Congressional Research Service
Informing the legislative debate since 1914

Federal Policies to Expand Electric Vehicle Charging Infrastructure

August 28, 2023

Congressional Research Service
https://crsreports.congress.gov
R47675

Congressional Research Service
Informing the legislative debate since 1914

Federal Policies to Expand Electric Vehicle Charging Infrastructure

SUMMARY

R47675

August 28, 2023

Melissa N. Diaz
Analyst in Energy Policy

Corrie E. Clark
Specialist in Energy Policy

On November 15, 2021, President Biden signed the Infrastructure Investment and Jobs Act (IIJA, P.L. 117-58). This broad infrastructure law addresses a range of issues. To expand the national network of electric vehicle charging stations, the IIJA established two new grant programs ($7.5 billion combined) within the Federal Highway Administration (FHWA), part of the U.S. Department of Transportation (DOT).

U.S. electric vehicle sales doubled between 2020 and 2021 and account for about 4% of all vehicles sold. Infrastructure to charge those vehicles exists along a range, from 120 volt plugs in many home garages to more expensive faster chargers with more than 400 volts. Market surveys have shown that consumers are concerned about the lack of an extensive charging network across the country, as well as the related concerns that some electric vehicles have a limited range before needing to be recharged. The IIJA grant programs were designed to address those concerns along major U.S. highways. In addition, the IIJA directs FHWA to develop standards for charging infrastructure funded by certain federally programs so charging is secure, provides a range of payment options, and meets certain installation requirements.

The federal government has in the past provided limited financial support for installation of electric vehicle charging stations, such as through the alternative fuel infrastructure tax credit—modified by the law commonly referred to as the Inflation Reduction Act of 2022 (IRA, P.L. 117-169)—and the Congestion Mitigation Air Quality Improvement program. With just over 50,000 charging stations in October 2022—and more than 130,000 ports for charging—electric vehicle charging capacity is far below one estimate that 2.4 million charging stations that may be necessary in 2030 to sustain an electric vehicle fleet of 26 million vehicles (an estimate from one group of what may be needed to support California and other states' zero-emission vehicle (ZEV) goals).

The two $7.5 billion grant programs established by IIJA are:

- The National Electric Vehicle Infrastructure (NEVI) Formula Program, which is to provide $5 billion in grants, with $1 billion distributed by FHWA in each of FY2022-FY2026. All states, the District of Columbia, and Puerto Rico are eligible, and funds must be used for charging along the national highway system and primarily along highways already designated as alternative fuel corridors. Under existing FHWA guidelines, new charging stations should be spaced a maximum of 50 miles apart. A new FHWA rule sets additional standards and requirements. In September 2022, all state plans were approved, opening access to FY2022 and FY2023 NEVI funding.
- The Charging and Fueling Infrastructure (CFI) grant program, which is to provide $2.5 billion over five years to strategically deploy alternative fuel infrastructure for vehicles powered by electricity and other fuels. Half of the new funding is to be used along FHWA corridors earmarked for those fuels. The other half is to be applied to uses in public building parking lots and in similar publicly-accessible locations. CFI grants differ from NEVI in two ways: (a) grants are to be subject to a competitive process, unlike the formula-based NEVI; and (b) priority are to be given to applicants in rural areas, disadvantaged communities, and areas with high rates of multi-unit housing.

In addition to the two FHWA grant programs, IIJA also establishes a $5 billion Clean School Bus Program within the Environmental Protection Agency (EPA) for FY2022-FY2026 that is to provide grants and rebates for the replacement of existing school buses with alternative fueled buses (electricity, natural gas, hydrogen, or biofuels) and includes funding for refueling or recharging infrastructure. This program is in addition to programs administered by the Federal Transit Administration (FTA) that can provide grants for electric buses such as the Bus and Bus Facilities Program and the Low and No Emission Vehicle Program.

Contents

Figures

Tables

Appendixes

Contacts

Introduction

In the United States, the transportation sector accounts for 27% of greenhouse gas (GHG) emissions, the largest of any sector.[1] To address concerns about the impact of GHG emissions on climate change, governments in major industrial countries have increasingly adopted motor vehicle GHG emission requirements in addition to requirements on the emission of other air pollutants. Options to meet these requirements include improvements to internal combustion engine vehicles and expansion of the manufacture and use of alternative fuel vehicles powered by electricity or hydrogen.

Electric vehicles (EVs), including plug-in hybrid and battery electric vehicles, are increasingly being produced by automakers as part of their fleet of vehicles to meet federal emission requirements and to address climate change concerns. Consumers have shown a growing interest in EVs: between 2020 and 2021, sales of light-duty plug-in hybrid and battery electric vehicles doubled, accounting for 4.2% of new U.S. vehicle sales in 2021.[2] One factor that impedes the sale of EVs—in addition to range limitations, the higher cost of EVs, and the high cost of battery system replacement at the end of their lifecycle—is the limited network of charging stations throughout the United States.

Data from the U.S. Department of Energy (DOE) Alternative Fuels Data Center (AFDC) indicate that the number of public and private EV charging stations in the United States is approximately 50,000, with more than 130,000 charging ports to charge vehicles.[3] These estimates do not include access to residential charging locations such as a single-family home with a garage or carport where an EV can be charged overnight. For comparison, in 2022, 116,641 convenience stores across the country reportedly sold motor fuels.[4]

This report will use terminology that aligns with AFDC terminology. The three basic components of EV charging, or electric refueling, are the refueling site, the hardware dispensing electric charge, and the connector that plugs into the vehicle from the hardware (**Table 1**); these are not unlike the components of gasoline refueling for internal combustion engine vehicles.

---

[1] Transportation sources include emissions from two- and three-wheelers, light duty vehicles, buses and minibuses, heavy trucks, shipping, and aviation. U.S. emissions from electric power accounted for the second largest portion (24.8%); emissions from industry accounted for the third largest portion (23.8%) of total U.S. greenhouse gas emissions in 2020. The remaining 24.2% of U.S. greenhouse gas emissions were contributed by the agriculture, commercial, and residential sectors, plus emissions from U.S. territories. Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2020*, EPA 430-P-22-003, April 14, 2022, p. ES-21, https://www.epa.gov/ghgemissions/draft-inventory-us-greenhouse-gas-emissions-and-sinks-1990-2020.

[2] Argonne National Laboratory, *Light Duty Electric Drive Vehicles—Monthly Sales Updates*, accessed March 21, 2022, https://www.anl.gov/es/light-duty-electric-drive-vehicles-monthly-sales-updates. Argonne provided CRS with annual data for 2020 and 2021 sales.

[3] U.S. Department of Energy (DOE), Alternative Fuels Data Center (AFDC), "Electric Vehicle Charging Station Locations," interactive tool, data downloaded March 7, 2022, https://afdc.energy.gov/fuels/electricity_locations.html#/find/nearest?fuel=ELEC. Includes public and private access electric vehicle (EV) charging stations and all charging levels, connector types, and charging networks.

[4] According to NACS, a trade association for convenience and fuel retail stores, "convenience stores sell an estimated 80% of fuel purchased in the United States." NACS, "U.S. Convenience Store Count," February 2022, https://www.nacsmagazine.com/issues/february-2022/us-convenience-store-count.

Table 1. Characteristics of Refueling Components

	Gasoline Refueling	Electric Refueling
Refueling Site	Gas station	Charging station
Dispensing Hardware	Fuel pump	Charging port
Filler Hardware for Fuel Receptacle	Fuel nozzle	Charging connector

Source: CRS.

While President Biden has called for funding a $15 billion EV charging program that could install as many as 500,000 EV charging ports,[5] the $7.5 billion provided in the Infrastructure Investment and Jobs Act (IIJA, P.L. 117-58), the first major federal program of its kind, will most likely fund a smaller number of charging ports without further public and private investments. While the federal government has in the past promoted investments in building EV charging infrastructure, IIJA centralizes and significantly expands federal programs to build a larger national charging network. One estimate is that if U.S. policies seek to support a fleet of 26 million EVs by 2030, then 2.4 million public and workplace charging ports would need to be in place by 2030.[6]

These new investments from the IIJA, and other recent legislation such as P.L. 117-169 (commonly referred to as the Inflation Reduction Act of 2022 or IRA), also include language in support of the equitable distribution of new charging infrastructure in rural areas and in underserved or disadvantaged communities. This language reflects policies outlined in the Biden Administration's Executive Order 14008 (Tackling the Climate Crisis at Home and Abroad)[7] and the Office of Management and Budget's Justice40 Initiative, which aims to direct 40% of certain federal investments to disadvantaged or Justice40 communities.[8]

This report summarizes existing federal EV charging infrastructure programs and discusses the elements in the IIJA that are to fund further expansion of that infrastructure.

Electric Vehicle Charging Fundamentals

Charging an EV involves a number of factors, such as the type of vehicle, the charging level, access, equipment compatibility, and charging patterns. Understanding these factors can help inform how and where to deploy charging infrastructure, differentiating between slower charging

[5] The White House, "FACT SHEET: Biden Administration Advances Electric Vehicle Charging Infrastructure," press release, April 22, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-biden-administration-advances-electric-vehicle-charging-infrastructure/. The statement makes reference to "chargers," which are also referred to as "ports."

