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Incorporating EV Charging Infrastructure in Frederick County

COURSE

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PALS

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PALS Partnership for Action Learning in Sustainability

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ABOUT PALS

The Partnership for Action Learning in Sustainability (PALS) is administered by the National Center for Smart Growth at the University of Maryland, College Park (UMD). It is a campus-wide initiative that harnesses the expertise of UMD faculty and the energy and ingenuity of UMD students to help Maryland communities become more environmentally, economically, and socially sustainable. PALS is designed to provide innovative, low-cost assistance to local governments while creating real-world problem-solving experiences for University of Maryland graduate and undergraduate students.

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Executive Summary

The purpose of this project is to examine codes, ordinances, and other incentives from jurisdictions around the US to inform recommendations for changes to Frederick County, Maryland's codes and ordinances regarding electric vehicle (EV) charging stations and electric vehicle supply equipment (EVSE).

While both the federal government and the State of Maryland have passed bills investing in programs to increase EV adoption, the locations of charging stations remain a major inhibitor to EV adoption. This is especially an issue in Frederick County, where much of the area is rural and access to EV charging stations is limited. The County seeks to remedy this by locating more EV charging stations in commercial, industrial, and multi-unit dwelling (MUD) residential areas.

This project pursues five objectives. The first is to identify codes and ordinances that support EV-readiness in multifamily residential, commercial, and industrial areas. This will help Frederick County businesses and organizations take measures to expand EV adoption and broaden the use of EV chargers.

Second, this project aims to identify codes and ordinances that illustrate EV-readiness in commercial and residential buildings undergoing significant renovation. This information will aid in determining proper EV infrastructure requirements for a wide array of buildings. The third objective is to define significant renovation.

The fourth is to examine the positive and negative aspects of mandating EV-readiness, and the fifth objective examines the costs of adopting EV infrastructure.

The project divides its research into regions: Northeastern, Southern, Midwestern/Mountainous, and Western. The findings were compiled and entered into a spreadsheet to organize and simplify them.

Results for the Northeastern Region found twenty-five incentives, two codes or ordinances, and nine other initiatives, with tax rebates making up a large portion of incentives offered. In the Southern Region we found twenty-three incentives, no codes or ordinances, and twenty-five other initiatives, that included

parking requirements for commercial and residential areas, Level 2 charger and DC fast charger (DCFC) rebates, and funding to support the expansion of EV infrastructure.

The Midwestern/Mountainous Region offers six incentives, three codes and ordinances, and one other initiative. As in other regions, incentives include grants for installing charging infrastructure, a rebate for the purchase and installation of a Level 2 charger, along with ordinances that detail EV parking space requirements.

Lastly, the Western Region offers four incentives, six codes and ordinances, and five other initiatives, including transitioning businesses to EV fleets, subsidies for public charging stations, and unique infrastructure projects that focus on transforming streetlights to accommodate EVs.

Overall, we recommend that Frederick County implement policies that ease the financial burden of purchasing and installing EV charging stations for low-income communities, encourage businesses to invest in EV fleets, and establish a tax credit program to promote the installation of charging stations.

Introduction and Background

As stated by the U.S. Environmental Protection Agency (EPA), unless humanity drastically decreases greenhouse gas (GHG) emissions, society will continue to experience undesired consequences such as climate change (City of Chicago Environmental Protection Agency, n.d.). According to the United Nations (UN), climate change is the “long-term shifts in temperatures and weather patterns.” (United Nations, n.d.)

Several practices influence the earth’s climate, such as deforestation, livestock farming, and burning fossil fuels (European Commission, n.d.). Carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated gasses are the main drivers of the greenhouse gas effect, with the mass of CO2 present in the atmosphere as the largest current contributor to this effect (European Commission, n.d.).

The transportation sector is one of the largest contributors to climate change, with fossil fuels the source of nearly a quarter of CO2 emissions and 14% of annual global emissions (Ge, Wang, 2019). In the US, this is especially concerning as GHG emissions have been rising since 2012, despite a previous decrease in 2005 (Ge, Wang, 2019). However, in recent years, Maryland has made significant strides toward curbing GHG emissions by setting an aggressive goal of 60% GHG emission cuts from 2006 levels by 2031 and achieving net zero emissions by 2045 (Cityoffrederickmd.gov, 2024).

The State's Climate Solutions Now Act of 2022 mandates strict carbon reduction measures. These include the electrification of government buildings, phasing out gas-powered school buses by 2025, and enacting more stringent building codes to improve energy efficiency (Kigochi, 2024).

To reduce the financial burden of this energy transition, Maryland offers tax incentives and rebates that subsidize the purchase and operation of green technologies such as EVs and the installation of renewable energy sources like solar panels. The Clean Cars Act offers residents rebates of up to $3,000 for the purchase of EVs, and the Maryland Energy Administration (MEA) provides grants that help businesses shift to clean energy technologies (Kigochi, 2024). A tax rebate program allows consumers who purchase "qualified alternative fueling equipment for installation" after January 1, 2023, through December 31, 2032, to receive a tax credit of up to 30% of the cost, capped at $1,000 (Maryland EV, n.d.).

Additionally, Maryland is a member of the Regional Greenhouse Gas Initiative (RGGI), a market-based cap-and-trade program that sets CO2 emissions limits for the power sector and sells emissions allowances. This program incentivizes companies to adopt cleaner energy practices. Revenue from the allowance sales is reinvested into clean energy projects and energy efficiency programs across the State.

While emissions reduction goals and initiatives at the State level are key to making widespread change, as seen in the substantial strides Maryland has made in its sustainability transition, local municipalities play a crucial role. Municipalities can best determine what initiatives would be the most effective for

their citizens and businesses. While policies and actions at higher levels of government are crucial for ensuring progress, municipalities can supplement these efforts and significantly speed up adoption in their communities.

EVs are a key technology in the automotive industry, shifting the traditional internal combustion engine (ICE) to a more sustainable and eco-friendly mode of transportation. When paired with electricity produced from a carbon-free energy source, EV tailpipe pollutants are essentially zero (U.S. Department of Energy, 2022).

Maryland's legislative actions encourage residents and require government agencies to adopt EVs. A recent statute, §12-205 (Article Public Safety) defines an electric vehicle as "a vehicle that uses electricity for propulsion," and EVSE as "a device or facility for delivering electricity to an electric vehicle" (Terrasa et al., 2023). It mandates electric vehicle readiness in all newly constructed or renovated housing units (Terrasa et al., 2023). More specifically, the statute requires a new or renovated housing unit to possess EVSE or an EV-ready parking space (Terrasa et al., 2023). An important caveat of §12–205 is that it only applies to dwellings with separate garages, carports, or driveways, unless they undergo major renovations, a term that the statue has not yet defined.

The terms EV-capable, EV-ready, and EV-installed are key distinctions in ordinances and building code requirements regarding EV charging. EV-capable refers to parking spaces equipped with the necessary electrical panel capacity and conduit to support future installation of EV chargers. This setup allows easier, cost-effective installation of chargers in the future.

EV-ready goes a step further, including not only conduit and panel capacity but also wiring that makes the space immediately ready to accommodate an EV charger, simplifying the final step of adding the charging station. Finally, EV-installed spaces have fully operational EV charging stations in place, allowing vehicles to charge immediately.

As part of these installations, various charger levels are specified based on power and charging speed. Level 1 chargers are standard 120-volt outlets, suitable for slower, overnight charging, often in residential settings. Level 2

chargers operate at 240 volts, providing faster charging speeds, suited for workplace or commercial locations where vehicles are parked for several hours. DC fast chargers are the fastest, charging at 480 volts, and are primarily intended for locations like highway rest stops where drivers need quick recharges.

Increasingly, municipal-level EV infrastructure codes mandate the inclusion of Level 2 and, in some cases, DC fast chargers in new developments. By requiring a percentage of parking spaces to be EV-ready, these policies aim to create more accessible, efficient EV charging infrastructure while avoiding the higher cost of retrofitting spaces.

Given that most existing housing stock is exempt from Statute §12–205 and that the State seeks to achieve total removal of fossil fuel-based vehicle sales by 2035, municipalities need to find ways to incentivize or otherwise support EV adoption through increased EVSE infrastructure installation.

Informing municipal officials of laws and codes instituted by other municipalities would help achieve this goal. Crafting and adopting codes and ordinances must consider existing infrastructure, demographics, and geographic characteristics of affected communities.

Municipalities must also consider the benefits and challenges associated with installing EVSE infrastructure. Potential benefits of EV-readiness include controlling customer dwell time (time spent at a charger), attracting a broader audience for EVs, offering convenience for residents, and empowering businesses and municipalities to make informed, strategic choices. Governments can promote EV adoption through incentives and grants without fully funding installations, encouraging private sector involvement while allocating resources to other environmental initiatives.

It’s also essential to address potential challenges, such as installation costs and accessibility issues, including obstacles for those with limited physical abilities.

A thorough assessment of the benefits and challenges will ensure that charging solutions are adaptable, resource-efficient, and responsive to evolving

community needs. This holistic approach supports long-term sustainability and helps meet policy goals and standards, minimizing disruptions and avoiding unnecessary overspending.

Frederick County, Maryland

Nearly half of Frederick County's GHG emissions are produced by the transportation sector (Electric Vehicle Readiness Plan, Frederick County, MD, n.d.). The county aims to reduce GHG by 50% before 2030 and to achieve zero GHG emissions by 2050 (Developing A Clean Green Fleet, Frederick County, MD, n.d.). Frederick County's location, adjacent to the State's panhandle and north of the Washington, DC metropolitan area, where I-70 and I-270 meet, makes the county a desirable location for industrial and commercial activities, including many road-based industries such as the trucking industry. The county's commercial and industrial centers provide a unique opportunity for promoting the greening of local industries through increased access to EVSE. Additionally, many residents in the county's growing population lack residential access to EVSE. Increasing access to charging stations in and around commercial locations can enhance the adoption of EVs by consumers who lack access to residential EVSE.

In its efforts to increase access to charging stations, the Frederick County Division of Energy and the Environment is exploring building codes and parking and zoning ordinances that will accelerate the transition to electric vehicles by county residents. As part of this exploration, the division seeks to learn from other municipalities' ordinances and codes that promote EV use. The division also seeks to learn the cost differences associated with implementing varying levels of EV-readiness as well as the potential benefits and disadvantages of implementing one EV-readiness approach over another.

Objectives

This project's goal is to assist Frederick County in increasing EV adoption throughout the county through its implementation of incentives, codes, ordinances, and other initiatives informed by a comprehensive review of actions in other municipalities to promote EVSE infrastructure and EV adoption. This project has four objectives.

1) Identify EVSE codes and ordinances that mandate certain levels of EV-readiness in new multifamily residential, commercial, and industrial development.
2) Identify EVSE codes and ordinances that mandate certain levels of EV-readiness in residential, commercial, and industrial buildings undergoing significant renovation.
3) Identify the pros, cons, and other considerations of requiring different levels of EV-readiness (i.e., EV-capable vs. EV-ready vs. EV-installed).
4) Identify the cost difference of installing EV infrastructure upfront vs. retrofitting parking spaces. If infrastructure is EV-installed, can it become a stranded asset?

Methodology

EVSE codes and ordinances requiring certain levels of EV-readiness were identified in a keyword search using the Google search web engine. This process incorporated both broad and targeted search methods. Broad keyword searches were used first to understand the general landscape of EV infrastructure policy, which helped establish a baseline of commonly discussed jurisdictions. As the research progressed, more targeted searches were conducted by pairing relevant keywords (such as “EV-ready building codes” and “EV infrastructure law”) with the names of specific states, cities, or counties identified as leaders or pioneers in EV policy. The jurisdictions for further examination were chosen based on a combination of academic and policy literature reviews. Scholarly articles, government reports, and case studies revealed the states and cities with a proactive stance on EV infrastructure.

