multi-Family Requirements

- The electric vehicle charging spaces may be counted towards the number of required low-emitting/fuel efficient parking in the CALGreen or LEED, as applicable.
- A sign shall be posted at the electric vehicle charging spaces stating “Electric Vehicle Charging Only.”

Accessibility Requirements (CBC Chapter 11B)

- In each group of charging stations, one space shall be provided with an accessible loading area (a minimum of 5’ wide and 18’ in length and striped). These spaces do not need to include signage dedicating them for disabled access use. These spaces shall not be counted as accessible parking spaces, as required by California Building Code.
- Operational controls and receptacles for the charging station controls (i.e. on/off buttons, payment readers, etc.) shall be located between 15” and 48” from finished floor/grade.

Create a more stringent municipal code

For municipalities having jurisdiction, the ability to develop their own or choose voluntary measures provided by the state to create more stringent standards for EVSE may be a good opportunity. In 2011, Los Angeles adopted provisions of the Green Building Code into its municipal code. The city adopted as mandatory provisions of CALGreen, adapting the provisions to require a slightly-higher-than-Tier-1 level of compliance.

Los Angeles Municipal Code (2010)¹¹⁴
Adopted Code Language:

99.04.106.6. Electric Vehicle Supply Wiring

1. For one- or two-family dwellings and townhouses, provide a minimum of:
 - a. One 208/240 V 40 amp, grounded AC outlet, for each dwelling unit; or
 - b. Panel capacity and conduit for the future installation of a 208/240 V 40 amp,

¹¹⁴ City of Los Angeles Ordinance No. 181480, December 15, 2010, http://ladbs.org/LADBSWeb/LADBS_Forms/PlanCheck/2011LAamendmentforGreenBuildingCode.pdf.

grounded AC outlet, for each dwelling unit.

The electrical outlet or conduit termination shall be located adjacent to the parking area.

2. For other residential occupancies where there is a common parking area, provide one of the following:
- a. A minimum number of 208/240 V 40 amp, grounded AC outlets equal to 5 percent of the total number of parking spaces. The outlets shall be located within the parking area; or
 - b. Panel capacity and conduit for future installation of electrical outlets. The panel capacity and conduit size shall be designed to accommodate the future installation, and allow the simultaneous charging, of a minimum number of 208/240 V 40 amp, grounded AC outlets, that is equal to 5 percent of the total number of parking spaces. The conduit shall terminate within the parking area; or
 - c. Additional service capacity, space for future meters, and conduit for future installation of electrical outlets. The service capacity and conduit size shall be designated to accommodate the future installation, and allow simultaneous charging, of a minimum number of 208/240 V 40 amp, grounded AC outlets, that is equal to 5 percent of the total number of parking spaces. The conduit shall terminate within the parking area.

When the application of the 5 percent results in a fractional space, round up to the next whole number.

Sample Electrical Code Amendments for EVSE

Amend the state electrical code to streamline the permitting process

The Oregon Building Codes Division started developing administrative rules to streamline permit and inspection protocol for the installation of EVSE within the state. The language of the rule below applies to levels 1 and 2 charging.

Oregon Electric Vehicle Charging Station Statewide Permit and Inspection Protocol, 918-311-0065¹¹⁵

Adopted Code Language:

To ensure a path for the emerging technology and enable the installation of charging stations for electric vehicles, the following permit and inspection protocols will apply throughout the state, notwithstanding contrary provisions contained in the Oregon Electrical Specialty Code.

- (1) Building officials and inspectors shall permit and allow installation of an electric vehicle charging station that has a Building Codes Division's special deputy certification label without further testing or certification.
- (2) Persons installing an electric vehicle charging station must obtain a permit for a feeder or branch circuit from the inspecting jurisdiction. No other state building code permit is required.
- (3) The jurisdiction may perform up to two inspections under the permit issued in subsection (2) above.
- (4) Inspection of the installation is limited to examining the feeder or branch circuit for compliance with the following Oregon Electrical Specialty Code provisions:
 - (a) Overcurrent protection, per articles 225 and 240;
 - (b) Physical protection of conductors, per article 300;
 - (c) Separation and sizing of the grounding and neutral conductors, per article 250.20;
 - (d) Provisions for locking out the breaker for maintenance, per chapter 4.
- (5) For the purpose of this rule, the service, feeder or branch circuit, and charging station pedestal will be considered a single structure as defined by the Oregon Electrical Specialty Code. The structure's

¹¹⁵ Electric vehicle charging station installation amendment Stat. Auth: ORS 455.065.

owner may opt to install a grounding electrode system to supplement lightning protection, but cannot be required to do so.

