BOLD THINKERS DRIVING REAL-WORLD IMPACT

WHITE PAPER

Leverage Public Policy to Support Electric Vehicle Adoption

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Executive Summary

The transportation sector contributes more than a quarter (28 percent) of the overall greenhouse gas (GHG) emissions in the United States.[1] As governments across the country implement climate action plans to decarbonize the transportation sector, many governments are focusing on transitioning from internal combustion engine (ICE) to electric vehicles (EVs) to achieve their goals.[2] EVs are projected to reach cost parity with ICE vehicles by 2025;[3] therefore, there will be growing demand for EV charging options.

A key factor for individuals considering the purchase of an EV is whether they have sufficient access to vehicle charging options. Since 80 percent of current EV owners report charging their vehicles at home[4] and approximately 50 percent of all vehicles in the United States reside in multi-unit dwellings (MUD),[5] it is important to consider EV charging access in MUDs. Residents of MUDs typically have limited, if any, ability to modify their buildings to install EV charging capability, referred to as EV supply equipment (EVSE). Governments can play a critical role in the expansion of EVs.

As local governments develop policies for EV infrastructure and evaluate locations for siting future EVSE, they should be mindful of how these decisions affect disadvantaged communities. While those communities are more greatly affected by pollution, residents also are less likely to own EVs given their current cost premium. In addition, disadvantaged communities are more likely to reside in MUDs where they may have less access to vehicle charging. Therefore, even if EVs reach cost parity with ICE vehicles, unless there are efforts to expand EV charging for MUDs, then it would be unlikely for EV ownership to expand substantially within low- and middle-income (LMI) households.

The following sections highlight several important questions governments will need to address.

How can building energy codes be used to promote EVs?

- States and local governments can adopt and modify model building energy codes, such as the 2021 International Energy Conservation Code (IECC)[6] and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1 standard,[7] which provide minimum EV charging infrastructure for new buildings. They can also adopt overlay codes, such as the 2018 International Green Construction Code (IgCC), which build on the IECC and ASHRAE frameworks, but set more aggressive energy efficiency and EV targets.[8]
- States may consider adopting their own energy codes, such as California's CalGreen code, to require buildings to meet more aggressive energy standards than may be included in model codes.[9]
- Where local governments have the authority to adopt codes that exceed the statewide code, they may consider implementing reach codes, which establish more aggressive baseline standards for EV infrastructure, energy efficiency, and renewable energy than what is required by the state.[10]
- As governments evaluate options for developing EV infrastructure requirements, they should be cognizant of the different stages of EV preparedness:
  - ***EV-Capable*** means that there is sufficient electric capacity for future EV charging, and that a conduit has been run to allow for the future installation of plugs and EVSE.
  - ***EV-Ready*** indicates that a full circuit (electrical capacity, raceway, conduit, plug, overprotection) is installed.
  - ***EVSE-Installed***, as the name implies, denotes that EV charging has been installed, and is the highest level of EV-Ready design.
- Finally, when local governments do not have the authority to implement reach codes, they may consider amending their zoning ordinance to

require EV infrastructure in new development. EV ordinances typically require EV infrastructure to be installed in buildings in proportion to the total amount of parking provided, and often require more EV infrastructure as overall parking amounts increase.

What technological and physical constraints should governments factor into their decisions?

As governments develop policies and ordinances that require EV infrastructure in new development, they should be aware of the different levels of EV charging. EVSE may be divided into the following broad categories: Level 1 charging, Level 2 charging, and Direct Current Fast Charging (DCFC). Level 1 charging requires the lowest electricity (typically 120 Volts) and provides roughly 3-4 miles of range per hour of charging. Level 2 charging requires 208-240 V and increases the charging rate to 25-30 miles of range per hour. Finally, DCFC typically provides more than 150 miles of range per hour.

In addition to evaluating the development of building codes or an EV-ready ordinance, local governments should consider the impacts on grid stability. The increased electrical load from EVs could have an adverse impact on the grid; therefore, local governments will need to either ensure that buildings have enough onsite electrical capacity or are constructed with smart charging technologies to manage additional EV energy load. A growth of EV ownership could also shift daily energy demand curves, moving demand to the evenings, when vehicles are plugged in to charge overnight.

