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# Pathways to EV: Preparing cities for the transition to electric vehicles

PREPARED FOR THE URBAN SUSTAINABILITY DIRECTORS NETWORK, CITY OF COLUMBIA, MISSOURI & PARTICIPATING COMMUNITIES

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Cadmus is a strategic and technical consultancy compelled to help solve the world's most challenging problems. Cadmus brings specialization in renewable energy policy, strategy development, and climate change planning. Cadmus has supported local level renewable energy policy, procurement, training, and engagement initiatives in over 200 communities across all 50 states, and has assisted state and national governments around the world with development of clean energy initiatives.

# Acronym List

BEV . . . . . Battery Electric Vehicle
CMAQ . . . . Congestion Mitigation and Air Quality Improvement Program
DOT . . . . . Department of Transportation
EV . . . . . Electric Vehicle
EVITP . . . . Electric Vehicle Information Training Practices
EVSE . . . . . Electric Vehicle Supply Equipment
FCEV . . . . . Fuel Cell Electric Vehicle
FHWA . . . . Federal Highway Administration
HEV . . . . . Hybrid Electric Vehicle
HDV . . . . . Heavy Duty Vehicle
HOV . . . . . High Occupancy Vehicle
ICE . . . . . Internal Combustion Engine
IOU. . . . . Investor Owned Utility
kWh . . . . . Kilo-watt hour
LDV . . . . . Light Duty Vehicle
LMI. . . . . Low to Moderate Income
MDV. . . . . Medium Duty Vehicle
MOU . . . . . Memorandum of Understanding
NFPA . . . . . National Fire Protection Association
NYC . . . . . New York City
PHEV. . . . . Plug-in Hybrid Electric Vehicle
TOU . . . . . Time-of-Use
USDN. . . . . Urban Sustainability Directors Network
ZEV . . . . . Zero Emission Vehicle

SECTION 1

# Introduction

Advancements in the transportation sector have the potential to disrupt traditional means for moving people and goods as the focus increases on sustainable transportation methods. Nowhere is this disruption more likely and impactful than in the rapidly growing market for electric vehicles (EVs),[1] particularly when EV deployment is coupled with a clean, sustainable, and renewable electricity supply.[2]

Cities have many tools for shaping the development of EVs due to their governance of public space and transportation, their ability to offer both financial and non-financial incentives, their control over municipal fleets and operations, their influence with the private sector, including the local electric utilities, and their avenues for collaboration with other municipal governments. With the growing demand for EVs, cities must act quickly to shape the outcomes to the greatest benefit of their constituents, and to align initiatives with their environmental, social, and economic priorities. However, while such communities generally recognize the potential benefits from EVs, they often face unique challenges to continued EV adoption.

This report is intended to help city decision-makers (and particularly those in the Midwest) understand

## Report Background: Participating and Observing Communities

This report draws from focus groups held throughout the Midwestern United States, and a Convening that discussed the resulting insights. These "participating" communities in the focus group process in the Midwest were accompanied by "observing" communities throughout the entirety of the United States. As such, this report is intended to provide lessons applicable for cities throughout the United States.

Participating Communities included: Columbia, MO, Dubuque, IA, Evanston, IL, Kansas City, MO, Indianapolis, IN, Springfield, MO, Des Moines, IA, St. Louis, MO, Lincoln, NE, Iowa City, IA

Observing Communities included: Aspen, CO, Westminster, CO, Austin, TX, Oklahoma City, OK, El Paso, TX, St. Peters, MO, Cedar Rapids, IA, Johnson County, IA, Fort Collins, CO, Alexandria, VA, West Hollywood, CA, Emeryville, CA, Bozeman, MT

1 For the purposes of this report, EVs refers to plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs, or all-electric vehicles).
2 For city-level strategies on transitioning to a clean and renewable energy supply, see the sister report to this Primer, the "Pathways to 100: An Energy Supply Transformation Primer for U.S. Cities," Meister Consultants Group, May 8, 2017, available online.

the policy and regulatory environments in which they operate and take appropriate action towards deploying greater numbers of EVs. To shed light on the trends and context for EV deployment in cities, this report examines the key factors that shape the demand for EVs and supporting policies, such as utility type and electricity regulation, federal and state incentives, and other "immutable" factors, such as terrain, housing composition, and urban/rural context. It then offers a menu of city-level policy options and describes various pathways for achieving such policies.

Finally, while there is significant anticipation and uncertainty regarding the convergence of EV technologies and connected, autonomous, and shared mobility solutions, these considerations are largely beyond the scope of this guide. Nonetheless, cities should actively consider the role of EVs in broader transportation systems, seeking to align EV initiatives with their transportation-related goals. This guide focuses on the nexus of EVs and the grid, and how policy, regulatory, and market development efforts can contribute to an environment that facilitates rapid improvements in vehicle energy use and pollution.

# Electric Vehicles: A Rapidly Growing Market

In the personal-use EV market, a more diverse offering of EVs has emerged in both pure battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). See Figure 1 for definitions and examples. For BEVs, the number of available models has increased from only three in 2011 to 15 in 2017, and their median ranges have increased by 56% over the same period: from 73 miles to 114 miles.[3] In the commercial market, vehicle manufacturers have begun to focus on electrifying medium- and heavy-duty vehicles, such as delivery vans, tractor trailers, and transit buses. Deployment of electric vehicle supply equipment (EVSE), or chargers, continues across the United States in urban spaces, at work places, and along highways, allowing EV owners greater travel flexibility and range.

Consumer demand in EVs is rising, automobile manufacturers are investing more in EVs, and cities and states across the United States are witnessing greater EV deployment and EVSE installation. As of September 2017, more than 500,000 EVs were deployed in the United States.[4] Upwards of 160,000 electric vehicles were sold in the United States in 2016 alone and 2017 sales were even higher.[5] Appendix A highlights the substantial demand growth in individual U.S. states for EVs over the past three years.

Finally, hybrid electric vehicles (HEVs), while not requiring plug-in charging and are thus generally not included under the definition of "electric vehicle," have continued to enjoy mainstream success. In this report, EVs are defined as PHEVs and BEVs.

3 U.S. Department of Energy, "Fact of the Week No. 1008: Median All-Electric Vehicle Range Grew from 73 Miles in Model Year 2011 to 114 Miles in Model Year 2017" December 18, 2017, available at: https://www.energy.gov/eere/vehicles/articles/fotw-1008-december-18-2017-median-all-electric-vehicle-range-grew-73-miles

4 U.S. Department of Energy, "National Plug-In Electric Vehicle Infrastructure Analysis," p. 7, citing IHS Market 2017, September 2017, available at: https://www.nrel.gov/docs/fy17osti/69031.pdf

5 International Energy Agency, "Global EV Outlook 2017," p. 17 available at: https://www.iea.org/publications/freepublications/publication/GlobalEVOutlook2017.pdf. Also see the monthly PV sales as of December 2017 from Argonne National Laboratory, available at: https://www.anl.gov/sites/anl.gov/files/evsales_fig1_12-17.jpg.

*Figure 1: Definitions and Examples of Types of Electrified Vehicles*

| Terminology | Hybrid Electric Vehicle (HEV) | Types of Electric Vehicle (EVs) | |
|---|---|---|---|
| | | Plug-in Hybrid Electric Vehicle (PHEV) | Battery Electric Vehicle (BEV) or All-Electric Vehicles (AEV) |
| **All-electric range** | Not applicable (cannot go all-electric) | 10-50+ miles (before switching to gasoline) | 80-150 miles (up to 300 miles in higher end models) |
| **Example models** | Toyota Prius (There are often hybrid versions of common car models) | Toyota Prius Prime<br>Chevrolet Volt | Nissan Leaf<br>Tesla Model S<br>Chevrolet Bolt |
| **Presence of Internal Combustion Engine (ICE)** | Yes | Yes | No |
| **Approach to charging** | No plug-in capability; charged via regenerative braking | Charged through plug-in charger or via regenerative breaking | Charges through plug-in charger or via regenerative braking |

SECTION 2

# The City Landscape for Electric Vehicle Policy

Crafting effective strategies to incentivize EV infrastructure and vehicle deployment at the local level requires a keen understanding of the issues that influence cities, utilities, consumers, and other stakeholders. The following section outlines the factors that shape consumer demand for EVs, the receptiveness of utilities towards greater EV adoption, and the capabilities of cities to manage EV deployment and infrastructure. These factors encompass the ownership and regulatory status of the electric utility, state and federal incentives and policies pertaining to EVs, and other intrinsic characteristics of the city, such as its housing composition and whether it is primarily an urban or rural setting. This section provides a series of questions intended to help the reader navigate the policy contexts that drive EV adoption.

## 2.1 What State Policies Apply?

City policymakers should consider the various incentives that are offered by their state. This can include financial tax incentives and rebates, other benefits such as high occupancy vehicle (HOV) lane access, toll and emission test exemptions, and whether there are state-level policy targets for EV deployment. These factors determine the prospective demand for EVs and the ability of city policymakers to align local EV initiatives with state goals.

### 2.1.1 Are there state-level EV targets or objectives?

States often establish EV targets or objectives that can drive EV initiatives at the state and local levels. Such target-setting can be set independently, as in the case of Virginia, Hawaii, and Washington, and in tandem with other states under the umbrella of a collaborative initiative.

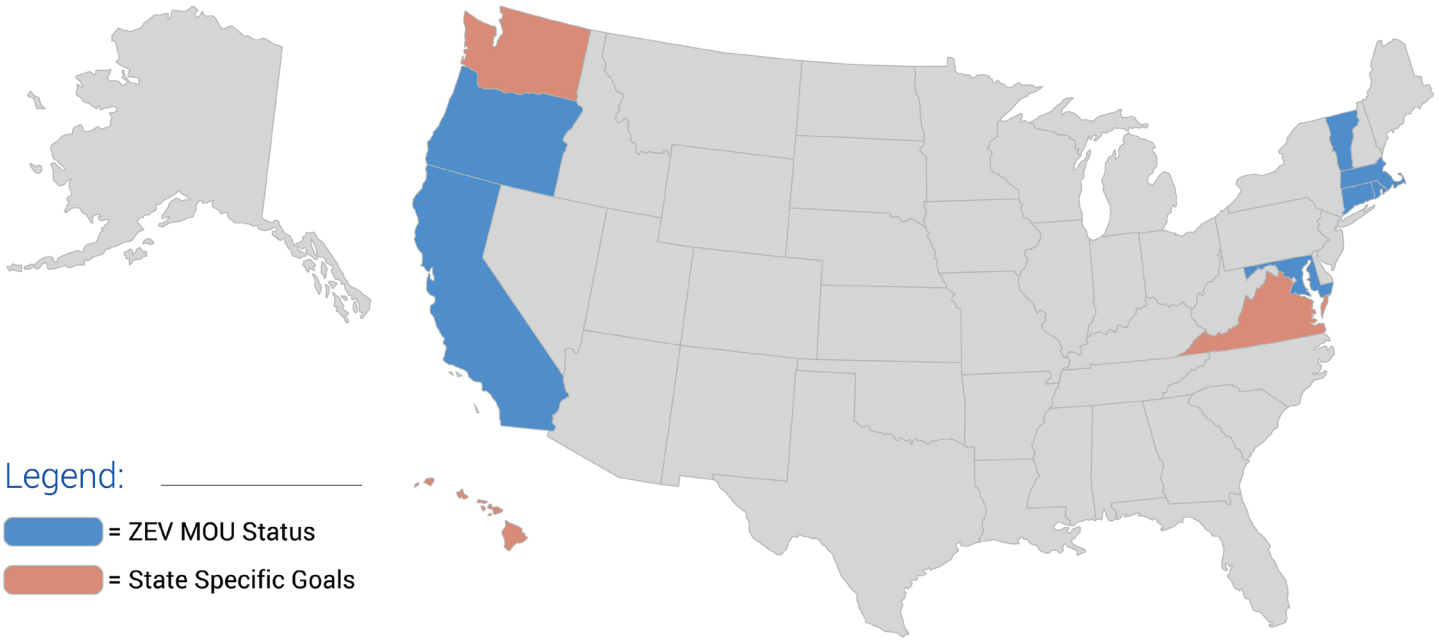
One example of such a multi-state target is the ZEV memorandum of understanding (MOU). In 2013, California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont signed a memorandum of understanding to coordinate implementation of their state zero-emission vehicle (ZEV) programs,[6] with a collective goal of 3.3 million ZEVs on the roadways in those states by 2025. [7] Importantly, the ZEV MOU requires

6 ZEVs, in this case, include PHEVs, BEVs, and fuel cell electric vehicles (FCEVs).
7 See the Multi-State ZEV Action Plan, "ZEV Program Implementation Task Force," May 2014, Available at: https://www.zevstates.us/about-us/

automakers to meet ZEV sales targets each year. This, in turn, means automakers promote ZEVs in these states to meet the targets, while recouping their losses on non-ZEV vehicles.

