



Towards Equitable and Transformative Investments in Electric Vehicle Charging Infrastructure

An Overview of Legislative Proposals and Opportunities for Federal Investments

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Executive Summary

Strategic federal investment in electric vehicle (EV) charging infrastructure can accelerate the transition to a less polluting transportation system and could be an impactful component of a national climate and infrastructure program. The EV charging infrastructure investments needed to address the climate and public health crises facing the United States also present an opportunity to advance equity and environmental justice, catalyze emerging markets for clean energy technologies, spur job creation, and help to avert a prolonged economic recession.

Drawing on lessons and examples from previous stimulus investments, existing state and federal programs, and recently-introduced clean energy, climate, and transportation bills, this paper provides a menu of options for federal infrastructure and stimulus packages and describes the scale of EV charging infrastructure investments needed to catalyze the transition to zero-emission transportation. The paper also discusses how new investments in transportation electrification can center equity and environmental justice to ensure better health and economic outcomes for communities overburdened by pollution, hardest hit by the COVID-19 pandemic, and underserved by the current transportation system.

Lessons Learned from Past Transportation Investment Programs

New federal investment proposals can draw lessons from the American Recovery and Reinvestment Act of 2009 (ARRA)—the fiscal stimulus bill signed by President Obama in response to the Great Recession. The ARRA included over \$90 billion in clean energy investments, including \$6.1 billion in spending on advanced vehicles and fuels. Overall, investments in transportation and charging infrastructure from the ARRA totaled in the hundreds of millions of dollars—only a small fraction of the total clean transportation and clean energy spending included in that stimulus package, but very significant in catalyzing the early market for EVs in the United States.

EV Charging Infrastructure in Recent Federal Legislative Proposals

Federal EV charging infrastructure legislation may draw from already-introduced clean energy, climate, and transportation bills. Recent federal proposals include funding for charging infrastructure installation, tax credits, strategic planning programs at the national and state level, public utility regulatory reform, and other programs. The proposals in front of Congress vary significantly in funding levels, as well as the scope and focus of investments.

Ensuring Equitable Transportation Electrification

Federal investments to catalyze the transition to an electric transportation system could be targeted and prioritize investments in communities overburdened by air pollution and underserved by the transportation system. Transportation pollution is highly concentrated in low-income communities and communities of color, as a result of historical and ongoing inequities, including the exclusion

of these communities from decision-making processes. This increased exposure to air pollution has also contributed to these communities suffering the greatest impacts of the COVID-19 pandemic. In addition to prioritizing emissions reductions in communities overburdened by air pollution, federal investments could also ensure equitable access to charging infrastructure, particularly for communities underserved by the transportation system.

An equitable federal charging infrastructure program may dedicate a minimum portion of investments to projects that benefit overburdened and underserved communities. Additionally, federal transportation electrification proposals can draw from recent state legislative frameworks with innovative community participation models, including those in which environmental justice communities and others overburdened by pollution or underserved by the transportation system have a leading role in planning, prioritizing, and implementing investments.

Scale of EV Charging Investment Needed to Meet Transportation Electrification and Climate Targets

It is clear that significant investments in charging infrastructure will be necessary to support a zero-emission transportation system in the United States. While these investments will be funded and implemented by a range of entities, including state and local governments, electric utilities, automakers, private EV charging providers, and other businesses, the federal government has a key role to play in providing funding for investments needed to help catalyze a robust market.

A majority of the proposals currently before Congress are at least an order of magnitude below what may be required to achieve the level of light duty vehicle electrification needed to meet climate targets. Moreover, significant additional funding is needed to electrify medium- and heavy-duty trucks, transit buses, school buses, and other vehicles types.

To maximize benefits, minimize costs, and achieve a transportation electrification market transformation, investment from both public- and private-sector actors must be accompanied by deliberate coordination and planning. This will require consideration of electrification needs within and across sectors (the transportation sector and buildings, for example), across states and regions, and across multiple decades. The federal government can play an important role by supporting this comprehensive planning and helping to coordinate these critical investments and programs.

Investing in Charging Infrastructure for Medium- and Heavy-Duty Vehicles

There is a significant opportunity for federal investment to catalyze the electrification of medium- and heavy-duty vehicles, including trucks, buses, and port equipment, which are a significant source of harmful local pollutants, such as ozone, nitrogen oxides, and particulate matter. Trucks and buses in particular have a potential for rapid electrification over the coming years, driven by accelerating technology developments, state and local regulatory policies, and ambitious corporate and public fleet electrification commitments. Federal support to accelerate the electrification of

medium- and heavy-duty vehicles could include direct investment in charging infrastructure as well as support for planning and analysis at the state, regional, local, and fleet level.

Building from Regional Fast Charging Corridor Collaborations

There is a significant opportunity for federal investment to leverage existing state and regional collaborations on EV charging infrastructure. This may be particularly effective for federal investments in the fast charging stations along highway corridors needed to enable convenient long-distance travel in EVs. Active regional collaborations include the Transportation and Climate Initiative, the Regional Electric Vehicle Plan for the West, or “REV West,” and the West Coast Electric Highway.

Conclusion

Investments in electric vehicle charging infrastructure represent a notable strategic opportunity to make progress on several of the most important challenges facing the United States today: the climate crisis, the need to accelerate economic recovery, harmful air pollution, and the systemic inequities affecting communities overburdened by pollution and underserved by the transportation system. The authors of this report hope it will provide a helpful resource to policymakers as they consider legislative proposals to respond to these opportunities.

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An Overview of Legislative Proposals and Opportunities for Federal Investments

Introduction

Infrastructure investment will likely be a significant focus of ongoing federal stimulus to rebuild the American economy, create jobs, and lessen the impacts of a recession caused by the COVID-19 pandemic. One of the key areas for investment to improve the economy while addressing the climate and public health crises will be the electrification of the transportation sector.

Transportation is the largest source of greenhouse gas (GHG) emissions in the United States and a major contributor to local air pollution in many communities. As we approach an inflection point on battery technology and electric vehicle (EV) costs, there is an opportunity to rapidly accelerate the benefits of transportation electrification through federal investments in charging infrastructure.

This analysis focuses on potential federal investments in EV charging infrastructure, and specifically addresses the scale of needed investments and the opportunities to target investments to advance equity and environmental justice while reducing GHG emissions and creating economic stimulus. The investment in charging infrastructure is part of a broader suite of investments and policies needed to electrify the transportation sector, including support for research, development, and deployment of vehicle and battery technologies, vehicle incentives and emissions standards, and other policies—all of which are outside the scope of this analysis.

While electrification of cars, trucks, buses, and other vehicles is necessary to reduce emissions, it will not be sufficient to meet our climate goals. Additional investments, regulations, and other policies are needed in the transportation sector, including support for transit systems, reducing emissions from freight movement, supporting more sustainable and livable communities, and decarbonizing aviation and other intercity transport. Transit systems across the United States have been particularly negatively impacted by COVID-19, and increased support for transit operations is critical to an equitable and just recovery from the pandemic.

This issue brief begins by presenting an overview of charging infrastructure investments that resulted from the last major round of federal stimulus spending after the Great Recession, highlighting approaches and successes of these programs. Then, it summarizes current and recent legislative proposals. Finally, this brief discusses how these legislative proposals compare to the investments that would be needed for true transformation of the transportation sector, highlighting the opportunity to focus on electrifying medium- and heavy-duty vehicles and advancing environmental justice and equity.