[6] In developing its analysis and forecast, International Council on Clean Transportation (ICCT) researchers made a number of assumptions. They assumed an increasing number of states would align with California's Zero Emission Vehicle (ZEV) regulation and, in those states, ZEVs would be 100% of sales in those states by 2035. ICCT also assumes the EV share of new light duty vehicle sales in states with ZEV regulations will reach 18% by 2025 and 61% by 2030. They utilized sales projections from U.S. Energy Information Administration's (EIA's) *Annual Energy Outlook*. Gordon Bauer, Chih-Wei Hsu, and Mike Nicholas, et al., *Charging Up America: Assessing the Growing Need for U.S. Charging Infrastructure Through 2030*, ICCT, July 2021, p. i, and pp. 10-11, https://theicct.org/wp-content/uploads/2021/12/charging-up-america-jul2021.pdf.

[7] The White House, "Executive Order on Tackling the Climate Crisis at Home and Abroad," press release, January 27, 2021, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/.

[8] Office of Management and Budget (OMB), *Interim Implementation Guidance for the Justice40 Initiative*, M-21-28, July 20, 2021, https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf.

where overnight charging is possible and faster charging adjacent to interstates and other primary highways where quicker charging may be desired.

Electric Vehicle Market Trends

Growth of the EV market will depend in part on the growth of the EV charging network; as more consumers see that there are more charging stations, they may decide that an EV can serve their vehicle needs as well as or better than a vehicle with an internal combustion engine. Several automakers have indicated they plan to end their worldwide sale of gasoline- and diesel-powered light duty vehicles by 2040.[9] Automakers are expanding their range of vehicle models that utilize electricity as a power source. In some vehicles, the electricity supplements a standard internal combustion engine, and in others, the vehicles operate entirely on electricity. The three major types of light vehicle EV technologies[10] are:

- *hybrid electric vehicles* (HEVs), of which there are more than 250 models, such as the Toyota Prius. HEVs have both an internal combustion engine and a battery that is recharged through regenerative braking and from power generated by the engine; they do not use an external source of electricity;
- *plug-in hybrid electric vehicles* (PHEVs), of which there are nearly 100 models, such as the Ford Escape. PHEVs operate on both electricity and gasoline, with both an internal combustion engine and a battery that is recharged from external sources of electricity; and
- *battery electric vehicles* (BEVs), of which there are more than 125 models, such as the Tesla 3. BEVs run only on electricity and must be recharged from an external source.[11]

Of the major types of light-duty vehicle EV technologies, only PHEVs and BEVs utilize EV charging infrastructure. **Table 2** summarizes annual sales in all three categories of vehicles. Sales in all three categories of vehicles have increased from 2020 to 2021.

Table 2. Sales of Electricity-Using Light Duty Vehicles

Number of Vehicles Sold

Year	Hybrid Electric	Plug-in Hybrid Electric	Battery Electric	Total Light Duty Vehicles	PHEV and BEV Sales as Percent of All Light Duty Vehicles
2020	454,890	69,049	238,540	14,472,032	2.1%
2021	798,105	164,824	466,328	14,959,386	4.2%

Source: Argonne National Laboratory, *Light Duty Electric Drive Vehicles—Monthly Sales Updates*, accessed March 21, 2022, https://www.anl.gov/es/light-duty-electric-drive-vehicles-monthly-sales-updates.

Notes: Light duty vehicles include passenger cars, sports utility vehicles, and pickup trucks.

[9] Caleb Miller, "Six Major Automakers Agree to End Gas Car Sales Globally by 2040," *Car and Driver*, November 10, 2021, https://www.caranddriver.com/news/a38213848/automakers-pledge-end-gas-sales-2040/.

[10] In addition to the three types of EV technologies identified (hybrid electric vehicle, plug-in electric vehicle, and battery electric vehicle), another type is fuel cell electric vehicle where energy stored as a fuel (e.g., hydrogen) is converted to electricity by a fuel cell. For additional information, see CRS Report R46231, *Electric Vehicles: A Primer on Technology and Selected Policy Issues*, by Melissa N. Diaz.

[11] Data on available vehicle models in each category from AFDC, "Availability of Hybrid and Plug-In Electric Vehicles," accessed March 22, 2022, https://afdc.energy.gov/vehicles/electric_availability.html.

Electric Vehicle Charging Technologies

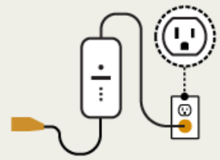
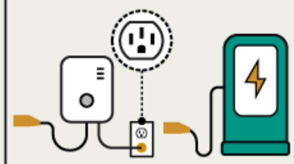
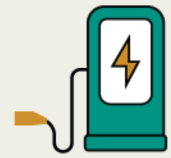
Electric vehicle charging infrastructure is typically categorized into three charging levels and three ownership types. Charging levels are differentiated by the voltage of the electrical source, with lower voltages corresponding to lower power outputs and slower rates of charge (see **Figure 1**). Level 1 charging equipment supplies 120 volts alternating current (AC) electricity; this voltage is supplied by standard U.S. electrical outlets.[12] Level 2 charging equipment supplies 240 volts AC electricity; this voltage is supplied by high-voltage outlets, such as those for electric ranges and other home appliances. Direct current fast charging (DC Fast) generally refers to any direct current (DC) charging equipment, typically supplying 480 volts DC electricity. This high voltage facilitates electricity rates in excess of 50 kW and is available only for non-residential installation. National Electric Vehicle Infrastructure (NEVI) Standards and Requirements require Level 2 or DC Fast for projects funded by NEVI or certain other federal programs.[13] The Standards and Requirements also require each DC Fast port to have an SAE J1772 Combined Charging System connector (CCS Type 1; combines the J1772 connector with an adapter that adds two bottom pins). The rule also allows the installation of additional non-proprietary connectors to accommodate a larger variety of vehicles, including those that use CHAdeMO or North American Charging Standard (NACS) connectors.[14]

[12] Alternating current (AC) is electrical current that reverses direction regularly. The majority of electricity in the United States is generated and distributed in AC at a frequency of 60 Hertz (i.e., cycles per second). Direct current (DC) is electrical current that flows constantly in a single direction. Batteries and many distributed generation systems generate electricity in DC, and many EVs, electronic devices, and appliances operate in DC.

[13] National Electric Vehicle Infrastructure (NEVI) Standards and Requirements, 23 C.F.R. 680 (2023).

[14] CHAdeMO is an abbreviation of "charge de move," derived from a Japanese phrase meaning "let's have a cup of tea" while charging ("o cha demo ikaga desuka"); CHAdeMO, "FAQ," accessed April 4, 2023, https://www.chademo.com/faq. The Nissan Leaf is one of the few vehicles available in the United States that uses CHAdeMO; Kelley Blue Book, "Can I Use Any Charger System with My EV?" accessed April 4, 2023, https://www.kbb.com/car-advice/what-charger-for-ev/. NACS refers to Tesla port and connector designs, formerly proprietary designs used only by Tesla's Supercharger network; Tesla, "Opening the North American Charging Standard," November 11, 2022, https://www.tesla.com/blog/opening-north-american-charging-standard.

Figure 1. Electric Vehicle (EV) Charging Equipment by Charging Level

Charging level	Level 1	Level 2	Level 3/DC Fast
AC - alternating current DC - direct current kW - kilowatt V - volt			
Outlet type	Standard residential outlet	Clothes dryer or stove outlet; public charging stations	Only available at public charging stations
Voltage	120 V AC	240 V AC	480 V DC or more
Typical power	1.2-1.9 kW	3.3-19.2 kW	50 kW or more
Miles of range per hour	Up to 6 miles	Up to 60 miles	100-200 miles or more
Types of vehicle connectors	SAE J1772	SAE J1772 NACS	SAE J1772 CCS CHAdeMO NACS
Hardware costs	$300-$1,500	$400-$6,500	$10,000-$75,000

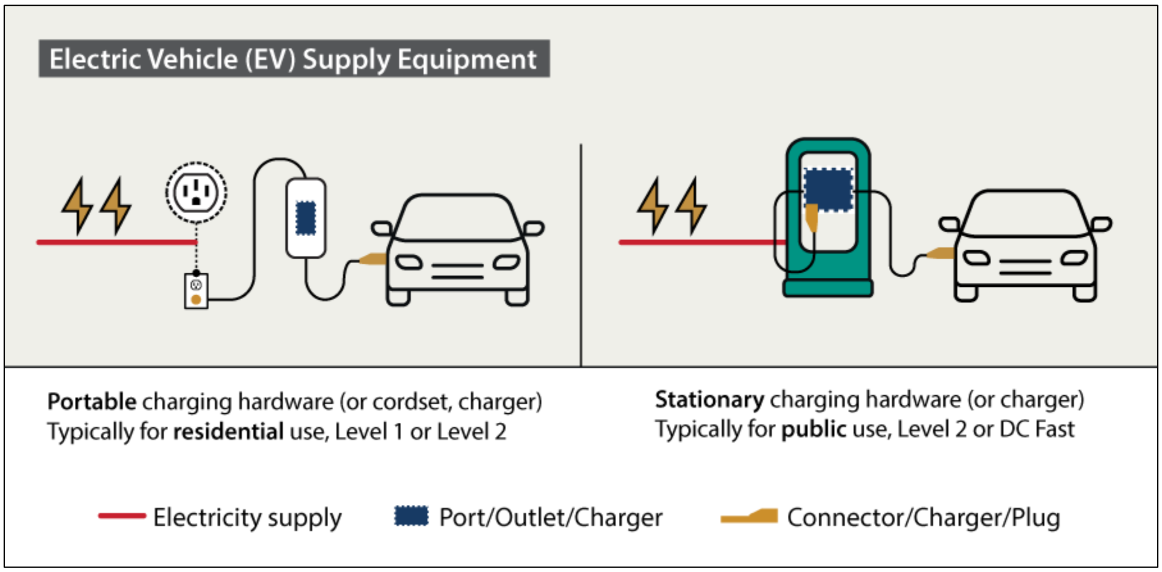
Source: CRS based on data from U.S. Department of Energy (DOE), Alternative Fuels Data Center (AFDC), "Developing Infrastructure to Charge Plug-In Electric Vehicles," accessed April 15, 2022, https://afdc.energy.gov/fuels/electricity_infrastructure.html#level1; and Michael Nicholas, Dale Hall, and Nic Lutsey, *Quantifying the Electric Vehicle Charging Infrastructure Gap Across U.S. Markets*, International Council on Clean Transportation, January 2019, p. 1, https://theicct.org/publication/quantifying-the-electric-vehicle-charging-infrastructure-gap-across-u-s-markets/. Cost estimates reflect cost ranges presented across sources.

