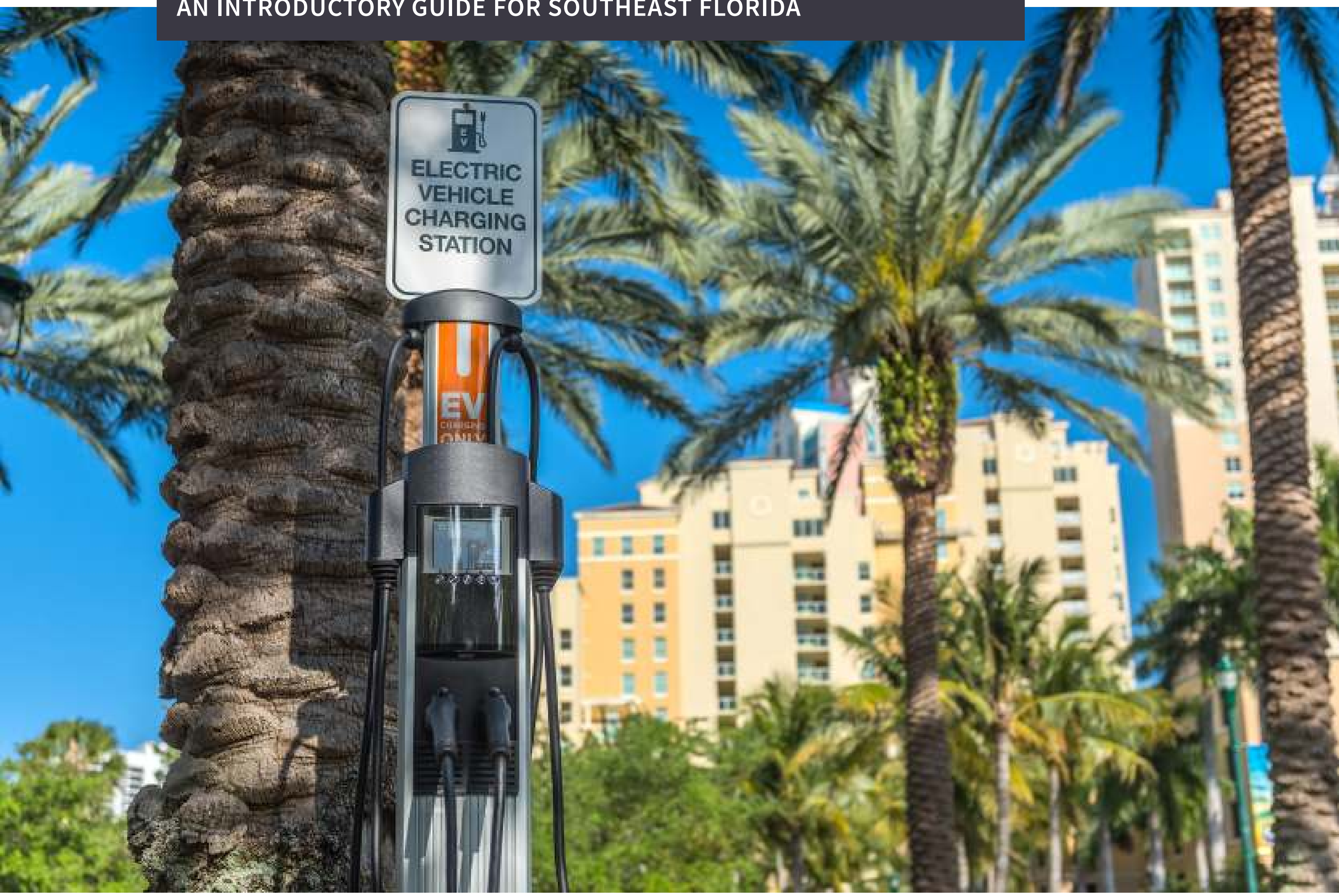
Electric Vehicles and EV Infrastructure

AN INTRODUCTORY GUIDE FOR SOUTHEAST FLORIDA



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Report prepared by:
Institute for Sustainable Communities (on behalf of the Southeast Florida Regional Climate Change Compact)

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ABOUT THE DOCUMENT

As part of the Southeast Florida Regional Climate Change Compact's ongoing efforts to build the capacity of practitioners and stakeholders in Southeast Florida to advance regional climate action, the Compact has developed this introductory report on electric vehicles and EV infrastructure. This compilation of resources builds on presentations and discussions from the Compact's Fall 2019 workshop on electric vehicles and offers additional curated resources and guidance on opportunities for local governments to support the transition to and expansion of electric vehicles.

ABOUT THE AUTHORS

Institute for Sustainable Communities

Since 1991, the Institute for Sustainable Communities (ISC) has worked in the United States and around the world to help communities, cities, industry, and NGOs accomplish their environmental, economic, and social goals. ISC uses training, technical assistance, peer-to-peer learning, and demonstration projects to help unleash the power of local people and institutions to address immediate challenges and opportunities – all while building those on-the-ground solutions into national and international best practices and policy. At the heart of the organization's approach is results focused, authentic and pragmatic engagement with all stakeholders, which unearths locally-driven and equitable solutions to the biggest challenge we face – global climate change. ISC provides implementation support to the Southeast Florida Regional Climate Change Compact. Learn more at sustain.org and us.sustain.org.

The Southeast Florida Regional Climate Change Compact

Established in 2009 through local government leadership, the Southeast Florida Regional Climate Change Compact (the Compact) is a ground-breaking regional collaborative between Broward, Miami-Dade, Monroe and Palm Beach counties focused on regional coordination and joint action to build climate resilience and reduce greenhouse gas emissions. For over 10 years, the Compact counties have successfully collaborated on mitigation and adaptation strategies, built bipartisan support for action, and forged partnerships with key stakeholders, including economic development entities, community-based organizations, and the academic community, enabling the development of a regional voice and vision for future prosperity in Southeast Florida. The Compact provides a regional vision for addressing climate change in Southeast Florida through the Regional Climate Action Plan (RCAP). Regional planning standards, shared policy platforms, and informational resources for municipal action can be found at www.southeastfloridaclimatecompact.org.

Introduction

In 2017, for the first time ever, the transportation sector emitted more carbon than the electric sector in the state of Florida, with more than 80% of transportation emissions coming from gasoline and diesel powered light, medium, and heavy duty vehicles.[1] To reduce emissions stemming from this key sector, leaders from the public and private sectors are investing in electric vehicles (EV) and electric vehicle infrastructure. Powered by electricity, electric vehicles offer a significant opportunity to reduce emissions, decarbonize the transportation sector, and reduce health impacts resulting from transportation pollution within communities.

Over the past several years, plans and investments to advance the adoption of electric vehicles have begun to take shape. For example, the Florida Department of Environmental Protection (DEP) developed the Diesel Emissions Mitigation Program, which uses funds from the Volkswagen Settlement and EPA's Diesel Emissions Reduction Act (DERA) State Grant Program for projects that mitigate mobile sources of emissions.[2] Through the VW Florida Beneficiary Mitigation Plan, DEP identified Broward, Miami-Dade, and Palm Beach counties as air quality priority areas. Of the total $166m allocated to Florida from the VW settlement, the plan allows the maximum allocation of 15% for light-duty electric vehicle supply equipment (EVSE) installation, and earmarks significant funds to electrify transit, school, and shuttle buses.[3]

The Florida Department of Agriculture and Consumer Services' Office of Energy is currently working on an Electric Vehicle (EV) Roadmap for the state. The roadmap will help identify EV charging infrastructure impacts on the electric grid, solutions for any negative impacts, areas that lack EV charging infrastructure, best practices for siting EV charging stations, and technical or regulatory barriers to expansion of EV charging infrastructure.[4]

Electrify America, a subsidiary of VW America, invested $2 billion in electric vehicle supply equipment nationally in the first cycle of its National Zero-Emission Vehicles Investment Plan, and is beginning the second cycle of investment. The company will focus on the installation of Level 2 and DC fast charging stations in the Miami metro-region and will explore renewable generation and storage to support long term economic sustainability of the infrastructure investments.[5] Florida Power and Light is making upgrades in infrastructure and plans to install 600 new EV charging stations at approximately 100 locations throughout its service area.[6]

At the national level, the federal government offers a federal income tax credit of up to $7,500 for the purchase or lease of an electric vehicle. The credit is gradually phased out as manufacturers reach various sales thresholds.[7]

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[1] Jill Dvareckas, "Driving the future of EVs in Florida," (presentation, Southeast Florida Regional Climate Change Compact RCAP Implementation Workshop: Electric Vehicles, Miami, FL, September 19, 2019).
[2] "DEMP - Volkswagen Settlement," Florida Department of Environmental Protection, accessed January 3, 2020, https://floridadep.gov/air/air-director/content/demp-volkswagen-settlement.
[3] Florida Department of Environmental Protection, State of Florida Mitigation Plan (Tallahassee: FDEP, 2019), 3, https://floridadep.gov/sites/default/files/Draft%20Beneficiary%20Mitigation%20Plan%20-%20Published%207.17.2019_0.pdf.
[4] "Florida Electric Vehicle Roadmap," Florida Department of Agricultural and Consumer Services, accessed April 29,2020, https://www.fdacs.gov/Energy/Florida-Electric-Vehicle-Roadmap.
[5] Electrify America, National ZEV Investment Plan: Cycle 2 (Reston, VA: Electrify America, 2019), 37, https://elam-cms-assets.s3.amazonaws.com/inline-files/Cycle%202%20National%20ZEV%20Investment%20Plan%20-%20Public%20Version%20vF.pdf.
[6] "EVSE Fact Sheet," Florida Power and Light, accessed January 3, 2020, https://www.fpl.com/energy-my-way/EVSE-fact-sheet.pdf.
[7] "Electric Vehicle Tax Credits: What You Need to Know," Edmunds, January 28, 2019, https://www.edmunds.com/fuel-economy/the-ins-and-outs-of-electric-vehicle-tax-credits.html.