- (6) An electrical contractor employing a general supervising electrician in accordance with OAR 918-282-0010 is authorized to use a minor installation label to install a new branch circuit limited to 40 amps 240 volts for the purpose of installing a wall mounted Electric Vehicle Supply Equipment (EVSE) unit in the garage of one and two family dwellings, and connect a listed wall mounted EVSE unit to that branch circuit. The electrical panel where the circuit originates must be in the garage within sight from the EVSE unit. This provision does not apply to installations in wet or damp locations.

Amend the municipal electrical code Seattle, Washington

In Seattle, Washington, the 2008 edition of the city's adopted version of the electrical code identified and added some notable changes specific to EVs, with the purpose of making it easier to install home and commercial EVSE. The Seattle Electrical Code (SEC) adds article 625.27 to address required space for physical equipment and space planning in order to install future conduit, panel and disconnect for EVSE. In addition, provisions in the SEC address outlet load calculations for residential EVSE, as well as feeder and conduit specifications for multifamily residential occupancies. Seattle's electrical code modifications speak to the potential to utilize a jurisdiction's electrical codes to meet localized market demands and projections; the city was planning ahead in the 2008 code edition to account for EVSE installation once the first Nissan LEAF vehicles hit the Seattle market in 2010.¹¹⁶ Article 625.27 of the SEC may offer best practice guidance to local jurisdictions seeking to plan in advance for EVs, and may also inform the National Fire Protection Association's next revision of the

¹¹⁶ City of Seattle, "Plug-In Electric Vehicles," https://www.seattle.gov/environment/documents/Electric%20Vehicles%20FAQ_Update_070511.pdf.

national model electrical code. The full SEC is available online.¹¹⁷

Adopted Code Language

ARTICLE 625, Electric Vehicle Charging System

625.27 Requirements for Future Installation of Outlets.

To facilitate future installation of electric vehicle outlets in residential occupancies, the following shall be provided:

- (1) Space shall be reserved in the electrical service equipment for installation of an overcurrent protective device to serve electric vehicle charging system branch circuits.
- (2) A location shall be designated, together with the required working clearances, for the electric vehicle charging system panelboard.

FPN No. 1: See also 220.57, Electrical Vehicle Outlets, for calculating demand loads.

FPN No. 2: Consideration of the location of the future electric vehicle outlets is recommended when designating a location for the electric vehicle outlet panelboard.

FPN No 3: Residential occupancies are defined in Chapter 3 of the Seattle Building Code.

¹¹⁷ Department of Planning and Development, *2008 Seattle Electrical Code Quick Reference*, Ordinance 122970, June 5, 2009, http://www.seattle.gov/dpd/static/2008%20qr%20complete_latestreleased_dpd016577.pdf.

APPENDIX F: PERMITTING

New Jersey EVSE Permitting Requirements

New Jersey’s Spring 2011 technical bulletin for code officials describes which types of EVSE installations require permitting. These requirements, from the Uniform Construction Code, apply statewide. The text applicable to EVSE is found below:

“At N.J.A.C. 5:23-2.14, Construction permits, when required, the UCC does not require a permit for cord-and-plug-connected electrical equipment. This includes equipment that is capable of being plugged in to an existing receptacle, no matter what the voltage rating of the equipment is. If the existing receptacle has the proper voltage rating, but the configuration is not compatible with the plug on the equipment, the replacement of the receptacle to one with the proper configuration would be considered Ordinary Electrical Maintenance (N.J.A.C. 5:23-2.7(c)3.i.) and no permit for, inspection, or notice to the enforcing agency of Ordinary Maintenance, is required. However, there are exceptions to this rule. For example: if there is an existing 120 volt receptacle on a 15 amp circuit that is to be replaced by a higher current 120 volt receptacle that requires a 20 amp circuit (NEMA 5-20R), the upgrade of the circuit would be considered Minor Work (N.J.A.C. 5:23-2.17A(c)3).

When a vehicle charging system is being installed that requires a new 120 or 240 volt receptacle or an electrical line that will be directly connected the system, it also is subject to the Minor Work provisions. As with all Minor Work, the issuance of a permit is not required before the work may proceed. However, the owner or contractor acting on behalf of the owner must provide notice to the enforcing agency before the work begins. Also, a permit application must be filed and must be delivered in person or by mail within five business days from the date of oral notice. The inspection of Minor Work must be performed within 30 days of the request for inspection and is based upon

what is visible at the time of the inspection with the certificate of approval stating so.”¹¹⁸