Lessons Learned from Past Transportation Investment Programs: 2009 Stimulus

The American Recovery and Reinvestment Act of 2009 (ARRA) was a fiscal stimulus bill signed by President Obama on February 17, 2009.¹ Crafted in response to the Great Recession, it resulted in \$831 billion of expenditures across multiple sectors, including unemployment benefits and general tax relief, state fiscal relief, health care, infrastructure, and education.

ARRA included over \$90 billion in clean energy investments, including \$6.1 billion in spending on advanced vehicles and fuels.² This spending is estimated to have created 37,000 job-years.³ Programs included \$2.2 billion in tax credits for plug-in hybrid and all EVs and \$2.4 billion in grants to support domestic manufacturing and deployment of advanced batteries and electric and plug-in hybrid vehicle components.⁴

Overview of EV Charging Investments in 2009 Stimulus

Though a small portion of overall spending, ARRA did include a variety of programs that provided funding for EV charging equipment either directly (i.e., with a program designed specifically for charging infrastructure) or indirectly (i.e., a program that allowed funds to be used for charging infrastructure). A summary of these programs, and key findings and impacts, is provided below.

Grant-Funded EV Charging Station Investments

Two matching grant programs provided direct funding for light duty charging infrastructure. These programs distributed \$130 million in federal funding and resulted in the deployment of nearly 19,000 home and public charging stations as well as the collection of data on the charging stations and enrolled vehicles.

The first was a \$15 million matching grant for the purposes of charging infrastructure deployment and data collection, administered through the U.S. Department of Energy's Transportation Electrification Initiative. The grant was awarded to ChargePoint, which leveraged the grant and other state and private funds to deploy over 4,600 home, public, and commercial EV charging stations.⁵ Completed in 2013, the project also provided data to Idaho National Laboratory, which publishes information regarding where EVs are charged, when and how much energy is used. The data, in turn, are used by researchers, municipal planners, and other stakeholders to help inform future infrastructure needs. ChargePoint states that, by leveraging state and private investment, it was able to deploy stations at an average cost of \$3,300 of federal funds per charging station, well below market costs at the time.

A second matching grant program—The EV Project—distributed \$115 million in matching grants to automakers, city, regional, and state governments, electric utilities, and other organizations.⁶

Together, the organizations deployed 14,000 Level 2 chargersⁱ and 300 DC fast chargersⁱⁱ across 22 metropolitan areas. More than 8,000 EVs (Chevrolet Volts, Nissan LEAFs, and Smart ForTwo Electric Drive) were also enrolled in the program. The demonstration deployed EVs and chargers to collect data characterizing charging station usage across different localities, evaluate effectiveness of charging infrastructure, and analyze charging impacts on the electric grid.⁷ Data was collected from 2011 through 2013 and captured almost 125 million miles of driving and six million charging events.⁸ The ultimate goal of The EV Project was to take the lessons learned from the deployment of these first PEVs and the charging infrastructure supporting them to enable the streamlined deployment of the next five million PEVs.⁹

Through these grant programs, federal funding helped to both advance and collect insight on the state of light-duty EV charging across the United States. Idaho National Labs released its report containing findings from both the ChargePoint grant program and the EV Project in 2015.¹⁰ The report was one of the first to reveal the fundamental difference between conventional and EVs: that despite installation of “extensive” public charging infrastructure, in most of the project areas, the vast majority of charging was done at home and work. However, this analysis was conducted during an early phase of EV deployment, when most commercially available EVs had a limited driving range and EVs were driven by a small subset of the U.S. population.

Smart Grid Regional and Energy Storage Demonstration Project

The Smart Grid Regional and Energy Storage Demonstration Project supported modernization of the electric grid. It directed \$684 million, along with a \$900 million industry cost share, towards 32 Regional Smart Grid Demonstration and Energy Storage Demonstration projects under the Smart Grid Demonstration Program. Though most of these programs were focused on distribution system resilience, one grant included a \$45 million award to Consolidated Edison, to demonstrate a scalable Smart Grid prototype that promotes cyber-security, distributed resources, EV charging and consumer participation in energy mix.¹¹

ⁱ Level 2 or “L2” operate at 208-240 V and output anywhere from 3 kW to 19 kW of AC power. Level 2 chargers are capable of providing 10 to 20 miles of range per hour of charge time, making them suitable for at-home, workplace, and extended public charging.

ⁱⁱ Direct-current fast chargers or “DCFC” stations operate at 480V direct current (DC) and, for light duty vehicles, typically output at 50 to 150 kW. DC fast chargers are capable of providing 60 to 80 miles of range per 20 minutes of charge time, making them suitable for high-volume public charging in urban areas and along heavily trafficked corridors.

Clean Cities Program Funding

The Clean Cities program, established in 1993, advances the nation's economic, environmental, and energy security by supporting local actions to cut petroleum use in transportation. Clean Cities carries out this mission through a network of nearly 100 coalitions.¹² Through ARRA, Clean Cities was provided \$300 million, around three quarters of the program's historical cumulative funding, which it used to fund 25 cost-share projects across the country. Nine of the 25 programs directed funding toward EV charging stations. In total, the Recovery Act funded Clean Cities projects that led to the installation of 1,380 alternative fuel stations, 62 percent of which were EV charging stations.¹³

Each of these EV infrastructure development projects was conducted in conjunction with broader programs, such as fleet transition assistance or other alternative fuel networks (such as compressed or liquified natural gas). Projects were highly community specific. A few key program details and findings highlighted from projects incorporating EV charging included: ¹⁴

Clean Cities Future Fuels (Connecticut): While large fleets received a lot of attention, a majority of fleets across the country were small and often relied on other small fleets for inspiration and advice on the best ways to increase the efficiency of their operations. In this project, every partner fleet grew as a result of participation— with some purchasing as many as 70 percent more alternative fuel vehicles than they originally anticipated.

Midwest Region Alternative Fuels Project (Iowa, Kansas, Missouri, and Nebraska): Though largely focused on CNG, this project deployed six EVs and 15 charging stations. Project partners found that deployed stations encouraged fleets in the area to further invest in alternative fuel vehicles and create travel corridors between and within the target metropolitan areas.

New York State Alternative Fuel Vehicle and Infrastructure Deployment Program (New York and New Jersey): This project helped to repower nearly 400 vehicles with alternative fuels and deployed nearly 100 EV charging stations. This project found that a technology that makes sense for one fleet may not make sense for another: similar fleets using the same technology often experienced very different outcomes based on infrastructure availability, driving routes, duty cycles, driver behavior, and climate.

Puget Sound Clean Cities Coalition Petroleum Reduction Project (Idaho, Oregon, and Washington): As part of this project, local partners deployed hundreds of EVs and nearly 300 charging stations. These partners noted that while the EVs didn't displace much petroleum during the course of the project, the installation of EV charging stations for pool car and commuter vanpool applications allowed many people to experience EVs firsthand. This factor, coupled with the state's EV purchase incentives, influenced a significant number of personal EV purchases.

The Ohio Advanced Transportation Partnership (Kentucky and Ohio): This project was intentionally broad in scope in order to leverage as many resources as possible. Despite being a challenge to manage, the project resulted in significant alternative fuel market growth. By funding one alternative fueling station and identifying an anchor fleet to fuel there, the overall station network was able to grow and benefit a wider variety of local and national fleets. Smaller fleets also made significant strides once they were able to acquire a small number of vehicles and access fueling without an issue.