In addition to ZEV sales targets, the ZEV MOU covers a broad scope of topics related to EVs; some of the suggested actions for EVs include: providing consumer incentives; increasing ZEVs in public fleets; promoting workplace charging; promoting ZEV infrastructure planning and investment; providing clear and accurate signage; removing barriers to ZEV charging installations; removing barriers to retail sale of electricity as transportation fuels; and promoting competitive plug-in electric vehicle charging rates. Cities that are in ZEV MOU states can build local EV initiatives around broader state policy goals and harmonize efforts, maximizing eventual EV deployment.

*Figure 2: State-Level Targets for EV Deployment*




## ZEV MOU Status:

**California:**
- 1.5 million ZEVs by 2025
- 5 million by 2030
- 250,000 EVSE stations by 2025

**Connecticut:**
- 150,000 ZEVs by 2025

**Maryland:**
- 60,000 ZEVs by 2020
- 300,000 ZEVs by 2025

**Massachusetts:**
- 300,000 ZEVs by 2025

**Oregon:**
- 50,000 EVs by 2020

**Rhode Island:**
- 43,000 vehicles by 2025

**Vermont:**
- EV adoption rate of 10% by 2025

## State Specific Goals:

**Hawaii:**
- 100% renewable ground transportation by 2045

**Virginia:**
- EV adoption rate of 15 percent by 2027 or 1 million EVs

**Washington:**
- 50,000 EVs by 2020

*Reflects available programs and incentives as of May 2018.*

### 2.1.2 Are there state-level tax incentives or rebates?

Tax incentives and rebates can play a major role in the demand for EVs at the state and city level. The specific incentives and their implementation vary widely. For example, tax incentives are applied to property taxes, sales and use taxes, and income taxes for individuals and businesses. Other untaxed entities, such as governments and non-profits, also can take advantage of the post-tax or rebate pricing by partnering with entities that monetize tax credits and subsequently lease the EVs. Rebates are typically used to offset the incremental costs of capital for vehicles, fuel, and infrastructure, and are applied either at the time of purchase or via a post-purchased application.

The presence of such incentives is considered one of the most significant factors in stimulating consumer demand. A preliminary study by the National Renewable Energy Laboratory concluded that every $1,000 in tax credit value is associated with a 5.8% increase in BEV registrations.[8] Other studies have detailed the relative effectiveness of such incentives in stimulating demand.[9] City decision-makers should be aware of the existence of rebates and tax incentives that alleviate the costs of EVs for prospective owners. The presence of such rebates and incentives not only stimulates consumer demand, but also can be further advertised in city marketing and public engagement.

Finally, even without a state-specific tax incentive or rebate, consumers in all states can access the federal EV tax credit, which offers $2,500 to $7,500 for every new EV, based on vehicle size and battery capacity. The value of these credits stays the same until 200,000 EVs are purchased from a given automaker, which then triggers a phase-out of the credits for that automaker.

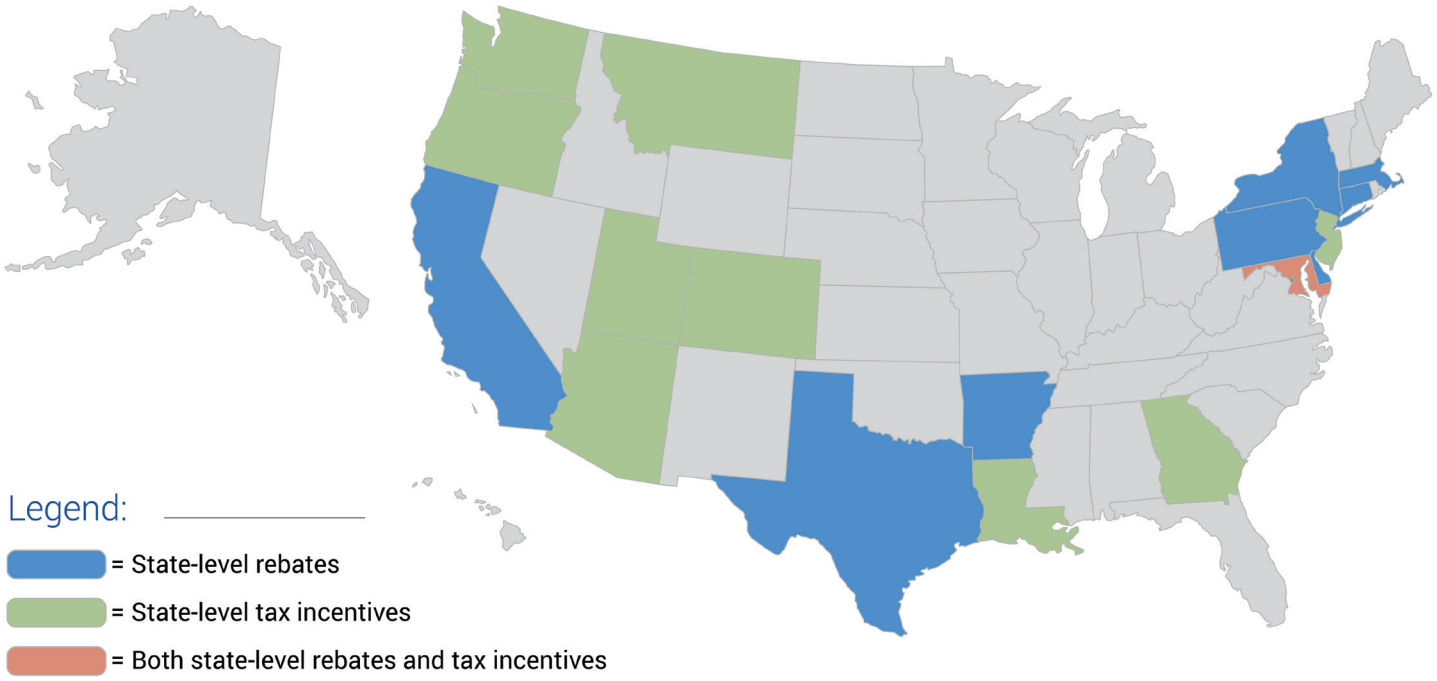
## Examples of tax incentives and rebates:

California offers rebates up to $7,000 for the purchase or lease of PEVs to individuals, businesses, government actors and non-profits. These rebates are scaled according to household income; those with income above a certain level are only eligible for rebates for fuel cell electric vehicles, while certain LMI households can claim the full $7,000 incentive on ZEVs and PHEVs.

Colorado offers a $5,000 tax credit for light-duty EV or PHEV, or a $2,500 credit for a lease, with additional credits for medium and heavy-duty vehicles.

Washington exempts alternative fuel vehicles (including EVs) from the state motor vehicle sales and use taxes.

*Figure 3: State Tax Incentives and Rebates*




*Reflects available programs and incentives as of May 2018.*

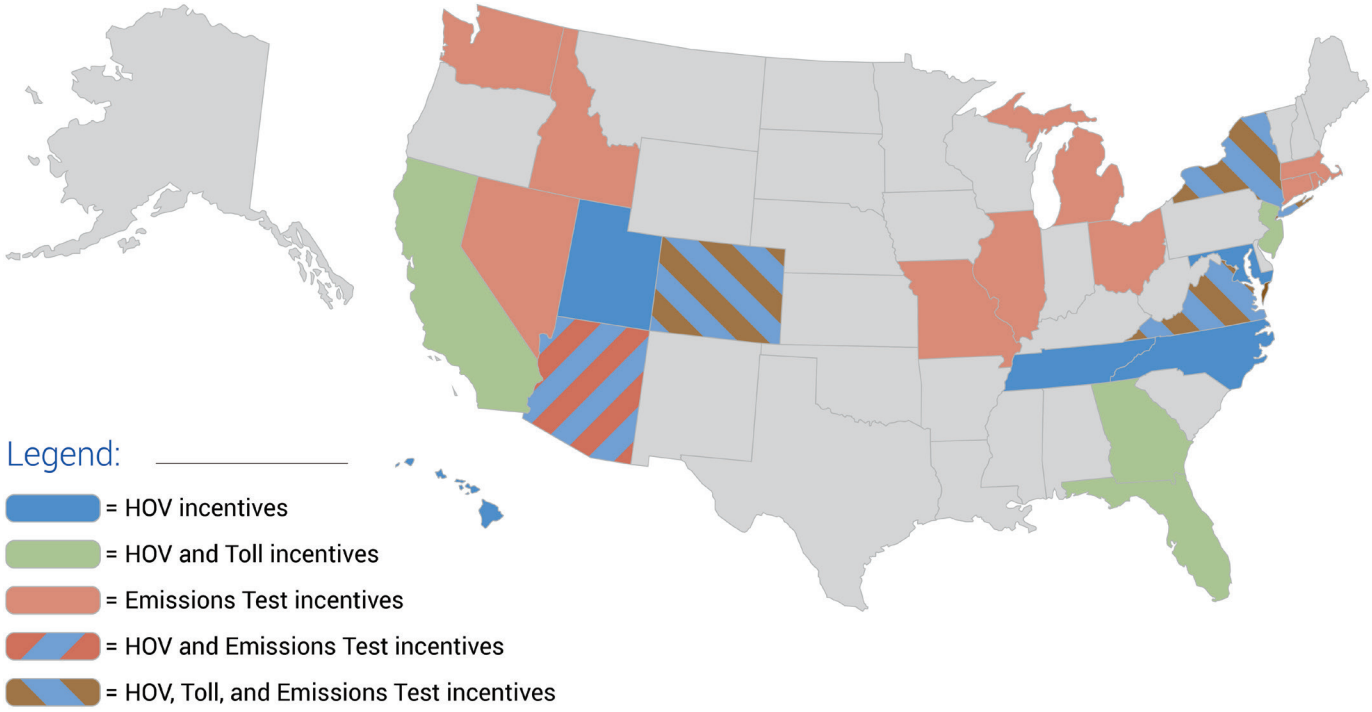
8 National Renewable Energy Laboratory, "Impact of Direct Financial Incentives in the Emerging Battery Electric Vehicle Market: A Preliminary Analysis," 2015, Available at: https://www.nrel.gov/docs/fy15osti/63263.pdf.

9 For an example of such studies of different incentive types for BEVs, see Hardman, Scott, Chandan, Amrit, Tal, Gil, Turrentine, Tom, "The effectiveness of financial purchase incentives for battery electric vehicles – A review of the evidence," Renewable and Sustainable Energy Reviews, 2017, Available at: https://www.sciencedirect.com/science/article/pii/S1364032117309012. For a study of tax waivers on HEVs, see Gallagher, Kelly Sims, Muehlegger, Erich, "Giving green to get green? Incentives and consumer adoption of hybrid vehicle technology," Journal of Environmental Economics and Management, 2011, Available at: https://www.sciencedirect.com/science/article/pii/S0095069610000768.

### 2.1.3 Does the state offer HOV exemptions, toll discounts, or other incentives?

States often enable other incentives, such as HOV lane access, toll discounts, or emissions test exemptions that encourage growth for EVs. Evidence from California indicates that HOV lane exemptions have been a particularly significant driver of EV sales, especially in communities near HOV corridors.[10] Such policies allow EV drivers to save money and time in their travels, and increase the overall visibility of the benefits of EVs. City governments, particularly those in high-congestion areas, should be aware of the potential effects that HOV lanes have on consumer demand in such communities and plan EVSE installations accordingly. In Midwestern U.S. cities and states, this benefit may be less relevant to prospective EV owners. As will be described in Section 4, local governments can also have an impact on visible EV benefits, such as preferred parking on-street, parking incentives, waivers of city vehicle taxes, and more.

*Figure 4: Additional State-Level Incentives*




*Reflects available programs and incentives as of May 2018.*

## 2.2 What are the characteristics of the utility?

The characteristics of the utility – in terms of its ownership, its regulatory status, the rates that it can offer, and whether it can invest in EVSE infrastructure and recover those costs through its "rate base" – affect the viability of various pathways to greater EV deployment and EVSE installation. These characteristics, typically determined by state regulators at public utilities commissions (PUCs) and state legislators, affect the ability of utilities to adapt to and contribute to the rising deployment of EVs.