Introduction

Climate Goals and Electric Vehicles

States and local governments nationwide are developing and implementing climate plans to reduce greenhouse gas (GHG) emissions. To achieve their climate goals, many governments are focusing on transitioning from internal combustion engine (ICE) to electric vehicles (EVs).[11] Given the drop in the cost of batteries in recent years, EVs are projected to reach cost parity with ICE vehicles by 2025.[12] With the increase in EVs in the coming decade, there will be growing demand for EV charging in buildings of all types.

A key factor for individuals considering the purchase of an EV is whether they have sufficient access to vehicle charging options. Since 80 percent of current EV owners report charging their vehicles at home[13] and approximately 50 percent of all vehicles in the United States reside in multi-unit dwellings (MUD),[14] it is important to consider EV charging access in MUDs. Residents of MUDs typically have limited, if any, ability to modify the building to install EV charging capability, referred to as EV supply equipment (EVSE). Consequently, governments will need to provide public EV charging to meet the growing demand.

This white paper introduces the different types of EV charging and approaches to incorporating EV infrastructure into the design of future buildings. The paper describes how building energy codes can play a significant role in the types of EV charging infrastructure that is installed in cities, the alternative approaches governments could evaluate for incorporating EV building design into local projects, and how considerations of equity can be incorporated into the development of EV infrastructure plans. In addition, the paper evaluates opportunities for future research that will be helpful to state and local governments as they expand EV infrastructure.

Technical Constraints and Factors

Electric Vehicle Infrastructure

While people may talk about EV charging broadly, there are significant differences in the types of charging infrastructure. EVSE may be divided broadly into three categories: Level 1 charging, Level 2 charging, and DCFC. As **Table 1** indicates, the electrical requirements, charging rates, and costs differ significantly among the different types of EV charging.

Table 1: EVSE Levels, Electric Power Requirements, and Charging Rates[15,16]

Charging Type	Voltage	Typical power	Charging Rates	Average Costs	Dwell Times	Location
Level 1	120 V AC	1.2-1.4 kW AC	3-4 miles/ hour	$1,400	Longer dwell times	Single-family residential; Some workplaces
Level 2	208-240 V AC	3.3-6.6 kW AC	25-30 miles/hour	$2,800	Medium dwell times	Office; Multi-family; Public
DCFC	400-1,000 V DC	50kW + AC	150-1,000 miles/hour	$18,500-$45,000	Short dwell times	Public

Level 1 charging (20 amp, 120 volts) allows users to charge on standard outlets. Given the low power associated with this type of EVSE, generally it is only suitable for longer dwell times (e.g., overnight) as it provides approximately 3-5 miles per hour.[17]

Level 2 charging (40 amp, 220/240 volts) requires more electrical capacity, but provides 6 to 7 times faster charging than Level 1 charging, delivering roughly 25-30 miles per hour. Therefore, Level 2 charging is more useful for workplace charging, where most EV owners can recharge their batteries during an 8-hour workday. Level 2 charging is also helpful in MUDs because of its faster charge times and ability to incorporate smart-charging software to allow for multiple vehicles to charge from a single station, while balancing the additional electricity loads and ensuring grid stability.

DCFC (20 kW) can provide 80 percent battery capacity in approximately one hour.[18] While DCFC can provide quick charging, the electrical capacity required makes the stations substantially more expensive than Level 1 or 2 EVSE. Given the quick charge times and the costs associated with their installation, DCFC stations are more appropriate for publicly accessible locations where cars will be parked for short periods, such as grocery store parking lots, than residential or commercial buildings where vehicles will be parked for longer durations. Local governments can develop frameworks for considering and prioritizing the location of publicly accessible DCFC stations, particularly in areas with lower instances of off-street EVSE.

As local governments analyze the appropriateness of EVSE, they should consider typical dwell times (the amount of time an EV would be parked at a charging station before being driven again). EV owners with residential EVSE will typically charge their vehicle overnight. Therefore, dwell times are frequently around 12 hours. Despite the longer dwell times, it would take close to 40 hours to charge a depleted Nissan Leaf battery on Level 1 charging.[19]

For workplace charging, dwell times typically follow the workday and are generally around 5-8 hours. Given the shorter timeframe, Level 2 EVSE is more appropriate for use at the workplace. As noted above, Level 2 EVSE has more opportunity to incorporate connected, smart charging technology that can share the load among multiple vehicles and help ensure grid stability.