Notes: Typical characteristics for electric vehicle (EV) charging in the United States. The standard SAE J1772 is available for all three levels; the J1772 Combined Charging System (CCS) has an adaptor that adds two bottom pins for Direct Current Fast charging (DC Fast). CHAdeMO is used internationally; in the United States, the Nissan Leaf is one of the few vehicles that uses CHAdeMO. The North American Charging Standard (NACS) refers to formerly proprietary designs used only by Tesla's Supercharger network. Equipment costs do not reflect potential savings from incentives, tax credits, or rebates from government, public, or private entities.

Charging sites have different access depending on ownership: residential, private, or public. Residentially-owned charging sites are privately accessed (e.g., garage in a single family home) and include portable Level 1 charging ports (i.e., cordset) used to charge EVs via standard outlets, and Level 2 ports installed in privately-owned residences. Residential charging sites are typically not reported by AFDC, though charging sites at multi-family residences may be reported as private charging stations.

Private and public charging stations typically have stationary charging ports (one or more) installed in a wall mount or pedestal, though some charging locations offer a designated outlet for use with a portable Level 1 charging port. Each stationary port may have more than one connector for compatibility with different vehicles, though each port can charge only one EV at a time. Private charging stations are limited for use by certain customers or vehicles, such as fleets, transit buses, and/or medium- and heavy-duty vehicles; included are those located at workplaces, government facilities, and other locations with limited or restricted access. Public charging stations are located in areas accessible to any member of the public. For NEVI- and certain other federally-funded charging infrastructure projects, NEVI Standards and Requirements address other characteristics that may restrict access, such as disallowing payment methods that require membership.[15]

Figure 2. Charging Equipment Terminology



Source: CRS based on information from U.S. Department of Energy (DOE), Alternative Fuels Data Center (AFDC), "Developing Infrastructure to Charge Plug-In Electric Vehicles," accessed April 15, 2022, https://afdc.energy.gov/fuels/electricity_infrastructure.html.

Notes: Non-exhaustive summary of various terms used in reference to electric vehicle (EV) charging equipment. Individual stations have different configurations of charging equipment. Each port can charge one EV at a time, though one port may offer more than one connector (e.g., for compatibility with different vehicles). The total number of vehicles that can charge simultaneously is determined by the number of ports, not the number of connectors.

Figure 2 summarizes common terminology used to describe the basic elements of EV charging infrastructure.[16] "Charger" is among the most common terms used to describe charging infrastructure and its many components from the portable and stationary charging ports to the wall mounts and pedestals to the connectors that are plugged into EVs.

Charging Station Inventory

According to October 2022 AFDC data, the number of public and private charging stations in the United States exceeds 50,000 (**Table 3**); as of October 2022, 93% of charging stations were public and 7% were private. Charging ports at a given charging station may be of different charging levels. Of the more than 134,000 reported individual charging ports, the majority were

---

[15] NEVI Standards and Requirements, 23 C.F.R. 680 (2023).

[16] The electric vehicle charging industry also uses another term—electric vehicle supply equipment (EVSE)—to refer to the individual outlets and corresponding technology used to charge a single EV at an EV charging station; AFDC, "Developing Infrastructure to Charge Plug-In Electric Vehicles," accessed April 15, 2022, https://afdc.energy.gov/fuels/electricity_infrastructure.html.

Level 2 ports (78%). AFDC provides information and collects data on EVs and charging stations, as well as other alternative fuel vehicles and infrastructure. Data from AFDC are gathered and verified by the National Renewable Energy Laboratory (NREL) and updated periodically.[17] Stations that are no longer providing charging services are removed from the database as they are identified.

Table 3. U.S. Electric Vehicle Charging Station Inventory

As of October 3, 2022

	Public	Private	Total
Charging Stations	46,995	3,669	50,664
Charging Ports	120,409	14,520	134,929
Level 1 Ports	869	2,129	2,998
Level 2 Ports	93,790	12,083	105,873
DC Fast Ports	25,750	308	26,058

Source: U.S. Department of Energy (DOE), Alternative Fuels Data Center (AFDC), "Alternative Fuel Stations," dataset, accessed October 3, 2022, https://afdc.energy.gov/data_download.

Notes: Residential charging sites are generally not counted in the DOE tabulation, with the exception of some multi-family residential sites. Public charging stations are accessible to any customer, while private charging stations are limited for use by certain customers or certain vehicles (e.g., at a workplace, for public transit vehicles). A charging station may have one or more charging ports. Charging levels are generally differentiated by voltage of the electrical source.

Compared to 2015 data from NREL, public and private charging ports increased more than threefold and increased by 20% between 2020 and 2021.[18] An NREL analysis of charging station location data demonstrated that public charging port growth varied regionally, ranging from 3.3% in the Southeast to 7.6% in the Mid-Atlantic between 2019 and 2021.[19]

Disadvantaged Community Access to Charging Stations

As EV sales and the number of charging stations continue to increase, some stakeholders have raised concerns about the distribution of charging stations and geographic and demographic access to charging.[20] In a February 2022 (updated and superseded in June 2023) memorandum on EV charging infrastructure, the Department of Transportation (DOT) noted that "many of the burdens from the transportation and energy systems have been historically and disproportionately borne by disadvantaged communities" and committed to emphasizing equity considerations at the

[17] According to DOE, "The National Renewable Energy Laboratory (NREL) obtains information about new stations from trade media, Clean Cities coordinators, the Submit New Station form on the Station Locator website, and through collaborating with infrastructure equipment and fuel providers, original equipment manufacturers (OEMs), and industry groups." See AFDC, "About the Alternative Fueling Station Data," accessed February 22, 2022, https://afdc.energy.gov/fuels/electricity_locations.html#/find/nearest.

[18] There were 34,151 charging ports in 2015; NREL, "Electric Vehicle Charging Infrastructure Trends, updated January 2022, https://afdc.energy.gov/fuels/electricity_infrastructure_trends.html.

[19] NREL used the Clean Cities Coalition Network regions for this analysis. NREL, *Electric Vehicle Charging Infrastructure Trends from the Alternative Fueling Station Locator: Fourth Quarter 2021*, Figure 12, https://afdc.energy.gov/files/u/publication/electric_vehicle_charging_infrastructure_trends_fourth_quarter_2021.pdf.

[20] For example, in the 117th Congress, a hearing examined EV infrastructure distribution issues in rural areas. U.S. Congress, House Committee on Agriculture, *Implications of Electric Vehicle Investments for Agriculture and Rural America*, 117th Cong., 2nd sess., January 12, 2022.

start for the IIJA charging station programs.[21] The framework for identifying disadvantaged communities comes from Justice40, which established a goal for 40% of overall benefits from certain federal investments to "flow to disadvantaged communities," including investments made by programs in clean transportation and clean transit.[22] DOT's interim definition identified Justice40 communities as tribal land, territories, and census tracts ranking in the top 50% in four or more transportation disadvantage categories: transportation access disadvantage, health disadvantage, environmental disadvantage, economic disadvantage, climate change resilience disadvantage, and equity disadvantage based on linguistic isolation.[23] The IIJA charging infrastructure programs are covered by Justice40.[24]

In January of 2023, agencies were directed by the Office of Management and Budget (OMB) to utilize the Climate and Economic Justice Screening Tool (CEJST), which was released out of beta in October 2022.[25] Agencies are not expected to switch to CEJST for existing programs with open funding announcements, but instead to incorporate CEJST for new funding announcements.[26] CEJST uses more than 30 indicators organized into 8 categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.[27] A census tract is identified as disadvantaged if it is at or above the threshold for one or more indicators in any category; and at or above the threshold for the associated socioeconomic indicator for that category. For the transportation indicators (diesel particulate matter, transportation barriers, and traffic proximity and volume) and most other indicators, the threshold is the 90th percentile of census tracts. For most categories, including transportation, the socioeconomic indicator is low income, defined as at or below 200% of the federal poverty level, with a threshold of 65th percentile of census tracts. CEJST also categorizes census tracts within lands of federally recognized tribes as disadvantaged.

Prior to these programs, some studies have sought to determine where public charging infrastructure was disproportionately less accessible to certain geographic areas or demographic groups. One study evaluated the extent to which public EV charging stations in California were located in areas accessible to below-median income households.[28] By combining public charging station location data with U.S. Census Bureau data from the American Community Survey, the

---

[21] DOT, Federal Highway Administration (FHWA), *National Electric Vehicle Infrastructure [NEVI] Formula Program Guidance (Update)*, June 2, 2023, p. 16, https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/nominations/90d_nevi_formula_program_guidance.pdf.