10 Sheldon, Tamara L., J.R. DeShazo, Richard T. Carson, and Samuel Krumholz, "Factors Affecting Plug-in Electric Vehicle Sales in California," UCLA Luskin Center for Innovation, 2017, available at: http://innovation.luskin.ucla.edu/sites/default/files/Factors%20Affecting%20Plug-in%20Electric%20Vehicle%20Sales%20in%20California.pdf

### 2.2.1 Who owns the utility?

Ownership of the local utility affects its capability to undertake innovative measures in city-level initiatives for clean energy. State PUCs typically do not regulate electric cooperatives utilities (coops) and municipal utilities (munis) to the degree of Investor Owned Utilites (IOUs), allowing coops and munis greater latitude and flexibility in innovating towards EV deployment and infrastructure. In contrast, IOUs are overseen by state regulators, limiting their capability to innovate absent the approval of regulatory authorities.

Utility ownership also affects the degree to which city decision-makers can influence the behavior of utilities. In the cases of IOUs and coops, the city's influence is relatively limited; the IOU is governed by its ownership and state regulators, and the coop is governed by its members and its board. Since munis often function as an agency of the local government, city decision-makers are better positioned to influence the behavior of munis.

*Figure 5: Electric Utility Types and Key Characteristics*

| | | Utility Type | | |
|---|---|---|---|---|
| **Key Characteristics** | | **Investor-Owned Utilities** | **Municipal Utilities** | **Utility Cooperatives** |
| **Governance** | **Ownership** | Privately owned. | Typically owned by the city. | Owned by the customers they serve. |
| | **Governance Structure / Management** | Company issues stock and is responsible to shareholders. Heavily regulates at the state level. | Structure varies significantly, ranging from a department within a city administration to a municipal utility district operating independently of the city administration. | Each customer is a member-owner with one vote under the "one person, one vote" cooperative principle. Member-owners elect the board of directors who make decisions. |
| | **Total number in the U.S.** | ~200 | ~2000 | ~900 |
| **Prevalence and Size** | **% U.S. customers served** | ~68% | ~15% | ~13% |
| | **Size of territory & customer base** | Large service territories in multiple states, serving a few thousand to a few million customers. | Generally small to mid-size customer base. | Typically large and sparsely populated service territories, serving a small customer base. |

### 2.2.2 Is the utility "regulated" or "deregulated"?

The regulatory status of the utility – specifically whether there is a competitive retail and generation market for electricity – can affect how consumers pay for EV charging. In "deregulated" jurisdictions, consumers can choose among electricity retailers, and electricity retailers can offer differentiated electricity rate plans to meet the specific needs of EV owners and charging station owners with energy purchased directly from a variety of suppliers, such as independent power producers. These choice offerings to consumers include a variety of specific "products," such as electricity only from renewable resources. City decision-makers should be aware that while EVs currently only unidirectionally draw power from the grid, utilities may eventually seek to use the batteries of EVs to provide services to the electricity grid, or "vehicle-to-grid" services. While these services are still in pilot-testing phases, in a deregulated market, entities independent of the utility could also potentially serve as the entities that provide such vehicle-to-grid services.

This contrasts with a "regulated" jurisdiction in which the retailer is the local utility, which provides the standard electricity mix at its offered rates. That noted, regulated utilities, with regulatory approval, can also offer innovative pricing and purchasing arrangements – such as green power products – that can mimic some of the offerings of a competitive retail market. The existence of these players and products implicates the partnerships for cities seeking to couple growing EV deployment with clean and renewable energy use.

### 2.2.3 Does the utility offer time-of-use or EV-specific electricity rates?

Since EV deployment can increase use of the electricity grid, it could also strain the grid at specific times of the day if not managed properly. These strains might require grid upgrades and additional energy generation. Both would impose costs on utilities, which are typically passed to ratepayers through electricity rates. Such rate increases could have inequitable outcomes if not managed appropriately; in effect, low-income households that do not own EVs could pay for the grid-related impacts of increased EV deployment on the electricity grid.

In some jurisdictions, the electricity rate does not change by the time of the day, which fails to incentivize EV owners to charge at times with reduced impact on the electricity grid. In contrast, "time-of-use" (TOU) rates, hourly rates, or potentially EV-specific rates vary electricity rates throughout the day based on the anticipated balance of electricity supply and demand. These rates can be an effective tool to manage demand by reflecting the costs and stresses on the electricity grid in a more granular manner, thereby encouraging EV owners to charge their vehicles at times that least impact the electricity grid. Moreover, time-variant pricing also enhances the long-term vehicle-to-grid market potential of BEVs; in effect, allowing for BEV charging when electricity prices are low, and providing electricity to the grid from such batteries when prices are high. Cities should be aware of the rate designs offered by their local utilities and the impacts that EV deployment may have for non-EV owners.

#### Example: Constellation and ChargePoint

Constellation, an energy retailer subsidiary of Exelon, has partnered with ChargePoint, an EV charging network, to allow Constellation customers to have ChargePoint stations installed at no upfront cost. Constellation recovers its investment via the electricity or gas supply agreement with the customer through Constellation's Efficiency Made Easy Program, which is available for electricity services in a large number of northeast, mid-Atlantic, and Midwest U.S. states, as well as Texas. This arrangement alleviates the need for businesses to provide up-front capital for charging stations.

#### Context-Setting: Reselling Electricity

Another regulatory question is whether EVSE businesses can resell electricity, which in part relates to whether the PUC has classified them as a "public utility." If EVSE businesses cannot resell electricity, they will have to charge customers via other metrics, such as time at the station or a fee for use of the station.

This discussion should not be conflated with the question of whether the utility is deregulated or regulated.

Finally, cities should be aware of the potentially detrimental effects of demand charges on EV charging costs, particularly for customers on commercial rates. Demand charges, which charge consumers according to their maximum electricity demand from the grid during a given period, are intended to cover the fixed costs of utilities related to energy production. These charges can have a detrimental effect on the economics of EV ownership, particularly for fleets and entities that may charge multiple EVs at the same time, as EVs typically require a large amount of power.

### 2.2.4 Can the utility recover infrastructure costs in the "rate base"?

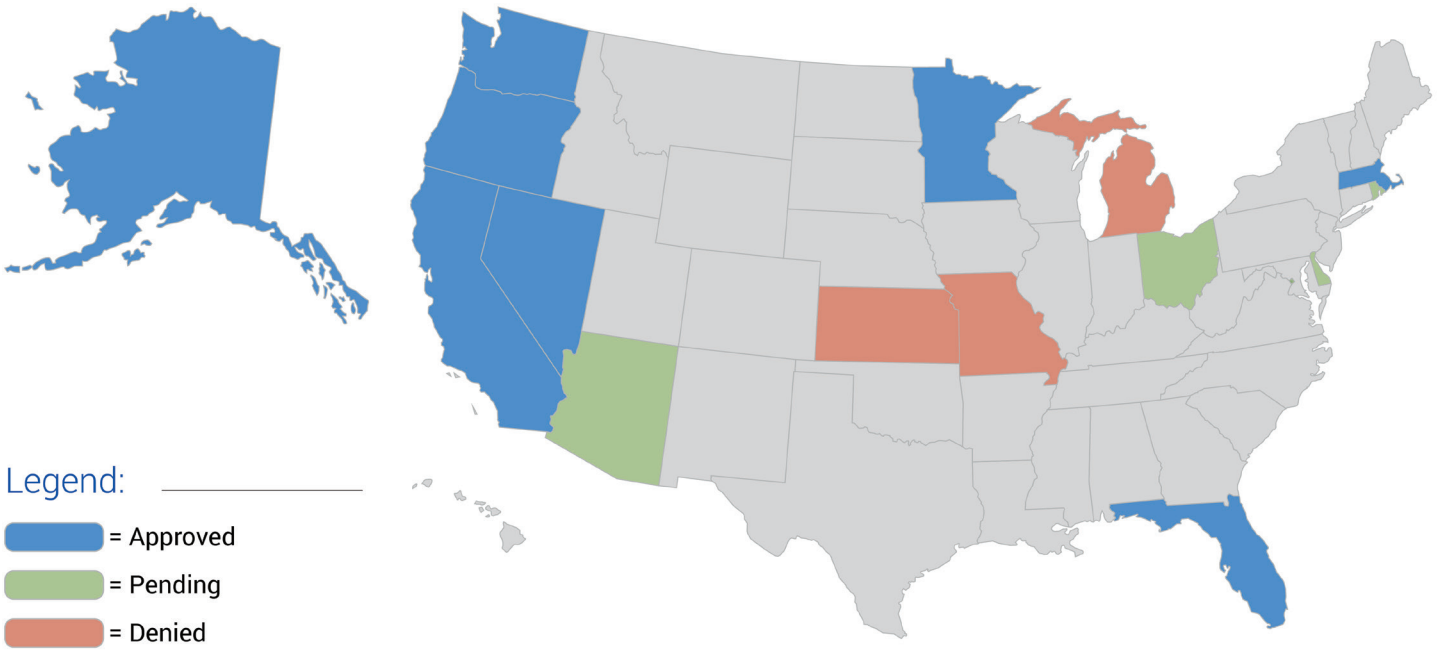
If the local utility is an IOU, another essential consideration is whether the utility can recover the cost of investments in EV infrastructure in the "rate base." The rate base is the assets on which a utility can earn a financial return, typically through the rates it charges to ratepayers. For IOUs, the state PUC oversees the process in which certain assets are included in the rate base, their cost recovery through electricity rates, and the amount of return earned by the utility. If the utility can rate-base such investments, then the utility can recover investments in EVSE through the electricity rates that it charges to ratepayers. Munis and coops are usually exempt from state PUC oversight of electricity rates.

State PUC or Public Service Commission (PSC) rulings on whether the utility can rate-base EV infrastructure are still in their nascent stages, and the outcomes thus far have varied. For example, the Missouri PSC ruled that such investments in EV infrastructure could not be recovered by the utility. Similar denials have occurred in Kansas and Michigan. Other states, such as Alaska, California, Massachusetts, and Oregon, have determined otherwise. If the utility cannot include charging infrastructure in its rate base, then other entities and business models will need to continue developing approaches to fulfill the task of infrastructure build-out, or the utility will need to seek non-ratepayer funding for EVSE. This impacts how cities, utilities, and potentially other partners can collaborate to craft and expand sustainable business strategies for EV infrastructure.

#### Example: Missouri Public Services Commission

In April 2017, the Missouri PSC denied a request by Ameren Missouri to offer a pilot program to install and operate EV Charging stations. The PSC determined that charging stations are not an "electric plant" as defined by statute. It stated that the charging service is the product sold, not the electricity. Moreover, the PSC argued that since EV drivers are not captive customers served by a single utility, but have choice of several charging services, charging stations cannot be regulated, and thus cannot be included in the rate base.

*Figure 6: Status of PUC "Rate Base" Approvals in the United States*




*Reflects data as of May 30, 2018.*

## 2.3 What are the characteristics of the city?

A city's characteristics, such as its population density, housing stock, renewable energy deployment, and vicinity to regional charging corridors also affect the prospective demand for EVs, their return on investment for consumers, and EV policy design for cities.

### 2.3.1 What is the urban-rural composition of the city?

The characteristics of urban, suburban, and rural settings affect the return on investment of EVs. Shorter-range EVs can perform well in urban environments, where distances between destinations are similarly short and there are opportunities to recoup energy from braking in stop-and-go traffic. Suburban environments can also be ideal for EVs due to the greater availability of private home locations for charging infrastructure and reasonably short distances between destinations.[11] Rural environments, with plenty of space, can offer flexibility for installations of chargers, but the long distances between destinations and the low density of population and prospective EV owners can undermine the business case for an EV charging network.

**Key Consideration: Weather and EV Performance**

Extreme variations in the climate can affect the performance of EVs, and thus can be a consideration in the overall strategy a city uses for EV deployment. For example, extreme cold can reduce the total charge of batteries, thereby extending charging time needed for a given range. Moreover, extreme cold or hot temperatures can lead to additional air conditioning or heating that reduces the charge of the battery, although such behavior similarly undermines the efficiency of conventional internal combustion engines (ICE) cars. Depending on vehicle capabilities, such extreme weather could potentially reduce an EV's range by about 25%. Car manufacturers and the federal government are developing approaches to mitigate these effects, such as improved battery insulation or ventilation, the use of high efficiency heat pumps for cabin heating, and other approaches. Of course, these impacts on consumers are less noticeable for longer range EV models.

### 2.3.2 What is the composition of the housing stock?

City policymakers should also consider the housing stock in their area. For the residential sector, single family homes with private parking can more easily install private at-home chargers. However, in areas in which the housing stock is primarily multifamily buildings, EV owners might need to rely on a multifamily building's common charger and public chargers.[12] In this case, there are significant challenges for installing EVSE in multifamily residences. Challenges range from physical constraints to the general unwillingness of building managers and owners to pay the upfront capital costs for EVSE. This reticence is partially due to the transient nature of multifamily residents and thus inconsistent usage of the EVSE over the long-term to recoup costs. Knowledge of the housing stock is particularly pertinent for city policymakers in urban environments seeking to prioritize and design policies that can have a broad public impact.[13]

11 For a further examination of suburban, urban, and rural impacts on EV infrastructure, and a case of EVs in non-urban contexts, see Newman, Daniel. Wells, Peter. Donovan, Ceri. Nieuwenhuis, Paul, Davies, Huw. "Urban, sub-urban or rural: where is the best place for electric vehicles?", International Journal of Automotive Technology and Management. 2014. Retrieved from: https://www.inderscienceonline.com/doi/abs/10.1504/IJATM.2014.065295.