As the range of electric vehicles increases, additional charging infrastructure is deployed, and the total cost of electric vehicles continue to decline (battery costs have declined more than 65% since 2014), the electric vehicle market is poised to grow significantly. Since 2013, ownership of EVs has increased by 300% in Florida.[8] Today, there are nearly 48,000 electric vehicles on Florida's roads[9] and by 2030, more than 780,000 electric vehicles will be registered in the state.[10]

According to an analysis by the energy and environmental consulting firm M.J. Bradley & Associates, Florida could achieve a 70-80% reduction in emissions from light-duty greenhouse gas (GHG) emissions, in conditions where nearly all vehicles are electric by 2050.[11] As one of the top recommendations outlined in the Rocky Mountain Institute's *The Carbon-Free City Handbook*, electric vehicle and EV infrastructure deployment are key opportunities for local governments to limit regional and local emissions.

In support of the Regional Climate Action Plan, which outlines regional opportunities to advance sustainability and reduce emissions, this guidance product explores the multiple roles and methods by which local governments can individually and collaboratively hasten the penetration of electric vehicles in Southeast Florida. It outlines useful tools for localities to develop EV-ready communities, install EV infrastructure, and to transition public fleets to electric vehicles. It also provides leading best practices for policy design and coordinating regional EVSE investment.

[8] "EVSE Fact Sheet," Florida Power and Light, accessed January 3, 2020, https://www.fpl.com/energy-my-way/EVSE-fact-sheet.pdf.
[9] Jill Dvareckas, "Driving the future of EVs in Florida," (presentation, Southeast Florida Regional Climate Change Compact RCAP Implementation Workshop: Electric Vehicles, Miami, FL, September 19, 2019).
[10] Patricia Gomez, e-mail message to author, May 6, 2020.
[11] Dana Lowell, Electric Vehicle Cost-Benefit Analysis: Plug-in Electric Vehicle Cost-Benefit Analysis: Florida (Concord, MA: M.J. Bradley & Associates, 2019), ii, accessed December 2019, https://www.mjbradley.com/reports/plug-electric-vehicle-cost-benefit-analysis-florida.

Key Terms

EV | EV – Electric vehicle; this includes battery electric vehicles and plug-in hybrids.

EVSE | Electric vehicle supply equipment; another term for charging stations.

Level 1 Charging | Level 1 is considered slow charging and operates on a 15 to 20-amp breaker on a 120-volt AC circuit. This is comparable to the wall plug used for most common household appliances, but has a special electric outlet for the car connection. These chargers are typically used at home by EV owners. Level 1 charging stations typically take 8 to 12 hours to fully charge.[11]

Level 2 Charging | Level 2 is considered medium charging and operates on a 40 to 100-amp breaker on a 208 or 240-volt AC circuit. The amount of energy this charger uses is comparable to an electric clothes dryer. These chargers also feature a special electric outlet for the car connection. Level 2 chargers are used for both home or commercial service purposes and typically take three to four hours to fully charge.[12]

Level 3 Charging | *Also known as "DC Fast Charging," (DCFC)* is considered fast or rapid charging and operates on a 60-amp or higher breaker on a 480-volt or higher three-phase circuit with special grounding equipment. These chargers are typically characterized by industrial-grade car connection electric outlets that allow for faster recharging times of 30 to 45 minutes. Level 3 chargers and the associated utility infrastructure are expensive to purchase and install. Therefore, these chargers are used primarily for commercial charging stations and are not likely to be used for personal use.[13]

Range Anxiety | The fear that a vehicle has insufficient range to reach its destination, and would thus strand the vehicle's occupants. Range anxiety is one of the greatest barriers to large scale adoption of EV.[14]

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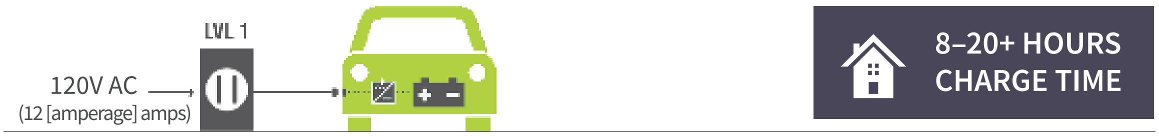
[12] Will Hutchings, "Planning for Electric Vehicle Charging Facilities," last modified April 2019, https://www.westernplanner.org/2019articles/2019/4/10/planning-for-electric-vehicle-charging-facilities.
[13] Ibid.
[14] Ibid.
[15] Rob Stumpf, "Americans Cite Range Anxiety, Cost as Largest Barriers for New EV Purchases: Study," last modified February 26, 2019, https://www.thedrive.com/news/26637/americans-cite-range-anxiety-cost-as-largest-barriers-for-new-ev-purchases-study.

LEVELS OF EV CHARGING[16]

LEVEL 1



ATTRIBUTES:

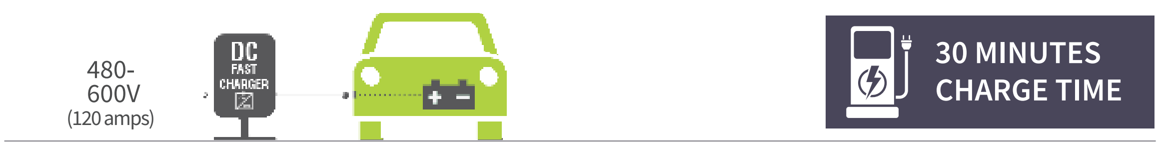
- A standard outlet can potentially fully recharge an EV battery in 8–12 hours
- This level is often sufficient for overnight, home charging
- Standard outlets can also provide an option for “peace of mind” charging using onboard equipment on the go

LEVEL 2

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

LEVEL 3 *(DC Fast Charge)*



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

[16] Image adapted from WXY Architecture + Urban Design, *Siting and Design Guidelines for Electric Vehicle Supply Equipment*, (Albany: NYSERDA and TCI, 2012), 3, accessed January 2020, https://www.transportationandclimate.org/sites/default/files/EV_Siting_and_Design_Guidelines.pdf.

Promoting Regional Coordination

To effectively and efficiently advance vehicle electrification, local governments must work collaboratively with regional and state agencies, and private sector partners. Regional coordination and partnership are particularly important for achieving economies of scale, such as with group purchasing or EV modeling. Coordination is also imperative to infrastructure planning and to the development of regional DC Fast Charging (DCFC) corridors, which can support emergency evacuations and other long distance EV trips.

COOPERATIVE PURCHASING

Cooperative purchasing offers communities an opportunity to leverage their collective buying power and accelerate the conversion of public fleets to EVs. The Climate Mayors Electric Vehicle Purchasing Collaborative, a national partnership for EV group purchasing and capacity building, provides a turnkey, one-stop, online procurement portal for U.S. cities, counties, state governments, and public universities to competitively bid for EVs and charging infrastructure. Users can browse by available electric vehicles, leasing options, and charging infrastructure.[17] The Collaborative also provides training, best practices, educational resources, and analysis support.

INFRASTRUCTURE PLANNING

To facilitate long-distance intercity travel and ensure consistency across jurisdictions, many communities are working collaboratively on infrastructure planning. For example, through the development of the singular, coordinated regional Central Sierra Zero-Emission Vehicle Readiness Plan the Tuolumne County Transportation Council in California was able to create economies of scale by considering shared studies and needs for the region. The readiness plan facilitated joint efforts to:

- Evaluate the current and future state of the Zero Emission Vehicles (ZEV) market;
- Study and analyze site locations needed for ZEV infrastructure deployment;
- Evaluate opportunities to streamline ZEV permitting, installation, and inspection to facilitate the timely approval and construction of ZEV infrastructure;
- Study and analyze the feasibility of ZEV adoption in municipal fleets;
- Create a venue for stakeholder coordination and gain input from key stakeholders on the ZEV Readiness Plan; and
- Identify funding sources for an implementation program.[18]

Other notable instances of regional EVSE planning include the Texas River Cities Plug-In Electric Vehicle Initiative, which aims to promote EV penetration in the Central Texas region, including the greater Austin and San Antonio communities. Additionally, the North Coast Plug-in Electric Vehicle Readiness Plan, developed by the Redcoast Energy Authority, a local government joint powers agency representing the Humboldt Bay Municipal Water District, the County of Humboldt, as well as the Cities of Eureka, Arcata,

[17] "Climate Mayors Electric Vehicle Purchasing Collaborative," Climate Mayors, accessed January 2020, https://driveevfleets.org/.
[18] Center for Sustainable Energy, *Draft Background Assessment Report for the Central Sierra Zero Emission Vehicle Readiness Plan* (Sonora, CA: Tuolumne County Transportation Council 2018), 6, accessed December 2019, https://caafb210-db14-4a97-9057-dca87ef38f2a.filesusr.com/ugd/fe950e_ac0c153741124ccab06c04b20ccf2dd2.pdf.