Sample EVSE Installation Costs¹¹⁹

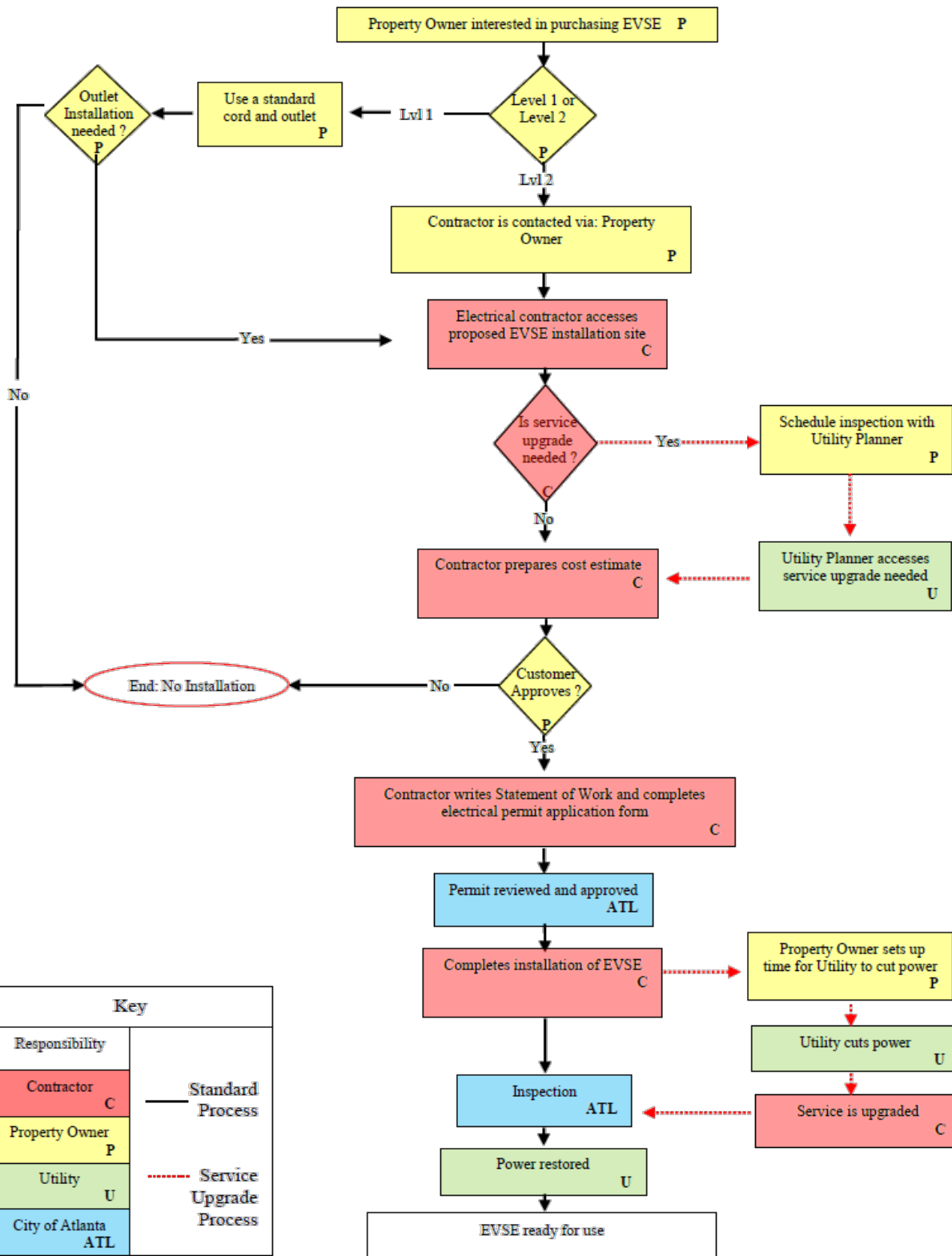
In “EV Infrastructure Installation Guide: EV Charging in Single Family Residences,” the Pacific Gas and Electric Company provides step-by-step instruction for EVSE purchasers and installers, including highlighting issues related to multi-family installations. The guide provides sample costs for installing in a single-family home, shown in the table below:

Item	Cost
Permits	\$45–\$110
Circuit breaker panel boards	
- 100A	\$450–\$685
- 225A	\$940–\$1,300
- 60A subpanel	\$385
- 40A circuit breaker	\$23–\$75
240 V outlet and 30 ft. wiring	\$195 installed
Drywall labor 6 ft x 8 ft	\$225
400 ft trenching	\$225
Cut and patch concrete - 221 ft	\$525
Ventilation	\$275 + installation
EVSE	\$100–\$3,000

¹¹⁸ Construction Code Communicator, 23(1), State of New Jersey, Spring 2011, http://www.state.nj.us/dca/divisions/codes/publications/pdf_ccc/ccc_2011_spring.pdf

¹¹⁹ Pacific Gas and Electric Company, “EV Infrastructure Installation Guide: EV Charging in Single Family Residences,” <http://www.pge.com/includes/docs/pdfs/shared/environment/pge/cleanair/ev6pt4.pdf>.