12 Turek, Alex and George DeShazo, "Overcoming Barriers to Electric Vehicle Charging in Multi-unit Dwellings: A South Bay Case Study," University of California, Los Angeles Luskin Center for Innovation and the South Bay Cities Council of Governments, 2016, available at: http://innovation.luskin.ucla.edu/sites/default/files/Overcoming%20Barriers%20to%20EV%20Charging%20in%20Multi-unit%20Dwellings.pdf

13 Hall, Dale and Nic Lutsey, "Emerging Best Practices for Electric Vehicle Charging Infrastructure," International Council on Clean Transportation, October 2017, available at: https://www.theicct.org/sites/default/files/publications/EV-charging-best-practices_ICCT-white-paper_04102017_vF.pdf

### 2.3.3 What are the renewable resources of the city?

To reach ambitious emissions goals, city decision-makers can consider how EVs fit into the broader scope of integrating EVs with renewable energy resources and goals. The impact of EV charging on regional emissions is related to how the electricity is produced. EVs operating on electricity from a coal power plant are less beneficial than EVs operating on electricity produced though solar, wind, or other renewable sources.

In seeking to craft EV policies, city decision-makers should be aware of potential synergies of EVs with other preexisting renewable energy resources. For example, cities in regions with abundant renewable resources can pursue coupled campaigns to link EV charging with solar procurement to help blunt the effects of EV charging on the grid during the mid-day or early evening peak hours. As vehicle-to-grid and smart charging technologies and programs advance, EVs can potentially play a role in minimizing the utility's challenge of ramping up significant amounts of energy production when the energy produced from renewable sources declines. If net metering is available from the local utility, consumers should be aware of the potential to utilize net metering credits from rooftop solar to pay for the cost of electricity for EV charging.

#### Example: Electrify America

From 2017 to 2027, Electrify America will invest $2 billion in ZEV infrastructure and education programs in the United States. $1.2 billion will be invested nationwide outside of California. These investments will occur through a series of investment cycles. The First Cycle will establish non-proprietary EVSE at over 650 community-based sites and nearly 300 highway sites across the country. Sites will be located no more than ~120 miles apart and on average just 70 miles apart. Highway sites will be located along high-traffic corridors, and will include between four and ten DC fast chargers at each location.

### 2.3.4 Is the city near a regional charging corridor?

City decision-makers could also consider the region surrounding of their city, and whether it possesses the EVSE infrastructure that enables EV owners to reach key regional destinations. For example, policymakers could consider whether any Federal Highway Administration (FHWA) Alternative Fuel Corridor designations are nearby. These designations collectively serve as a national network of alternative fueling and charging infrastructure along national highway system corridors, with signs indicating EVSE stations. Another indicator of EVSE regional infrastructure are Electrify America ZEV investments in charging sites across the country, which can also help alleviate range anxiety. The lack of these designations may also be a policy opportunity for municipal officials. Figure 7 illustrates existing and planned regional corridors and the charging infrastructure in participating and observing communities of this study.

*Figure 7: FHWA EV Corridors and Charging Infrastructure in Participating and Observing Communities*


Legend:

= FHWA EV Corridor Pending

= FHWA EV Corridor Ready

= Observing Commuity

= Participating Commuity

## Observing Community Public Chargers:

1. Alexandria, VA: 23
2. Aspen, CO: 26
3. Austin, TX: 195
4. Bozeman, MT: 2
5. Cedar Rapids, IA: 12
6. El Paso, TX: 25
7. Emeryville, CA: 8
8. Fort Collins, CO: 38
9. Johnson County, IA: 9
10. Oklahoma City, OK: 9
11. St. Peters, MO: 3
12. West Hollywood, CA: 23
13. Westminster, CO: 11

## Participating Community Public Chargers:

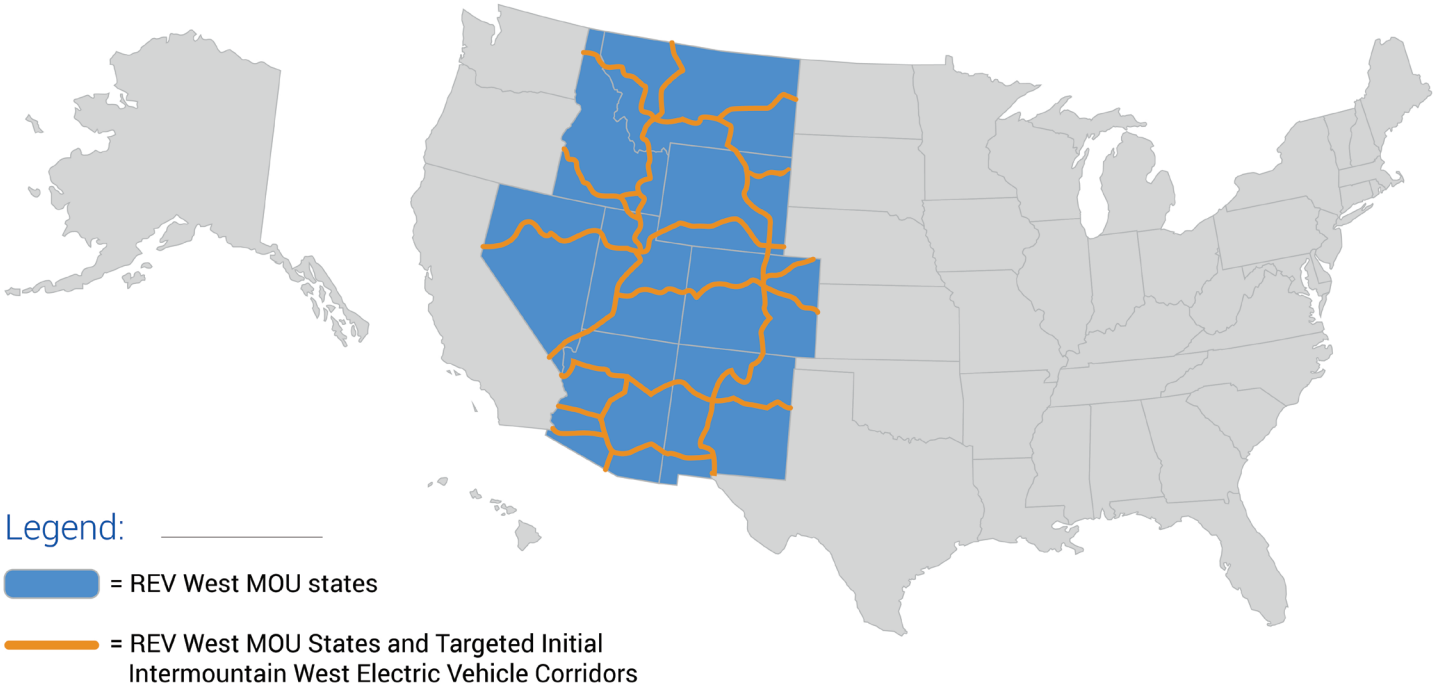
14. Columbia, MO: 5
15. Des Moines, IA: 11
16. Dubuque, IA: 5
17. Evanston, IL: 15
18. Indianapolis, IN: 36
19. Iowa City, IA: 6
20. Kansas City, KS: 152
21. Lincoln, NE: 16
22. Springfield, MO: 16
23. St. Louis, MO: 19

*Source: www.afdc.energy.gov/stations*

States also participate in multi-state initiatives to build out regional charging corridors for EVs. One example is the Regional Electric Vehicle (REV) West MOU, which establishes a framework for a regional electric vehicle corridor for the Western United States[14]. The REV West MOU seeks to harness best practices and procedures for promoting consumer awareness and acceptance; site EV charging to avoid redundancy; encourage economies of scale; create voluntary minimum standards for EVSE; identify opportunities to incorporate EVSE into planning and development processes; and encourage manufacturers to stock and market EVs. The REV West MOU also defines specific interstate corridors that will make up its Intermountain West Electric Vehicle Corridor, as shown in Figure 8. With support from the DOE State Energy Program, state governments have begun to implement the REV West MOU.

14 REV West MOU states include Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

*Figure 8: REV West MOU States and Targeted Initial Intermountain West Electric Vehicle Corridors*



SECTION 3

# City-Level Strategy

Cities have many reasons to pursue strategies for increasing the deployment of EVs. These include environmental benefits, such as decreased transportation emissions (see Figure 9) and improved air quality, and economic benefits, such as the reduced cost of ownership of electric vehicles, growth in jobs and local industry for EVs,[15] and other ancillary economic effects. For these reasons, EVs offer significant promise to city policymakers seeking to improve the quality of life for their constituents, which can be further realized through purposeful integration with other sustainable forms of transportation in mass transit, biking, and walking. The following section outlines the strategies that cities can take to encourage consumers, utilities, and its own municipal operations, to further adopt EVs.

15 For example, for a summary of net job estimates, see Table 1 in International Economic Develop Council, "Creating the Clean Energy Economy: Analysis of the Electric Vehicle industry, " 2013, p. 13, available at: https://www.iedconline.org/clientuploads/Downloads/edrp/IEDC_Electric_Vehicle_Industry.pdf.

*Figure 9: Cost and Emissions Comparison of EVs in Participating and Observing Communities*

| City | State | Gasoline Grams of $CO_2e$ Per Mile | PHEV Grams of $CO_2e$ Per Mile | BEV Grams of $CO_2e$ Per Mile | State Average Price of Gasoline ($) | eGallon Equivalent ($) |
|---|---|---|---|---|---|---|
| | | | | | Using Feb 2018 Prices | Using Feb 2018 Prices |
| Emeryville | California | 381 | 177 | 95 | 3.36 | 1.68 |
| West Hollywood | California | 381 | 177 | 95 | 3.36 | 1.68 |
| Aspen | Colorado | 381 | 247 | 224 | 2.37 | 1.07 |
| Fort Collins | Colorado | 381 | 247 | 224 | 2.37 | 1.07 |
| Westminster | Colorado | 381 | 247 | 224 | 2.37 | 1.07 |
| Evanston | Illinois | 381 | 237 | 206 | 2.43 | 1.13 |
| Indianapolis | Indiana | 381 | 237 | 206 | 2.43 | 1.03 |
| Cedar Rapids | Iowa | 381 | 235 | 202 | 2.43 | 1.05 |
| Des Moines | Iowa | 381 | 235 | 202 | 2.43 | 1.05 |
| Dubuque | Iowa | 381 | 235 | 202 | 2.43 | 1.05 |
| Iowa City | Iowa | 381 | 235 | 202 | 2.43 | 1.05 |
| Johnson County | Iowa | 381 | 235 | 202 | 2.43 | 1.05 |
| Columbia | Missouri | 381 | 268 | 263 | 2.43 | 0.9 |
| Kansas City | Missouri | 381 | 250 | 231 | 2.43 | 0.9 |
| Springfield | Missouri | 381 | 268 | 263 | 2.43 | 0.9 |
| St. Louis | Missouri | 381 | 268 | 263 | 2.43 | 0.9 |
| St. Peters | Missouri | 381 | 268 | 263 | 2.43 | 0.9 |
| Bozeman | Montana | 381 | 184 | 108 | 2.44 | 0.99 |
| Lincoln | Nebraska | 381 | 235 | 202 | 2.43 | 0.93 |
| Oklahoma City | Oklahoma | 381 | 239 | 210 | 2.43 | 0.86 |
| Austin | Texas | 381 | 219 | 174 | 2.28 | 1.01 |
| El Paso | Texas | 381 | 221 | 176 | 2.28 | 1.01 |
| Alexandria | Virginia | 381 | 200 | 138 | 2.44 | 1.01 |

= Participating Communities = Observing Communities

**Note: Emissions figures are taken from the Environmental Protection Agency's E-Grid data, which provides emissions profiles of the various sub-regions of the U.S. electricity grid, and thus may encompass a region larger than the city under consideration.*

# Integrating Equity into EV Initiatives

Many cities seek to integrate their sustainability priorities with social equity, and in this context, will want to ensure that the benefits of EVs are realized equitably by all members of their communities. Low-income and minority community members suffer from the largest burden of transportation-related pollution. Moreover, clean technology incentive programs and deployment of charging infrastructure have not always been equitably designed to ensure access for all community members. EVs present an opportunity to reduce disproportionate air quality impacts over the long-term, but not all policies will achieve equitable outcomes for disadvantaged groups. City policymakers must consider how they design EV policies and initiatives, convey information about EVs, and distribute public charging infrastructure. This two-page section will define different types of equity, the definition of equity utilized in this report, and highlight which of the following policies are ripe for equity integration.