TIGER/ BUILD Program

The Transportation Investments Generating Economic Recovery (TIGER) grant program is a competitive grant program run by the U.S. Department of Transportation (DOT). It originated in ARRA under the description “national infrastructure investment” (as it has been in subsequent appropriations acts), though in fiscal year 2018 the program was renamed the Better Utilizing Investments to Leverage Development (BUILD) program.¹⁵

The program’s stated purpose is to fund projects of national, regional, and metropolitan area significance, though regional and metropolitan projects have dominated awards. Congress has directed that the funds be distributed equitably across geographic areas, between rural and urban areas, and among transportation modes; however, while grants under the Obama Administration were fairly evenly distributed across modes and population areas, the Trump Administration has prioritized grants to road projects in rural areas.¹⁶ In two published reports on the program, DOT has noted that measuring the performance of the array of projects in several modes eligible for TIGER grants is challenging.

Over the years, a small number of projects have utilized TIGER/BUILD funding for EV charging infrastructure. One of the smallest grants of 2010 directed \$2 million to provide DC fast charge stations for the length of the I-5 corridor in Oregon with gaps not exceeding 50 miles, with a goal of deploying 42 sites. This funding worked in conjunction with that of the EV Project, noted above.¹⁷ In 2015, two projects incorporated EV charging stations into broader local transportation improvement projects (in Rhode Island and rural Texas),¹⁸ while in 2019 two projects in Antelope Valley, California and Houston, Texas were approved to fund electric buses and charging equipment.¹⁹

Findings and Discussion

Overall, investments in transportation and charging infrastructure arising from ARRA have totaled in the hundreds of millions of dollars—a significant sum, but only a small fraction of the total clean transportation and clean energy spending included in the stimulus. On a total funding basis, the two direct grant programs constituted the majority of investment. However, the indirect/integrated TIGER/BUILD and Clean Cities programs, though smaller in total dollars, represented a range of approaches and investment opportunities for cities and states. These projects

took advantage of the existing Clean Cities programs, greatly expanding it and allowing for rapid deployment of funds to a diverse set of recipients through an existing grant management program.

ARRA was passed in the early days of EV deployment—at the time, the only commercially available fully EV was the Tesla Roadster, with very limited production and a base price over \$100,000. The first non-luxury model, the Nissan LEAF, was released in 2010 and had a range of less than 100 miles. According to the Alternative Fuels Data Center, there were only 94 publicly accessible charging stations across the U.S. at the end of 2009.ⁱⁱⁱ Accordingly, data collection and study was a significant focus of these projects. The Idaho National Labs study, published in 2015, continues to be cited in current (2018 and later) research on charging networks. Even in today’s more evolved market, one could expect that new data collection and research efforts could provide significant added value to many stakeholders across the electric transportation market, especially in the more nascent medium- and heavy-duty sectors.

Additionally, the Obama Administration noted that federal investment in charging infrastructure at that time could be utilized to address “network externalities.” These externalities influence the adoption of new technologies that rely on network effects—products that have network effects have a greater value when there is a larger network of users of that product. For instance, EV charging stations are more valuable if there is a large network of charging stations and many EV drivers. The Obama Administration noted that “government support can not only provide the needed funds, but it can also act as a signal to the market that a particular technology has support, influencing expectations of future growth and investment decisions.”²⁰ The findings from the Clean Cities programs, in particular, are consistent with this pattern. Investments helped to increase the value of EVs and drive incremental third party and private investment in additional EVs.

Finally, the projects implemented through ARRA reflect a diversity of electrification approaches, modes, and locations. Projects were implemented across the U.S., in urban and rural areas, and for a range of applications (though largely focused on the light duty vehicle sector).

ⁱⁱⁱ For comparison, there are currently more than 33,000 public stations in service as of March 2021. *Alternative Fueling Station Locator*, Alternative Fuels Data Center, <https://afdc.energy.gov/stations/#/analyze?fuel=ELEC>.

EV Charging Infrastructure in Federal Legislative Proposals

Investments in new or expanded EV charging networks could help to reduce emissions and improve air quality, benefiting public health while also spurring job creation and helping to avert a prolonged economic recession from the COVID-19 pandemic. Comprehensive federal infrastructure investment or economic stimulus legislation may draw from already-introduced clean energy, climate, and transportation bills, and other existing legislative proposals. Many of the recent legislative proposals were referenced in the House Select Committee on the Climate Crisis Majority Staff Report released in June 2020.²¹

These proposals include direct funding for infrastructure, rebates to individuals and business, and planning programs to help cities, states, and other local governments integrate electric transportation. Taken together, these proposals can be viewed as a “menu” of legislative options to expand funding for charging infrastructure across the country. See Appendix 1 for a list of all referenced bills and proposals.

Electrification Planning and Broad-Based Programs

Some bills have proposed support for state energy transportation plans with funding and guidance for states to invest in EV charging.

- **CLEAN Future Act** (H.R. 1512, Rep. Pallone (D-NJ)):²² Appropriates \$300 million over 10 years to the Department of Energy (DOE) to provide states with financial assistance to develop state energy transportation plans, to be included in state energy conservation plans, and would include means of supporting electrification of transportation, reduced fuel consumption and improved air quality.
- **Moving Forward Act** (H.R. 2, Rep. De Fazio (D-OR)):²³ Amends the Energy Policy and Conservation Act to authorize \$25 million annually for preparation of State Energy Transportation plans by State energy offices; allows DOE to provide funding to a state to develop plans to promote electrification of the transportation system, reduce consumption of fossil fuels, and improve air quality. Requires metropolitan planning organizations and states to consider carbon pollution and emissions reduction, climate change, resilience, and hazard mitigation throughout the planning process. Adds additional planning considerations for accessibility and equity, including a holistic look at housing and land use policies.

Infrastructure Incentive Programs

Many bills and proposals would allocate significant funding directly toward planning for and installing charging infrastructure. These programs provide funding using different mechanisms, including grants, rebates, and tax credits.

Planning Initiatives

Numerous proposals would direct DOE and/or DOT to establish planning processes for the national deployment of an EV charging network. These proposals are largely focused on light duty vehicles.

- **CLEAN Future Act:** Requires DOE to establish a program to provide grants to, or enter into cooperative agreements with, eligible entities to conduct EV charging station mapping activities in order to determine where EV charging stations will be needed to meet the current and future needs of EV drivers in the next five years. In addition, DOE would also be required to establish an EV Charging Equity Program to increase deployment and accessibility of EV charging infrastructure in underserved or disadvantaged communities.
- **The Clean Energy Innovation and Deployment Act** (H.R. 7516, Rep. DeGette (D-CO)):²⁴ Requires DOE to assess progress in the development of standards necessary to support the expanded deployment of EV charging equipment, develop an EV charging network to provide reliable charging nationwide, and ensure the development of such network will not compromise the stability and reliability of the electric grid.
- **EV Freedom Act** (H.R. 5770, Rep. Levin (D-MI)):²⁵ Requires DOE and DOT to study, develop, and design a plan to increase EV charging along highways and public roads. Within five years of enactment, the bill would require DOE and DOT to implement a national grant funding program to implement the EV charging equipment plan.
- **Moving Forward Act:** Directs DOE to conduct assessment and report on availability, opportunities for additional deployment, and best practices to encourage deployment of EV charging infrastructure in underserved communities. Requires Assistant Secretary of the Office of Electricity Delivery and Reliability to convene a group to assess the development of standards necessary to support expanded deployment of a nationwide EV charging network.
- **Electric Vehicles for Underserved Communities Act of 2020** (H.R. 5751, Rep. Clarke (D-NY)):²⁶ Requires DOE to assess the state of, challenges to, and opportunities for the deployment of EV charging infrastructure in urban areas, particularly in underserved or disadvantaged communities. If practicable, DOE must ensure that relevant programs provide access to EV infrastructure, address clean transportation needs, and provide improved air quality in such communities.