Search phrases included electric vehicle infrastructure, EV charging, building renovation codes, electric vehicle EJ (environmental justice), and electric vehicle infrastructure law.

The searches were made specific to various levels of authority or governance by adding the name of a state or jurisdiction identified as a known or potential source of one or more EVSE-related codes or ordinances. The governmental unit modifier for the keyword search was selected based on several criteria, such as existing state-level EV infrastructure incentives, known leadership in environmental and transportation policy, and regional or demographic similarities to Frederick County.

By including jurisdictions such as California, New Jersey, New York City, Montgomery County, Maryland, and other locations with established EV infrastructure codes, the search targeted areas that had set precedents in EV policy or had conditions that could make their policies relevant to Frederick County. This approach ensured that the research captured a comprehensive array of EV-ready building codes and ordinances applicable to similar or aspirational policy environments.

The US was examined by subdividing the country into four regions. The regions consisted of states in the Northeast, South, Midwest and mountainous US, and the West. Within each region, tax rebates, incentives, codes, and ordinances for EVSE adoption in residential, commercial and industrial settings were examined. A single document was created to limit redundancy in identified information to facilitate synthesis of contrasting policy recommendations.

An important consideration was distinguishing between regulations and incentives at the state and local jurisdiction levels. If a state is proactive in setting requirements, this can influence initiatives by local jurisdictions. Additionally, not all states share legislative authority with counties and municipalities to the same degree. In Maryland legislative flexibility presents Frederick County with a unique opportunity to establish its own ambitious standards, unlike jurisdictions that must defer to state standards.

For each reliable source identified, its citations were explored for further details about political mechanisms, and implemented legislation, ordinances, and codes. Exploring the citations of keyword-searched sources allowed for thorough vetting of a source's legitimacy and expedited the research.

To determine the cost difference between upfront EVSE installation and retrofitting, a comparative cost analysis was conducted. It was based on data from industry reports, case studies, and government resources on initial installation and retrofitting costs.

Sources such as the Department of Energy, Virginia Clean Cities, and Southwest Energy Efficient Project provided insights into cost variables, including labor, materials, electrical capacity, and permitting requirements. Cost estimates for upfront installation were examined in new construction projects, where EV-readiness features were integrated from the outset, reducing the need for structural modifications. Retrofitting costs were assessed by reviewing data on projects requiring additional electrical upgrades, trenching, and potential structural modifications to accommodate EV infrastructure. This approach gave a side-by-side comparison that highlighted the financial advantages or challenges of each option, factoring in long-term maintenance and energy efficiency savings when applicable.

Results and Findings

Table 1 summarizes the incentives, codes, ordinances, and initiatives identified by this project. It summarizes the specific incentives, codes and ordinances, and initiatives presented in Tables 2 through 5, as well as additional identified incentives, codes and ordinances, and initiatives with wording that was deemed nearly the same as information reported in Tables 2 through 5.

As such, Table 1 summarizes the identified sources from all governments that were found during this project's research and that are reported in the master spreadsheet. This spreadsheet can be found at: (https://docs.google.com/spreadsheets/d/1Y4SfNZg6GsFxWCraCKcQ7rjBX053pVIxLOa1Q1Uo3mw/edit?gid=0#gid=0)

Table 1. EV incentives, codes, ordinances, and initiative by US regions that promote EVSE adoption in residential, commercial, and industrial locations

	Incentives	Codes/Ordinances	Other Initiatives
Northeastern Region	25	13	9
Southern Region	23	5	25
Midwestern/ Mountainous Region	6	3	1
Western Region	4	6	5

Northeastern Region Summary

Table 2 reveals that many states in the Northeastern Region use tax rebates to incentivize EV adoption. Examples include Massachusetts' MOR-EV program, which offers up to $5,000 for low- to middle-income buyers of EVs under $55,000, and subsidies provided by the State of Maine that cover up to 80% of Level 2 charger installation costs for businesses.

Virginia has adopted policies that emphasize EV infrastructure readiness by requiring building code provisions such as EV-related measures for new and

renovated buildings exceeding 5,000 square feet. Similarly, a Montgomery County, Maryland, ordinance mandates EV charging in 20% of parking spaces in new facilities. Various states, including New Jersey and Vermont, support public and workplace charging through generous grant programs, while urban initiatives like New York City's EV School Bus Initiative target the elimination of diesel vehicles. Additionally, energy utilities like New York's Con Edison incentivize off-peak charging with financial rewards, and Washington, D.C. supports EV adoption with public permits and free, fast-charging incentives.

Table 2. Incentives, codes, ordinances, and other initiatives adopted by Northeastern Region states or municipalities to promote EVSE adoption in commercial, industrial, and multifamily locations

	Incentives
Delaware statewide Delaware Clean Transportation Incentive Program	- rebates up to $3,500 per port to purchase Level 2 EV charging stations for use at public, workplace, commercial fleet, and multifamily dwelling locations - public access, fleets, and workplaces receive rebates up to 60% of charging station cost for commercial projects and up to 80% for government and nonprofit projects - maximum rebate is $2,500 for a single-port charger and $5,000 for a dual-port charger, limited to 10 charging ports (or five dual charging stations) - available since May 1, 2024 *(Power Sonic, n.d.)*
Maine statewide Maine Jobs and Recovery Plan	- subsidy for installing Level 2 EV chargers at hotels, restaurants, retail, and public parking lots where vehicles can charge for an hour or more - reimbursement up to 80% of installation costs, with a maximum of $5,000 per Level 2 plug for networked chargers or $2,000 for non-networked chargers - application deadline November 15, 2022, with projects completed by May 31, 2023

	(Green Energy Times, 2022)
Massachusetts statewide MassEVIP	- grants for public and commercial entities - covers 80% of installation cost (up to $50,000 per port) - aimed at level 2 and DCFC installation - submitted June 6, 2024 *(Massachusetts Department of Environmental Protection., n.d.)*
Massachusetts statewide MassEVIP Per-port rebates to install level 2 or DCFCs	- rebates for EV-capable installations, capped at $50,000 per facility - for businesses, fleet facilities, and multi-unit dwellings - must own, lease, or operate a site where vehicles sit at least 2 hours *(Massachusetts Department of Environmental Protection, n.d.)*
New York ConEdison service area Smart Charge New York Program	- charging stations and car owners can earn money charging their cars during off-peak hours: 2 pm to 6 pm - 10 cents per kWh for off-peak charging - $35 per month to avoid charging during peak hours - program runs from June 1 to September 30 *(Consolidated Edison Company of New York, Inc., n.d.)*
North Carolina Duke Energy service area Fleet EV Charging	- rebate up to $2,500 for commercial/industrial businesses managing EV fleets *(EUCI, 2023)*
Vermont statewide Electric Vehicle Supply Equipment (EVSE) Grant Program	- covers between 90-100% of cost to install EV charging stations in workplaces, public locations, and multifamily residences - launched July 6, 2023 *(Vermont Agency of Commerce and Community Development, n.d.)*
Virginia Dominion Energy service area Level 2 Charging Program	- rebates for commercial and industrial customers up to 50% of the cost of installing Level 2 EV chargers

	- maintenance support for stations installed through the program, and installation and maintenance of residential Level 2 EV chargers for a fixed monthly fee - Oct 1, 2023 *(Level 2 Charging Program | Virginia | Dominion Energy, 2024)*
Virginia Fairfax County Charge Up Fairfax	- reimbursements between $5,000 and $10,000 for communities installing Level 2 single/double port charging stations - application deadline November 8, 2024 *(Fairfax County Government, 2024)*
Washington, D.C. district-wide DC Fast Charging Expansion	- DC Fast Charging networks in major East Coast cities - incentives for workplaces to install charging ports include rebates, reduced parking fees, and free charging at various public stations - fosters EV adoption in urban business districts - expansion announced August 22, 2024 *(East Coast Advice, n.d.)*
Codes and Ordinances	
Maryland Montgomery County Zoning Text Amendment 14-01	- requires new parking facilities to include EV charging equipment for 20% of spaces, prioritizing future expansion to support increased EV adoption as demand grows - completed February 14, 2012 *(Montgomery Planning Board, 2014)*
New Jersey statewide New Jersey Uniform Construction Code	- requires all EVSE installations to comply with the New Jersey Uniform Construction Code, including safety standards for electrical installations to ensure safe operations - effective September 1, 2021 *(New Jersey Department of Community Affairs, 2021)*
New York statewide New York State Uniform Fire Prevention and Building Code	- requires electrical work, including EVSE installations, be performed by a licensed electrician - local amendments may specify further licensing requirements - released in 2020

	(New York State Energy Research and Development Authority., n.d.)
New York statewide Code Outreach Program Ordinance	- simplified permitting process for EV charging stations - published January 8, 2024 *(New York Department of State, 2023)*
Virginia Dominion Energy service area Smart Charging Infrastructure Pilot (SCIP) Program	- rebates for installation of Level 2 and DCFC chargers to support the adoption of electric vehicle (EV) chargers - multi-family properties: $4,000 for dual-port stations, $11,000 for make-ready - workplaces: $2,700 for dual-port stations, $11,000 for make-ready. - transit systems: $53,000 for dual-port stations, $73,000 for make-ready - commercial customers: $35,000 for dual-port stations, $73,000 for make-ready - ended December 31, 2022 *(Powering Smart Transportation | Virginia | Dominion Energy, 2022)*
Virginia Appalachian Power Company service area ENERGY STAR® Electric Vehicle Charging Equipment	- customers can receive one ENERGY STAR® Electric Vehicle Charging Equipment rebate per calendar year. Only Level 2 Chargers are eligible for rebate - rebate can't exceed the purchase price (excluding taxes, shipping, and installation charges) - 1/1/2022 and 12/31/2026 *(ENERGY STAR® Electric Vehicle Charging Equipment, 2019)*
Virginia statewide Parking of Vehicles in Parking Spaces Reserved for Charging Electric Vehicles: Civil Penalties	- any vehicle not charging actively can't park in a designated EV parking space - penalty for violation is up to $25, and local governments may issue an additional penalty of up to $25 - enacted April 27, 2022

	(*§ 46.2-1219.3. Parking of Vehicles in Parking Spaces Reserved for Charging Electric Vehicles; Civil Penalties*, 2024)
Virginia statewide EV Charging Station New Construction and Building Renovation Requirement	- new buildings more than 5,000 square feet or renovation more than 50% of the building's value must include EV charging infrastructure - EV charging infrastructure must support charging for every centralized fleet vehicle based at that building - enacted March 31, 2021 (*Virginia Code 2.2-1182 and 2.2-1183)*
Washington, D.C. district-wide EV make-ready parking spaces in new multi-unit residential and commercial buildings	- projects with at least three off-road spaces need "make-ready" EV infrastructure that can accommodate chargers in 20% of the parking spaces *(Ordinance: § 6–1451.03a)*
Other Initiatives	
Maine statewide Zero Emission School Bus Acquisition and Working Group	- review types of zero-emission school buses; their benefits and challenges - could help promote EV practicality - findings published January 2023 *(U.S. Department of Energy, Alternative Fuels Data Center., n.d.)*
Maine statewide Dirigo Business Incentives	- address workforce challenges by encouraging businesses to invest in training and capital investments as well as job creation - tax credits for investing in training in high-value sectors like manufacturing and agriculture - industrial and commercial entities can invest in electrician and contractor training programs to establish an EVSE maintenance sector - began January 1, 2025 *(Maine Department of Economic and Community Development, n.d.)*
Maryland statewide	- Department of Energy funded, focus on I-95 corridor - to build an extensive charging network for medium-sized,