Flow Chart of Typical Permitting Process¹²⁰



Key	
Responsibility	
Contractor C	Standard Process
Property Owner P	
Utility U	Service Upgrade Process
City of Atlanta ATL	

¹²⁰ City of Atlanta, "Permitting Process for Electrical Vehicle Supply Equipment (EVSE) in a Commercial Setting," <http://www.atlantaga.gov/modules/showdocument.aspx?documentid=537>.

Alternative Fuel Data Center EVSE Permitting Template¹²¹

Permit for Charging Equipment Installation Electric Vehicle Supply Equipment (EVSE)

Jurisdiction: **City, State**

Compliance with the following permit will allow the installation and operation of electric vehicle charging equipment at a residence in the **City, State** jurisdiction. This permit addresses one of the following situations:

- Only an additional branch circuit would be added at the residence
- A hard-wired charging station would be installed at the residence. The attached requirements for wiring the charging station are taken directly out of the 2011 edition of the National Electrical Code® (NEC) ® NFPA 70, Article 625 Electric Vehicle Charging System. This article does not provide all of the information necessary for the installation of electric vehicle charging equipment. Please refer to the current edition of the electrical code adopted by the local jurisdiction for additional installation requirements. Reference to the 2011 NEC may be made at www.nfpa.org/70.

This permit contains a general reference to the NEC or electrical code used in the jurisdiction. All work and installed equipment will comply with the requirements of the NEC or the electrical code used in the jurisdiction. The jurisdiction maintains the authority/responsibility to conduct any inspections deemed necessary to protect public safety. The charging station installer shall also be responsible for notifying or coordinating any work with the utility company where needed.

Section 1 of the permit application requires basic identifying information be submitted. Note that there is a separate portion of the form requesting information on the property owner who may not be the individual requesting the installation.

Section 2 of the permit application identifies which code needs to be complied with depending on whether a branch circuit and meter or a hard-wired charging station is being installed.

The technical installation requirements address the following specific elements of electric vehicle charging station safety:

- Listing and labeling requirements
- Wiring methods
- Breakaway requirements
- Overcurrent protection
- Indoor siting
- Outdoor siting

Section 3 consists of standard certification statement that could be modified as needed by the jurisdiction. By signing the certification statement, the applicant agrees to comply with the standard permit conditions and other applicable requirements. This consent would give the jurisdiction the option of allowing the applicant to proceed with installation and operation of the charging equipment.

Section 4 of the document gives an example of a checklist the jurisdiction could develop to track key information on the application. The example under section 4 contains only a few items of the many that the jurisdiction might wish to track.

This permit package also includes a schematic drawing depicting a typical indoor installation. In this installation the wiring path follows the exterior of the structure, and the charging station is located indoors. The NEC® allows for interior wiring and outdoor installations. The purpose of the schematic is only to show how the charging station equipment could be arranged and is not intended to convey any permit requirements.

¹²¹ The rest of the template can be found here: Office of Energy Efficiency and Renewable Energy, "Permit for Charging Equipment Installation Electrical Vehicle Supply Equipment (EVSE)," U.S. Department of Energy, June 24, 2012, http://www.afdc.energy.gov/pdfs/EV_charging_template.pdf

Results of EVSE Installation in and around Philadelphia

Facilitated through Greater Philadelphia Clean Cities, grants from Amerigreen and the EV Project funded EVSE installations at Lehigh Gas Corporation’s gas stations and Parkway Corporation’s parking garages. Below are the costs and procedures involved for eight of those installations:¹²²

Municipality	Location Type	Permit Type(s)	Permit Cost(s)	Time to Receive Permit	Additional Approvals	Type of Charger	Other Requirements
Harrisburg	Gas Station	Electrical	\$14 Electrical	2 weeks	None	Level 2 Eaton	Spec sheets
Hatfield	Gas Station	Electrical	\$250 Electrical \$75 Contractor	2 weeks	None	Level 2 Eaton	Spec sheets
Woodlyn	Gas Station	Electrical	\$150	3 weeks	None	Level 2 Eaton	Sealed drawings
Philadelphia	Parking Garage	Electrical	\$75	1 week	None	Level 2 Eaton	None
Philadelphia	Parking Garage	Electrical	\$75	1 week	None	Level 2 Eaton	None
Philadelphia	Parking Garage	Electrical	\$75	1 week	None	Level 2 Eaton	None
Philadelphia	Parking Garage	Electrical	\$75	1 week	None	Level 2 Eaton	None
Philadelphia	Parking Garage	Electrical	\$75	1 week	None	Level 2 Eaton	None

¹²² Source: Tony Bandiero, Greater Philadelphia Clean Cities