Grant Programs

Many bills would establish grant programs to deploy charging infrastructure. Some of these programs would be directed specifically at charging infrastructure, while others list charging infrastructure among a wide range of eligible fund uses.

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- **Clean Corridors Act of 2019** (H.R. 2616, Rep. DeSaulnier (D-CA)):²⁷ Directs the DOT to award grants to certain governmental entities and planning organizations to install EV charging infrastructure and hydrogen fueling infrastructure along designated alternative fuel corridors. \$300 million would be appropriated annually for 10 years.
 - **America's Transportation Infrastructure Act** (S. 2302, Sen. Barrasso (R-WY)):²⁸ Authorizes highway spending from the Highway Trust Fund for cost-shared EV charging infrastructure (along with other alternative fuels), including: (1) a \$1 billion competitive grant program for state and local governments to deploy charging and fueling infrastructure for electric, hydrogen, and natural gas vehicles along designated alternative fuel corridors; (2) a \$370 million competitive grant program to reduce emissions from trucks idling at port facilities; and (3) supplemental formula funding and competitive grants to states to expand investment in transportation improvements that reduce on-road mobile sources of carbon emissions.
 - **USA Electrify Forward Act** (H.R. 1879; Rep. Dingell (D-MI)):²⁹ Expands and re-establishes the grant program under the Energy Independence and Security Act of 2007, allocating \$2 billion annually for ten years to a competitive program to provide grants on a cost-shared basis to State governments, local governments, metropolitan transportation authorities, air pollution control districts, private or nonprofit entities, or combinations of those governments, authorities, districts, and entities, to carry out one or more projects to encourage the use of plug-in electric drive vehicles and plug-in EV charging equipment.
 - **Clean Cars for America Proposal** (Sen. Schumer):³⁰ Directs \$45 billion in grants to states, cities, and municipalities to ensure that “all Americans have access to charging infrastructure.” State and local governments can utilize the funding to provide publicly accessible charging infrastructure along city streets and public parking areas, with a focus on expanding infrastructure to lower-income communities. In addition, communities would be able to offer grants to entities that install infrastructure in homes, apartment buildings, private garages, or any other private residential or commercial properties in communities of all sizes.
 - **Moving Forward Act:** Establishes a \$350 million annual competitive grant program for FY 2022–2025 to deploy EV charging and hydrogen, natural gas, and propane fueling infrastructure. The program makes funds available to states and local governments to provide publicly accessible charging or fueling stations along designated alternative fuels corridors. Individual project selection will be primarily based upon the ratio of projected emissions reductions to federal investment.

Rebates

Rebate programs would direct funding to individuals as well as, in some cases, public entities to defray the costs of EV charging infrastructure.

- **Moving Forward Act:** Directs DOE to establish a program to provide rebates to eligible entities that install publicly accessible EV charging equipment.
- **NO EXAUST Act** (H.R. 5545, Rep. Rush (D-IL)):³¹ Authorizes DOE to implement an EV charging rebate program for private and public entities, providing either 75 percent of covered expenses or \$2,000 for non-networked level 2 charging, \$4,000 for networked level 2 charging, or \$75,000 for networked direct-current fast charging equipment, whichever is less.
- **CLEAN Future Act:** Requires DOE to establish an EV charging equipment rebate program for private individuals, entities, state, local, and tribal governments and municipal planning organizations (MPOs). Multi-port installations would be eligible for the full rebate for the first port and for each subsequent port. No more than 40 percent of total funds could be used for networked DC fast charging equipment. \$100 million would be allocated per year for ten years.

Tax Credits

Other proposals would reestablish and extend the currently expired alternative fuel infrastructure tax credit (30(C)), which was first established in 2005 and was extended through 2021 at the end of 2020.³²

- **Moving Forward Act:** Extends 30C through 2025. Beginning in 2021, the Act would expand the credit for electric charging infrastructure by allowing a 20 percent credit for expenses in excess of \$100,000.
- **Securing America's Clean Fuels Infrastructure** (S. 3735, Sen. Carper (D-DE), Sen. Alexander (R-TN)):³³ Extends 30C to 2029, expands tax credit eligibility to a per-unit rather than per-location basis, and increases commercial EV charging tax credit from \$30,000 to \$200,000 per property.

Public Utility Regulatory Policy Act Reform

Many proposals would utilize reforms to the Public Utility Regulatory Policy Act of 1978 (PURPA) to encourage utility investment in charging infrastructure and to facilitate the development of other programs to support development of charging stations.

- **Moving Forward Act and CLEAN Future Act:** Amends PURPA to require states to consider authorizing measures to encourage deployment of EV charging stations, authorizing recovery of capital investments in equipment to enable deployment of an EV charging network by utilities, and allowing other private or public entities that are not regulated electric utilities to sell electricity to the public only through EV chargers.
- **Clean Energy Innovation and Deployment Act:** Amends PURPA to require each state to consider authorizing utilities to establish rates sufficient to recover from

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- ratepayers any capital, operating expenditure, or other costs related to deployment of infrastructure for vehicle charging or load management
- **LIFT America Act** (H.R. 1848, Rep. Pallone (D-NJ)):³⁴ Amends PURPA to direct states to consider authorizing each electric utility of the State to recover from ratepayers any capital, operating expenditure, or other costs of the electric utility relating to the deployment of EV charging equipment designed to provide vehicle charging or load management.
 - **NO EXHAUST Act:** Amends PURPA to direct states to consider authorizing measures to stimulate investment in and deployment of EV charging equipment and to foster the market for vehicle charging; authorize each electric utility of the State to recover from ratepayers any capital, operating expenditure, or other costs of the electric utility relating to load management, programs, or investments associated with the integration of EV charging equipment onto the grid and promoting greater electrification of the transportation sector; and allow other private or public entities that are not regulated electric utilities to sell electricity to the public only through EV chargers.

Clean Cities Program

Two proposals would codify the Clean Cities program at funding levels similar to those in ARRA, significantly above recent years' appropriations. Clean Cities Coalition Program (H.R. 5518, Rep. McEachin (D-VA)) and the Moving Forward Act would both appropriate \$50 million in 2020, rising to \$100 million in 2025. In order to be eligible for the authorized funds, projects must “reduce petroleum consumption, improve air quality, promote energy and economic security, and[/or] encourage deployment of a diverse, domestic supply of alternative fuels in the transportation sector,” such as by “expediting the establishment of local, regional, and national infrastructure to fuel alternative fuel vehicles.”

Model Building Codes

Building codes, while not a direct investment in infrastructure, can have a large impact on both private and public charging installation availability and costs. Multiple bills direct DOE to develop model building codes to facilitate EV charging.

- **Clean Energy Innovation and Deployment Act:** Requires DOE to establish or update model building codes for integration of EV charging equipment (including space for parking), as well as the integration of onsite renewable power equipment and electric storage equipment (including the use of EV batteries as storage) in residential and commercial buildings.
- **LIFT Act and CLEAN Future Act:** Directs DOE to develop model building codes for residential and commercial buildings that facilitate the integration of EV charging

equipment and the integration of onsite renewable energy and battery storage technology.

- **Moving Forward Act:** Requires DOE to update model building codes for integrating EV charging equipment into multi-family buildings.

Discussion and Considerations for Policymakers

The electric transportation market has progressed significantly in the almost dozen years since the last broad-based stimulus package, though it does remain a growing market highly sensitive to public policy intervention. In addition, the critical need to reduce GHG emissions, and in particularly emissions from the transportation sector—now the largest source of GHG emissions in the United States, is a more central focus of federal policy discussions. The growth of the EV market and the urgency of reducing transportation emissions are reflected in the significant focus on transportation in clean energy stimulus bills, including billions of dollars of proposed spending on charging infrastructure development alone. As the U.S. faces inter-related challenges of climate change, public health, air pollution, inequality, and economic recession, there is an opportunity for federal electrification investments to center equity and environmental justice, to be made at the scale needed to catalyze the transition to zero-emission transportation, and to support emerging technologies and market opportunities. Federal investment can build upon the work of states, cities, and regional initiatives, which have played a leading role in transportation electrification over the past decade.