East Coast Commercial ZEV Corridor	zero-emission vehicles *(CALSTART, 2023)*
New Jersey statewide EV Tourism	- owners and operators of unique attractions such as parks, boardwalks, and lodging establishments can apply for up to six Level 2 and two DC Fast Chargers - applications accepted until May 30, 2024 *(New Jersey's Clean Energy Program, n.d.)*
New York statewide New York City's EV School Bus Initiative	- replace diesel buses with EV school buses - initiative started in 2022 *(Earth.org, n.d.)* In Frederick, fully electric school buses throughout the county could lower parent concerns. Fewer bus breakdowns, no exhaust emissions and an upgrade in design may persuade parents to purchase an EV
Virginia City of Virginia Beach Virginia Beach Resort Area Mobility Plan and Freebee Rideshare	- app-based rideshare service uses five city-owned, all-electric Tesla Model X EVs. Rides on-demand Monday-Sunday: 11 a.m.-11 p.m. - service is free - June 17th, 2022 *("City of Virginia Beach—Service Area", n.d.)*
Washington, D.C. district-wide Department of Transportation Electric Vehicle Charging Station Program	- public space permits for EV charging station vendors on residential blocks and business corridors - requires dual ports and Level 2 or DC fast chargers - includes cord covers for charging wires on sidewalks from buildings to vehicles on the street *(District Department of Transportation, n.d.)* could suit Frederick County row house neighborhoods and strip malls

Southern Region Summary

Table 3 highlights how Southern Region communities are advancing EV adoption through tailored infrastructure programs and mandates. Georgia has taken notable steps with statewide ordinances requiring all public EV charging stations to measure and display electricity dispensed per kWh, with violations subject to fines up to $1,000 (GA Code § 10-1-222 (2023)). Atlanta has implemented a forward-looking code mandating an EV-capable parking space for single-family homes and 20% EV-capable parking in multi-unit dwellings and commercial properties *(Atlanta Passes Electric Vehicle Readiness Ordinance, 2017)*. In Kentucky, the ZEV Infrastructure Program allocates $3.056 million for EV charging, with 75% dedicated to DC Fast Chargers and requiring 50% cost matching, supporting statewide EV infrastructure readiness *(Kentucky and the Volkswagen Settlement—Kentucky Energy and Environment Cabinet, 2019)*.

While some states, like Oklahoma, offer grants covering up to 80% of EV project costs, the Southern Region generally relies on utility-led initiatives for incentives, with local government codes and ordinances remaining limited. Examples from Georgia and Kentucky demonstrate growing local efforts to complement utility programs, focusing on readiness and equitable EV infrastructure expansion.

Table 3. Incentives, codes, ordinances, and other initiatives adopted by states or municipalities in the Southern Region to promote EVSE adoption in commercial, industrial, and multifamily locations

Incentives	
Alabama Alabama Power service area Commercial Electric Vehicle (EV) Charger Rebates	- $2,000 rebate per port for Level 2 chargers: 6.6 kW, 4-20 ports per site, 60 applications/year - $5,000 rebate per port for DC fast chargers: 20 kW, 4-15 ports per site, 30 applications/year - $10,000 rebate per port for DC fast chargers: 50 kW, 2-4 ports per site, 24 applications/year - $15,000 rebate per port for DC fast chargers: 100 kW, 2-4 ports per site, 24 applications/year

	- $20,000 rebate per port for DC fast chargers: 150 kW, 2-4 ports per site, 24 applications/year - began January 5, 2024, with complete construction by December 1, 2024 *(Make Ready Program for Businesses, n.d.)*
Alabama statewide Electric Vehicle Fee	- annual fees: $203 for all-electric vehicles; $103 for plug-in hybrids - fee increase: $3 every four years - supports the Electric Transportation Infrastructure Grant Program for EV charging grants - January 1, 2020 *(Alabama Code Title 40. Revenue and Taxation § 40-12-242, n.d.)*
Arkansas statewide Arkansas Level 2 Electric Vehicle Supply Equipment (EVSE) Rebate Program	- rebates from the state's Department of Environmental Quality to government, private, and nonprofit entities for construction and installation of Level 2 EV charging stations - public access government applicants: $6,850 for 1 port, $9,300 for 2 or more ports - non-government applicants: $5,325 for 1 port, $7,225 for 2 or more ports - private access workplaces and multi-unit dwellings: $1,875 for 1 port and $3,375 for 2 or more ports - applications accepted since February 1, 2021 *(E and E Continuing Investment in EV Charging Infrastructure—Energy and Environment, 2022)*
Florida TECO Service Area TECO Drive Smart Program	- up to $5,000 per port rebate for purchase and installation of public EV charging stations. - eligible locations include workplaces, public or retail sites, multi-unit dwellings, income-qualified areas, and government sites - TECO will install, own, and maintain the chargers - *Four-year program starting December 2022* *(Drive Smart, 2024)*

Florida Florida Power & Light service area Commercial Electric Vehicle (EV) Charger Incentive	- FPL will purchase, install, operate, and maintain direct current (DC) fast-charging EV chargers on commercial properties at no cost to the site host - enacted August 3, 2023 *(FPL | FPL EVolution | Business Solutions | EV Tariffs, 2024)*
Georgia statewide EV Charging Station Tax Credit	- tax credit for eligible businesses to purchase or lease and install qualified EV charging stations - 10 % credit, up to $2,500 - tax credit may be carried forward for up to five years (three years starting January 1, 2025) - *enacted: Jul 1, 2015, amended: May 6, 2024* *(Clean Vehicle Related Tax Credits, n.d.)*
Kansas Energy service area	- rebates to commercial and multifamily customers - up to $2,500 per Level 2 EV charger port and up to $20,000 per direct current (DC) fast charger - maximum rebate of $25,000 per site for up to ten Level 2 EV charging ports *(Multifamily EV Charging Rebate - Evergy, 2024)*
Louisiana Southwestern Electric Power Company service area Electric Vehicle (EV) Charger Rebate	- $250 rebate for residential customers for the installation of ENERGY STAR-certified Level 2 EV charger - eligible for charging equipment installed after January 1, 2017 *(Charging Stations, 2024)*
Louisiana Entergy service area	- rebates for commercial customers who purchase select EVs and Level 2 EV chargers - electric forklifts, up to $500; electric drayage trucks, $1,500; electric truck refrigeration, up to $25,000; electric scissor and boom lift, $100; light-duty electric burden carrier, $100; electric walk-behind floor scrubber, $100; electric riding floor scrubber, $150; electric golf cart, $150, Level 2 EV charger, $250, Direct Current Fast Charger (DCFC), up to $1,500 *(Entergy Electric Technology Programs and Incentives, n.d.)*

Louisiana Entergy service area Electric Vehicle Charging Station Time-of-Use (TOU) Rebate	- Entergy offers residential customers in New Orleans a $7 monthly rebate to charge EVs at least three times per month during off-peak hours, 9 pm - 5 am *(Energy Smart BYOC, 2024)*
Louisiana New Orleans Electric Vehicle (EV) Charger Pilot	- installed 30 free Level 2 EV chargers at 25 sites throughout the city, usable through the ChargePoint app - operational December 2023 *(Electric Vehicles and ETech, n.d.)*
Mississippi Mississippi Power service area Commercial Electric Vehicle (EV) Charger and Off-Road Equipment Rebate	- rebates for commercial customers purchasing Level 2 EV chargers, truck electric auxiliary power unit plugs, or truck electric transport refrigeration units - Level 2 EV charger, truck electric auxiliary power unit plug, or truck electric transport refrigeration unit: $2,000, Electric forklift: up to $1,000 *(Electric Vehicles, 2021)*
Mississippi Mississippi Power service area Residential Electric Vehicle (EV) and EV Charger Rebate	- rebates for residential customers purchasing new, leased, or pre-owned electric vehicles (EVs) and Level 2 EV chargers - new, all-electric vehicle: $1,250; leased all-electric vehicle: $1,000; pre-owned all-electric vehicle: $750; new plug-in hybrid electric vehicle: $750, leased PHEV: $500, pre-owned PHEV: $500, Level 2 EV charger: up to $250 *(Electric Vehicles, 2021)*
North Carolina Energy United service area	- residential customers get a $500 rebate for installing a Level 2 EV charging station - archived October 14, 2022 *(Rebates | EnergyUnited, 2023)*
North Carolina Duke Energy service area Park & Plug Program (MUD and Commercial)	- Duke Energy owns and operates 25 locations at multifamily buildings where free Level 2 chargers have been installed - turnkey station installation includes equipment, installation, warranty, and network connection services, free of charge *(Park & Plug - EV Infrastructure - Duke Energy, 2024)*

Oklahoma statewide Income Tax Credit for Electric Vehicle Infrastructure	- income tax credit for 45% of project cost *(Electric Vehicles | City of OKCm 2021)*
Oklahoma statewide Alternative Fuel Vehicle (AFV) Tax Credit	- one-time tax credit up to $50,000 available for purchasing or converting a vehicle to alternative fuel - tax credits based on gross vehicle weight rating (GVWR): 6,000 lbs. or below, up to $5,500; 6,001 to 10,000 lbs., up to $9,000: 10,001 to 26,500 lbs., up to $26,000; greater than 26,501 lbs., up to $100,000 - tax years beginning before December 31, 2028 *(Eskridge Chevrolet, 2022)*
Oklahoma Oklahoma Electric Cooperative service area Energy Efficiency Rebates	- for Level 2 EV chargers with scheduled vehicle charging during off-peak hours, 9 pm to 5 am - rebate up to $300 - effective February 1, 2023 *(Energy Efficiency Rebates | OEC, n.d.)*
Oklahoma statewide Alternative Fueling Infrastructure Tax Credit	- tax credit up to 45% of instillation cost of commercial alternative fueling infrastructure (natural gas, propane, hydrogen, and electricity) - tax credit up to 50% of cost of installing residential propane, compressed natural gas, or liquefied natural gas fueling system for noncommercial purposes, up to $2,500 - tax credits may be carried forward for up to five years - applies to tax years before December 31, 2028 *(Oklahoma Statute 68-2357.22., n.d.)*
Oklahoma statewide Alternative Fuel School Bus and Electric Vehicle (EV) Charger Rebate Program	- rebates up to 45% to repower or replace an actively used engine dated 2009 or older, such as a diesel school bus, with an alternative fuel model - eligible alternative fuels and technologies include all-electric, propane, and natural gas

	- charging infrastructure for electric buses is eligible for funding but is subject to a per-charger maximum and project cap - since 2018 *(Alternative Fuel School Bus Program-Oklahoma Department of Environmental Quality, n.d.)*
Oklahoma Statewide ChargeOK Electric Vehicle (EV) Charger Grant	- eligible projects include DC fast charging stations along designated EV transportation corridors and DCFC or Level 2 EV chargers at destination locations or community charging hubs - DEQ will award competitive grants for up to 80% of eligible project costs - first round (2019): transportation corridors and single-point locations - second round (FY2021): target locations to fill in the charging network *(ChargeOK – Oklahoma Electric Vehicle Charging Program, n.d.)*
South Carolina Duke Energy service area Duke Energy EV Home Charger Rebate	- $500 rebate and a monthly credit of $13.87 to residential customers to install a Level 2 EV charging station and charge their EVs during off-peak hours - archived: 3/16/2023 *(Charger Installation Credits-Duke Energy, 2024)*
South Carolina Santee Cooper service area Santee Cooper EV Charging Station Rebate	- rebate for residential customers to purchase a qualified Level 2 EV charging station, up to $250 *(Santee Cooper, 2023)*
Tennessee TVA service area (MS, GA, AL, NC, TN, VA, KY) Electric Vehicle (EV) Charging Station Rebates	- rebates for public DCFC stations at EV corridor gaps, up to $150,000 per DCFC station - eligible projects must include two to four DCFC ports per location - program participants identify suitable sites and agree to own, operate, and maintain stations for at least five years proposals received starting in 2021 *(Fast Charge TN Network for Electric Vehicle-TVA EnergyRight, 2024)*