## Defining Equity

The Urban Sustainability Directors Network (USDN) has defined four types of equity for sustainability planning, decision-making, and program and policy design. The USDN definitions are:

- Procedural (Inclusion): inclusive, accessible, authentic engagement and representation in the process to develop or implement programs or policies.
- Distributional (Access): programs and policies result in fair distributions of benefits and burdens across all segments of a community, prioritizing those with highest need.
- Structural: decision-makers institutionalize accountability; decisions are made with a recognition of the historical, cultural, and institutional dynamics and structures that have routinely advantaged privileged groups in society and resulted in chronic, cumulative disadvantage for subordinated groups.
- Transgenerational: decisions consider generational impacts and do not result in unfair burdens on future generations.

Strategies in this report focus primarily on building procedural and distributional equity into EV policy and program design. These strategies seek to address equity primarily via an economic lens (with disadvantaged communities defined as low-to-moderate income [LMI] communities), but wherever possible city decision-makers should consider intersectional solutions, such as those aligned with advancing racial, gender, and geographic equity.

## Key Questions for Procedural and Distributional Equity

To design equitable EV policies and programs, city staff can begin by considering the following framing questions:

- How does the city define equity and consider equity in its decision-making?
- What baseline data does the city have to understand who is served by EV policies and who is impacted most by air pollution and other adverse impacts of traffic?
- What goals does the city have to ensure equitable benefits from its EV policies and programs?
- What processes can the city put into place to ensure that underrepresented communities can participate in designing policies and programs?
- Have EV programs and policies been designed to ensure that underrepresented communities receive substantial benefits and minimal burdens?
- What community partners can the city work with to ensure that programs benefit underrepresented groups?

City staff can strive to achieve greater procedural and distributional equity by ensuring that underrepresented communities are able to participate in the policymaking process. Inclusive participation can help ensure that the priorities, needs, and concerns of underrepresented communities are part of policy design, and help city decision-makers to craft policies that prioritize their needs.

## Equity Challenges and Opportunities:

In the specific context of EVs, underrepresented communities face several challenges:

- **Financing:** It can be difficult for LMI communities to shoulder the up-front and operating costs of owning an EV, especially if many of those costs must come out-of-pocket at the time of purchase. This is compounded by an inability to access credit or lack of a strong credit record.
- **Housing:** LMI residents more commonly live in multifamily housing, where gaining access to charging infrastructure may be more difficult. Installing EVSE in multifamily units can be more expensive than installing in a private home due to technical challenges. Multifamily residents who rent tend to be more transient, making it harder to commit to EV ownership.
- **Local Perception:** EVs might be perceived as primarily for high-income households. Local dealerships that serve LMI communities may also under-stock EVs for prospective purchase by LMI communities.

Opportunities to address these inequities include:

- **Financial Incentives:** To help overcome financial barriers, financial incentives can be designed to offer more significant support for LMI customers, or to offer immediate benefits at the point of sale so that LMI customers can realize immediate benefits. If offering loan products, EV incentive programs can use alternative methods to evaluate customers' credit to overcome credit score barriers.
- **Car-sharing:** To avoid the cost of ownership, cities can institute car-sharing programs that allow LMI communities to drive EVs without undertaking significant ownership and operation costs. Cars can be sited close to LMI housing and discounts can be offered to make using the cars affordable.
- **Education and training:** Cities can seek to educate local dealerships on the cost benefits of EVs for LMI communities and the vast range of financial incentives that lower the cost.
- **Targeted incentives:** Since LMI communities tend to be disproportionately located near high-traffic areas, cities can seek to target EVSE installations near the parking of those areas, helping to alleviate both income and geographic-based disparities.

## Resources: Greenlining Institute, "Electric Vehicles for All"

The Greenlining Institute has crafted a toolkit titled "Electric Vehicles for All" that outlines some of the equity concerns related to certain policy designs. It offers suggestions for how to craft policies that deliver benefits to low-to-middle income households.

## 3.1 Group 1: Consumer-Oriented Strategies

City decision-makers possess a broad range of tools for facilitating the growth of EVs and EVSE. These strategies cover both the "hard costs" of initial purchase and operation, as well as the "soft costs" of expanding EVs and EVSE, such as permitting requirements. These options include financial incentives, outreach strategies, regulatory approaches, training and education, and others.

### Example: Group Purchase Programs in Kansas City

Modeled after successful EV group purchases in Colorado and Utah, the Mid-America Regional Council (MARC) and the Metropolitan Energy Center (MEC) partnered with Nissan North America and Kansas City Power & Light to secure a discount of $10,000 for any purchaser of a Nissan LEAF in the fall of 2016. The campaign required the recruitment of an anchor public fleet, that of the City of Kansas City, to extend a "fleetail" discount to the retail market. Six area Nissan dealerships participated and an 87% increase in LEAF sales was achieved year-over-year with over 100 LEAFs purchased in just 45 days. Due to the success of the initial period, the program was extended until March 31, 2017, and again until June 30. During each calendar quarter, the Kansas City region was ranked the fastest-growing EV market in the U.S.

### Example: National Drive Electric Week

The 2017 National Drive Electric Week, spearheaded by the Sierra Club, Plug In America, and the Electric Auto Association, led to 278 events in 251 cities across 6 countries and in all 50 states. This included more than 8,000 ride and drives.

### 3.1.1 Bulk purchase programs

Cities, typically in partnership with nonprofits, have launched successful bulk purchase programs for EVs. These programs have a proven track record for encouraging EV ownership by households that otherwise might not have considered EVs. Like "Solarize" programs for rooftop solar installations, such programs allow interested consumers to purchase cars at a significant discount. In addition, dealerships benefit from reduced costs related to customer acquisition, marketing, and transactions. This is because bulk purchase programs can leverage the city's network to gauge interest and engage with prospective owners and eliminates the need to negotiate the individual prices of each EV.

### 3.1.2 Educational campaigns

Educational campaigns are another avenue for increasing consumer awareness and interest in EVs. Such educational campaigns can be targeted towards specific audiences, such as fleet managers and company representatives, major retailers, and local officials. One of the most prevalent activities in educational campaigns are "ride and drives," which are test drive events where EV owners, dealers, or manufacturers showcase vehicles and allow interested participants to drive an EV. In addition to increasing sales of EVs, cities can use ride and drives to build relationships with dealerships, focus on specific populations, and highlight other city and state-level initiatives in promoting EVs. Other educational campaign events include film screenings and school presentations, among others.

Cities can also engage local community partners to help low-income populations navigate the decision-making process of purchasing an EV, including the incentives available and possible avenues for financing. These educational campaigns can seek to change the perception of EVs as primarily an upper-income means of transportation.

### 3.1.3 Parking incentives

Municipalities can offer a variety of parking incentives to encourage more EV adoption. This can include discounted parking at city-owned and publicly accessible parking locations, or incentives for private companies to offer such parking at a discount. Depending on the maturity of the local market, cities can also prescribe specific penalties for non-EVs that park in EV-designated spaces. For free parking lots, cities can also offer "premium" parking spaces to EVs. Beyond city-owned parking spaces, implementation of these incentives can require collaboration with garage and parking lot operators, and building owners.

### 3.1.4 EV-ready ordinances

Cities can also seek to "future-proof" new building stock by requiring that they provide EV parking spaces and be equipped with the necessary infrastructure to support EV charging stations. Incorporating these preparations for EVs into building construction are particularly cost effective since workers are already on-site, and permitting and other administrative costs can be bundled with the other paperwork necessary for construction. Moreover, such EV-ready buildings face lower subsequent utility service upgrade costs.

### 3.1.5 Facilitating on-street parking

City policymakers should be aware that in some cases, on-street EV charging may be a necessity for residents who do not have access to off-street parking or sufficient electrical service for charging infrastructure. Several cities have offered specific programs for property owners with EVs to install charging stations on-street outside of their building. Most of these programs have only been pilot programs, require an application to the city to install an EVSE charger, and in some cases, also require the owner to shoulder the costs. Policymakers should also be aware of possible tradeoffs with other forms of sustainable transportation, such as ongoing initiatives to transform on-street parking spaces into bike lanes or bus lanes.

#### Example: Sacramento's EV Parking Program

Since 1994, the City of Sacramento has offered an EV Parking Program that provides free or discounted parking to EV drivers. Customer surveys in 2017 revealed that 36% of respondents judged the EV Parking program to be "very influential" on their decision to own or lease an EV, and that they would not have done so without the program in place.

#### Example: Atlanta's "EV Ready" Ordinance

The City of Atlanta passed ordinance 17-0-1654, which required all new residential homes and public parking facilities to be "EV Ready." This requires that 20% of spaces in all new commercial and multifamily parking structures are EV ready, and that all new residential homes are equipped with the infrastructure (conduit, wiring, and electrical capacity) needed to install EV Charging stations.

#### Example: Kane County's Updated Ordinances

Kane County, Illinois passed an update to the county ordinances that allows for Level 1 and Level 2 EV charging stations in all zones and restricts Level 3 charging stations to certain zones, as well as classifying land for retail EV charging enterprises similarly to gas stations' classifications.

#### Example: Berkeley's Curbside Charging Pilot

The City of Berkeley implemented a curbside charging pilot in 2014 that allowed for up to 25 curbside charging spaces until 2017. The applicant would bear most of the costs, and must not have a driveway or garage where they could place a charging station. The program also does not grant the owner exclusive rights to the adjacent parking space, and requires the applicant to notify neighbors before they are approved for the program.

### Example: Raleigh's EVSE Permitting Process

The City of Raleigh offers a "stand alone" and "walk through" process, which is described as such because the permit is completed as the applicant is walked through the process by permitting personnel. Receiving a permit takes approximately one hour, and inspections can be performed the day after, leading to a total assessment, permitting, installation, and inspection process as few as two days. Raleigh also allows for electronic submission of permitting forms via fax.

### Resource: EV Permitting Checklists

California, in its 2013 ZEV Community Action Guidebook, provides a guideline permitting checklist that could serve as a useful template for other municipalities. Such a checklist should be adapted to the unique context of each municipality, as not all rules and regulations in California will apply out-of-state.

### Example: Auburn Hills's Updated Zoning

Auburn Hills, Michigan has updated their zoning ordinance to specify requirements for items such as EV charging station lighting, outlet heights, and signage.

### 3.1.6 Reducing permitting costs and timeline

Cities can also streamline permitting and inspection processes for installation of EVSE. Burdensome permitting costs can add to the cost of EV infrastructure. These costs vary widely; permit fees for EV charging infrastructure around the country range from $0 to $624.[16] To streamline the permitting process, city policymakers can also establish mechanisms for ensuring that city officials, inspectors, and electricians understand the permitting process. One straightforward approach may be folding EVSE permitting into preexisting permitting mechanisms for appliances. Otherwise, cities can help reduce complexity by minimizing differences in permitting requirements across jurisdictions, thoroughly disseminating templates and checklists for permitting processes, utilizing online permitting systems, and minimizing the need or times for plan checks.

### 3.1.7 Trainings

Cities can also facilitate trainings on a variety of tasks related to EVSE. These can include trainings for EVSE installers, inspectors, EV technicians, dealers, and first responders. For example, these trainings can help educate stakeholders on the details of the permitting process. In some cases, training field inspectors has replaced the plan review process in permitting entirely. Other use cases for trainings include public safety requirements, such as fire safety and other emergency situations. Trainings with dealerships can be particularly beneficial for bolstering deployment, since EVs are often relatively unfamiliar to car salesmen.

Even if city staff are not implementing such trainings, they can assist with outreach strategies and work with local partners to ensure that training sessions have broad participation. Cities can also encourage participation by sharing the information of trained contractors with auto dealerships to establish a referral list for prospective consumers.

16 California Plug-in Electric Vehicle Collaborative, "Streamlining the Permitting and Inspection Process for Plug-In Electric Vehicle Home Charger Installations. Report and Recommendations, Version 2." 2012, available at: http://www.pevcollaborative.org/sites/all/themes/pev/files/PEV_Permitting_120827.pdf

### 3.1.8 Code revisions

Cities also oversee numerous other ordinances and local regulations that affect EV deployment. Regulations pertaining to zoning, parking, electricity, and buildings offer opportunities for encouraging EV and EVSE. In line with state mandates, cities can amend zoning text to not only allow, but encourage installation of EVSE. For example, city policymakers can pre-specify where Level 3 charging stations can be allowed. [17] One possibility, while still largely untested, is allowing for a reduction in minimum parking requirements for facilities that provide EVSE spaces, subject to certain constraints.[18] Focusing on design standards for charging stations, signage, and accessibility standards could also be a beneficial focus for regulations that impact EVSE. Local building, zoning, and development regulations can encourage innovations and support EVSE installation across all building types.