[22] Executive Order (E.O.) 14008, 86 *Federal Register* 7619 (January 27, 2021).

[23] DOT, "Transportation Disadvantaged Census Tracts (Historically Disadvantaged Communities) Interim Definition Methodology," updated April 27, 2023, https://www.transportation.gov/priorities/equity/justice40/transportation-disadvantaged-census-tracts-historically-disadvantaged. DOT calculated the percentile value for each census tract for 22 indicators, which were grouped into the six Transportation Disadvantage categories. DOT then calculated the average percentile for each tract for each of the six categories. A tract is considered disadvantaged for any category where it is in the 50th percentile or higher, except for resilience to climate change where the 75th percentile is disadvantaged. Census tracts that are disadvantaged in four or more categories are identified as transportation disadvantaged.

[24] DOT, "Covered Programs," updated April 4, 2023, https://www.transportation.gov/priorities/equity/justice40/covered-programs.

[25] OMB, *Addendum to the Interim Implementation Guidance for the Justice40 Initiative, M-21-28, on Using the Climate and Economic Justice Screening Tool (CEJST)*, M-23-09, January 27, 2023, https://www.whitehouse.gov/wp-content/uploads/2023/01/M-23-09_Signed_CEQ_CPO.pdf.

[26] OMB, *Addendum*. The memorandum allows for "certain special circumstances" under which an agency may issue a limited exception to the use of CEJST.

[27] CEJST, "Methodology," released November 22, 2022, https://screeningtool.geoplatform.gov/en/methodology.

[28] Chih-Wei Hsu and Kevin Fingerman, "Public Electric Vehicle Charger Access Disparities Across Race and Income in California," *Transport Policy*, vol. 100 (2021), pp. 59-67.

study found that census block groups with below-median household incomes had less access to public charging than areas with higher incomes.[29] Access to public charging was highest directly next to freeways or highways, although this access was not equally distributed across socioeconomic groups. Compared to other ethnic majority groupings and controlling for highway distance, Black and Hispanic majority census block groups had the lowest access to public charging.

Another study analyzed access to public EV charging stations across the 50 most populous U.S. cities, focusing on the challenges faced by existing and potential EV drivers lacking dedicated off-street parking.[30] The study modeled walking zones around each charging station of one-quarter mile or five-minute walk, a distance the study described as a "realistic maximum distance a driver would regularly walk to access charging."[31] The study found that 9.7% of residents in these cities lived within walking zones, though actual access varied based on population density and concentration of charging infrastructure. For example, while 18.5% of New York City residents lived within walking zones, a large number of these residents had access to the same few charging stations. Racial disparities were found to affect Black and Hispanic populations overall (compared to Asian, White, and other/unknown populations), though not consistently from city to city. In cities like Atlanta, Chicago, and Washington, DC, the share of residents within walking zones that were Black was more than 20% lower than the rest of the city.[32] Median household income was higher within walking zones ($79,000) compared to outside of walking zones ($63,000); these values may be influenced by a small number of highly populous cities where "charging infrastructure strongly favors more affluent households."[33]

To illustrate the current state of deployment of charging infrastructure in disadvantaged communities, CRS used geospatial data from DOT that identifies disadvantaged communities at the census tract level to map EV charging station location data from AFDC, summarized in **Table 4**.[34] Disadvantaged census tracts made up 30% of all census tracts. The share of public charging stations and public ports in disadvantaged tracts was 28%. Level 2 ports made up the majority (76%) of public charging ports in disadvantaged communities. The table focuses on public charging stations and ports since these make up the largest share of charging, and public charging infrastructure is the target of NEVI and other federal programs established in the 117th Congress.

[29] Ibid., p. 62.

[30] Mobilyze.ai, *Access to Electric Vehicle Charging in the United States*, August 2021.

[31] Ibid., p. 6. This distance is meant to capture "managing for infrastructure cost and utilization" by the driver.

[32] Ibid., p. 12.

[33] Ibid., p. 14.

[34] AFDC, "Alternative Fuel Stations," dataset, accessed October 3, 2022, https://afdc.energy.gov/data_download. DOT, *Transportation Disadvantaged Census Tracts*, shapefile, posted May 5, 2022, https://www.transportation.gov/equity-Justice40; census tracts using the interim definition can also be viewed online at https://usdot.maps.arcgis.com/apps/dashboards/d6f90dfcc8b44525b04c7ce748a3674a.

Table 4. Charging Infrastructure in Disadvantaged Communities

Total number of census tracts considered 72,842

	Tracts, Population, and Infrastructure in Disadvantaged Areas	Percentage of Total in Disadvantaged Areas
Census Tracts (72,842 total)	21,973	30%
Population (322,903,030 total)	99,515,431	31%
Charging Stations (50,664 total)	14,045	28%
Private Charging Stations	1,071	29%
Public Charging Stations	12,974	28%
Public Charging Ports	33,600	28%
Public Level 1 Ports	285	33%
Public Level 2 Ports	25,521	27%
Public DC Fast Ports	7,794	30%

Source: CRS analysis. Department of Energy (DOE), Alternative Fuels Data Center (AFDC), "Alternative Fuel Stations," dataset, accessed October 3, 2022, https://afdc.energy.gov/data_download. Department of Transportation (DOT), *Transportation Disadvantaged Census Tracts*, shapefile, posted May 5, 2022, https://www.transportation.gov/equity-Justice40.

Notes: Disadvantaged census tracts were identified from DOT analysis. Residential charging sites are generally not counted in the DOE tabulation, with the exception of some multi-family residential sites. Public charging stations are accessible to any customer, while private charging stations are limited for use by certain customers or certain vehicles (e.g., at a workplace, for public transit vehicles). A charging station may have one or more charging ports. Charging levels are generally differentiated by voltage of the electrical source.

In the aggregate, 28% of the total charging stations are located in disadvantaged areas which represent 30% of all census tracts containing 31% of the U.S. population. This aggregate snapshot might appear to indicate equal distribution of public charging infrastructure; however, a difference of one percentage point may impact hundreds of census tracts and millions of people. Also, the physical distribution of charging stations may not meet local needs or high deployment in certain areas may be compensating for low deployment in other areas. Deployment efforts can be used to help ensure reliable and broad access to charging for all drivers. In addition, with the official launch of CEJST, which applies to DOT programs that were not already active and utilizing the DOT interim definition, the observed distribution of charging infrastructure may change due to differences in indicators. At a high level, CEJST identified more census tracts as disadvantaged (27,248 census tracts) which may include more or less charging infrastructure than when utilizing the DOT interim definition for disadvantaged communities.[35]

Electricity Demand and Sale for Resale or Service

The growth in EV use, and thus electricity demand for EVs, will likely depend on several factors, including state and federal regulations affecting the sale of electricity, different costs of electricity in each state, pricing structures for EV charging stations, and individual vehicle specifications.

In the United States, the sale of electricity is governed by many different federal, state, and local regulations. When it comes to the sale of electricity for the purpose of charging EVs, the states generally have regulatory jurisdiction over retail electricity transactions, though federal and

[35] CEJST, "Downloads," Communities List Data [spreadsheet], released November 22, 2022, https://screeningtool.geoplatform.gov/en/downloads.

municipal authorities may also play a role. Jurisdiction over the sale of electricity to or from an EV charging station hinges upon its definition as either a retail transaction or a sale for resale (i.e., wholesale). States typically regulate retail electricity transactions, while the Federal Energy Regulatory Commission (FERC) has jurisdiction over the transmission and wholesale sales of electricity in interstate commerce.[36] To date, FERC has not intervened in state decisions regarding the classification and regulation of EV charging infrastructure.[37] In the absence of clear or comprehensive and consistent state policies, some cities and counties have become the de facto regulators of EV charging stations within their regions. State approaches to regulation vary considerably, and according to the National Association of Regulatory Utility Commissioners (NARUC), the approaches focus on two questions:

1. Charging station ownership: Whether regulated utilities should be permitted to own charging stations or provide make-ready investments in front of and behind the meter and earn a rate of return on these investments.
2. Rate design: Whether there should be a role for load management via EV rate design or demand response programs. By influencing charging times and lowering overall load factors from EVs, rate design and demand response can manage the grid impacts—positive or negative—that EVs may have on overall system load.[38]

Because of the varied approaches to charging station ownership and rate design, payback periods and return on investments for EV charging stations vary. In addition, the price of electricity varies regionally, and different rates are allocated to residential and commercial customers. The 2021 U.S. average was 11.10 cents per kilowatt-hour (kWh), with an average price of 13.66 cents per kWh for the residential sector, 11.22 cents per kWh for commercial, 7.18 cents per kWh for industrial, and 10.20 cents per kWh for transportation.[39] According to the U.S. Energy Information Administration (EIA), electricity price projections for a reference case over the next five to ten years may potentially remain relatively stable given projected growth in the percentage of renewable electricity in the generation mix.[40] Decisions by EV drivers regarding where to

---

[36] For more information on the Federal Energy Regulatory Commission's (FERC's) role in transmission and wholesale sales of electricity, see CRS In Focus IF11411, *The Legal Framework of the Federal Power Act*, by Adam Vann, and CRS Report R44783, *The Federal Power Act (FPA) and Electricity Markets*, by Richard J. Campbell.