Texas Austin Energy service area Austin Energy EV Charging Rebates	- up to $5,000 for businesses installing EV charging stations and up to $1,300 for purchasing eligible e-bikes. - homeowners' rebate for Level 2 home chargers. - customers earn bill credits through the Power Partner℠ program for charging during low energy demand periods - last reviewed September 5, 2024 *(Plug-in Austin Electric Vehicles, n.d.)*
Codes and Ordinances	
Alabama City of Tuscaloosa 2021 Electric Vehicles and Building Codes Amendments	- requires single and two-family homes to have at least 1 EV-ready space per unit with a 40-amp, 208/240-volt branch circuit - requires multifamily dwellings to set aside a percentage of parking spaces that are EVSE-Installed, EV-ready, or EV-capable based on the total parking provided - requires new commercial buildings to allocate EVSE-installed, EV-ready, and EV-capable spaces as a percentage of total parking spaces
Alabama statewide Electric Vehicle Readiness Requirements	- mandates EV-capable parking spaces for facilities with 100 or more spaces - two EV-capable spaces required plus one additional space per 50 spaces thereafter - standards include electrical panel space and load capacity to support a branch circuit and necessary raceways for EVSE. - EV-capable spaces must be located at least 50 feet from any structure - passed May 23, 2024 (Ordinance: No. 24-287, § 1*70.3. - Electric Vehicle Readiness Requirements.*, 2024a)
Georgia statewide	- all public EV charging stations must accurately measure and display the electricity dispensed on a per-kilowatt-hour (kWh) basis - violators may be subject to a fine of up to $1,000 - enacted May 2, 2023

	(GA Code § 10-1-222 (2023))
Georgia Atlanta EV-Capable Space Requirements	- one EV-capable parking space per one- or two-family dwelling. - multi-unit dwellings (MUD) and commercial properties must provide at least 20% of parking spaces as EV-capable - passed December 12, 2017 *(Atlanta Passes Electric Vehicle Readiness Ordinance, 2017)*
Other Initiatives	
Arkansas statewide Advanced Bus and Clean (ABC) Transportation program	- grants for all-electric or alternative fuel buses replacing diesel school and transit buses - eligible fuels: compressed natural gas, liquid natural gas, propane, and electricity - funded by state's share of the Volkswagen Environmental Mitigation Trust - eligible applicants: public school districts and transit authorities *(DEQ Makes Funding Available for New School and Transit Buses - Energy and Environment, 2021)*
Florida Sarasota County ChargeUp!	- rebates up to 50% of buying and installing new EV charging stations - NGOs and government organizations have a rebate maximum of 50%, up to $4,000; businesses are eligible for 25% or up to $2,000 *(EV Charging Incentives, Grants, & Rebates in the USA—EVESCO, 2024)*
Georgia statewide EV Charging Service Tariff and Excise Tax	- entities providing electric vehicle (EV) charging services not regulated by the Georgia Public Service Commission are not considered public utilities - excise tax per kilowatt-hour is applied to electricity sold at public EV charging stations - enacted May 2, 2023 *(Georgia General Assembly, 2024)*
Kentucky statewide	- installation of Level 2 and DC fast chargers with 25% allocated for Level 2 chargers, 75% allocated for DC fast chargers

Light-Duty Zero-Emission Vehicle (ZEV) Infrastructure Program	- 50% cost match required by law - total funding: $3,056,700, $765,000 for Level 2 chargers, $2.2 million for DC fast chargers - call for applications May 1st, 2024; more to come *(Kentucky and the Volkswagen Settlement—Kentucky Energy and Environment Cabinet, 2019*
North Carolina statewide Phase 2: Volkswagen Settlement Level 2 State Agency Program, Round 1	- funding to install 103 Level 2 EV charging ports at 25 state sites, including parks, museums, aquariums, government buildings, universities, and community colleges - 22 ports are in historically under-resourced counties, and 13 will support charging state agency fleet vehicles to transition to zero-emission vehicles (Executive Order No. 80). - remaining chargers are for public use - Round 1 funding: $1,009,684 - awarded October 17, 2022 *(Level 2 State Agency Program | NC DEQ, n.d.)*
North Carolina statewide Phase 2: Volkswagen Settlement Level 2 State Agency Program, Round 2	- funding to install 50 Level 2 EV charging ports at 17 state sites, including parks, museums, aquariums, government buildings, universities, and community colleges - 16 of the charging ports are in historically under-resourced counties; 10 will support charging state agency fleet vehicles, with the rest available for public use - total round 2 funding: $739,839 - awarded November 20, 2023 *(Level 2 State Agency Program | NC DEQ, n.d.)*
Oklahoma statewide Tax on Electricity Used to Charge or Recharge Electric Vehicles	- public EV charging stations are taxed at $0.03 per kilowatt-hour - tax doesn't apply to charging stations at private residences. - revenue will be apportioned to the Driving on Road Infrastructure with Vehicles of Electricity (DRIVE) Revolving Fund - as of January 1, 2024 *(Okla. Admin. Code § 710:55-8-3 - Tax Rate, 2024)*

Oklahoma statewide Electric Vehicle (EV) Charger Tax	- public EV chargers are taxed at $0.03 per kilowatt-hour apportioned to the Driving on Road Infrastructure with Vehicles of Electricity (DRIVE) Revolving Fund - as of January 1, 2024 *(2023 Oklahoma Statutes: Title 68. Revenue and Taxation: §68-6504. Tax on Electricity Used to Charge or Recharge Electric Vehicles., n.d.)*
Oklahoma statewide Electric Vehicle (EV) and Plug-In Hybrid Electric Vehicle (PHEV) Annual Registration Fee	- EV and PHEV owners pay annual registration fee in addition to standard fees - fees vary based on gross vehicle weight rating (GVWR) - fees range from $110 for EVs and $82 for PHEVs under 6,000 lbs. to $2,250 for EVs and $1,687 for PHEVs over 26,501 lbs. - a portion of the revenue supports the DRIVE Revolving Fund *(2023 Oklahoma Statutes: Title 68. Revenue and Taxation: §68-6511. Weight-Based Electric Vehicle Fee – Fee Apportionment., 2023)*
Tennessee Chattanooga, Knoxville, and Memphis Transit and Shuttle Bus Grant	- replace nine 2009 or older diesel transit buses with six all-electric and three diesel-hybrid buses - $5,690,860.50 grant - page last updated June 5, 2024 *(Transit and Shuttle Bus Grant, n.d.)*
Tennessee Nashville Metro Shared Electric Vehicle	- fleet of 11 Nissan Leaf 100% electric vehicles is available to qualified employees for public business during business hours - since 2023 *(Section 4-3-1109 - Energy Efficient State Vehicles, n.d.)*
Tennessee Nashville Department of General Services-Operated Public EV Charging Stations	- General Services manages about 90 electric vehicle charging ports across 27 locations - most charging stations are available for public use free of charge *(Metro Nashville Sustainable Mobility | Nashville.gov, n.d.)*
Texas San Antonio	- Vehicles with an authorized Hybrid and Electric Vehicle placard park free at downtown street parking meters or pay stations within a designated time limit

Free Parking Program for Hybrid/Electric Vehicles	*(San Antonio Parking > Permit Parking > Hybrid/Electric Vehicles, 2024)*

Midwestern/Mountainous Region Summary

The findings in Table 4 reveal that the Midwestern/Mountainous Region has created incentives and frameworks for supporting EVSE adoption and charging infrastructure for commercial, industrial, and residential areas. Incentives in the region include grants, vehicle rebates, charger installation rebates, and a tax rebate. Overall trends for grants vary widely, with award amounts ranging from $250 per charging port to $250,000 for the installation of charging infrastructure. Several incentives, such as the Indiana Michigan Power and Charge Ahead Colorado grant, offer grants to both commercial businesses and MUDs. Additionally, a $300 rebate from the Linn County Rural Electric Cooperative is offered for the installation and purchase of a Level 2 charger (Linn County REC, n.d.). Act 121, established by the Wisconsin Legislative Council, includes an excise tax of three cents per kilowatt-hour and a public utility exemption for EV charging stations (Wisconsin Legislative Council, 2024), which exempts anyone providing electricity to a charging station “as a public utility” if they charge a fee to consumers per kilowatt-hour and if “all the electricity supplied is provided by the person’s electric utility or retail electric cooperative.” (Wisconsin Legislative Council, 2024).

Moreover, there are two ordinances and a code that are important supports to charging station requirements and incentives. The Republication of the Revised Ordinances of St. Louis County, Missouri, 1974, details two requirements: 10% of spaces dedicated to EV-ready and 2% of spaces dedicated to EVSE. These requirements “shall apply to all new construction and major remodel when the required parking, existing or new, to serve the new construction or major remodel exceeds 30 spaces.” (Office of the St. Louis County Counselor, 2020).

A Salt Lake City Council ordinance outlines requirements for parking: 20% of spaces EV-Ready and 20% of spaces in multifamily units that are “Accessible (ADA)” must be EV-Ready (Lyons, 2022). The Illinois Environmental Protection Agency also established a Charging Infrastructure Grant Program as part of a code that provides grants for Level 2 chargers of up to $500 and DC fast charger grants of up to $2,500 (35 III. Adm. Code 285).

Finally, a unique initiative has been established in Iowa City, Iowa. Climate Action Grants aim to inspire and support public involvement in making the city more energy efficient, promoting the transition to zero- or lower-emission transportation, and more (ICGov.org, n.d.). Those eligible for Climate Action Grant funds up to $10,000 can be used to buy equipment and supplies for “Non-Profit and Community Based Organizations” and “for-profit businesses” (ICGov.org, n.d.). Iowa City has also created Climate Innovation Grants, which aim to promote electrification, support zero- or lower-emission transportation, along with other initiatives (ICGov.org, n.d.). Again, non-profit organizations, community organizations, and for-profit businesses are eligible and can put the grant toward new technology (ICGov.org, n.d.).