Fortuna, and others supports planning to increase penetration of EVs to approximately 2% of all light duty vehicles in the community by 2025.

Regional coordination of EVSE deployment is particularly important for Southeast Florida, given the region's vulnerability to hurricanes. In the event of a mass evacuation, drivers must be able to access an extensive, convenient, and reliable network of charging stations. Without regional coordination to support mass evacuations, charging stations could become inundated, or unavailable due to outages, or the grid could become overloaded.[19] Localities should work collaboratively, along with their utilities to plan for regionally EV resilient infrastructure—built outside of flood zones and powered by solar.

DC Fast Charging

Many other local governments are also working together to advance the installation of DCFC. For example, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming signed a memorandum of understanding (MoU) to work collaboratively on a regional EV fast charging network spanning across 5,000 miles of freeway. The partners aim to:

- Coordinate station locations to maximize use and minimize inconsistency between charging infrastructure.
- Develop practices and procedures to encourage the adoption of EVs and address range anxiety.
- Develop operating standards for charging stations.
- Incorporate EV charging stations in the planning and development process.
- Encourage automotive OEMs to stock a variety of EVs in participating states.
- Collaborate on funding and finding opportunities for the network.[20]

ELECTRIC VEHICLE INFRASTRUCTURE PROJECTION TOOL

The National Renewable Energy Laboratory created Electric Vehicle Infrastructure Projection Tool (EVI-Pro) Lite, a free, web-based tool that uses detailed data on personal vehicle travel patterns, electric vehicle attributes, and charging station characteristics in bottom-up simulations to estimate the quantity and type of charging infrastructure necessary to support regional adoption of electric vehicles.

[19] Shawn A. Adderlya et al., "Electric vehicles and natural disaster policy implications," Energy Policy 112, (January 2018):437, https://isiarticles.com/bundles/Article/pre/pdf/143011.pdf.

[20] "Mountain West States Buy In on Regional EV Fast Charging Network," Guidehouse Insights, December 14, 2017, https://www.navigantresearch.com/news-and-views/mountain-west-states-buy-in-on-regional-ev-fast-charging-network.

Planning and Policy

Communities have a number of planning and policy tools they can employ to facilitate and accelerate installation of EVSE, key to helping residents overcome range anxiety—the fear that a vehicle has insufficient range to reach its destination and would thus strand the vehicle's occupants. Not only can localities encourage the development of charging stations, but they can also work with their planners, community leaders, private businesses, and EVSE providers to identify areas for EVSE installation that will maximize public and private benefits. Common strategies and tactics to engage the private sector in fostering and creating built environments supportive of EV are outlined below.

SETTING GOALS FOR EV INFRASTRUCTURE IN COMPREHENSIVE AND SUSTAINABILITY PLANS

Governments can provide a vision for the deployment of electric vehicle infrastructure in their comprehensive and sustainability plans. For example, in its Climate Change and Resilience Vision of its 2017 Comprehensive Plan, Broward County articulated a goal to pursue "municipal and public-private partnerships in order to develop an infrastructure network that provides public access to alternative fuels and EV charging," and as part of the county's efforts to reduce greenhouse gas emissions by 2% per year."[21]

[21] Broward County, *Broward County Land Use Plan of the Broward County Comprehensive Plan* (Ft. Lauderdale: Broward County, 2019), 4, accessed December 2019, https://www.broward.org/PlanningCouncil/Documents/LandUsePlan/Broward%20County%20Land%20Use%20Plan.pdf.

CASE STUDY

Expanding EV Access in Low-Income Communities

BlueLA Charging Stations and Electric Vehicles
Photo: Streetsblog L.A./Joe Linton

Low-income communities and communities of color are disproportionately burdened by climate change and greenhouse gas emissions, as these communities frequently live near busy roads and freeways, where they face exposure to dangerous levels of emissions. Often, individuals in these communities suffer from higher rates of asthma, cancer, and other pollution-related illnesses.[22] Many cities are working to ensure that as they advance their GHG emission reduction and zero emission mobility goals, they target, prioritize, and protect the most impacted residents.

In Los Angeles, the city launched BlueLA carsharing to deploy 100 vehicles and 200 charge points in communities with greater socioeconomic challenges, a need for mobility options, and exposure to environmental pollution. With $1.6 million from the California Air Resources Board and $2.8 million from city agencies, BlueLA is able to offer discounted subscription and use fees for thousands of low-income users. The city seeks to recruit households with annual incomes below $35,000, and aims for at least 50% of all trips to be made by members with household incomes less than $35,000.[23] BlueLA service has reduced local GHG emissions nearly 900 metric tons, equal to 100,114 gallons of gasoline consumed.[24]

In Sacramento, California, which received $44 million in VW Settlement Funds, the city established Our Community CarShare, an EV-sharing program which will put 140 EVs at 70 low-income apartment complexes for car-sharing. This program is a partnership between the Sacramento Metro Air District, Zipcar, the city of Sacramento, the Sacramento Municipal Utility District (SMUD), the Sacramento Housing Redevelopment Authority, and the nonprofits Mutual Housing and Policy in Motion.[25]

To support equitable access to EVSE infrastructure across its shared mobility hubs, the city of Seattle developed an EVSE prioritization matrix, which includes equity and environmental justice indicators. The matrix uses a Traffic Pollution Index, based on Vehicle Miles Traveled (VMT) locations, "as a proxy to prioritize areas bearing inequitable environmental burdens that can be partially addressed by higher EV adoption" and assigns greater consideration for areas with high concentrations of low-income and minority households. Additionally, equity and environmental justice criteria account for 20% of a weighted score used by the city to prioritize EVSE deployment.[26]

For more information on advancing equity in EV and EVSE planning and development, see:

- Electric Vehicles for All: An Equity Toolkit
- Electric Carsharing in Underserved Communities: Considerations for Program Success
- Expanding access to electric mobility in the United States

[22] Greenling Institute, *Electric Vehicles for All: An Equity Toolkit*, (Oakland: Greenlining Institute, 2019), accessed December 2019, https://greenlining.org/resources/electric-vehicles-for-all/#tab4-section1.

[23] The International Council on Clean Transportation, *Expanding Access to Electric Mobility in the United States*, (Washington, DC: ICCT, 2017), https://theicct.org/sites/default/files/publications/Expanding-access-electric-mobility_ICCT-Briefing_06122017_vF.pdf.

[24] "EV Carsharing Pilot Program (BlueLA Carsharing) Project," California Air Resources Board, accessed April 24, 2020, https://ww3.arb.ca.gov/msprog/lct/pdfs/bluela.pdf.

[25] Bradley Berman, Are Electric Cars Only for the Rich? Sacramento Is Challenging That Notion, *New York Times*, January 24, 2019, https://www.nytimes.com/2019/01/24/business/electric-vehicles-electrify-america-sacramento.html.

[26] City of Seattle, *EVSE Roadmap for Shared Mobility Hubs* (Seattle: Seattle Department of Transportation, 2018), accessed April 2020, http://evsharedmobility.org/wp-content/uploads/2018/12/SDOT_EVSE_Roadmap_for_Shared_Mobility_Hubs.pdf.

EV PARKING MINIMUMS AND STANDARDS

Cities can use municipal zoning codes to encourage and target development of EVSE infrastructure along key corridors and land uses. In doing so, they "can eliminate confusion about what is and isn't allowable while also affirming the desirability of EVSE within the community."[27] Some communities have provided transparency by setting different zoning regulations by EV charging infrastructure. Typically, Level 1 and Level 2 charging stations are permitted in all areas, while Level 3 charging stations are zoned for commercial or industrial use.[28] Others have amended zoning ordinances to clarify that Level 3 charging is an accessory use that does not require further zoning board approval.[29]

Many cities apply zoning to establish numerical or percentage-based goals for EVSE infrastructure and EV reserved parking or allow developers to count EV parking toward overall parking requirements. For example, in Mountlake Terrace, Washington, the community used zoning to require EVSE development in multifamily residential, medical and office facilities, as well as lodging and municipal zones.[30] In Stockton, California, developers are able to count one charging space as two parking spaces, for up to 10% of total required parking.[31]

AN EXAMPLE OF EV PARKING MINIMUMS IN MOUNTLAKE TERRACE, WA [32]

Land Use Type	Percent Parking Spaces
Multi-household Res	10%
Lodging	3%
Retail, eating and drinking	1%
Office, medical	3%
Industrial	1%
Institutional, Municipal	3%
Recreation/Entertainment/Cultural	1%
Other	3%

In their joint report, *Creating EV-Ready Towns and Cities: A Guide to Planning and Policy Tools*, The New York State Energy Research and Development Authority and Transportation and Climate Initiative suggests that when developing zoning actions, municipalities should:

- Ensure the zoning resolution or ordinance permits EVSE in logical locations
- Establish clear definitions for EVs and EVSE, as well as use groups[33]
- Consider relevant comprehensive planning frameworks for EVs and EVSE

[27] "Leading the Charge: City Codes and Electric Vehicles," Iowa Clean Cities Coalition, accessed January 2020, https://dmampodemo.files.wordpress.com/2013/06/evzoning.pdf.
[28] Ibid., 1.
[29] Elaine O'Grady and Jesse Way, *Preparing Our Communities for Electric Vehicles: Facilitating Deployment of DC Fast Chargers* (Boston: The Clean Air Association of the Northeast States, 2019), 4, accessed December 2019, https://www.nescaum.org/documents/dcfc-permit-streamlining-whitepaper-final-5-14-19.pdf.
[30] Claire Cooke and Brian Ross, *Summary of Best Practices in Electric Vehicle Ordinances* (Minneapolis: Great Plains Institute, 2019), 13, accessed January 2020, https://www.betterenergy.org/wp-content/uploads/2019/06/GPI_EV_Ordinance_Summary_web.pdf.
[31] California Governor's Office of Business and Economic Development, *Electric Vehicle Charging Station Permitting Guidebook* (Sacramento: GO-Biz, 2019), accessed December 2019, http://businessportal.ca.gov/wp-content/uploads/2019/07/GoBIZ-EVCharging-Guidebook.pdf.
[32] Cooke and Ross, *Summary of Best Practices in Electric Vehicle Ordinances,* 13.
[33] Use groups refers to a designated group of land uses that are considered to be allowed as-of-right.

- 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

For additional examples and model ordinances of localities around the country that have updated zoning to define and clarify electric vehicle charging stations as permitted land uses, review section 1 of the 2019 report, *Summary of Best Practices in Electric Vehicle Ordinances*, developed by the Great Plains Institute (GPI), a nonpartisan, national, nonprofit organization focused on transforming the energy system to benefit the economy and environment. This report provides examples of cities delineating use permitted zoning districts by charging station type, requiring conditional or special use permits for charging stations, and those that have restricted charging stations in the right of way.[34]

For resources to support transportation and community planners in prioritizing EVSE locations, see the *Integrated Approaches to EV Charging Infrastructure and Transit System Planning* report, which provides policy insights for integrating EV infrastructure development with transit systems, and the *EVSE CLUSTER ANALYSIS: Electric Vehicle Supply Equipment Support Study* report. The reports explore the key factors that underpin an ideal EVSE cluster and provide examples of communities that have clustered EVSE around medical facilities, higher education, multi-family, regional transit, and other distinct land uses.

MAKE-READY STANDARDS

Cities may also develop "make-ready standards," embedded into zoning, which require developers to pre-install appropriate electrical capacity and conduits to support future EVSE. Make-ready standards can provide significant cost savings and avoid future costly retrofits associated with trenching and resurfacing parking areas to install EVSE, which can be "91%+ more expensive than outfitting garages during the initial construction phase."[35] As a local example, Miami-Dade County determined that for all projects with more than ten off-street parking spaces required, 10% of the parking spaces (before January 2022) and 20% of the parking spaces (after January 2022) must be EV-ready.[36]

DENSITY BONUSES

Density bonuses can incentivize the inclusion of charging stations in a construction project. The city of San Carlos, California allows developers to exceed the maximum floor area ratio by 10% if they provide additional environmental design features, such as electric car facilities. Scottsdale, Arizona, extends bonus development standards consideration if developers install at least five charging stations or 5% of the total number of required spaces in the development plan, whichever is greater.[37]

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[34] Cooke and Ross, *Summary of Best Practices in Electric Vehicle Ordinances*.
[35] Cooke and Ross, *Summary of Best Practices in Electric Vehicle Ordinances*, 8.
[36] Miami-Dade County, Ordinance No. 19-17, March 2019, http://www.miamidade.gov/govaction/legistarfiles/MinMatters/Y2019/190662min.pdf
[37] County of Santa Clara, *Electric Vehicle Local Incentives and Funding Mechanisms* (San Jose: County of Santa Clara Office of Sustainability, 2018), 6-7, accessed December 2019, https://www.sccgov.org/sites/dnz/Documents/Task-3C-Electric-Vehicle-Local-Incentives-and-Funding-Mechanisms.pdf.

DESIGN CRITERIA FOR EVSE INSTALLATION AND PARKING

Cities can also establish EVSE siting and design standards in zoning ordinances or traffic manuals. This can help avoid costly, unsafe EVSE installations and can also encourage a smooth permitting process. Common design considerations include:

- Setbacks
- Pedestal height for freestanding units
- Flood elevation
- Signage for EV parking spaces (voltage and amperage levels, applicable usage fees)
- Parking space size and location[38]

For additional examples and design considerations for EVSE installation and parking, review Great Plains Institute's 2019 report, [*Summary of Best Practices in Electric Vehicle Ordinances*](), section 4.

[38] Cooke and Ross, *Summary of Best Practices in Electric Vehicle Ordinances*, 8.

PARKING ENFORCEMENT

Through changes in zoning, communities can also establish rules to limit off-street parking in EVSE spaces to electric vehicles. They may also use parking code to encourage EVSE installations in on-street parking, municipal parking lots, and garages. Similar to zoning, communities can use parking code to establish numerical or percentage-based goals for EVSE infrastructure, determine the scope of EVSE pre-wiring or installation, and to regulate use. When designating locations for EV charging stations, local governments should consider applicable definitions, restrictions, enforcement policies, time limits, and fees.[39]

ELECTRIC VEHICLE ZONING ORDINANCES AROUND SOUTHEAST FLORIDA					
LOCALITY	**YEAR UPDATED**	**ZONING TOOL**	**DESCRIPTION**	**APPLICATION**	**UNIQUE FEATURES**
[City of Boca Raton]()	2017	EV Parking Minimums & Standards	At least 2% of spaces equipped with Level 2 EVSE	Where a building that includes multifamily residential, commercial, or industrial uses, or any combination thereof is enlarged, resulting in 1) an increase in the number of motor vehicle parking spaces for the entire site; and 2) a requirement for 50 or more motor vehicle parking spaces for the entire site after expansion When the use of a portion or all of a structure or land is changed to a multifamily residential, commercial or industrial use, or any combination thereof, and the entire site is required to provide 50 or more motor vehicle parking spaces	
		Parking Enforcement	Electric vehicle parking spaces shall be reserved for the exclusive use of electric vehicles		
		Make-Ready Standard	Electrical power supply rated at 240 volts or greater	Multifamily residential uses developments with 50 or more units. Hotels, apartment hotels and motels with 50 or more rooms	
[City of Coral Gables]()	2019	EV Parking Minimums & Standards	At least 2% of spaces equipped with Level 2 EVSE	All new construction required to provide 20 or more off-street parking spaces except for single-family residences, duplexes, and townhouses.	All components shall be located above the minimum flood elevation.
		Make-Ready Standard	At minimum of 3% of the required off-street parking spaces shall have electrical power supply rated at 240 volts or greater	When 20 or more off-street parking spaces are required	
		Make-Ready Standard	A minimum of 15% of the required off-street parking spaces shall have listed raceway (conduit) and electrical capacity (breaker space) allocated in a local subpanel	When 20 or more off-street parking spaces are required	