Ensuring Equitable Transportation Electrification

Federal investments to catalyze the transition to an electric and zero-emission transportation system could realize important interrelated benefits by prioritizing communities overburdened by air pollution and underserved by the transportation system. Not only are these communities hit first and worst by the impacts of climate change, they also face severe impacts from local air pollution. Transportation pollution is highly concentrated in low-income communities and communities of color³⁵ as a result of historical and ongoing inequities, including the exclusion of these communities from decision-making processes and the siting of interstate highways, ports, industrial facilities, and bus depots. In addition to increased rates of asthma and other chronic respiratory diseases, frontline and environmental justice communities are also suffering the greatest impacts of the COVID-19 pandemic. Recent research from the Harvard University T.H. Chan School of Public Health found that communities with even a small increase in long-term exposure to PM_{2.5} have a significant increase in their COVID-19 death rate.³⁶

In addition to ensuring that the benefits of an electric transportation system go to communities overburdened by air pollution, federal investments could also address communities underserved by the transportation system. Many communities—urban, suburban, and rural—have limited access to safe and affordable transportation options, due to lack of access to transit, low rates of vehicle ownership, land use planning decisions, and other factors. A just transition in the transportation sector could also include other important considerations, such as creating well-paying union jobs, reducing the cost of transportation for low-income families, improving and expanding transit systems, providing opportunities for fossil fuel workers and businesses to transition to clean energy industries, and more.

The CLEAN Future Act, in its newly revised draft, includes an expanded focus on expanding access to EVs in underserved communities through providing technical assistance, directing funding from existing programs, and establishing a dedicated infrastructure funding program. However, in general, equity and disadvantaged communities are included in only a selection of these existing congressional proposals. There is a significant opportunity to make equity a greater focus of federal investments and fully realize the multiple benefits of electric transportation: local emissions reductions, climate change mitigation, transportation access, cost savings, and job creation. Federal proposals can build from strong commitments to equity and environmental justice found in state climate and transportation programs, many of which were developed by or in collaboration with organizations representing frontline communities, communities of color, transit advocates, and others.

Dedicated Investments

Several state climate programs require a dedicated minimum portion of investments be made to advance equity and environmental justice goals and benefit priority populations. For example, California set a statutory requirement that at least 35 percent of California Climate Investments must benefit “disadvantaged communities,”^{iv} low-income households, or low-income communities.^{v,37} The state has significantly exceeded the statutory minimum: as of 2020, the California Air Resources Board estimates that 57 percent of the cumulative investments from California Climate Investments projects have benefitted priority populations.³⁸ Another example is New York’s Climate Leadership and Community Protection Act (CLCPA), which mandates “disadvantaged communities shall receive no less than 35 percent of the overall benefits of spending on clean energy and energy efficiency programs” with “a goal for disadvantaged

^{iv} “Disadvantaged Communities” is a defined term under California Health and Safety Code § 39711. CA Assembly Bill No. 1550 (Gomez), 2016.

^v The California dedicated investment requirement is composed of multiple, additive requirements, totaling a 35 percent minimum level of investment. Pursuant to California Assembly Bill (AB) 1550 (Gomez, Statutes of 2016), “The investment plan developed and submitted to the Legislature pursuant to Section 39716 shall allocate a minimum of 25 percent of the available moneys in the fund to projects located within the boundaries of, and benefiting individuals living in, communities described in Section 39711” [(i.e., “disadvantaged communities”)], “the investment plan shall allocate a minimum of 5 percent of the available moneys in the fund to projects that benefit low-income households or to projects located within the boundaries of, and benefiting individuals living in, low income communities located anywhere in the state”, and “the investment plan shall allocate a minimum of 5 percent of the available moneys in the fund either to projects that benefit low-income households that are outside of, but within a 1/2 mile of, communities described in Section 39711, or to projects located within the boundaries of, and benefiting individuals living in, low-income communities that are outside of, but within a 1/2 mile of, communities described in Section 39711.a minimum of 5 percent of the available moneys in the fund either to projects that benefit low-income households that are outside of, but within a 1/2 mile of” “disadvantaged communities.”

communities to receive 40 percent of overall benefits of spending.”³⁹ In December 2020, the governors of Massachusetts, Connecticut, and Rhode Island, and the mayor of the District of Columbia signed a memorandum of understanding (MOU) to launch the Transportation and Climate Initiative Program (TCI-P), a multi-jurisdiction cap-and-invest program for carbon dioxide (CO₂) emissions from transportation fuels.⁴⁰ The TCI-P MOU includes a commitment that “no less than 35 percent of the proceeds from the auction of allowances” will be dedicated “to ensure that overburdened and underserved communities benefit equitably from clean transportation projects and programs.”⁴¹

One important component of a dedicated investment commitment is how the targeted communities are identified and defined, as well as how the benefits of investments are calculated. The priority populations in the California Climate Investments program include “disadvantaged communities” identified by the California Environmental Protection Agency based on “geographic, socioeconomic, public health, and environmental hazard criteria.”⁴² The New York CLCPA directs the statutorily-created Climate Justice Working Group, comprised of representatives from environmental justice communities statewide, to establish the criteria for defining disadvantaged communities.⁴³ The TCI-P signatory jurisdictions have committed in their recent MOU to each designate an Equity Advisory Body,^{vi} which, among other roles, will develop “criteria for defining overburdened and underserved communities.”⁴⁴

Utility EV charging infrastructure investment programs and resources, for both the light-duty and heavy-duty segments, have increasingly included a focus on disadvantaged communities. Public utility commissions across the country have started to require that ratepayer funded utility make-ready infrastructure programs are deployed equitably across service territories by allowing utilities to offer increased incentives for make-ready infrastructure deployed in low- and moderate-income (LMI), multi-unit dwelling, and disadvantaged communities. Utilities have also developed customer education programs that direct assistance to specific communities.

For example, New York and California each require that a certain percentage of utility light duty make-ready infrastructure be deployed in disadvantaged communities: New York requires that 20 percent of each utility’s Make-Ready budget be used to support additional incentives for charging infrastructure in or near EJ or LMI communities, and California requires 30 percent of EV charging infrastructure be deployed in disadvantaged communities. Similarly, New Jersey requires that utility proposals “provide equitable access to the EV Ecosystem in overburdened communities.”⁴⁵ In Massachusetts, the utility regulator approved Eversource’s EV charging equipment investment

^{vi} The Equity Advisory Body in each TCI-P signatory jurisdiction will be “composed of diverse stakeholder groups, with a majority of members being representatives of overburdened and underserved communities or populations.” Transportation and Climate Initiative Program (TCI-P), Memorandum of Understanding (2020), <https://www.transportationandclimate.org/sites/default/files/TCI%20MOU%2012.2020.pdf>.

plan which will direct at least 10 percent of a \$45 million investment toward infrastructure that serves disadvantaged communities.^{46, 47}

Utilities also incorporate a focus on serving overburdened and disadvantaged communities into other electrification programs. For example, Portland General Electric runs the Drive Change Fund, which provides support to community organizations, nonprofits, and businesses with the goal of advancing EV and infrastructure deployment and providing communities with EV education. Importantly, in addition to providing funding to support EV procurement and charging infrastructure deployment, the program directs outreach to community members to try and find community-based organizations that are eligible for the program and then assists those organizations in the application process. Core to the program is its focus on addressing the needs of underserved communities.