Table 4. Incentives, codes, ordinances, and other initiatives adopted by states or local municipalities within the Midwestern/Mountainous Region to promote EVSE adoption in commercial, industrial, and multifamily locations

Incentives	
Colorado statewide Charge Ahead Colorado Grant	- funding for level 2 and DCFC community charging stations - funding applies to “businesses & industry, government, non-profit organizations, workplaces, and multifamily housing.” - Up to $250,000 per applicant *(Colorado Energy Office, n.d.)*
Illinois statewide_Commercial EV Charger Incentives in Chicago	- Solar CC provides information on commercial EV charger incentives in Chicago, including a federal tax grant, an IEPA grant, and discounts for electric fleet conversions - see also the “Driving a Cleaner Illinois Program,” which “aims to support the installation of commercial EV charging stations in Chicago and Illinois” - maximum award of $80,000 per charger”

	- grants for electric fleet conversion began July 1, 2022, but there are other timelines for fleet conversion *(Solar CC, n.d.)*
Indiana statewide Indiana Michigan Power	- $500 incentive for small businesses and "a discounted off-peak rate up to a 40% reduction from our standard rate" for customers who average 4,500 kWH or less each month - Commercial, industrial and multi-unit dwellings are eligible for "a separate I&M PEV incentive program for Level 2 (240 v) PEV charging for employees, fleet, and MUD residents." - The I&M PEV program offers $250 per charging port if power can be provided for a Level 2 charger from the customer's own electric panel *(Indiana Michigan Power, n.d.)*
Iowa Linn County Linn County Rural Electric Cooperative	- Level 2 charger rebate up to $300 for purchase and installation - part of "Residential and Small Commercial Rebates" program *(Linn County REC, n.d.)*
Michigan City of Kalamazoo Meeting Agendas and Packets: Acceptance of an Energy Efficiency and Conservation Block Grant (EECBG)	- recommendation for the City Commission to accept an Energy Efficiency and Conservation Block (EECBG) - $135,750 grant from the U.S. Department of Energy, including an EECBG Rebate Agreement that reimburses the city for the cost of purchasing and installing EV charging equipment - issued February 19, 2024 *(Deters, 2024)*
Wisconsin statewide Wisconsin Legislative Council – 2023,_Wisconsin Act 121	- exemptions for EV charging stations for public utility and government use - excise tax at three cents per kilowatt-hour - excise tax applies to governmental entities but not charging stations at residences - sales tax on electricity powering an EV charging station - effective March 22, 2024

	(Wisconsin Legislative Council, 2024)
Codes/Ordinances	
Illinois statewide Charging Infrastructure Grant Program	- created by the Illinois Environmental Protection Agency, outlines qualifications for “funding opportunities” in the installation of charging stations. Funding amounts can be found in Section 285.200 of the adopted rules - funding of “up to $500 dollars per charging port for Level 2 and up to $2,500 per port for Level 3” - Notice of Funding Opportunity (NOFO) will specify "additional incentives that shall be awarded per port for charging stations installed in an eligible community and charging stations located to support eligible persons” - also provides charging station requirements - individuals, companies, and private organizations are eligible - effective June 1, 2023 *(35 Ill. Adm. Code 285)*
Missouri St. Louis County (1985) Republication of the Revised Ordinances of St. Louis County, Missouri, 1974	- Chapter 1119 of the Electric Vehicle Charging Code (Kansas City, MO) outlines EV charging station requirements, compliance with applicable laws and ordinances, and penalties - requires 10% of parking spaces to be EV-ready and 2% of parking spaces to be EVSE-ready - effective 90 days after County Executive approval *(Office of the St. Louis County Counselor, 2020)*
Utah Salt Lake City City Council Transmittal	- Ordinance, “Electrical Vehicle Readiness Off-Street Parking Stalls Amendment” reviews requirements for multifamily buildings and required off-street parking - the readiness plan also includes comments and feedback on the proposed ordinance - effective on date of first publication, December 6, 2022 *(Lyons, 2022)*
Other Initiatives	
Iowa Iowa City Climate Action Grants	- Community Action Grants to “inspire and promote public participation” and is part of “Iowa City’s Climate Action and Adaptation Plan,” which aims to support energy efficiency, encourage minimal or no emission transportation, and more.

	- non-profits and for-profit businesses, and community-based organizations can get up to $10,000 - funds can be used to buy equipment, supplies, etc. - application period from March 1 to April 1, 2024 *(ICGov.org, n.d.)*
Iowa Iowa City Climate Innovation Grants	- help businesses and organizations adopt new technology to advance electrification or support the adoption of no or minimal emissions - This grant is “designed for emerging technologies that don’t fit under other funding structures” - non-profits and for-profit businesses, community organizations, and for-profit businesses are eligible - can apply any time for Climate Innovation Grants (ICGov.org, n.d.)

Western Region Summary

Table 5 indicates that municipalities and states in the Western Region are relying on traditional rebates and building code requirements as well as some unique programs to bolster EVSE installation and ultimately EV adoption, particularly among businesses, by helping them transition to electric fleet vehicles.

Seattle has several programs that emphasize helping businesses transition to electric fleet vehicles, including significant subsidies for EV chargers for businesses with electric fleet vehicles. It also offers higher subsidies for “small businesses and nonprofits, women and minority owned businesses, tribal entities, all entities within overburdened communities” (Seattle City Light, n.d.). Eligible businesses can receive between $15,000 per site and $200,000 per site (ranging from a 240V outlet and portable charger to a DC charger).

For businesses that don't fit this category, subsidies range from $15,000 per site to $100,000 per site depending on the charger (from a 240V outlet and portable charger to a DC fast charger). These significant subsidies for charging equipment show Seattle's commitment to helping businesses make the switch to EV fleets.

The city also offers a Fleet Electrification Program that provides businesses with free assistance to help them plan for and transition to EV fleets.

Eugene, Oregon, and Los Angeles, California offer subsidies for public charging stations, although Eugene's subsidies are much lower because they are per port instead of per site, ranging from $1,500 per Level 2 port to $15,000 per DC fast charging station. Los Angeles offers subsidies ranging from several thousand dollars for Level 2 stations to over $100,000 for DC fast charging stations.

Portland, Oregon implemented building codes in 2023 that stipulate specific numbers of EV-ready parking spaces for multifamily buildings. The requirements are significant—50% of parking spaces when more than six spaces are offered. In California, both Sacramento and Los Angeles have implemented similar requirements, although the required percentages are lower at 20% and 30%, respectively, for multifamily dwellings, regardless of the total number of parking spaces offered.

As well, both Sacramento and Los Angeles have implemented unique EV infrastructure projects. Sacramento constructed a high-speed EV charging hub at a light rail station that can charge both standard EVs, such as cars and pickup trucks, as well as heavy-duty vehicles, such as electric trucks, and buses. Los Angeles has invested in using existing streetlight circuitry to add public EV chargers—a uniquely low installation cost option. The program is responsive to citizen interests, with forms for residents to request a charger at a streetlight near them.

Table 5. Incentives, codes, ordinances, and other initiatives adopted by states or local municipalities within the Western Region to promote EVSE adoption in commercial, industrial, and multifamily locations

Incentives

California Los Angeles Commercial EV Charging Station Rebate Program	- "Level 2 charging station rebates to charge light-duty EVs of up to $5,000 per charging station if deployed in a Disadvantaged Community." - "Direct current fast chargers (DCFCs) rebates to charge light-duty EVs of up to $100,000 per charging station depending on power output." - "Charging station rebates to charge medium- and heavy-duty EVs of up to $125,000 per charging station depending on power output." *(Los Angeles Department of Water & Power, n.d.)*
Oregon Eugene Electric Vehicle Incentives and Rebates	- rebates for public charging stations (both Level 2 and DC fast chargers) - Level 2 public charging stations for business, workplace, fleet, or multifamily buildings: $1,500 rebate per port - Level 2 public charging stations for multifamily affordable housing sites: $2,000 rebate per port - Single-port DC fast charging public stations: $10,000 rebate per station - Multi-port DC fast charging public stations: $15,000 rebate per station *(Eugene Water and Electric Board, n.d.)*
Oregon Eugene Electric Vehicle Incentives	- up to $500 rebate for the purchase and installation of Level 2 chargers - installations of new and existing construction are eligible for rebate *(Eugene Water and Electric Board, n.d.)*
Washington State Seattle EV Charger Rebates for Fleets	Tier 1 Rebates for large businesses, nonprofits, and public/government entities located outside of overburdened communities - 240V Outlet & Portable Charging Equipment: Capped at 100% of total project costs, up to $15,000 per site. The outlet must be able to track energy usage and must provide proof of fleet electric vehicle purchase and proof of portable Level 2 charger

	- Level 2 Hardwired Charging Equipment: Capped at 50% of total project costs, up to $25,000 per site. Charging equipment must be hardwired and able to track station-specific energy usage. It must also provide proof of fleet electric vehicle purchase - DC fast charging Equipment: Capped at 50% of total project costs, up to $100,000 per site. Charging equipment must be able to track station-specific energy usage and must provide proof of fleet electric vehicle purchase Tier 2 Rebates for small businesses and nonprofits, women and minority owned businesses, tribal entities, and all entities within overburdened communities - 240 V Outlet & Portable Charging Equipment: Capped at 100% of total project costs, up to $15,000 per site. Outlet must be able to track energy usage and must provide proof of fleet electric vehicle purchase and proof of portable Level 2 charger - Level 2 Hardwired Charging Equipment: Capped at 100% of total project costs, up to $50,000 per site. Charging equipment must be hardwired and able to track station-specific energy usage. It must also provide proof of fleet electric vehicle purchase - DC fast charging Equipment: Capped at 100% of total project costs, up to $200,000 per site. Charging equipment must be able to track station-specific energy usage and must provide proof of fleet electric vehicle purchase *(Seattle City Light, n.d.)*
Codes and Ordinances	
California Los Angeles 4.106.4.2.1.1Electric vehicle charging stations (EVCS)	- "When EV chargers are installed, EV spaces required by Section 4.106.4.2.2, Item 3, shall comply with at least one of the following options:" - "1. The EV space shall be located adjacent to an accessible parking space meeting the requirements of the California Building Code, Chapter 11A, to allow use of the EV charger from the accessible parking space." - "2. The EV space shall be located on an accessible route, as defined in the California Building Code, Chapter 2, to the building." - amended in 2020

	(City of Los Angeles, 2020)
California Los Angeles 4.106.4.2. New multifamily dwellings and R occupancies other than one- and two-family dwellings and townhouses	- "Where multifamily dwelling units and other R occupancies are constructed on a building site and parking is available, 30 percent of the total number of parking spaces provided, but in no case less than one, shall be electric vehicle charging spaces (EV spaces) capable of supporting future electric vehicle supply equipment (EVSE)." - amended in 2020 *(City of Los Angeles, 2020)*
California Sacramento Code Amendment Adding Chapter 15.38 for Nonresidential Sites	- "For new nonresidential, twenty (20) percent of the total number of parking spaces on a building site, provided for all types of parking facilities, but in no case less than one, shall be electric vehicle charging spaces (EV spaces) capable of supporting future EVSE. Calculations for the required number of EV spaces shall be rounded up to the nearest whole number. An electric vehicle charging station shall be installed in at least one electric vehicle charging space." - amended in response to 2019 updates to the California Green Building Standard Code *(California Energy Codes & Standards, n.d.)*
California Sacramento Code Amendment Adding Chapter 15.38 for Multifamily Dwellings	- "For new multifamily dwellings, twenty (20) percent of the total number of parking spaces on a building site, provided for all types of parking facilities, but in no case, less than one, shall be electric vehicle charging spaces (EV spaces) capable of supporting future EVSE. Calculations for the required number of EV spaces shall be rounded up to the nearest whole number. An electric vehicle charging station shall be installed in at least one electric vehicle charging space." - amended in response to 2019 updates to the California Green Building Standard Code *(California Energy Codes & Standards, n.d.)*
Oregon Portland Electric Vehicle (EV) Ready Code Project	- amendment to the city Zoning Code requires "all new multi-dwelling and mixed-use development with five or more units—that include onsite parking—to provide EV-ready charging infrastructure at higher rates than required by state rules." Code Amendments - "Require developments with five or more new dwelling units, when including parking spaces, to provide electric vehicle-ready

	infrastructure as follows: 100% of parking spaces when six or fewer spaces are provided" or "50% of parking space when more than six spaces are provided." - "Add development standards (e.g., placement) for all EV-ready installations." - "Clarify how EV-ready installations are categorized in land use code; they are generally an accessory use, but occasionally they could be a primary use." - "Exclude the cost of EV improvements in the value of the site's improvements for retrofits." - Implemented March 31, 2023 *(City of Portland, Oregon, n.d.)*
Other Initiatives	
California Los Angeles Streetlight EV Charging Stations	- Bureau of Street Lighting adds EV chargers to existing streetlights - a cost-effective program with the chargers utilizing existing streetlight circuitry. - residents can request installation of a streetlight EV charger via a form on LA Light's website *(Los Angeles Bureau of Street Lighting, n.d.)*
California Sacramento Sacramento High-Speed Electric Vehicle Charging Hub Project	- high-speed EV charging hub at the Power Inn light rail station - used 55 underutilized spaces in a park-and-ride lot near mixed-use retail, housing, a major highway, and industrial and commercial development - the hub can accommodate 20 vehicles, including a range of vehicles: cars, trucks, and buses - opened June 2023 *(Federal Highway Administration, n.d.; Sacramento Regional Transit, 2023)*
Washington Seattle Fleet Electrification Program	- free assistance to businesses navigating a transition to an EV fleet *(Seattle City Light, n.d.)*

Cost Analysis

Purchasing and installing EVSE infrastructure in parking spaces is expensive. The costs vary depending on whether infrastructure was installed during the initial construction or retrofitted, and the level of infrastructure installed. As discussed, the terms EV-capable, EV-ready, and EV-installed are key distinctions in ordinance and building code requirements and refer to different levels of EVSE infrastructure installation.