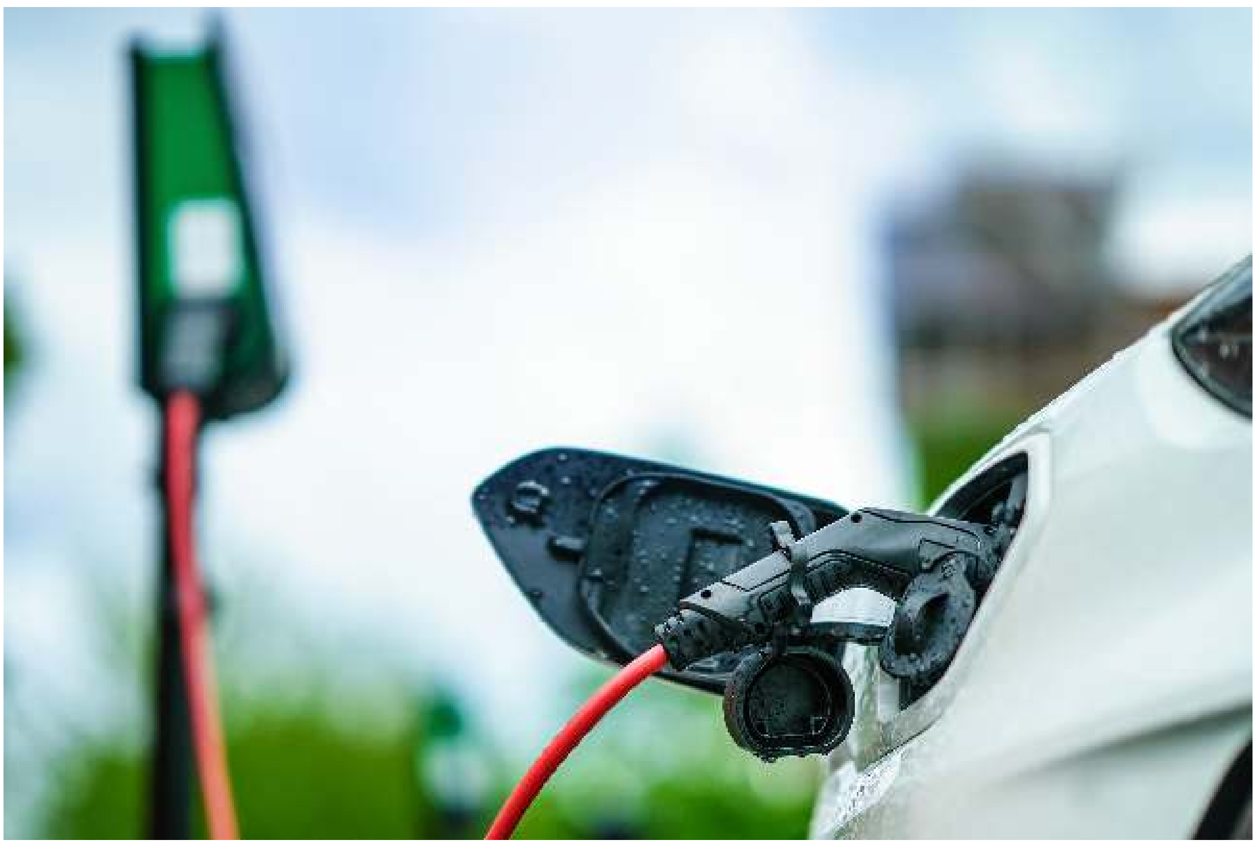
[39] ICF, Plug-in Electric Vehicle Best Practices Compendium (Santa Clara, CA: Santa Clara County, 2018), accessed December 2019, https://www.sccgov.org/sites/dnz/Documents/Task-1A-EV-Best-Practices-Compendium.pdf.

City of Hollywood	2016	Make-Ready Standard	At minimum, must install one EV- ready space with an empty three-quarter-inch raceway from the branch circuit panel board to a location in the garage or a designated parking area, with a two-gang junction box with a blank plate	All new residential or commercial construction	
City of Miami Beach	2016	EV Parking Minimums & Standards	At least 2% of spaces equipped with EVSE	Wherever off-street parking is required, except single-family residential districts	Developers may pay a fee ($8,000) in lieu of required EV parking space. Funds generated shall be deposited into the city's sustainability and resiliency fund.
		EV Parking Minimums & Standards	Electric vehicle parking spaces shall, at a minimum, be equipped with a Level 2 charger	Commercial and residential multifamily zoning districts	
		Parking Enforcement	All electric vehicle parking spaces shall be reserved for the exclusive use of electric vehicles	Commercial zoning districts, where 20 or more off-street parking spaces are required by the land development regulations	
		Make-Ready Standard	Electrical power supply rated at 240 volts or greater	Any residential multifamily or hotel development with 20 or more units	
Miami-Dade County	2019	EV Parking Minimums & Standards	10% of required parking spaces equipped with EVSE (before January 2022) 20% of required parking spaces equipped with EVSE (after January 2022)	All new uses required to provide 10 or more off-street parking, with the exception of single-family, duplex, townhouse, and properties with a current certificate of use or occupancy for a church or religious use	
		Parking Enforcement	All electric vehicle parking spaces shall be reserved for the exclusive use of electric vehicles. Restriction does not apply to any person who makes use of space that is specifically assigned to, or wholly owned by, that person.		
Town of Surfside	2014	Make-Ready Standard	Electrical power supply rated at 220 volts or greater	All new multifamily or hotel development with 20 or more units	
		EV Parking Minimums & Standards	Electric vehicle charging stations shall be limited to electric vehicle charging level 2 or level 3	Applies to projects within the SD-B40 special zoning district	All electrical components must be 12 inches above the 100-year floodplain.

BUILDING AND ELECTRICAL CODES

Jurisdictions can amend building and electrical codes to facilitate EVSE deployment. They may choose to set numerical or percentage-based goals or limits for the percentage of required parking to be built and wired to be EVSE ready. They can also help drive down administrative costs by outlining new permitting or inspection protocols. While these codes changes are not needed from a safety standpoint, updated building and electrical codes can enhance EV readiness.[40] Some cities that have led in Southeast Florida in developing EV-ready building codes include Surfside, Miami Beach, Jupiter, and Pinecrest.[41]

Updated EV-ready building codes and practices should specify charging infrastructure types and service ratings, charging infrastructure circuit recommendations, and installation recommendations for different building types. Localities may also outline building load management opportunities and make recommendations for energy efficiency upgrades to offset the new EV circuit loads panel service requirements.[42] For examples of local codes from model states and municipalities, see page 24 of the report *EV Ready Codes and the Built Environment.*



[40] WXY Architecture + Urban Design and Energetics Incorporated, *Creating EV-Ready Towns and Cities: A Guide to Planning and Policy Tools* (Albany, NY: New York State Energy Research and Development Authority and the Transportation and Climate Initiative, 2018), accessed December 2019, https://www.transportationandclimate.org/sites/default/files/EVSE_Planning_and_Policy_Tool_Guide.pdf
[41] ED Pike,"EV Infrastructure Building Codes (presentation, Roadmap 11: Portland, OR, June 20, 2018), EV Infrastructure Building Codes http://roadmapforth.org/program/presentations18/EdPike.pdf.
[42] California Plug-In Electric Vehicle Collaborative, *A Toolkit for Community Plug-In Electric Vehicle Readiness* (Sacramento: Veloz, 2012),18-20, accessed December 2019, https://www.veloz.org/wp-content/uploads/2018/11/PEV_Tool_kit_120827.pdf.

CASE STUDY

Incorporating EVSE into Multi Unit Dwellings

In South Florida, more than 40% of residents live in multi-family dwellings with three or more units.[43] Given this, multi-unit dwellings (MuD) represent a key opportunity for expanding the EV charging market. However, it remains an untapped opportunity, as MuD installation costs can be prohibitive and unpredictable. To become EV-ready, multi-unit dwellings may require electrical upgrades and new wiring, the cost of which depends on the length of wiring required in configuration of the parking garage or lot.[44]

To expand charging availability, many localities are developing education and outreach programs to support property developers, managers, and owners, as well as EV owners and utilities in installing charging equipment at MuDs. The city of Chicago, for example, developed a how-to guide outlining the EVSE installation process for EVSE installed in multi-unit dwellings.[45] Local governments are also developing grant programs to assist property owners with the costs of EVSE and installation, the biggest hurdle to incorporating EVSE into mult-ifamily housing. Many states, including Massachusetts, Vermont, New Jersey, and Minnesota have used funding from the VW settlement to cover installation, purchase, and maintenance of charging in multi-family housing.

For additional information on electric vehicle charging for multi-unit dwellings, see:

- PEV Charging Guide for Property Owners, Managers and Homeowner Associations
- Ready-made templates to survey residents' current and future interest in PEVs undefined
- MuD How-to Guide for PEV readiness
- Decision tools to help owners calculate and plan for charging infrastructure
- PEV Charging Infrastructure Guidelines for Multi-unit Dwellings

STREAMLINING PERMITTING PROCESSES

Efficient permitting and inspection practices will help accelerate the expansion of EVSE. Chicago, Palo Alto, and Sacramento have all developed streamlined permitting processes.[46] The Center for Sustainable Energy identified the following key best practices in its 2016 report, *Electric Vehicle Charging Station Permitting and Inspection Best Practices: A Guide for San Diego Region Local Governments*[47]:

> **Clear and Consistent Website Information:** Building departments can use their websites to provide clear and consistent instructions on permitting processes. Providing clear steps and submittal requirements online can save valuable staff time and resources.

[43] US Census Bureau. 2018: ACS 1-Year Estimate Data Profiles, Selected Housing Characteristics. Accessed March 2020.

[44] South Bay Cities Council of Governments and the UCLA Luskin Center for Innovation, *Assessing the Multi-Unit Dwelling Barrier to Plug-in Electric Vehicle Adoption in the South Bay* (Sacramento: California Energy Commission, 2017), accessed December 2019, http://southbaycities.org/sites/default/files/ARV-14-035%20ZEV%20MUD%20-%20Final-Draft%20Rpt_0.pdf.

[45] Drive Electric Chicago, *How to Install Electric Vehicle Charging Stations at Multi-unit* (Chicago: City of Chicago, n.d.), accessed December 2019, https://www.chicago.gov/content/dam/city/progs/env/CACCEVGuide.pdf.

[46] "EV Charging Access & Infrastructure: Policy Tools, "GoEV City, accessed April 2020, https://www.goevcity.org/ev-charging-access-infrastructure.

[47] Center for Sustainable Energy, *Electric Vehicle Charging Station Permitting and Inspection Best Practices: A Guide for San Diego Region Local Governments* (San Diego, City of San Diego, 2016), accessed December 2019, https://energycenter.org/sites/default/files/docs/nav/transportation/plug-in_sd/Plug-in%20SD%20Permitting%20and%20Inspection%20Report.pdf.