Equitable Processes & Community-led Planning

Federal transportation electrification proposals can also draw from recent state frameworks with innovative community participation models, including those in which environmental justice communities and others overburdened by pollution or underserved by the transportation system have a leading role in planning and prioritizing investments. The New York Climate Leadership and Community Protection Act directs “state agencies, authorities and entities” to work “in consultation with the environmental justice working group and the climate action council” to direct climate investments to targeted communities.⁴⁸ Under the TCI-P MOU, the designated Equity Advisory Bodies would provide “recommendations for equitable investments of program proceeds” and develop metrics for evaluating investments.⁴⁹

One important aspect of enabling ongoing and meaningful participation is to direct funding to community-based organizations to lead the planning and implementation of low-carbon transportation investments. One innovative example is California’s Transformative Climate Communities program, which funds communities most impacted by pollution to develop infrastructure projects that reduce emissions and advance other social goals identified by those communities.⁵⁰

Scale of EV Charging Investment Needed to Meet Transportation Electrification and Climate Targets

It is clear that significant investments in charging infrastructure will be necessary to support a zero-emission transportation system in the United States. While these investments will be funded and implemented by a range of entities, including state and local governments, electric utilities, automakers, private EV charging providers, and other businesses, the federal government has a key role to play in providing funding for investments needed to help catalyze a robust market. The proposals in front of Congress now vary significantly in funding levels, as well as the scope and focus of investments. Many legislative proposals allocate millions of dollars of funding toward charging infrastructure each year; in total this may result in spending in the low billions over the

course of the coming decade.^{vii} While significant, these proposals are likely insufficient to support a fundamental shift toward electric transportation.

Using very simplified assumptions, MJB&A estimates that public charging infrastructure that would be sufficient to serve a 20 percent penetration of EVs in the light duty segment in the United States could cost between \$9 and \$27 billion by 2030. Of note, this cost estimate does not include any private charging infrastructure (such as home charging, which is an eligible use of funding under a number of proposals explored above) nor does it include significant electric grid and other energy infrastructure improvements necessary to meet increased electric power demand from EVs.^{viii} While this projection of vehicle penetration assumes more EVs than most current market projections, it would likely fall far below the level of vehicle electrification needed to meet midcentury emissions reductions targets. For example, a recent economy-wide decarbonization analysis modeled that EVs need to reach 44 percent^{ix} of the US passenger vehicle stock by 2030 to meet 2050 net zero emissions targets.⁵¹

In other words, a majority of the proposals before Congress are at least an order of magnitude below what one may expect to be required to truly drive the required level of light duty vehicle electrification.

To maximize benefits, minimize costs, and achieve this market transformation through transportation electrification, this scale of investment must also be accompanied by deliberate coordination and planning. This will require entities to jointly consider electrification needs within and across sectors (both within and between the transportation and building sectors, for example), across states and regions, and across multiple decades. The federal government can play an important role by supporting this comprehensive planning and helping to coordinate these critical investments and programs.

^{vii} The exceptions, the USA Electrify Forward Act and the Clean Cars for America Proposal, would, respectively, allocate \$2 billion per year over ten years and \$45 billion total over an unspecified timeline.

^{viii} This high-level estimate is in line with other estimates of charging infrastructure investment needs; for example, an analysis conducted by the International Council on Clean Transportation (ICCT) of the public, workplace, and home EV charging infrastructure needs across the 100 most populous U.S. metropolitan areas projected total capital costs of \$2.3 billion between 2019 and 2025. Although ICCT's analysis covers 75% of the overall U.S. vehicle market, it does not include the cost of EV fast charging infrastructure along highways and other locations outside major metro areas. See Appendix 3 for a summary table of estimated charging infrastructure needs and costs from other published analyses.

^{ix} The Deep Decarbonization Pathways Project modeled 44 percent of the light duty vehicle stock being electric by 2030. The Net Zero America Project model found a more moderate 6-17 percent fleet electrification in 2030 before ramping up in later decades. E. Larson et al., Princeton University, Net Zero America (2020).

Job Creation and Economic Opportunity

In addition to ensuring an equitable distribution of the benefits of a zero-emission transportation sector, federal spending on charging infrastructure has the potential to directly create economic opportunity through a significant number of new, high-quality jobs. Recent analyses have shown the potential to create between 10,000 and 15,000 jobs per \$1 billion spent on charging infrastructure.⁵² For example, the \$3 billion infrastructure investment proposed under the Clean Corridors Act is estimated to create 42,000 jobs.⁵³

The nationwide buildout of charging infrastructure at the scale needed to support the transition to an electrified transportation sector will require a large, skilled workforce. Construction, site development, and installation of charging equipment are particularly labor intensive and account for the majority of potential jobs created, but charging investments also support jobs in areas such as equipment design and manufacturing, software development, operations and maintenance, accounting, and customer support. Some legislative proposals further leverage the job creation potential of federal investments by incorporating provisions that require or incentivize American-made equipment and/or certified workers.⁵⁴ Federal support for comprehensive training and certification programs can encourage the development of the workforce needed to build out a national network of EVs charging stations.^x

Investing in Charging Infrastructure for Medium- and Heavy-Duty Vehicles

There is a significant opportunity for federal investment to catalyze the electrification of medium- and heavy-duty vehicles, including trucks, buses, and port equipment. The medium- and heavy-duty sector is a critical component of this country's transportation network, and one in which electrification can provide significant benefits. In addition to driving down GHG emissions, accelerating the electrification of heavy- and medium-duty vehicles could reduce air pollution, which has a significant negative impact on public health and is often concentrated in communities of color and low-income communities. However, most federal transportation electrification legislative proposals to date (such as those discussed above) are focused on charging infrastructure for light-duty or passenger vehicles, with medium- and heavy-duty investment limited to transit and school buses.

In addition to not meeting a significant funding need, leaving medium- and heavy-duty vehicle electrification largely out of the conversation is also at odds with the growing and important political and social focus on environmental equity and a just transition toward a clean energy

^x The Electric Vehicle Infrastructure Training Program (EVITP) is one such program that provides certification in charging equipment installation. *Training*, Electric Vehicle Infrastructure Training Program, <https://evitp.org/training/>.

future. These sectors are a significant source of harmful local pollutants, such as ozone, nitrogen oxides (NO_x), and particulate matter (PM), especially in frontline communities around ports, shipping hubs, and transportation corridors. Current programs to reduce emissions from this sector are primarily focused on repowering diesel engines, such as the Diesel Emissions Reduction Act (DERA) program.⁵⁵ This program is highly effective—the 2019 program report to Congress states that the program has reduced 72,700 tons of NO_x, 15,490 tons of PM, and 5.1 million tons of CO₂, resulting in \$19 billion in public environmental benefits for only \$629 million invested by Congress. However, the demand for the program far exceeds funding available: for every \$1 in DERA funds available, there are \$5 in unfulfilled requests.⁵⁶ There is a strong demand for emissions reducing and cost savings technology that can be filled by increased investment in medium- and heavy-duty electrification.

Trucks, buses, and other medium- and heavy-duty vehicles have a potential for rapid electrification over the coming years, driven by accelerating technology developments, state and local regulatory policies,^{xi} and ambitious corporate⁵⁷ and public fleet⁵⁸ electrification commitments. Arguably, the medium- and heavy-duty sector is more advanced today than the light duty sector was in 2009 when the ARRA was enacted and is ripe for additional federal incentives and programmatic support. This could include direct investment in charging infrastructure as well as support for planning and analysis at the state, regional, local, and fleet level.