EV-capable parking spaces are equipped with electrical panel capacity and conduit to support easier, cost-effective installation of chargers later. EV-ready takes the concept a step further by including conduit and panel capacity as well as wiring that makes the space immediately ready to accommodate an EV charger, simplifying the final step of installing the charging station. Finally, EV-installed spaces have fully operational EV charging stations in place, allowing vehicles to charge immediately.

Ultimately, retrofitting EVSE infrastructure is significantly more expensive than installing it upfront (Salcido et al., 2021; Virginia Clean Cities, 2023). Several studies analyze the cost difference between upfront installation and retrofitting. Several key factors contribute to the higher cost of retrofits including the costs of demolition and repair of surface parking, breaking and repairing walls, longer conduit runs for electrical equipment, upgrading electric service panels, and various costs such as permitting, planning, inspections, and project management (Virginia Clean Cities, 2023). Multiple sources listed similar factors as contributing to the increased costs of retrofits (Virginia Clean Cities, 2023; Southwest Energy Efficiency Project, n.d.; Salcido et al., 2021; City of Oakland, 2020; Pike & Steuben, 2016).

A study by the City and County of San Francisco found that retrofit installation costs for Level 2 EV charging stations are several times higher than the cost of installing them with new construction (Salcido et al., 2021, p. 12). As an example, this study analyzed the cost of electric infrastructure installation for Level 2 charging at a multifamily building for two EV-ready spaces in a lot of ten parking spaces. This study found that retrofitting two spaces would cost $3,710

while creating two EV-ready spaces as part of new construction would cost just $920, reducing the cost by about 25% (Salcido et al., 2021, p. 12).

Even for projects with many EV-ready spaces that would benefit from economies of scale cost savings, retrofits still cost significantly more than incorporating the EV-ready spaces in new construction. For example, in a 60-spot parking lot with 12 EV-ready parking spaces, the per-space cost for EV-readiness would be about $860 for new construction versus about $2,370 if the spaces were part of a retrofit (Salcido et al., 2021, p. 12). This ratio of 12 of 60 parking spaces is 20%, which aligns with the general range of EV-ready parking space requirements in the research.

In a similar study by Denver, Colorado, installing an EV-ready space during new construction was estimated at $1,300 per space versus $6,300 per space as a retrofit, eliminating about 80% of the cost (Southwest Energy Efficiency Project, n.d.). For EV-capable spaces, the study estimated the cost of each space at $300 in new construction versus $2,500 per space a retrofit, eliminating about 88% of the cost (Southwest Energy Efficiency Project, n.d.).

The California Electric Transportation Commission studied the costs of an EV-capable requirement for parking in commercial developments, including various-sized office and retail buildings. As expected, larger developments experienced economies of scale and lower associated per-space costs than smaller developments, but the cost trend noted in the studies above remained true—the cost of installing EV-capable infrastructure during a retrofit was roughly four to six times more expensive than building it as part of new construction (Southwest Energy Efficiency Project, n.d.).

The new construction cost per EV-capable space for a small office or retail surface parking lot was $905 versus $5,540 for a retrofit, $901 for a medium office or school surface parking lot versus $4,155 for a retrofit, and $739 for a large office, retail, or hospital enclosed parking lot versus $2,779 for a retrofit (Southwest Energy Efficiency Project, n.d.).

This further illustrates the value of requiring EV-ready and EV-capable parking spaces in building codes—it dramatically reduces the cost of EVSE infrastructure and makes retrofits less necessary. Preemptively installing

EV-ready infrastructure benefits business owners and landlords who can avoid the higher installation costs of retrofits. Additionally, it can extend the network by saving significant government funds that might otherwise be used to provide larger subsidies to promote EVSE infrastructure installation as more expensive retrofits.

The cost of different types of EV chargers depends on varied factors, but the three different levels of chargers present fundamentally different costs as well as different use cases and benefits. Level 1 chargers simply use a standard 120 V power connection. Installing a single-port EVSE unit for Level 1 charging generally costs between $0 and $3,000 (Salcido et al., 2021, p. 12). This is an inexpensive option but not useful for many situations given how long it takes to charge an EV with this method.

A Level 2 single-port EVSE unit generally costs between $600 and $12,700 (Salcido et al., 2021, p. 12). Level 3 single-port EVSE (DC fast charging) generally costs between $4,000 and $51,000 (Salcido et al., 2021, p. 12). This is a general sense of the scale of the cost differences among different EV chargers, but specific options, such as multi-port units and contracts with manufacturers, could reduce costs.

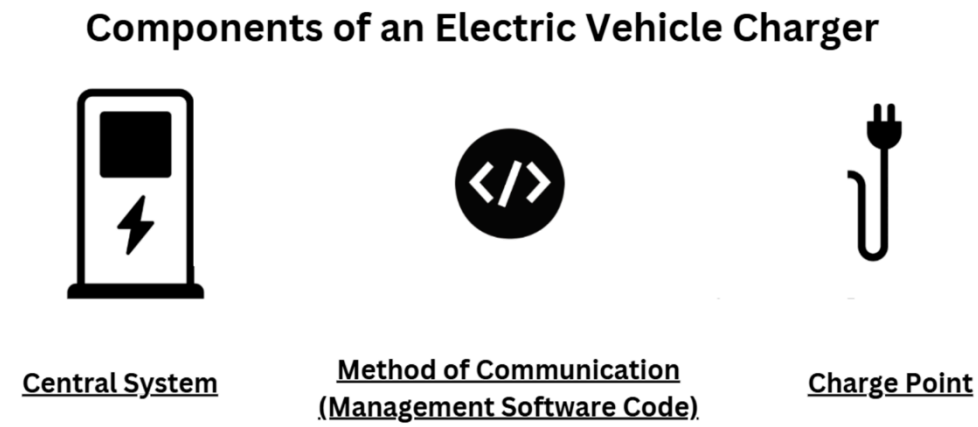
Given that EVSE infrastructure costs can be quite high, municipalities should incentivize installation of chargers that use the Open Charge Point Protocol (OCPP). OCPP "physically separates the appliance aspects of the charging infrastructure from the network backend component," which means that "the site host can easily switch charging networks without expensive equipment upgrades" (U.S. Department of Energy, n.d.). This ensures that investment in the EVSE infrastructure remains useful by eliminating reliance on a singular charging provider (U.S. Department of Energy, n.d.).

Table 6. Per space comparison of EVSE projects for retrofitting versus new construction

Example Project	Location	Retrofit	New Construction	New Construction Percentage of Retrofit Cost

2 EV-ready spaces, 10 space lot, multifamily	San Francisco, CA	$3,710	$920	25%
12 EV-ready spaces, 60 space lot	San Francisco, CA	$2,370	$860	36%
EV-capable		$2,500	$300	12%
EV-ready		$6,300	$1,300	21%

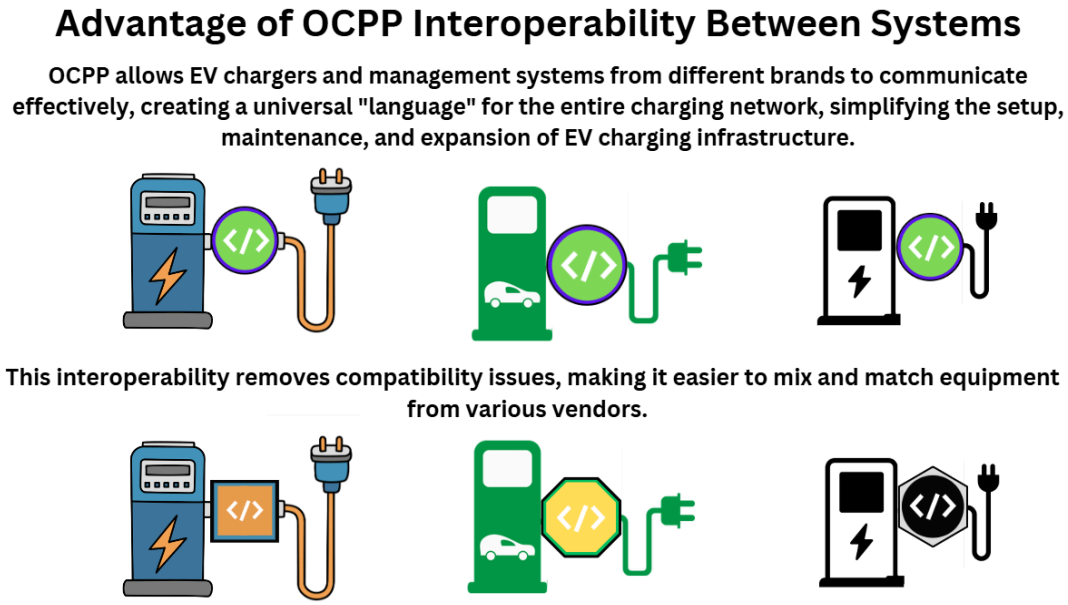
Figure 1. OCPP-enabled communication between EV chargers (charge points) and management software (central systems), defining each component's role in the system



The central system, charge point, and management software work together to create an EV charger. Figure 1 illustrates the relationship between these core components. The central system is the core platform, facilitating communication between charge points, processing data, integrating with payment systems, and enabling remote monitoring and control (Open Charge Point Protocol, n.d.). The charge point is the physical device where EVs connect to charge, deliver power, collect session data, and communicate with the central system using protocols like OCPP for interoperability (Open Charge Point

Protocol, n.d.). Meanwhile, the management software acts as an operator interface, enabling configuration, user and billing management, smart charging, and generating analytics for efficiency (Open Charge Point Protocol, n.d.).

Figure 2. OCPP allows various brands of EV chargers to connect with central management systems, promoting compatibility and flexibility across the EV charging network



As illustrated in Figure 2, integrating the central system, charge points, and management software is a practical application of OCPP that ensures interoperability and flexibility in EVSE infrastructure. By standardizing communication among these components, OCPP allows municipalities and site hosts to maintain the long-term utility and cost-effectiveness of their charging networks (Open Charge Point Protocol, n.d.). Network providers can be switched without costly equipment upgrades, ensuring that investments remain valuable, while the universal "language" created by OCPP facilitates seamless interaction between chargers and management systems from different vendors (Open

Charge Point Protocol, n.d.). This flexibility simplifies installation and maintenance and supports the scalability of EV charging infrastructure.

Analysis

The array of programs and initiatives promoting EVSE adoption in the US reflect a complex interplay of regional priorities, economic conditions, and policy approaches. Each region—Northeastern, Southern, Midwestern/Mountainous, and Western—uses strategies tailored to its needs and electorate, resulting in significant variations in how EVSE infrastructure is developed and promoted. However, a common challenge across all regions is the high cost associated with purchasing and installing EVSE infrastructure, which can vary depending on whether the installation occurs during initial construction or as a retrofit and whether the infrastructure is EV-capable, EV-ready, or EV-installed.