### 3.1.9 Financial incentives

While the federal government and many states offer financial incentives toward the purchase or conversion of electric vehicles, it is rarer for cities or municipalities to do so. However, municipalities have also offered financial incentives for the purchase or conversion of EVs or the installation of EVSE. While cities are generally constrained by their budgets, such direct financial incentives can help encourage initial uptake of EVs and demonstrate governmental commitment to EV deployment. In addition, rebates can also be offered through municipal utilities under city control.

To incorporate considerations of equity into financial incentives, cities may seek to scale such incentives according to income brackets and provide remuneration at the point of sale. Otherwise, certain consumers may be excluded from claiming certain tax credits due to having too low of taxable income. Moreover, remuneration at the point of sale can support low-income households that have less disposable income or savings to support them while waiting for delayed or mail-in rebates. Cities may also seek to explicitly target such incentives in historically disadvantaged areas with lower than median incomes.

#### Example: Indianapolis's Zoning Requirements

Indianapolis, Indiana updated its zoning requirements to lower a development's required number of parking spaces if EV charging stations are included.

#### Example: Seattle's Modified Electric Code

In 2008, Seattle adopted a modified electric code that included specific provisions for required space for physical equipment and space planning to install future conduit and panels for EVSE. It also provides outlet load calculations for residential EVSE and feeder and conduit specifications for multifamily residences.

#### Training Resources: Electric Vehicle Information Training Practices (EVITP), National Fire Protection Association (NFPA)

**The EVITP is a collaborative industry initiative to certify electricians to install EVSE to the highest standards of safety and quality. NFPA is a trade association that facilitates first responder safety training, and has developed a program related to handling crashes involving BEVs and HEVs.**

#### Example: Vancouver's Car Sharing Reduction

Vancouver allows new developments to reduce their total required parking by increasing dedicated car-share spaces. This is at a 1:5 ratio of car share spaces to reduced parking space requirements, with certain limits.

While not specific to EV, this model could be applied to EVSE charging stations.

17 WXY Architecture + Urban Design, "The EVSE Toolkit: Administrative and Planning Strategies for Local Jurisdictions." Prepared for the New York State Energy Research and Development Authority (NYSERDA) and the Transportation and Climate Initiative, November 2012.
18 WXY Architecture + Urban Design , "The EVSE Toolkit: Administrative and Planning Strategies for Local Jurisdictions."

### Example: Riverside's Vehicle Purchase Subsidy

For residents of Riverside, California, and for purchases of EVs from an auto dealership within the City of Riverside, the City of Riverside offers a $500 rebate for EVs, $250 rebate for Electric Motorcycles, and $250 for a Neighborhood Electric Vehicle. This excludes plug-in hybrids, hybrid, and compressed natural gas vehicles.

### Example: Maryland's EV Excise Tax Credit

Maryland offers a one-time excise tax credit of up to $3000. While this is an example of a current state-level incentive, similar proposals have been recently proposed in Boston, MA and have been implemented and subsequently removed in various VA counties, such as Loudoun County.

### Example: Los Angeles' BlueLA Carsharing Program

With a grant from the California Air Resources Board, the City of Los Angeles has partnered with the Bolloré Group of France, an operator of one of the world's largest and successful car sharing services in Paris, to roll out an electric car sharing pilot program in select communities in Los Angeles.

### Example: New York City's Electric Taxi Roadmap

As a part of Mayor Bloomberg's initiative to establish a one-third electric taxi fleet by 2020, New York City established an Electric Taxi Task Force that created a roadmap that outlined the necessary requirements for taxi electrification and corresponding recommendations.

#### 3.1.10 City taxes on vehicles

In some cases, cities or counties assess excise or property taxes on registered motor vehicles. In this respect, cities can structure such vehicle taxes to support adoption of EVs. Through tax reductions or exemptions, cities can decrease the cost of ownership of an EV relative to an internal combustion engine (ICE) vehicle, encouraging their use.

#### 3.1.11 Electric carsharing

A select few cities have implemented pilot programs for electric car-sharing programs, many of which are targeted towards LMI communities. Through public private partnerships with car-sharing business entities and local community stakeholder groups, these programs allow individuals with a license to access a network of shared vehicles and chargers at a low rate. While individuals with higher incomes are usually not prevented from using such networks, such programs typically both provide a subsidized rate to LMI communities and are intentionally situated near their vicinity.

#### 3.1.12 Electrifying taxis and ridesharing companies

Cities can also craft broader policies to electrify taxi fleets and ridesharing services. Through taxicab and transportation commissions, cities have explored the use of electric vehicles in taxi fleets, established pilot programs for their integration, provided financial incentives for taxi and ridesharing electrification, and set broader goals for electrifying taxi fleets. In some cases, cities have exercised authority over rideshare companies at certain high-traffic facilities, such as airports. Leveraging their regulatory oversight and ability to award concessions, cities can offer guidance to taxis and other ride-sharing services on achieving fleet electrification. That noted, municipalities are limited in their ability to mandate emissions reductions on taxi companies due to federal law and whether the state in question has delegated such authority to municipalities.[19]

19 The Energy Policy Conservation Act (EPCA) prohibits states and their political subdivisions from "adopt[ing] or enforc[ing] a law or regulation related to fuel economy standards." The CAA precludes adoption or enforcement of "any standard relating to the control of emissions from new motor vehicles." See 95 49 U.S.C. § 32919(a) (2012), and 95. 42 U.S.C. § 7543(a) (2012).

### 3.1.13 Establishing a "right to charge"

Some cities have explored codifying a "right to charge" that allows electric vehicle owners to install charging stations on their properties without condominium or homeowners' associations banning or placing unreasonable regulations on such EVSE installations. These ordinances typically describe the rights of the owner, as well as their responsibilities, such as paying for costs, repairs for damages, and relevant disclosures. This "right to charge" can clarify the legal pathways for tenants to install EVSE in a multi-unit dwelling.

### 3.1.14 Applying for a corridor designation

Cities can also work with state and neighboring localities to apply for a FHWA Alternative Fuel Corridor designation if they're not already near or part of one. The development and designation of corridors help alleviate range anxiety, which is one of the primary consumer impediments to greater adoption of EVs. Even if the city cannot participate as part of an official FHWA Alternative Fuel Corridor, city officials should consider the siting of EV charging stations such that they facilitate the development of a regional corridor, allowing EV drivers to make their way along main artery roadways and never be too far from a charging station.

## 3.2 Group 2: Muicipality-Oriented Strategies

Beyond targeting consumer adoption of EVs, municipalities can lead through example by demonstrating greater EV use in municipal fleets and EVSE installation in city-owned buildings and infrastructure. The following section outlines strategies for increasing EV and EVSE deployment in municipal operations.

### 3.2.1 Fleet procurements

One of the most straightforward steps for greater EV use is to procure EVs as a part of municipal fleets. Municipal fleets provide a variety of services to residents, ranging from health and building code inspectors, policing, and park vehicles. For city owned and operated vehicles, municipalities can require that EVs be used when feasible. To accomplish this goal, municipalities can make aggregated purchases or leases of EVs for their public fleets. Moreover, these purchases can capture the full value of any incentives at the state and federal level via leasing arrangements with private entities.

#### Example: Port of Seattle's SEA-TAC Airport Environmental Regulations

In 2017, the SEA airport allowed select transportation companies, such as Uber, Lyft, and Wingz to pick up and drop off riders at SEA, while outlining fuel efficiency and emissions standards for such vehicles that meet their specific Environmental Key Performance Indicators (E-KPI). The E-KPIs are enforced through additional $5 per trip fees.

#### Example: Boston's Right to Charge Ordinance

In 2017, Boston filed an ordinance that codifies the right of Boston residents to install personal charging stations. It outlines the rights and responsibilities of EVSE ownership, as well as the responsibilities and duties of the association that oversees the application to install the EVSE station.

#### Example: New Bedford, Massachusetts

New Bedford, Massachusetts, has converted approximately one-third of its 70-vehicle passenger fleet to all-electric vehicles, constituted primarily of Nissan LEAFs. The City is seeking to electrify 80% of its fleet by 2025.

#### Example: San Francisco, Los Angeles, Portland, Seattle Joint Procurement

In 2017, these four cities have issued a joint request for information for procuring EVs for their fleets. Together, they could buy or lease up to 24,000 total.

Further cost savings can be achieved through participating in a multi-city joint procurement. They can also enact municipal policies to require that EVs are the default vehicle type, with exceptions for ICEs determined on a case-by-case basis. While most efforts in fleet electrification have occurred for light-duty vehicles, there will be increased opportunities to procure medium and heavy-duty electric vehicles with further market development. These actions illustrate a governmental commitment towards reducing emission, and can also encourage local dealerships to consider stocking more EVs, given the public exposure of municipal vehicles.

## Resource and Example: Fleets for the Future's Regional Cooperative Procurements

Funded by a U.S. Department of Energy grant, five regional councils have been collaborating with a national team of experts to develop cooperative procurement initiatives that leverage the collective purchasing power of public fleets across large regions. By helping vehicle vendors achieve economies of scale in their supply chains, this project has produced numerous competitively awarded contracts that reduce the cost premium of electric and other alternative fuel vehicles.

For vehicle electrification, the team awarded contracts that provide any public or nonprofit entity nationwide to receive 15-30% discounts on Level 2 EVSE (hardware costs) through a buying cooperative called SourceWell. Additionally, one of the participating regional councils, Boston's Metropolitan Area Planning Council, secured discounts of 11-19% on XL Hybrid upfits for medium duty vehicles during a time-limited campaign. In addition to the substantial savings provided by these cooperative contracts, public fleets have saved substantial amounts of administrative time by eliminating the need to perform individual competitive solicitations at the municipal level. The Mid-America Regional Council (Kansas City region) estimated the administrative cost savings from its own Fleets for the Future procurement (in which 30 agencies participated and purchased over 500 vehicles) to be approximately $150,000.

The Fleets for the Future team is continuing to develop additional cooperative procurement contracts. A current solicitation is for dealerships to provide fleet management and leasing services, with the motivation of finding fleet management companies that will monetize the federal EV tax credit for public sector entities. For more information, visit www.fleetsforthefuture.org.

### 3.2.2 Readiness and action plans

Cities can also craft readiness and action plans for EVs, or include EVs in broader master plans (including Climate Action Plans) that outline the city's transportation strategy. These plans coordinate the actions of municipal agencies, help prioritize EVs as a governmental initiative, and illustrate leadership on the deployment EVs and EVSE. Such action plans should ideally include an assessment of the status quo (including current technologies and demand), specific goals for the rollout of EVSE and EVs, recommendations for accomplishing such goals, and metrics for judging success. These plans should also be updated over time with advances in research and technology. Ideally, these plans are formed through thorough public and stakeholder engagement to determine city priorities and needs.

### 3.2.3 Public charging stations

Cities can install EV chargers in publicly owned buildings, including those related to municipal workforces, for significant impact. Additional sites include community areas with public parking lots. These locations also present an opportunity to establish pilot projects on advanced, "smart charging" EVSE. In the case of municipal workforces, studies conducted by the US Department of Energy have shown that workplaces with EVSE were significantly more likely to encourage EV adoption than otherwise.[20] Such charging stations allows cities to educate their employees and local stakeholders about the benefits of electric vehicles, contributing to an increase in EV adoption. Additionally, the option of owning an electric vehicle appears more feasible to employees and community members if such parking is publicly visible and available.[21]

## 3.3 Group 3: Utility-Oriented Strategies

Except in the case of municipal utilities, city policymakers generally have little control over the electric utility. The decision-making of investor-owned utilities (IOUs) tends to be regulated by state PUCs, while coops tend to be self-regulated, relying on the decision-making of their board and the votes of their customer-owners. The following section outlines strategies by which cities can influence the decision-making of IOU and coop utilities to accommodate and encourage greater EV and EVSE adoption, and additional policy options that can be implemented through control over municipal utilities.

**Resource: Atlas Public Policy's Fleet Procurement Analysis Tool**

**Atlas Public Policy has released a *fleet procurement analysis tool* that allows fleet managers to compare the financial and environmental impacts of various ICE and EVs.**

**Example: Portland's Electric Vehicle Strategy**

In 2017, Portland updated its Electric Vehicle Strategy following its first version in 2010. This strategy is integrated into a broader Climate Action Plan that seeks to electrify public transit and maximize benefits for low-income residents.