Incorporating EV Infrastructure into Building Design

In addition to the different levels of charging, it is important for governments to understand the continuum of design options for including infrastructure in building design. The following definitions are used:

- ***EV-Capable*** means that there is sufficient electric capacity for future EV charging, and that a conduit has been run to allow for the future installation of plugs and EVSE. By providing the electrical capacity and running the conduit, the developer has included the more expensive elements up-front, which reduces future retrofit costs and allows for the future installation of EVSE.
- ***EV-Ready*** indicates that a full circuit (electrical

capacity, raceway, conduit, plug, overprotection) is installed. As its name suggests, through EV-Ready design, the developer has reduced barriers to installing future EVSE by providing necessary infrastructure besides the EVSE itself.

- ***EVSE-Installed*** is the highest level of EV-Ready design and, as the name implies, denotes that EV charging has been installed. By installing charging during construction, the developer would avoid costs associated with retrofitting existing buildings to accommodate charging infrastructure.

Table 2: Costs of Level 2 EVSE Installation During and Post-Construction[20]

Infrastructure Type	Cost During Construction	Cost Post-Construction	Savings
EV-Capable	$300	$2,500	$2,200
EV- Ready	$1,300	$6,300	$5,000

As **Table 2** indicates, there is substantial savings associated with including Level 2 EV infrastructure during construction rather than providing these components through a future retrofit. A significant portion of the EV infrastructure costs is in expanding the electrical capacity to accommodate future EV charging load. Therefore, while local governments may want to require more advanced infrastructure in new construction (e.g., EV-Ready parking spaces), it is most critical for developers to install sufficient electrical capacity. In addition to the materials and labor required to retrofit buildings for future EVSE, there are associated permitting and inspection costs for these post-construction renovations that can add to the cost of modifications.[21]

Policy Options for Governments

Why Building Codes Are Important for Electric Vehicles

Building energy codes establish the standards for constructing commercial and residential buildings. According to the U.S. Department of Energy, the implementation of energy codes is projected to save a cumulative $126 billion in energy savings and 841 MMT of avoided CO_2 emissions from 2010 to 2040.[22] Model codes are developed by international organizations, and then adopted by each state or locality, often with revisions to the model code. The International Energy Conservation Code (IECC)[23] and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1 standard[24] establish baseline energy benchmarks for buildings. The IECC code and ASHRAE standard are widely in use across the United States.[25]

In addition to establishing energy efficiency requirements, building energy codes can establish infrastructure requirements for clean energy and EVs. For example, the 2021 IECC expands upon previous versions of the code and will require minimum levels of EV charging in one- and two-family dwellings, multi-family dwellings, and commercial buildings. Through adoption of building energy codes requiring a minimum standard, governments can ensure that future buildings will at least provide baseline charging infrastructure that can support EV adoption.

Second, new buildings are expected to exist for 40 to 50 years. Therefore, they need to be constructed with enough electrical capacity to meet future EV charging demand. As noted above, charging availability is key to the decision to purchase an EV. For EVs to meet the expected market share, EV charging infrastructure will need to be integrated into multi-family dwellings and commercial buildings. If buildings are not constructed with the ability to install charging, they will hinder the adoption of EVs.

Third, installation of EV charging infrastructure (e.g., electric capacity, conduit, raceways, outlets, EVSE) is cheaper to install during the initial construction. As noted above, installing EV infrastructure post-construction can be 4 to 6 times more expensive than incorporating them in the building during the time of construction. The cost of installing EV through a retrofit is higher because building owners must install new electrical capacity, demolish and reconstruct parking, run the conduit, and obtain construction permits.[26]

Options for Integrating EV-Ready Codes

States and local governments generally fall within three broad categories regarding their abilities to adopt energy codes. First, state governments in home rule states, such as Maryland, adopt statewide energy codes, while permitting local governments to develop stretch or reach codes, which exceed the statewide standards.[27] Second, state governments, particularly those in Dillon Rule states (e.g., Virginia[28]), adopt energy codes at the state level, but prohibit local governments from exceeding the state-adopted code. Finally, there are states, such as Mississippi and North Dakota, that do not adopt statewide energy codes.[29] In these states, local governments are often permitted to adopt their own energy codes.