Electric Vehicle Charging Station Guide or Checklist: Provide a guide to applicants prior to submission that can help them navigate through the application and plan review process. This helps assure all necessary documentation is present at the time of the application submission and can lead to a speedy review.

Electric Vehicle Charging Station-specific, fillable application: Providing fillable PDF applications and compliance documents (when applicable) on jurisdiction websites can decrease applicant wait times at the permit counter. Further, providing online PDFs that allow electronic signatures can potentially lead to alternate submittal processes, such as via email.

Permit Fee Incentives: Jurisdictions can consider adopting a fee incentive or waiver for EVSE installations. This reduces installation costs for applicants, incentivizes permit pulling, and allows cities to track EVSE installations in the community.

Review and Inspection Corrections Lists: When building department staff – permit reviewers and inspectors – use lists that identify common corrections and provide solutions to addressing these corrections, it greatly assists in expediting the overall plan check and inspection process.

Online Permitting and Inspection Services: Online permit services can optimize the permit application and plan review process by providing a digital method to submit applications, as well as capture and track reviewer comments and feedback.

DCFC providers and developers are particularly encumbered by lengthy permitting processes. In fact, a survey by the Northeast States for Coordinated Air Use Management (NESCAUM), a nonprofit association of air quality agencies in the Northeast which supports states in the implementation of the Clean Air Act, characterized the DCFC permitting process as, "fraught with delays due to unfamiliarity with the technology, protracted zoning reviews, and undefined requirements for permitting DCFC."[48] In some extreme instances, station developers withdrew permit applications and went to neighboring towns to develop new charging station sites.

To help local governments overcome these challenges, NESCAUM outlines specific recommendations to streamline permitting processes for DCFC. The report, *Preparing our Communities for Electric Vehicles: Facilitating Deployment of DC Fast Chargers*, details tactics as varied as amending zoning ordinances to clarify that DCFC is an accessory use that does not require further zoning board approval, to offering pre-permitting meetings during the siting phase for DCFC stations to help identify potential issues for station developers to consider.

[48] O'Grady and Way, *Preparing Our Communities for Electric Vehicles,* 4.

Leveraging Public Assets

Local governments own and control key assets that help hasten the transition to electric vehicles. They can transition public fleets to electric vehicles and encourage EVSE installation at public facilities and garages. Cities may also choose to charge fleet vehicles through solar powered EV infrastructure, as has been piloted by the city of Ft. Lauderdale.[49]

TRANSITIONING PUBLIC FLEET

A number of local governments in Southeast Florida have begun to incorporate EV into their fleet. For example, Coral Gables, which owns one of the largest municipal government electric vehicle fleets in the State of Florida, has committed to a goal of owning 78 electric vehicles by the fiscal year 2021.[50] Broward County aims to purchase only zero-emissions electric fleet and transit vehicles by 2030.[51] Miami-Dade County, which recently purchased 33 electric buses, found that every zero-emission bus could help eliminate 1,690 tons of carbon dioxide, equivalent to taking 27 cars off the road, over its 12-year lifespan.[52] By transitioning public fleets to EVs and aligning with fleet replacement schedules, local governments can advance cleaner, more sustainable, innovative transportation systems, reduce exposure to fuel volatility, and attain cost savings.

Consider that a light-duty EV with electricity costs only 3 to 5 cents per mile, whereas fueling a gasoline car that has a fuel economy of 27.5 mpg would incur costs of 14 cents per mile. One estimation by the National Renewable Energy Laboratory shows that if an EV travels 15,000 miles per year in all-electric mode, savings could range from $1,300 to $1,600 in annual fuel costs.[53]

ALTERNATIVE FUEL LIFE-CYCLE COSTS TOOL

Local governments can examine the environmental and economic costs and benefits of alternative fuel and advanced vehicles using the Clean Cities Coalition's Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) tool.

[49] "City of Fort Lauderdale Selects Envision Solar's EV ARC™ Product for Fleet," January 17, 2019, Bloomberg, https://www.bloomberg.com/press-releases/2019-01-17/city-of-fort-lauderdale-selects-envision-solar-s-ev-arc-product-for-fleet-services.

[50] Maria Rosa Higgins Fallon, "City has largest municipal EV fleet in state of Florida," July 22, 2019, Miami's Community Newspapers, https://communitynewspapers.com/coral-gables-news/city-has-largest-municipal-ev-fleet-in-state-of-florida/.

[51] "County Joins Under2 Coalition; Announces Ambitious Electric Vehicle Goals," Broward County, September 12, 2018, https://webapps.broward.org/NewsRelease/View.aspx?intMessageId=11286.

[52] "Miami-Dade County to acquire its first electric buses," Miami-Dade County, November 4, 2019, http://www.miamidade.gov/releases/2019-11-04-dtpw-electric-buses.asp.

[53] Clean Cities, *Plug-In Electric Vehicle Handbook for Fleet Managers* (Washington, DC: U.S. Department of Energy, 2018), accessed December 2012, https://afdc.energy.gov/files/pdfs/pev_handbook.pdf

Assessing Feasibility

While not every fleet application is a good fit for electrification today, a few key factors of fleet operating profiles optimize fleet electrification:

- "Return-to-base," when fleet vehicles are charged at their own facilities instead of relying on limited public charging infrastructure;
- Fleets that operate fixed routes with relatively short daily mileage and enough downtime to allow for the battery to charge;
- High annual mileage fleets, as this helps to maximize fuel costs savings to achieve a favorable total cost of ownership.[54]

CASE STUDY

Broward County Transit Electric Bus Program

Broward County Transit (BCT) intends to transition more than 300 of its bus fleet to all electric as part of the county's ambitious commitment to electrify its entire fleet by 2030. To date, BTC has purchased 5 electric buses, using funds from the Federal Transit Administration's Low- or No-Emissions grant program, and $4.7 million dedicated by Broward County.[55] With the cost of electric buses ranging from $800,000 to $1 million for a single bus, BTC understood the imperative of careful planning and analysis to ensure quality of service to riders and long term maintainability of electric buses. To identify electric buses and charging infrastructure that meets the unique demands of BTC bus service, whose routes range from 188 to 288 miles, BTC completed a route analysis, considering length or route, layover and bus stops, deadhead miles, and how this would impact selection of electric buses. BTC partnered with electric bus manufacturers to test vehicles and observe impacts on services. BTC supplements depot charging with en-route charging and is integrating 100% backup power.[56]

EV Charging Infrastructure

Though fleet operating profiles (miles driven per day, hours of operation, and hours available to charge) look different, there are a few key steps that should be taken to estimate EV charging infrastructure needs and costs, including paying for upgrades to electric infrastructure, as demonstrated in the chart below. In consultation with the EV and EVSE provider, fleet managers should determine whether Level 2 or DC Fast Charging is required and identify current and future EV needs. From there they may conduct an analysis of on-road times and expected charge times, which will determine the number of chargers required.

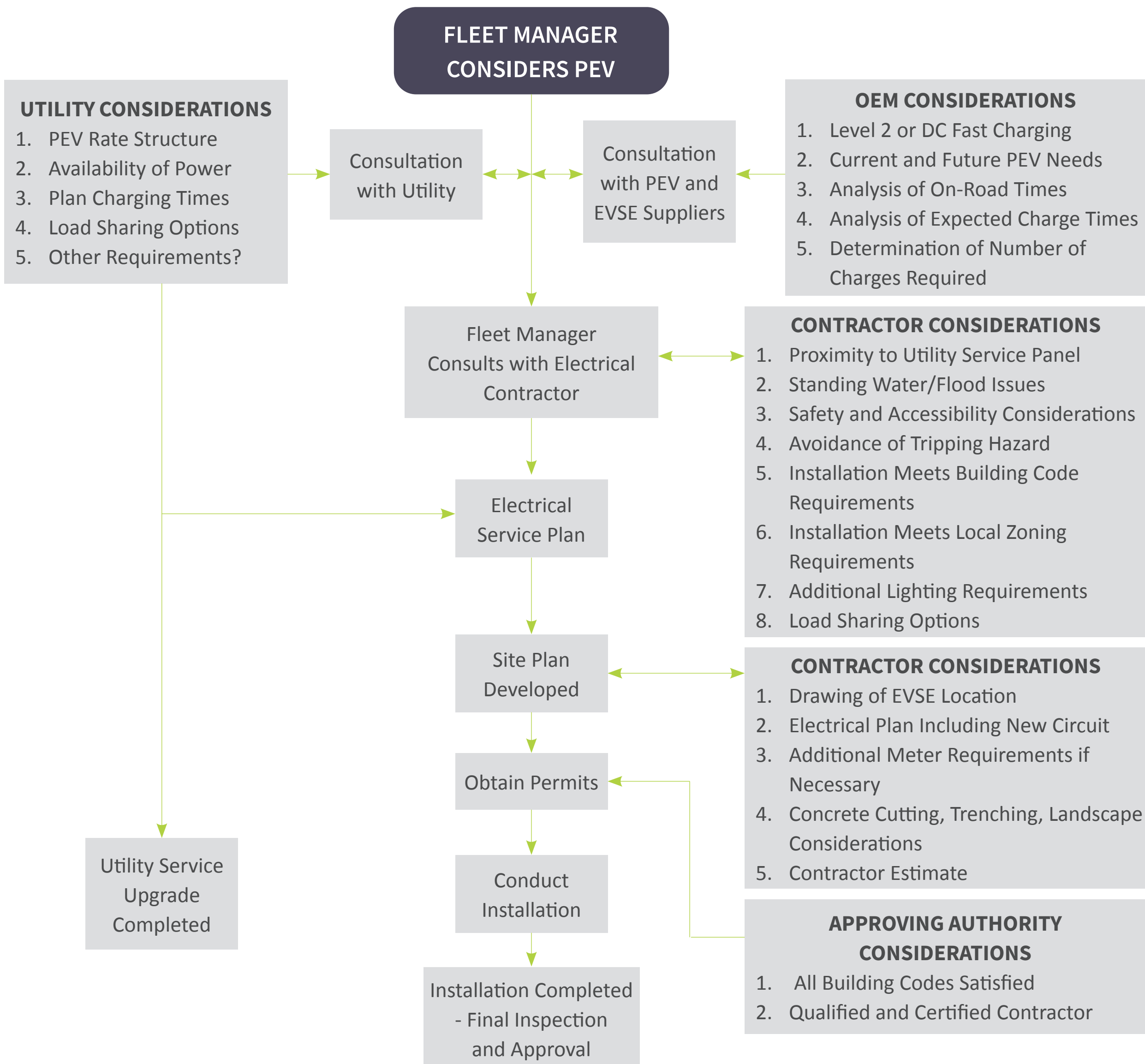
[54] Edison Electric Institute, the American Public Power Association, & the National Rural Electric Cooperative Association, *Preparing To Plug In Your Fleet 10 Things to Consider* (Washington, DC: EEI, 2019), 5, accessed December 2019, https://www.eei.org/issuesandpolicy/electrictransportation/Documents/PreparingToPlugInYourFleet_FINAL_2019.pdf