**Example: San Jose's Electric Vehicle Chargers**

In San Jose, California, Silicon Valley businesses have invested heavily in EVSE workplace charging stations. This has led the City of San Jose to have the largest market share of EVs in the 50 largest cities in the country – even surpassing that of San Francisco.

**Example: Alameda County's Smart Charging Pilot**

Alameda County is testing smart charging software for electric vehicles with local partners ChargePoint, Kisensum, and Lawrence Berkeley National Lab.

20 U.S. Department of Energy, "Workplace Charging Challenge. Mid-Program Review: Employees Plug In," 2015, available at: https://energy.gov/sites/prod/files/2015/12/f27/105313-5400-BR-0-EERE%20Charging%20Challenge-FINAL_0.pdf

21 Electrification Coalition, "Drive Electric Northern Colorado: Establishing an EV Accelerator Community," September 2017, available at: http://www.cityofloveland.org/home/showdocument?id=36753

### 3.3.1 Utility engagement

Cities can engage their local utility on its vision for EVs and EVSE. Given the relative novelty of EVs and their potential both as load and energy storage, cities may find it useful to understand how the utility envisions their future role in EV and EVSE deployment. Cities can potentially align their policymaking with utility goals. Cities and utilities will also need to deliberate over other key questions, such as metering requirements (i.e. whether the EV will need a separate meter), how EVs fit into broader visions of the "smart grid," and how to facilitate business models for EVSE.

| Strategy | Strategies for All Utilities (IOU, Muni, Coop) or Only Muni Utilities |
|---|---|
| Utility Engagement | All Utilities |
| Information Sharing | All Utilities |
| Participation in Regulatory Proceedings | All Utilities |
| Integration of Utilities into Interconnection | All Utilities |
| Support for Planning Efforts | All Utilities |
| Support for Pilot Projects | All Utilities |
| Utilizing Curbside Infrastructure for EVs | All Utilities |
| Appointment of Muni Officials | Muni Utilities |
| Offering Financial Incentives for EVs | Muni Utilities |

### 3.3.2 Information sharing

Cities can help facilitate information sharing with utilities. For example, cities, through their regulatory oversight (i.e., via permitting processes), may have access to information related to the potential amount and concentration of EV chargers or parking spaces, which utilities may not have access to, depending on the type of charger and if notification to the utility is required. Moreover, cities could inform and consult utilities on plans for EV-ready ordinances or other EVSE requirements. Through these actions, cities can assist utilities with anticipating future load, which would aid the utility in system planning and analysis.

On the other hand, cities should also be aware of the possible implications of growing EV loads on distribution systems. Certain residential feeders, for example, may experience reliability issues over the long term since they typically have lower ratings than commercial or industrial feeders. Cities may seek to be aware of such information from utilities, and target their policies accordingly.

### 3.3.3 Participation in regulatory proceedings

Cities often serve as important stakeholders throughout state regulatory processes and should continue to be involved as interested parties. Given the nascent nature of PUC approval of EV-related items, cities can offer input on PUC decisions on items such as:

- Whether EV investments should be included as part of the utility rate-base;
- How rates for EVs are determined;
- Whether retail EV chargers should qualify as "public utilities," and if there should be any exemptions;
- Whether other business entities can resell electricity;
- Potential compensation rates for vehicle-to-grid services.

#### Example: Electrify Heartland Steering Committee Process and Notification Systems

The Electrify Heartland Steering Committee in 2012 conducted several meetings with public utilities throughout Kansas and Missouri. These meetings revealed that information sharing, particularly a notification system in the permitting process, could substantially aid the utility in its load planning processes.

These are only some of the regulatory issues that are likely to arise with the further growth of EVs, but they will all likely require the input of cities and municipalities. In this respect, cities can also engage their ratepayer advocate or attorney general offices to seek optimal outcomes for their constituents.

### 3.3.4 Integration of utilities into interconnection

For safety, grid reliability, and a host of other reasons, utilities will continue to be interested in the interconnection processes for EVSE. These processes will grow more complex and challenging if they involve communication with utility systems. As EVs become more advanced, and as EVSE similarly becomes more capable of offering vehicle-to-grid services, cities should be sure to include and engage utilities throughout permitting and related interconnection processes to ensure that the appropriate infrastructure is installed for ensuring the safety and reliability of equipment.

### 3.3.5 Support for planning efforts

Cities can also help shape the development of the long-term energy plans of utilities (i.e., "integrated resource plans" or "energy generation plans"). Additional load and vehicle-to-grid services, including energy capacity, may eventually be reflected in long-term energy plans. Such plans may also include resources dedicated to potential demonstration projects for EVs. A municipal utility's energy generation plan may require approval from the city council, depending on the utility's governance structure. For IOUs, these plans typically require approval from the state regulatory body (Public Utility Commission or Public Service Commission). As previously mentioned, cities can engage in state level regulatory proceedings for IOUs.

### 3.3.6 Support for pilot projects

Utilities often seek to establish pilot projects for new energy programs and may seek to collaborate with cities to do so. Cities can offer an excellent platform for demonstration projects when such projects align with city goals, such as reducing emissions and the costs of operation. Given the promise of EVs, there is still much room for innovation and demonstration projects. Some of the areas ripe for pilot projects include:

- The potential deployment of electric non-light-duty vehicles.
- Expanding the development of vehicle-to-grid services.
- Using smart charging infrastructure.
- Granting curbside space to utilities.
- Financial incentives (other than rates) for off-peak charging.
- Expanding the use of electric vehicles in low-to-moderate income households.

## Example: Alameda Municipal Power's EV Charging Discount

Alameda Municipal Power, the municipal utility serving Alameda County, California, established an experimental electric vehicle charging discount for different weight classes of electric vehicles in both volumetric terms ($/kWh used) and the use of the vehicle itself ($ per Vehicle Per Month).

## Pilot Project Examples: ConEd and NYC

**Electric School Buses**

In 2017, ConEd sought suggestions on whether the electric buses planned for trial by the New York City's Metropolitan Transportation Authority can offer vehicle-to-grid services. ConEd also planned to use school buses as batteries during the summer months.

**Sharing of Curbside Space**

The NYC Department of Transportation and the New York Police Department have reserved approximately 100 EV curbside parking spots for ConEd to equip with EVSE charging stations as part of an initial pilot project.

**Smart Charge New York Program**

NYC will earn approximately $150,000 per year for charging its municipal fleet during off-peak hours as a part of the Smart Charge New York Program. The program also offers incentives to private fleets.

While examples of such initiatives are still sparse, city departments of transportation and other departments can design pilot programs intended to explore the viability and interest in broader utility-city collaboration.

### 3.3.7 Utilizing curbside infrastructure for EVSE

In select cases, municipal utilities have creatively repurposed curbside infrastructure to provide for EVSE charging. For example, utility poles have been repurposed with EVSE charging stations. Businesses have also sought to explore how to attach EV charging stations to light poles. The use of this preexisting infrastructure can negate the need to "dig up ground" in order to establish the necessary wiring for EVSE, potentially reducing costs of EVSE.

#### Example: LADWP and EVSE on Utility Poles

LADWP, the municipal utility serving the Los Angeles area, has begun to explore the possibility of attaching EVSE to utility poles. It attached its first EVSE to a utility pole in Watts, California in December 2016.

### 3.3.8 Appointment of muni officials

The next several strategies outline steps that are uniquely applicable for municipal utilities. First and foremost, for municipal utilities, cities can appoint officials who can help guide the further development of EVs and EVSE. Depending on the governance structure, this can allow cities to exert greater control over utility policymaking with regards to EVs.

### 3.3.9 Offering financial incentives for EVs

Some municipal utilities have also offered discounted electricity rates for electric vehicles, which is distinct from time-of-use or other variable rates. The EV owner can receive a discount of the electricity use of the vehicle or the type of vehicle. Since the rates of municipal utilities are not regulated by State PUCs, city policymakers often have flexibility in crafting innovative rate schedules and compensation mechanisms for ratepayers who own an EV. Moreover, municipal utilities can also offer significant incentives for charging stations as well, targeted to specific housing sectors or market segments.

SECTION 4

# Organizing for Transformation

The rapid deployment of EVs is a complex endeavor that requires engagement with a broad range of stakeholders. This includes EV owners, advocacy groups, dealerships, utilities, installers, various levels of government, among others. Cities should not only build the in-house capacity necessary for successful promotion of EV activities, but should also partner with interested parties and leverage additional resources when possible. Through partnerships, cities can leverage the unique skillsets of each entity to accomplish ambitious EV goals.

## 4.1 Staffing Strategies

Cities should ensure that they have the staffing to provide the in-house capacity and technical expertise for managing the growth and development of EVs. Such staffing capabilities should be able to evaluate EVs as a component of both energy and mobility systems and prepare for future trends. The strategies listed below are intended to ensure that EV deployment is meaningfully integrated into broader city transportation and sustainability initiatives.

### 4.1.1 Investment in city staffing

Cities can establish positions with direct oversight over the deployment of EVs and installations of EVSE. The creation of a "point person" on such topics can alleviate the workload of other staff and clarify communications with the municipal government on all things EV-related. While finding the resources for an additional staff member can be challenging, the position can potentially lead to long-term economic and environmental benefits, and potentially may lead to increased revenue from taxes related to job creation, sales, utility fees, and innovative partnerships. Through financial support from nonprofits and foundations, cities can establish fellowships that provide indispensable expertise and capacity.

**Example: Sacramento County Electric Vehicle Working Group**

This working group, comprised of partners in the County of Sacramento, City of Sacramento, the Municipal Utility District, the Metropolitan Air Quality Management District, Valley Vision, the SacEV Owner's Association, SACOG, and Sacramento Clean Cities, constitutes a collection of public agencies, nonprofits, and stakeholders with the shared goal of deploying ZEVs in the Sacramento County.

### 4.1.2 Interdepartmental linkages and integration

EVs operate at the intersection of many different departments, ranging from transportation, housing, energy, and the provision of government services through fleets. To be effective, city EV policies should acknowledge and reconcile these perspectives to ensure that policies achieve maximal benefits in a holistic manner. City governments can accomplish this by creating an interdepartmental committee or by establishing an entirely new department from existing resources.

**Example: Electrification Coalition's Fellows Program in Atlanta**

Atlanta, in cooperation with the nonprofit Electrification Coalition, established a one-year fellowship program in its office of sustainability to explore the deployment of electric vehicles on a mass scale.

### 4.1.3 Steering committees and working groups

To gain outside expertise, cities can establish and recruit for steering committees and working groups, and offer a platform for conflicting stakeholders to gather and discuss their interests. Cities can leverage this resource to develop an advisory or coordinating committee on transitioning towards greater numbers of EVs. This effort can include private sector representatives (dealerships, developers, building owners, car owners), academics and policy experts, community and advocacy groups, and utilities. These steering committees also provide an opportunity for cities to pursue and accomplish other priorities related to transportation and EV deployment.

## 4.2 Partnerships and networks

Engagement with external partners and networks provides an essential means for cities to accomplish their clean transportation goals. As a relatively "neutral" platform, the cities provide excellent venues for networking and facilitating partnerships. Such partnerships allow each party to contribute their skillsets, and capabilities to EVs, extend the influence of cities across sectors, and can support broader advocacy efforts. The following section outlines partnerships that the city can undertake to remove three major barriers to EV deployment: costs, awareness, and infrastructure.

### 4.2.1 Partnering to reduce costs

Cities should focus on partnering to reduce both up-front and operational costs of EV use. There are many opportunities for partnerships to help reduce the cost of ownership. For example, cities can partner with other cities in a joint procurement to reduce the up-front costs. Moreover, cities can support the ongoing efforts of advocacy groups, utilities, and other entities to help establish policies at the state-level that may have a more direct impact on costs. Finally, cities can collaborate with utilities to seek charging and rate models that, under review by state regulators, minimize the ongoing costs of charging EVs.

### 4.2.2 Partnering to increase awareness

Cities can also take steps to increase awareness of EVs through marketing and communication efforts. These awareness and marketing efforts should cover all aspects of EVs, including financial incentives, environmental benefits, and general awareness. For example, cities can promote preexisting efforts by other entities, such as advertising a discount at a dealership or a rebate at a utility. Working with utilities on introductory offers for home charging stations can be an effective strategy for promoting EV purchases.[22] Conversely, if cities have established a financial incentive, they can partner with dealerships or utilities to ensure that such incentives are advertised by partners and captured by consumers.

22 Drive Electric Ohio, "Electric Vehicle Readiness Plan for Ohio, 2013, p. 37, available at: https://docs.wixstatic.com/ugd/cf3da3_b1f02f0e415640ec9de80c1c3c37eb84.pdf.