The following section provides a description of the types of codes that governments can adopt.

International Energy Conservation Code (IECC)

The IECC sets provisions for the minimum regulations for both Commercial and Residential buildings. While the International Code Council (ICC) develops new versions of the IECC model code every three years, states have adopted older versions of the code. Although the 2018 code is the most current version of the IECC, states can operate under previous versions (e.g., the 2015 IECC).

The 2021 version of the IECC, which will go into effect this year, includes provisions that establish minimum standards that will require:

- One- and two-family dwellings to provide at least one EV-Ready space per dwelling unit with a dedicated 40A, 240V.
- Multi-family dwellings to provide two EV-Ready spaces and EV-Capable infrastructure for 20 percent of the total parking.
- Commercial buildings to provide two EV-Ready spaces and EV-Capable infrastructure for 20 percent of the parking spaces.[30]

Governments that have adopted the 2018 code will be in a position to adopt the 2021 code. Through adoption of the 2021 code, governments can establish a baseline of EV charging in future multifamily- and commercial buildings.

While the 2021 IECC does establish baseline requirements for EVs, the ICC announced a new process for developing the model codes,[31] which would limit the input of state and local governments in future code revisions. EV advocates expressed concern about the ICC's decision, which would prevent thousands of governments from participating, and argued that governments should embrace reach codes as an alternative if future IECC codes are not appropriately aggressive.[32]

International Green Construction Code (IgCC)

The International Green Construction Code is a green building code which provides an alternative energy code for local governments to consider, particularly in states that allow local governments to exceed the statewide building code.[33] IgCC is developed as an overlay code which is designed to coordinate with the IECC, ASHRAE 90.1, other ICC standards, and LEED certification requirements. The code uses the commercial IECC as the baseline and then requires 10 percent energy efficiency above the IECC standards.[34] In the 2018 adoption of the IgCC, the code merged with the ASHRAE Standard 189.1-2017.[35] Therefore, local governments can adopt it in concert with or instead of other codes. While not as prevalent as the IECC, the IgCC provides an alternative approach for local governments to consider when evaluating the building energy codes.

Section 501.3.7.3 of the IgCC-ASHRAE 189.1 establishes the standards for required EV-Capable spaces that should be provided and are related to the number of overall spaces in the building.[36] **Table 3** outlines these provisions. Addendum az of the IgCC-ASHRAE 189.1-2017 provides governments with the ability to modify Section 501.3.7.3 of Standard 189.1-2017 to require that when a commercial building has 20 or more parking spaces, no fewer than 4 percent of the total parking spaces or no less than 8 percent of the employee parking spaces should be EV-Ready.[37] The addendum also changes Section 501.3.7.3 to require residential buildings to provide EV-Ready spaces for 20 percent of the parking.[38]

Table 3: Number of Spaces Required to Have Raceways According to IgCC-ASHRAE 189.1[39]

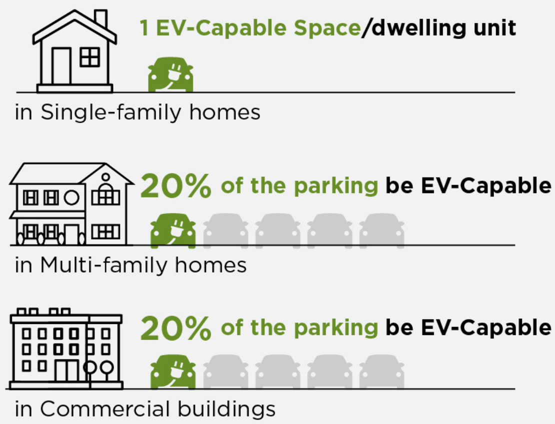
Total # of Parking Spaces Provided	# of Spaces Required to Have Raceways
1 through 25	1
26 through 50	2
51 through 75	4
76 through 100	5
101 through 150	7
151 through 200	10
201 and over	5 percent of total