[37] In September 2020, FERC approved tariff revision proposals by the California Independent System Operator (CAISO) that were designed to enhance demand response, which is a reduction or shift in power consumption by a customer during peak energy demand periods or when grid reliability may be at risk. The tariff proposals pertained to electric vehicle charging stations and energy storage. See CAISO Corporation, 172 F.E.R.C. ¶ 61,298 at P 1 (2020).

[38] Charles Harper, Gregory McAndrews, and Danielle Sass Byrnett, *Electric Vehicles: Key Trends, Issues, and Considerations for State Regulators*, National Association of Regulatory Utility Commissioners (NARUC), October 2019, p. 11.

[39] According to EIA, values for 2021 are final. While these are national averages, local electricity prices may vary. For example, in 2021 Hawaii had the highest electricity prices of any state with an all-sector average of 30.31 cents per kilowatt (kW) while Idaho had one of the lowest all-sector average price of 8.17 cents per kW. According to EIA, the transportation sector is defined as "electrified rail, primarily urban transit, light rail, automated guideway, and other rail systems whose primary propulsive energy source is electricity." EIA, *Electric Power Monthly*, "Table 5.3: Average Price of Electricity to Ultimate Customers," accessed March 14, 2023, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_03; EIA, *Electric Power Annual*, "Table 2.10: Average Price of Electricity to Ultimate Customers by End-Use Sector, by State," accessed March 14, 2023, https://www.eia.gov/electricity/annual/html/epa_02_10.html; EIA, *Electric Power Annual*, "Technical Notes," November 2022, p. 9, https://www.eia.gov/electricity/annual/pdf/tech_notes.pdf.

[40] Projections provide estimates of future energy system conditions based upon stated assumptions. During the same period, EIA projects growth in the percentage of renewable electricity generation from 21% of the U.S. electricity generation mix in 2020 to 30% of the mix in 2025 to 35% of the mix in 2030. EIA, *Annual Energy Outlook 2021 (AEO 2021)*, "Table 8: Electricity Supply, Disposition, Prices, and Emissions," https://www.eia.gov/outlooks/aeo/data/browser (the displayed text for this hyperlink has been shortened).

charge their vehicles may vary according to the price of electricity at home versus elsewhere.[41] Furthermore, some EV charging stations do not charge for electricity.

Some EV charging station users may encounter demand charges, or additional charges or higher rates added to a customer's electricity bill according to the customer's peak power usage. These may be applied by utilities to commercial and industrial customers (e.g., EV charging stations) to encourage customers to manage their energy consumption and avoid charging activity at times of peak demand. Depending on a charging station's location and utilization rate, demand charges may represent a large portion of a customer's electricity bill.[42] As DC Fast charging ports can draw large amounts of power quickly, DC Fast charging station deployment may be more affected by high demand charges than other charging levels. If the regulatory regime of a utility allows for rate incentives to defer charging to lower demand periods, the impact of power demand could be lessened. Such approaches may require "smart" charging systems or require an EV owner to subscribe to a rate incentive program. Additional power demand management could include two-way electricity flow for vehicle-to-grid options.[43]

Demand charges for EV charging stations that are based upon a customer's peak power usage (which may or may not occur at peak system demand) have been of interest to Congress. Citing a report[44] that found that demand-based charges can account for most of an EV charging station's operating expense and can exceed the revenue generated by the station, some Members of Congress have asked FERC to "initiate rate review and reform efforts to address barriers to transportation electrification on the same schedule as IIJA §40431 obliges all 50 states to act."[45]

Pricing for charging an EV can depend on location, timing, and service provider. For EV drivers, public charging may be free of charge at certain locations[46] or may be subject to a pricing structure such as pay-as-you-go or monthly subscription.[47] Membership or subscription setup, for

[41] Gil Tal, et al., "Factors Affecting Demand for Plug-in Charging Infrastructure: An Analysis of Plug-in Electric Vehicle Commuters," University of California, Institute of Transportation Studies, pp. 16-18, https://escholarship.org/uc/item/1jh8127j.

[42] EVGo, a charging station owner-operator, reportedly shared that demand charges can represent up to 93% of monthly electricity bills for a charging station depending on location and utilization rate, as well as rate design in the area. Future Electric Utility Regulation, *The Future of Transportation Electrification: Utility, Industry and Consumer Perspectives*, August 2018, p. 75, https://eta-publications.lbl.gov/sites/default/files/feur_10_transportation_electrification_final_20180813.pdf.

[43] Vehicle-to-grid (V2G) options allow not only electricity to be drawn from the grid to charge a vehicle battery but also electricity to be delivered to the grid from the vehicle battery. In this way, electricity stored in an otherwise idle vehicle battery could supply electricity to the grid rather than drawing power from it during peak demand periods.

[44] Arara Blue Energy Group LLC, *An EV Future: Navigating the Transition*, a Voices of Experience report prepared for DOE Advanced Grid Research and Development Division, October 2021, pp. 10-11, https://smartgrid.gov/files/documents/An_EV_future_10.21.21_FINAL.pdf. See "Measures to Promote Electrification of the Transportation Sector" for information on IIJA §40431.

[45] Letter from Senator Hickenlooper, Senator Tillis, Representative Kuster, and Representative Dusty Johnson to FERC Chairman Glick and Commissioners, June 16, 2022, https://subscriber.politicopro.com/f/?id=00000181-87a5-d221-a5c5-a7afc61f0000.

[46] Some automakers may offer free charging for drivers of certain models (limits may apply to the amount of charging or the duration of applicability). Tesla and Toyota are two such automakers. Electrek, "How to Tell If Your Tesla Qualifies for Free Supercharging," July 21, 2021, https://electrek.co/2021/07/21/how-to-tell-if-your-tesla-qualifies-for-free-supercharging/. InsideEVs, "2023 Toyota bZ4X Buyers Will Get One Year of Free EVgo Charging," February 24, 2022, https://insideevs.com/news/569723/toyota-bz4x-evgo-1year-freecharging/.

[47] Enel X, "The Ultimate Guide to Electric Vehicle Public Charging Pricing," November 12, 2019, https://evcharging.enelx.com/resources/blog/579-the-ultimate-guide-to-electric-vehicle-public-charging-pricing. At least one instance exists of a utility piloting a program to provide unlimited charging for a flat monthly rate. Utility Drive, "Duke May Offer Some EV Customers 'All You Can Charge' for Just $19.99/month (Restrictions Apply)," (continued...)

free or for a fee, may also be required for free or pay-as-you-go charging.[48] Pay-as-you-go may charge by time, by electricity usage, or as a flat fee. Additional fees may include idle fees (where a vehicle is connected to a charging station but not actively charging), termination fees, and credit card fees. For EV charging infrastructure projects that receive federal funds, FHWA established through rulemaking minimum standards and requirements that state that the price for charging must be based on the price for electricity to charge in $/kWh.[49]

In addition to ownership, rate design, and pricing, the rate of energy consumption by an EV charging station also depends upon the vehicles using the station and the frequency of their use. Vehicle-specific factors can include vehicle size and weight, engine efficiency, energy consumption of auxiliary systems (e.g., heating and cooling), and battery capacity.[50] For EVs, everything from the driving to the climate control system is powered by the same battery pack. A number of driving factors also influence fuel economy, and thus electricity consumption. These include how quickly the driver accelerates, the amount of stop-and-go driving, and the amount of idling. The effect on fuel economy by any one of these factors varies.[51]

Total electricity demand associated with EV charging stations depends upon these above factors, as well as the number of EVs on the road. According to one analysis, 4.68 terawatt-hours (TWh) were used to power EVs in the United States in 2020, an increase from 3.87 TWh in 2019.[52] In an analysis sponsored by DOE, an unmanaged charging scenario, which was considered as an illustrative "worst case" scenario, estimated that "12 GW [gigawatts] of dispatchable generating capacity is equivalent to the aggregate demand of nearly 6 million new EVs. This accounts to 1 to 3 times the projected EV market growth through 2030 in the high and medium scenarios respectively."[53] The scenario did not account for managed charging, which can reduce the peak demand associated with vehicle charging through charging schedule flexibility. The conclusion from the study is that "sufficient energy generation and generation capacity is expected to be available to support a growing EV fleet as it evolves over time, even with high EV market growth."[54] For comparison, in 2020 the total U.S. electric power sector capacity was approximately 1,091 GW.[55] The DOE-supported report estimates that each EV requires 3.8 megawatt-hours per year, assuming consumption at a rate of 300 watt-hours per mile, 12,000

February 23, 2022, https://www.utilitydive.com/news/duke-may-offer-some-ev-customers-all-you-can-charge-for-just-1999month/619210/.

[48] For NEVI- and certain other federally-funded charging infrastructure projects, NEVI Standards and Requirements disallows payment methods that require membership; NEVI Standards and Requirements, 23 C.F.R. 680 (2023).

[49] See 23 C.F.R. § 680.116 and Department of Transportation, Federal Highway Administration, "National Electric Vehicle Infrastructure Standards and Requirements," 88 *Federal Register* 12749, March 30, 2023.

[50] CRS Report R46420, *Environmental Effects of Battery Electric and Internal Combustion Engine Vehicles*, by Richard K. Lattanzio and Corrie E. Clark, pp. 16-18.

[51] EPA, "Your Mileage May Vary," accessed March 1, 2022, https://www.epa.gov/greenvehicles/your-mileage-may-vary.

[52] S&P Global, "US EV Sales Tumble in 2020, but EV Load Increases with More Charging Stations," January 29, 2021, https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/012821-us-ev-sales-tumble-in-2020-but-ev-load-increases-with-more-charging-stations.