The Northeastern Region primarily leverages regulatory mandates and financial incentives to lay a groundwork for EV adoption. Massachusetts and Virginia exemplify this approach by integrating EV infrastructure requirements into urban planning and development codes. Massachusetts' MOR-EV program offers up to $5,000 rebates to low- and middle-income residents purchasing EVs, directly stimulating consumer demand. Virginia mandates the inclusion of EV infrastructure in new construction over 5,000 square feet and in significant renovations, ensuring buildings are inherently EV-ready.

This regulatory emphasis on incorporating EV-capable and EV-ready infrastructure during new construction is crucial in mitigating retrofitting costs. Studies consistently show that retrofitting EVSE infrastructure is substantially more expensive than installing it upfront. For instance, the City and County of San Francisco found that retrofitting two EV-ready spaces in a multifamily building with 10 parking spaces would cost $3,710, compared to $920 if included in new construction—a reduction of about 25% (Salcido et al., 2021, p. 12). The Northeastern Region aims to reduce future expenses and promote widespread EV adoption by mandating EV-ready infrastructure in new development. However, focusing on new development and urban areas may inadvertently

overlook existing structures and rural communities, potentially limiting widespread accessibility and equitable adoption.

In contrast, Southern states concentrate on expanding the charging network to address accessibility gaps, particularly in under-resourced or remote areas. Programs like Tennessee's Metro EV fleet and Oklahoma's ChargeOK initiative provide substantial grants for installing fast chargers along critical transportation corridors. This strategy prioritizes immediate accessibility, enabling broader coverage across diverse geographies without imposing stringent mandates on developers.

While this approach accelerates the expansion of the charging network, it may miss opportunities to integrate EV infrastructure into long-term urban planning and development. The lack of mandates for EV-capable or EV-ready installations in new construction could lead to higher long-term costs due to the expensive nature of retrofitting. For example, installing an EV-ready space during new construction in Denver was estimated at $1,300 per space versus $6,300 as a retrofit, nearly five times more expensive. By not addressing the upfront integration of EV infrastructure, the Southern US might face financial and logistical barriers in the future.

The Midwestern/Mountainous Region adopts a balanced strategy emphasizing accessibility and community impact. States like Colorado and Illinois implement grant programs targeting multifamily housing and public facilities, ensuring that EV infrastructure benefits a wide range of residents, including those in underserved communities. Illinois' Climate and Equitable Jobs Act intertwines environmental goals with job creation and economic development, supporting EV infrastructure while aiming to phase out carbon emissions from coal and gas plants.

However, the Southern and Midwestern/Mountainous Regions may need to catch up in implementing policies that encourage the installation of EV-capable or EV-ready infrastructure during new construction. The absence of such mandates could result in higher costs due to the expense of retrofitting. For instance, installing an EV-capable space during new construction is significantly lower than retrofitting, with estimates showing new construction costs at $300 per

space versus $2,500 per space as a retrofit—more than eight times as expensive.

The Western Region stands at the forefront of EVSE adoption. Its innovative programs, robust financial incentives, and strict regulatory frameworks emphasize the importance of integrating EV infrastructure during new construction. Cities like Seattle and Los Angeles offer targeted support for small businesses, nonprofits, and disadvantaged communities. Seattle provides subsidies of up to $200,000 for DC fast chargers, specifically assisting minority- and women-owned small businesses. Los Angeles introduces unique initiatives like streetlight-integrated chargers and repurposing existing infrastructure for cost-effective EVSE deployment.

Building code amendments in Oregon and California require a high percentage of EV-ready parking spaces in new developments, setting these communities and developments up for future success once EV adoption increases. By requiring EV-capable or EV-ready infrastructure upfront, these regions avoid the substantially higher retrofit costs. For example, a California study found that installing EV-capable infrastructure during new construction costs $905 per space for a small office or retail surface parking lot versus $5,540 for a retrofit (Southwest Energy Efficiency Project, n.d.). This proactive approach ensures that new buildings are prepared for the inevitable rise in EV ownership, reducing long-term costs and facilitating widespread adoption.

Moreover, adopting the Open Charge Point Protocol (OCPP) plays a crucial role in maximizing the utility and cost-effectiveness of EVSE infrastructure, as well as preventing them from becoming stranded assets. OCPP standardizes communication between EV chargers (charge points) and management software (central systems), enabling interoperability across different vendors and preventing reliance on a single charging provider. This flexibility allows site hosts and municipalities to switch network providers without incurring expensive equipment upgrades, safeguarding their investments in EV infrastructure.

Comparative Analysis: Contrasting Regional Approaches

The Western Region offers higher rebates and subsidies, making EV adoption more financially attractive. In contrast, the Southern and Midwestern/Mountainous Regions provide moderate rebates and grants, aiming for broader coverage but potentially limiting the scale of individual projects. The Northeastern and Western Regions impose regulatory mandates. However, the Western Region requirements are more stringent, including provisions for installing EV-capable and EV-ready infrastructure during new construction. The Southern Region relies less on mandates, focusing on infrastructure support to expand accessibility, which may result in higher future costs due to retrofitting.

The Western Region leads in creative solutions such as high-speed commercial vehicle charging hubs, EV chargers installed in streetlights, and free assistance programs to help businesses transition to electric fleet vehicles. Other regions may need more innovative approaches, potentially slowing the pace of adoption and increasing long-term costs. Innovative programs like Los Angeles' streetlight-integrated chargers offer scalable solutions that can be replicated in resource-constrained areas.

However, regions that need more infrastructure may face implementation challenges. By installing EV-capable and EV-ready infrastructure during new construction, regions can avoid the substantial costs of retrofitting, promoting scalable and sustainable EVSE deployment. Programs targeting disadvantaged communities, such as Seattle's higher subsidies for minority-owned businesses, highlight efforts to make EV adoption equitable. Expanding these programs across all regions is crucial to prevent EV adoption from becoming concentrated in affluent areas. Additionally, installing EV infrastructure in multifamily housing and public facilities ensures that all residents can access charging options.

The varying costs associated with different levels of EV chargers—Level 1, Level 2, and DC fast chargers—influence regional approaches. Level 2 chargers balance cost and efficiency, with single-port installations ranging from $600 to $12,700. Regions that provide subsidies and mandates for higher-level chargers facilitate faster and more convenient charging options, encouraging broader EV adoption. Some regions, particularly the Midwestern/Mountainous

Region, lack comprehensive long-term strategies like those in the Western Region, including mandates for EV-ready infrastructure. This gap presents an opportunity for cross-regional collaboration to share best practices and develop cohesive policies. Sharing innovative solutions can inspire broader adoption. For example, the Southern and Midwestern/Mountainous Region could benefit from adopting the Western Region's approach to integrating EV infrastructure into urban planning and leveraging existing assets. Embracing standards like OCPP can enhance interoperability and reduce costs across regions.

Investments in EV fleets, such as Nashville's all-electric vehicles, and urban EV hubs, like those in Sacramento, directly support emission reduction goals and improve regional air quality. Tying EV adoption to job creation and economic development, as in Illinois' Climate and Equitable Jobs Act, demonstrates the multifaceted benefits of a robust EV infrastructure. By reducing the costs associated with EVSE installation through proactive planning and adopting open standards, regions can allocate resources more effectively, further enhancing environmental and economic outcomes.

Recommendations for EVSE Installation and EV Adoption in Frederick County

1. Transition public transportation to EV

EV adoption in Frederick County should be led through transitioning public transportation system technology, such as school buses and transit buses, to electric models. Drawing inspiration from successful programs like Maine's Zero-Emission School Bus Acquisition and New York City’s EV School Bus Initiative, Frederick County can implement its own initiative to modernize its school bus fleet.

Maine’s statewide working group reviewed various zero-emission bus technologies, identifying benefits such as lower operating costs and reduced emissions, along with challenges like upfront investment and infrastructure needs (U.S. Department of Energy, Alternative Fuels Data Center, n.d.). Similarly, New York City’s program, which began in 2022, replaced diesel buses with electric

ones, demonstrating the practical benefits of EVs for public use. Parents reported feeling more receptive to EVs after seeing their children on buses with fewer breakdowns, zero emissions, and a modern design (Earth.org, n.d.).

These types of initiatives illustrate considerations of switching to EV public transportation as well as transforming a city to be EV-capable, EV-ready, or EV-installed. A comparable initiative in Frederick County would demonstrate the feasibility and desirability of EV technology, encouraging wider adoption among residents while aligning with the county's sustainability goals.

2. DC fast chargers at community hubs

Frederick County could also advance EV adoption by focusing on the placement of DC fast chargers at commercial hubs like shopping malls and other destinations. Initiatives such as New Jersey's EV Tourism Program and Oklahoma's ChargeOK Grant demonstrate how accessible charging infrastructure can make EV use more practical and appealing.

New Jersey's program encouraged businesses, including parks and hotels, to install up to six Level 2 chargers and two DC fast chargers, providing reliable charging options for EV drivers (New Jersey's Clean Energy Program, n.d.). Likewise, Oklahoma's ChargeOK program offered competitive grants to expand charging infrastructure, strategically addressing gaps along major travel routes and within community hubs (ChargeOK—Oklahoma Electric Vehicle Charging Program, n.d.). Implementing similar measures in Frederick County could enhance convenience for EV owners and boost foot traffic to local businesses, making the county a leader in sustainable transportation solutions.

3. Technical education

High levels of EV adoption in Frederick County would necessitate technical support to expedite repairs and upgrades on privately owned vehicles. Frederick County can prepare for this new market in the same way Carroll County has, by funding and providing specialized technical education through the community college system (Carroll Community College, 2024).

Carroll Community College's Hybrid/Electric Vehicle Technician program is a model for workforce development through targeted training programs that can

support local job seekers and businesses adapting to the green economy (Carroll Community College, 2024). Training is short-term and offers certification in skills like battery diagnostics, safety protocols, and power electronics in collaboration with automakers and local repair shops (Carroll Community College, 2024). These trainings align with Frederick County's sustainability and economic development objectives and would position the county as a leader in sustainable workforce development.

4. Transition business fleets to EV

Frederick County has a unique opportunity to lead the region in helping businesses transition to electric fleet vehicles through a multifaceted approach that includes investing in building public charging infrastructure for commercial vehicles and investing in subsidies for businesses to purchase chargers for electric fleet vehicles.

The Illinois Environmental Protection Agency's "Charging Infrastructure Grant Program" provides funding to companies, private organizations, and others for the installation of charging stations (35 III. Adm Code 285). This could ease the anxiety of establishing EV infrastructure and is an example of how Frederick County might provide financial support to businesses.

Beyond investments in physical infrastructure and subsidies, additional assistance can encourage businesses that are hesitant to transition to electric fleet vehicles. Electric vehicles are a new technology to many, and smaller businesses may be hesitant to take a risk or invest the time to learn about the potential benefits of an EV fleet. To combat this hesitancy and encourage EV adoption and EVSE installation, Frederick County should provide a free assistance program for local businesses to help them navigate the transition to electric fleet vehicles, similar to a program that Seattle has implemented (Seattle City Light, n.d.).

5. High-speed charging hub in the I-70 Corridor

Given the prevalence of the trucking industry in Frederick County supported by convenient access to several interstate highways, the county

should invest in building at least one high-speed charging hub along the I-70 corridor that can charge heavy-duty commercial vehicles, including trucks, transit buses, and coach buses. A similar project was successfully completed in Sacramento at an underused light rail park-and-ride lot (Federal Highway Administration, n.d.; Sacramento Regional Transit, 2023).