Stretch or Reach Codes

In addition to the statewide codes, such as the IECC, local governments can adopt compliance standards that are more stringent than the statewide code, which are frequently referred to as stretch or reach codes. A stretch code is created by a locality through the voluntary adoption of optional appendices to the statewide minimum energy code,[40] which can better align the building or energy code with government objectives, such as the installation of EV charging or on-site renewable energy.[41] Organizations such as the New Building Institute have developed model stretch codes that local governments can adopt to increase energy efficiency and address other measures.[42] A reach code, unlike the stretch code, allow builders optional construction standards that exceed the statewide energy standards.[43]

Atlanta's EV Charging Infrastructure Readiness Requirement for New Construction

The city of Atlanta adopted a zoning ordinance amendment in 2017 that required:



Source: [Atlanta's EV-Ready Ordinance]

EV-Ready Ordinance

While governments can adopt the 2021 IECC or other model codes (e.g., the 2018 IgCC) that include minimum infrastructure for EV charging, some states do not permit local governments to exceed the code adopted statewide.[44] For local governments that cannot adopt the most recent IECC, the government could consider developing an EV-Ready ordinance to establish minimum EV charging infrastructure in the zoning ordinance.

Local governments can determine the level and amount of EV infrastructure required for a certain building type. Ordinance language can specify a ratio or percentage of EV-Capable spaces, EV-Ready spaces, or EVSE-Installed in relation to the amount of parking in a new building (see the call-out box for a description of Atlanta's EV infrastructure requirements).[45] For example, an ordinance might require a new development to provide one EVSE-Installed parking space for every 15 parking spaces in the building and stipulate that the remaining spaces should be EV-Capable. Under this example, the provision of EV-Capable spaces would allow EVSE to be installed in the future since there would be adequate electrical capacity and conduit to facilitate the expansion of charging. In addition, governments frequently require a higher percentage of EV infrastructure as the number of parking spaces increases (e.g., Seattle).[46]

Specific State Codes

Some states have adopted state-specific green building and energy codes. California, one of the first to develop such a code, adopted the CalGreen code in 2007 to help the state achieve its GHG goals.[47] The CalGreen code requires that 10 percent of all parking in new MUDs be EV-Capable.[48] In addition, CalGreen requires that nonresidential buildings with 10 or more parking spaces must install EV-Capable infrastructure for 6 percent of the parking spaces.[49] Connecticut is also considering establishing a state-wide baseline for EV parking in the next update to its statewide building code to push EV adoption.[50]

Implementation Considerations

In addition to evaluating the development of building codes or the option of developing an EV-Ready ordinance, local governments should consider the issues discussed below.

Equity

Overburdened communities are often exposed to multiple sources of pollution, including from vehicle emissions. Therefore, prioritizing EV charging locations in disadvantaged communities to reduce barriers to expanded EV ownership can reduce tailpipe emission exposure and the overall pollution burden in these communities. As local governments try to expand access to EVs, they should be aware of the barriers that may prevent disadvantaged communities from purchasing EVs and how certain policies could have a detrimental effect on these communities.

First, EVs currently cost more than a comparable ICE vehicle. Given the increase in cost for EVs, the percentage of EV ownership among LMI households is relatively low.[51] In addition, the federal tax credits for EVs[52] exclude most LMI households because they do not have the necessary tax liability.[53] While some states, such as Connecticut (see box above),[54] have adopted programs to reduce the cost of EVs for LMI households, the cost of EVs remains a barrier to ownership. While EVs are projected to reach cost parity with ICE vehicles within the next four years, cost may continue to be a barrier. Vehicle ownership is lower among poorer households, with 27 percent of households below the poverty line without a vehicle, compared to only 4 percent of households above the poverty line.[55] In addition, vehicle age is higher among households with lower incomes. For households making less than $25,000, the average vehicle age was 13 years, which is 40 percent older than households making more than $100,000.[56]

Connecticut's Hydrogen and Electric Automobile Purchase Rebate (CHEAPR) program

CHEAPR is a program administered by the Center for Sustainable Energy which **provides incentives of up to $5,000 to Connecticut residents** that purchase or lease an eligible battery-powered electric, fuel cell, or plug-in hybrid electric vehicle. Through the program's rebates, alternative vehicles can be more accessible to LMI households.