[55] "Broward County Transit Awarded $2.25 Million to Buy Electric Buses," Broward County, August 24, 2018, https://webapps6.broward.org/newsrelease/View.aspx?intMessageId=11249.

[56] Arethia Douglas, "Broward County Transit Electric Bus Program Implementation," (presentation, Southeast Florida Regional Climate Change Compact RCAP Implementation Workshop: Electric Vehicles, Miami, FL, September 19, 2019), https://southeastfloridaclimatecompact.org/wp-content/uploads/2019/09/Broward-County-Transit-EV-Bus-Implementation.pdf.

At the same time, fleet managers should engage their utilities to discuss EV rate structure, availability of power, charging times, and load sharing options. It is also important to engage facilities managers in this process, as they provide unique expertise given their familiarity with electric companies and rates, lead times for new electrical service, and experience optimizing facility energy usage to minimize electricity costs. The general process for installing EVSE at a fleet facility is outlined above.[57]

GENERAL PROCESS FOR INSTALLING EVSE AT A FLEET FACILITY[58]



[57] Clean Cities, *Plug-In Electric Vehicle Handbook for Fleet Managers,* 2018.
[58] Image adapted from Clean Cities, *Plug-In Electric Vehicle Handbook for Fleet Managers*, 14, 2018.

The Edison Electric Institute, the American Public Power Association, and the National Rural Electric Cooperative Association, in their 2019 report, *Preparing To Plug In Your Fleet: 10 Things to Consider*, recommend that when selecting EVSE and designing charging facilities, facility and fleet managers should consider:

> **Matching power levels to meet operational needs:** The peak power at which an EV may be charged is a function of both the vehicle's battery management system and the charging station that is supplying the electricity. Charging stations should be right sized to meet the operational needs of the fleet, which may not be the maximum power that the EV can accept.
>
> **Future-proofing with interoperability**: Standardization between vehicles and charging connectors is still evolving, as are communication protocols between charging stations and backend networking services. Interoperability is a factor to consider, as it may give fleet owners optionality in the future to interchange EVs, charging stations, and charging network services from different vendors.
>
> **Designing the site for vehicle and electricity infrastructure access**: Where vehicles park may not be near an existing electrical panel, potentially requiring additional behind-the- meter investments. Furthermore, space constraints may influence the choice of charging equipment and how it is arranged at the site.[59]

EV Procurement

Once set on the path for fleet electrification, local leaders have a number of tools at their disposal to direct local agencies to acquire EVs. They can set specific electric vehicle procurement goals for fleets, prioritize consideration of electric vehicles first for light-duty vehicles, or set preferences for low/no emission vehicles. "Total Cost to Own"[60] models may also support in making the financial case to purchase electric vehicles.61 Local governments may choose to acquire electric vehicles through direct purchase, leasing options, or by converting existing vehicles to electric.

TOTAL COST OF OWNERSHIP MODEL, CITY OF SEATTLE[62]
Comparing the City's vehicles over a 10-year period.

Vehicle	Ford Focus	Toyota Prius	Nissan LEAF	Nissan LEAF + Tax Incentives*
Acquisition Cost	$21,284	$28,773	$32,466	$21,649
Fuel Cost	$8,000	$4,000	$1,872	$1,872
Maintenance Cost	$11,790	$6,890	$6,030	$6,030
Salvage Value	($2,128)	($2,877)	($2,165)	($2,165)
Total	**$38,946**	**$36,786**	**$38,203**	**$27,386**

**Tax incentives include $7,500 federal tax credit and WA state sales tax exemption*

[59] EEI, *Preparing To Plug In Your Fleet 10 Things to Consider*, 2019.
[60] For more information see The Carbon-Free Regions Handbook: Finance, Rocky Mountain Institute, 2018, https://rmi.org/insight/carbon-free-regions-handbook-finance/.
[61] "Policies for Local Governments to Accelerate Electric Vehicles Toolkit," Electrify the South, accessed December 2019, https://www.electrifythesouth.org/fleet-goals.
[62] "Member Spotlight: City of Seattle," Western Washington Clean Cities Coalition, January 2018, https://pscleanair.gov/DocumentCenter/View/3063/Member-Spotlight-City-of-Seattle-PDF.

Public entities that wish to purchase a new EV may buy vehicles directly from the vendor using the $7,500 federal EV tax credit.[63] They may also fund the purchase with debt through a bond issuance or third-party financing. "Leasing is possible, and in some cases preferred, as an ownership structure for some state and local fleets," according to Atlas Public Policy, however "some public agencies may have specific policies dictating whether a public agency can use bond financing for operating expenses, which is how vehicles leases may be treated."[64]

Some local governments, such as the city of Austin, Texas, have acquired EVs by converting current gasoline vehicles in its fleet into electric through a process in which engines are removed and a battery pack, electric motor, charging equipment, and control equipment are installed. Key candidates for conversion included older vehicles, vehicles with low daily mileage or high lifetime mileage, and SUVs and minivans deemed expensive to operate.[65]

For a more detailed discussion on EV procurement accounting structures, lease options, third party financing, price negotiation, and bid solicitation, refer to Section II Evaluation of Procurement Elements of the 2017 Atlas Public Policy report Electric Vehicle Procurement for Public Fleet. Atlas Public Policy also provides case studies of EV fleet procurement for the public sector.

DECISION SUPPORT TOOLS FOR FLEET PROCUREMENT

The Fleet Procurement Analysis Tool, developed by Atlas Public Policy, allows fleet managers to develop models of net present value of cash flow and environmental impact analysis. Users can analyze scenarios for gasoline, plug-in hybrid, and battery electric vehicles, under various leasing and purchasing procurement arrangements, with and without tax incentives. Additionally, users can customize inputs to incorporate fleet specific usage and costs, the vehicle pricing structure, incentives and discounts, and optional electric vehicle charging infrastructure. Local governments may also refer to the Alternative Fuel Data Center's tool, the Alternative Fuel and Advanced Vehicle Search, to find up-to-date listing of currently available light-, medium-, and heavy duty EVs and vehicles available for conversion.

EVSE AT PUBLIC PARKING FACILITIES

Many governments in Southeast Florida are installing public charging in their public garages and other public parking facilities. Communities like Boca Raton, Boynton Beach, Broward County, Coral Gables, Delray Beach, Fort Lauderdale, Hollywood, Key West, Miami Beach, and West Palm Beach are helping to expand access to EVSE to both government employees and the general public by installing Level 1, Level 2, and at times, DCFC stations. They have found that success requires attention to site selection and design, hardware and network selection, as well as operations and maintenance.