[53] Grid Integration Tech Team and Integrated Systems Analysis Tech Team, *Summary Report on EVs at Scale and the U.S. Electric Power System*, November 2019, p. iv, https://www.energy.gov/sites/prod/files/2019/12/f69/GITT%20ISATT%20EVs%20at%20Scale%20Grid%20Summary%20Report%20FINAL%20Nov2019.pdf.

[54] Ibid., p. v.

[55] EIA, *AEO 2021*, "Table 9: Electricity Generating Capacity," February 3, 2021, https://www.eia.gov/outlooks/aeo/.

miles traveled annually, and 4.9% system losses.[56] As of December 31, 2021, 1,454,500 BEVs were registered in the United States, and 786,700 PHEVs were registered.[57]

Infrastructure Investment and Jobs Act

The IIJA includes several provisions that address vehicle electrification, including new spending to increase the EV charging network.[58] Two new programs with $7.5 billion in total funding over five years (FY2022-FY2026) constitute IIJA's major EV charging priorities: $2.5 billion authorized and appropriated from the Highway Trust Fund for the Grants for Charging and Fueling Infrastructure (CFI) program and $5 billion in multi-year general fund appropriations for the National Electric Vehicle Infrastructure (NEVI) Formula Grant program. Division J of the IIJA also authorized the Joint Office of Energy and Transportation to implement these and other programs. Following is a summary of the major IIJA provisions affecting EV charging deployments. **Appendix B** provides an overview of spending levels for these programs.

Joint Office of Energy and Transportation

The IIJA directed the establishment of the Joint Office of Energy and Transportation ("Joint Office") within DOE and DOT to handle issues between the agencies, including strategies to reduce transportation-related emissions and the effects of climate change. The Joint Office is directed to provide support for the deployment of the $7.5 billion investments in EV charging infrastructure and to provide technical assistance to states in developing their EV charging plans.[59]

Coordinating the Federal Role in EV Charging

The Departments of Energy (DOE) and Transportation (DOT) entered into a memorandum of understanding (MOU) on December 14, 2021, defining the purpose and scope of a new office—which will be housed at DOE—and aligning the two agencies' resources and expertise. The specific issues the Joint Office of Energy and Transportation ("Joint Office") will address include technical assistance and data sharing in deploying and operating electric vehicle supply equipment (EVSE) and hydrogen fueling infrastructure; development of related training and certification programs; and performance of a study of EVSE and hydrogen infrastructure needs that will support "community resilience and electric vehicle (EV) integration." As stipulated in the IIJA, the Joint Office staffing and programs will be funded by $300 million as part of the FY2022 NEVI apportionment. The MOU remains in effect until terminated by either agency and will be re-evaluated at least every two years and may be modified.[60] The Joint Office website is https://driveelectric.gov.

[56] Energy consumption assumed to be AC; Grid Integration Tech Team and Integrated Systems Analysis Tech Team, *Summary Report on EVs at Scale and the U.S. Electric Power System*, November 2019, p. 3.

[57] AFDC, "Light-Duty AFV Registrations," updated August 2022, https://afdc.energy.gov/data/10861.

[58] Section 11403 of the IIJA (P.L. 117-58) also establishes a new DOT Carbon Reduction Program that can be used for a range of programs to reduce transportation emissions; among the projects that are eligible for these grants are acquisition, installation, and operation of publicly available EV charging infrastructure.

[59] DOE, "DOE and DOT Launch Joint Effort to Build Out Nationwide Electric Vehicle Charging Network," press release, December 14, 2021, https://www.energy.gov/articles/doe-and-dot-launch-joint-effort-build-out-nationwide-electric-vehicle-charging-network.

[60] DOE and DOT, *Memorandum of Understanding*, December 14, 2021, https://www.energy.gov/sites/default/files/2021-12/DOE%20DOT%20Joint%20Office%20MOU%2012.14.21_0.pdf.

National Electric Vehicle Infrastructure (NEVI) Formula Program

Division J of IIJA establishes a $5 billion formula grant program ($1 billion in each of FY2022-FY2026) within DOT to provide funding for states for the deployment of EV charging infrastructure along the national highway system and primarily along alternative fuel corridors (AFCs; see box below for details) designated for EVs. The federal cost-share for NEVI projects is 80%. Although funding for each state will be based on a formula, states will be required to submit plans for that spending, based on FHWA criteria. In March 2023, FHWA published the NEVI Standards and Requirements, which establish minimum standards around the installation, operation, and maintenance of NEVI- and certain other federally-funded charging infrastructure.[61] Projects must be directly related to EV charging that is open to the general public, with a priority of building out charging infrastructure along AFCs. If a state builds out its AFCs, the installation of charging infrastructure at other publicly accessible locations is allowed at the discretion of the state.[62] The Standards and Requirements provide guidance on other aspects of the strategic deployment of charging infrastructure, including:

- The Standards and Requirements complement FHWA NEVI program guidance encouraging new charging stations along AFCs to be spaced a maximum distance of 50 miles apart, within 1 mile of the roadway, and establishing a process for states to request exceptions;
- Charging stations are required to have a minimum of four ports (Level 2 or DC Fast, to charge a minimum of four EVs simultaneously), with an additional requirement of a minimum of four network-connected DC Fast ports for charging stations located along and designed to serve users of AFCs, and with flexibility in the number of ports for community-focused charging stations near AFCs; and
- DC Fast ports located along AFCs and designed to serve those users must supply up to 150 kW per port simultaneously, and each Level 2 port must supply at least 6 kW per port simultaneously. Power sharing is allowed under certain conditions.

FHWA's NEVI program guidance from February 10, 2022 (updated and superseded on June 2, 2023), provides many details about its operation and requirements.[63] Among its guidance:

- FHWA expects most state recipients will engage private contractors to install, operate, and maintain the EV infrastructure and those private companies are permitted to provide all or part of the 20% nonfederal cost-share. States may also own or lease EV charging infrastructure;
- States are encouraged to seek technical assistance from the Joint Office so their plans comply with all guidance and requirements, including maps showing expected investments, analysis of anticipated usage rates and peak demand, cybersecurity plans, and trained workforce considerations. All approved plans will be publicly accessible on DOT's website; and
- NEVI "will emphasize equity considerations at its inception" and will require states to develop their plans through engagement with "rural, underserved and disadvantaged communities."[64]

---

[61] NEVI Standards and Requirements, 23 C.F.R. 680 (2023). FHWA, *NEVI Formula Program Guidance*, p. 28.

[62] NEVI Standards and Requirements, 23 C.F.R. 680 (2023). Such locations could be public schools and parks, private parking facilities available for public use, or parking at public buildings, including on locations on federal lands.

[63] FHWA, *NEVI Formula Program Guidance*.

[64] Ibid, pp. 16.

In July 2023, the Joint Office published its first annual report for NEVI.[65] The report provides an overview of the first year of state deployment plans and certain activities of the Joint Office.

[65] Joint Office of Energy and Transportation, *National Electric Vehicle Infrastructure Formula Program, Annual Report, Plan Year 2022-2023*, July 2023, https://driveelectric.gov/files/nevi-annual-report-2022-2023.pdf.

Alternative Fuel Corridors

Section 1413 of the Fixing America's Surface Transportation Act (FAST Act; P.L. 114-94) requires the Department of Transportation (DOT) to designate and periodically update national alternative fuel corridors (AFCs) to promote vehicle use of electricity, hydrogen, propane, and natural gas. DOT's Federal Highway Administration (FHWA) has worked with other federal, state, and local officials and industry groups to designate these corridors. FHWA assigns designations to highways as either "corridor ready"—those with sufficient fueling stations to serve a corridor—or "corridor pending"—those with insufficient fueling. In the case of electric vehicles (EVs), a corridor-ready designation applies if there are EV charging stations at 50-mile intervals, with a goal of establishing direct current fast charging (DC Fast) infrastructure along those routes (**Figure 3**).

Figure 3. Electric Vehicle Alternative Fuel Corridors

Source: Department of Transportation (DOT), Federal Highway Administration (FHWA), https://highways.dot.gov/newsroom/usdot-announces-all-50-states-dc-and-puerto-rico-now-have-alternative-fuel-corridor.

Notes: Designations through 2022. "Ready" designations are those corridors with electric vehicle (EV) charging at regular intervals; "Pending" designations are those corridors without EV charging at regular intervals. Corridor-ready EV designations for Round 6 (the current round as of May 2023) use the same criteria as the National Electric Vehicle Infrastructure (NEVI) Formula Program for "fully built out" corridors. FHWA used different criteria for previous corridor-ready EV designations in prior rounds.

Under this program, FHWA has developed standardized AFC signage and other forms of public education, and encouraged regional cooperation in planning new fueling networks. FHWA has undertaken six rounds of AFC nominations, the latest announced in July 2022. FHWA has identified building out alternative fuel corridors on the most traveled Interstates, such as I-95 and I-80, as priorities for funding. With round six, AFC corridors have been designated in 50 states, the District of Columbia, and Puerto Rico.[66]

[66] Federal Highway Administration, "USDOT Announces All 50 States, DC and Puerto Rico Now Have Alternative Fuel Corridor Designations, Which Will Help Build Out National Electric Vehicle Charging Network," press release, July 6, 2022, https://highways.dot.gov/newsroom/usdot-announces-all-50-states-dc-and-puerto-rico-now-have-alternative-fuel-corridor.