Source: Connecticut Department of Energy and Environmental Protection: Connecticut Hydrogen and Electric Automobile Purchase Rebate

Second, people in disadvantaged communities are more likely to live in MUDs where EV charging infrastructure is less prevalent. As noted above, a significant portion of EV owners report charging their vehicles at home. In addition, according to surveys, the availability of charging is the third most important of the factors that determine if individuals purchase an EV, behind cost and range.[57] Therefore, even if EVs reach cost parity with ICE vehicles, unless there are efforts to expand EV charging for MUDs, then it would be unlikely for EV ownership to expand substantially within LMI households.

Third, since LMI EV ownership is relatively low, EV parking that displaces traditional parking could hinder LMI households more disproportionately. Local governments should be aware of this issue, particularly when siting EV infrastructure in parking spaces in the public right-of-way (ROW). As local governments begin to assess their options for expanding access to EV charging, they should be intentional about including representatives from vulnerable communities in planning processes and consider best practice resources, like those developed by the Greenlining Institute, for engaging these communities.[58] Providing equal access to the decision-making process will not only ensure that all stakeholders have an opportunity to weigh in on these complex issues but will also lead to more equitable policies.

Greenlining Institute's Electric Vehicles for All: An Equity Toolkit

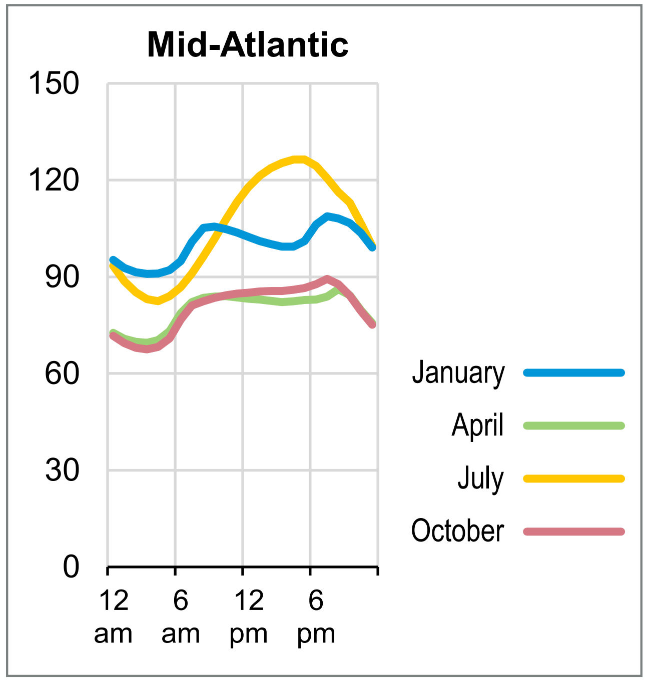
The Greenlining Institute has developed a toolkit that includes information to help governments engage disadvantaged communities in a deliberate, thoughtful, and productive manner.

Source: Greenlining Institute's Electric Vehicles for All: An Equity Toolkit

Accessibility by the Disabled

In addition to evaluating how EV infrastructure may affect LMI households, local governments should ensure that future codes and ordinances provide accessible EV parking spaces for individuals with disabilities. While there are no federal EV parking standards, states, such as California,[59] and councils of government[60] have developed guidelines regarding the design of accessible EV parking spaces. These should be consulted in the development of regulations for EV infrastructure to ensure that EVSE are accessible to all users.

Figure 1: Average hourly electricity load during typical day in the Mid-Atlantic Region (million kWh), selected months



Source: U.S. Energy Information Administration: Average hourly electricity load during typical day by region, selected months

Grid Stability

The increase of electrical load on the grid due to the increase of EV charging can create stability issues without proper planning or systems. While there is some variation, electricity demand is typically the highest from around noon to 6 p.m. daily, as shown in **Figure 1**.[61] Over the course of the evening, electricity demand tapers as people go to bed and stop using electrical devices.