Investing in a high-speed charging hub would particularly help local businesses switch to electric fleet vehicles by providing convenient access to commercial chargers that would otherwise be prohibitively expensive, particularly for smaller businesses more hesitant to transition.

6. Business subsidies for EVSE installation

While a public high-speed charging hub capable of charging commercial vehicles would help promote EV adoption of commercial vehicles, non-commercial electric fleet vehicles still present a potential business challenge. To encourage adoption of non-commercial fleet vehicles, Frederick County should offer a tiered system of business subsidies to purchase Level 2 chargers and DC fast chargers.

The subsidy should cover up to 50% of the project costs per location, capped at $25,000, for installing Level 2 charging stations for fleet vehicles. If a business instead chooses to install a DC fast charger, the subsidy should cover 50% of the project costs per location, capped at $100,000. These limits are similar to a subsidy program offered by Seattle (Seattle City Light, n.d.).

By covering only up to 50% of the project cost or a given dollar limit, the program provides a significant incentive to businesses to install EV chargers and buy electric fleet vehicles while still maintaining governmental fiscal responsibility for residents who may be skeptical of this investment of government funds; this is a partnership with businesses.

7. Require EVSE in new construction and renovations

Frederick County is one of the state's fastest-growing counties; growth that has driven significant renovation and expansion of shopping centers, residential neighborhoods, and work facilities to meet the increased population. While this renovation is underway, the county could implement an ordinance

similar to Virginia's *"Electric Vehicle Charging Station New Construction and Building Renovation Requirement"* that states, "Any executive branch agency or institution designing new building construction of more than 5,000 square feet, or a renovation that costs more than 50% of the value of the building, must include EV charging infrastructure unless located in an Interstate System right-of-way**."**

Implementing EV-ready or EV-installed infrastructure for Frederick's commercial or residential buildings would demonstrate to residents that the county accepts the new technology and is willing to support its feasibility in their daily lives. Furthermore, this could promote EV adoption by residents seeing and experiencing the new amenities serving EV owners.

8. Tax credit program

Frederick County could introduce a comprehensive tax credit program aimed at businesses, multifamily residences, and eligible homeowners to encourage the installation of electric vehicle charging stations. This initiative, which would provide financial incentives covering 20 to 30% of installation cost with a maximum cap per project, is tailored to different property types to ensure accessibility and equitable adoption. For example, businesses that install multiple charging stations could qualify for a higher, maximum tax credit, reflecting the potential for greater impact on the community.

Single-family homes or small multifamily properties could be capped at one or two chargers, ensuring widespread participation without overextending county resources. This approach, modeled after Georgia's successful *EV Charging Station Tax Credit Program*, seeks to offset the upfront cost that deter property owners from investing in EV infrastructure.

Implementation in Frederick County could involve partnerships with local utility companies, like Potomac Edison, to streamline installation processes and ensure alignment with the county's electrical grid capabilities. The county could also leverage state or federal funding to supplement the tax credit, particularly for installations and underserved high-traffic areas. An application process could be developed to verify eligibility and prioritize high-impact locations, such as commercial hubs, residential complexes, and commuter corridors.

9. Vehicle penalties

Frederick County can enhance the efficiency and accessibility of its EV charging infrastructure by implementing penalties for vehicles that park at charging stations beyond the charging period. “Charger hogging” limits the availability of spots for other EV users and can hinder the overall adoption of EVs due to perceived inconvenience.

As in Virginia, which imposes fines on non-charging vehicles occupying EV-designated spots, Frederick County can establish similar regulations to encourage responsible use of charging facilities (Virginia Clean Cities, 2023). For example, Virginia enforces penalties of up to $25 for violations, effectively promoting turnover at charging stations and ensuring greater access for all EV drivers. Implementing such measures in Frederick County would optimize the use of existing infrastructure, reduce wait times, and enhance the overall user experience for EV owners.

10. EVSE infrastructure at public schools

Integrating EV charging infrastructure into public schools offers Frederick County a strategic opportunity to promote sustainable practices while providing practical community benefits. The county can provide convenient charging options for teachers, staff, parents, and visitors by installing EV chargers at all public schools.

This initiative mirrors programs like Colorado's Charge Ahead grant program, which funds EVSE installations at public facilities to enhance accessibility and community impact (Southwest Energy Efficiency Project, n.d.). Installing EV-capable or EV-ready infrastructure during new school construction or significant renovations is cost-effective—upfront installation is substantially less expensive than retrofitting—potentially reducing costs by up to 75% (Salcido et al., 2021).

For instance, a study found that installing two EV-ready spaces during new construction costs approximately $920, compared to $3,710 for retrofitting the same spaces (Salcido et al., 2021). Moreover, incorporating EV chargers in schools serves an educational purpose, exposing students to renewable energy

technologies and fostering environmental stewardship from a young age. This approach aligns with Frederick County's sustainability goals and is committed to innovative, forward-thinking infrastructure development.

11. EVSE infrastructure at public parking lots

Expanding EV charging infrastructure to public parking lots in commercial and industrial areas is essential for supporting the growing number of EV users in Frederick County. By mandating that parking lots include EV chargers compatible with open-source protocols like the Open Charge Point Protocol (OCPP), the county can ensure interoperability and flexibility across the charging network (U.S. Department of Energy, n.d.). OCPP allows different brands of EV chargers to communicate with central management systems, preventing reliance on a single charging provider and facilitating easier upgrades or changes in the future (U.S. Department of Energy, n.d.).

This strategy reflects best practices in the Western Region, where stringent building codes require a high percentage of EV-ready parking spaces in new development (Southwest Energy Efficiency Project, n.d.). This approach would prevent the chargers from becoming stranded assets.

Additionally, installing EV-capable or EV-ready infrastructure during initial construction is significantly more cost-effective than retrofitting. Studies have shown that installing an EV-capable space during new construction can be as low as $300, compared to $2,500 for a retrofit—over eight times more expensive (Southwest Energy Efficiency Project, n.d.). By proactively requiring open-source EV chargers in new public parking developments, Frederick County can reduce future costs, promote a competitive market for charging services, and ensure that its infrastructure remains adaptable to technological advancements.

12. Financial incentives for residential sites

Frederick County can significantly boost EV adoption by offering substantial financial incentives for installing Level 2 chargers in existing single-family and multifamily residential units. By covering up to 80% of the total installation costs, the county would alleviate the financial burden on property owners, encouraging them to invest in EV infrastructure.

This approach is informed by successful programs in other regions that have effectively increased residential EV charger installations through generous incentives. For instance, Massachusetts' MassEVIP program provides rebates for EV charging stations at multifamily properties, demonstrating the effectiveness of financial support in promoting infrastructure development (Massachusetts Department of Environmental Protection, n.d.).

Installing Level 2 chargers during initial construction is crucial due to the significantly lower costs compared to retrofitting. Studies have shown that retrofitting EV charging infrastructure can be up to five times more expensive than installing it during new construction (Salcido et al., 2021). For example, installing an EV-ready space during new construction may cost approximately $1,300 per space, whereas retrofitting the same space could cost around $6,300 (Southwest Energy Efficiency Project, n.d.). By subsidizing most installation costs, Frederick County can encourage property owners to choose new installations over costly retrofits, promoting long-term cost savings and infrastructure readiness.

Moreover, focusing on multifamily residential units addresses equity concerns by ensuring that residents of apartments and condominiums, who often face barriers to accessing EV charging, have the necessary infrastructure. This strategy aligns with initiatives like Colorado's Charge Ahead grant program, which targets multifamily housing to enhance accessibility and community impact (Southwest Energy Efficiency Project, n.d.). Frederick County can promote inclusive EV adoption and support its sustainability goals by prioritizing financial incentives for these residences.

13. Mandate 25% EV-ready

To prepare for the increasing demand for EVs, Frederick County should require all new multifamily and commercial constructions to include at least 25%

EV-ready parking spaces. This mandate ensures that a significant portion of parking infrastructure is equipped with the necessary electrical capacity and conduit to support future EV charger installations. Such proactive planning is cost-effective and aligns with best practices observed in regions leading in EV adoption.

The cost benefits of installing EV-ready infrastructure during new construction are substantial. A study by the City and County of San Francisco found that installing EV-ready spaces during new construction costs approximately 75% less than retrofitting the same spaces later (Salcido et al., 2021). For instance, creating two EV-ready spaces as part of new construction costs around $920, compared to $3,710 for retrofitting (Salcido et al., 2021). Similarly, for developments with larger numbers of parking spaces, economies of scale further reduce per-space costs during initial construction (Southwest Energy Efficiency Project, n.d.).

Mandating a 25% threshold aligns with policies in forward-thinking regions. The Western Region, for example, has stringent building code amendments requiring high percentages of EV-ready parking in new developments (Southwest Energy Efficiency Project, n.d.). In Portland, Oregon, building codes require that 20% of parking spaces in new multifamily and mixed-use developments be EV-ready (City of Portland, Oregon, n.d.). Such mandates ensure that infrastructure keeps pace with EV adoption rates, preventing future logistical and financial challenges associated with retrofitting.

By implementing this requirement, Frederick County prepares for future demand and demonstrates a commitment to sustainability and innovation. This mandate supports residents and businesses in transitioning to EVs by ensuring the necessary infrastructure is readily available, thereby removing a significant barrier to adoption.

14. Grants to under-resourced communities

To better assist the county's low-income residents, Frederick County could provide incentives for those who are financially burdened and can't afford to purchase or install a Level 2 charger. According to the 2024 Alice Report, which examines those who are struggling financially, 32% of households in

Frederick County “cannot afford basic needs” (United Way Frederick County, 2024). Providing low-income residents with a higher grant or rebate amount would incentivize adopting EV infrastructure at home and increase availability to all residents regardless of income.

This incentive is modeled after the Charge Ahead Colorado Grant, which features grants for multifamily housing, businesses, workplaces, and others (Colorado Energy Office, n.d.). The grant includes “enhanced incentives” for “disproportionately impacted” communities, which includes low-income public housing, community centers, and more (Colorado Energy Office, n.d.).

Additionally, grant applicants can determine their eligibility for enhanced incentives by using the Transportation Equity Screening Tool for Colorado Energy Office Transportation Programs and identify whether they reside in an area considered a “disproportionately impacted community (DIC)” (Transportation Equity Screening Tool for Colorado Energy Office Transportation Programs, n.d.).

Maryland has its own EJ screening option, the MDE EJ Screening Tool, which can be used to identify overburdened and underserved communities (Maryland Department of the Environment, n.d.). Incorporating this tool would be useful in finding low-income communities in Frederick that need special incentives for purchasing and installing EV infrastructure. Overall, providing special incentives would promote EV adoption and allow a wider demographic to afford installation and purchase of Level 2 chargers.

Limitations

Throughout this project, the main limitations were variations in policy language, outdated information, and limited data at the local level.

One of the main research difficulties were variations in policy language and structure. EVSE policy in various states and counties use different terminology and formatting, which made it challenging to directly compare policies.

Outdated information comes from the recent vast expansion of the EV sector generated by rapid technological advancements at companies such as Tesla and Ford. As a result, innovative policies are made obsolete by the next new technology. States and counties then need to update or add policies to incorporate new technology and increase their effectiveness. Researchers who aren't experts in EV technology may find it difficult to sift through policies to find those that are still relevant.

There is also limited data at the local level. Because EVs are a major source of emissions reduction, new policies on installing EVSE or promoting EV adoption are coming from the State level. Finding policies and conditions like Frederick County's was difficult, but State-level policies can be modified for implementation at the county level.

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