In terms of marketing for LMI communities, cities can develop partnerships with local stakeholder groups and community organizations to better understand the needs of LMI communities and whether EVs can be an effective means for solving those challenges. Some of these partnerships can help cities ensure that LMI communities can navigate the process of purchasing an EV and installing EVSE. They can also be better positioned to help change the perception that EVs are only for upper-income households.

### 4.2.3 Partnering to expand infrastructure

Cities can also foster partnerships with entities that both expand EVSE and improve the capabilities of EVSE. By providing city infrastructure for private use, cities can serve as a test bed for researchers at academic institutions or private companies seeking to test out new ideas or research. As previously described, steering committees and working groups provide an excellent resource for conducting rigorous research on the effectiveness of various policy interventions and the impacts of new technologies. Cities can also pool resources with other municipalities to site fast chargers appropriately and help to defray their costs.

## Technical Assistance Resources

Many technical resources exist to assist in the proliferation of EVs. Several such resources are noted below:

- **Alternative Fuel Toolkit:** This online toolkit, an initiative by FHWA and the Oregon Department of Transportation, aims to help transportation agencies learn, plan, and act to support the expansion of alternative fuel usage, including for EVs. Notable tools include the Alternative Fuel Vehicle Cost Calculator, an interactive Alternative Fuel Station Map, and a dashboard on Truck Parking and Truck Stop Electrification.
- **FHWA Alternative Fuel Corridors webpage:** FHWA's webpage on Alternative Fuel Corridors provides guidance on the corridor designation process, as well as miscellaneous support resources and webinars.
- **Electric Vehicle Cost-Benefit (EV-CB) Framework:** This spreadsheet-based tool assists with projecting societal costs and benefits from EV usage expansion.
- **AFLEET Tool:** This online calculator from Argonne National Laboratory allows for comparing vehicle technologies for NOx, PM and GHG emissions. Additionally, Argonne offers a similar calculator that focuses specifically on heavy-duty vehicles, the Heavy-Duty Vehicle Emissions Calculator.
- **Collablocation:** Geodesign for Facility Location: This online, open-source geodesign platform provides a collaborative way to consider and locate facilities, including charging facilities.
- **Electric Vehicle Infrastructure Planning Tools:** This Excel-based tool helps assess and locate EVSE along priority corridors.
- **Incentives Databases:** The Department of Energy and Plug-In America each offer resources detailing federal and state incentives for EVs.

SECTION 5

# Conclusion

As cities pursue broader climate goals, it will become increasingly necessary for them to explore pathways to decarbonizing the transportation sector, which now emits more greenhouse gases than the power sector. Along with innovations in other alternative fuel vehicles and transportation modes, EVs offer significant promise in reducing emissions in the transportation sector. Buoyed by declining prices, increased industry investment, and growing consumer interest, EVs will continue to be a pillar of transportation decarbonization ambitions.

Despite these trends in EV growth, the outcomes of the rising deployment of EVs for the electricity grid remain to be seen. While many utilities may stand to benefit from the increased load generated by EVs, public officials and other stakeholders must take care to ensure that the integration of EVs is executed in a manner that is equitable and delivers the potential benefits for consumers. Cities are an essential fixture of the institutional landscape that governs the deployment of EVs and associated EVSE.

This primer helps city decision-makers understand the contexts that govern EV development and deployment. By shedding light on the state, utility, and city-level incentives and regulations that govern electricity and transportation, this report supports city decision-makers in navigating their unique environments and identifying opportunities to make meaningful progress towards decarbonizing the transportation sector. It also arms cities with information on resources, partnerships, and organization strategies to accomplish those aims.

Drawing from the proliferation of city action plans and resources, focus groups, and an accompanying workshop, this report synthesizes the multitude of city-level policy innovations and advancements for electric vehicles. Due to the relative novelty of EV policies compared to other clean energy policy, many cities are still piloting and testing various approaches to deploying adequate infrastructure and EVs on their roads. Through its accompanying literature review, this report highlights where cities have achieved success and where promising next steps may lie.

SECTION 6

# Appendix

## 6.1 Demand growth for EV by state

| State | PHEV Sales 2014 | PHEV Sales 2017 | PHEV Sales Change (%) (2014-2017) | BEV Sales 2014 | BEV Sales 2017 | BEV Sales Change (%) (2014) |
|---|---|---|---|---|---|---|
| Alabama | 136 | 208 | 53% | 87 | 173 | 99% |
| Alaska | 39 | 44 | 13% | 11 | 41 | 273% |
| Arizona | 966 | 1141 | 18% | 766 | 1835 | 140% |
| Arkansas | 78 | 114 | 46% | 41 | 73 | 78% |
| California | 29797 | 44787 | 50% | 28749 | 50085 | 74% |
| Colorado | 722 | 1490 | 106% | 821 | 2666 | 225% |
| Connecticut | 505 | 1311 | 160% | 321 | 993 | 209% |
| Delaware | 97 | 266 | 174% | 43 | 135 | 214% |
| Florida | 2211 | 3062 | 38% | 2021 | 3511 | 74% |
| Georgia | 600 | 1034 | 72% | 9945 | 1393 | -86% |
| Hawaii | 257 | 609 | 137% | 865 | 1325 | 53% |
| Idaho | 102 | 153 | 50% | 51 | 88 | 73% |

| State | PHEV Sales 2014 | PHEV Sales 2017 | PHEV Sales Change (%) (2014-2017) | BEV Sales 2014 | BEV Sales 2017 | BEV Sales Change (%) (2014) |
|---|---|---|---|---|---|---|
| Illinois | 1059 | 1421 | 34% | 1033 | 2391 | 131% |
| Indiana | 409 | 495 | 21% | 288 | 438 | 52% |
| Iowa | 169 | 293 | 73% | 64 | 140 | 119% |
| Kansas | 136 | 239 | 76% | 65 | 213 | 228% |
| Kentucky | 141 | 196 | 39% | 58 | 164 | 183% |
| Louisiana | 85 | 159 | 87% | 71 | 124 | 75% |
| Maine | 137 | 340 | 148% | 55 | 124 | 125% |
| Maryland | 956 | 1787 | 87% | 551 | 1457 | 164% |
| Massachusetts | 756 | 2733 | 262% | 747 | 1899 | 154% |
| Michigan | 2651 | 2003 | -24% | 249 | 739 | 197% |
| Minnesota | 341 | 653 | 91% | 258 | 745 | 189% |
| Mississippi | 24 | 74 | 208% | 13 | 54 | 315% |
| Missouri | 427 | 531 | 24% | 256 | 619 | 142% |
| Montana | 56 | 61 | 9% | 29 | 82 | 183% |
| Nebraska | 134 | 158 | 18% | 58 | 102 | 76% |
| Nevada | 257 | 460 | 79% | 270 | 608 | 125% |
| New Hampshire | 137 | 573 | 318% | 83 | 215 | 159% |
| New Jersey | 1083 | 3040 | 181% | 844 | 1993 | 136% |
| New Mexico | 153 | 193 | 26% | 101 | 176 | 74% |
| New York | 3311 | 6593 | 99% | 1021 | 3497 | 243% |
| North Carolina | 601 | 1071 | 78% | 660 | 984 | 49% |
| North Dakota | 19 | 22 | 16% | 5 | 17 | 240% |
| Ohio | 834 | 1099 | 32% | 433 | 992 | 129% |

| State | PHEV Sales 2014 | PHEV Sales 2017 | PHEV Sales Change (%) (2014-2017) | BEV Sales 2014 | BEV Sales 2017 | BEV Sales Change (%) (2014) |
|---|---|---|---|---|---|---|
| Oklahoma | 133 | 156 | 17% | 107 | 535 | 400% |
| Oregon | 769 | 1688 | 120% | 1293 | 2300 | 78% |
| Pennsylvania | 938 | 2174 | 132% | 548 | 1172 | 114% |
| Rhode Island | 98 | 267 | 172% | 51 | 166 | 225% |
| South Carolina | 213 | 337 | 58% | 124 | 225 | 81% |
| South Dakota | 35 | 44 | 26% | 12 | 35 | 192% |
| Tennessee | 274 | 317 | 16% | 384 | 474 | 23% |
| Texas | 1528 | 2341 | 53% | 2192 | 3078 | 40% |
| Utah | 229 | 528 | 131% | 478 | 635 | 33% |
| Vermont | 201 | 519 | 158% | 79 | 352 | 346% |
| Virginia | 801 | 1555 | 94% | 529 | 1377 | 160% |
| Washington | 1291 | 2422 | 88% | 3354 | 4646 | 39% |
| West Virginia | 44 | 75 | 70% | 10 | 38 | 280% |
| Wisconsin | 435 | 656 | 51% | 191 | 920 | 382% |
| Wyoming | 18 | 27 | 50% | 6 | 24 | 300% |

Source: All figures from the Auto Alliance's Advanced Technology Vehicle Sales Dashboard. Available at: http://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/

## 6.2 Status of EVs in the utility rate base

| State | Status: Approval, Denial, Pending | Utility | Date | Explanation |
|---|---|---|---|---|
| Alaska | Approved | Alaska Electric Light and Power Company | Oct-17 | Alaska Electric Light & Power was approved to install and maintain a Level 2 EV charging station on a customer's property for a monthly fee of $11.28. |
| Arizona | Pending | Arizona Public Service | Ongoing | Arizona Public Service is seeking to invest $3.58 million in pilot programs for EVSE charging stations and school bus EVs. |
| California | Approved | Pacific Gas & Electric<br>San Diego Gas & Electric<br>Southern California Edison | Jan-18 | Pacific Gas & Electric, San Diego Gas and Electric, and Southern California Edison received approval to pursue 15 pilot projects for EVs at a combined budget of $42 million. Some exploratory areas include electrification of school buses, delivery trucks, truck stops, fast charger installation, and car dealership incentives. |
| District of Columbia | Pending | Pepco | Ongoing | Pepco is seeking approval for pilot programs that allow for discounted EVSE installations and special electricity rates, including deployment of up to four fast chargers owned by PEPCO, with a total budget of $1.7 million |
| Delaware | Pending | Delmarva Power and Light | Ongoing | Delmarva is seeking approval for a PEV program, including installation of chargers owned by Delmarva, with a total budget of $1.7 million |
| Florida | Approved | Duke Energy Florida<br>Gulf Power | Nov-17<br>May-17 | Duke Energy received approval to move forward with a pilot program of installing and owning at minimum 530 EVSE at customer locations with a budget up to $8 million. Gulf Power received approval for a similiar plan with $62 million increase in the rate base. |
| Kansas | Denied | Kansas City Power & Light | Sep-16 | Regulators rejected KCP&L's plan to install 1,000 charging stations that would cost $5.6 million to ratepayers. |

| State | Status: Approval, Denial, Pending | Utility | Date | Explanation |
|---|---|---|---|---|
| Massachusetts | Approved | Eversource | Nov-17 | Eversource received approval for $45 million investment in EV charging infrastructure, including both fast and level-2 chargers. |
| Michigan | Denied | Consumers Energy | Feb-17 | Consumers Energy withdrew its plan to install 800 EV charging stations with a cost of $15 million after opposition by state regulators and the attorney general due to ratepayer funding. |
| Minnesota | Approved | Xcel Energy | May-18 | Xcel Energy has received approval for a pilot program installing Xcel-owned EVSE with upfront or ongoing fixed monthly fees from the consumer. |
| Missouri | Denied | Ameren | Apr-17 | Ameren's plan to install six charging stations at an approximate investment of $700,000 was rejected by state regulators. It is now seeking approval for "Charge Ahead", which would partner with third party companies to install charging stations. |
| Nevada | Approved | NV Energy | May-18 | NV Energy received approval to own and operate EVSE and include them in its rate base. |
| Ohio | Approved | AEP Ohio | Apr-18 | AEP Ohio received approval for a rebate incentive program for 300 Level 2 charging stations and 75 DC Fast charging stations. |
| Oregon | Approved | Pacificorp | Feb-18 | Pacificorp was approved for $4.6 million investment in EV charging infrastructure. |
| Oregon | Approved | Portland General Electric | Feb-18 | Portland General Electric was approved for $4.3 million investment in EV charging infrastructure. |
| Rhode Island | Pending | National Grid | Ongoing | National Grid's recent filing in Massachusetts include $3.6 million for power sector modernization, which includes EVSE. |
| Washington | Approved | Avista | Ongoing | Avista already operates an EVSE pilot program and ahs requested an extension of the program to June 30, 2019. |

# SECTION 7
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# About Cadmus

Cadmus is a strategic and technical consultancy compelled to help solve the world's most challenging problems. We assemble outstanding teams of leading experts who work seamlessly across disciplines to help our clients achieve extraordinary results. From energy, water, and transportation to safety, security, and resilience—together, we are strengthening society and the natural world. Cadmus' more than 600 consultants serve government, commercial, and nongovernmental organizations around the world.

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