Comprehensive fleet and infrastructure planning is critical to ensuring an effective and efficient electrification of medium- and heavy-duty vehicles.⁵⁹ This may be even more important than for light-duty vehicles, given the increased power supply requirements of electric buses and trucks and the need for transit and delivery vehicles to run on defined schedules. Transportation logistics and electric utility planning is needed at fleet facilities—including bus depots, ports, logistics hubs,

^{xi} The California Air Resources Board (CARB) approved the Advanced Clean Truck Rule (ACT) in June 2020, which will require manufacturers to sell zero-emissions trucks as an increased percentage of their annual sales starting in 2024. *Advanced Clean Trucks*, California Air Resources Board <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks>. Building on the Advanced Clean Trucks rule, 15 states and DC signed the Multi-State Medium- And Heavy-Duty Zero Emissions Vehicle Memorandum of Understanding in July 2020. The MOU committed the states to a goal of 30 percent new trucks and heavy-duty vehicles being zero-emission by 2030 and a target of 100 percent by 2050. The signatories committed to accelerate the deployment of these vehicles to benefit in particular those communities who have been historically burdened with higher levels of pollution. *Medium- and Heavy-Duty Zero-Emission Vehicles: Action Plan Development Process*, NESCAUM (2021), <https://www.nescaum.org/documents/medium-and-heavy-duty-zero-emission-vehicles-action-plan-development-process/>.

and trucking fleet terminals. Additionally, federal support for data collection and analysis could be helpful in identifying the need for public charging infrastructure for electric trucks, as a supplement to depot charging. There could be advantages to considering electrified on-road transportation more comprehensively—for both light-duty and medium- and heavy-duty—in both planning and infrastructure investment. For example, the utilities who collaborated on the West Coast Clean Transit Corridor Initiative report, (see more details below), noted that “upgrading electric utility hardware to meet the power demand of [light duty] EV charging, for example, may pave the way for the installation of [medium- and heavy-duty] EV charging infrastructure.”⁶⁰

A substantial initial investment in both public and private charging infrastructure will be needed to enable significant levels of heavy- and medium-duty EV adoption. Analyses that have been conducted for segments of the vehicle market and specific charging applications illustrate the scale of the needed investment. A study conducted by the West Coast Clean Transit Corridor Initiative,^{xii} which explored how to facilitate the planning of electric charging sites for trucks along the entire length of the I-5 corridor from California to Washington state, found that costs *per charging site*^{xiii} would be \$3.4 million and \$17.3 million to serve medium- and heavy-duty trucks, respectively. Translating these figures across the country’s entire shipping, trucking, transit, and other medium- and heavy-duty on-road sectors points to investment needs well in excess of \$200 billion dollars to again reach a 20 percent electric medium- and heavy-duty vehicle penetration rate. High-level analysis conducted by MJB&A estimates that charging infrastructure to serve a 20 percent electric U.S. bus fleet, including both transit systems and school buses, could cost more than \$6 billion (see appendix for more details).

The CLEAN Future Act reflects the most comprehensive existing proposal for medium- and heavy-duty vehicle electrification, including \$2.5 billion per year for 10 years to retrofit or replace existing school buses with zero-emission school buses and \$2 billion per year for 10 years to support port electrification. As noted above, a few additional existing federal legislative proposals also include funding for school bus and transit bus electrification. The Moving Forward Act establishes a manufacturer tax credit for zero-emission buses and allocates \$1.7 billion for zero-emission bus grants and \$325 million for low- or zero-emission school bus grants, rebates, and low-cost revolving loans. The funding authorized under these provisions is generally usable to acquire necessary charging infrastructure in addition to the vehicles themselves.

^{xii} The WCCTCI included nine electric utility companies and two agencies representing more than two dozen municipal electric utilities along the I-5 corridor. More information can be found here: <https://westcoastcleantransit.com/>

^{xiii} Each charging site includes ten charging ports.

Building from Regional Fast Charging Corridor Collaborations

There is a significant opportunity for federal investment to leverage existing state and regional collaborations on EV charging infrastructure. This may be particularly effective for federal investments in the fast charging stations along highway corridors needed to enable convenient long-distance travel in EVs. Given the importance of seamlessly connecting cities, tourism destinations, and other locations across state boundaries, states across the country have been collaborating in regional EV corridor planning initiatives. The regional collaboratives share best practices, engage with stakeholders—including EV charging providers, utilities, and automakers—conduct technical analyses of charging infrastructure needs,^{xiv} and engage with the U.S. Federal Highway Administration Alternative Fuel Corridor program.

One active regional collaboration is the Transportation and Climate Initiative in the Northeast and Mid-Atlantic, which includes state energy, environment and transportation agencies in the 14 jurisdictions from Maine to North Carolina.⁶¹ The northeast corridor states have also collaborated to develop interoperability recommendations^{xv} and model procurement contract provisions^{xvi} for EV charging stations, designed to ensure that public investments in charging stations lead to a reliable and convenient network of charging stations for drivers. Another regional collaboration, the Regional Electric Vehicle Plan for the West, or “REV West,” is a coalition launched by 8 Intermountain West states (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming).⁶² The West Coast states developed the West Coast Electric Highway, a network of fast charging stations initially funded as part of the American Recovery and Reinvestment Act and expanded through public-private partnerships and state grant funding.⁶³

There is a significant opportunity to leverage the coordination and planning efforts already undertaken by these regional collaborations to quickly and efficiently build out the national network of EV fast charging stations along highways.

^{xiv} For example, The Infrastructure Location Identification Tool developed by M.J. Bradley & Associates and the Georgetown Climate Center with the Transportation & Climate Initiative (TCI) jurisdictions uses a Geographic Information Systems (GIS)-based analysis to evaluate the existing EV public fast charging network across the TCI region, and uses transportation network, commercial, and demographic data to identify possible suitable locations for future fast charging infrastructure development. www.mjbradley.com/mjb_form/EV-tools

^{xv} Multi-State ZEV Task Force and Northeast Corridor Steering Committee, Electric Vehicle Charging Interoperability Recommendations for State Policy Makers (2020), https://www.nescaum.org/documents/ev-charging-interoperability-recommendations_5-1-20.pdf/

^{xvi} Building Reliable EV Charging Networks: Model State Grant and Procurement Contract Provisions for Public EV Charging (2019), <https://www.nescaum.org/documents/model-contract-provisions-for-public-evse-5-24-19.pdf/>

Biden-Harris Administration Actions Toward Equitable Transportation Electrification

Many of the considerations for centering equity and environmental justice in climate investments discussed above align with the stated priorities of the Biden-Harris Administration. In their first weeks in office, the Biden-Harris Administration has undertaken multiple steps to lay out a framework for equitable climate action. This has included:

- *Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*, which called for the revision of federal vehicle emissions standards and a recalculation of the social cost of GHGs, which will inform future emissions reductions rulemakings;
- *Executive Order On Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*, which requires OMB to identify opportunities to promote equity in the President's budget and study strategies for allocating Federal resources to increase investment in underserved communities, requires a Federal Agency Equity Assessment, and establishes a series of working groups to solicit input, gather data, and develop recommendations to improve the equity outcomes of Federal policy; and
- *Executive Order on Tackling the Climate Crisis at Home and Abroad*, which directs federal agencies to procure carbon-free electricity and clean, zero-emission vehicles; establishes a White House Environmental Justice Interagency Council and Environmental Justice Advisory Council to prioritize environmental justice issues; establishes the Justice40 Initiative with the goal of delivering 40 percent of the benefits of relevant federal investments to disadvantaged communities; and directs the Council on Environmental Quality to develop a Climate and Economic Justice Screening Tool.