With the increase in EV ownership, the electricity demand curve will likely shift to the evening as people charge their vehicles overnight. In addition, with the anticipated rise in building electrification, there will be a growing burden on the electric grid with the shift of gas-powered activities (e.g., residential hot water) to electric power.

To help manage the impact on the grid, current smart charging systems can optimize the needs of both the grid and EV users when multiple EVs are plugged in at once.[62] As the International Renewable Energy Agency notes, the objective of smart charging is "optimizing the charging process according to distribution grid constraints, the availability of local renewable energy sources, and customers' preferences."[63] For example, a Level 2 charger in an office building may have technology that would allow three vehicles to plug in simultaneously, but only draw 16 amps at a time per vehicle.

In addition, smart charging can allow EVs to provide energy back to the grid when needed, to provide additional stability and resilience. Smart charging mechanisms can range from one directional control that allows for the management of charging rate to bidirectional management systems, such as vehicle-to-grid (V2G), vehicle-to-home (V2H), and vehicle-to-building (V2B) technologies that allow vehicles to provide backup power when needed.[64]

Questions for Future Research

Although currently EVs represent about 2 percent of new vehicle sales, as EVs reach cost parity with internal combustion engine vehicles within the next five to six years, sales will increase.[65] As the number of EVs grows, additional guidance and tools will be needed, along with further research to help governments determine EV best practices.

EVSE Guidelines for Public Right of Way

As EVSE expand throughout cities, it will be imperative for governments to integrate EV charging into policies for curbside management to ensure that the public ROW is designed with all users in mind. Guidelines for siting EVSE in the public ROW should address the proper dimensions for on-street EVSE parking for a variety of parking types, including parallel, 90-degree, and 45-degree parking. Guidelines should provide frameworks to allow for the evaluation of sites, particularly the location and dimensions of planting strips, clear sidewalks, building facades, and vertical obstructions in relation to proposed EVSE. The guidelines should address issues of equity, such as how the government would evaluate the restricted use of on-street space for EV charging, particularly in disadvantaged neighborhoods. Specifically, governments could consider the availability of on-street parking by type (e.g., EV parking vs. non-EV parking) and the percentage of on-street parking that is occupied during peak and non-peak times, among other factors. In addition, guidelines should include policies outlining the proper design for accessible EVSE parking to ensure compliance with the Americans with Disabilities Act.

EVSE Rate Design

As EV charging becomes more prevalent, it will be critical to design electricity rates that promote EV charging, encourage turnover for vehicles at EVSE, and compensate utilities adequately for the additional energy load on the grid. Utilities can develop specific EV charging rates, which are separate and distinct from other uses. In addition, utilities can incorporate time-of-use rates that can encourage EV owners to shift charging to non-peak times. Further analysis of rate design best practices could help inform the development of specific policies to promote EV adoption.

Projected Health Co-Benefits with Additional EVSE

In addition to the GHG reductions connected with the use of EVs, the expansion of EVSE and related EV infrastructure can have associated health co-benefits. Additional research could be done to help governments quantify these co-benefits and factor them into their planning. The analysis can utilize and build on existing resources, such as EPA's CO-Benefits Risk Assessment (COBRA) tool.[66]

Conclusion

As EVs reach cost parity within the coming decade, it will be incumbent on governments to develop policy and legal frameworks to provide a minimum level of charging infrastructure so that the transition away from ICE vehicles is viable. Additional research should be done to consider ways to expand LMI households' access to EVs, develop best practices for EVSE rate design, and create policy guidance for the siting of EVSE in the public ROW.

While the transition to EVs is important to reducing GHGs from the transportation sector, it will not be a silver bullet. Governments should also promote active transportation modes, such as biking and walking, along with transit options to reduce GHG emissions. Finally, while EVs do not have tailpipe emissions, it is important to consider the electricity grid which is powering these vehicles when evaluating the associated GHG benefits. If the grid is supplied by fossil fuel generation instead of renewable energy, then the GHG benefits associated with the transition to EVs may be diminished. Additional research could be conducted on efforts to utilize renewable energy to power EV charging, including options for collocating solar arrays and EVSE, to reduce GHGs further.

Endnotes

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