Grants for Charging and Fueling Infrastructure

Section 11401 of IIJA establishes a $2.5 billion competitive grant program within DOT for the strategic deployment of publicly accessible alternative fuel infrastructure—electricity, hydrogen, propane, and natural gas—along designated AFCs. Each fiscal year, half of the grant funding is to be applied to facilities along highway corridors—the Corridor Charging Grant Program—and the other half is to be applied to off-highway uses in parking lots of public buildings and other similar publicly-accessible locations—the Community Charging Grant Program.[67] Eligible state and local governments and public transportation authorities that receive grants may establish partnerships with private entities such as corporations, partnerships, companies, and nonprofit organizations to acquire and install fueling infrastructure. The IIJA states that priority shall be given to projects within rural areas, low- and moderate-income communities, and communities with lower rates of private parking spaces or higher rates of multi-unit dwellings.

Electric Vehicle Working Group

Section 25006 of IIJA directs DOT and DOE to establish a working group to produce three reports over a period of six years describing the status of EV adoption, identifying barriers and opportunities, and making recommendations regarding the integration of light, medium, and heavy duty EVs into the transportation system. The working group is directed to submit the reports to the Senate Committees on Commerce, Science, and Transportation, and Appropriations, and the House Committees on Transportation and Infrastructure, and Appropriations. The Secretaries of Transportation and Energy are directed to use these reports to develop strategies for EV adoption and deployment.[68] The working group is to have no more than 25 members representing diverse perspectives from federal agencies, industry and other nonfederal stakeholders, such as public utilities, and state and local governments.

State Energy Program (SEP)

DOE's State Energy Program (SEP) provides grants and technical assistance to states, the District of Columbia, and U.S. territories to promote the efficient use of energy and reduce the rate of growth of energy demand through the development and implementation of specific state energy programs. The SEP originated as the State Energy Conservation Program, which was authorized by the Energy Policy and Conservation Act of 1975 (P.L. 94-163), and the program has been amended several times.

The IIJA further amends the SEP. Section 40109 of IIJA authorizes funding and technical assistance to states, the District of Columbia, and U.S. territories to promote the efficient use of energy and reduce the rate of growth of energy demand through the development and implementation of specific state energy plans.[69]

Section 40109 of IIJA amends the mandatory features and optional features for financial assistance. Mandatory features are expanded to include activities to support transmission and distribution planning. Optional features are amended by making changes to a provision related to

---

[67] FHWA, "Charging and Fueling Infrastructure [CFI] Discretionary Grant Program," updated March 30, 2023, https://www.fhwa.dot.gov/environment/cfi/.

[68] Joint Office of Energy and Transportation, "Electric Vehicle Working Group," accessed April 7, 2023, https://driveelectric.gov/ev-working-group/.

[69] The State Energy Program (SEP) is authorized under Part D of the Energy Policy and Conservation Act (EPCA; 42 U.S.C. §§6321 et seq.). EPCA Section 362 specifies mandatory features and optional features of state energy plans in order to be eligible for financial assistance through the SEP. DOE administers the SEP.

programs that increase transportation efficiency. Previously, the provision included programs that accelerate alternative fuels. Section 40109 expands the options to include programs to help reduce carbon emissions in the transportation sector by 2050, accelerate the use of alternative transportation fuels, and accelerate transportation electrification. Section 40109 also expands the optional program focus to "state government vehicles, fleet vehicles, taxis and ridesharing services, mass transit, school buses, ferries, and privately owned passenger and medium- and heavy-duty vehicles."

Appropriations totaling $500 million for SEP are provided by Division J, Title III for the period FY2022 through FY2026. Section 40109 specifies that the distribution of funds to states shall be according to the formula in effect on January 1, 2021, and that there is not a cost-share requirement associated with these funds.

Data Collection on Electric Vehicle Integration with the Electricity Grids

Section 40414 of IIJA requires EIA to expand within one year its data collection related to EVs. Data sources may include charging stations, utilities, owners of EVs, and electric balancing authorities.

Manual on Uniform Traffic Control Devices Updates

The Manual on Uniform Traffic Control Devices (MUTCD), issued by FHWA, defines the nationwide standards used by road managers to install and maintain traffic control devices and signage on all public streets, highways, and bikeways. Its principles of safe traffic control and related devices are supported and amended from time to time by a nonprofit organization.[70] Section 11129 of IIJA directs that the MUTCD be updated to address issues with EV charging infrastructure, including requirements that EV charging stations provide non-proprietary charging connectors and also have access to secure and convenient payment methods.

Measures to Promote Electrification of the Transportation Sector

Section 40431 of IIJA amends Section 111(d) of the Public Utility Regulatory Policies Act of 1978 (PURPA; 16 U.S.C. §2621(d)) (as amended by Section 40104(a)(1)) by adding a standard for EV charging programs. The section directs states to consider measures to promote greater transportation electrification. These measures include establishing rates that promote affordable and equitable EV charging options for residential, commercial, and public charging infrastructure; improving the customer experience for light-, medium-, and heavy-duty vehicles; accelerating third-party investment in EV charging; and recovering the marginal costs of delivering electricity to EVs and charging infrastructure.

Section 40431 also establishes time periods for commencing consideration (no later than one year after enactment) and completing consideration and determination (no later than two years after enactment) of the EV charging programs standard. For states that have acted prior to enactment either through implementing an EV charging program standard, conducting a regulatory

[70] The Highway Safety Act of 1966 required states to adhere to uniform standards as a condition of receiving federal highway funding. To meet this requirement DOT adopted MUTCD in 23 C.F.R. 655.603. The National Committee on Uniform Traffic Control Devices is a private, nonprofit organization that recommends changes to the manual from time to time. It is comprised of transportation groups, such as the American Association of State Highway and Transportation Officials (AASHTO), and safety groups such as the National Safety Council and the American Automobile Association (AAA).

proceeding to consider a standard, or voting on legislation on implementation of a standard, compliance requirements do not apply.

State approaches to regulation vary considerably. Rules and regulations governing the retail sale of electricity generally originate with a state public utility commission. Under Section 111(d) of PURPA (16 U.S.C. §2621(d)), as amended, state regulatory authorities are required to consider the implementation of certain standards. Per Section 111(a) each state regulatory authority and each nonregulated electric utility shall consider each standard established by Section 111(d) and make a determination concerning whether or not it is appropriate to implement such standard. State electricity regulators (i.e., state public utility commissions) "must consider," for their regulated electric utilities (usually but not always only investor-owned utilities), whether to adopt the standards as requirements on those electric utilities. Note that PURPA requires that its "states-must-consider" provisions apply only to electric utilities over a certain minimum size threshold (42 U.S.C. §2612).

Clean School Bus Program

Section 71101 of IIJA establishes a $5 billion Clean School Bus Program within the Environmental Protection Agency (EPA) with funds appropriated for FY2022 through FY2026.[71] The program provides competitive grants and rebates for the replacement of existing school buses with alternative fuel buses (e.g., operated entirely or in part with natural gas, hydrogen, or biofuels) and zero emission buses (i.e., produce no pollutants or GHG emissions from the tailpipe). Eligible entities include those providing school bus service to one or more public school systems or purchasing school buses, contractors involved in the sale of vehicles, charging infrastructure, and other relevant equipment, and nonprofit school transportation association. At least 50% of allocated funds must be provided for grants to replace existing buses with zero-emission buses, exclusively. EPA is directed to develop an education and outreach program and submit an annual report to Congress evaluating the implementation of this section.

Low or No Emission Vehicle Program

The Low or No Emission Vehicle Program is a competitive grant program administered by the Federal Transit Administration (FTA) that provides funding for capital expenses to purchase or lease buses that emit low levels of pollutants, including GHGs.[72] This funding can be used for the "purchase or lease of zero-emission and low-emission transit buses, including acquisition, construction, and leasing of required supporting facilities such as recharging, refueling, and maintenance facilities."[73] Facilities that support these buses are also eligible for funding. Funding provided totals about $1.1 billion a year, $1.05 billion appropriated from the general fund and the rest authorized from the Highway Trust Fund. In the previous authorization of public transportation programs, as extended, the Low or No Emission Vehicle Program was funded at $55 million per year from FY2016 through FY2021.

[71] EPA, "Clean School Bus Program," updated February 8, 2023, https://www.epa.gov/cleanschoolbus.

[72] 49 U.S.C. §5339(c).

[73] Department of Transportation (DOT), Federal Transit Administration (FTA), "FY 2023 Competitive Funding Opportunity: Low or No Emission Grant Program and the Grants for Buses and Bus Facilities Competitive Program," 88 *Federal Register* 18, January 27, 2023, p. 5401.

This program is in addition to programs administered by FTA that can provide grants for EVs including non-road vehicles. Such grant programs include the Buses and Bus Facilities Competitive Program and the Electric or Low Emitting Ferry Pilot Program.[74]

Other Federal Programs

In addition to programs authorized and funded through the IIJA, other federal programs encourage the deployment of EV charging stations. These have evolved over the past few decades among several agencies and within the tax code. A summary of existing programs follows.