Conclusion

Investments in electric vehicle charging infrastructure represent a notable strategic opportunity to make progress on several of the most important challenges facing the United States today: the climate crisis, the need to accelerate economic recovery, harmful air pollution, and the systemic inequities affecting communities overburdened by pollution and underserved by the transportation system. The authors of this report hope it will provide a helpful resource to policymakers as they consider legislative proposals to respond to these opportunities.

Appendix 1. Referenced Federal Bills and Proposals

America's Transportation Infrastructure Act (S. 2302, Sen. Barrasso (R-WY))^{xvii}

Clean Cars for America Proposal (Sen. Schumer (D-NY))^{xviii}

Clean Cities Coalition Program (H.R. 5518; Rep. McEachin (D-VA))

Clean Corridors Act of 2019 (H.R. 2616, Rep. DeSaulnier (D-CA))^{xix}

The Clean Energy Innovation and Deployment Act (H.R. 7516, Rep. DeGette (D-CO))^{xx}

CLEAN Future Act (H.R. 1512, Rep. Pallone (D-NJ))^{xxi}

Electric Vehicles for Underserved Communities Act of 2020 (H.R. 5751; Rep. Clarke (D-NY))^{xxii}

EV Freedom Act (H.R. 5770, Rep. Levin (D-MI))^{xxiii}

LIFT America Act (H.R. 1848, Rep. Pallone (D-NJ))^{xxiv}

Moving Forward Act (H.R. 2, Rep. De Fazio (D-OR))^{xxv}

NO EXAUST Act (H.R. 5545, Rep. Rush (D-IL))^{xxvi}

Securing America's Clean Fuels Infrastructure (S. 3735, Sen. Carper (D-DE), Sen. Alexander (R-TN))^{xxvii}

USA Electrify Forward Act (H.R. 1879; Rep. Dingell (D-MI))^{xxviii}

^{xvii} <https://www.congress.gov/bill/116th-congress/senate-bill/2302>.

^{xviii} www.democrats.senate.gov/imo/media/doc/Clean%20Cars%20for%20America%20-%20Detailed%20Summary.pdf

^{xix} <https://www.congress.gov/bill/116th-congress/house-bill/2616/text>.

^{xx} <https://www.congress.gov/bill/116th-congress/house-bill/7516>.

^{xxi} <https://energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/documents/CFA%20Bill%20Text%202021.pdf>.

^{xxii} <https://www.congress.gov/bill/116th-congress/house-bill/5751/all-info>.

^{xxiii} <https://www.congress.gov/bill/116th-congress/house-bill/5770/>.

^{xxiv} <https://www.congress.gov/bill/117th-congress/house-bill/1848>.

^{xxv} <https://www.congress.gov/bill/116th-congress/house-bill/2>.

^{xxvi} <https://www.congress.gov/bill/116th-congress/house-bill/5545>.

^{xxvii} <https://www.congress.gov/bill/116th-congress/senate-bill/3735>.

^{xxviii} <https://www.congress.gov/bill/117th-congress/house-bill/1879>.

Appendix 2. Methodology of National EV Charging Infrastructure Cost Estimate

MJB&A performed a preliminary analysis to estimate potential charging infrastructure needs and associated costs for on-road vehicles (light-, medium-, and heavy-duty) and buses (transit and school). The analysis accounts for major driving assumptions to estimate EV penetration and costs (current value) but does not consider market dynamics, and was not produced with financial modeling necessary for capital budgeting or investment planning.

Cost assumptions are generally inclusive of materials and equipment, labor, permitting and installation; results do not include costs associated with project design, management, annual operations and maintenance, utility-side upgrades, and other expenses.

General Analysis Assumptions

Light-Duty Vehicles

- Charging infrastructure needs per EV calculated using NREL EVI-Pro Lite assumptions
- Average capacity of installed DCFC chargers (50-350 kW) is not estimated; costs from RMI⁶⁴
- Low-cost assumptions for level 2 charging from ICCT⁶⁵
- High-cost assumptions for level 2 charging from Brattle and include utility-side upgrades⁶⁶
- Future technology costs of charging infrastructure are not considered

Medium- and Heavy-Duty Vehicles

- Corridor charging cost results of WCCTCI study⁶⁷ converted to approximate cost per vehicle mile traveled (VMT) and expanded to cover ~20 percent of total medium-/heavy-duty VMT across all major freight roadways (calculated using FHWA Highway Performance Monitoring System across ~60,000 miles of designated primary and non-primary Highway Freight System)
- Depot charging requirements estimated using SoCal Edison Fleet Calculator⁶⁸
- Future changes in medium-/heavy-duty traffic not considered

Transit and School Buses

- Transit bus count based on National Transit Database (only articulated, over-the-road, double-decker, and other/undesignated buses included)
- School bus count based on most recent data from School Bus Fleet Magazine⁶⁹
- School bus depot charging requirements estimated using SoCal Edison Fleet Calculator⁷⁰
- Future changes in bus counts not considered

Appendix 3. Survey of Analyses of EV Charging Infrastructure Needs and Cost Estimates

The table below presents recent findings from various organizations and research institutions on the amount of charging equipment—and related costs—needed to support anticipated EV penetration by identified target dates. The findings are presented at various scales from national to state-level, and public and shared^{xxix} charging infrastructure needs and costs have been separated from private infrastructure where possible. More comprehensive estimates are limited to light-duty charging infrastructure, but two project- or corridor-level estimates for medium- and heavy infrastructure have been identified.

Author(s)	Geographic Scope	Target Year	Total Chargers Needed	Total Cost Estimate	Public & Shared Chargers Needed	Public & Shared Cost Estimate
<i>National</i>						
The Brattle Group ⁷¹	National	2030	7,250,000–11,250,000	\$30–50 billion	900,000–2,200,000	Not provided
Institute for Electric Innovation & Edison Electric Institute ⁷²	National	2030	9,600,000	Not provided	2,100,000	Not provided
National Renewable Energy Laboratory ⁷³	National	2030	Not provided	Not provided	628,500	Not provided
<i>Subnational</i>						
California Energy Commission ⁷⁴	California	2030	Not provided	Not provided	1,546,000	Not provided

^{xxix} “Public and shared charging” includes DCFC and Level 2 charging that is either publicly accessible or located at workplaces, multi-unit dwellings, or other shared locations. This category excludes personal use, at-home charging.

Author(s)	Geographic Scope	Target Year	Total Chargers Needed	Total Cost Estimate	Public & Shared Chargers Needed	Public & Shared Cost Estimate
New York Department of Public Service ⁷⁵	New York	2025	Not provided	Not provided	132,815	\$828 million ^{xxx}
The International Council on Clean Transportation ⁷⁶	The 100 most populous U.S. metropolitan areas	2025	1,086,000	\$2.3 billion	119,000	\$937 million
M.J. Bradley & Associates ⁷⁷	The 12 largest utility service territories in seven selected states	2035	2,700,000–17,500,000	\$2.7–17.6 billion	121,000–754,000	\$0.7–4.0 billion
<i>Heavy Duty/Off Road</i>						
HDR, CALSTART, S Curve Strategies, Ross Strategic ⁷⁸	I-5 corridor (California, Oregon, Washington)	2030	Not provided	Not provided	270–410	\$90.7–332.9 million
Port of Long Beach ⁷⁹	Port of Long Beach, California	2022	~40	\$16.8 million	Not provided	Not provided

^{xxx} Estimated cost covers 79% of total public & shared charging infrastructure needs across New York.

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