[63] While local governments cannot directly take advantage of the $7,500 federal tax credit for purchasing an electric vehicle, the federal tax code allows auto dealers and third-parties to transfer the credit's value to public agencies, helping to improve cost savings for public agencies. For more information see the Atlas Public Policy Institute report Electric Vehicle Procurement for Public Fleet.
[64] Nick Nigro and Alexander Walsh, *Electric Vehicle Procurement for Public Fleet* (Washington DC: Atlas Public Policy Institute, 2017), 24, accessed January 2020, https://atlaspolicy.com/wp-content/uploads/2017/10/Electric-Vehicle-Procurements-for-Public-Fleets.pdf.
[65] "Fleet Electrification Study and Plan," City of Austin, October 5, 2016, http://www.austintexas.gov/edims/document.cfm?id=264039

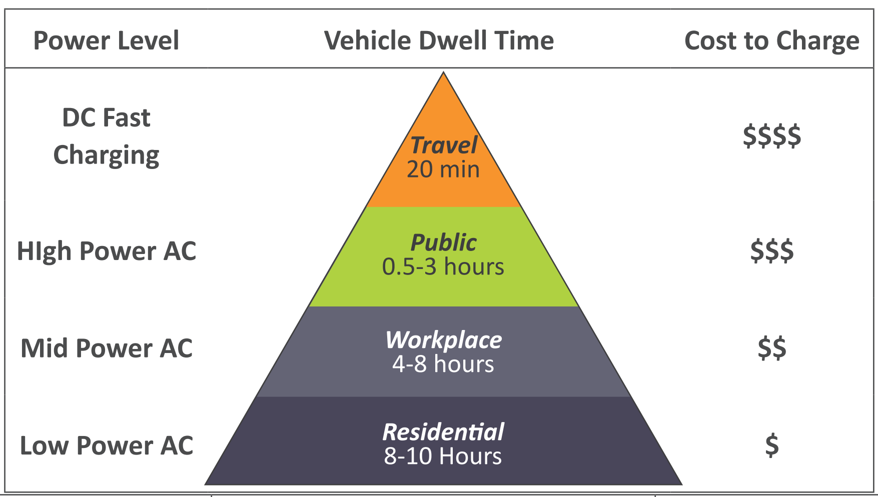
Site Selection and Design

When selecting a site for EVSE installation, local governments should consider how actively the site might be used, based on surrounding traffic patterns and likelihood of the public to use the equipment. They should also examine whether the proposed facilities have access to sufficient power for the EVSE and what trenching/boring, panel work, and repaving might be required to connect EVSE to the electrical service. Additionally, they should verify that the location has adequate telecommunications networks such as wi-fi, ethernet, or cellular connections to allow EVSE users to pay charging fees. For a full discussion, see the report, *Siting and Design Guidelines for Electric Vehicle Supply Equipment.*

EV Charge Type

There are several important considerations when selecting an EV charger, most prominently, facilities managers should understand the type of charging they wish to provide. Level 1 chargers, which provide 2-5 miles of range per hour of charge, typically cost a few hundred dollars and have negligible installation costs. They are often used for workplace charging, where employees have longer idle times. Level 2 chargers, which provide 10-20 miles of range per hour of charge, cost anywhere from $500 -$8,000. Typical installation costs range from $600-$13,000 per charger. Level 3 chargers, which are not typically installed in publicly owned facilities, provide 60-80 miles of range per hour of charge and cost $15,000-$40,000. Installation costs range from $8,000-$50,000 per charger.[66]

THE CHARGING PYRAMID[67]



LOW POWER AC (LEVEL 1)	MID-HIGH POWER AC (LEVEL 2)	DC FAST CHARGING (DCFC)
• 120 Volts AC, 12-16 A • 2-3 miles of range per hour of charge • Typical EVC cost: a few hundred dollars • Typical installation cost: $0	• 208/240 Volts AC, up to 80 Amps • 10-20 miles of range per hour of charge • Typical EVC cost: $500-$8,000 • Typical installation cost: $600-$13,000 per charge	• 200-500 VDC, up to 350 A • 60-80 miles of range per hour of charge • Typical EVC cost: $15,000-$40,000 • Typical installation cost: $8,000-$50,000 per charge

[66] City of Mount Shasta, Siskiyou County Economic Development Council, Redwood Coast Energy Authority, Schatz Energy Research Center, the Local Government Commission/Civic Spark, *Electric Vehicle Charger Selection Guide* (Eureka, CA; Redwood Coast Energy Authority, 2018), 3, accessed December 2019, https://afdc.energy.gov/files/u/publication/EV_Charger_Selection_Guide_2018-01-112.pdf.
[67] Image adapted from City of Mount Shasta, *Electric Vehicle Charger Selection Guide*, 2018.

It is also important to consider operations and maintenance costs of the charger, which include:

- Electricity consumption and demand charges
- EVSE network subscription to enable additional features
- Management time
- Billing transaction costs
- Preventative and corrective maintenance on EVSE unit
- Repairs (scheduled and unscheduled)

Other factors to consider include meeting open standard protocols for network communication, pay-by-credit card capabilities, data logging capabilities, durability and reliability, kW charging capacity, ability to serve more than one vehicle per charging unit, ease of use, aesthetics, and a retractable cord set to deter theft and minimize cord handling requirements.[68]

EVSE PRODUCT OPTIONS SELECTION TOOL

For a listing of EVSE product options, searchable by charging level and network type, see the GoElectricDrive Foundation.

Network Communication

Once the charging type is determined, facilities managers should decide whether to install stand-alone or "dumb" chargers, which do not have network access, or networked chargers. Stand-alone charges are unable to track usage or bill consumers, and are therefore typically reserved for residential or fleet applications. These chargers have lower installation costs and lack recurring fees such as payment processing and cloud connectivity. For sites with poor cell reception, or at low-use, where network fees (ranging from $100-$900 annually, depending on the type of EVSE unit, the EVSE unit features, and the EVSE manufacturer or provider) would likely outweigh the cost of allowing free access, stand-alone chargers may be the preferred option.[69]

For those who wish to install a networked charger, they may choose between subscription-only or open access service networks. With subscription-only access, electric vehicle owners subscribe to the service network and charge their vehicles using a dedicated RFID[70] card or smart phone app. EV owners pay a subscription fee, charging session fees, an incremental fee based on the amount of electricity consumed, or some combination of the above. Open access networks also offer subscription services, but also accept universal payment methods such as credit cards. Many local governments push for open access payment so that drivers can access EVSE, regardless of network subscription. Interoperability of billing standards has been identified as a key opportunity for reducing range anxiety.[71]

[68] Redwood Coast Energy Authority, *North Coast Readiness Plan* (Eureka, CA; Redwood Coast Energy Authority , 2014), 10, accessed December 2019, https://redwoodenergy.org/wp-content/uploads/2019/02/North-Coast-Plug-in-Electric-Vehicle-Readiness-Plan.pdf.
[69] City of Mount Shasta, *Electric Vehicle Charger Selection Guid*e, 2018.
[70] RFID refers to Radio-frequency identification, which uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID tag consists of a tiny radio transponder; a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. This number can be used to inventory goods.
[71] "Electric Vehicle Charging Interoperability," MJ Bradley & Associates, May 13, 2019, https://mjbradley.com/sites/default/files/MJB%26A%20Interoperability%20Issue%20Brief%20May%202019.pdf

Ownership Models

EV charging station ownership models vary. Some charging station hosts may choose to purchase, install, and operate stations themselves, which enables the host to keep all revenue from service and occupancy parking fees and advertising revenue. Others may contract with a third party who pays the station equipment, installation, and maintenance costs and manages the logistics in return for lease payments or a share of the station's revenue.[72] For example, the city of Miami Beach contracted with Blink Charging, the owner and operator of the Blink Network, to provide turnkey services to purchase, install, and maintain the EVSE at four city owned parking garages, and to coordinate logistics. In exchange, the city provides lease payments or a share of the station's revenue. User fees allowed the city to recoup 15% of net expenditures.[73] The city's RFP is available for reference.

Policies and Procedures for EVSE Parking Use

As local governments deploy EVSE for public use, they are developing policies and procedures for the use of EVSE and the parking spots associated with it. They may institute customer payment policies and programs in which users are charged per event, billed according to time-of-use rate, or use a subscription model. In addition to setting user fees and structures, EVSE hosts often develop EVSE reservation policies and plans and policies for removing cars that are illegally parked in an EVSE spot. They also develop EVSE monitoring and usage plans and EVSE troubleshooting and diagnostics plans.[74]

Conclusion

Local governments have a number of tools they may employ to electrify the transportation sector. By working collaboratively with other cities and counties, local governments can pool resources to plan for EVSE and to acquire electric vehicles for fleet use. Local governments can also develop plans and policies to support strategic deployment of EV charging infrastructure within their communities. They can even leverage publicly-owned assets by installing EV charging at public facilities or by transitioning fleet vehicles to electric. Success in this work will require Southeast Florida communities to consider the resilience of its infrastructure and how EV networks can be developed strategically to best achieve emissions reduction goals.

[72] Clean Cities, *Plug-In Electric Vehicle Handbook for Fleet Managers*, 14, 2018.
[73] Saul Frances, "Resiliency and Sustainability Electric Vehicle Charging (presentation, Southeast Florida Regional Climate Change Compact RCAP Implementation Workshop: Electric Vehicles, Miami, FL, September 19, 2019), https://southeastfloridaclimatecompact.org/wp-content/uploads/2019/09/City-of-Miami-Beach-EVSE-and-private-sector-partnerships.pdf.
[74] Texas River Cities, *Texas River Cities Plug-In Electric Vehicle Initiative regional Plan and Final Report* (Texas; Texas River Cities, 2018), 2-12 , https://cleancities.energy.gov/files/u/projects_and_partnerships/project_material/supporting_material/252/texas_river_cities_readiness_plan.pdf.

SOUTHEAST FLORIDA REGIONAL COMPACT CLIMATE CHANGE

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