Clean Cities Program

The DOE's Clean Cities program supports local actions to reduce petroleum use in transportation.[75] The program funds transportation projects nationwide through a competitive application process, and leverages these funds with additional public- and private-sector matching funds and in-kind contributions.[76] While the program supports a variety of alternative fuels and vehicles in an effort to reduce petroleum use, funding opportunities from Clean Cities that directly support EVs include educational best practices programs for communities planning workplace events to promote EV charging and the EV Everywhere Plug-In Electric Vehicle Local Showcases. Since 1998, DOE has awarded more than $490 million to 632 transportation alternative fuels project awards—including some for EV charging—that leveraged an additional $844 million in matching funds and in-kind contributions from private and other public sector partners.[77]

Federal Highway Funding

Federal highway funding is generally eligible for alternative fueling infrastructure, including EV charging infrastructure and AFC signage.[78] For example, FHWA's Congestion Mitigation and Air Quality Improvement (CMAQ) Program provides funding to states and local governments to fund transportation projects and programs to help meet the requirements of the Clean Air Act. Projects that are expected to reduce transportation emissions, including installation of alternative fuel infrastructure, are eligible for funding.[79]

---

[74] For more information on FTA programs, see CRS Report R47002, *Federal Public Transportation Program: In Brief*, by William J. Mallett.

[75] EERE, *Clean Cities: Building Partnerships to Cut Petroleum Use in Transportation*, DOE/GO-102015-4743, November 2015, https://www.afdc.energy.gov/uploads/publication/clean_cities_overview.pdf.

[76] For more information see EERE, Clean Cities Coalition Network, "Goals and Accomplishments," https://cleancities.energy.gov/accomplishments/.

[77] Clean Cities, "Funded Projects," https://cleancities.energy.gov/partnerships/projects. In addition to the EV Everywhere Plug-In Electric Vehicle Local Showcase, the Electric Vehicle Community Readiness program provided one-time funding of $8.5 million in 2011 to 16 projects to help communities prepare for plug-in electric vehicles and charging infrastructure. As part of the readiness program, community partnerships collaborated on plans to deploy EVs, including activities such as streamlining permitting processes, revising building codes, training emergency personnel, educating the public, and developing incentives. AFDC, "Plug-In Vehicle Readiness," https://afdc.energy.gov/pev-readiness.html.

[78] FHWA, *Federal Funding Is Available for Electric Vehicle Charging Infrastructure on the National Highway System*, April 22, 2022, https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/resources/ev_funding_report_2022.pdf.

[79] FHWA, "Congestion Mitigation and Air Quality Improvement (CMAQ) Program," updated March 23, 2020, https://www.fhwa.dot.gov/environment/air_quality/cmaq/.

Alternative Fuel Infrastructure Tax Credit

One of the primary federal incentives for EV charging infrastructure is the Alternative Fuel Vehicle Refueling Property Credit, which was extended and modified in Section 13404 of the IRA.[80] Qualifying property includes EV charging stations, and is expanded to include charging stations of 2- and 3-wheeled vehicles (for use on public roads) and bidirectional charging equipment (i.e., vehicle-to-grid or V2G).[81] Starting in 2023, qualifying property is limited to that placed in service within low-income or non-urban census tracts; this limitation would apply for both business and residential properties. For business property, the credit amount is 6% of the cost with a maximum amount of $100,000.[82] Business property meeting prevailing wage and registered apprenticeship requirements may be eligible for a credit amount of 30% (but subject to the same $100,000 maximum). For residential property, the credit amount is 30% with a maximum amount of $1,000.[83]

Electrify America

In 2016, Volkswagen Group of America reached a number of legal settlements concerning violations of the Clean Air Act.[84] As part of its settlement terms, Volkswagen Group pledged to invest $2 billion over a 10-year period in zero-emissions vehicle infrastructure and education in select U.S. cities.[85] Volkswagen Group has met the terms of this settlement by establishing Electrify America, a subsidiary of Volkswagen Group, which plans to have more than 1,700 DC Fast charging stations and 9,500 individual charging ports installed in the United States by the end of 2025.[86] As an additional condition, Volkswagen Group was also required to fund a $2.7 billion national Environmental Mitigation Trust, funds from which are available to states and other beneficiaries for mitigating the negative impacts of the excess diesel emissions that were released by Volkswagen Group's noncompliant vehicles. States could choose to spend some of this special funding on bus electrification, including school buses.

[80] 26 U.S.C. §30C. Established by the Energy Policy Act of 2005 (P.L. 109-58).

[81] The credit can be claimed one time per station location regardless of the number of charging ports at the location.

[82] Previously, the credit amount for business property was 30% with a maximum of $30,000.

[83] This is continued from the previous credit amounts.

[84] EPA, "EPA Approved National ZEV Investment Plan," press release, April 9, 2017, https://www.epa.gov/enforcement/epa-approved-national-zev-investment-plan-public-version; and CRS Report R44372, *Volkswagen, Defeat Devices, and the Clean Air Act: Frequently Asked Questions*, by Bill Canis et al.

[85] Of that amount, $800 million is to be spent in California.

[86] Electrify America, "Electrify America Announces Its 'Boost Plan' to More Than Double Its Current EV Charging Network by End of 2025," press release, July 13, 2021, https://media.electrifyamerica.com/en-us/releases/149.

Appendix A. Apportionment of FY2022 Highway Infrastructure Program Funds for Electric Vehicle Charging

Table A-1. National Electric Vehicle Infrastructure (NEVI) Formula Program

Apportionments in millions of dollars

State	FY2022	FY2023	State	FY2022	FY2023
Alabama	11.7	16.9	Montana	6.3	9.1
Alaska	7.8	11.2	Nebraska	4.5	6.4
Arizona	11.3	16.3	Nevada	5.6	8.1
Arkansas	8.0	11.5	New Hampshire	2.6	3.7
California	56.8	81.7	New Jersey	15.4	22.2
Colorado	8.4	12.0	New Mexico	5.7	8.2
Connecticut	7.8	11.2	New York	26.0	37.4
Delaware	2.6	3.8	North Carolina	16.1	23.2
District of Columbia	2.5	3.6	North Dakota	3.8	5.5
Florida	29.3	42.2	Ohio	20.7	29.8
Georgia	20.0	28.7	Oklahoma	9.8	14.1
Hawaii	2.6	3.8	Oregon	7.7	11.1
Idaho	4.4	6.4	Pennsylvania	25.4	36.5
Illinois	22.0	31.7	Puerto Rico	2.0	2.9
Indiana	14.7	21.2	Rhode Island	3.4	4.9
Iowa	7.6	10.9	South Carolina	10.4	14.9
Kansas	5.8	8.4	South Dakota	4.4	6.3
Kentucky	10.3	14.8	Tennessee	13.1	18.8
Louisiana	10.9	15.6	Texas	60.4	86.9
Maine	2.9	4.1	Utah	5.4	7.7
Maryland	9.3	13.4	Vermont	3.1	4.5
Massachusetts	9.4	13.5	Virginia	15.7	22.7
Michigan	16.3	23.4	Washington	10.5	15.1
Minnesota	10.1	14.5	West Virginia	6.8	9.7
Mississippi	7.5	10.8	Wisconsin	11.6	16.8
Missouri	14.6	21.1	Wyoming	4.0	5.7
			Total:	**615**	**885**

Source: Department of Transportation (DOT), Federal Highway Administration (FHWA), "Apportionment of Fiscal Year (FY) 2022 Highway Infrastructure Program Funds for the National Electric Vehicle Infrastructure (NEVI) Formula Program Pursuant to the Infrastructure Investment and Jobs Act (IIJA)," Notice, February 10, 2022, https://www.fhwa.dot.gov/legsregs/directives/notices/n4510863.cfm. DOT, FHWA, "Apportionment of FY 2023 Highway Infrastructure Program Funds for the NEVI Formula Program Pursuant to the IIJA," Notice, October 6, 2022, https://www.fhwa.dot.gov/legsregs/directives/notices/n4510873.cfm.

Notes: Data in the table have been rounded.

Appendix B. Electric Vehicle (EV) Charging Funding in IIJA

Table B-1. EV Charging Authorizations and Appropriations

Millions of Dollars

Section	Unspecified Year	FY2022	FY2023	FY2024	FY2025	FY2026	Total
Division A—Surface Transportation							
Title I—Federal-Aid Highways							
Subtitle D—Climate Change							
Sec. 11401		300	400	500	600	700	2,500
Division D—Energy							
Title I—Grid Infrastructure and Resiliency							
Subtitle A—Grid Infrastructure Resilience and Reliability							
Sec. 40109	500						500
Division G—Other							
Title XI—Clean School Buses and Ferries							
Sec. 71101		1,000	1,000	1,000	1,000	1,000	5,000
Division J, Appropriations							
Title VIII—Transportation, Housing and Urban Development, and Related Agencies							
National Electric Vehicle Infrastructure (NEVI) Formula Program							
		1,000	1,000	1,000	1,000	1,000	5,000
Joint Office of Energy and Transportation							
							300

Source: CRS analysis of P.L. 117-58 and Federal Highway Administration, *National Electric Vehicle Infrastructure [NEVI] Formula Program Guidance (Update)*, June 2, 2023, p. 8, https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/nominations/90d_nevi_formula_program_guidance.pdf.

Notes: Not all programs are specifically for EVs. Some programs are broadly for alternative fuel vehicles and related charging and refueling infrastructure. The Joint Office funding is a set-aside from the NEVI program's FY2022 funding. In addition to the appropriations provided here in Division J, funding for some programs may be provided through the Highway Trust Fund.

Author Information

Melissa N. Diaz
Analyst in Energy Policy

Corrie E. Clark
Specialist in Energy Policy

Acknowledgments

A special thanks goes to Bill Canis, retired CRS Specialist in Industrial Organization and Business, who contributed to this report.

Disclaimer